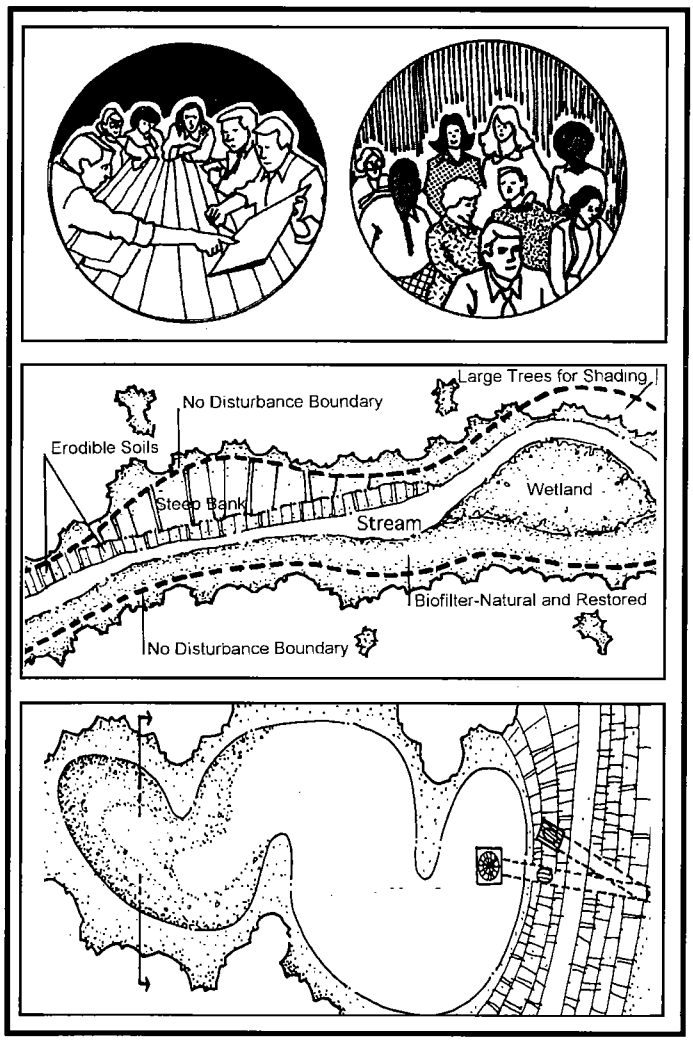

NONPOINT SOURCE POLLUTION CONTROL

GUIDEBOOK

For LOCAL GOVERNMENT

June 1994

Oregon Department of Environmental Quality and Oregon Department of Land Conservation and Development

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NONPOINT SOURCE POLLUTION CONTROL GUIDEBOOK

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NONPOINT SOURCE POLLUTION CONTROL GUIDEBOOK

USING THIS GUIDEBOOK TO BENEFIT YOUR COMMUNITY

How important is clean water to you and your community?

The values and benefits of clean water are many. Healthy waterways provide valuable fish and wildlife habitat, aesthetic resources, recreational opportunities, and safe drinking water supplies. They are an integral part of our individual and community well-being.

WHAT IS NONPOINT SOURCE POLLUTION?

Nonpoint source (NPS) pollution results from land uses and development that:

- Discharge pollution (such as suspended solids, sediments, and nutrients) into surface water and groundwater in a diffuse manner

  or

- Affect water quality by increasing temperature, changing pH, or reducing dissolved oxygen.

Most NPS pollution problems originate from water flowing past exposed pollutant sources and picking up soil or other chemicals. The pollution comes from many places and many activities, including farms, construction sites, lawns and gardens, timber-cutting areas, industrial plants, roads, streets, and highways. This is in contrast to point source pollution, which can be traced to a specific point of discharge, such as a wastewater treatment plant or factory.

NPS pollution may flow directly into surface waters, or may slowly infiltrate into the ground and later emerge in streams and lakes.

One of the unique problems of NPS pollution is that it results from the accumulation of many small actions. Each action has a small individual impact, but the combined cumulative effects are large.

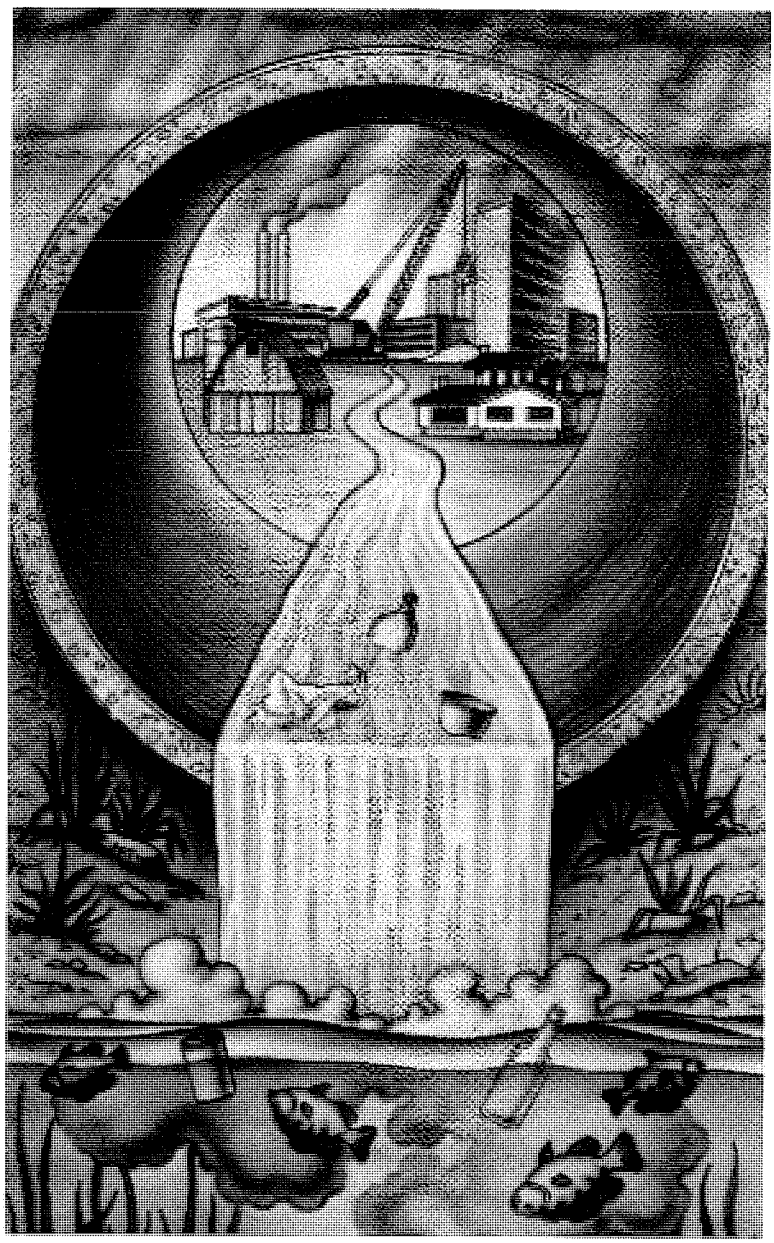
Nonpoint source (NPS) pollution is affecting Oregon's waterways and threatening these beneficial water uses. The problems caused by NPS pollution result in unacceptable environmental, economic, and social costs to communities and their citizens. They are problems that state and local officials across the country will increasingly need to address in their daily decisions.

This guidebook is written for local planners, engineers, water quality specialists, elected officials, and interested citizens. It emphasizes the important role of local government in protecting water quality and tells how to find solutions appropriate for local problems. It also discusses how everyday activities contribute to NPS pollution and how citizens can be involved in recognizing and solving the problem.

Federal and state regulations and programs have been developed over the last 20 years to control nonpoint sources of pollution. Many of them can be implemented only at the local level. The effect of these regulations and programs has generally been limited, since many communities are not fully aware of what nonpoint sources are, much

less how to control them. The incentives and requests for NPS pollution control programs at the local level are now evolving into federal mandates. Future amendments to the Federal Clean Water Act (FCWA) are expected to increase that pressure. The objectives are becoming increasingly clear, but many of the choices about how to reach them are still left primarily to local governments, where most land use and stormwater management decisions are made.

The Oregon Department of Environmental Quality (DEQ) and the Oregon Department of Land Conservation and Development (DLCD) are committed to communicating better with local governments and communities about NPS pollution and providing specific information about what can be done. Fortunately, local governments can use many of their existing programs and resources to control NPS pollution. Planning, permitting, capital improvements, and other existing programs can be applied, without the need to create new organizations or processes. Special dedicated funding opportunities exist so that NPS programs do not need to compete with other local programs for funding.



Local governments are the primary public service providers to Oregonians. Their proven capabilities need to be combined with the strengths of Oregon's comprehensive planning process and public works programs and the technical expertise of state agencies. Working together at the state and local levels can achieve far greater environmental benefits than separate action.

The guidebook is intended to provide assistance, rather than to mandate a specific set of rules. Its goal is to show how the various levels of government can work together, and how communities can find solutions that are applicable, efficient, and cost-effective. Most important, it is intended to help local governments provide the leadership

and innovation necessary to control NPS pollution before control requirements become inflexible and mandated.

This guidebook is meant as a general introduction to NPS pollution and its control. More detailed information is available from the Oregon Departments of Environmental Quality and Land Conservation and Development.

ORGANIZATION OF THE GUIDEBOOK

Section I: Background, discusses the important role of local government in preventing and controlling NPS pollution. It describes the causes and sources of NPS pollution and identifies the environmental, social, and economic impacts that can result. It then provides an overview of possible control measures that local governments can use, and discusses the various approaches that can be taken to implement those measures.

Section II: Choosing the Right Approach, discusses how each community can choose the NPS pollution control options and approach that work best for it.

Section III: Nonpoint Source Pollution Control Measures - Local Government and Citizen Processes, describes the authorities and functions that allow various local government entities to address NPS pollution control. It then describes control measures that are classified as "management processes." These are existing processes (such as land use regulations, capital improvement programs, or design/construction standards) that can be adapted to incorporate NPS pollution control elements. Public involvement and stewardship opportunities are also discussed.

Section IV: Nonpoint Source Pollution Control Measures - Facilities and Practices, describes facilities (such as detention ponds or roof drains) and practices (such as logging methods) that can be used to control NPS pollution. It identifies the advantages, disadvantages, and requirements of each measure, so communities can select those that best meet their particular conditions.

Section V: Summary of Federal and State NPS Pollution Control Authorities, summarizes the various federal and state laws and regulations related to NPS pollution control.

The **Glossary** contains terms relevant to NPS pollution.

The **References** identify sources that can provide more detailed information about NPS pollution and control measures.

The **Appendices** contain material that supplements the information in the guidebook.

INTRODUCTION

This guidebook can be viewed as a "tool chest" of techniques, which communities can evaluate and incorporate as needed in their planning, regulatory, and capital improvements programs. No single approach is likely to be adequate; a combination of the various control measures will produce the best results.

In using the guidebook, it will be useful to follow a general four-step approach for planning and implementing NPS pollution control in your community. This approach is summarized here and discussed in more detail in Section II.

First: Educate and involve staff, local officials, and citizens in NPS pollution issues and solutions.

Second: Inventory and assess NPS pollution problems and the related environmental, political, and social conditions in your area.

Third: Develop alternatives for NPS pollution control (including funding) that are appropriate for your community, as part of the comprehensive planning and surface water management planning processes.

Fourth: Choose and implement the control measures that will efficiently solve the problems, fulfill state and federal water quality goals, and best fit your community's needs and conditions.

SECTION I

BACKGROUND

SUMMARY OF SECTION I

- Discusses the important role of local governments in creating effective nonpoint source (NPS) pollution control programs
- Describes the causes and sources of NPS pollution
- Provides an overview of NPS pollution control measures
- Identifies various approaches local governments can take to implement NPS pollution control measures

THE IMPORTANT ROLE OF LOCAL GOVERNMENTS

This guidebook is designed to help local jurisdictions prevent and control nonpoint source (NPS) pollution and reduce water quality problems in their communities. Without the help of local governments, adequate prevention and control of NPS pollution will not happen.

The guidebook is not intended to regulate or mandate local government activities, nor to serve as a design standards manual for practices or facilities. It summarizes the existing regulations related to NPS pollution, discusses legislative and policy trends, and provides examples of NPS control practices for use by local government.

The U.S. Congress has declared the intention of the federal government to abate and control nonpoint source pollution through three federal laws: the creation and reauthorization of the Federal Clean Water Act (FCWA); the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA); and the Safe Drinking Water Act (SDWA). That charge is also passed on to each state. Oregon recognizes its responsibility to develop a program that works statewide, and has information and technical resources to support that effort.

The state also recognizes the critical role played by local jurisdictions—cities, counties, regional governments, and special districts—to create programs that work locally. These jurisdictions regulate and control activities that affect the land and the water flowing over it—by development regulation, by planning and constructing public facilities, and by creating performance

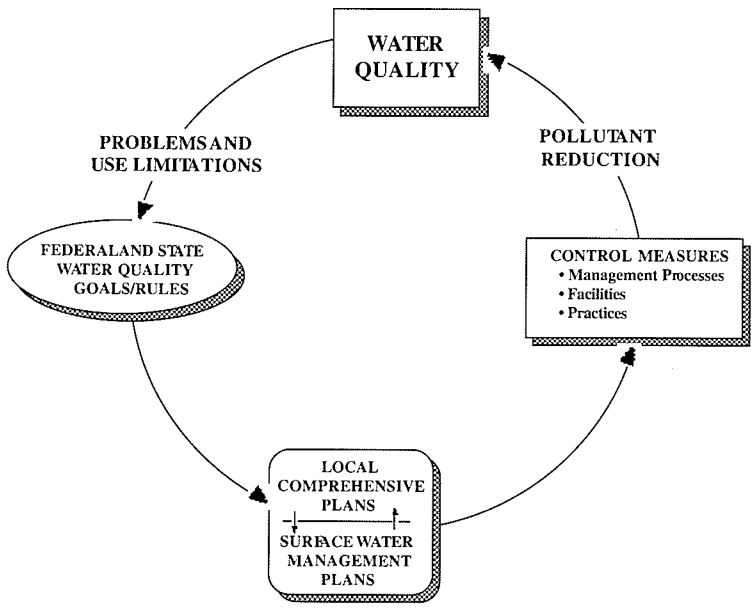
standards for land managers and owners. Most often, Oregon's local jurisdictions deal with the people who daily develop and use the land, deposit materials on or near watercourses, or otherwise take actions that affect water quality. This contact occurs as part of local permitting activities, during implementation of local comprehensive plans, or in the course of delivering a particular service (e.g., streets, sewers, and parks).

