ATTACHMENT O

Rules Relating to Erosion Standards and Guidelines

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RULES RELATING TO SOIL EROSION STANDARDS AND GUIDELINES

April 1999

Department of Planning and Permitting
City and County of Honolulu
Honolulu, Hawaii

Department of Planning and Permitting
City and County of Honolulu

RULES RELATING TO

SOIL EROSION

STANDARDS AND GUIDELINES

February 26, 1999 (Adoption Date)

April 8, 1999 (Effective Date)

DEPARTMENT OF PLANNING AND PERMITTING

CITY AND COUNTY OF HONOLULU

RULES RELATING TO SOIL EROSION STANDARDS AND GUIDELINES

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RULES OF
THE DEPARTMENT OF PLANNING AND PERMITTING
RELATING TO SOIL EROSION STANDARDS AND GUIDELINES

CHAPTER 1

§ 1 -1 PURPOSE

These Rules reflect the most recent requirements at the City and County, State and Federal levels, most notably Chapter 14, Articles 13-16, Revised Ordinances of Honolulu (ROH), as amended (1990), and the City's National Pollutant Discharge Elimination System (NPDES) permit. Together, these requirements have increased the need for the control of erosion by construction activities. Specifically these Rules:

- Comply with the City and County of Honolulu's National Pollutant Discharge Elimination System (NPDES) permit requirements.
- Require that erosion control measures be applied based on the size of the project, grading permit requirements, and point of discharge from the project. For Category 1, 2 and 3 projects, these Rules are recommended guidelines only. For Category 4 and 5 projects, these Rules are mandated.
- Require that Minimum Best Management Practices (BMP) checklists be adhered to for each project.
- Use the Natural Resources Conservation Services' (NRCS) allowable soil loss rates as the basis for design of erosion control plans.
- Incorporate State Department of Health's water quality standards for the Island of Oahu.
- Establish guidelines for temporary and permanent erosion control measures.

These Rules offer a new standard for evaluation and control of soil losses. The Severity Rating Number System, previously used to evaluate projects, has been replaced by a new system which recommends "small" projects to use selected Best Management Practices (BMPs) to control soil losses. "Large" projects shall be required to limit soil loss rates to acceptable levels. The acceptable soil loss rates shall be less than the allowable levels established based on soil types and erosivity. The acceptable soil loss rates for sheet and rill erosion are estimated using the Universal Soil Loss Equation (USLE). The USLE has been in use for many years in estimating soil loss rates for land under agricultural use.

The USLE was developed by the Agricultural Research Service (ARS) and the Natural Resources Conservation Service (NRCS). The USLE has been used extensively and has proven itself reliable for use in many areas of the United States, and has been adapted for use in Hawaii by the U.S. Department of Agriculture's NRCS.

The City has gone through a major reorganization to make it more customer oriented. As a result of this reorganization, administration of the grading ordinance, as well as these Rules, is now the responsibility of the Department of Planning and Permitting. The Director of the Department of Planning and Permitting shall be the final authority in administering and interpreting these Rules.

[Eff: APR 8 1999 *(Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(I), ROH).*

§ 1-2 DEFINITIONS

As used in these Rules, the following definitions shall apply unless the context indicates otherwise:

"Best management practices" or "BMPs" means pollution control measures, applied to nonpoint sources, on-site or off-site, to control erosion and the transport of sediments and other pollutants which have an adverse impact on waters of the state. BMPs may include a schedule of activities, the prohibition of practices, maintenance procedures, treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, or drainage from raw material storage.

"City" means the City and County of Honolulu.

"Contractor" means a company licensed in the State of Hawaii and presently in the business of building or remodeling facilities and/or constructing infrastructure.

"Department" means the Department of Planning and Permitting, City and County of Honolulu.

"Developer" means one who causes land to be developed.

"Development" means land which is being developed or developed lands.

"Director" means the Director of the Department of Planning and Permitting.

"Discharge" means the deposit, disposal, injection, dumping, spilling, leaking or placing of any substance into a drainage facility or natural watercourse.

"Drainage problem" means the discharge of effluent or a pollutant onto a public right-of-way and/or into a drainage facility which causes the hydraulic capacity of that drainage facility to be exceeded and results in flooding. This definition includes the discharge of a pollutant which reduces the hydraulic capacity of a drainage facility by the deposit of solids therein.

"Effluent" means any substance other than storm water runoff that is discharged onto a public right-of-way and/or into a drainage facility including nonstorm water discharges which are not sources of pollutants, and any NPDES-permitted discharges.

"Engineer" means a person duly registered as a professional engineer in the State of Hawaii.

"Engineering control facility" means any drainage device such as a basin, well, pond, ditch, dam, or excavation used for the temporary or permanent storage of storm water by means of detention, retention, divergence, or infiltration for the purpose of reducing storm water volume and/or peak storm discharge flows, and which may provide gravity settling of particulate pollutants. It includes but is not limited to detention ponds, retention ponds, infiltration wells or ditches, holding tanks, diversion ditches or swales, drainpipes, check dams, and debris basins.

"Flood" or "flooding" means the inundation to a depth of three inches or more of any property not ordinarily covered by water. The terms shall not apply to inundation caused by tsunami wave action.

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

"National Pollutant Discharge Elimination System permit" or "NPDES permit" means the permit issued to the City pursuant to Title 40, Code of Federal Regulations, Part 122, Subpart B, Section 122.26(a)(1)(iii), for storm water discharge from the city separate storm sewer systems; or the permit issued to a person or property owner for a storm water discharge associated with industrial activity pursuant to Title 40, Code of Federal Regulations, Part 122, Subpart B, Section 122.26(a)(1)(ii), or other applicable sections of Part 122; or the permit issued to a person or property owner for the discharge of any pollutant from a point source into state waters through the city's separate storm sewer system pursuant to Hawaii Administrative Rules, Chapter 11-55, "Water Pollution Control."

"Person" means and includes corporations, estates, associations, partnerships and trusts, as well as one or more individuals.

"Pollutant" means any waste, cooking or fuel oil, waste milk, waste juice, pesticide, paint, solvent, radioactive waste, hazardous substance, sewage, dredged spoils, chemical waste, rock, sand, biocide, toxic substance, construction waste and material, and soil sediment.

"Pollution problem" means the discharge of any pollutant into state waters directly or by conveyance through a drainage facility which creates a nuisance or adversely affect the public health, safety or welfare or causes a drainage facility to violate any provisions of the city National Pollutant Discharge Elimination System permit or violates any water quality standards of the State of Hawaii.

"Property owner" means the fee simple owner of record, lessee of record, administrator, administratrix, executor, executrix, personal representative, receiver, trustee, property management agent, or any other individual, corporation, or unincorporated association who has the use, control or occupation of land with claim of ownership, whether the owner's interest be in absolute fee or a lesser estate.

"Remedial work" means the construction or installation of catch basins or other devices to resolve localized drainage problems.

"ROH" means Revised Ordinance of Honolulu.

"Rules" means the "Rules Relating to Soil Erosion Standards and Guidelines" of the Department of Planning and Permitting, City and County of Honolulu.

"Separate storm sewer" means a conveyance or system of conveyance including city roads and streets with drainage systems, catch basins, curbs, gutters, ditches, man-made channels, or storm drains owned by the city, and designated or used for collecting or conveying storm water.

"State waters" means the same as that term is defined in Hawaii Revised Statutes (HRS) Section 342D-1.

"Storm water" means storm water runoff, surface runoff, street wash, or drainage and may include discharges from fire fighting activities.

"Water quality standards" means the water quality standards adopted by the State of Hawaii pursuant to HRS Section 342D-5.

[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

§ 1-3 STANDARDS

The standards underlying these Rules are anchored around the size of a project. Projects can be broken into the following five categories, based on ROH Section 14-14.2 and, where applicable, coverage under the State Department of Health's General NPDES permit.

Category 1. ***Projects not required to get a grading permit but which require a building permit and where grading, stockpiling or grubbing is to occur.***

Category 2. ***Projects which require a grading permit where the area of the zoning lot or portion thereof subject to the permit is less than 15,000 square feet for single-family or two-family dwelling uses and less than 7,500 square feet for other uses.***

Category 3. ***Projects which require a grading permit where the area of the zoning lot or portion thereof subject to the permit is 15,000 square feet or more for single-family or two-family dwelling uses, or 7,500 square feet or more for other uses.***

Category 4. ***Projects which require a grading permit where the total area including any areas developed incrementally that is to be graded is 15,000 square feet or more for single-family or two-family dwelling uses, or 7,500 square feet or more for other uses, or in the event a proposed cut or fill is greater than 15 feet in height for single-family or two-family dwelling uses, or 7.5 feet in height for other uses.***

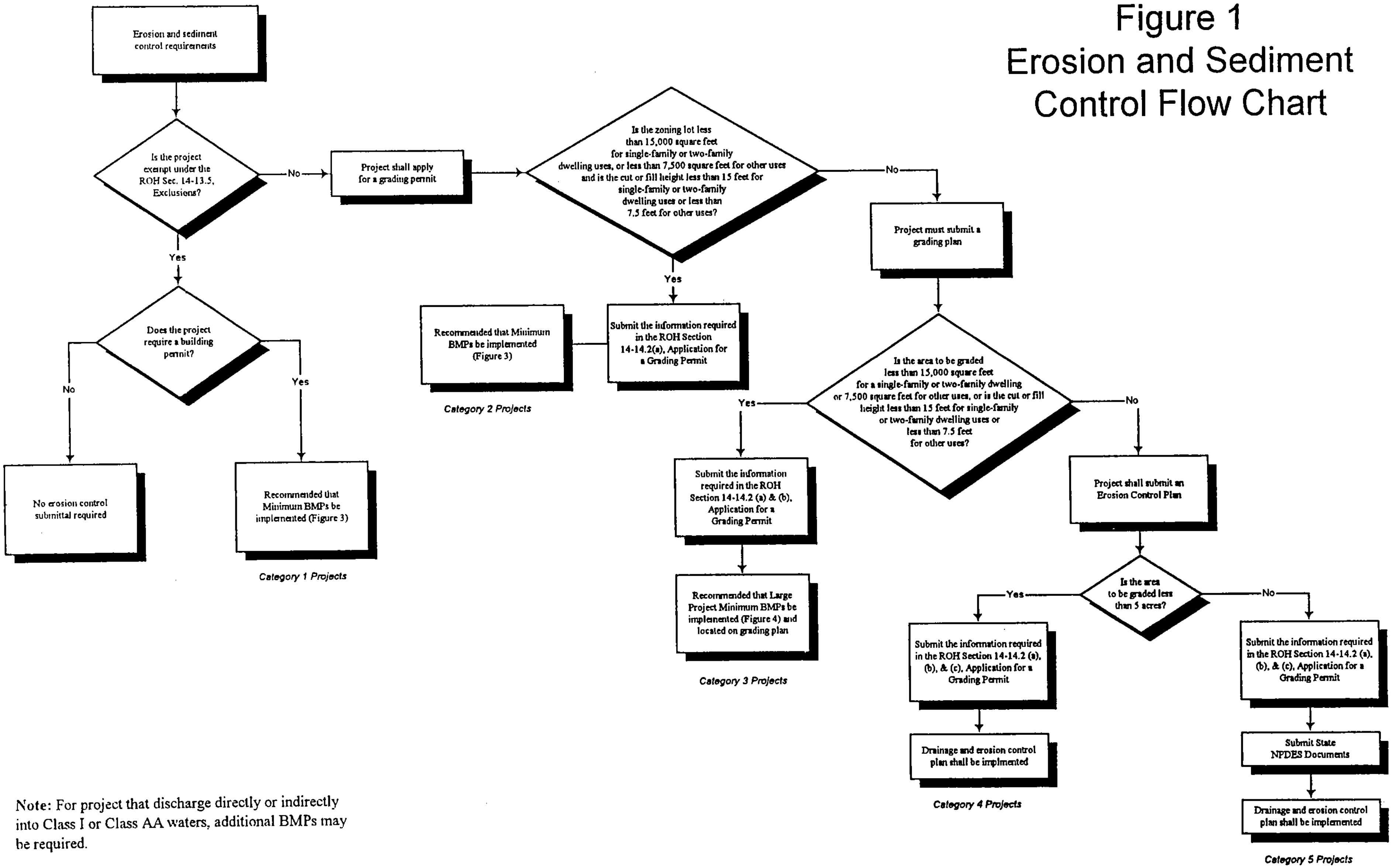
Category 5. ***Projects which require a grading permit where the total area including any areas developed incrementally that is to be graded is more than 5 acres and Department of Health, State of Hawaii, general permit coverage for construction activities is required.***

For small projects (categories 1, 2 and 3), implementation of certain BMPs is recommended and should be adequate to ensure the control of soil losses. Although not a requirement of these Rules, any person or property owner doing "small" projects (Categories 1, 2 and 3) should be aware that he/she is still responsible to comply with Section 14-12.23(a), ROH, as amended, which states that "it shall be unlawful for any person to discharge or cause to be discharged any pollutant into any drainage facility which causes a pollution problem in State Waters, or causes a violation of any provision of the City's NPDES permit or the water quality standards of the State of Hawaii." Therefore, included in the next section and further described in § 1-5 Guidelines for Erosion Control Measures, are recommended measures and BMPs in which to accomplish this compliance. Large projects (categories 4 and 5) are required by these Rules to be designed to limit soil loss rates as determined by the Universal Soil Loss Equation (USLE) to acceptable levels. The acceptable soil loss rates are to be less than the allowable level established based on soil types and erosivity (Exception: For Category 4 projects, Large Site BMP checklist may be substituted for soil loss calculations). The BMPs are minimum guidelines, and modifications to the BMPs may be necessary to mitigate pollution during construction.

1-3.1 EROSION CONTROL REQUIREMENTS

The recommendations/requirements for each of the five project categories are presented in the flowcharts shown in Figures 1 and 2. For projects which discharge directly or indirectly into Class I or Class AA waters, there may be additional BMP measures required. Project that satisfy the criteria for more than one category, the requirements of the more stringent category will apply.

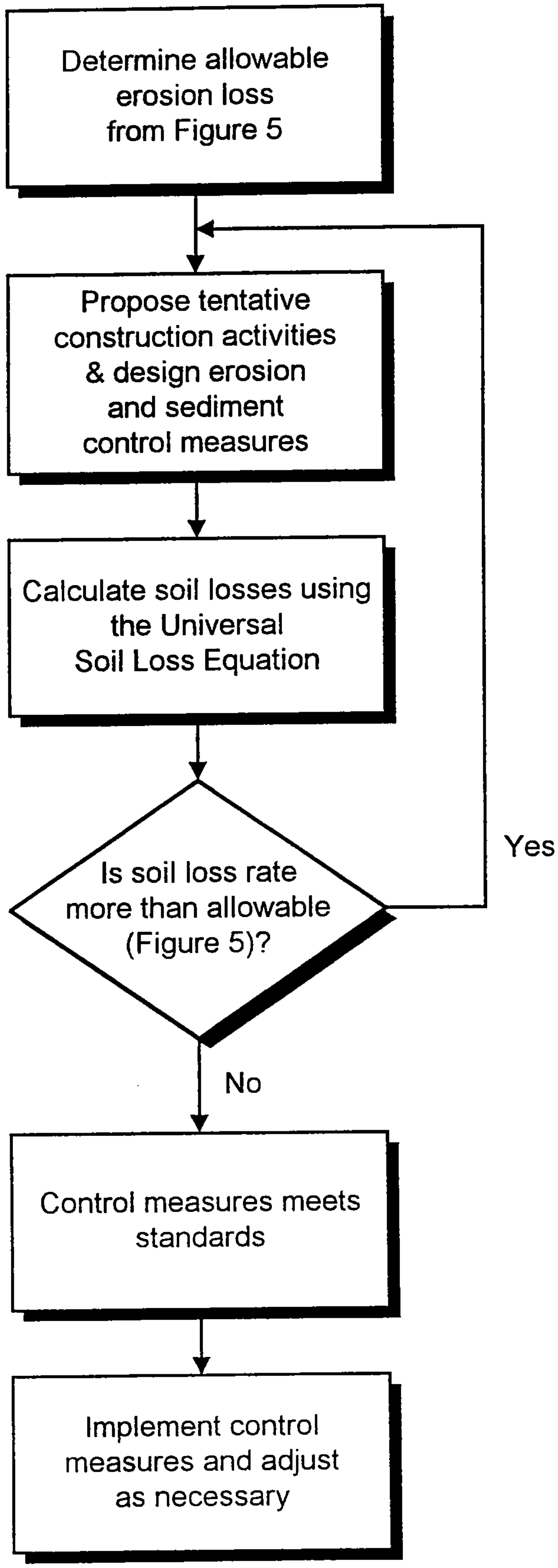
Figure 1
Erosion and Sediment Control Flow Chart



Note: For project that discharge directly or indirectly into Class I or Class AA waters, additional BMPs may be required.

ROH – Revised Ordinance of Honolulu

Figure 2
Erosion and Sediment Control Measures Flow Chart



Note: for projects that discharge either directly or indirectly into Class I or Class AA waters, additional BMPs may be required.

The following paragraphs summarize recommendations/requirements for each category.

Category 1 ***Projects Which are Required to Get a Building Permit But Do Not Need to Get a Grading Permit and Where Grading, Stockpiling or Grubbing is to Occur***

A Minimum Best Management Practices (BMP) Checklist for Small Projects is shown in Figure 3.

Category 2 ***Projects Less Than 15,000 Square Feet for Single-Family or Two-Family Dwelling Uses or Less Than 7,500 Square Feet for Other Uses***

The Minimum BMP Checklist for Small Projects (Figure 3) should be used. These recommendations are in addition to the current grading permit submittal requirements of ROH Section 14-14.2(a).

Category 3 ***Projects Where the Area of the Zoning Lot or Portion Thereof Subject to the Permit is 15,000 Square Feet or More for Single-Family or Two-Family Dwelling Uses, or 7,500 Square Feet or More for Other Uses, But Where Total Area Graded is Less Than 15,000 Square Feet for Single-Family or Two-Family Dwelling Uses and Less Than 7,500 Square Feet for Other Uses***

These projects should complete and submit the Minimum BMP Checklist for Large Projects (Figure 4), and these BMPs should be located on the grading plan. These requirements are in addition to the current grading permit submittal requirements of ROH Section 14-14.2(a)and Section 14-14.2(b).

Category 4 ***Projects Where the Total Area Including Any Areas Developed Incrementally That is to be Graded is More Than 15,000 Square Feet or More for Single-Family or Two-Family Dwelling Uses or 7,500 Square Feet or More for Other Uses or Where a Proposed Cut or Fill is Greater Than 15 Feet in Height for Single-Family or Two-Family Dwelling Uses or 7.5 Feet in Height for Other Uses***

Category 4 projects shall submit a drainage and erosion control plan. The temporary erosion and sediment control measures included in the drainage and erosion control plan must be designed to limit soil loss during construction to less than the allowable soil loss rate applicable to the area as shown in Figure 5. Soil loss during construction shall be determined using the Universal Soil Loss Equation (USLE) as provided in the reference "Erosion and Sediment Control, Guide for Hawaii", (1981), included in § 1-8 Appendices. In lieu of detailed soil loss calculations for temporary erosion control measures the permittee may be allowed to submit the Large Site Minimum BMP checklist (Figure 4) for projects if the total area to be graded is less than 5 acres.

Category 5 ***Projects Where the Total Area Including Any Areas Developed Incrementally That is to be Graded is More Than 5 Acres***

Category 5 projects shall submit a drainage and erosion control plan. The temporary erosion and sediment control measures included in the drainage and erosion control plan must be designed to limit soil loss during construction to less than the allowable soil loss rate applicable to the area as shown in Figure 5. Soil loss during construction shall be determined using the Universal Soil Loss Equation (USLE) as provided in the reference "Erosion and Sediment Control, Guide for Hawaii", (1981), included in § 1-8 Appendices. Additionally, projects greater than 5 acres require coverage under the State Department of Health's General NPDES permit if there is storm water discharge to the municipal separate storm sewer system or state waters. Sediment basins providing 3,600 cubic feet of storage per acre, or equivalent measures, are required for all projects larger than 10 acres which discharge storm runoff to the municipal separate storm sewer system or state waters.