Local land use planning includes developing inventories of important resources and creating policies to protect, prioritize, or otherwise allocate resource use. These decisions are based upon local values, but must comply with Oregon's statewide planning goals. The zoning and other regulations used to implement the local comprehensive plan contain processes for controlling the siting of roadways, marinas, wellfields, industries, and countless other uses that directly or indirectly affect water quality.

Local jurisdictions can also work with other agencies such as the U.S. Forest Service and soil and water conservation districts to implement NPS pollution control measures in agricultural and forest harvest areas.

No one program is sufficient to address a subject as diverse as NPS pollution, but every community in Oregon has the existing legal authorities and processes needed to address many aspects of NPS pollution control.

NONPOINT SOURCE POLLUTION CONTROL PROCESS



This guidebook identifies control measures that can be used to prevent NPS pollution in an efficient and cost-effective manner. With this guidebook and the technical resources available in state agencies, local governments can choose among the various measures to find the optimal approach for a particular activity, site, or watershed.

State and local governments have the opportunity to establish a strong partnership by combining resources and acting together. This team approach is particularly important when limited financial resources are available to take on new tasks. The variety of options available to local governments puts them in a position to take a real leadership role in protecting Oregon's water quality.

THE NONPOINT SOURCE POLLUTION PROBLEM

OVERVIEW

Most NPS pollution problems originate with water flowing past exposed pollutant sources. Although soil is the predominant pollutant, other materials can be involved, such as industrial, agricultural, and forestry-related chemicals; farm materials such as manure; mine tailings; or simply street dirt from impervious surfaces such as asphalt. Agricultural land uses are often the major contributor to NPS pollution (1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution, DEQ, 1988) but on-site spills, urban development, forestry activities, highway maintenance, and runoff from urban uses are also involved.

Suspended sediments and nutrients such as nitrogen and phosphorus are the predominant NPS pollutants. (See the American Planning Association newsletter on NPS pollution in Appendix A.) Oil and grease are major contaminants, in addition to salts, metals, reduced dissolved oxygen, and toxic organic chemicals. Metals, pesticides, other inorganics and some pathogens affect water bodies in many places throughout the state. Because of the nature of estuaries and their uses, many of these pollutants are of critical concern in coastal waters.

An excellent source of information about water quality in Oregon is the 305b Report prepared by DEQ every 2 years. This report is required by the Federal Clean Water Act, Section 305b, and contains data about all types of environmental issues and about the progress being made to improve conditions. While the document contains considerable technical information, it is written in a manner that allows the interested citizen to review and understand it.

HYDROLOGY AND WATER QUALITY

When water hits the ground, two processes can occur. First, the water may infiltrate into the groundwater, leaching or picking up chemicals as it moves through the soil and rock zones. Plants may take up, or transpire, some of this water and pass it into the atmosphere. Complex groundwater interactions with soil, soil microbes, and air can either raise or lower the concentrations of the various chemicals present.

Second, the water may move as surface water. After precipitation or flowing water detaches and picks up soil particles or other pollutants, it flows over the ground surface and transports the pollutants downstream. The pollutant transport process that follows entrainment is also complex. This involves deposition (sedimentation), re-entrainment, and re-deposition. Since the transport of contaminants down through a stream system is primarily dependent on high flows, the rate that pollutants move through even a small watershed can vary from days to many years in the same watershed. The most important hydrologic variables affecting this process are stream gradient (steepness) and runoff velocities, which increase or decrease because of stream flow or

precipitation. Other important variables include soil type and the amount of exposed soil or pollutant. Land development exposes soil and often increases flood flows, which increases erosion.

As runoff flows through stream pools, ponds, lakes, and wetland systems, the pollutants being transported can settle out or be otherwise removed, reducing their concentration in the water. This natural process can present major problems, such as the impairment of fish spawning areas by sediment deposition. On the other hand, deposition also provides "water treatment" if the facilities involved have been constructed or adapted and maintained for water quality improvement purposes.

While most NPS problems originate with precipitation striking, or water flowing past, exposed pollutant sources, there are exceptions, such as on-site wastewater systems that discharge directly to the groundwater. Groundwater usually discharges into surface water and vice versa, so nonpoint sources that affect one will usually affect the other.

Temperature problems are usually classed as nonpoint source problems. They commonly result from the removal of streamside vegetation that would otherwise protect the water from direct sunlight. Summer flow reduction can also increase temperature. These flow reductions can result from degraded riparian area and less infiltration to groundwater storage because of additional impervious cover (such as asphalt).

ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS

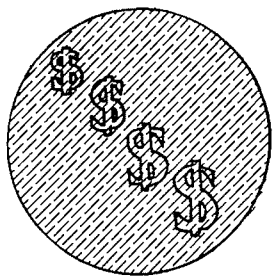
The continued degradation by pollutants such as silt, pesticides, nutrients, pathogens, and metals affects the use of rivers, creeks, lakes, and estuaries throughout each basin in Oregon.

Groundwater and wellhead areas are increasingly threatened by a variety of pollutants, and costly remedial or preventive activities must be undertaken to protect the public health.

No one knows the total cost of NPS pollution in terms of illness, expense, or lost quality of life. Yet, everyone knows of places where they can no longer fish or swim without concern. The social effect of so many small losses to the quality of life cannot be quantified. It is, however, reflected in people's growing skepticism about the future of our nation and our communities, and about the ability of public officials to effectively address persistent problems.

The economic costs to build water treatment systems, treat people made ill by exposure to contaminants in the water, or construct NPS pollution remedial systems can be significant. These actions are taken to protect ourselves from pollutants that do not need to be in the water to begin with. Other costs can include the effect on local economies from lost

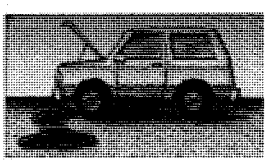
tourism, lost fish resources or the loss of funds used for pollution control that could have been available for other community needs.



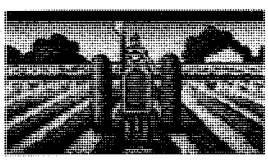
The best solution is to avoid contaminating the water in the first place. The solution to pollution is prevention.

NONPOINT SOURCES OF WATER POLLUTION

Most NPS pollution results from disturbances, alterations, or uses of the land surface. Nonpoint sources can be generally grouped by the types of land use listed below. This list shows the percentage of pollution caused by each use statewide and describes the most immediate impacts. In addition to the intensity of the NPS pollution activity, the real extent of the type of activity is important to consider.

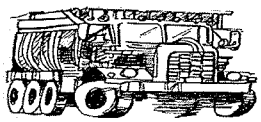


Urban (11.8%)—includes residential, transportation, commercial, and industrial uses. Impacts: Toxic substances enter the food chain; petroleum products are harmful to fish and wildlife; excessive nutrients increase algal blooms; water quality is reduced.

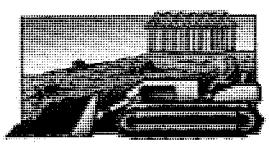


Agriculture (38.7%)—includes range and field activities. Impacts: Bacteria and nutrients increase in streams; increased temperature damages fish habitat; erosion and vegetative loss occur; bacteria can cause human illness; algal growth increases.

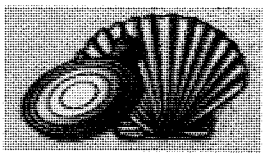
Forestry (17.4%)—includes logging and related road construction. Impacts: Increased temperatures and turbidity harm aquatic life; sediment buries fish habitat; habitat area is lost from other effects.



Mining (5.2%)—(Not addressed in this guidebook.) Impacts: toxics can enter streams; erosion can alter streams.



Construction (3.3%). Impacts: Erosion can destroy aquatic life; toxics have long-term impacts on fish and wildlife; flooding can occur more frequently, while less water is available for aquatic life in the summer.



Marine recreation (13.8%)—includes boating and other marine activities. (Not addressed in this guidebook.) Impacts: Pollutants such as oil, toxics, and debris can reduce or kill fish and wildlife; bacteria can make humans ill.

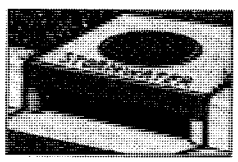
Natural (9.7%)—includes natural erosion and naturally occurring nutrients. Impacts: Streams can usually handle some pollutants, but humans accelerate the NPS pollution process and disrupt the natural balance.

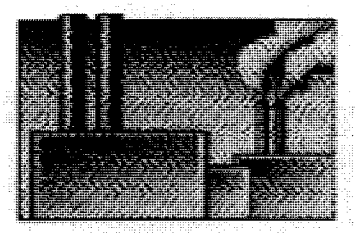
Urban

Urban NPS pollution is similar for residential, transportation, commercial, and industrial activities. Most of the problems originate when water flows past soil, exposed chemicals, or impervious surfaces such as streets, driveways, and roofs. Erosion from construction activities is also a major concern in urban areas. "Street dirt" can contain contaminants such as heavy metals, organic chemicals of various types, phosphorous, oil, and grease.

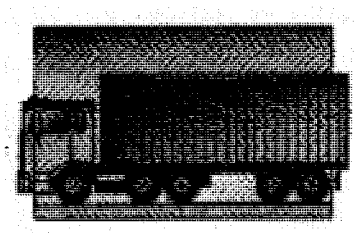
Residential sources include:

- Septic tanks (not addressed in this guidebook), which produce primarily oxygen-demanding pollutants, nitrates, and bacteria
- Stormwater systems
- Lawn and garden chemical use
- Garbage transfer and recycling stations
- Incinerators and trash-burning sites
- Vehicles (e.g., petroleum products)
- Erosion caused by soil exposure or high runoff velocities from impervious surfaces
- Golf courses
- Disposal or accidental releases of various chemicals





Industrial areas (for example, loading docks or storage areas where hazardous materials are exposed) can release industrial chemicals to storm drains, streams, and groundwater. Many industrial NPS problems result from accidents such as fires, spills, and leaks involving warehouses, manufacturing plants, storage/loading areas, and transport vehicles.

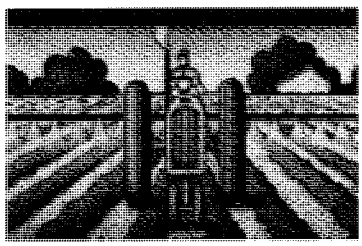


Commercial areas (such as commercial sales or service areas) vary widely in their NPS pollution potential, depending on the materials that are stored, used, or transported on the site and the landscaping programs that are used.

All three urban sources can be addressed through the various control measures discussed in Sections III and IV.

Agriculture, Forestry, and Mining

Soil erosion is the primary NPS concern in farm, forest, and mining areas. Suspended solids (sediments), phosphorous, temperature changes, timing of pollutant release, and attached metals can all be involved.



Agricultural runoff can include fertilizers, herbicides, and pesticides in the water or attached to the soil. The exposure of stored chemicals or waste (such as manure) to precipitation can also cause problems in a farming area. While agricultural contributions of phosphorus, nitrogen, and herbicides or pesticides to surface water and groundwater are of concern, erosion (sedimentation) is the most significant problem.

Forestry practices also affect surface waters through erosion, particularly from logging roads and skid trails. Forest chemicals can be contributed through poor storage or application practices, as well as leaks or spills. Forest residues, such as the vegetation remaining after the forest is harvested, are usually a minor factor.

Mining can affect surface water and groundwater through the leaching of heavy metals and other chemicals to surface water and groundwater systems. Most leaching occurs in tailings piles or ponds, but can also occur from whatever mining surface is exposed to air and water. NPS pollution control measures relating to mining are not addressed in this guidebook.

GRESHAM EROSION CONTROL TECHNICAL GUIDANCE HANDBOOK

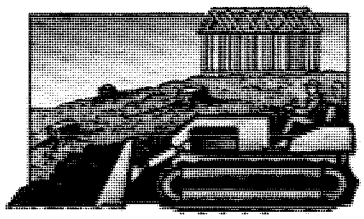
The City of Gresham developed a guidebook to reduce the amount of soil materials removed from construction sites. The guidebook is used by the city for its construction projects, as well as by private builders and contractors that work within the city limits. The primary concern was soils eroding from sites because of storm runoff.

The guidebook contains a number of effective management practices for reducing and controlling soil erosion during construction. It is anticipated that these practices will also help contain any on-site chemical spills.

Since adoption, the city has found the guide to be helpful in preventing soil erosion.

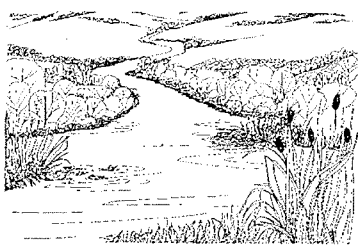
Construction

Soil erosion and the subsequent downstream sedimentation are the primary problems associated with construction activities in urban, agricultural, and forestry areas. Because of the high degree of soil exposure involved, construction activities are a major source of water quality problems. This is particularly true in a watershed where new projects start up as others end; the watershed may be exposed to extremely high erosion rates for decades, even though individual projects may last only a few years. Polluted sediments can destroy the usefulness of spawning beds. Stored chemicals, building materials, road surface treatments, and landscaping/weed control practices can also affect water quality.



Stream Alteration and Riparian Disturbances

Stream alteration and riparian disturbance can result from any of the preceding uses. Stream alterations can expose the beds and banks of streams to the forces of erosion, particularly during high-flow periods. During high flows, many of the sediment particles are quickly washed through the stream system. If downstream water resources can absorb the loadings, this process may have little effect on water quality. However, much of the entrained soil will be deposited downstream and act as a source for continuing erosion and deposition processes. This results in serious downstream problems, particularly for fish.

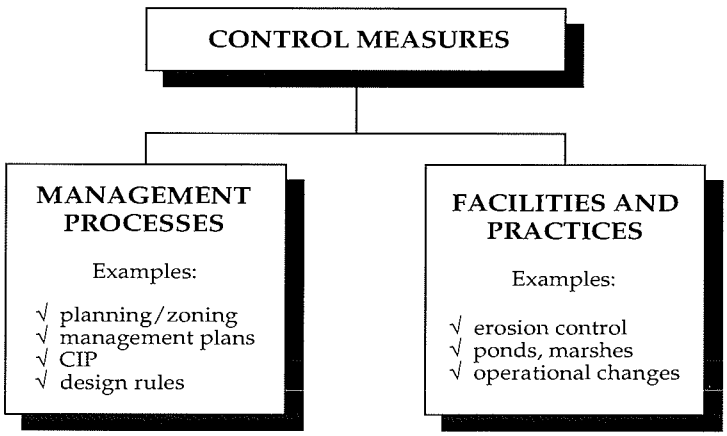


Watershed alterations, such as urbanization and the loss of vegetative cover, are an important factor in stream alteration. They create higher runoff velocities and consequently more channel erosion.

AN OVERVIEW OF NPS POLLUTION CONTROL MEASURES

This guidebook presents a variety of NPS pollution control measures. These measures, which emphasize prevention, can be classified into two categories:

- Management processes
- Facilities and practices



Management processes include authorities and functions that are currently available to local governments and can be used to address NPS pollution control. They particularly emphasize pollution prevention and include:

- Comprehensive planning
- Land use regulation (e.g., zoning regulations or development permits)
- Surface water management plans
- Watershed planning
- Capital improvement programs
- Design/construction standards
- Local agency coordination

Section III describes these management processes in more detail.

Facilities and practices are constructed facilities or operational practices that can be used to prevent or remedy NPS pollution. Examples include:

- Erosion control practices.
- Ponds, marshes, and sediment trap facilities for sediment deposition. These facilities can also include other water quality functions, where vegetation filtration or soil infiltration processes are used to provide biochemical removal of various chemicals.
- The protection of various pollutant sources, such as chemical storage areas.

- Conservative application practices for herbicides, pesticides, and fertilizers, as well as alternative practices.
- The adjustment of land development, farm, and forest harvesting practices so they are more responsive to water quality issues.
- Protection of sensitive areas such as steep slopes, erodible soils, streams, wetlands, and riparian areas.

Section IV gives detailed descriptions of these facilities and practices for urban (residential, commercial, and industrial), agriculture, and forestry uses. Mining, marine recreation, and on-site wastewater systems are not addressed in Section IV.

These control measures provide local governments with a number of options for dealing with the many NPS pollution situations arising in their communities. Once an inventory of existing conditions has been prepared, local officials can develop an appropriate list of control measures adapted specifically to their communities. A complete NPS pollution control program must be composed of several elements from each of the two major categories.

By understanding when and why to use these various systems and practices, local officials can provide valuable resource protection for their communities and become an important part of the national system for protecting the environment.

IMPLEMENTATION APPROACHES

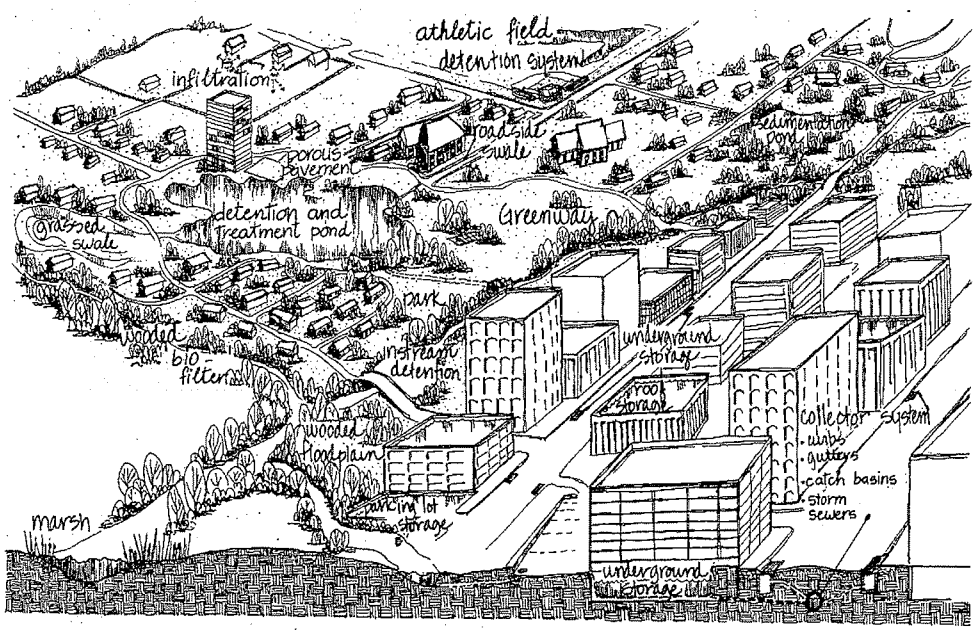
A number of approaches are possible for implementing NPS pollution control. They range from those that are low cost and politically acceptable to those that require more effort and commitment.

One approach is to rely on information and education programs to achieve voluntary compliance. Voluntary approaches have been extensively used over the last two decades, particularly for agriculture, and have had modest success. Opinions vary about the potential of these information and voluntary compliance programs, but very few people, if any, believe they will do the job alone.

Another approach is to combine information, education, and voluntary compliance with a stronger, more active role for state and local government. With this approach, the local jurisdiction coordinates and, if necessary, regulates activities that affect the quality of waters within its jurisdiction. This can include coordination/negotiation sessions with federal land management agencies, such as the U.S. Forest Service or the U.S. Bureau of Land Management. It can also involve a stronger proactive local role to support the enforcement of federal and state water quality laws and regulations.

In urban areas, both site development requirements and regional public water quality facilities are needed. Site development requirements are needed for both the construction and post-construction periods. They involve erosion control, special protection zones, remedial facilities such as sedimentation ponds, and the reduction of impervious surfaces (e.g., minimizing road widths and roof areas). Since many parts of an urban/suburban area are already developed and site-by-site retrofitting site is difficult, if not impossible, regional NPS control facilities may also be required. Such facilities treat surface waters coming from the developed urban surfaces, primarily impervious areas such as streets and driveways.

The most productive approach is one that is receiving increased federal and state emphasis. It involves the participation of multiple jurisdictions and disciplines in watershed planning and management to address NPS problems, followed by enforceable regulations and regional public facilities. This is now being done in many communities in Oregon.



Whatever approach is used, special attention must be given to public participation options to ensure that the best method for informing and involving the public is used. Section III contains more information about reaching citizens in the community.

SECTION II

CHOOSING THE RIGHT APPROACH

SUMMARY OF SECTION II

- Discusses how each community can choose the NPS pollution control procedures, facilities, and practices that work best for it

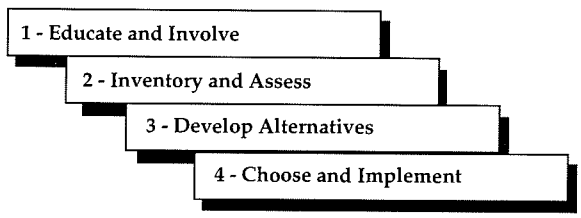
Section II

Section III identifies the various management processes that can be used to control NPS pollution. Section IV identifies the facilities and practices that can be applied to NPS pollution problems. Together, these provide a basic "toolchest" of alternatives, which communities can evaluate and implement as appropriate. This section discusses how each community can choose the processes, facilities, and practices that work best for it.

THE FOUR-STEP PROCESS

A general four-step approach can be used to determine how the community's NPS pollution control needs can best be met.

FOUR STEP PROCESS



Step 1: Educate staff, local officials, and citizens about NPS pollution issues and involve them in the solutions.

It is important to establish a shared body of knowledge and to educate people about the issues and terminology. It is then possible to move on to involving the public in solutions to the existing problems. The political environment and level of current public knowledge should be considered in determining the best education and involvement methods.

Step 2: Inventory and assess NPS pollution problems and the related environmental, political, and social conditions in the area.

This can be done by answering a series of questions, such as the following:

- What problems exist with surface water or groundwater quality, stormwater run-off, erosion-prone areas, or chemical contamination of streams?
- What are the designated beneficial uses for the streams in the planning area?
- Do nonpoint sources exist that are likely to be contributing pollutants to surface water or groundwater? Are the sources from residential, commercial, industrial, agricultural, or forestry areas?
- Does the community have special areas of concern (such as estuaries, wellheads, or wetlands) that are sensitive to water quality?
- What is the capacity of the local waters to assimilate likely pollutants?
- How effective are the community's regulations and policy documents in addressing NPS pollution? Can specific examples of regulatory and policy deficiencies be identified?
- Does the community need to prepare an updated drainage master plan, which could be developed to include NPS pollution controls and become a surface water management plan?
- How has the community been involved with environmental issues in the past, and who would be currently interested?
- Is it possible to determine the costs and benefits of NPS pollution control in this community?

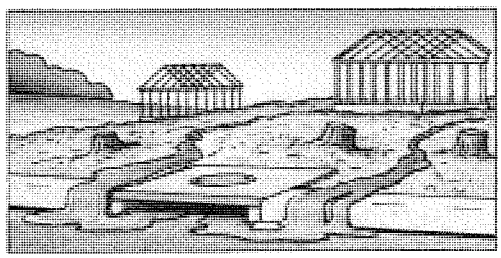
Step 3: Develop alternatives for NPS pollution control (including funding) that are appropriate for the community, as part of the comprehensive planning and surface water planning processes.

These alternatives should include management processes, as well as facilities and practices. (See Sections III and IV.)

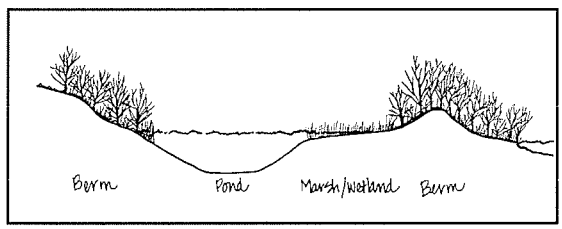
Step 4: Choose and implement the control measures that will efficiently solve the problems, fulfill state and federal water quality goals, and best fit the community's needs and conditions.

- Are regulations for development or land use necessary? If so, what regulations should be added? (See Section III.)

- How can coordination between the various local, state, and federal agencies be improved?
- How can facilities and practices be brought into the regulations? (See Section IV.)
- Are the problems primarily in future development or use areas (which would suggest the need for development regulations and better management practices); existing developments and past use areas (which would suggest the need for NPS control facilities); or both?



- What are the local agencies, districts, or other entities that can be used to address these issues?
- Would a pilot project be useful to demonstrate the issues and possible benefits?
- Are outside experts needed, or can the issues be handled by existing staff?



- What financial resources are available? Is there a willingness to establish new funding mechanisms, such as stormwater utility fees and charges?
- What measurement/monitoring program will be needed to gauge the needed improvement, and who will be responsible for the reporting duties?

This may seem like a lot of questions. However, each one provides an answer that will help define the best approach and the proper set of regulatory tools to use in the community.

For example, a community may have an involved public that is knowledgeable about NPS pollution. In that case, little need will exist for an extensive new citizen involvement process, and it is likely that the basic policy framework is in place. More effort can then be focused on inserting the control measures into the development regulations and initiating a surface water management plan that leads to capital improvements and water quality facilities. In addition, it is likely that a more regulatory approach and capital improvements will be supported. Further, it will probably be acceptable to use public information and existing planning commissions or other citizen committees, rather than forming special committees and developing multiple workshops as part of the startup process.

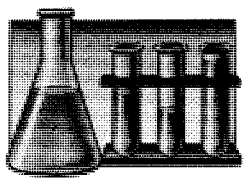
Some communities, however, may have a substantial number of sensitive areas, such as coastal areas where estuaries and wetlands are common. In that case, it may be advisable to expend more effort to educate and involve property owners and the building community. This can be coupled with advisory committees, which can recommend the best course of action and identify regulations and capital improvements based on the alternative management processes and facilities/practices. Where activities of special concern are likely to occur in sensitive areas, it may be necessary to impose increased protection quickly.

If most of the NPS pollution problems exist now, regional NPS control facilities are probably needed. On the other hand, regulations and better management practices will be effective if it is anticipated that future land use or development will affect future water quality conditions.

MONITORING

An important feature of local NPS pollution control programs is monitoring the water quality of the streams and lakes affected by NPS pollution. Such monitoring should use a system that can help determine the location of NPS problems. All land uses, particularly those that involve soil exposure or impervious cover, should be included. Section IV contains additional monitoring information.

All local programs that address nonpoint sources associated with commercial and industrial sites should include monitoring and maintenance as high-priority budget items. The recommended monitoring should include priority pollutant scans, monitoring for the chemicals that may be present within and below each specific site, and tissue and sediment sampling below the site. The monitoring program should include systemwide surface water and groundwater components, as well as grab sample sites above and downgradient from each facility location. Sediment samples and fish tissue sampling can indicate whether occasional releases have occurred that would not be detected in systemwide water quality monitoring.



The systemwide monitoring should include standard parameters such as nutrients and suspended solids. However, the more important parameters are priority pollutants, metals, oil and grease, and the chemicals expected at the specific industrial site for industrial, commercial, agricultural, and forest harvest areas.

The primary alternative to public monitoring and maintenance is to legally require the site owners to provide monitoring and maintenance for their site, and also possibly for the water systems potentially affected by their site. If site owners do not have this capability, public agencies can sometimes provide this service under contract.

While volunteer monitoring is possible, the jurisdiction must eventually define and fund a monitoring program. Whatever program is chosen should be coordinated with state monitoring activities.

COORDINATION

Coordination among existing organizations and programs is an essential component of any NPS control approach. This important tool will help educate planners, elected officials, public works officials, and others about the realities and opportunities provided by NPS pollution control. New regulations are often more likely to be accepted if they are integrated into existing programs.

Coordination can be used effectively in rural areas, where the County Extension Service can help create educational programs. Irrigation districts and soil and water conservation districts can help train land owners and monitor many activities. State agency regional offices can provide technical assistance. The existing county land use and building permit system can be augmented with more effective processes and alternative control measures, which can be achieved through cooperative efforts.

TILLAMOOK RURAL CLEAN WATER PROJECT

This is a joint project of the Agricultural Stabilization and Conservation Service and the Soil Conservation Service, in cooperation with the Oregon Department of Environmental Quality and Oregon State University. The Rural Clean Water Program is a federally sponsored program to control agricultural nonpoint source pollution in rural watersheds. The Tillamook area is one of 21 watershed projects in the country participating in this program.

Activities associated with the project include:

- Using a rating system to identify critical farm operations
- Establishing a regular monitoring program
- Helping create manure storage and holding facilities
- Educating a large number of local farmers about NPS pollution and helping create a local group of peer leaders to help the project go forward
- Developing a report that identifies progress made and additional work that is needed

In agricultural and forestry areas, local governments can participate in DEQ's establishment of load allocations (LA) under the total maximum daily load (TMDL) process and in the groundwater and the nonpoint source programs. They should also work with other agencies (the Oregon Department of Agriculture, Oregon Department of Forestry, and U.S. Forest Service) to implement NPS pollution control measures. In the case of federal lands, local NPS pollution control requirements can be established through the Federal Clean Water Act (Section 313).

This coordinated management system can create effective NPS pollution control programs in many areas of the state. To be effective, the programs must contain local agency commitment and broadly based coordination among all affected agencies.

PILOT PROJECTS

Pilot projects that actually apply control techniques can be used to demonstrate a program's effectiveness. The standards and criteria developed for the project can then serve as a model for others seeking to perform similar work.