1-3.2 SPECIAL REQUIREMENTS FOR ALL PROJECTS THAT DISCHARGE, DIRECTLY OR INDIRECTLY, INTO CLASS I OR CLASS AA WATERS

For any project, regardless of its category, that could discharge into Class I or Class AA waters, either directly or indirectly, consideration should be given to BMP measures that would greatly reduce or eliminate the impacts of any discharge. These measures could include items such as upstream and downstream monitoring, larger or additional sedimentation basins, grass lined swales, mulching of exposed areas or other BMPs as shown within these standards. The city and County of Honolulu Department of Planning and Permitting may also require additional BMP measures after review of the Soil Erosion Control Plan, if it deems them necessary. Figure 6 is the Water Quality map of Oahu which designates the Class 1 and Class AA waters.

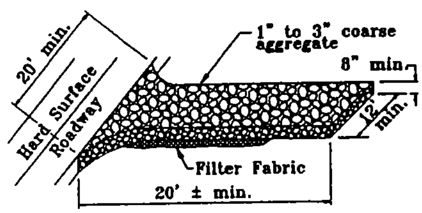
Ultimately, the contractor and/or engineer and/or developer shall be held responsible for reducing or eliminating impacts of any discharge to Class I or Class AA waters. If the installed BMPs are not adequate to maintain the water quality of the Class I or Class AA waters, the contractor and/or engineer and/or developer shall be required to implement additional measures to ensure the water quality standards of the designated waters.

[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

FIGURE 3

MINIMUM BMP CHECKLIST FOR SMALL PROJECTS

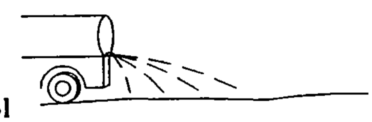
Stabilized Construction Entrance



- □ STABILIZED CONSTRUCTION ENTRANCE
  All points of egress and ingress to a site shall be protected with a stabilized construction entrance.

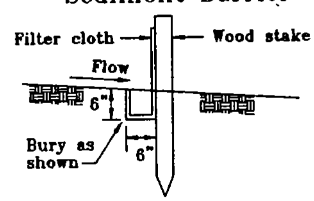
- □ STOCKPILES
  Stockpiles shall not be located in drainage ways or other areas of concentrated flows. Sediment trapping devices such as fences, traps, basins or barriers shall be used around the base of all stockpiles.

Dust Control



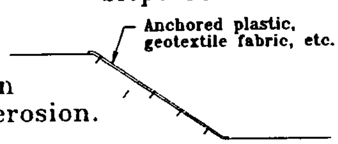
- □ DUST CONTROL
  Dust control should be applied to reduce dust emissions. The Contractor, at his own expense, shall keep the project area and surrounding area free from dust nuisance. The work shall be in conformance with the air pollution control standards contained in Hawaii Aministrative rules: Chapter 11-60, "Air Pollution Control".

Sediment Barrier



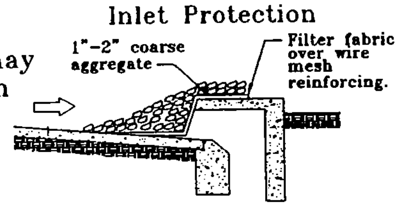
- □ SEDIMENT BARRIERS OR TRAPS
  Sediment trapping devices such as fences, traps, basins or barriers shall be used down slope of all disturbed areas and around the base of all material stockpiles.

Slope Protection



- □ SLOPE PROTECTION
  Surface flow from above an exposed slope shall not be allowed to flow over the slope without protection. Slope protection shall be used on areas with slopes greater than 50% and on areas of moderate slopes that are prone to erosion.

Inlet Protection



- □ INLET PROTECTION
  All storm drain inlets on site, and those offsite which may receive runoff from the site shall use an inlet protection device.

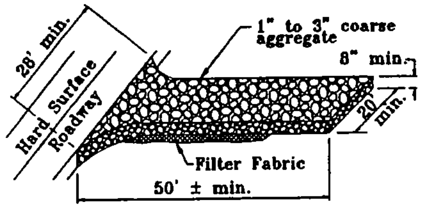
- □ TEMPORARY STABILIZATION
  Is not required when the disturbed area will be worked within a 14 day period. Stabilization is required for disturbed areas at final grade and for those areas that will not be worked within a 14 day period.

- □ PERMANENT STABILIZATION
  All disturbed areas shall be permanently stabilized prior to removing erosion and sediment measures. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed. Trapped sediment and areas of disturbed soil which result from the removal of the temporary measures shall be immediately permanently stablilized.

FIGURE 4
MINIMUM BMP CHECKLIST FOR LARGE PROJECTS

Base Measures

Stabilized Construction Entrance



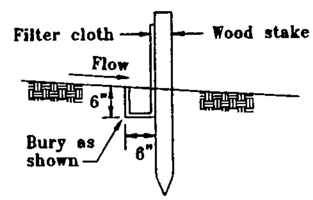
- ☐ **STABILIZED CONSTRUCTION ENTRANCE**
  All points of egress and ingress to a site shall be protected with a stabilized construction entrance.

- ☐ **STOCKPILES**
  Stockpiles shall not be located in drainage ways or other areas of concentrated flows. Sediment trapping devices such as fences, traps, basins or barriers shall be used around the base of all stockpiles.

Dust Control

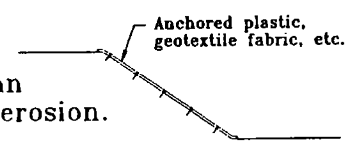
- ☐ **DUST CONTROL**
  Dust control should be applied to reduce dust emissions. The Contractor, at his own expense, shall keep the project area and surrounding area free from dust nuisance. The work shall be in conformance with the air pollution control standards contained in Hawaii Aministrative rules: Chapter 11-60, "Air Pollution Control".

Sediment Barrier



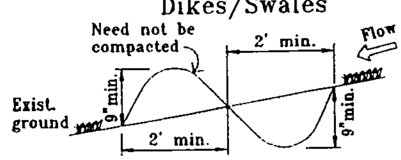
- ☐ **SEDIMENT FENCE/BARRIER AT TOE OF DISTURBED AREA OR STOCKPILE**
  Sediment fences or barriers shall be used down slope of all disturbed areas or stockpile areas.

Slope Protection



- ☐ **SLOPE PROTECTION**
  Surface flow from above an exposed slope shall not be allowed to flow over the slope without protection. Slope protection shall be used on areas with slopes greater than 50% and on areas of moderate slopes that are prone to erosion.

Temporary Interceptor Dikes/Swales

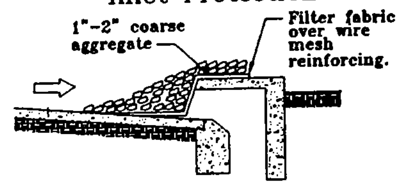


Cross section

- ☐ **TEMPORARY INTERCEPTOR DIKES/SWALES AROUND ACTIVE WORK AREA**
  Temporary interceptor dikes and swales shall be installed around the active work areas to intercept storm water runoff from drainage areas above unprotected slopes and direct to a stabilized outlet and also to prevent runoff from leaving the disturbed site.

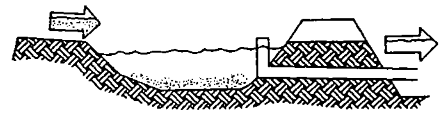
FIGURE 4
MINIMUM BMP CHECKLIST FOR LARGE PROJECTS

Inlet Protection



□ INLET PROTECTION
All storm drain inlets on site, and those offsite which may receive runoff from the site shall use an inlet protection device.

□ SEDIMENT BASIN
A sediment basin shall be created by excavation or by constructing an embankment. The basin shall be designed to retain or detain runoff to allow excessive sediment to settle.



Wet Weather Measures

□ ESTABLISHED GRASS
Grass shall be established on disturbed areas which are at final grade or will not be worked for longer than 14 days. Alternatives to grass include 2" minimum straw mulch cover, erosion blankets with anchors, 6-mil plastic sheets, sedimemt traps or ponds, or interceptor dikes/swales.

Post Construction Measures

□ ESTABLISHED GROUND COVER
Established ground cover or landscape prior to removing erosion control measures.

Notes: The maximum period of exposure shall not exceed 14 days. Areas which will be exposed shall be temporarily seeded or stabilized before this period. If after 14 days, the temporarily seeded areas have not attained 98% cover, these areas shall be re-seeded.

Slopes steeper than 1:3 (vertical:horizontal) shall be sodded or mulched and seeded. Until the slopes are stabilized a sediment fence or barrier shall be installed at the toe of the slope and on contours at spacings not to exceed 25'.

Cut and fill slopes shall be protected in 5' vertical sequential increments as construction progresses.

All earth basins, traps, berms, diversions, waterways, swales, ditches and related structures should be stabilized immediately after they are built. Before a stormwater conveyance structure is made operational, adequate outlet protection and any required lining shall be installed or established.

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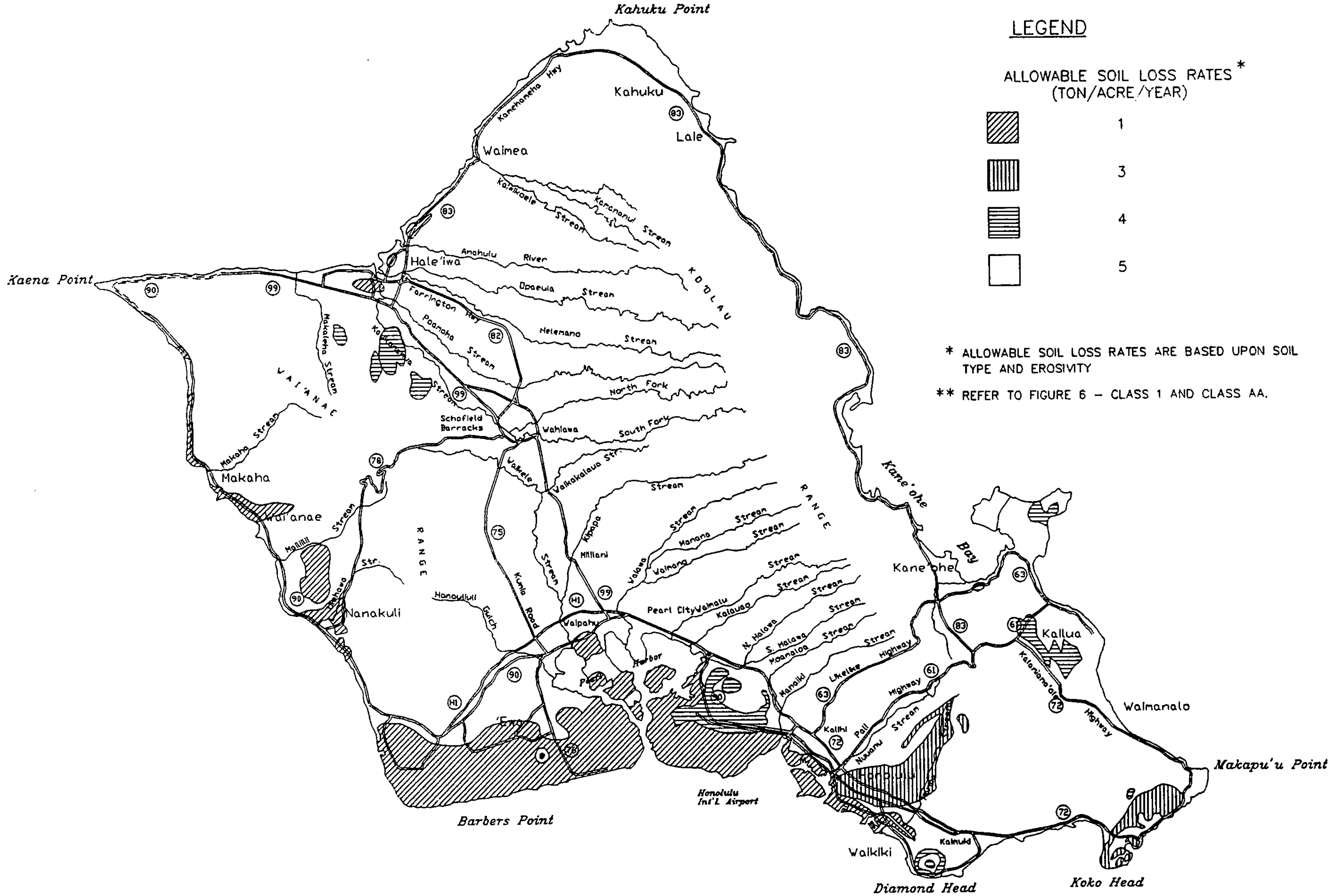

FIGURE 5 – ALLOWABLE SOIL LOSS RATES FOR THE ISLAND OF OAHU (TON/ACRE/YEAR)
(SOURCE: SOIL SURVEY OF ISLANDS OF KAUAI, OAHU, MAUI, MOLOKAI, AND LANAI, STATE OF HAWAII, 1972)

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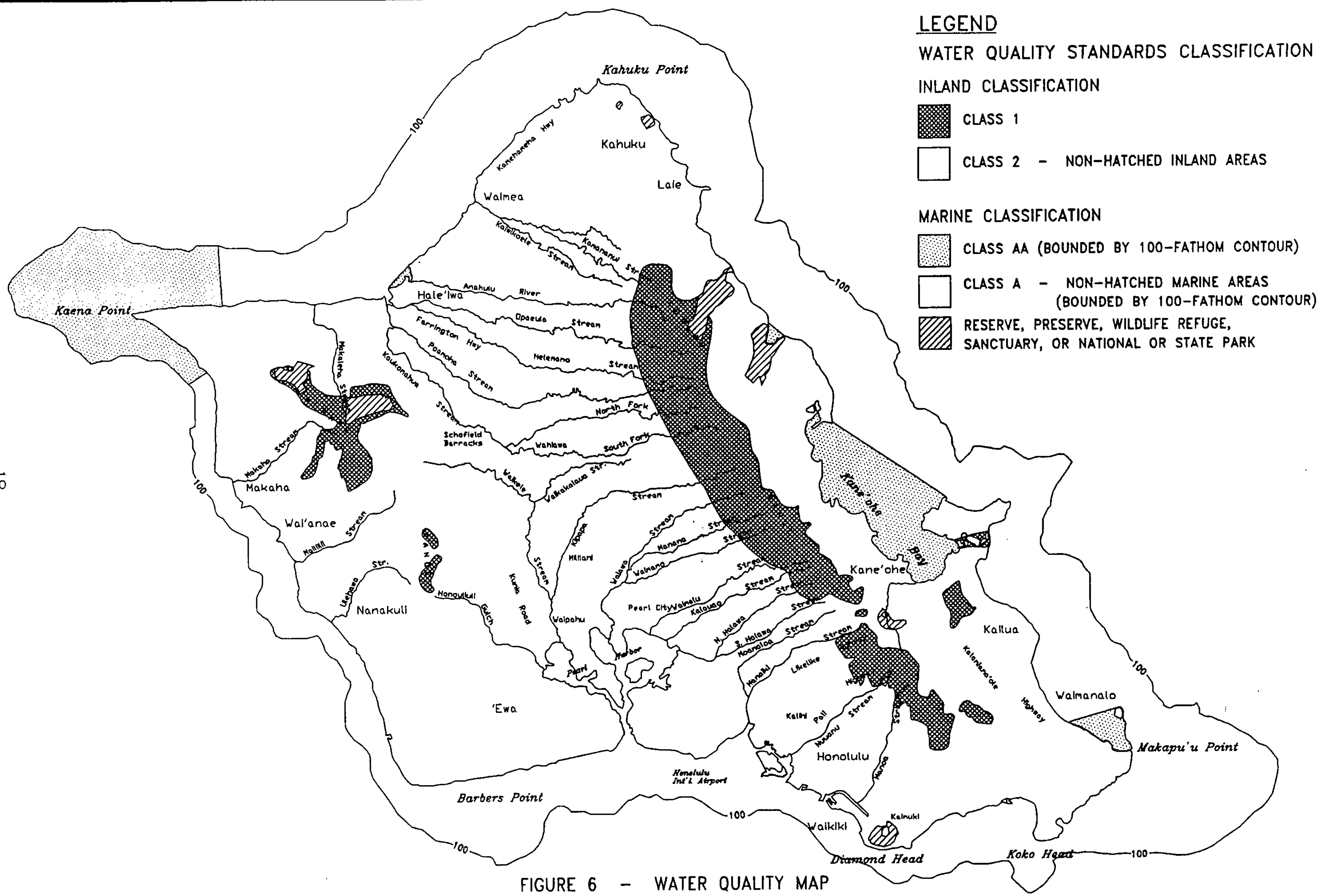


FIGURE 6 - WATER QUALITY MAP
(SOURCE: WATER QUALITY STANDARDS MAP OF THE ISLAND OF OAHU, 1987. STATE OF HAWAII DEPARTMENT OF HEALTH)

SC2430AS

§ 1-4 EROSION CONTROL PLANNING

Erosion control planning should occur concurrently with the planning for the development of a project. Adding erosion and sediment control measures after the project has been planned can make the task more difficult.

1-4.1 DEVELOPMENT OF EROSION CONTROL PLANS

Erosion control plans are required by Section 14-14.2(c)(1) of the Revised Ordinance of Honolulu (ROH) for the following projects:

a) The total area including any areas developed incrementally that is to be graded is 15,000 square feet or more for single-family or two-family dwelling uses;

b) The total area including any areas developed incrementally that is to be graded is 7,500 square feet or more for other uses;

c) In the event a proposed cut or fill is greater than 15 feet in height for single-family or two-family dwelling uses; or

d) In the event a proposed cut or fill is greater than 7.5 feet in height for other uses.

The erosion control plan may be developed as a separate document or incorporated with maps and plans for the development and identified as the "Erosion Control Plan". Erosion control plans shall be stamped by an engineer.

The required components of an Erosion Control Plan can be grouped into four areas:

- Administrative requirements
- Existing site conditions
- Site conditions during construction
- Site conditions at final stabilization

A construction schedule shall be included in the Erosion Control Plan. The schedule shall show which areas are to be disturbed, the scheduled dates for the estimated start of work and the estimated completion dates for the clearing, grading, installation of drainage facilities and installation of erosion and sediment control measures. In the case where events beyond the control of the developer or contractor require changes in the construction schedule, an amended or revised schedule and changes to the Erosion Control Plan (if necessary) shall be submitted for approval and made a part of the Erosion Control Plan.

The Erosion Control Plan shall also list and describe the erosion and sediment control measures to be used and a narrative explaining the erosion and sediment control system shall be included. Erosion and sediment control measures shall be located and shown on a map. Plans, details and designs shall be included for erosion and sediment control measures such as sediment basins, filter fabric barriers, filter berms, mulching waterways, swales and other measures. For vegetative stabilization methods the plan shall also show the species of seed or planting materials, and planting method, amendments to be applied, provisions for mulching, netting or irrigation as required.

A copy of the Erosion Control Plan shall be available on the job site at all times.

A sample Erosion Control Plan is presented in § 1-8 Appendices for illustrative purposes.

1-4.2 ADMINISTRATIVE REQUIREMENTS

Administrative requirements are used to determine the purpose of the project, the status of the project with relation to other applicable Federal, State and City regulations and to determine responsible parties on the applicant's part.

The administrative requirements are:

1. Names and Addresses of the owner or owners of the properties and lessee or lessees.

2. Names, Addresses and Telephone Numbers of the permittee(s).

3. Name, Address and Telephone Number of the person responsible for the work to be performed; and persons, contractors, and/or employees responsible for requesting the inspection required herein.

4. A Vicinity Map or Plan adequately indicating the site location; property lines, easements and setbacks of the property or properties on which the work is to be performed, the location of any buildings, structures and improvements on the property where the work is to be performed and the location of any building or structure on any adjacent property which is within 15 feet of the property to be graded when the grading may affect the building or structure; elevations, dimensions, location, extent and the slopes of all proposed grading shown by contours and/or other means; the area in square feet of the land to be graded; the quantities of excavation and fill involved; and the location of any streams, waterways and wetlands.

5. Location of project by TMK, street address and location maps, development plan land use map designation and zoning designation of any property that will be subject to the permit.

6. The purpose of the grading work in terms of use or structure permitted on the zoning lot under Chapter 21, Revised Ordinances of Honolulu.

7. Environmental Assessment, or Environmental Impact Statement if one was required for the project.

8. If the use or structure for which the grading work is being done requires a conditional use permit, plan review use resolution, planned development approval, site plan review permit, special district permit, special management area use permit or special management area minor permit, the applicant shall include a copy of the applicable permits, approvals and resolutions. If the use or structure for which the grading work is being done requires an amendment to any permit, resolution or approval referred to above, the applicant shall include a copy of the amendment.

1-4.3 EXISTING SITE CONDITIONS

In order for the City to evaluate the erosion and sediment control measures used by a project, the applicant shall submit information regarding existing site conditions, as well as conditions in areas adjacent to the project site, so that the impact of the project activities can be evaluated. Important information which shall be provided by the applicant are:

1. Soil types, depth and slope from the SCS's soil survey for Oahu (USDA, SCS, 1972).

2. Soil erodibility (K), and existing average annual soil loss rates, and a description of any changes in the land use within the last two years.

3. The amount of runoff generated by the design storm from the project site as well as from areas upslope from the project site.

4. Soils report and soils recommendations for the site if a soils investigation has been made. This shall be required of the larger projects, especially where land use has changed from preservation or agriculture.

5. Topographic map with existing contour intervals at same scale as grading plans including adjacent acres. Enough information shall be provided to determine the drainage runoff characteristics from off site and from on site to adjacent areas. Existing drainage patterns shall be shown.

6. Existing land use, structures, impervious areas and vegetation. This shall include existing permanent erosion and sediment control structures.

7. Location of nearby streams, channels, drainage structures. These can be provided on a map of a different scale. The location of the 100-year flood plain shall also be shown, using Plate 6 of the City's Storm Drainage Standards.

1-4.4 CONSTRUCTION SUBMITTAL REQUIREMENTS

The applicant shall be required to provide plans and narratives which can be used by the City to evaluate the effectiveness of the Erosion Control Plan. These plans and narratives shall explain how the erosion and sediment control system works to meet the allowable soil loss rate standard, where and how runoff from the site is to be monitored for turbidity and how minimum BMPs are being met. To do this, these plans and narratives shall include:

1. Detailed construction plan and construction information.

2. Construction schedules and phasing of construction activities.

3. Schedule of monitoring and maintaining erosion and sediment control measures.

4. Emergency planning which addresses the erosion and sediment control system.

5. Narrative which explains the erosion and sediment control system, including dimensions and how each measure is designed to work individually and as a system.

1-4.4.1 Erosion Control Drawing

A detailed erosion control drawing and construction information are required to assess the erosion control measures and to ascertain that measures are being properly employed. For that reason, the Erosion Control Plan shall include:

1. A plan showing the sequence and time frame of earth disturbing activities and the construction of erosion control measures.

2. A topographic map showing contour intervals at various phases of construction at the same scale and contour interval as that provided for existing topographic information. The map shall also show the limits of disturbance.

3. The expected soil loss rates for the project site. The total estimated soil loss shall include sheet and rill erosion (via USLE) plus concentrated flows (e.g., ephemeral gullies which must be estimated as no model is available).

4. Expected runoff flows at the design storm for the various construction phases.

5. Location of construction entrances, access points, roads, equipment fueling areas, fuel storage areas, material storage areas, stockpiles and disposal areas. The erosion control drawing shall also address erosion control for stockpiles and disposal areas located off-site.

6. There shall also be a narrative explaining how areas outside grading or construction limits are to be protected.

7. The topographic map shall also show the location of erosion and sediment control measures (ESCM) including a legend of the symbols used. The erosion control submittal shall also include a brief narrative explaining how the ESCM will work together to prevent erosion and to prevent sediment from leaving the project site. A plan for the inspection and maintenance of the erosion and sediment control measures shall also be submitted. Design calculations for the ESCM as appropriate, calculations for soil loss and calculations for runoff.

8. Description of Materials to be used in the construction of erosion and sediment control measures.

9. A Schedule for the removal of temporary erosion control methods, an explanation of how trapped sediment will be disposed of and affected areas stabilized.

1-4.4.2 Scheduling, Time Frame, and Sequencing of Construction

A schedule of construction phasing and activities is necessary to determine the area of land which will be disturbed at any point in the project and the expected soil loss from the disturbance. The scheduling for the construction of erosion control measures, the construction of drainage structures, and any activity which may impact drainage patterns on the project site are also important. The construction schedule shall include:

1. The estimated date of commencement of work;

2. The estimated duration for rough grading and grubbing operations;

3. The estimated duration for temporary erosion and sedimentation control measures and drainage structures;

4. The estimated duration for any work in sensitive areas such as streams, existing drainageways, wetlands etc.; and

5. The estimated time to complete all permanent vegetation and landscaping.

The following is the most desirable sequence of operations in the normal development and should be followed unless conditions make it impractical. If this is the case, a sequence that will provide the most effective erosion control must be developed and included in the drainage and Erosion Control Plan.

1. Construct lined channels or other major outlets for the permanent drainage system.

2. Install sediment basins, if any are planned.

3. Construct temporary interceptor ditches, dikes, or berms as needed to direct run-off into sediment basin.

4. Clear and grub remainder of the site or first increment of grading. Where vegetation along lower boundary and drainage ways is suitable to serve as a filter strip (thick sod of tall grass is best), leave a strip or strips 15 feet or wider in place as long as possible.

5. When cleared and grubbed areas are not to be graded or disturbed for 60 days or more, seed, plant, or hydroseed temporary vegetation, unless remaining vegetation provides adequate protection.

6. Install remaining parts of permanent drainage system with temporary filter inlets.

7. Construct interceptor ditches, dikes, berms, with associated filter berms and filter inlets, or other temporary measures, as planned.

8. Grade the site, or first increment, as planned. Relocate, reconstruct and maintain structures in Item 7 above as needed to keep them effective at all times.

9. Build temporary dikes and outlets as needed to keep water from running down graded slopes.

10. Plant permanent vegetation according to landscaping plan on terraces, benches, and steep slopes as soon as grading is completed. Plant or seed temporary vegetative cover as planned.

11. Install temporary or permanent irrigation system for areas in Item 10 above. When a permanent irrigation system is planned, it should be installed prior to seeding.

12. Proceed with construction with least possible disturbance of vegetative areas and temporary structures.

13. Plant permanent ground cover according to landscaping plan as soon as possible.

14. Remove or dismantle temporary erosion control structures after full establishment of permanent vegetative cover and permanent erosion control measures (if required).

1-4.4.3 Monitoring and Maintenance of Erosion and Sedimentation Control Measures

The applicant shall also be required to submit a schedule for the monitoring and maintenance of erosion and sedimentation control measures (ESCM). The name and phone number and means of contacting the individual responsible for the maintenance shall be provided. The responsible individual shall also be required to maintain a log of which ESCM was inspected, the time and date, any actions taken to maintain the ESCM, and any actions which need to be scheduled to maintain the ESCM.

When the required work is completed, a notation of the starting and finishing dates for the work shall be annotated into the inspection log. The responsible person shall also log, as necessary, the quantities and disposal site for sediment removed from an ESCM. The erosion and sedimentation control plan shall also include an emergency maintenance and repair plan for the ESCMs.

A plan for the long term monitoring and maintenance of permanent erosion control measures shall be submitted. The plan shall include the person or organization responsible for the monitoring and maintenance, the areas required for access to the permanent erosion control measures, the equipment, material and manpower requirements, the frequency and method of inspection, and any other information necessary to assess the monitoring and maintenance requirements.

1-4.4.4 Emergency Planning

Many of the erosion and sediment control measures (ESCMs) are designed for particular rainfalls and flows. Occasionally, the design storms and flows can be exceeded, leading to the failure of some of the ESCMs. The Erosion Control Plan shall also address emergency measures and site specific BMPs to be used to prevent excessive erosion and soil loss. The emergency planning shall address the availability of required equipment, personnel and materials. The emergency planning shall also provide the name, phone numbers and method of contacting the person responsible for the implementation of the emergency work. Alternate contacts shall be provided. The City shall be kept updated if the emergency plans or responsible individuals are changed.

1-4.5 FUTURE (PERMANENT) CONDITIONS

A complete Erosion Control Plan shall include the following items for future conditions:

1. Finished contours.
2. The location of all permanent buildings, structures and impervious areas.
3. The location and type of plantings for all permanently vegetated areas.
4. The planned drainage patterns, the location of permanent drainage structures and permanent ESCM.

5. Expected storm runoff flows and soil loss rates related to the finished project.

6. Schedule of maintenance for permanent erosion control facilities. Name of person(s) responsible for maintenance.

[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

§ 1-5 GUIDELINES FOR EROSION CONTROL MEASURES

Best Management Practices (BMPs) are any one of the physical, structural, or managerial practices used to prevent or reduce water pollution. This section presents the recommended temporary and permanent BMPs for construction activities. A summary of the BMPs and their respective advantages and disadvantages is provided in Table 1. Further design guidance is available in publications listed in the reference section of this report. The reference section includes recommended resource materials and is not mandatory.

1-5.1 PHYSICAL OR STRUCTURAL BMPs

Plastic, Geotextile Covering, Etc.

Temporary plastic or geotextile covering consists of securely anchored sheets which prevent rainfall and runoff from contacting areas of disturbed soils.

Plastic or geotextile covering is used to provide immediate erosion protection to slopes, stockpiles and other disturbed areas when vegetative cover cannot be achieved due to poor soils, steep slopes, or weather conditions. Other materials such as geomembranes, geonets, geocomposits, natural vegetation, and stone blankets may also be used.

Dust Control

Dust control is a temporary measure used to stabilize soil and protect soil from wind erosion, and to reduce the dust generated from land disturbance, demolition and construction activities. Dust which settles on both on-site and off-site surfaces may be carried by runoff into waterways. Different forms of dust control consists of the following: vegetative cover; mulch; spray on adhesives; calcium chloride; sprinkling; stones; topsoiling; and barriers.

Vegetative Stabilization

Vegetative stabilization measures use plants to cover disturbed and exposed soils to protect the soil from the forces which cause erosion. Vegetative stabilization can be either temporary or permanent. When soil is stabilized with vegetation, the soil is less likely to erode and more likely to allow infiltration of rainfall, thereby reducing the sediment loads and runoff to areas downslope.

Table 1 RECOMMENDED STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

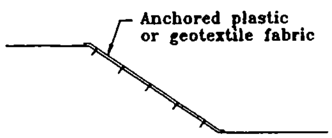
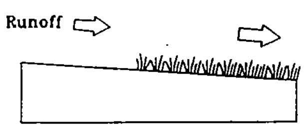
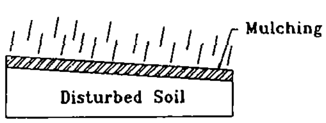
Figures	Category 1	Category 2	Category 3	Category 4	Category 5	Advantages	Disadvantages
Plastic or Geotextile Covering 	X	X	X[1]	X[1]	X	Easy to place and remove. Protects high risk areas from temporary erosion.	Provides only temporary protection. When cover is removed, the soil may require additional protection.
Dust Control 	X	X	X	X	X	Stabilizes soil from wind erosion and reduces dust generated by land disturbing activities.	Must be maintained continuously during construction until all construction areas area stabilized.
Vegetative Stabilization 			X	X	X	Protects barren soil from erosion. Promotes infiltration.	Needs to be irrigated and maintained.
Mulching 			X[1]	X[1]	X	Protects soil from rainfall impact. Increases infiltration. Aids in plant growth for seedlings and plantings by holding the fertilizers and topsoil in place until growth occurs.	Needs to be irrigated and maintained.

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Table 1 RECOMMENDED STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

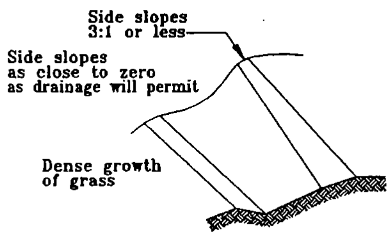
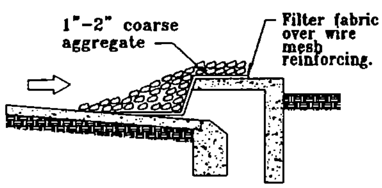
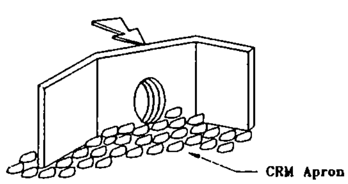
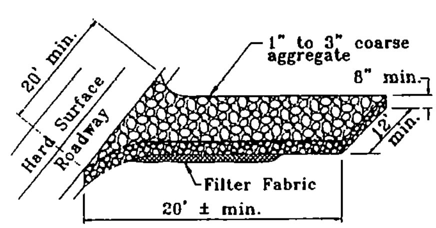
Figures	Category 1	Category 2	Category 3	Category 4	Category 5	Advantages	Disadvantages
Grassed Swale 					X	Requires minimal land area. Economical.	Low pollutant removal rates.
Storm Drain Inlet Protection 	X	X	X	X	X	Prevents sediment from entering inlet structures.	Needs to be replaced or repaired immediately when clogged.
Outlet Protection 					X	Reduces the speed of concentrated storm water. Reduces erosion or scouring at outlets and paved channel sections.	Needs to be inspected after high flows. Repairs should be made immediately.
Stabilized Construction Entrance (Small Projects) 	X	X	X	X	X	Reduces or eliminates the tracking of sediment onto public right-of-ways or streets.	Should be removed within 30 days after final site stabilization is achieved.

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Table 1 RECOMMENDED STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

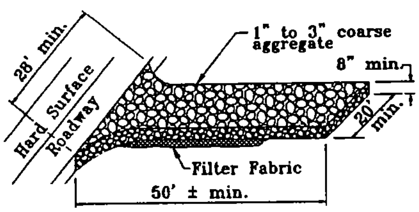
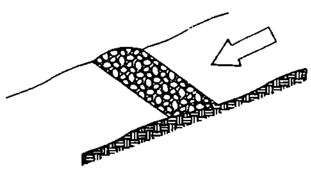
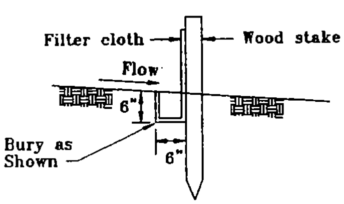
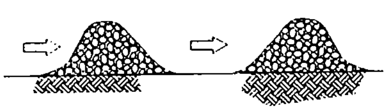
Figures	Category 1	Category 2	Category 3	Category 4	Category 5	Advantages	Disadvantages
Stabilized Construction Entrance (Large Projects) 			X	X	X	Reduces or eliminates the tracking of sediment onto public right-of-ways or streets.	Should be removed within 30 days after final site stabilization is achieved.
Filter Berm 			X	X	X	Efficient method of sediment removal.	More expensive to install than other BMP's which use use materials found on-site. Regular inspection is required.
Silt Fence or Filter Fabric Fence 	X	X	X	X	X	Detains sediment.	Sediment must be removed as needed.
Check Dams 					X	Reduce the velocity of concentrated storm water. Aids in sediment capture. Reduces erosion.	Drainage area above the check dam cannot exceed two acres. Needs to be checked after every storm. Could remain in place for up to 30 days after site stabilization.

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Table 1 RECOMMENDED STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

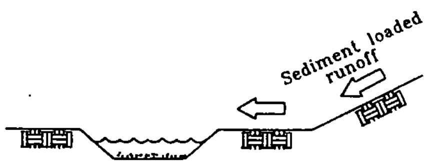
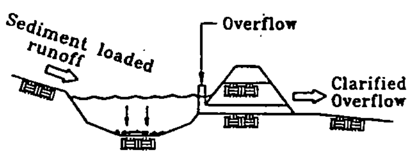
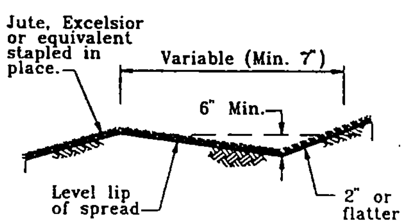
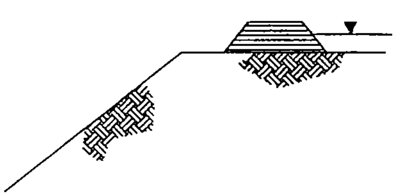
Figures	Category 1	Category 2	Category 3	Category 4	Category 5	Advantages	Disadvantages
Sediment Trap 			X	X	X	Sediment will not cause clogging of downstream impoundments and other facilities.	Not suitable for areas greater than 5 acres. Only practical in removing sediment to about the medium silt size. Must be continually monitored and regularly maintained.
Sediment Basin  * See "Erosion & Sediment Control Guide for Hawaii - 1985"					X	Capable of trapping smaller sediment particles than sediment traps.	May become an attractive nuisance". Inspection should be made regularly, especially after large storms.
Level Spreader 					X	Converts channelized flow into sheet flow. Simple to construct.	The area below the spreader should have a slope of 10% or less and should not re-concentrate the runoff after release.
Containment Dike 			X	X	X	Practical, inexpensive method to divert runoff from erosive areas.	Should be inspected after every storm event.

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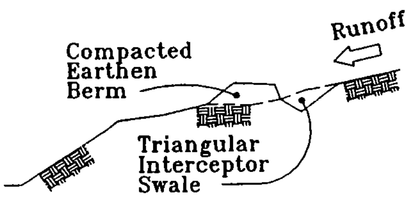
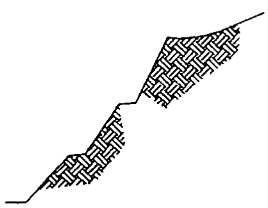
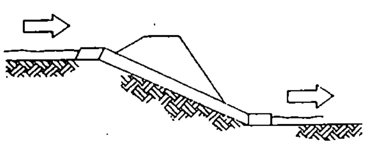
Table 1 RECOMMENDED STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

Figures	Category 1	Category 2	Category 3	Category 4	Category 5	Advantages	Disadvantages
Interceptor Dikes and Swales 			X	X	X	Channels runoff away from high risk erosion areas. Converts sheet flow into channelized flow.	Should be inspected after every storm event. Disturbed material is easily eroded.
Gradient Terraces or Benches 					X	Reduce erosion damage by capturing surface runoff and directing it to a stable outlet at a velocity that minimizes erosion.	Use is usually limited to long, steep slopes with a water erosion problem. Should not be constructed on sandy or rocky slopes.
Pipe Slope Drain 					X	Reduces erosion on slopes.	Needs to be used in conjunction with a runoff collection device. Should be inspected after every storm.

[1] Alternative to vegetation stabilization
[2] Alternative to silt fence

SC2430AJ

Mulching

Mulching is the practice where material is applied to the soil to protect the soil from rainfall impact erosion, to increase infiltration, to conserve moisture around vegetation, to prevent the compaction and cracking of the soil, and to aid in the growth of plants by holding seeds, fertilizer and topsoil in place until the plants can be established. Mulching is used as a method of temporarily stabilizing areas, and in assisting vegetative methods of permanently or temporarily stabilizing areas. Different types of mulches include: straw; wood chips; bark; wood fibers; other organic materials; and gravel.

Mulch blankets are designed to be used in swales, ditches, steep slopes, and other critical areas. Mulch blankets can be made of excelsior blanket, glassroot, jute netting, or conwed turf establishment blanket.

Grassed Swale

Grassed swales are temporary drainage swales which are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment basins or traps. Grassed swales are also used to filter suspended sediment which is being transported with the runoff.

Storm Drain Inlet Protection

Storm drain inlet protection is a filtering measure placed around any inlet or drain to trap sediment. This temporary mechanism prevents sediment from entering inlet structures. Additionally, it serves to prevent the silting-in of inlets, storm drainage systems, or receiving channels. Inlet protection may be composed of gravel and stone with a wire mesh filter, block and gravel, filter fabric, sandbag, curb, or sod.

Outlet Protection

Outlet protection reduces the speed of concentrated storm water flows, and therefore reduces erosion or scouring at storm water outlets and paved channel sections. In addition, outlet protection lowers the potential for downstream erosion. This type of protection can be achieved through a variety of techniques, including stone or riprap, concrete aprons, paved sections, and settling basins installed below the storm drain outlet. Outlet protection can be used as either a temporary or a permanent structure.