Public construction projects can be a valuable source for such demonstrations. These may include new park projects, construction of new public buildings, special standards for constructing roads in sensitive areas, or other typical public developments. The local capital improvement program (CIP) process can be used to identify appropriate projects. The responsible parties can then develop the necessary information and standards before construction begins, as part of the pilot project process. Cooperative public/private projects are also possible.

DEVILS LAKE WATER IMPROVEMENT DISTRICT

Devils Lake has received NPS pollution from human activities in the watershed for the past 100 years. Sediment and nutrient inputs have changed the lake's chemical balance and increased the eutrophication process. NPS sources include sediments from urban development, logging roads and skid trails, and agriculture. Nutrient inputs in the past included a sewage treatment plant, dairy farm, agricultural farmland, and fish poisonings. Septic drainfields and urban runoff are currently the largest sources of NPS nutrients.

The result is a reduction in lake volume because of sedimentation (6 percent between 1920 and 1965). The NPS pollution has also resulted in increased growth of aquatic weeds and high coliform bacteria counts in some areas, thereby reducing recreational use.

To counter this situation, the citizens of Lincoln City have worked with local and federal funds to spend over $1 million to build sewers and take other actions to help Devils Lake recover. A strong erosion control ordinance in currently being prepared for use by local governments.

PUBLIC INVOLVEMENT

No program will be successful unless it involves the public and reflects the character of the community. It is essential to educate the public about NPS pollution and solicit their involvement in identifying appropriate solutions. The community will then feel more committed to the solutions and will be more supportive of regulations and funds required to support the final program.

The public involvement program should include a variety of techniques and activities. That approach will involve more people and will keep the issues accessible to the community over a longer period of time. Working with local environmental groups or education programs (e.g., schools, community colleges, extension service) can often provide needed resources and opportunities. Programs that help children (and, consequently, their families) become better informed can make a real difference over time.

Additional information is provided in Section III under "Public Involvement and Stewardship Opportunities."

TYING IT TOGETHER

The four-step process outlined in this section should be used in developing a local program. It is important to create an educated and involved public if the overall program is to be supported and successful. An inventory of existing conditions and rational decisions based on local conditions, processes, and political characteristics are essential. By considering the questions posed under "The Four-Step Process," above, communities can understand their situation and design effective programs.

Coordination of NPS pollution control activities between the various local agencies and organizations can substantially reduce costs and improve the effectiveness of the programs and projects that are developed. The case studies in this guidebook (set off in boxes) are examples of effective and efficient programs that relied greatly or entirely on coordination.

As part of the coordination activities, it is important to recognize the relationship with federal and state programs, mandates, and resources before determining what the local program will be. Federal and state agencies should be contacted early in the process. The regional offices of DEQ are a useful source of information and materials for help in developing the local program. They can provide inventories of pollutants and water bodies, access to models used elsewhere, and technical advice. One of the most useful and readable sources of information is the *305b Report* prepared by DEQ to meet federal requirements. This document contains a wealth of information and useful descriptions of state and federal programs.

Many of the management processes, facilities, and practices identified in Sections III and IV of this guidebook are only starting points, which can be further explored with the help of DEQ and DLCD staff. EPA also has a variety of documents that can help explain NPS pollution and pollution control to the community.

ADDITIONAL INFORMATION

Additional information about NPS pollution and its regulation can be obtained from:

- Oregon Department of Environmental Quality (Surface Water Program)
  811 SW Sixth Avenue
  Portland, OR 97204
  (503) 229-6121

- Oregon Department of Land Conservation and Development
  (Coastal-Ocean Management Program)
  800 NE Oregon Street, #18
  Portland, OR 97232
  (503) 731-4065

- A variety of federal agencies, particularly the U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration

NONPOINT SOURCE POLLUTION CONTROL MEASURES - LOCAL GOVERNMENT AND CITIZEN PROCESSES

SUMMARY OF SECTION III

- Reviews the nonpoint source (NPS) pollution problem in Oregon
- Describes the authorities that allow local governments to address NPS pollution control
- Identifies the management processes local governments can use to plan and implement an NPS pollution control program
- Discusses the importance of community involvement in NPS pollution control efforts
- Gives examples of successful NPS pollution control activities

INTRODUCTION

This section provides a basic introduction to the authorities, processes, and programs that are currently available to local governments, and describes how they can be used to control nonpoint source (NPS) pollution. State and federal agencies responsible for dealing with NPS pollution also have special expertise and authorities, which are explained in Section V.

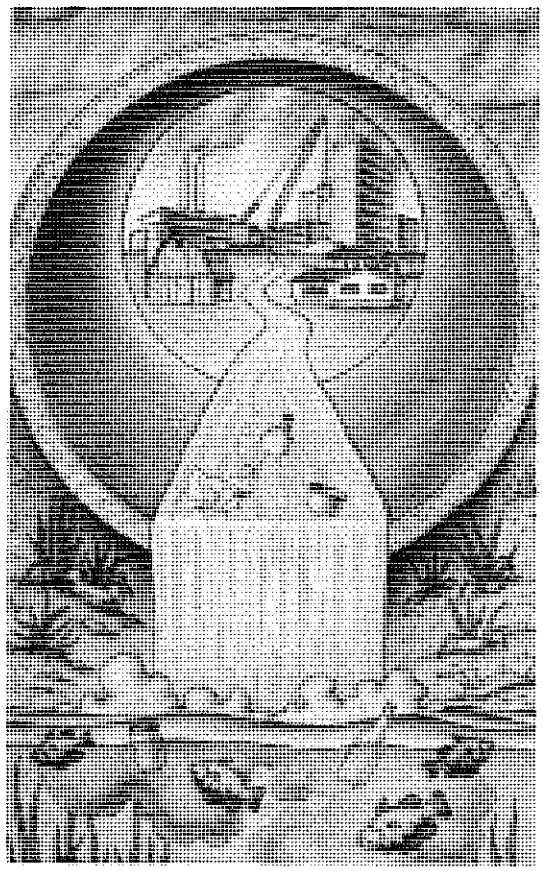
It is important to remember that local processes that can be used to reduce NPS pollution begin, like most regulatory systems, with the general and lead to the more specific. Local governments are granted broad powers and responsibilities. Local comprehensive plans and surface water management plans bring those broad powers to bear on specific sites and problems, through land use or nuisance regulations, capital improvement programs, or other public facility plans and management programs.

It is also important to remember that the creation of a local government regulatory program will not in itself be sufficient. To be truly effective, an NPS pollution control program must recognize and develop opportunities for enhanced stewardship by watershed residents. Through education and involvement, citizens can come to understand how their everyday actions affect water quality, and how they can participate in NPS pollution control strategies. Knowledgeable and committed citizens are an invaluable resource.

THE NPS POLLUTION PROBLEM AND LOCAL GOVERNMENTS IN OREGON

The following description of NPS pollution is provided to help explain where local governments need to become involved in NPS pollution control in Oregon.

Nonpoint source pollution essentially results from land use activities. The effects of NPS pollution in Oregon include reduced fish habitat quality; impaired aesthetics, recreational opportunities, and other beneficial uses; and drinking water supply problems. The risk of downstream flooding can also be increased by increased runoff and by the blockage of drainage systems by silt and debris. NPS pollution can seriously disrupt local economies based upon tourism if the area becomes less attractive to visit, if fishing or wildlife is affected, or if human activities such as swimming are prohibited. Polluted water supplies can make residential areas uninhabitable and can stop or reduce industrial development .



The 1972 Federal Clean Water Act required that states designate "beneficial uses" for all waters of the state. The Oregon Legislature has declared the following to be the beneficial uses of state waters: domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife and fish uses, and pollution abatement. The Water Resources Commission of Oregon classifies the waters of the state as to their "highest and best use" through adoption of Water Use Programs for each basin.

The DEQ 1988 Nonpoint Source Assessment indicated that over 15,000 miles of streams had one or more NPS-caused water quality problems that resulted in either a moderate or severe impact on a beneficial use. This is out of a total of 27,700 miles of streams in the NPS database. (Approximately 110,000 miles of streams exist in Oregon, but the 27,700 miles include all of the main streams and most important tributaries of Oregon's 19 river basins.) Of the 27,700 miles in the database, 14 percent were rated as having severe NPS pollution problems based on water quality data, and 11 percent were rated severe based on observation. Approximately 30 percent were rated moderate, 10 percent using actual data and 20 percent by observation.

According to the 1988 assessment, the common NPS pollutants are soil eroded from farms, forestry operations, unpaved roads, and construction sites; oils, rubber, and metals washed from streets and highways; fertilizers and pesticides from cropland; and bacteria and nutrients from animal waste and domestic gardening. Other more isolated problems include elevated stream temperatures resulting from streamside vegetation removal and poor fish habitat resulting from stream channelization or other flood control programs.

In addition to NPS surface water problems, Oregon has NPS groundwater problems in a number of areas. These include the City of Portland's Columbia South Shore municipal drinking water well field, where some wells cannot be used for domestic water supplies because of contamination by industrial solvents. Other examples of groundwater contamination include the coastal sand dune aquifers along Oregon's coast and certain aquifers in Eastern Oregon affected by agricultural activities.

Given the land use planning and stormwater management authorities provided to them, local governments in Oregon are well situated to deal with many of these conditions through their land use, surface water management, and nuisance regulations.

LOCAL AUTHORITIES

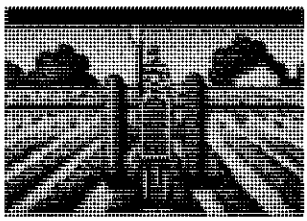
THE ROLE OF CITIES AND COUNTIES

Cities and counties in Oregon have a variety of authorities and processes that allow them to address NPS pollution control. That authorization begins with a broad charge given to them by the Oregon Constitution and the Oregon Legislature to protect the public's health, safety, and general welfare.

More specific responsibilities and authorities are provided in the Oregon Revised Statutes. Chapters 92, 196, 197, 215, and 227 give local governments broad powers to regulate land uses within their jurisdictions. (See Section V of this guidebook.) Some limited authority also exists to address local health hazards. In addition, cities and some counties, through their municipal charters, can assign themselves further home-rule authority to go beyond the powers provided by the legislature.

The U.S. Congress has given state and local governments new responsibilities to address NPS pollution. This is particularly important in coastal areas. The Coastal Zone Act Reauthorization Amendments of 1990 give new emphasis to state and local agencies working together to develop a coordinated coastal nonpoint pollution control program (CNPCP). The Environmental Protection Agency (EPA) and National Oceanic and Aeronautics Administration have coordinated their approach to the new rules by providing guidelines to states involved with CNPCP. These guidelines give greater specificity to the standards that must be addressed in each of six categories:

agriculture, forestry, urban areas, marinas and recreational boating, hydromodification (channels, dams, shorelines), and wetland/riparian areas.



The control of NPS pollution from agricultural and forestry areas is primarily at the state and federal levels, but local governments can have an important role. For agricultural areas, local governments can work with the local soil and water conservation districts in the development of farm management plans. The Oregon Department of Agriculture has a new responsibility under Senate Bill 1010 to develop water quality plans for DEQ-designated water quality water bodies, and local governments can participate. For both agriculture and forestry, local governments can participate in DEQ's establishment of load allocations under the total maximum daily load (TMDL) process. For federal lands in the local jurisdiction's area, NPS pollution controls can be applied through provisions of the Federal Clean Water Act, Section 313.

Local governments play an active role in final siting decisions concerning urban uses (residential, commercial, and industrial), marinas, shipyards, site changes for new or modified waterways, and wetlands and riparian areas.

One of the most direct and effective ways to reduce NPS pollution effects on water quality is through regional NPS control systems. These systems include facilities (e.g. sedimentation ponds) and practices (e.g., maintenance activities designed specifically for water quality). They are primarily implemented through the capital improvements programs of local governments.

JOHNSON CREEK CORRIDOR COMMITTEE

One of the most successful and mature watershed planning efforts in the Portland metropolitan area is the Johnson Creek Corridor Committee (JCCC). The JCCC serves as a model for specific NPS projects. It illustrates how to involve citizens, shows coordination among local governments, and highlights public-private partnerships to carry out NPS programs. State agencies have also played a major role in providing resources and expertise to the process. Use of a watershed vision to guide activities is an example of the creative approaches being taken.

The program has already resulted in a number of "hands-on" projects undertaken by local residents and agencies. These projects include both construction and other techniques, such as education, to protect the watershed and stream corridor. The projects are reinforced with environmental protection zoning and park/trail land acquisition programs.

The JCCC is currently preparing a watershed resources management plan to provide long-term direction for the watershed area.

The proactive, action-oriented approach taken by the JCCC demonstrates that local governments can take an active role in watershed management and in forging productive working relationships.

Additional information can be obtained from Eric Macharro of Portland's Bureau of Environmental Services (823-7044).

Oregon cities and counties have authority to regulate activities for the purpose of NPS pollution control in several ways. Land use regulations provide the most obvious route. This is accomplished through the local comprehensive plan and related development regulations, as discussed later under "Comprehensive Planning." The first step in that process is to identify areas and activities where NPS pollution is or could be a problem. These could include geographic districts with highly erodible soils, or land uses that remove vegetative cover or introduce the potential for hazardous material spills. Other activities resulting from both private and public decisions may also provide opportunities to reduce NPS pollution; examples include the maintenance of public parks, the siting and management of golf courses, and planning for open space areas in other types of development.

Three applications of local NPS pollution control are:

1) **Regulation of land uses.** When a particular development is proposed, land uses or development designs incompatible with NPS pollution control can be identified and regulated. The development regulations can include standards to ensure that the appropriate management practices are used during construction of new activities (for example, providing temporary protective systems such as filter fabric and straw bale barriers). This will most often occur in terms of conditions of approval.

   Land modifications routinely occur when land is divided. This is an opportune time to ensure that facilities needed to control stormwater runoff (such as infiltration basins or trenches, catch basins, or ponded wetlands) are provided.

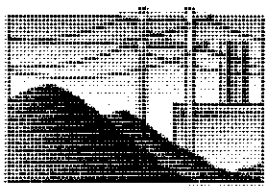
2) **Use of regional NPS control facilities.** These can include constructed wetlands, stream or riparian restoration, sedimentation ponds, vegetated swales, or other facilities or practices installed or managed by public agencies. Such systems are usually needed to reduce NPS loads from existing development.

3) **Regulation of nuisances.** Nuisance controls can regulate a wide variety of activities that contribute to NPS pollution, such as unvegetated vacant land (soil erosion from wind and water) and inappropriate storage of discarded materials. The local jurisdiction will often have simplified enforcement mechanisms (such as civil citations) in place, making it easier to achieve compliance with these rules.

As mentioned previously, individual actions by local citizens are also an essential element of any NPS pollution control strategy. An important role of local governments is to help create a broad-based stewardship ethic, where community members understand, support, and actively participate in pollution prevention.