Stabilized Construction Entrance

A stabilized construction entrance consists of a temporary stabilized pad of aggregate underlain with a filter cloth. The stabilized construction entrance shall be located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking lot. The purpose of the stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public right-of-ways or streets. Reduction in the tracking of sediments and other pollutants onto paved roads helps to prevent the deposition of sediments into local storm drains and the production of airborne dusts.

Filter Berm

A gravel or stone filter berm (water bar, rock filter berm) is a temporary ridge constructed of loose gravel, stone, or crushed rock. It slows and filters flow, diverting it from an exposed traffic area. Diversions constructed of compacted soil may be used where there will be little or no construction traffic within the right-of-way. Filter berms are also used for directing runoff from the right-of-way to a stabilized outlet.

Silt Fence or Filter Fabric Fence

A silt fence, also called a "filter fence, or filter fabric fence", is a temporary measure for sedimentation control. The silt fence usually consists of filter fabric stretched across a series of posts, and sometimes supported with a wire fence. The lower edge of the fence is vertically trenched and covered by backfill to anchor the fabric. A silt fence is used in small drainage areas to detain sediment. These fences are most effective where there is overland flow (runoff that flows over the surface of the ground as a thin, even layer), or in minor swales or drainageways. The fences prevent sediment from entering receiving waters.

Aside from the traditional wooden post and filter fabric method, there are several variations of silt fence installation. For example, silt fences can be purchased with pre-sewn pockets where steel fence posts can be inserted.

Check Dams

Check dams are small temporary dams constructed across a swale or drainage ditch. Check dams reduce the velocity of concentrated stormwater flows, thereby reducing erosion of the swale or ditch. The dams also decrease water velocity to increase sediment capture.

Sediment Trap

A sediment trap is a small area, usually with a gravel outlet formed by excavation and/or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared and/or graded during construction. It is intended for use on small drainage areas with no unusual drainage features. It should help in removing coarse sediment from runoff.

The sediment trap is a temporary measure with a design life of approximately six months, and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment Basin

A sediment basin (or pond) is a temporary settling pond with a controlled storm water release structure used to collect and store sediment produced by construction activities. A sediment basin can be constructed by excavation and/or by placing an earthen embankment across a low area or drainage swale. Sediment basins can be designed to maintain a permanent pool or to drain completely dry. The basin detains sediment-laden runoff from large drainage areas long enough to allow most of the sediment to settle out.

Level Spreader

A level spreader is a non-erosive temporary outlet for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope. The purpose of the level spreader is to turn small concentrated flows into low velocity sheet flow to reduce the risk of erosion.

Containment Dike

A containment dike is a ridge of soil constructed completely around the perimeter of a small level area such as a house pad. The purpose of a containment dike is to prevent runoff by holding all rain falling within the diked area and allowing it to infiltrate the underlying soil.

Interceptor Dikes and Swales

Interceptor dikes (ridges of compacted soil) and swales (excavated depressions) are used to keep upslope runoff from crossing areas where there is a high risk of erosion. They reduce the amount and speed of flow, and guide the flow to a stabilized outfall (point of discharge) or sediment trapping area. Intercepter dikes and swales divert runoff using a combination of earth dike and vegetated swales. Runoff is channeled away from locations where there is a high risk of erosion by placing a diversion dike or swale at the top of sloping disturbed area. Dike and swales collect overland flow, changing it into concentrated flows. Interceptor dikes and swales can be either temporary or permanent storm water control structures.

Gradient Terraces or Benches

Gradient terraces are temporary or permanent earth embankments or ridge-and-channels constructed along the face of a slope at regular intervals. Gradient terraces are constructed at a positive grade. They reduce erosion damage by capturing surface runoff and directing it to a stable outlet at a speed that minimizes erosion.

Pipe Slope Drain

A pipe slope drain reduces the risk of erosion by discharging runoff to stabilized areas. Pipe slope drains are made of either flexible or rigid pipe, and carry concentrated runoff from the top to the bottom of a slope that has already been damaged by erosion, or is at high risk for erosion. They are also used to drain saturated slopes that have the potential for soil slides. Pipe slope drains can be either temporary or permanent depending on the method of installation and material used.

1-5.2 CHEMICAL STABILIZATION

Chemical stabilization practices are often referred to as chemical mulch, soil binder, or soil palliative. These practices are temporary erosion control practices. Materials made of vinyl, asphalt, or rubber are sprayed onto the surface of the soil to hold the soil in place, and to protect against erosion from storm water runoff and wind. Chemical stabilization is easily applied, effective in stabilizing areas where plants will not grow, and provides immediate protection to soils that are in danger of erosion. However, chemical stabilization may create water quality problems if not properly applied, and is usually more expensive than vegetative cover.

Many of the products used for chemical stabilization are human-made, and many different products are on the market. The type and quantity of the product used should not result in a storm water pollution problem.

The U.S. EPA, State Department of Health, or State Department of Agriculture approval must be received for the specific proposed use of any chemical stabilization product.

[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

§ 1-6 REPEAL

The City and County of Honolulu's Soil Erosion Standards and Guidelines, dated November, 1975, are repealed.

[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

§ 1-7 REFERENCES

1. Atlanta, Georgia, *An Ordinance Amended to the Erosion and Sedimentation Act of 1975.*

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[Eff: APR 8 1999 *] (Auth: Sec 14-14.2(c)(1), ROH) (Imp: Sec 14-14.2(c)(1), ROH).*

§ 1-8 APPENDICES

1-8.1 ESTIMATING SOIL LOSS

The Universal Soil Loss Equation (USLE)[1] is designed to estimate longtime average annual soil losses from sheet and rill erosion. It can be used to estimate erosion on farm fields, construction sites and other areas.

The USLE is useful in evaluating the need for conservation measures. Soil losses from a field can be estimated for the present condition or for a future condition, for example, after erosion control measures are applied. Thus, conservation measures can be selected to reduce erosion to an acceptable level.

The soil loss equation is

$$A = R\,K\,L\,S\,C\,P$$

where

- A is the computed soil loss per unit area (tons per acre per year)
- R is the rainfall factor
- K is the soil erodibility factor
- L is the slope-length factor)
  > = combined LS value
- S is the slope-gradient factor)
- C is the cover and management factor
- P is the erosion control practice factor

Soil losses calculated with the USLE are the best available estimates for sheet and rill erosion. They should be regarded as estimates, not absolutes. These amounts are expressed as average annual soil loss over a number of years. The amount of erosion occurring in any one year may be more or less than the average. The USLE does not apply to erosion caused by heavy concentration of run-off water, for example, gully and streambank erosion.

1-8.1.1 Applying the Soil Loss Equation

To calculate average annual soil loss A from a field, select R, K, LS, C and P values for the particular field from appropriate maps and tables. Use the following procedure:

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[1] Detailed information on the universal soil loss equation is in the following publications:

a. U.S. Department of Agriculture, *Predicting Rainfall Erosion Losses - A Guide to Conservation Planning*, Agricultural Handbook No. 537, Science and Education Administration, December 1978.

b. U.S. Department of Agriculture, "Procedure For Computing Sheet and Rill Erosion On Project Areas," *Technical Release* No. 51 (Rev.), Soil Conservation Service, January 1975.

1. Determine rainfall factor R. R is the total erosive effect of an average year's rainfall. Value for this factor is to be obtained from the map, "Average Annual Values of Rainfall Factor, R." Values should be interpolated for points between lines.

   When the period of disturbance is to be less than 1 full year, or it is desired to calculate A for a shorter period than 1 year, it will be necessary to use the proper fraction of the R value. This can be determined by Percent of Erosive Rainfall Accumulation (For Leeward Sides or Windward Sides of Oahu, as applicable).

   Example: A site near Kaneohe, R = 350, to be cleared May 1 and fully protected by November 30.

%cumulative occurring up to November 30	=	0.86
%cumulative occurring up to May 1	=	0.47
		0.39

   The difference, or 0.39% is the fraction of the total R to be expected during the exposed period; therefore, 0.39% of 350 or 137 is the value of R to be used in the equation to determine A for this period.

2. Determine soil erodibility factor K.

   a. First, determine the soil from appropriate soil survey.[2]

   b. Obtain K for the soil using Table 14.

3. Determine slope-length and slope-gradient factors LS.

   a. First, determine slope length (feet) and gradient (percent) at the site. Slope length is defined as the distance from the point of origin of overland flow to the point where either the slope gradient decreases enough that deposition begins, or runoff water enters a well-defined channel that may be part of a drainage network or a constructed channel.

   b. Obtain LS value (L and S are combined and given as one value). Use Table 16.

4. Determine the appropriate protective effect of ground cover and management factor C using Tables 17 to 22.[3]

5. P is the factor for use of mechanical or engineering erosion control measures. Selection of this factor will require analysis of the grading and construction schedule, and erosion control plan for the project. Tables 23 and 24 describes various conditions for "P" values that may be applicable. The value chosen should be after careful analysis of planned conditions and application of the engineer's, planner's or contractor's best judgement.

6. Multiply the values R, K, LS, C and P obtained in the previous steps. The product A is the computed average annual soil loss expressed in tons per acre per year.

If 90 percent or more of the site is made up of one soil, calculate soil loss for the area based on that soil. If no soil occupies 90 percent or more of the site, calculate soil loss for each soil that makes up at least 10 percent of the area. Obtain a weighed average annual soil loss for the area. The soil loss equation can be used to evaluate erosion hazard for various periods of the year. This is useful on construction sites to determine the period of least hazard for land grading. To determine soil loss by periods, use one of the "Expected Monthly Distribution of Erosive Rainfall."

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[2] U.S. Department of Agriculture, *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, Soil Conservation Service, Aug. 1972. U.S. Department of Agriculture, *Soil Survey of Island of Hawaii, State of Hawaii*, Soil Conservation Service, Dec. 1973.

[3] If no controls of any kind are applied, the value of "C" or "P" shall be 1.0.

Table 14

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
ALE3	ALAELOA	0.10	5	B	I
ALF	ALAELOA	0.10	5	B	I
AME3	ALAELOA	0.05	5	B	I
ANE	ALAELOA	0.05	5	B	I
AaB	ALAE	0.10	5	A	IV
AcA	ALAE	0.10	5	A	IV
AcB	ALAE	0.10	5	A	IV
AeB	ALAELOA	0.10	5	B	I
AeC	ALAELOA	0.10	5	B	I
AeE	ALAELOA	0.10	5	B	I
BL	BADLAND	0.49	3	C	
BM	BADLAND	0.49	3	C	
BM	MAHANA	0.43	5	B	IV
BS	BEACHES	0.05	5	A	
BW	BLOWN-OUT LAND	0.17	2	B	
CO	COLLUVIAL LAND	0.10	5	B	
CR	CORAL OUTCROP	0.02	1	D	
DL	DUNE LAND	0.10	5	A	
EaA	EWA	0.17	5	B	II
EaB	EWA	0.17	5	B	II
EaC	EWA	0.17	5	B	II
EcA	EWA	0.15	5	B	II
EcB	EWA	0.15	5	B	II
EmA	EWA	0.17	3	B	II
EmB	EWA	0.17	3	B	II
EsA	EWA	0.17	5	B	II
EsB	EWA	0.17	5	B	II
EtB	EWA	0.15	5	B	II
EwA	EWA	0.15	5	B	II
EwB	EWA	0.15	5	B	II
EwC	EWA	0.15	5	B	II
FL	FILL LAND, MIXED	0.10	4	C	
Fd	FILL LAND	0.10	1	C	
GL	GULLIED LAND	0.37	5	C	
HID	HALAWA	0.10	4	B	II
HID3	HALAWA	0.10	4	B	II
HJE	HALAWA	0.17	4	B	III
HJF2	HALAWA	0.17	4	B	III
HKLD	HANA	0.05	3	A	I
HKMD	HANA	0.05	3	A	I
HKNC	HANA VARIANT	0.05	2	A	I
HKOC	HANA VARIANT	0.05	3	A	I
HLMG	HELEMANO	0.17	5	B	II
HMMF	HIHIMANU	0.17	5	B	III
HNUD	HULUA	0.05	2	D	I
HNUF	HULUA	0.05	2	D	I
HaB	HAIKU	0.10	5	B	I
HaC	HAIKU	0.10	5	B	I
HbB	HAIKU	0.10	5	B	I
HbC	HAIKU	0.10	5	B	I
HcB	HALEIWA	0.17	5	B	II

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
HdC	HALEIWA	0.10	5	B	II
HeA	HALEIWA	0.17	5	B	II
HeB	HALEIWA	0.17	5	B	II
HfB	HALII	0.10	5	B	I
HfC	HALII	0.10	5	B	I
HfD2	HALII	0.10	5	B	I
HfE2	HALII	0.10	5	B	I
HgB	HALIIMAILE	0.17	5	B	II
HgC	HALIIMAILE	0.17	5	B	II
HhB	HALIIMAILE	0.17	5	B	II
HhC	HALIIMAILE	0.17	5	B	II
HkC2	HALIIMAILE	0.15	5	B	II
HlB	HAMAKUAPOKO	0.10	5	B	I
HlC	HAMAKUAPOKO	0.10	5	B	I
HlC2	HAMAKUAPOKO	0.10	5	B	I
HmA	HANALEI	0.17	5	C	II
HnA	HANALEI	0.17	5	C	II
HnB	HANALEI	0.17	5	C	II
HoB	HANALEI	0.15	5	C	II
HpA	HANALEI	0.10	5	C	II
HrB	HANALEI	0.17	5	C	II
HsB	HANAMAULU	0.10	5	B	I
HsC	HANAMAULU	0.10	5	B	I
HsD	HANAMAULU	0.10	5	B	I
HsE	HANAMAULU	0.10	5	B	I
HtE	HANAMAULU	0.10	5	B	I
HuE	HANAMAULU	0.10	5	B	I
HvA	HOLOMUA	0.28	5	B	III
HvB	HOLOMUA	0.28	5	B	III
HvB3	HOLOMUA	0.28	5	B	III
HvC	HOLOMUA	0.28	5	B	III
HvC3	HOLOMUA	0.28	5	B	III
HwC	HONOLUA	0.10	5	B	I
HwD	HONOLUA	0.10	5	B	I
HxA	HONOULIULI	0.28	5	D	II
HxB	HONOULIULI	0.28	5	D	II
HyB3	HOOLEHUA	0.17	4	B	II
HzA	HOOLEHUA	0.17	5	B	II
HzB	HOOLEHUA	0.17	5	B	II
HzC	HOOLEHUA	0.17	5	B	II
HzE	HOOLEHUA	0.17	5	B	II
ISD	IO	0.20	5	B	IV
IaA	IAO	0.17	5	B	II
IaB	IAO	0.17	5	B	II
IbB	IAO	0.15	5	B	II
IbC	IAO	0.15	5	B	II
IcB	IAO	0.17	5	B	II
IcC	IAO	0.17	5	B	II
IoB	IOLEAU	0.10	5	C	I
IoC	IOLEAU	0.10	5	C	I
IoD2	IOLEAU	0.10	5	C	I

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
IoE2	IOLEAU	0.10	5	C	I
JL	BLOWN-OUT LAND	0.17	2	B	
JL	JAUCAS	0.10	5	A	IV
JaC	JAUCAS	0.10	5	A	IV
JcC	JAUCAS	0.10	5	A	IV
JfB	JAUCAS	0.10	5	A	IV
JkB	JAUCAS VARIANT	0.10	5	A	IV
KASD	KAHANUI	0.10	3	C	I
KATD	KAHANUI	0.10	3	C	I
KBID	KAILUA	0.05	5	A	I
KCXD	KAIMU	0.02	3	A	I
KDIE	KAIPOIOI	0.17	5	B	III
KDVE	KAIPOIOI	0.17	5	B	III
KDVE	ROCK OUTCROP	0.02	1	D	
KEHF	KALAPA	0.10	5	B	I
KEHF	ROCK OUTCROP	0.02	1	D	
KFID	KALAUPAPA	0.17	1	D	IV
KFID	ROCK OUTCROP	0.02	1	D	
KGKC	KAMAOLE	0.10	2	B	III
KGLC	KAMAOLE	0.10	2	B	III
KHMC	KANEOHE	0.10	5	B	I
KHME	KANEOHE	0.10	5	B	I
KHMF	KANEOHE	0.10	5	B	I
KHOF	KANEOHE	0.10	5	B	I
KIG	KAPAA	0.10	5	B	II
KKTC	KAPUHIKANI	0.10	2	D	II
KLUD	KAUPO	0.10	3	A	IV
KLVD	KAUPO	0.10	3	A	IV
KMW	KEALIA	0.17	5	D	IV
KNXD	KEAWAKAPU	0.10	3	B	II
KOYE	KEKAHA	0.10	5	B	III
KPZ	BADLAND	0.49	3	C	
KPZ	KEHOO	0.17	5	B	II
KRL	BADLAND	0.49	3	C	
KRL	KOELE	0.17	5	B	II
KRX	KOELE	0.17	5	B	II
KRX	ROCK OUTCROP	0.02	1	D	
KSKE	KOKEE	0.10	3	B	I
KSKF	KOKEE	0.10	3	B	I
KTKE	KOKOKAHI	0.10	5	D	II
KUL	KOLOKOLO	0.10	5	B	II
KVSB	KOOLAU	0.05	3	C	I
KVSE	KOOLAU	0.05	3	C	I
KZC	KUNUWEIA	0.05	5	B	I
KaB	KAENA	0.28	5	D	II
KaC	KAENA	0.28	5	D	II
KaeB	KAENA	0.17	5	D	II
KaeC	KAENA	0.17	5	D	II
KaeD	KAENA	0.17	5	D	II
KanE	KAENA	0.10	5	D	II
KavB	KAENA VARIANT	0.28	5	D	II

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
KavC	KAENA VARIANT	0.28	5	D	II
KbB	KAHANA	0.17	5	B	II
KbC	KAHANA	0.17	5	B	II
KbD	KAHANA	0.17	5	B	II
KcB	KALAE	0.10	5	B	I
KcC	KALAE	0.10	5	B	I
KcC3	KALAE	0.10	5	B	I
KcD3	KALAE	0.10	5	B	I
KcE3	KALAE	0.10	5	B	I
KdD	KALAPA	0.10	5	B	I
KdE	KALAPA	0.10	5	B	I
KdF	KALAPA	0.10	5	B	I
Ke	KALIHI	0.28	5	D	II
Kf	KALOKO	0.17	5	D	II
Kfa	KALOKO	0.17	5	D	II
Kfb	KALOKO VARIANT	0.17	5	D	II
KgB	KANEOHE	0.10	5	B	I
KgC	KANEOHE	0.10	5	B	I
KhB	KANEPUU	0.17	5	B	II
KhB2	KANEPUU	0.17	5	B	II
KhC	KANEPUU	0.17	5	B	II
KhC2	KANEPUU	0.17	5	B	II
KkB	KAPAA	0.10	5	B	I
KkC	KAPAA	0.10	5	B	I
KkD	KAPAA	0.10	5	B	I
KkE	KAPAA	0.10	5	B	II
KlA	KAWAIHAPAI	0.17	5	B	II
KlB	KAWAIHAPAI	0.17	5	B	II
KlC	KAWAIHAPAI	0.17	5	B	II
KlaA	KAWAIHAPAI	0.15	5	B	II
KlaB	KAWAIHAPAI	0.15	5	B	II
KlbC	KAWAIHAPAI	0.10	5	B	II
KlcB	KAWAIHAPAI	0.17	5	B	II
KmA	KEAAU	0.28	3	D	II
KmaB	KEAAU	0.17	3	D	II
KmbA	KEAAU	0.28	3	D	II
KnB	KEAHUA	0.17	5	B	II
KnC	KEAHUA	0.17	5	B	II
KnaB	KEAHUA	0.15	5	B	II
KnaC	KEAHUA	0.15	5	B	II
KnaD	KEAHUA	0.15	5	B	II
KnbD	KEAHUA	0.10	5	B	II
KncC	KEAHUA	0.17	5	B	II
KnhC	KEAHUA	0.15	5	B	II
KnsC	KEAHUA	0.15	5	B	II
KoA	KEKAHA	0.17	5	B	III
KoB	KEKAHA	0.17	5	B	III
KobA	KEKAHA	0.17	5	B	III
KpB	KEMOO	0.17	5	B	II
KpC	KEMOO	0.17	5	B	II
KpD	KEMOO	0.17	5	B	II

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
KpE	KEMOO	0.17	5	B	II
KpF	KEMOO	0.17	5	B	II
KrB	KOELE	0.17	5	B	II
KrC	KOELE	0.17	5	B	II
KrD	KOELE	0.17	5	B	II
KsB	KOKO	0.17	3	B	IV
KsC	KOKO	0.17	3	B	IV
KsD	KOKO	0.17	3	B	IV
KtC	KOKOKAHI	0.28	5	D	II
KuB	KOLEKOLE	0.17	3	C	III
KuC	KOLEKOLE	0.17	3	C	III
KuD	KOLEKOLE	0.17	3	C	III
KvB	KOLOA	0.15	2	C	I
KvC	KOLOA	0.15	2	C	I
KvD	KOLOA	0.15	2	C	I
Kw	KOLOKOLO	0.17	5	B	II
KxC	KULA	0.17	3	B	IV
KxD	KULA	0.17	3	B	IV
KxaD	KULA	0.15	3	B	IV
KxbE	KULA	0.17	3	B	IV
KxbE	ROCK OUTCROP	0.02	1	D	
KyA	KUNIA	0.17	5	B	II
KyB	KUNIA	0.17	5	B	II
KyC	KUNIA	0.17	5	B	II
LME	LAUMAIA	0.17	5	B	III
LMF	LAUMAIA	0.17	5	B	III
LNE	LAUMAIA	0.10	5	B	III
LPE	LUALUALEI	0.10	5	D	II
LaA	LAHAINA	0.17	5	B	II
LaB	LAHAINA	0.17	5	B	II
LaB3	LAHAINA	0.17	5	B	II
LaC	LAHAINA	0.17	5	B	II
LaC3	LAHAINA	0.17	5	B	II
LaD	LAHAINA	0.17	5	B	II
LaD3	LAHAINA	0.17	5	B	II
LaE3	LAHAINA	0.17	5	B	II
LcB	LAWAI	0.10	5	B	I
LcC	LAWAI	0.10	5	B	I
LcD	LAWAI	0.10	5	B	I
LeB	LEILEHUA	0.10	5	B	I
LeC	LEILEHUA	0.10	5	B	I
LhB	LIHUE	0.15	5	B	II
LhC	LIHUE	0.15	5	B	II
LhD	LIHUE	0.15	5	B	II
LhE2	LIHUE	0.15	5	B	II
LlB	LIHUE	0.15	5	B	II
LlC	LIHUE	0.15	5	B	II
LoB	LOLEKAA	0.10	5	B	I
LoC	LOLEKAA	0.10	5	B	I
LoD	LOLEKAA	0.10	5	B	I
LoE	LOLEKAA	0.10	5	B	I

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	Erosion Factors T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
LoF	LOLEKAA	0.10	5	B	I
LuA	LUALUALEI	0.28	5	D	II
LuB	LUALUALEI	0.28	5	D	II
LvA	LUALUALEI	0.24	5	D	II
LvB	LUALUALEI	0.24	5	D	II
MBL	BADLAND	0.49	3	C	
MBL	MAHANA	0.43	5	B	IV
MID	MAKAALAE	0.17	3	B	III
MJD	MAKAALAE	0.10	3	B	III
MWE	MAKAALAE	0.17	3	B	III
MXC	MAKENA	0.17	4	B	III
MXC	STONY LAND	0.10	2	C	
MYD	MALAMA	0.02	3	A	I
MZ	MARSH	0.02	5	D	
MaC	MAHANA	0.43	5	B	IV
MaD	MAHANA	0.43	5	B	IV
MaD3	MAHANA	0.43	5	B	IV
MaE	MAHANA	0.43	5	B	IV
MaE3	MAHANA	0.43	5	B	IV
McC2	MAHANA	0.43	5	B	IV
McD2	MAHANA	0.43	5	B	IV
McE2	MAHANA	0.43	5	B	IV
MdB	MAKALAPA	0.28	3	D	II
MdC	MAKALAPA	0.28	3	D	II
MdD	MAKALAPA	0.28	3	D	II
MeB	MAKAPILI	0.10	5	B	I
MeC	MAKAPILI	0.10	5	B	I
MeD	MAKAPILI	0.10	5	B	I
MeE	MAKAPILI	0.10	5	B	I
MfB	MAKAWAO	0.10	5	B	I
MfC	MAKAWAO	0.10	5	B	I
MgB	MAKAWELI	0.17	5	B	II
MgC	MAKAWELI	0.17	5	B	II
MgD	MAKAWELI	0.17	5	B	II
MgE2	MAKAWELI	0.17	5	B	II
MhB	MAKAWELI	0.15	5	B	II
MhC	MAKAWELI	0.15	5	B	II
MhD	MAKAWELI	0.15	5	B	II
MhE	MAKAWELI	0.15	5	B	II
MkA	MAKIKI	0.17	5	B	II
MlA	MAKIKI	0.15	5	B	II
MmA	MALA	0.17	5	B	II
MmB	MALA	0.17	5	B	II
MnC	MAMALA	0.15	1	D	II
MoB	MANANA	0.10	5	C	I
MoC	MANANA	0.10	5	C	I
MoD2	MANANA	0.10	5	C	I
MpB	MANANA	0.10	5	C	I
MpC	MANANA	0.10	5	C	I
MpD	MANANA	0.10	5	C	I
MpD2	MANANA	0.10	5	C	I

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MpE	HANANA	0.10	5	C	I
Mr	MOKULEIA	0.10	5	B	IV
Ms	MOKULEIA	0.10	5	B	IV
Mt	MOKULEIA	0.10	5	B	IV
Mta	MOKULEIA VARIANT	0.17	2	B	IV
Mtb	MOKULEIA	0.17	5	B	IV
MuA	MOLOKAI	0.20	5	B	II
MuB	MOLOKAI	0.20	5	B	II
MuB3	MOLOKAI	0.20	5	B	II
MuC	MOLOKAI	0.20	5	B	II
MuC3	MOLOKAI	0.20	5	B	II
MuD	MOLOKAI	0.20	5	B	II
MvD3	MOLOKAI VARIANT	0.20	5	B	II
NAC	NAIWA	0.37	4	B	III
NAC3	NAIWA	0.37	4	B	III
NLE	NIULII	0.10	2	C	I
NME	NIULII VARIANT	0.10	2	C	I
NcC	NIU	0.17	5	B	II
NcD	NIU	0.17	5	B	II
NcD2	NIU	0.17	5	B	II
NcE2	NIU	0.17	5	B	II
Nh	NOHILI	0.28	3	D	II
NnC	NONOPAHU	0.28	5	D	II
NoC	NONOPAHU	0.17	5	D	II
OAD	OANAPUKA	0.10	4	B	III
OED	OANAPUKA	0.10	4	B	III
OFC	OLELO	0.10	5	B	I
OMB	OLI	0.17	2	B	III
OME	OLI	0.17	2	B	III
OMF	OLI	0.17	2	B	III
ONC	OLINDA	0.17	3	B	III
OND	OLINDA	0.17	3	B	III
ONE	OLINDA	0.17	3	B	III
OOE	OLOKUI	0.05	2	D	I
OPD	OPIHIKAO	0.02	1	D	I
OlD	OLI	0.17	2	B	III
PGE	PAAIKI	0.17	3	B	III
PGF	PAAIKI	0.17	3	B	III
PHXC	PAKALA	0.10	5	B	II
PID	PAHOA	0.28	5	B	III
PID2	PAHOA	0.28	5	B	III
PJD2	PAHOA	0.17	5	B	III
PXD	PANE	0.17	5	B	III
PYD	PAPAA	0.28	4	D	II
PYE	PAPAA	0.28	4	D	II
PYF	PAPAA	0.28	4	D	II
PZ	BADLAND	0.49	3	C	
PZ	PAUMALU	0.10	5	B	I
PZUE	PUUONE	0.10	3	C	IV
PZVE	PUU PA	0.10	3	A	IV
PaC	PAALOA	0.10	5	B	I

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PbC	PAALOA	0.10	5	B	I
PcB	PAIA	0.17	5	B	II
PcC	PAIA	0.17	5	B	II
PcC2	PAIA	0.17	5	B	II
PdA	PAKALA	0.17	5	B	II
PdC	PAKALA	0.17	5	B	II
PeB	PAUMALU	0.10	5	B	I
PeC	PAUMALU	0.10	5	B	I
PeD	PAUMALU	0.10	5	B	I
PeE	PAUMALU	0.10	5	B	I
PeF	PAUMALU	0.10	5	B	I
PfB	PAUWELA	0.10	5	B	I
PfC	PAUWELA	0.10	5	B	I
PfD	PAUWELA	0.10	5	B	I
Ph	PEARL HARBOR	0.28	5	D	II
PkB	POHAKUPU	0.17	5	B	III
PkC	POHAKUPU	0.17	5	B	III
PlB	POOKU	0.10	5	B	I
PlD	POOKU	0.10	5	B	I
PmB	POOKU	0.10	5	B	I
PmC	POOKU	0.10	5	B	I
PmD	POOKU	0.10	5	B	I
PmE	POOKU	0.10	5	B	I
PnA	PUHI	0.10	5	B	I
PnB	PUHI	0.10	5	B	I
PnC	PUHI	0.10	5	B	I
PnD	PUHI	0.10	5	B	I
PnE	PUHI	0.10	5	B	I
PoB	PULEHU	0.17	5	B	III
PoaB	PULEHU	0.15	5	B	III
PpA	PULEHU	0.17	5	B	III
PpB	PULEHU	0.17	5	B	III
PrA	PULEHU	0.15	5	B	III
PrB	PULEHU	0.15	5	B	III
PsA	PULEHU	0.17	5	B	III
PtA	PULEHU	0.15	5	B	III
PtB	PULEHU	0.15	5	B	III
PuB	PULEHU	0.15	5	B	III
PvC	PULEHU	0.10	5	B	III
PwC	PUU OPAE	0.10	5	B	I
PwD	PUU OPAE	0.10	5	B	I
PwE	PUU OPAE	0.10	5	B	I
TAE	TANTALUS	0.10	5	A	IV
TAF	TANTALUS	0.10	5	A	IV
TCC	TANTALUS	0.10	5	A	IV
TCE	TANTALUS	0.10	5	A	IV
TR	TROPAQUEPTS	0.10	5	D	
ULD	ULUPALAKUA	0.17	5	B	III
UME	UMA	0.05	5	A	IV
UMF	UMA	0.05	5	A	IV
URD	ROCK OUTCROP	0.02	1	D	

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URD	UMA	0.05	5	A	IV
UwB	UWALA	0.17	5	B	II
UwC	UWALA	0.17	5	B	II
UwC3	UWALA	0.17	5	B	II
WID2	WAIAKOA	0.10	2	C	II
WJF	ROCK OUTCROP	0.02	1	D	
WJF	WAIAWA	0.28	1	D	II
WaA	WAHIAWA	0.15	5	[illegible]	II
WaB	WAHIAWA	0.15	5	[illegible]	II
WaC	WAHIAWA	0.15	5	B	II
WaD2	WAHIAWA	0.15	5	B	II
WbB	WAHIKULI	0.17	2	B	II
WcB	WAHIKULI	0.15	2	B	II
WcC	WAHIKULI	0.15	2	B	II
WdB	WAHIKULI	0.10	2	B	II
WeB	WAIAKOA	0.17	2	C	II
WeC	WAIAKOA	0.17	2	C	II
WfB	WAIAKOA	0.15	2	C	II
WgB	WAIAKOA	0.10	2	C	II
WgC	WAIAKOA	0.10	2	C	II
WhB	WAIAKOA	0.10	2	C	II
WhC	WAIAKOA	0.10	2	C	II
WkA	WAIALUA	0.28	5	B	III
WkB	WAIALUA	0.28	5	B	III
WlB	WAIALUA	0.17	5	B	III
WlE	WAIALUA	0.17	5	B	III
WmD	WAIALUA	0.10	5	B	III
WnB	WAIALUA	0.28	5	B	III
WoA	WAIHUNA	0.28	5	D	II
WoB	WAIHUNA	0.28	5	D	II
WoC	WAIHUNA	0.28	5	D	II
WoD	WAIHUNA	0.28	5	D	II
WohB	WAIHUNA	0.20	5	D	II
WpB	WAIKANE	0.10	5	B	I
WpC	WAIKANE	0.10	5	B	I
WpE	WAIKANE	0.10	5	B	I
WpF	WAIKANE	0.10	5	B	I
WpF2	WAIKANE	0.10	5	B	I
WpaE	WAIKANE	0.10	5	B	I
WrA	WAIKAPU	0.17	5	B	II
WrB	WAIKAPU	0.17	5	B	II
WrB3	WAIKAPU	0.17	5	B	II
WrC3	WAIKAPU	0.17	5	B	II
Ws	WAIKOMO	0.17	1	D	II
Wt	ROCK OUTCROP	0.02	1	D	
Wt	WAIKOMO	0.17	1	D	II
Wu	ROCK OUTCROP	0.02	1	D	
Wu	WAIKOMO	0.17	1	D	II
WvB	WAILUKU	0.17	5	B	II
WvC	WAILUKU	0.17	5	B	II
WwC	WAILUKU	0.15	5	B	II

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WxB	WAINEE	0.10	5	B	II
WxC	WAINEE	0.10	5	B	II
WyB	WAINEE	0.10	5	B	II
WyC	WAINEE	0.10	5	B	II
WzA	WAIPAHU	0.28	5	C	II
WzB	WAIPAHU	0.28	5	C	II
WzC	WAIPAHU	0.28	5	C	II
rAAE	ALAKAI	0.05	5	D	I
rAHD	AMALU	0.05	2	D	I
rAOO	AMALU	0.05	2	D	I
rAOO	OLOKUI	0.05	2	D	I
rCI	CINDER LAND	0.02	5	A	
rHOO	HONOMANU	0.05	5	A	I
rHR	AMALU	0.05	2	D	I
rHR	HONOMANU	0.05	5	A	I
rHT	HYDRANDEPTS	0.05	5	B	
rHT	TROPAQUODS	0.05	2	D	
rLW	LAVA FLOWS, AA	0.02	1	A	
rRH	RIVERWASH	0.05	4	A	
rRK	ROCK LAND	0.10	1	D	
rRO	ROCK OUTCROP	0.02	1	D	
rRR	ROUGH BROKEN LAND	0.05	2	C	
rRS	ROUGH BROKEN AND STONY LAND	0.05	2	C	
rRT	ROUGH MOUNTAINOUS LAND	0.20	1	D	
rRU	RUBBLE LAND	0.02	1	A	
rSL	SANDY ALLUVIAL LAND	0.17	5	A	
rSM	STONY ALLUVIAL LAND	0.10	5	B	
rSN	STONY BLOWN-OUT LAND	0.15	2	B	
rSO	STONY COLLUVIAL LAND	0.10	5	B	
rST	STONY LAND	0.10	5	B	
rSY	STONY STEEP LAND	0.10	5	B	
rTO	TROPAQUODS	0.05	2	D	
rTP	DYSTRANDEPTS	0.10	3	B	
rTP	TROPOHUMULTS	0.10	4	C	
rVS	VERY STONY LAND (MAUI)	0.10	1	C	
rVS	VERY STONY LAND	0.10	2	C	
rVT2	VERY STONY LAND, ERODED	0.10	2	C	
rWAF	WAIALEALE	0.05	3	D	I

1/ Replaces Table 14 in Erosion and Sediment Control Guide for Hawaii (1981).

2/ A soil symbol that is repeated indicates the soil map unit has two or more components. See the soil survey to obtain percentage of each component, or make on-site determination.

TABLE 16. Slope-effect (LS) values[1]

Percent slope	Slope length (feet)											
	25	50	75	100	150	200	300	400	500	600	800	1,000
0.5	0.065	0.080	0.091	0.099	0.112	0.122	0.138	0.150	0.160	0.169	0.185	0.197
1	.085	.105	.119	.129	.146	.159	.180	.196	.210	.222	.242	.258
2	.133	.163	.185	.201	.227	.248	.280	.305	.326	.344	.376	.402
3	.190	.233	.264	.287	.325	.354	.400	.437	.466	.492	.536	.573
4	.230	.303	.357	.400	.471	.528	.621	.697	.762	.820	.920	1.01
5	.268	.379	.464	.536	.656	.758	.928	1.07	1.20	1.31	1.52	1.69
6	.336	.476	.583	.673	.824	.952	1.17	1.35	1.50	1.65	1.90	2.13
8	.496	.701	.859	.992	1.21	1.40	1.72	1.98	2.22	2.43	2.81	3.14
10	.685	.968	1.19	1.37	1.68	1.94	2.37	2.74	3.06	3.36	3.87	4.33
12	.903	1.28	1.56	1.80	2.21	2.55	3.13	3.61	4.04	4.42	5.11	5.71
14	1.15	1.62	1.99	2.30	2.81	3.25	3.98	4.59	5.13	5.62	6.49	7.26
16	1.42	2.01	2.46	2.84	3.48	4.01	4.92	5.68	6.35	6.95	8.03	8.98
18	1.72	2.43	2.97	3.43	4.21	4.86	5.95	6.87	7.68	8.41	9.71	10.9
20	2.04	2.88	3.53	4.08	5.00	5.77	7.07	8.16	9.12	10.0	11.5	12.9
25	2.95	4.17	5.10	5.89	7.22	8.33	10.2	11.8	13.2	14.4	16.7	18.6
30	3.98	5.62	6.89	7.95	9.74	11.2	13.8	15.9	17.8	19.5	22.5	25.2
40	6.33	8.95	11.0	12.7	15.5	17.9	21.9	25.3	28.3	31.0	—	—
50	8.91	12.6	15.4	17.8	21.8	25.2	30.9	—	—	—	—	—
60	11.6	16.4	20.0	23.1	28.4	—	—	—	—	—	—	—

1. Based on the formula:

$$LS = \left(\frac{\lambda}{72.6}\right)^m \left(\frac{430x^2 + 30x + 0.43}{6.57415}\right)$$

where $m = 0.5$ if $s = 5\%$ or greater, 0.4 if $s = 4\%$, and 0.3 if $s = 3\%$ or less; and $x = \sin \theta$.

Values shown for slopes of less than 3%, greater than 18%, or longer than 400 feet, represent extrapolations of the formula beyond the range of research data.

TABLE 17. C values for sugarcane[1]

24-month, irrigated	0.10
24-month, dryland	0.13
27-month, dryland	0.15
30-month, dryland	0.16
36-month, dryland	0.16

1. Where cane residue covers the soil evenly at a rate of 2,000 pounds per acre or more, reduce "C" value by 50 percent.

REFERENCE: USDA-Soil Conservation Service, Technical Note, Agronomy No. 7, "Estimating Crop Residue on Sugarcane Land," December 1976.

TABLE 18. C values for diversified agricultural crops

Type of Crop	Clean-tilled Operation	Green-manure crop or weed cover utilized
Vine Crops	0.30	0.20
Leafy vegetables	0.36	0.25
Corn	0.40	0.30
Head vegetables	0.40	0.30
Root crops	0.45	0.25

TABLE 19. C values for macadamia orchards[1]

Treatment for mature orchards	Fullball canopy (100% canopy cover)	Semiball or triangular canopy (75% canopy cover)
No treatment	0.20	0.15
Remove every third row of trees and establish grass filter strips	0.09	0.07
Remove every second row of trees and establish grass filter strips	0.06	0.04
Ground covered with netting (mesh size = 6–8 holes per square inch)	0.01	0.01

1. Select C values for other orchard crops from Table 20, "C values for permanent pasture and idle land."

TABLE 20. C values for permanent pasture and idle land[1]

Vegetal canopy		Cover that contacts the surface						
			Percent ground cover					
Type and height[2]	Percent cover[3]	Type[4]	0	20	40	60	80	95–100
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees, but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

1. All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists.
2. Average fall height of waterdrops from canopy to soil surface: m = meters.
3. Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).
4. G = cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 inches deep. W = cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) and/or undecayed residues.