THE ROLE OF REGIONAL GOVERNMENTS

Regional governments, such as METRO (Portland area) and LCOG (Lane County), coordinate the regional water quality planning (Section 208, PL 92-500) for their regions. They play a major role in establishing programs and projects that help ensure NPS pollution controls are included in local wastewater and stormwater programs.



In addition, economic development and transportation planning functions are often focused at the regional level. Both of these activities can substantially affect NPS pollution control. One example is the siting of new industries. By recognizing the potential for NPS pollution, changes can often be made that substantially reduce pollution potential.

The siting of transportation facilities provides similar opportunities. The location of new roads, bus/train parking lots, bicycle trails, or other facilities can have substantial positive impacts on water quality.

THE ROLE OF SPECIAL DISTRICTS

Drainage Districts

Drainage districts are created under state law (ORS 547) to deal with the stormwater runoff and waterways associated with large marshy areas. Because many uses are adjacent to, within, or upstream of these districts, the districts can play an important role in anticipating and dealing with NPS pollution. They can coordinate their responsibilities with nearby local governments to ensure that the waters reaching their area are of the best feasible quality. Further, they can work directly with businesses and industries located along their waterways to ensure that the runoff from these sites is cleaned and controlled for the community's benefit before entering the drainage district's facilities. The participation of Multnomah County Drainage District No. 1 in forming a watershed council is an example of active and effective involvement.

Sanitary Districts

Sanitary districts are created under state law (ORS 450) to provide treatment for domestic and/or commercial wastes. These districts are often in an excellent position not only to treat or convey stormwater, but also to impose conditions on granting sewage permits for new development. This could include requiring management practices that deal effectively with runoff and other types of NPS pollution. This should be done in conjunction with the city or county that has land use jurisdiction. Such coordinated activity is required in urban growth areas under new land use legislation (SB 122) that passed the Oregon Legislature in 1993.

County Service Districts

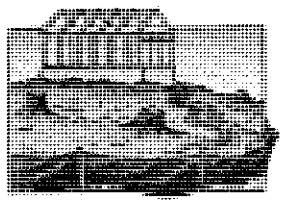
County service districts (ORS 451) are very similar to the previously described special districts, but are administered by the county. The county governing body usually serves as the board of directors, but meets as a separate entity. Their functions are basically the same as those of the other special districts, such as sanitary districts, and they have the same ability to impose reasonable conditions on new development within their jurisdiction.

Vector Control Districts

Vector control districts (ORS 452) are responsible for protecting the public from noxious insects or other disease-carrying hosts. To perform their task, they must often use chemicals on and near waterways. Proper care, reduced use, or no use of chemicals where possible are examples of how to help reduce NPS pollution in those areas.

Soil and Water Conservation Districts

Soil and water conservation districts (ORS 568) are charged with helping to preserve water quality and reduce soil erosion. Their ability to understand the intricacies of soil and water, and their existing relationship with the agricultural community and the U.S. Soil Conservation Service, place them in an excellent position to advocate, persuade, and educate farmers and ranchers about NPS pollution control. They can also train landowners how to better control and eliminate stream sedimentation, and how to reduce the introduction of pesticides, herbicides, petroleum products, and other chemicals in surface and groundwater.



They are also authorized to be involved in implementing Senate Bill 1010, which passed during the 1993 legislative session. This bill gives the Department of Agriculture the authority to develop water quality management plans under certain conditions and to require landowners to carry out those plans. It also includes provisions for fines and appeals. Local governments can also be involved in implementing SB 1010. (See Appendix A.)

STRATEGIC WATERSHED MANAGEMENT GROUP

With the passage of HB 2215, the Oregon Legislature created the opportunity for local watershed councils to be formed. The Strategic Water Management Group is directed to help develop pilot watershed action programs. The program's overall goal is to improve the quality of the watersheds by dealing with water flows, riparian issues, and other activities associated with water

quality and quantity. This is achieved by developing consensus at the local level, but involves state and federal resources. Local governments, property owners, state and federal agencies, and other interested parties are all involved with finding and implementing appropriate solutions.

DEQ has identified ten program elements to guide water quality improvement efforts and to define the capabilities necessary for the overall watershed program. While other elements may emerge, those currently identified are:

- **STANDARDS:** Definitions of desirable and acceptable conditions to support beneficial uses.
- **ASSESSMENT:** Assessment of water conditions, focusing on the standards above.
- **COORDINATED WATERSHED PLANNING:** Cooperative evaluation and plan development by all stakeholders for the sound management of the watershed.
- **EDUCATION:** Information about watershed functions, values, conditions, responses, and management techniques.
- **DEMONSTRATION PROJECTS:** Relatively small-scale projects to demonstrate the viability of sound management techniques; dispersed throughout the state; and designed to galvanize local activism.
- **TECHNICAL ASSISTANCE:** Field-based experts and literature to help land managers select and implement the best management measures in their ecoregions.
- **COST-SHARE ASSISTANCE:** Financial assistance and incentives for implementing watershed management practices on private land, coupled with contractual agreements to maintain the enhancements.
- **STEWARDSHIP:** Promotion, technical assistance, and financial support for the concept of watershed enhancement and protection of local stewardship groups.
- **WATERSHED ENHANCEMENT PROJECTS:** Coordinated enhancement and protection projects covering whole watersheds and implemented over a number of years; targeted at higher priority areas, but distributed equitably throughout every ecoregion and geopolitical area in the state.
- **ENFORCEMENT:** Field-based capability to investigate and remedy the violation of applicable standards or regulations.

Additional information about the Strategic Watershed Management Group can be obtained from DEQ and the Oregon Department of Water Resources.

MCKENZIE RIVER WATERSHED COUNCIL

The McKenzie River Watershed Council was formed to help address watershed management issues in the McKenzie River Watershed and provide coordination and cooperation among key interests in developing and implementing a watershed action program.

The Watershed Council is an advisory body to established decision-making bodies and communities of interest. As such, the council makes recommendations concerning the protection, restoration, and enhancement of the quality of the McKenzie River Watershed.

Council partners keep their respective agencies, organizations, and interests informed about the work of the council and bring their groups' concerns to the council. The Lane Council of Governments is responsible for staff functions, and can be reached at (503) 687-4283.

PLANNING AND IMPLEMENTATION PROCESSES

The authority to implement environmental regulations is one matter; applying those rules to real people and places is quite another. Local government staff often face the challenge of applying complicated regulatory systems in a variety of circumstances. For that reason, it is important to have a number of techniques available in order to find the most appropriate mix of regulations and programs.

The processes listed below are a starting point for finding the correct tools to apply to a community's specific situation.

PLANNING PROCESSES

Two main planning processes currently exist for developing an NPS pollution control program: comprehensive planning and surface water management planning.

Comprehensive plans primarily provide the basis for local land use and development regulations. Surface water management plans provide the basis for local public works or capital improvement projects. The two types of planning overlap, but emphasize different aspects of government programs and are equally important. Because they require information from each other and share plan components, they must be coordinated.

Comprehensive Planning

Comprehensive planning is an important tool for addressing NPS pollution. Early in the planning process, the benefits of clean water to the public health and the community's economic vitality should be identified.

The importance of inventorying and analyzing potential NPS pollution activities and areas before development occurs cannot be overemphasized. This includes identifying wetlands, aquifer recharge areas, wellhead districts, steeply sloped areas, highly erodible soils, or other areas of special sensitivity. Protective actions can then be taken before construction applications and the associated politically charged permitting process occur. Inventories should identify:

- Floodplain areas
- Steeply sloped areas
- Soil types (Soil Conservation Service and engineering classifications to identify constraints and opportunities)
- Appropriate water quality standards
- Wetlands
- Vegetation types (to identify areas with potential high runoff areas)
- Impervious cover (areas of extensive coverage)
- Important riparian or aquatic areas
- Designated beneficial uses for streams in the study area and pollutants that will likely affect those uses
- The capacity of the streams to assimilate pollutants (if it is know or can be determined)
- NPS pollution control opportunities

It is also important to inventory the uses and activities that could adversely affect water quality. Examples include:

- Industrial or commercial developments that store or use hazardous chemicals
- Landfills
- Agricultural or forestry uses
- Mining or gravel extraction areas
- CERCLA/RCRA sites or licenses
- Wastewater treatment plants
- Onsite wastewater treatment areas (e.g., septic tanks, cesspools)
- Construction areas (planned and existing)
- Areas with extensive impervious cover
- Disturbed/exposed soil areas
- Riparian areas with inadequate cover
- Disturbed stream beds, lake shorelines/beds or marine/esturine areas

The preparation of comprehensive plan policies to address NPS pollution includes considering policy alternatives and choosing programs that best fit the water quality goals and community perspective. Many existing comprehensive plans contain policies in compliance with Oregon Statewide Planning Goal Six: Air, Water, and Land Resources Quality. These local policies can be expanded upon to include more specific statements about NPS pollution control. An example could be:

> The city/county shall develop an active program to address the federal and state requirements for the prevention and/or reduction of nonpoint source pollution.

In addition, policies may be added that require the local government to create a local NPS education program, develop a coordinated NPS pollution program with DEQ and the Department of Land Conservation and Development (DLCD), or add NPS control management measures to its land use regulations.

Surface Water Management/Master Plans

Surface water management plans have been prepared under a number of labels, including stormwater master/facility plans, storm sewer master plans, watershed management plans, and water resources management plans. Specific examples of management plans can be found in this guidebook's References section.

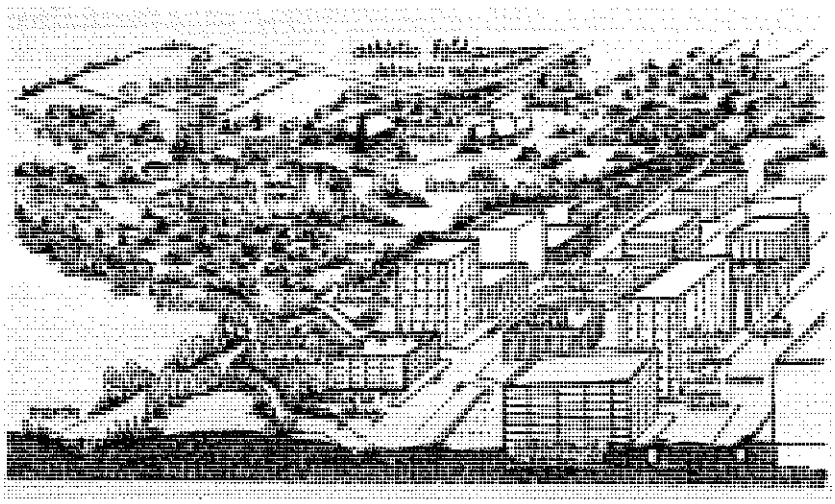
In the past, such plans have primarily addressed drainage and flood control (water quantity) and not water quality. Because of new regulatory requirements, particularly concerning NPDES permits and TMDL limits, water quality is now usually included. This inclusion is a logical extension of local planning and public works efforts, since managing runoff directly affects water quality. In the context of Oregon's comprehensive planning program, a surface water management plan is likely to become part of the local comprehensive plan.

The **basic steps** of local surface water management planning are:

- Development of the information base to be used (e.g., maps, resource reports, watershed inventories)
- Monitoring and analysis of water quantity and water quality data
- Public involvement and education
- Watershed analysis
  - Inventory of existing water quality and quantity conditions, facilities, and management systems
  - Inventory of soils, vegetation, and sensitive lands
  - Inventory of pollution sources
  - Inventory of improvement opportunities and constraints
- Hydrologic/hydraulic analysis
- Water quality and pollutant loading analysis
- Evaluation of alternatives (flood flow reduction,, water quality measures, financial, operation and maintenance, and environmental/social)
- Preparation of an implementation plan, including a capital improvement program
- Adoption

The **important elements** of a surface water management plan are:

- NPS pollution control objectives
- Identification of NPS pollution sources
- Description of the analytical quantity/quality models used, which can be updated and applied over time
- Identification of the existing systems
- Location, size, and cost of planned conveyance facilities (pipes and open channels) and detention facilities



- Location, size, cost, and performance/design criteria for planned NPS pollution control facilities
- Outline of the control practices (e.g., erosion control) to be implemented for NPS pollution, drainage, and flood control, including identification of the "local requirements" for Section 313 of the Federal Clean Water Act
- The operation and maintenance basics for the planned facilities
- A schedule of implementation actions, including a capital improvements plan
- Recommendations for ordinances, guidebooks, and continued monitoring
- An estimate of the quantity/quality benefits associated with plan implementation

As stated previously, it is beneficial to prepare surface water management plans that integrate water quality control measures with drainage and flood control measures, since they are inseparable. An example of a typical surface water planning report outline is presented in Appendix E.

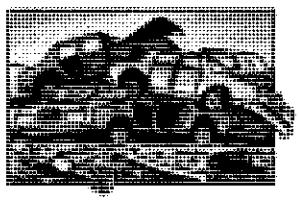
IMPLEMENTATION PROCESSES

Once the comprehensive plan and/or other public policy documents are prepared, an implementation program should be developed.

Implementation requires substantial commitment to a variety of tools. It is rare that one process or system will be sufficient to accomplish all of the desired results. Instead, several overlapping or parallel programs should be established. It is likely that most local regulatory agencies can apply existing systems to NPS pollution control, and the need for new systems will be small.

The following descriptions provide a useful compendium of practical mechanisms for implementing NPS pollution control within the existing processes already familiar to most local planners. The list should not be viewed as sufficient for all jurisdictions. Other permits, processes, or standards may work better in some local regulatory environments. These examples of management processes are a place to start. Jurisdictions can develop systems that fit locally, as long as they achieve the desired control of NPS pollution.

Land Use Zoning Districts



Land use zones allow local jurisdictions to regulate the type of activities that will occur in specified areas, as well as to impose a variety of land use standards on new development.

A land use district (zone) will usually contain a listing of permitted uses that are compatible with the land's ability to support the activities normally associated with these uses. If some concern exists about certain impacts on the land, special standards may be imposed to better assure compatibility.

Examples of standards related to NPS pollution control include:

- Restricting the amount of impervious surface that is allowed (thereby reducing runoff)
- Prohibiting construction in wetlands or steeply sloped areas
- Imposing special design requirements for chemical storage or transport

Section IV gives examples of the type of facilities/ practices that can be used.

Advantages: This is a widely understood and generally accepted method of regulating land uses. All cities and counties in Oregon have existing programs that can have NPS pollution control provisions incorporated. The additional cost is likely to be limited. This method provides clear notice at the beginning of the development process of the issues and costs that may be involved.

Disadvantages: Considerable planning and analysis work are required at the beginning of the process. In some circumstances, this may be expensive and challenging for local staffs. Certain sites may prove unusually challenging and expensive to address.