TABLE 21. **Values for woodland**

Stand condition	Percent tree[1] Canopy	Forest litter percent[2] of area	Undergrowth[3]	C Factor
Well stocked	100-75	100-90	Managed[4]	0.001
			Mismanaged[4]	.003-.01 1
Medium stocked	70-40	85-75	Managed	0.002-0.004
			Mismanaged	0.01-0.04
Poorly stocked	35-20	70-40	Managed	0.003-0.009
			Mismanaged	0.02-0.09[5]

1. When tree canopy is less than 20 percent, the area will be considered as grassland for estimating soil loss.
2. Forest litter is assumed to be at least 2 inches deep over the percent ground surface area covered.
3. Undergrowth (usually found under canopy openings) is defined as shrubs, weeds, grasses, vines, etc., on the surface area not protected by forest litter.
4. Managed: grazing and fires are controlled. Mismanaged: stands that are overgrazed or subjected to repeated burning.
5. For mismanaged woodland with litter cover of less than 75 percent, C values should be derived by taking 0.7 of the appropriate values. The factor of 0.7 reflects the higher organic-matter content in woodland soils.

TABLE 22. **C Values for ground cover**

Kind of Ground Cover	0.01
Grass Sod	0.01
Seedlings (fully established stand):	
Permanent grasses (rhizomatous or stoloniferous)	0.01
Field bromegrass	0.03
Ryegrass (perennial)	0.05
Small grain	0.05
Millet or sudangrass	0.05
Ryegrass (annual)	0.10
Mulches:	
Bagasse (2 tons/acre)	0.02
Hay (2 tons/acre)	0.02
Small grain straw (2 tons/acre)	0.02
Woodchips (6 tons/acre)	0.06
Wood cellulose fiber (I 3/4 tons/acre)	0.10
Bare soil	1.00

TABLE 23. **P value for erosion control practice (Agricultural)**

Percent slope	Up & down slope farming	Contour planting	Contour irrigation furrows	Cross slope farming
2-7	1.00	0.50	0.25	0.75
7.1-12	1.00	0.60	0.30	0.80
12.1-18	1.00	0.80	1.00	0.90
1 8. 1 -24	1.00	0.90	1.00	0.95
Above 24	1.00	1.00	1.00	1.00

TABLE 24. **P value for Erosion Control Measures (Non Agricultural)**

P = 0.6	Use of Sediment Basin installed at the beginning of grading (sized for 1" rainfall per acre)
P = 0.8	Use of filter inlets and berms, sediment traps, chutes and flumes, containment dikes and any other suitable practice.

1-8.2 RAINFALL FACTORS

Refer to the following map and tables for rainfall factors for Leeward and Windward O'ahu (April 16, 1990).

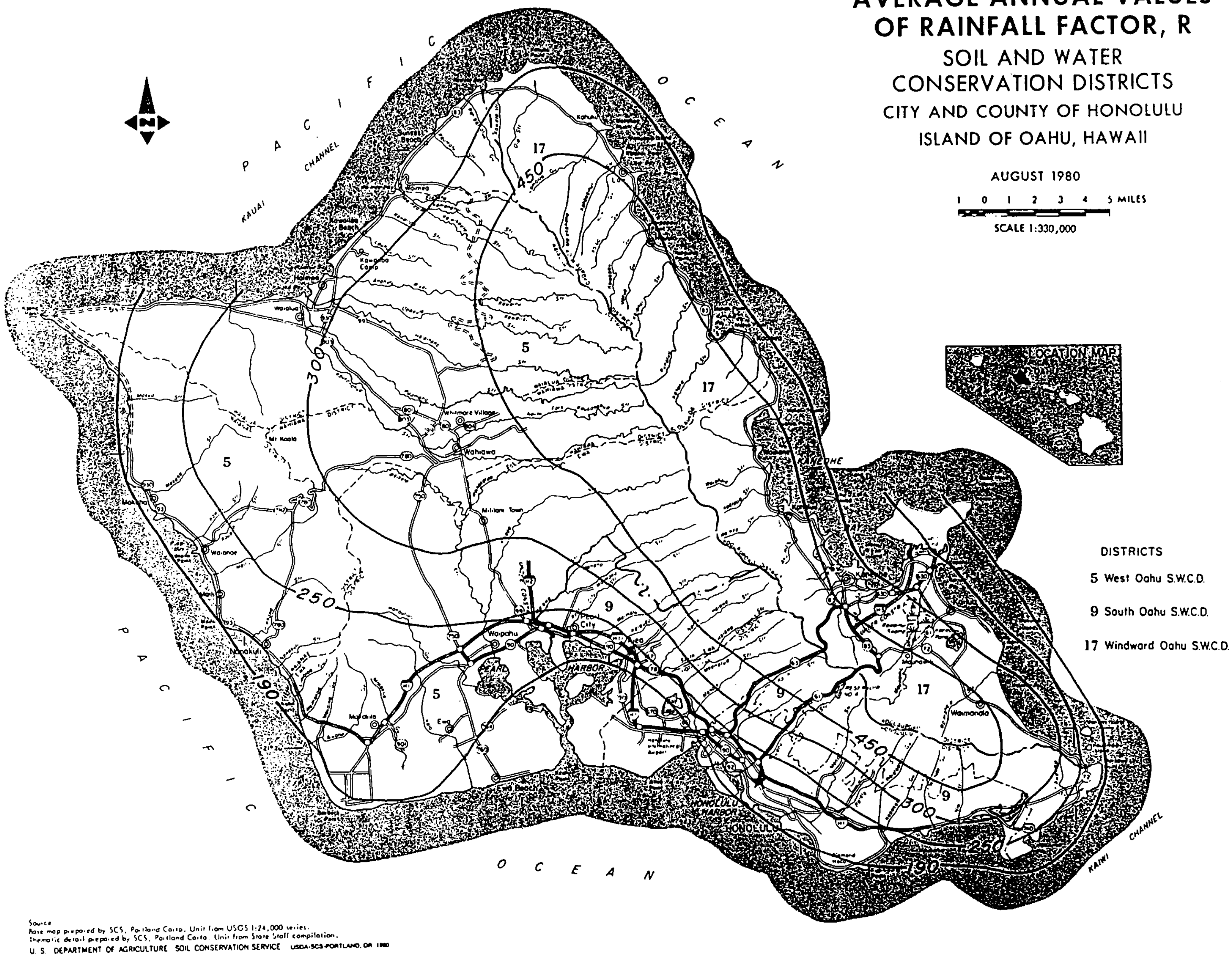
AVERAGE ANNUAL VALUES OF RAINFALL FACTOR, R

SOIL AND WATER CONSERVATION DISTRICTS

CITY AND COUNTY OF HONOLULU

ISLAND OF OAHU, HAWAII

AUGUST 1980



RAINFALL FACTORS FOR LEEWARD O'AHU (APRIL 16, 1990)

Expected Monthly Distribution of Erosive Rainfall
Leeward Side of Oahu

Winter									Summer								
Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum
Jan 1	1	0.006	Feb 1	32	0.180	Mar 1	60	0.338	Apr 1	91	0.466	May 1	121	0.528	Jun 1	152	0.558
2	2	0.011	2	33	0.186	2	61	0.343	2	92	0.469	2	122	0.529	2	153	0.558
3	3	0.017	3	34	0.191	3	62	0.349	3	93	0.472	3	123	0.531	3	154	0.559
4	4	0.023	4	35	0.197	4	63	0.354	4	94	0.474	4	124	0.532	4	155	0.559
5	5	0.028	5	36	0.203	5	64	0.360	5	95	0.477	5	125	0.534	5	156	0.560
6	6	0.034	6	37	0.208	6	65	0.366	6	96	0.479	6	126	0.535	6	157	0.560
7	7	0.039	7	38	0.214	7	66	0.371	7	97	0.482	7	127	0.536	7	158	0.561
8	8	0.045	8	39	0.219	8	67	0.376	8	98	0.484	8	128	0.537	8	159	0.561
9	9	0.051	9	40	0.225	9	68	0.381	9	99	0.487	9	129	0.539	9	160	0.561
10	10	0.056	10	41	0.231	10	69	0.386	10	100	0.489	10	130	0.540	10	161	0.562
11	11	0.062	11	42	0.236	11	70	0.391	11	101	0.491	11	131	0.541	11	162	0.562
12	12	0.068	12	43	0.242	12	71	0.395	12	102	0.493	12	132	0.542	12	163	0.562
13	13	0.073	13	44	0.248	13	72	0.400	13	103	0.496	13	133	0.543	13	164	0.563
14	14	0.079	14	45	0.253	14	73	0.404	14	104	0.498	14	134	0.544	14	165	0.563
15	15	0.084	15	46	0.259	15	74	0.408	15	105	0.500	15	135	0.545	15	166	0.564
16	16	0.090	16	47	0.264	16	75	0.412	16	106	0.502	16	136	0.546	16	167	0.564
17	17	0.096	17	48	0.270	17	76	0.416	17	107	0.504	17	137	0.547	17	168	0.564
18	18	0.101	18	49	0.276	18	77	0.420	18	108	0.506	18	138	0.548	18	169	0.565
19	19	0.107	19	50	0.281	19	78	0.424	19	109	0.508	19	139	0.549	19	170	0.565
20	20	0.113	20	51	0.287	20	79	0.428	20	110	0.510	20	140	0.550	20	171	0.565
21	21	0.118	21	52	0.293	21	80	0.431	21	111	0.512	21	141	0.551	21	172	0.566
22	22	0.124	22	53	0.298	22	81	0.435	22	112	0.513	22	142	0.551	22	173	0.566
23	23	0.129	23	54	0.304	23	82	0.438	23	113	0.515	23	143	0.552	23	174	0.566
24	24	0.135	24	55	0.309	24	83	0.442	24	114	0.517	24	144	0.553	24	175	0.567
25	25	0.141	25	56	0.315	25	84	0.445	25	115	0.519	25	145	0.554	25	176	0.567
26	26	0.146	26	57	0.321	26	85	0.448	26	116	0.520	26	146	0.554	26	177	0.568
27	27	0.152	27	58	0.326	27	86	0.451	27	117	0.522	27	147	0.555	27	178	0.568
28	28	0.158	28	59	0.332	28	87	0.454	28	118	0.523	28	148	0.556	28	179	0.568
29	29	0.163				29	88	0.457	29	119	0.525	29	149	0.556	29	180	0.569
30	30	0.169				30	89	0.460	30	120	0.527	30	150	0.557	30	181	0.569
31	31	0.174				31	90	0.463				31	151	0.557			

Expected Monthly Distribution of Erosive Rainfall
Leeward Side of Oahu

Summer									Winter								
Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum
Jul 1	182	0.569	Aug 1	213	0.581	Sep 1	244	0.593	Oct 1	274	0.612	Nov 1	305	0.672	Dec 1	335	0.812
2	183	0.570	2	214	0.581	2	245	0.593	2	275	0.614	2	306	0.675	2	336	0.818
3	184	0.570	3	215	0.582	3	246	0.593	3	276	0.615	3	307	0.678	3	337	0.824
4	185	0.571	4	216	0.582	4	247	0.594	4	277	0.616	4	308	0.681	4	338	0.837
5	186	0.571	5	217	0.583	5	248	0.594	5	278	0.617	5	309	0.684	5	339	0.843
6	187	0.571	6	218	0.583	6	249	0.594	6	279	0.619	6	310	0.687	6	340	0.843
7	188	0.572	7	219	0.583	7	250	0.595	7	280	0.620	7	311	0.691	7	341	0.850
8	189	0.572	8	220	0.584	8	251	0.595	8	281	0.622	8	312	0.694	8	342	0.856
9	190	0.572	9	221	0.584	9	252	0.596	9	282	0.623	9	313	0.698	9	343	0.862
10	191	0.573	10	222	0.584	10	253	0.596	10	283	0.625	10	314	0.701	10	344	0.868
11	192	0.573	11	223	0.585	11	254	0.596	11	284	0.626	11	315	0.705	11	345	0.875
12	193	0.574	12	224	0.585	12	255	0.597	12	285	0.628	12	316	0.709	12	346	0.881
13	194	0.574	13	225	0.585	13	256	0.597	13	286	0.630	13	317	0.713	13	347	0.887
14	195	0.574	14	226	0.586	14	257	0.598	14	287	0.631	14	318	0.717	14	348	0.893
15	196	0.575	15	227	0.586	15	258	0.598	15	288	0.633	15	319	0.721	15	349	0.900
16	197	0.575	16	228	0.587	16	259	0.599	16	289	0.635	16	320	0.726	16	350	0.906
17	198	0.575	17	229	0.587	17	260	0.600	17	290	0.637	17	321	0.730	17	351	0.912
18	199	0.576	18	230	0.587	18	261	0.600	18	291	0.639	18	322	0.735	18	352	0.918
19	200	0.576	19	231	0.588	19	262	0.601	19	292	0.641	19	323	0.740	19	353	0.925
20	201	0.577	20	232	0.588	20	263	0.602	20	293	0.643	20	324	0.745	20	354	0.931
21	202	0.577	21	233	0.588	21	264	0.603	21	294	0.645	21	325	0.750	21	355	0.937
22	203	0.577	22	234	0.589	22	265	0.603	22	295	0.647	22	326	0.756	22	356	0.944
23	204	0.578	23	235	0.589	23	266	0.604	23	296	0.649	23	327	0.762	23	357	0.950
24	205	0.578	24	236	0.590	24	267	0.605	24	297	0.652	24	328	0.768	24	358	0.956
25	206	0.578	25	237	0.590	25	268	0.606	25	298	0.654	25	329	0.774	25	359	0.962
26	207	0.579	26	238	0.590	26	269	0.607	26	299	0.656	26	330	0.781	26	360	0.969
27	208	0.579	27	239	0.591	27	270	0.608	27	300	0.659	27	331	0.787	27	361	0.975
28	209	0.580	28	240	0.591	28	271	0.609	28	301	0.661	28	332	0.793	28	362	0.981
29	210	0.580	29	241	0.591	29	272	0.610	29	302	0.664	29	333	0.799	29	363	0.987
30	211	0.580	30	242	0.592	30	273	0.611	30	303	0.666	30	334	0.806	30	364	0.994
31	212	0.581	31	243	0.592				31	304	0.669				31	365	1.000

RAINFALL FACTORS FOR WINWARD O'AHU (APRIL 16, 1990)

Expected Monthly Distribution of Erosive Rainfall
Windward Side of Oahu

Winter									Summer								
Date	Day	% Cum	Date	Day	% Cúm	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum
Jan 1	1	0.004	Feb 1	32	0.139	Mar 1	60	0.261	Apr 1	91	0.387	May 1	121	0.470	Jun. 1	152	0.529
2	2	0.009	2	33	0.144	2	61	0.266	2	92	0.390	2	122	0.472	2	153	0.530
3	3	0.013	3	34	0.148	3	62	0.270	3	93	0.393	3	123	0.474	3	154	0.532
4	4	0.017	4	35	0.153	4	63	0.275	4	94	0.396	4	124	0.477	4	155	0.533
5	5	0.022	5	36	0.157	5	64	0.279	5	95	0.400	5	125	0.479	5	156	0.535
6	6	0.026	6	37	0.161	6	65	0.283	6	96	0.403	6	126	0.481	6	157	0.536
7	7	0.031	7	38	0.166	7	66	0.288	7	97	0.406	7	127	0.483	7	158	0.537
8	8	0.035	8	39	0.170	8	67	0.292	8	98	0.409	8	128	0.485	8	159	0.539
9	9	0.039	9	40	0.174	9	68	0.296	9	99	0.412	9	129	0.487	9	160	0.540
10	10	0.044	10	41	0.179	10	69	0.301	10	100	0.415	10	130	0.489	10	161	0.542
11	11	0.048	11	42	0.183	11	70	0.305	11	101	0.418	11	131	0.491	11	162	0.543
12	12	0.052	12	43	0.187	12	71	0.309	12	102	0.421	12	132	0.493	12	163	0.544
13	13	0.057	13	44	0.192	13	72	0.314	13	103	0.424	13	133	0.495	13	164	0.546
14	14	0.061	14	45	0.196	14	73	0.318	14	104	0.427	14	134	0.497	14	165	0.547
15	15	0.065	15	46	0.200	15	74	0.322	15	105	0.429	15	135	0.499	15	166	0.548
16	16	0.070	16	47	0.205	16	75	0.327	16	106	0.432	16	136	0.501	16	167	0.549
17	17	0.074	17	48	0.209	17	76	0.331	17	107	0.435	17	137	0.503	17	168	0.551
18	18	0.078	18	49	0.214	18	77	0.335	18	108	0.438	18	138	0.505	18	169	0.552
19	19	0.083	19	50	0.218	19	78	0.339	19	109	0.440	19	139	0.507	19	170	0.553
20	20	0.087	20	51	0.222	20	79	0.343	20	110	0.443	20	140	0.509	20	171	0.554
21	21	0.092	21	52	0.227	21	80	0.347	21	111	0.446	21	141	0.510	21	172	0.555
22	22	0.096	22	53	0.231	22	81	0.351	22	112	0.448	22	142	0.512	22	173	0.557
23	23	0.100	23	54	0.235	23	82	0.355	23	113	0.451	23	143	0.514	23	174	0.558
24	24	0.105	24	55	0.240	24	83	0.358	24	114	0.453	24	144	0.516	24	175	0.559
25	25	0.109	25	56	0.244	25	84	0.362	25	115	0.456	25	145	0.517	25	176	0.560
26	26	0.113	26	57	0.248	26	85	0.366	26	116	0.458	26	146	0.519	26	177	0.561
27	27	0.118	27	58	0.253	27	86	0.369	27	117	0.460	27	147	0.521	27	178	0.562
28	28	0.122	28	59	0.257	28	87	0.373	28	118	0.463	28	148	0.522	28	179	0.563
29	29	0.126				29	88	0.376	29	119	0.465	29	149	0.524	29	180	0.564
30	30	0.131				30	89	0.380	30	120	0.468	30	150	0.525	30	181	0.565
31	31	0.135				31	90	0.383				31	151	0.527			

Expected Monthly Distribution of Erosive Rainfall
Windward Side of Oahu

Summer									Winter								
Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum	Date	Day	% Cum
Jul 1	182	0.566	Aug 1	213	0.592	Sep 1	244	0.616	Oct 1	274	0.653	Nov 1	305	0.735	Dec 1	335	0.868
2	183	0.567	2	214	0.592	2	245	0.617	2	275	0.655	2	306	0.739	2	336	0.872
3	184	0.568	3	215	0.593	3	246	0.618	3	276	0.657	3	307	0.743	3	337	0.876
4	185	0.569	4	216	0.594	4	247	0.619	4	277	0.659	4	308	0.747	4	338	0.881
5	186	0.570	5	217	0.595	5	248	0.620	5	278	0.661	5	309	0.751	5	339	0.885
6	187	0.571	6	218	0.596	6	249	0.620	6	279	0.663	6	310	0.756	6	340	0.890
7	188	0.571	7	219	0.596	7	250	0.621	7	280	0.665	7	311	0.760	7	341	0.894
8	189	0.572	8	220	0.597	8	251	0.622	8	281	0.667	8	312	0.764	8	342	0.898
9	190	0.573	9	221	0.598	9	252	0.623	9	282	0.669	9	313	0.768	9	343	0.903
10	191	0.574	10	222	0.599	10	253	0.624	10	283	0.671	10	314	0.773	10	344	0.907
11	192	0.575	11	223	0.600	11	254	0.625	11	284	0.673	11	315	0.778	11	345	0.912
12	193	0.576	12	224	0.600	12	255	0.626	12	285	0.676	12	316	0.783	12	346	0.916
13	194	0.577	13	225	0.601	13	256	0.627	13	286	0.678	13	317	0.787	13	347	0.921
14	195	0.577	14	226	0.602	14	257	0.629	14	287	0.681	14	318	0.792	14	348	0.925
15	196	0.578	15	227	0.603	15	258	0.630	15	288	0.683	15	319	0.796	15	349	0.929
16	197	0.579	16	228	0.603	16	259	0.631	16	289	0.686	16	320	0.801	16	350	0.934
17	198	0.580	17	229	0.604	17	260	0.632	17	290	0.688	17	321	0.805	17	351	0.938
18	199	0.581	18	230	0.605	18	261	0.633	18	291	0.691	18	322	0.810	18	352	0.943
19	200	0.581	19	231	0.606	19	262	0.635	19	292	0.693	19	323	0.814	19	353	0.947
20	201	0.582	20	232	0.607	20	263	0.636	20	293	0.696	20	324	0.819	20	354	0.951
21	202	0.583	21	233	0.607	21	264	0.637	21	294	0.699	21	325	0.823	21	355	0.956
22	203	0.584	22	234	0.608	22	265	0.639	22	295	0.702	22	326	0.828	22	356	0.960
23	204	0.585	23	235	0.609	23	266	0.640	23	296	0.705	23	327	0.832	23	357	0.965
24	205	0.585	24	236	0.610	24	267	0.642	24	297	0.708	24	328	0.837	24	358	0.969
25	206	0.586	25	237	0.611	25	268	0.643	25	298	0.711	25	329	0.841	25	359	0.974
26	207	0.587	26	238	0.611	26	269	0.645	26	299	0.714	26	330	0.846	26	360	0.978
27	208	0.588	27	239	0.612	27	270	0.646	27	300	0.718	27	331	0.850	27	361	0.982
28	209	0.588	28	240	0.613	28	271	0.648	28	301	0.721	28	332	0.855	28	362	0.987
29	210	0.589	29	241	0.614	29	272	0.650	29	302	0.724	29	333	0.858	29	363	0.991
30	211	0.590	30	242	0.614	30	273	0.651	30	303	0.728	30	334	0.864	30	364	0.996
31	212	0.591	31	243	0.615				31	304	0.731				31	365	1.000

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

These rules were adopted on *February 26*, 19*99*, following public hearing held on *December 22*, 19*98*, after public notice was given on *November 20*, 19*98*, in the Honolulu Star-Bulletin.