Overlay Zones

Overlay zones are zoning districts that are added to other zoning districts to provide necessary additional regulations where special conditions warrant extra care.

An example would be a special environmental protection zone that overlays other residential or commercial zoning districts. These districts can be used where the community wants to allow the uses in the underlying zone, but also recognizes that a wetland, steep slope, or particular soil type may require special protection.

Overlay zones are excellent tools to use for watershed protection. The underlying zoning pattern can be maintained, while the overlay district identifies the physical outline of the watershed and attaches special conditions to activities occurring in the watershed area.

A clear purpose statement should identify the reason for establishing the particular zone. This will allow those who implement the rules to understand when and how particular uses should be allowed or denied, and under what conditions applications may be approved.

In areas of particular concern, such as steep slopes, special conditions can be imposed at the time of permit approval. For instance, construction may be allowed only during the drier summer months. Another approach is to eliminate certain uses in specific areas. For example, service stations or arterial streets can be prohibited in areas where soils or topography make it infeasible to prevent petroleum products from entering the water.

Advantages: The major benefit of using an overlay zone is that it allows special regulations to be added in areas of particular concern without substantially affecting existing zoning patterns or inventories. The zones can also be more easily modified if new information suggests the standards need to be adjusted.

Disadvantages: Overlay zones add more rules to be administered. If a clear method does not exist for informing applicants and training staff, the regulations may surprise some people, resulting in political controversy. Because of their "add-on" character, they may be confusing to some people or may create conflicting interpretations unless they are well analyzed before adoption.

Special Purpose Districts

Special purpose districts specify the uses that are to be allowed and the criteria for approval. These districts are the primary zone for a particular area. They are considered special purpose because they refer to a particular concern or use rather than the more general use districts.

An example would be creation of a floodplain zone to protect the public from the dangers of high water. While protecting the public from flooding, the setbacks and use restrictions can also reduce NPS pollutants entering the streams.

Advantages: Special purpose zones have no extra layer of rules to be remembered by staff or found by the applicants. The purpose of the zone can be clearly specified and the permitted uses listed. These zones are most effectively initiated when there is a general updating of the zoning districts.

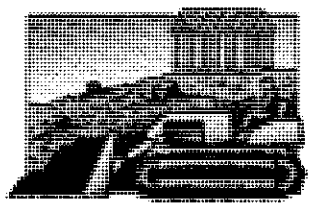
Disadvantages: These zones require extra time and analysis before they can be introduced into the community. Politically, they may stand out from the other regulations and become targets for skeptics or others seeking to discredit the zoning program.

Performance Standards/Planned Unit Developments

Performance standards are another way to ensure that new developments produce certain benefits for the community or avoid undesirable consequences. Many communities are experimenting with performance standards, and examples of limited performance standards can be found in several cities. *Performance Zoning*, edited by Lane Kendig and published by the American Planning Association, is an excellent source of information on this topic. (Contact the American Planning Association at (312) 955-9100.)

Rather than setting predetermined requirements (such as 20-foot setbacks), the standards may mandate a percentage of lot coverage or allow the developer to indicate how the structures will provide access for air, light, and public safety activities.

By creating a performance standard that requires water quality protection, that value will have to be taken into account before any development can be approved. In addition to the standard, criteria must be developed to indicate what is and is not acceptable; this will ensure that the regulations are administered equitably.



Advantages: This approach allows for far greater flexibility in siting buildings or determining what uses are appropriate. Further, many developers have found that it allows projects to be located in difficult sites with a greater degree of public approval.

Disadvantages: The increased flexibility reduces predictability. For that reason, both the development community and neighbors often resist this approach. Local governments that have used this approach have found that it involves substantially greater staff time because of the extensive negotiations that are required.

Conditional Use Permits

Conditional use permits have been a popular regulatory tool for many years. They allow conditions to be applied to permitted uses; applicants must satisfy these conditions before they can establish the proposed use or build the new activity. The conditions are not a standard set of requirements; rather, they are formulated at the time of permit approval to meet the purposes of the zone.

An example of a conditional use permit may be allowing higher-density housing in single-family residential districts. Many communities allow duplexes under certain conditions (e.g. larger lots on arterial streets). At the time of approval, certain conditions may be imposed, such as increased buffering or landscaping, limits to permitted parking, or particular standards for outside lighting.

The following examples show conditional use requirements that can be used for NPS pollution control:

- Preparation of a soil erosion plan by a qualified geotechnical engineer or soil scientist in areas of high soil erodibility, thereby reducing potential stream sedimentation
- Containment facilities for controlling potential chemical spills
- Special, more effective septic systems in areas with inadequate existing systems

Advantages: The conditional use permitting process allows uses that might otherwise be denied; because of special conditions, they can be made compatible with the neighborhood and the environment. Further, the conditions can be fashioned to fit the special character of the use and the neighborhood.

Disadvantages: The courts are justifiably skeptical of conditions that go beyond a reasonable concern for the community's needs. Careful crafting of the standards and criteria is important. In addition, conditional use permits may require time-consuming inspections on a regular schedule, which may be beyond the resources of the local agencies.

Design Review

Local governments use design review extensively to evaluate and control the character of development. In some communities, design review may look only at certain site concerns, such as street access or landscaping. In others, the scale, color, or character of the architecture may be controlled.

In most cities, some kind of site plan or design plan is usually required for any use other than a single-family residence. In counties, site plans are common for many commercial, industrial, and residential uses. Review and inspection of new construction is required everywhere in Oregon, except on federal properties. Under Section 313 of the Clean Water Act (see Appendix A), federal properties can also be included in the local review and inspection process for water quality purposes.

Design review is an excellent opportunity to apply conditions or standards to meet NPS pollution control needs. One example is to create a standard set of criteria for new construction that ensures development will consider and reduce NPS pollution through the use of a variety of NPS control facilities and practices such as those described in Section IV. Design approval can require effective buffers for riparian and wetland areas. The design review process can also be used to implement useful management practices, such as regular maintenance for drainage or water storage facilities.

Advantages: Design review is a widely used and understood tool for ensuring that new development meets community objectives. By using a set of standard criteria, the system will be predictable and more easily accepted.

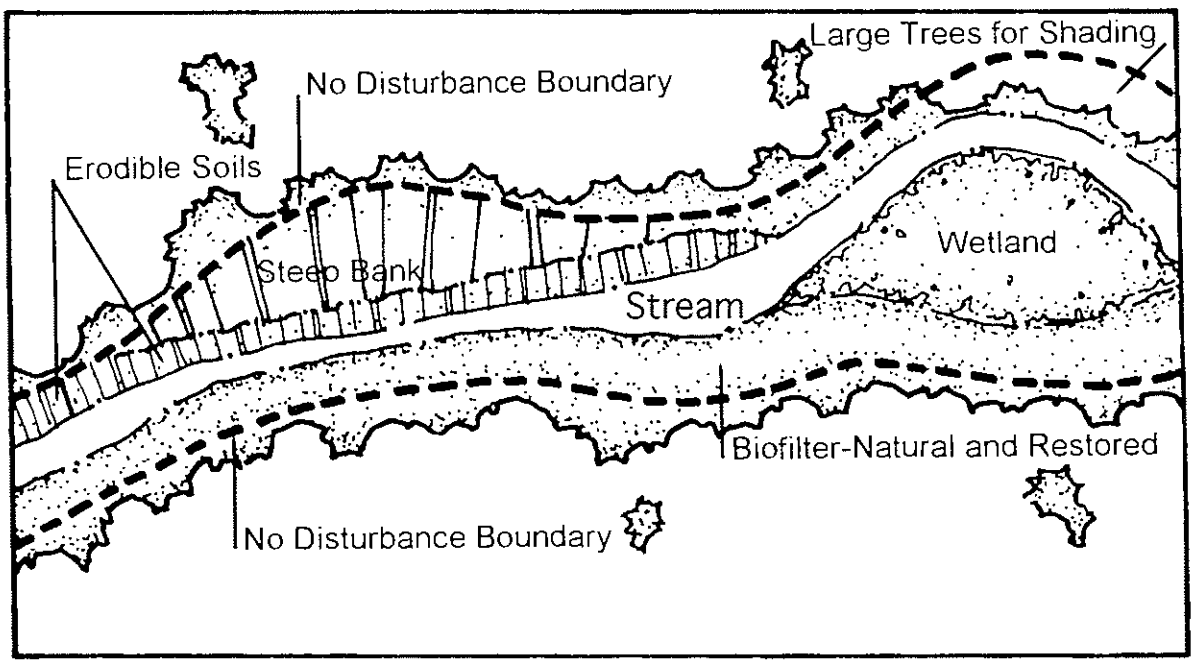
Disadvantages: NPS pollution control will be another addition to an already large set of purposes to be achieved by design review. Smaller jurisdictions will require some assistance to establish the initial criteria and measures list.

Buffers

Stream, lake or estuary buffers (e.g., undisturbed riparian areas) are effective protective tools that can be applied in a variety of ways. The buffer can be part of a land use or overlay district; attached as a condition to a conditional use or variance permit; or included in a design review approval. It is an extremely effective and flexible regulatory device, but it must be adapted to local conditions. Local governments should be prepared to defend their buffer distance based upon available facts about impacts or by referring to accepted standards.

Advantages: Buffers are effective mechanisms for intercepting sediments or other materials that might otherwise enter the waterway. They are an easily understood and easily enforced way to protect streams or lakes from damage by construction and other land use activities.

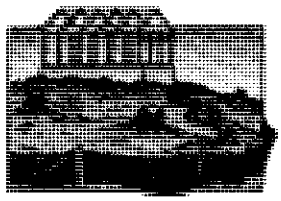
Disadvantages: Some property owners will be concerned about the loss of developable area. The rationale for the size and character of the buffer needs to be clearly explained if it is to be accepted and successful.



Building or Development Permits

Building or development permits are issued prior to construction. They regulate the actual fabrication of the proposed building or the modification of the land for the new use. Since erosion from construction sites probably represents the single largest source of stream pollution from residential areas, this is a useful time to implement NPS pollution control.

Programs to control erosion during construction can be very effective. The building inspection staff can administer these regulations when they visit the sites for routine structural, electrical, or plumbing inspections. Standards need to be developed and adopted that are consistent with federal and state regulations.



Advantages: Existing staff can be used to administer these permits. The system is simple and can be adjusted by the individual inspector to meet the needs of a particular site, type of construction, or climatic condition.

Disadvantages: Individual builders or homeowners may resist these permits because of inconvenience, expense, or both. An effective educational program is important. In addition, inspectors and other regulatory staff will have to be trained.

Land Division

Certain actions frequently must be taken to protect water quality at the time of land division, whether it is a subdivision or a simple partition. The optimal time to create retention or detention systems and to provide underground drainage facilities is when new streets are created or lot lines are established. Lot configurations must avoid destruction of riparian areas, provide for onsite surface water storage and onsite septic systems where appropriate, and avoid difficult soils and slopes.

All local jurisdictions already have some kind of land division rules in place. These rules often make vague reference to stormwater protection, but lack the more specific language that provides clarity and predictability to the process. In recent years, the legislature has moved to make land division less complex by reducing the required approvals and creating clearer surveying and recording requirements.

Early site inspections should check for the following conditions:

- Disturbed soil areas
- Riparian areas with poor cover
- Depressions (e.g., behind a road fill, where a pond-marsh or infiltration facility could be developed)
- Wetlands
- Ditches, which could be converted to vegetated swales
- All ponds, ditches, and streams
- Culverts and pipes
- Slopes
- Vegetation types

The existence, absence, or nature of these variables will establish the NPS pollution control opportunities and objectives.

Advantages: The benefit of using land division requirements is that the developer will already be considering alteration of the slopes, drainages, and other characteristics. Modifications that reduce NPS pollution can increase site costs. However, they can actually save money if considered early in the process, particularly for large developments where slope failure during construction can cause expensive delays. If adequate precautions are taken at the time of development, the community will ultimately benefit from reduced costs for dealing with water pollution.

Disadvantages: Some people may resist the added regulations and expense. Administration may be difficult if staff members are not educated about the reason for the rules. This is especially true for small staffs that rarely have time to completely check development conditions.

Capital Improvement Programs

Capital improvement programs (CIPs) originate initially from surface water management plans and are updated annually. They list the capital investments the jurisdiction plans to make during a future period, usually 5 or 6 years. In addition to surface water facilities such as swales or ponds, a CIP should list expenditures planned for items such as stream/riparian restoration projects, slope stabilization projects, monitoring equipment to be purchased, and any equipment needed for operations and maintenance.

CIPs can have a tremendous impact by funding structures to manage or prevent NPS pollution. In addition, they help focus public attention on pollution and the cost to the public. They often provide useful education and incentives to private development to leverage other improvements.

Advantages: The CIP process is already mandated in Oregon and is familiar to most jurisdictions. Local governments can often use the CIP as a basis for seeking funding assistance from state and federal agencies.

Disadvantages: CIPs that are not connected to the overall comprehensive plan and surface water management plan may waste funds or perform counter-productive work. Without public education, CIP expenditures may be seen as unnecessary uses of local funds and can be politically controversial.

Design/Construction Standards

Many Oregon jurisdictions update their design/construction standards every 3 to 6 years. Such standards apply to facilities (such as streets, sewers, water lines, sidewalks, or other similar public structures) constructed within the jurisdiction by the agency or by a private developer, and ensure consistent design and construction.

Very few design/construction standards currently in effect in Oregon address NPS pollution control facilities, such as sedimentation ponds. New standards to achieve water quality objectives should be developed as part of the implementation of surface water management plans.

The NPS pollution control facility design/construction standards should include:

- Hydrologic criteria (the design storm)
- Typical plan and section views for hydraulic structures
- Configuration guidelines for ponds, marshes, landscape measures, and infiltration facilities
- Erosion controls for construction
- A preferred vegetation list
- Geotechnical criteria
- Grading and landscaping criteria
- Requirements for a basic water budget
- Cleanup and no-disturbance-zone guidelines
- Specifications for monitoring systems
- Guidelines for preparation of a maintenance plan that fits the design

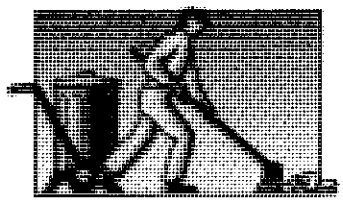
Advantages: Design/construction standards can make many projects, both public and private, more responsive to NPS pollution control, resulting in more protection at less cost.

Disadvantages: It is expensive and time consuming to reach consensus about construction standards. They can often be politically controversial because of their impact on the construction industry. They will not be successful unless accompanied by an effective inspection program to enforce the requirements.

Operation and Maintenance Programs

An operation and maintenance (O & M) program is one of the most important aspects of NPS pollution control. O&M is costly and often involves new procedures and equipment. However, it is critical to ensure that NPS pollution control facilities continue to function properly after they are in place and that the pollutants, such as sediment, are removed from the system.