These rules shall take effect ten days after filing with the City Clerk of the City and County of Honolulu.

JAN NAOE SULLIVAN
Director
Department of Planning and Permitting

APPROVED:

JEREMY HARRIS
Mayor
City and County of Honolulu

Dated: March 19, 1999

APPROVED AS TO FORM
AND LEGALITY:

Deputy Corporation Counsel

Filed

Given unto my hand and affixed with the Seal of the City and County of Honolulu this 29th day of March, 1999.

GENEVIEVE G. WONG, City Clerk

EXAMPLES ILLUSTRATING APPLICATION OF RULES RELATING TO SOIL EROSION STANDARDS AND GUIDELINES

PREPARED BY THE

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

April 1999

Help protect our waters ... for life!

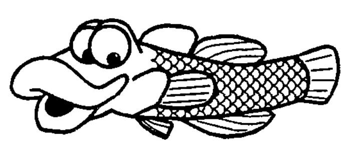


TABLE OF CONTENTS

A. INTRODUCTION

This booklet contains examples, which are intended to illustrate the application of the "Rules Relating to Soil Erosion Standards and Guidelines (Rules)" of the Department of Planning and Permitting, City and County of Honolulu.

The information is brief and subject to change. The user is encouraged and invited to consult with the appropriate staff of the Department of Planning and Permitting for discussions on site specific best management practices ("BMP") to the maximum extent practicable.

EXAMPLE 1

A RESIDENTIAL LOT WITH LESS THAN 15,000 SQUARE FEET OF ZONING AREA

This example involves construction and grading work on a residential lot of 4,880 square feet. Since the area is less that 15,000 square feet (zoned area), this project falls in Category 2.

This project requires:

1. A Building Permit, and
2. A Grading Permit.

As a Category 2 project, it is recommended that the applicant submit:

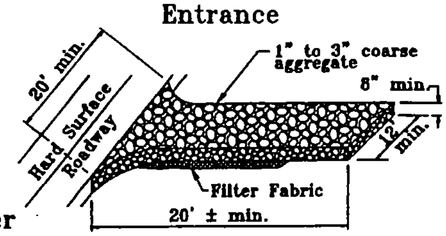
1. Minimum BMP Checklist for Small Projects (see Figure 3 of the Rules), and
2. A plan showing the location of best management practice ("BMP") measures which will be implemented as part of the project. In addition, the plan shall include all of the information described in item 2 of the enclosed "Grading Permit Procedures".

EXAMPLE 1

FIGURE 3

MINIMUM BMP CHECKLIST FOR SMALL PROJECTS

Stabilized Construction Entrance



☑ STABILIZED CONSTRUCTION ENTRANCE
All points of egress and ingress to a site shall be protected with a stabilized construction entrance.

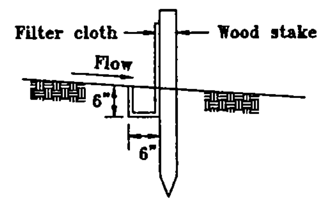
☑ STOCKPILES
Stockpiles shall not be located in drainage ways or other areas of concentrated flows. During periods of wet weather, such as the rainy season, stockpiles shall be stabilized.
Stockpiles covered in plastic when not in use.

Dust Control

☑ DUST CONTROL
Dust control should be applied to reduce dust emissions.
Contractor to spray water as necessary.

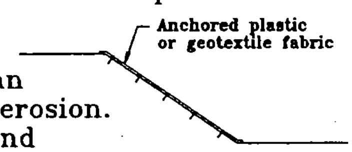
☐ TEMPORARY STABILIZATION Not applicable, see below.
Disturbed areas which are at final grade or will not be worked for longer than (14) days shall be stabilized.

Sediment Barrier



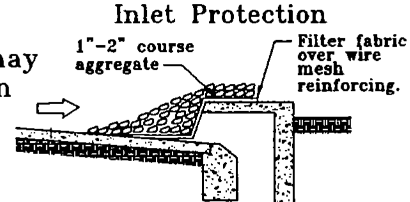
☑ SEDIMENT BARRIERS OR TRAPS
Sediment trapping devices such as fences, traps, basins or barriers shall be used down slope of all disturbed areas and around the base of all material stockpiles.
Stockpiles to be covered with plastic.

Slope Protection



☑ SLOPE PROTECTION
Surface flow from above an exposed slope shall not be allowed to flow over the slope without protection. Slope protection shall be used on areas with slopes greater than 50% and on areas of moderate slopes that are prone to erosion. Slope protection shall also be used on ground surfaces and stockpiles exposed during wet weather.
Anchor plastic over retaining wall excavation.

Inlet Protection



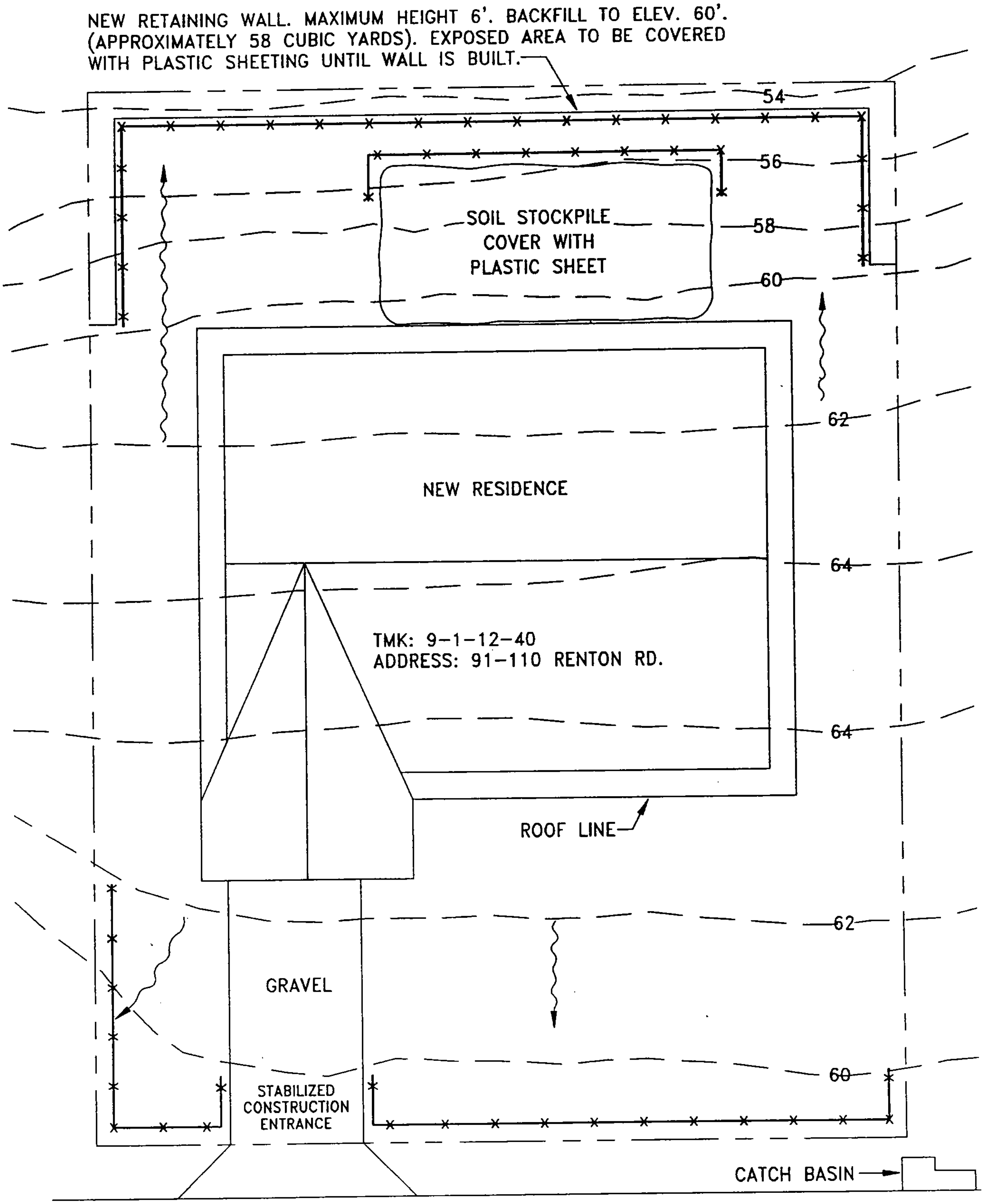
☐ INLET PROTECTION
All storm drain inlets on site, and those offsite which may receive runoff from the site shall use an inlet protection device. Not applicable.

☑ PERMANENT STABILIZATION
All disturbed areas shall be permanently stabilized prior to removing erosion and sediment measures. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed. Trapped sediment and areas of disturbed soil which result from the removal of the temporary measures shall be immediately permanently stablilized.

Area to be permanently seeded/mulched within 14 days or final grade except house area which will be formed and slabbed within 14 days.

SC2430AR

EXAMPLE 1



AREA = 4,880 SQ. FT.

NOTE:
EXPOSED AREAS TO BE PERMANENTLY SEEDED/MULCHED WITHIN 14 DAYS.

KEY

—x—x—x— FILTER FABRIC FENCE (SEDIMENT BARRIER)

~~~~→ FLOW LINES

PLAN

SCALE: 1"=10'-0"

SC2430AQ
~~~~

EXAMPLE 2

NON-RESIDENTIAL LOT WITH MORE THAN 7,500 SQUARE FEET OF ZONING AREA BUT LESS THAN 7,500 SQUARE FEET OF GRADED AREA

This example is of a non-residential lot with more than 7,500 square feet of zoning area, but less than 7,500 square feet of graded area. This is a "Category 3" project.

This project requires:

1. A Building Permit

2. A Grading Permit

3. A Grading Plan

As a Category 3 project, it is recommended that the applicant submit:

1. Minimum BMP Checklist for Large Projects (see figure 4 of the "Rules"), and

2. Locate BMPs on the Grading Plan for implementation. The Grading Plan shall include all of the information described in item 2 of the enclosed "Grading Permit Procedures".

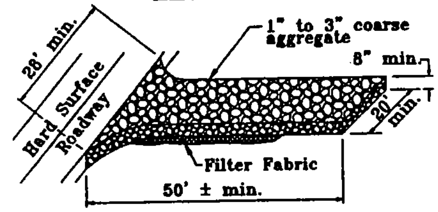
EXAMPLE 2
MINIMUM BMP CHECKLIST FOR LARGE PROJECTS
(FIGURE 4)

Base Measures

☑ STABILIZED CONSTRUCTION ENTRANCE

All points of egress and ingress to a site shall be protected with a stabilized construction entrance.
Gravel construction entrance.

Stabilized Construction Entrance



☑ DUST CONTROL

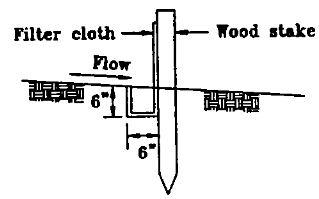
Dust control should be applied to reduce dust emissions.
Will water during construction to control dust.

Dust Control

☑ SEDIMENT FENCE/BARRIER AT TOE OF DISTURBED AREA OR STOCKPILE

Sediment fences or barriers shall be used down slope of all disturbed areas or stockpile areas.
Sediment fences below large disturbed areas and to intercept flow leaving site.

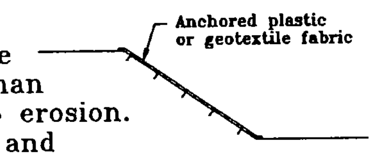
Sediment Barrier



☐ SLOPE PROTECTION

Surface flow from above an exposed slope shall not be allowed to flow over the slope without protection. Slope protection shall be used on areas with slopes greater than 50% and on areas of moderate slopes that are prone to erosion. Slope protection shall also be used on ground surfaces and stockpiles exposed during wet weather.
Not applicable

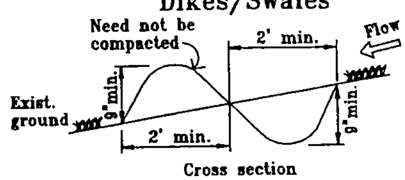
Slope Protection



☐ TEMPORARY INTERCEPTOR DIKES/SWALES AROUND ACTIVE WORK AREA

Temporary interceptor dikes and swales shall be installed around the active work areas to intercept storm water runoff from drainage areas above unprotected slopes and direct to a stabilized outlet and also to prevent runoff from leaving the disturbed site.
No run-off entering site.

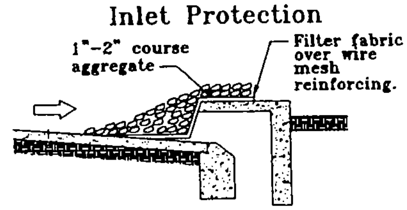
Temporary Interceptor Dikes/Swales



☐ INLET PROTECTION

All storm drain inlets on site, and those off site which may receive runoff from the site shall use an inlet protection device.
Not applicable

Inlet Protection

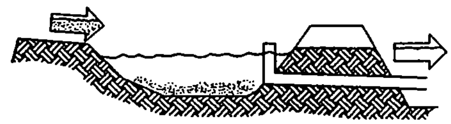


SC2430AT

MINIMUM BMP CHECKLIST FOR LARGE PROJECTS (SEE FIGURE 4)

☐ SEDIMENT BASIN

A sediment basin shall be created by excavation or by constructing an embankment. The basin shall be designed to retain or detain runoff to allow excessive sediment to settle.
(EPA Baseline General Permit Requirements Part IV.D.2.a.(2).(a))
Per EPA requirements, a sediment basin is only required for projects over 10 acres.



Wet Weather Measures

☑ ESTABLISHED GRASS

Grass shall be established on disturbed areas which are at final grade or will not be worked for longer than 14 days. Alternatives to grass include 2" minimum straw mulch cover, erosion blankets with anchors, 6-mil plastic sheets, sediment traps or ponds, or interceptor dikes/swales.
Will cover exposed areas with sheeting during wet months.
Will mulch/seed area above septic field.

Post Construction Measures

☑ ESTABLISHED GROUND COVER

Established ground cover or landscape prior to removing erosion control measures.
Area will be landscaped.

Notes: The maximum period of exposure shall not exceed 14 days. Areas which will be exposed shall be temporarily seeded or stabilized before this period. If after 14 days, the temporarily seeded areas have not attained 98% cover, these areas shall be re-seeded.

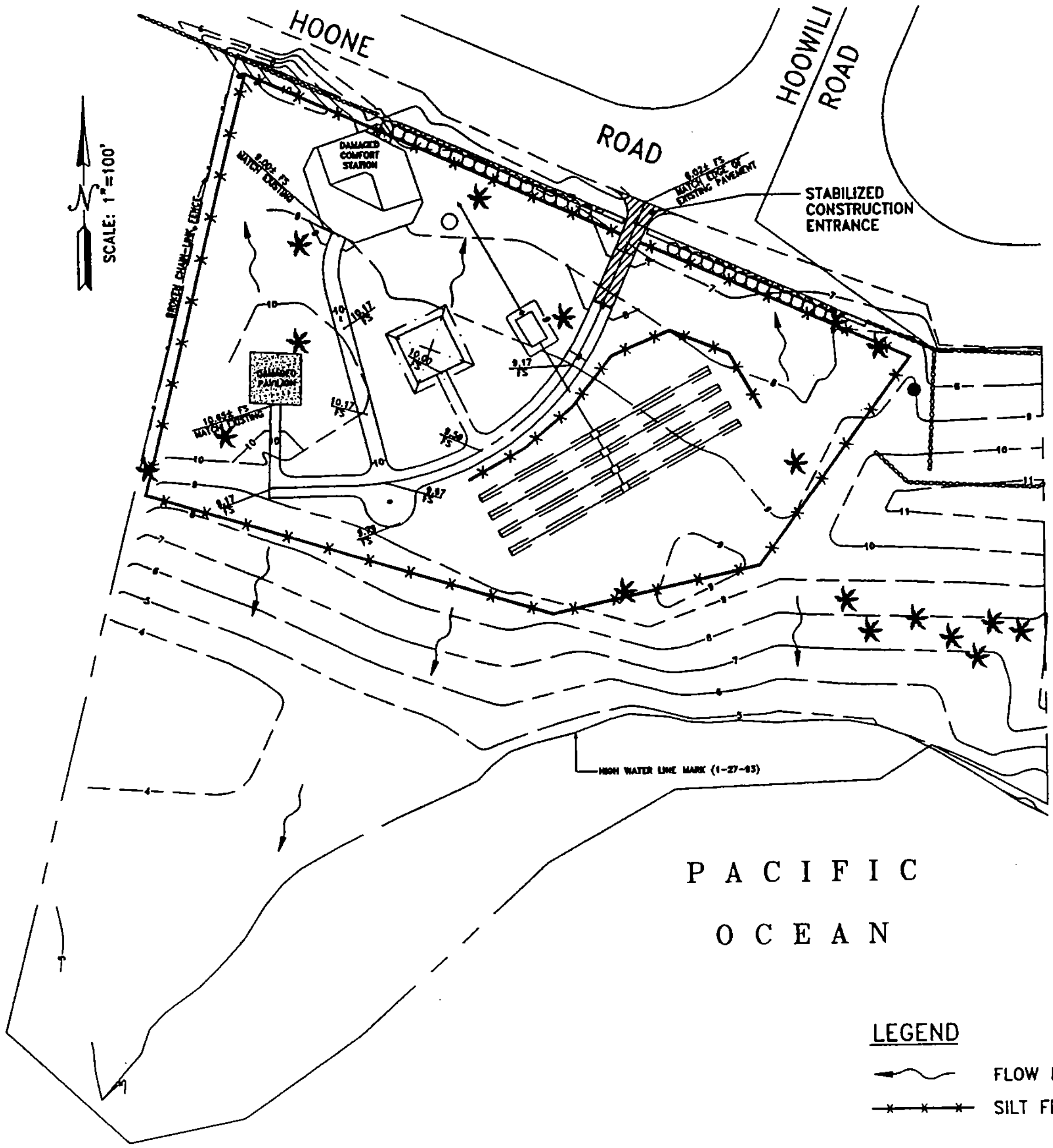
Slopes steeper than 1:3 (vertical:horizontal) shall be sodded or mulched and seeded. Until the slopes are stabilized a sediment fence or barrier shall be installed at the toe of the slope and on contours at spacings not to exceed 25'.

Cut and fill slopes shall be protected in 5' vertical sequential increments as construction progresses.

All earth basins, traps, berms, diversions, waterways, swales, ditches and related structures should be stabilized immediately after they are built. Before a storm water conveyance structure is made operational, adequate outlet protection and any required lining shall be installed or established.

SC2430AT

EXAMPLE 2



NOTE

1. TOTAL GRADED AREA FOR NEW ROADWAY IS LESS THAN 7,500 SQ. FT.
2. WATER DURING CONSTRUCTION FOR DUST CONTROL.
3. COVER EXPOSED AREAS WITH SHEETING OR MULCH/SEED DURING WET MONTHS.
4. PROVIDE PERMANENT LANDSCAPING.