The basic O&M functions are:



- Sediment and debris removal
- Trash rack cleaning
- Vegetation cutting and removal
- Facility repair and replacement
- Checking of hydraulic function and condition through regular inspections

Advantages: O & M is a routine part of existing local jurisdictions' activities throughout the state. Funding for some activities is often available through an existing fee system, and administrative and operation systems are often already in place.

Disadvantages: There is rarely enough funding to take on major new activities without fee increases, which may be politically unpalatable. O & M alone is insufficient; it must be part of an integrated NPS program.

PUBLIC INVOLVEMENT AND STEWARDSHIP OPPORTUNITIES

INTRODUCTION

An effective citizen involvement program is key to successfully completing any public activity, particularly those that deal with meeting long-range community goals. A complete program must include tools to obtain useful information about public needs and priorities. To provide this kind of information, citizens must be informed about the conditions that need to be addressed, the legal issues involved, and the particular local circumstances. Once they are informed and involved, citizens can be insightful observers and commenters. Their efforts can be far-reaching and contribute greatly to the success of the program.

It is important to clearly define the objectives of the citizen participation effort. It is insufficient just to want to involve people. Rather, the program should focus on what purposes are to be achieved by the involvement. Assuming the primary focus is more effective implementation of the NPS pollution controls, citizens should be involved at a variety of levels.

To educate the public about water quality issues, basic informational materials and a forum in which to provide the education should be developed. The November 1993 newsletter of the Environment and Development Division of the American Planning Association provides the type of information required, in a useful format. (See Appendix A-6.) EPA and DEQ can provide additional information.

Existing citizen involvement and advocacy groups can provide the easiest access to the public. These include planning commissions, environmental advisory committees, environmental or fish organizations, neighborhood associations, and citizen participation organizations. Once educated, members of these groups can be effective advocates for the program and useful monitors of local conditions.

The local comprehensive plan is an important policy document for the community's water quality program. Informed citizens can provide input to the development of reasonable controls and effectively participate in the adoption process. As a result, elected officials can become better informed and can benefit from the political support of these groups during the public hearings process.

Once the basic goals have been clarified and the legal conditions established, a more long-term commitment can be made to funding public involvement activities. The public involvement program should include a variety of techniques, including training staff so they can provide assistance to the public and effectively enforce the NPS pollution control program.

Stewardship

In addition to involving the public in the establishment of local government NPS regulations, it is important to inform citizens about how their activities affect NPS pollution. When the issues are brought to the individual level, people can better understand how NPS pollution affects their quality of life and how they can participate in the solutions.

Stewardship of our natural resources is a concept that receives considerable discussion. But it is not often made clear to people how the concept of stewardship ties into their daily life and activities. Citizens are rarely given the educational opportunities they require to fully understand the relationship of their everyday actions to the natural environment, upon which they depend for employment, health, safety, and ultimately survival. Everyone who lives, works or otherwise affects the water within each watershed must come to understand their role and accept their responsibility to maintain or enhance water quality.

Stewardship can occur in a variety of forms. It can be volunteer water monitors checking the waterways for pollution dumping; youth groups painting "no dumping" signs on surface/stormwater drains; participants in advisory groups; or homeowners taking extra care with paint, petroleum products, or other potential pollutants. Whatever the form, it must be an ongoing community commitment, where people see the benefit of their involvement.

Advantages: Stewardship can have a tremendous impact by preventing NPS pollution before it occurs. If successful, community response can help control a variety of pollutants and may often be the most cost-effective approach available.

Disadvantages: Unfortunately, stewardship often requires a commitment that few agencies have been able to maintain. It is often hard to demonstrate the effects of a stewardship program. This creates problems for managers who would like to continue the program, but are unable to measure its success. New types of public polling to measure effectiveness may help resolve this issue. Stewardship in itself will not be sufficient without other more direct activities, but it is an essential component of any program.

Advisory Committees

Citizen committees can advise how to develop and effectively implement the NPS pollution control program. They can be very useful for identifying techniques that are locally supportable and for convincing skeptical citizens of the usefulness of the activities. These groups may be defined as review or advisory groups, or may function as consensus or constituency-building forums.

"Blue ribbon" committees are advisory committees selected for their policy or political expertise. They usually comprise well-known and respected citizens whose involvement will assure responsiveness to local needs and perspectives. This type of committee will help build local support and commitment to the overall program.

"Watchdog" committees are usually formed to review the work of the technicians and bureaucrats. They help build public confidence in the final outcome, improve communication with local stakeholders, and assure more responsiveness to local perspectives.

"Ad hoc" committees are formed to provide citizen involvement and guidance to specific projects. They function as long as the project and are dissolved when the identified work is complete.

"Standing" committees represent an ongoing commitment to public participation in a program. These committees are formally appointed by a governing body and usually have a long-term involvement with a specific mission. Their tasks may involve advice to technicians, communication between citizens and the jurisdiction, or even decisions on certain matters (as delegated by the governing body).

Advantages: Committees are often an excellent way to obtain or maintain a high public involvement and recognition for a particular issue or concern. These bodies often include informed and committed citizens who can affect the political decisions and activities of the community.

Disadvantages: Committees can be expensive to maintain. Without adequate training, committees can be divisive and unable to work effectively.

TILLAMOOK BAY SANITATION ADVISORY COMMITTEE

The Board of County Commissioners established the Tillamook Bay Sanitation Advisory Committee in fall 1987 to help identify, monitor, and address the causes and extent of pollution in the county's rivers and bays. The committee was primarily motivated by concern about potential effects on the shellfish industry and tourism.

As a result of this partieipation, 1,838 onsite sewage disposal sites were surveyed and 160 possible failures were found. Substantial progress has been made in resolving these problems. The county has created a number of programs, including a floating restroom on Tillamook Bay for use by anglers.

The State Health Division regularly samples the water in the bays to help identify potential problems. Other monitoring and cleanup efforts have also begun, such as working with the dairy industry.

In addition, the county has worked with state and federal agencies to identify wetlands. The county regulates areas in private ownership to ensure that activities there are compatible with preservation of wetland values.

COLUMBIA SLOUGH WATERSHED COUNCIL

The Columbia Slough is located in the Portland metropolitan area and serves a variety of interests, ineluding industrial, agricultural, recreational, residential, and conservation. The increasing pollution and land use conflicts resulted in the need to create a coordinated group to deal with the growing controversies. However, no collaborative forum was available to develop the needed organization.

Multnomah County Drainage Distriet No. 1 joined with the City of Portland, the Soil and Water Conservation District, and a number of interest groups to form a steering committee that represents the various interests in the watershed. The steering committee has hired a consultant with funds donated by the various entities in the watershed, and has developed a program for collaborative decision-making, conflict resolution, and education.

Community Workshops/Forums/Open Houses

When beginning a new program, it is important to provide several opportunities for citizens to review the information being used to make decisions. This is particularly true when dealing with technically complex information. The chance to explore the issue with staff members or informed citizen committee members will do much to gain people's support.

Possible forums include open committee meetings or educational open houses. Sponsorship of the activity by a group or organization will often provide needed credibility and an immediate constituency.

Workshops offer the public a chance to "get involved" in some manner. This may require maps, interactive tools such as games and computers, surveys, or small group sessions.

EUGENE COMPREHENSIVE STORMWATER MANAGEMENT PLAN

The Eugene City Council adopted the Comprehensive Stormwater Management Plan on November 17, 1993. The plan describes how the city will meet federal stormwater quality mandates and how it will finance the stormwater management program.

The plan is based upon policies contained in the Metropolitan Plan (the comprehensive plan for Eugene and Springfield). It calls for constructing a variety of capital improvements, after proper evaluation. A new fee is created, based upon impervious surfaces on each property. Wetlands are to receive particular attention, as are the city's development regulations. The City Council is to adopt new erosion control provisions and development standards in 1995.

A variety of public involvement techniques are being used. These include informational handouts, citizen committees (focusing primarily on people who are specifically affected), public hearings, and public presentations for interested groups.

It is sometimes best to take the forum to the people. This could include speaking at schools, chambers of commerce, or local service groups; providing telephone hotlines; or using cable television.

Advantages: Workshops and open houses can be a quick way to educate and involve a large number of people. They also give the news media an event to cover and report to the entire community.

Disadvantages: Creating effective workshops and forums requires a substantial commitment of time and resources. If the event is not well advertised, attendance may be low.

Public Hearings

Public hearings are another way to inform the public and hear citizen concerns. Public hearings have an order of presentation and are governed by certain procedures. Time limits may be established and other formalities may be involved.

Public hearings are required by state law before amending local comprehensive plans and development regulations. They must be conducted according to specific procedures at those times.

In addition to hearings required by law, it may be advisable to hold a public hearing or less formal public meeting at other times as well. This will allow citizens to hear information provided by staff members and respond to it.

Advantages: Hearings are familiar to all governments, and the process will be understood by most governmental staff involved. If hearings are already scheduled for other purposes, the added cost will be small.

Disadvantages: Because hearings tend to be fairly formal, they lack the relaxed atmosphere that fosters public involvement and acceptance. Many citizens are not used to such legal environments and are intimidated or alienated by the process.

Charettes/Brainstorming/Delphi

One way to create a credible information base, as well as a constituency, is to bring together informed, knowledgeable, or otherwise involved persons to help clarify issues and create answers to community-wide issues.

Charettes provide a useful tool for focusing the energies of persons with particular skills or talents on design-oriented issues. They involve a session or series of sessions that focus on a particular design issue that needs to be resolved. Everyone needed to resolve the issue is brought into the room, and the sessions are facilitated to find an acceptable solution by the end of the activity. These sessions can be quite grueling, since they can go on for hours or days if necessary.

Brainstorming is a free-flowing exchange of ideas and/or collecting of issues. The process requires several persons with responsibilities to the group. A facilitator keeps the group on-track and ensures that all speakers are allowed to make their suggestions unimpeded. A recorder lists the ideas as they are generated. It is also best to have a designated spokesperson if smaller groups must report back to the large group at the end of the process.

Delphi is a technique often used by policy makers. Experts in particular issues are brought together to share their knowledge and to develop an understanding or position on a particular topic. This pool of knowledge is usually focused on a particular issue or concern. The group may meet only once or over an extended period, sometimes covering several topics and changing members as needed.

DAYLIGHTING TANNER CREEK STUDY

The City of Portland conducted a workshop in January 1993 to develop a program for dealing with the creek flows in the Tanner Creek basin. This water is currently routed into the Tanner basin sewer, which is a combined sewer for storm and sanitary flows. The city sought help with finding a better design that would deal with the deterioration of the brick sewer and the need to separate the two types of water. A design charette was held with about 50 planners, architects, and other interested persons. The participants focused on how to return the creek to the surface in a way that could best meet concerns about NPS pollution, sewer capacity, and urban aesthetics.

The Tanner Creek charette was only one of the city's efforts to deal with NPS pollution and the combined sewer overflow program. It is often used as a model for innovatively involving people in an important urban design issue.

Advantages: Charettes, brainstorming, and Delphi groups are excellent ways to obtain useful information. They often develop a technically acceptable answer in a relatively short time.

Disadvantages: All of these techniques require the participation of experts, who may not be available or affordable. The issues that need to be resolved often require more time and technical information than is available. These approaches solve technical concerns, not political issues (although they can provide a beginning there, also).

Public Information Materials

Newsletters, brochures, or other public information materials can be used to involve and educate the public. These tools are often most effective if they stir the public's curiosity to attend an event where more information is available or to otherwise become more involved.

Newsletters allow information to be distributed to a variety of people for relatively small cost. It is often possible to use existing newsletters that are published by other agencies or organizations within the community.

Brochures are a useful way to transfer information to persons interested in a particular issue or concern. Their production requires technically competent people and a substantial commitment of resources to ensure accuracy and adequate distribution. The exact purpose of the brochure must be identified so the material remains focused rather than scattered over too many topics.

Videos and slideshows can be excellent tools for communicating issues to the public. Many people are more used to obtaining their information from such visual sources and will respond more quickly. Certain topics lend themselves to visual presentation (for example, showing how pollutants entering local streamways) and benefit greatly from this type of treatment.

UNIFIED SEWERAGE AGENCY'S RIVER RANGER PROGRAM

This program is aimed primarily at children and families. Through the use of informational materials and staff presentations, it promotes an understanding of water quality and shows how people can become involved in protecting the environment. Materials include a colorful brochure in a comic book format and stickers for labeling items at home. Staff members give presentations to schools and other interested groups on a rotating, voluntary basis. This program has won awards for its effectiveness and has been adopted by a number of other jurisdictions.

News releases and articles/stories are a useful way to reach a wider public. The news media has an effective system for distributing information and professionals to help with the communication process. Their help should be solicited and used as much as possible. A thoughtful series of informative stories or articles will quickly catch the public's attention.

Displays of informative materials placed in public areas or at local events is often a useful first step in contacting the public and seeking their involvement. The materials must be kept up-to-date and should be accompanied by materials that the viewer can take home.

Maps are excellent visual tools for informing the public. A map of major pollution sites can focus attention on particular issues or sites quickly. Other maps can show a variety of resource information.

Advantages: All of these tools can effectively involve the public and help educate citizens about important issues and opportunities for action. The more visual approaches are particularly effective with younger people.

Disadvantages: The creation of useful visual products requires competent technicians and sufficient resources to ensure accurate and pertinent information. Fewer visuals will cost less, but may make the program less effective. Use of the news media is cost effective, but media information may not always reflect the program's priorities.

Pilot Projects

Local projects where people can actually visit a site and see the improvement can have a dramatic effect in convincing people of the benefits of NPS pollution control. It is important to develop an effective information program to inform as many people as possible about the improvements and tell them how they might participate.

Both private and public opportunities should be pursued. Capital improvement programs may include projects that can be used as public pilot projects. Coordination between local governments can result in a number of useful projects that, once documented, will be a valuable public information tool.

Private opportunities may come from local development projects or activities undertaken to mitigate regulatory violations. The developer will often see this a way to improve the acceptability of the project.

Advantages: Pilot projects can capture people's imaginations and educate the uninformed more effectively than many other techniques. When combined with projects that are already planned and funded, they can be very cost effective.

Disadvantages: When undertaken independently, these projects can be expensive. Unless it is properly documented, the effort will be wasted. Projects are often dependent on a certain set of circumstances and are not transferable elsewhere.

BALCH CREEK WATERSHED

In 1992 and 1993, the City of Portland's Bureau of Environmental Services conducted a stormwater management plan for the Balch Creek Watershed west of Portland. This watershed is approximately 2 square miles of primarily forested land, with pockets of urban development, particularly along the ridges. Water quality and flood management were the two primary purposes of the planning. Fish, wildlife, and education/recreation were important secondary objectives.