REVISION NO.	SYM.	DESCRIPTION	SHT.___ OF___	DATE

DESIGNED BY:	CHECKED BY:		DRAWING NO.
DRAWN BY:	APPROVED BY:	DATE	SHEET
SCALE: AS NOTED			OF___ SHEETS

SC2430AU

EXAMPLE 3

A SUBDIVISION DEVELOPMENT WHERE THE TOTAL GRADED AREA IS OVER 5 ACRES

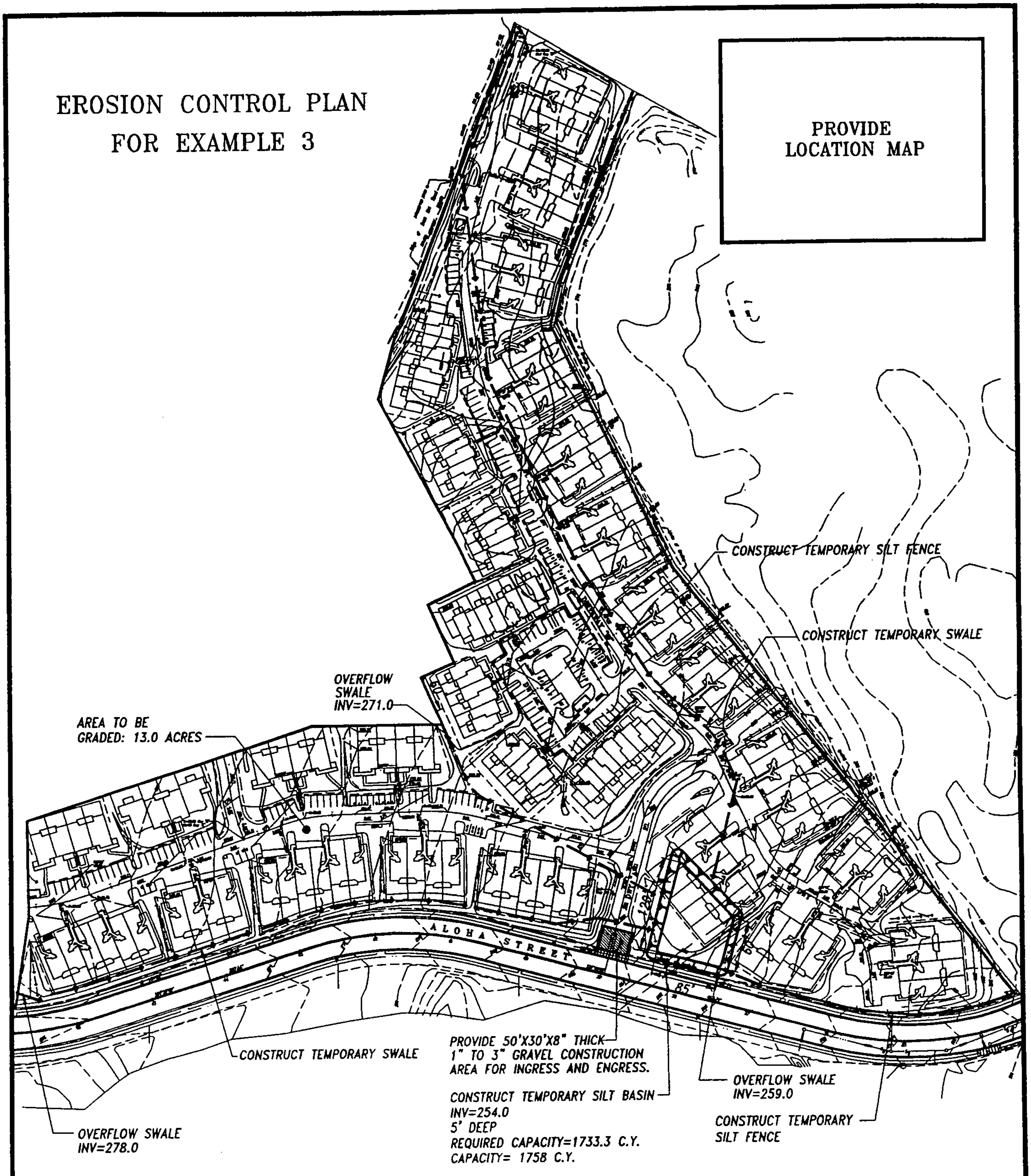
This example is a residential development located in Leeward O'ahu, just above Pearl Harbor. It consists of 13 acres, all of which will be graded. The site is classified as Urban and Zone A-1. The land currently has good vegetative cover and will be converted to single-family residences and low-rise condominium units. This is a "Category 5 project".

This project requires:

1. A Grading Permit.
2. A Grading/Drainage Plan. The grading plan shall include all of the information described in item 2 of the enclosed "Grading Permit Procedures".
3. An Erosion Control Plan.
4. Coverage under the State's NPDES General Permit for Construction Activities and meet all requirements set by the conditions of the General Permit, and incorporate temporary and permanent erosion control measures.

The temporary erosion and sediment control measures on this project shall result in a soil loss rate which is less than the maximum allowable.

EROSION CONTROL PLAN FOR EXAMPLE 3



EROSION CONTROL PLAN

APPROVED:

DIRECTOR, DEPT. OF PLANNING AND PERMITTING — *DATE*

SC2430AX

Administrative Requirements:

____________	____________	____________
Name of Development	Developer	Engineer
____________	____________	____________
Location	TMK No.	Area (acres)

Prepared by: ______________________ Date: ______________________

License Number: ______________________

Owner: ______________________ ________ ______________________
Phone # Mailing Address

Developer: ______________________ ________ ______________________
Phone # Mailing Address

Preparer: ______________________ ________ ______________________
Phone # Mailing Address

Contractor: ______________________ ________ ______________________
Phone # Mailing Address

The project is located at TMK 0:0:0 and has a street address of 11-111 Aloha Street, Pearl Harbor 96819. The land use classification is urban and is zoned A-1. The purpose of the grading is to prepare the site for a mixed development of single family residences and low rise condominium units. The person responsible for the installation, maintenance and monitoring of the erosion and sediment measures will be John Smith of the Jane Doe Company who can be reached at all hours at 555-6677.

Existing Site Conditions

The land is currently in pasture with good vegetative cover. The area to be graded encompasses a total area of 13 acres at an average slope of 2%. There are no nearby streams to the site and the 100 year floodplain does not encompass any part of the site. Drainage from the site currently collects in a natural swale until it flows out toward Aloha Street. A catch basin located at the curb, near the site entrance currently captures all runoff and diverts it to the City's MS4.

Soils

Molokai silty clay loam, 3 to 7 percent slopes (MuB). The Molokai series consists of well-drained soils on upland areas. These soils formed in material weathered from basic igneous rock. Runoff is slow to medium.

(Data from Soil Survey Report by Soil Conservation Service, University of Hawaii cooperating).

Erosion Hazards

The erosion hazard is slight to moderate.

Construction Time Frame

Construction is scheduled for June 1999 and will be completed by December 1999.

Soil Loss Calculations

The Universal Soil loss equation will be used to determine: (1) soil loss under existing conditions, (2) soil loss once the site is cleared and grubbed, and (3) soil loss with the site cleared and graded.

$$A = R\,K\,(LS)\,C\,P$$

"R" is determined by obtaining the annual rainfall factor from the map "Average Annual Values of Rainfall Factor R." (See Section 1-8.2 of the Rules.) For cases where the construction period is less than one year, R can be corrected to reflect a value applicable to the construction period.

For our example, an annual value of 220 is obtained from the map. From Section 1-8.2, the cumulation factors are selected as follows:

% Cum. Dec. 31, 1999 - 1.000
% Cum. June 1, 1999 - 0.558
0.442

$R = 220 \times 0.442 = 97.2$

"K" is the soil erodibility factor which is 0.20 for "Molokai Silty Clay Loam, MuB" (see Table 14 of the Rules).

"LS" is obtained from the slope length and the slope. Here are the values for this example:

existing condition – Length of slope – 1000'
Slope – 2%
(or a drop of 20 ft.)

graded condition – Length of slope – 1000'
Slope – 1%

From Table 16 the (LS) values are:

existing condition (LS) = 0.402
graded (finished) condition (LS) = 0.258

"C" is the ground cover factor, which from Table 20 is:

C = 0.011 for pasture with good cover

C = 1 for cleared land

"P" is the factor to account for erosion control measures. It equals 1 when these measures are not applied.

With these parameters established, we can now calculate the expected soil loss and compare this to the "allowable" soil loss as given by Figure 5, which for our example is 5 Tons/Acre/Yr.

Existing condition:

A = RK (LS) C P

A = (97.2) (.20) (0.402) (0.011) (1)

A = 0.086 Tons/Acre/Yr

Cleared and grubbed condition (before grading):

A = R K (LS) C P

A = (97.2) (0.20) (0.402) (1) (1)

A = 7.81 Tons/Acre/Yr

Cleared and graded condition:

A = R K (LS) C P

A = (97.2) (0.20) (0.258) (1) (1)

A = 5.02 Tons/Acre/Yr

As seen above, both the cleared and grubbed and the graded condition are greater than the allowable amount of 5 Tons/Acre/Yr.

Therefore, erosion control measures must be considered.

One option would be to construct a sedimentation basin. By constructing a sedimentation basin before clearing and grubbing, the erosion values fall below 5 (as P = 0.6 for sedimentation basin as given in Table 24).

Cleared and grubbed with basin in place:

A = R K (LS) C P

A = (97.2) (0.20) (0.402) (1) (0.6)

A = 4.69 Tons/Acre/Yr

Cleared and graded with basin in place:

A = R K (LS) C P

A = (97.2) (0.20) (0.258) (1) (.6)

A = 3 Tons/Acre/Yr

A sedimentation basin will limit erosion to acceptable levels.

Construction Schedule

1.	Construct temporary silt fence.	June 8, 1999
2.	Construct silt basin.	June 9–11, 1999
3.	Construct temporary swales along Aloha Street perimeter.	June 12, 1999
4.	Clear and grub.	June 13–30, 1999
5.	Construct temporary swales.	June 31, 1999
6.	Mass grading.	July 1–31, 1999
7.	Plant temporary vegetative cover on exposed areas.	Aug. 1–15, 1999
8.	Proceed with remainder of improvements.	Aug. 31 – Dec. 31, 1999

Temporary Erosion Control Measures

1. Temporary swales.

2. Temporary silt fence.

3. Silt basins.

4. Vegetative cover to be planted immediately as finish grades are achieved: 40 lbs./acre common rye grass seed, 400 lbs./acre 10-10-10 or equivalent fertilizer. Temporary irrigation system to be installed concurrently with all plantings.

Permanent Erosion Control Measures

Permanent erosion control measures will be covered under the proposed revisions to the Drainage Standards, City and County of Honolulu.

Future Soil Loss

More than three-fourths of the land area of this project will be covered with either buildings or roadways. The open space will be grassed, which gives a "C" of 0.1. Length of slope for the developed project will be a maximum 200 feet, with a slope of 0.5%, which gives an LS factor of 0.122. The future soil loss will be:

$$A = R\,K\,(LS)\,C\,P$$

$$A = (220)\,(0.2)\,(.122)\,(0.1)\,(1)$$

$$A = 0.536 \text{ Tons/Acre/Yr}$$

However, since three-fourths of this area is under cover, the actual value is:

$$A = (0.536)\,(0.25) = 0.13 \text{ Tons/Acre/Yr}$$

While the future soil losses from the site will be greater than that experienced under the existing condition, nevertheless it is far less than 5 Tons/Acre/Yr.

Special Notes

This project would require NPDES general permit coverage from the State Department of Health.

Incremental Grading

As an alternative to constructing the sediment basin, the owner could consider dividing the site into two parcels and grading incrementally. In this case, the slope length and slope values are reduced by half. Construction would proceed by clearing and grubbing the lower half, leaving the upper half undistributed. For this example, the lower half has a size of 8 acres, a slope length of 500 feet, a slope of 1% existing, and 1/2% developed. The upper site has an area of 5 acres with approximately the same slope length and slope.

The construction sequence would be as follows:

Phase I

1. Clear and grub lower site.
2. Grade to finish.
3. Mulch lower site.

Phase II

1. Clear and grub upper site.
2. Grade to finish.
3. Grass both sites.

Soil losses would be as follows:

$$A = \underbrace{R\,K\,(LS)\,C\,P\,(F)}_{\text{Upper Site}} + \underbrace{R\,K\,(LS)\,C\,P\,(F)}_{\text{Lower Site}}$$

LS values are: LS = 0.210 for 500 ft., 1% slope (existing condition)
LS = 0.160 for 500 ft., 1/2% slope (finish grade)

F is fraction of total area for each site.

For Phase I construction, before grading –

$$A = \underbrace{(97.2)(0.20)(.210)(.01)(1)(5/13)}_{\text{(upper site)}} + \underbrace{97.2\,(0.20)(.210)(1)(1)(8/13)}_{\text{(lower site)}}$$

A = 0.016 Tons/Acre/Yr + 2.51 Tons/Acre/Yr

A = 2.53 Tons/Acre/Yr

(This would be further reduced under the graded condition.)

For Phase II construction, before grading the upper site –

$$A = \underbrace{(97.2)(0.20)(0.210)(1)(1)\,5/13}_{\text{(upper site)}} + \underbrace{97.2\,(.20)(.160)(.02)^{*}(1)\,8/13}_{\text{(lower site)}}$$

A = 1.57 Tons/Acre/Yr + 0.038 Tons/Acre/Yr

A = 1.61 Tons/Acre/Yr

The phasing of grading activities brings the soil losses below 5 Tons/Acre/Yr.

---

*Mulched at 2 Tons/Acre, C = 0.02.

Conclusions:

Since the graded area for this project is greater than 5 acres, an erosion control plan was required. This project also required calculations of soil loss rates to determine if the actual rate was less than the allowable. The erosion control measures were sufficient to reduce the annual soil loss rate to less than the allowable.

GRADING PERMIT PROCEDURES

1. Permit is required for grading which changes the drainage pattern with respect to abutting properties, exceeds 50 cu. yds. of cut or fill, or exceeds 3 ft. in vertical height at its deepest point.

2. When grading permit is required by Chapter 14, ROH 1990 as amended, submit 2 copies of grading plan drawn to scale.

   A. For total graded area or developed area less than 15,000 sq. ft. for Single-Family or Two-Family Dwelling uses or less than 7,500 sq. ft. for other uses:
   Information to be shown on grading plan.
      1. Name and address of the property owner.
      2. Location Map, Address, and Tax Map Key of the job site.
      3. Lot plan with property lines, dimensions, building setbacks, easements, and total area of the lot.
      4. Location of all structures, improvements and location of any building or structure on adjacent property which is within 15 ft. of the property to be graded when the grading may affect the building or structure.
      5. Location of any streams, waterways, and wetlands.
      6. Existing and finished ground shown by spot elevations or by contour lines and cross sections. Identify BM.
      7. Maximum slope ratio of cut or fill must not exceed Table A.
      8. Minimum slope setback distance from lot lines. See Table B.
      9. Show limits of area to be graded.
      10. Show existing and new drainage pattern of this and of adjacent lots affected by this work.
      11. Quantity of cut and/or fill in cubic yards and area to be graded in square feet.
      12. Description of existing material and fill material.
      13. State on plan in cubic yards, waste from or import to lot, and location of disposal and/or borrow sites.
      14. Disposal and/or borrow sites must also conform to Grading Ordinance.
      15. State the current development plan land use map designation and zoning designation of the lot and the purpose of the grading work.

   B. Other Requirements (If Applicable)
      1. A copy of any environmental impact statement or environmental assessment required by the United States or by any State or City Agency.
      2. State the purpose of the grading work in terms of a use or structure permitted on the zoning lot under Chapter 21.
      3. If the use or structure for which the grading work is being done requires a conditional use permit, plan review use resolution, planned development approval, site plan review permit, special district permit, special management area use permit or special management area minor permit, the applicant shall include a copy of the applicable permits, approvals and resolutions.
      4. If the use or structure for which the grading work is being done requires an amendment to any permit, resolution or approval referred to in subdivision, the applicant shall include a copy of the amendment.

3. In addition to the foregoing, if the proposed total graded area including any areas developed incrementally is 15,000 sq. ft. or more for Single Family Dwelling (SFD) or Two Family Dwelling (TFD) uses or 7,500 sq. ft. or more for other uses or if the proposed cuts or fills exceed 15 ft. in height for SFD or TFD uses or 7.5 ft. in height for other uses, the grading plans must be submitted for review and approval of the Director. Additionally, a drainage plan and erosion control plan and procedures must also be submitted for review and approval.

4. Soils report required for one or more of the following conditions:

   A. A proposed cut or fill is greater than 15 ft. in height for Single-Family or Two-Family Dwelling uses or 7.5 ft. in height for other uses.
   B. The proposed grading is on land with existing slopes exceeding 15 percent.
   C. Any fill is to be placed over a gully, or a swamp, pond, lake, waterway or wetland.
   D. The fill material will be a highly plastic clay.
   E. The fill is to be used to support foundations for residential or other buildings.

5. General Information

   A. A permit fee is required. A bond is required for volume over 500 cu. yds., or for cut or fill over 15 ft. in vertical height or for work being done in increments of 500 cu. yds. or less which is part of a larger development.
   B. All grading is subject to inspection.
   C. Name and address of permittee responsible for grading.
   D. The person signing the grading application for the permittee shall present evidence that he or she is authorized to act for the permittee.

FOR MORE INFORMATION CALL THE PERMIT COUNTER AT 523-4921 OR 523-4164

FEES and BONDS

GRADING PERMIT FEES

Grading permit fees are based on cut or fill quantity, whichever is greater.

0 to 1,000 Cu. Yds.	$15.00 for each 100 Cu. Yds. or fraction thereof.
1,001 to 10,000 Cu. Yds.	$150.00 for first 1,000 Cu. Yds. plus $15.00 for each additional 1,000 Cu. Yds. or fraction thereof.
10,001 Cu. Yds. or more	$285.00 for first 10,000 Cu. Yds. plus $9.00 for each additional 1,000 Cu. Yds. or fraction thereof.

STOCKPILING PERMIT FEES

101 to 1,100 Cu. Yds. or more	$18.00, plus $3.00 for each additional 1,000 Cu. Yds. or fraction thereof.

GRUBBING PERMIT FEES

15,001 to 16,000 Sq. Ft. or more	$33.00, plus $3.00 for each additional 1,000 Sq. Ft. or fraction thereof.

AMOUNT OF BOND FOR GRADING AND STOCKPILING

The amount of the bond shall be based upon the number of cubic yards of material in either excavation, fill or stockpiling, whichever is the greatest volume. The amount of the bond shall be computed as set forth in the following schedule:

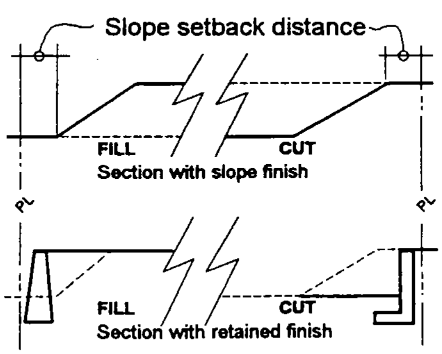
10,000 cubic yards or less	$8.00 per cubic yard.
10,001 to 100,000 cubic yards	$80,000.00 plus $3.00 per cubic yard for each additional cubic yard in excess of 10,000. cubic yards
100,001 cubic yards or more	$350,000.00 plus $1.00 per cubic yard in excess of 100,000 cubic yards.

TABLE A
Maximum slope of cut or fill

Cut slope ratio		
Hori.	Vert.	Material
½	1	Rock or mud rock
1	1	Decomposed rock
1½	1	Stable soil
Fill slope ratio		
Hori.	Vert.	Material
2	1	All types

TABLE B
Minimum slope setback distance from lot line for cut or fill finished with slope.

Height of cut or fill	Set back distance
0 - 4 feet	2 feet
4 - 8 feet	4 feet
8 - 15 feet	6 feet
15 feet or more	8 feet



SYMBOLS

Show Work By	Existing	Finished
Contour Lines	10	10
Spot Elevation	10	10
Water Flow		
Bank of Slope	10 5	10 5
Slope Ratio	1 2	1 2