The watershed contains a major urban wildlife education center (the Audubon House), the southern extension of Portland's Forest Park, and some very active neighborhood associations. The Balch Creek Citizen's Task Force (BCCTF) was established to develop early citizen support in this highly visible watershed. The BCCTF developed a "concept plan," which established objectives and recommended policy for the various categories of the plan, including water quality. As a result of this process, most committee members supported the management plan that was developed. Some nearby residents had concerns about a pilot project that involves detention, water quality benefits, and fish/stream enhancement. The public involvement process allowed these concerns to be brought to the forefront early.

The primary value of the BCCTF was that it educated the project team about citizen concerns early in the process and provided for the continual involvement and education of the citizens in the watershed. The concept plan also provided a sound basis for the team's planning activities.

Staff Training

Local staff should be trained in the purposes and processes associated with NPS pollution control. This will ensure that citizens receive useful advice and accurate information. Many important programs have foundered on insufficient training, where staff members do not know how to perform the work for which they are responsible.

Most contact that occurs between local government staff and the people they serve is by telephone or at the information counter. If those contact persons are not informed, the program will have substantially lower results.

Training does not always have to be complex or time consuming. The time needed can often be spread over a number of sessions and worked into the normal routine. This approach may also promote better staff participation.

Advantages: The public is better served by well-trained staff. Fewer errors and omissions occur that could cause negative publicity and reduce the program's effectiveness.

Disadvantages: Training can cost money and take time from other projects. A little training can be worse than none at all if it is improperly done or has insufficient support and time.

Gaming and Roleplaying

Innovative techniques such as gaming and roleplaying can provide interactive involvement between the public and staff. Many citizens will be more effectively engaged if they participate in a dialogue about a particular issue and understand the effects of their decisions.

Gaming is a tool that uses a set of rules combined with an interactive medium such as a computer, game board, or paper forms. These formats guide the player through a scenario where they vicariously experience the effects of their actions on an issue or concern. This tool can be particularly useful for involving children, or as one element in a series of educational activities.

Roleplaying is a commonly used technique for training staff. It is particularly helpful when the program involves complex issues and requires a substantial amount of public interaction.

Advantages: These techniques can be very effective in training or involving people. They allow a substantial amount of interaction and help promote acceptance.

Disadvantages: Because of their relative sophistication, these techniques can be expensive. If improperly constituted, they can create great confusion.

Surveys/Polls

Surveys can help determine public interest and knowledge about topics of interest and can help guide the kind of overall program and approach that should be developed. By knowing what the public is willing to support, and what important issues or information is not well understood, the local agency can better focus its resources.

Surveys must be created by technically competent staff that know the proper techniques and processes. Once the information is assembled, it must be analyzed to ensure it is accurate and truly reflective of the community.

Surveys come in many forms. They may poll the entire population or only designated segments, depending on the needs and concerns being addressed.

Funding for surveys can be local, or it is sometimes possible to obtain grants for hiring professional consultants. Many universities have classes that perform this kind of work as part of their student training activities.

Advantages: Surveys can be a powerful tool for informing local agencies of what work needs to be done. Equally important, they can concentrate people's attention on the topics and engage citizens in debate. This can lead to increased local involvement and commitment.

Disadvantages: Improperly constituted surveys may not reflect local attitudes. Surveys that are properly designed and analyzed will require professional staff which will cost money.

Tours

Touring actual sites allows citizens to see the effects of pollution or meet people actively engaged in NPS pollution control. Tours that demonstrate particular issues or solutions will attract the interest of the community and its leadership. These tours are often media events that can generate useful news coverage.

A successful tour requires a planned agenda, as well as staff resources adequate to make the necessary presentations and develop the information materials.

One way to simplify the process is to prepare a video or self-guided paper tour. People can then progress as they have the time and revisit sites or people as needed. This approach is, however, less interactive than a guided tour.

Advantages: The combination of visual, written, oral, and interactive opportunities has the best possible chance of educating those involved.

Disadvantages: The resources required are expensive and time consuming. Tours are often dependent on the weather, and transportation logistics can be difficult. Details are very important, and careful attention to all aspects is required.

Education Programs

An effective educational program is one of the best ways to promote knowledge about water quality and NPS pollution issues. By involving people at a variety of levels throughout the community, it is possible to develop a group of informed people who can in turn help create useful and supported local programs. Educational programs can involve activities through formal educational systems, such as schools, as well as through less formal associations, such as youth, cultural, or special interest groups.

Local agencies or groups can organize "work days" for students, scouting groups, fraternal or service organizations. Participants work on an activity that actually makes an improvement or prevents a problem. Work days both educate the participants and produce real results.

Governmental and philanthropic agencies often have grants available for certain types of group or activity. These funds can be used to support projects such as work days.

A good example of an education program is "Educating for Action," developed by the Puget Sound Water Quality Authority, Olympia, Washington. (Call 206-407-7300 for information.)

Advantages: Partnerships with educational institutions can use resources effectively and allow more to be accomplished. Education can be successful with all age groups. Educational activities are often seen as less threatening than some other types of activity and are more readily accepted by all members of the community. Evidence of this kind of activity, such as pictures of children planting seedlings along a stream, can capture both the medias' and the public's attention.

Disadvantages: Education is a long-term investment. Organizations that begin such programs should be willing to make a multi-year commitment. That commitment will involve money and time, and should be based on an effective plan and measurable goals.

INTEGRATING THE ELEMENTS

The plans, regulations, and programs presented above are all conceptually and procedurally linked.

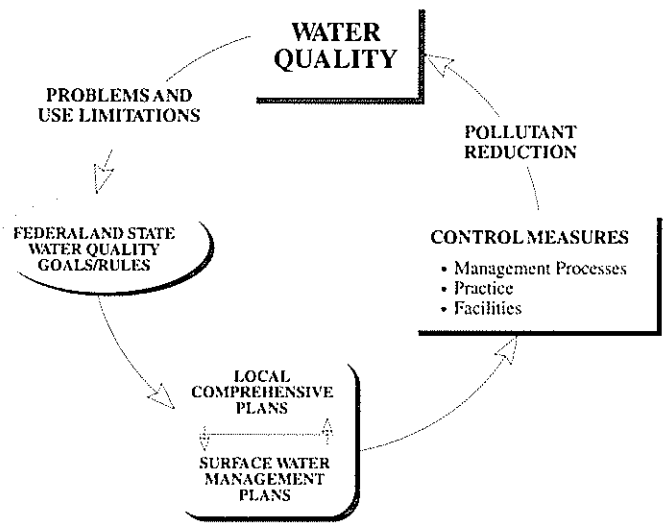
The comprehensive plan, particularly the planned pattern of community land use, is implemented through various local programs, including land use regulations.

Surface water management plans provide the basis for specific water quality measures in the CIP, through such elements as erosion control requirements and constructed facilities. To implement CIPs, design and construction standards are necessary for consistent, sound design. Design and construction standards are also the logical mechanisms for implementing many NPS pollution control measures within private developments or land use activities.

Once a facility is constructed, it will not function properly without an effective operations and maintenance program. Operations and maintenance must be founded in a sound policy context in order to maintain their priority for funding.

The preceding techniques and processes are tools in the overall system. The most important aspect of the entire process is the development of an appropriate stewardship ethic and a cadre of committed individuals. The program must be more than just a public relations campaign. People must understand how their involvement is important, both locally and within the larger societal context. The control of NPS pollution is not just a local concern, but it requires the involvement of local people willing to become educated and take on leadership roles in their community. A successful program requires advocates.

NONPOINT SOURCE POLLUTION CONTROL PROCESS



There is no magic system, no predetermined blend of management techniques, practices, and processes. Each community must inventory its situation and choose actions that will achieve the desired results. All pertinent local interests must be brought into that process. Care must be taken to ensure that the impacts of regulations and procedures are equally felt throughout the community and are not concentrated unreasonably upon one group. The process should strive

for unanimity, but recognize that something less may be acceptable. The results must be tangible and significant. The intent to ensure safe water for everyone must be met, and must be achieved in ways consistent with state and federal regulations. At the same time, if the program is to survive and prosper locally, good communication within the community is critical. The commitment to educational, regulatory, and informational processes must be long-term.

The final outcome will eventually be determined by the nurturing of an effective community leadership. These are people who are willing to contribute their time and resources, continue through the debates and various social/political interactions, and strongly advocate for the principles and actions required to address NPS pollution.

SECTION IV

NONPOINT SOURCE POLLUTION CONTROL MEASURES - FACILITIES AND PRACTICES

SUMMARY OF SECTION IV

- Reviews types of NPS pollution problems and related control measures
- Describes nine groups of control measures
- Summarizes the effectiveness of various control measures in table form
- Presents questionnaire results concerning the effectiveness of various control measures
- Identifies additional sources of information
- Provides descriptions of over 40 individual control measures

INTRODUCTION

This section summarizes nonpoint source (NPS) pollution control measures that can be applied to various sources and activities within a watershed. It includes both facilities (for example, sedimentation ponds) and practices (for example, riparian protection). Some of the measures, such as pond/marsh facilities or erosion control, can be used to reduce the pollutant loads from several types of nonpoint sources. Others are specific to one type of source: for example, trapped catch basins in urban development or skyline logging for forest harvest activities.

The effectiveness of these control measures varies considerably, depending on the pollutants of concern; the source characteristics; the water bodies of interest; the watershed hydrology; and other watershed characteristics, such as soils, slopes, geology, type of cover, and the nature and extent of development. Effectiveness also depends on the planning and design criteria used. Many measures fail to meet expectations simply because they were not designed or applied correctly. This section discusses how and when the various control measures should be applied.

In keeping with the overview nature of the guidebook, **the descriptions are basic and do not present design/planning criteria**. Other sources, such as those listed later in this section or in the References section, present design criteria.

TYPES OF NPS POLLUTION PROBLEMS AND RELATED CONTROL MEASURES

Most NPS pollution results from disturbances, alterations, and uses of the land.

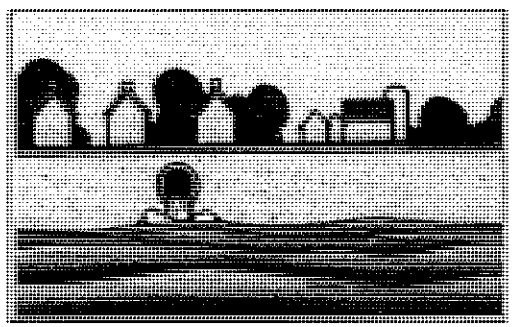
Disturbances include soil exposure that causes erosion and sedimentation in streams, lakes, or estuaries.

An example of an **alteration** is the replacement of natural vegetation with an asphalt parking lot. This increases runoff velocities and downstream channel erosion, and increases the load of pollutants (such as oil and particulates) discharged into a water body.

All types of **land uses** can create NPS pollution problems.

For the presentation of control measures in this section, NPS pollution problems are categorized into five basic types: residential, commercial, industrial, agricultural, and forest harvest.

RESIDENTIAL



Residential NPS pollution problems involve typical urban neighborhoods containing single-family or multifamily dwelling units. The problems originate from soil that has been eroded from lawns and gardens, or from impervious surfaces that increase water velocities and volumes and cause stream channel erosion. Various types of particulates on residential impervious surfaces (for example, "street dirt") can also be washed into streams and lakes, causing water quality problems involving sedimentation, metals, and various urban chemicals. Home-use chemicals such as fertilizers, herbicides/pesticides, paints, and solvents may also be transported into receiving waters. The most effective approaches to NPS control for developing areas are different from those for developed areas.

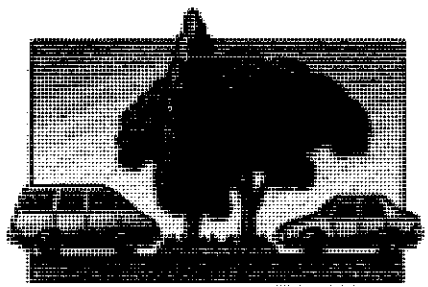
The most effective control measures involve:

- Public education
- Regional NPS control facilities, such as wetlands and vegetated swales (for developed areas)

- Various kinds of sediment traps in urban stormwater systems (for developed areas and new development)
- Landscape design and erosion control (for new development)
- Infiltration facilities
- Less use of chemicals
- Recycling and the proper disposal of chemicals
- Maintenance of on-site septic systems

COMMERCIAL

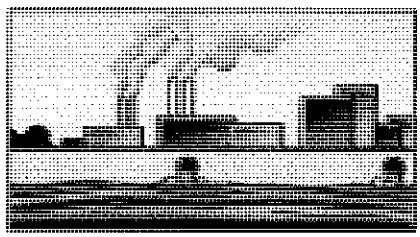
Commercial NPS pollution problems originate in the relatively large areas of impervious surfaces associated with most commercial developments, such as office complexes, shopping centers, marinas, or downtown areas. The NPS mechanisms involved are primarily increased runoff velocities that cause channel erosion; the entrainment and transport of particulates from impervious surfaces; and spills or leaks of various chemicals, such as oil from cars or solvents from loading docks. As with residential development, the most effective NPS pollution controls vary from one area to another, depending in particular on the degree of current development.



The most effective control measures are:

- Hydrological site containment concepts included in the design of new commercial developments
- Landscaping measures to provide pollutant removal, such as ponds or vegetated swales
- Site manager training/education
- Spill response procedures for certain high risk sites
- Proper disposal of chemicals such as cleaners and print shop inks

INDUSTRIAL



Industrial developments that can cause NPS pollution problems include most, if not all, types of industrial activity. Examples in Oregon include recreational vehicle manufacturing, pulp and paper mills, plating factories, food processors, metal foundries and fabricators, shipyards, and paint or chemical manufacturers. To be consistent with the National Pollutant Discharge Elimination System (NPDES) permits for industrial stormwater discharges, land development of any type is defined as an industrial activity. The NPS mechanisms involved from industrial developments are primarily the entrainment and transport of industrial chemicals that have leaked or spilled on the site. Soil erosion is also a factor.

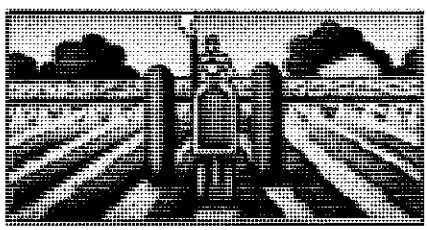
The most effective control measures for industrial plants are:

- Containment of site runoff from the site
- Plant employee training
- Spill response procedures

The best control measures for construction are:

- Erosion control
- Sediment traps (e.g., ponds)

AGRICULTURAL



For the purposes of this guidebook, agricultural activities include all types of row crops, orchards, nurseries, forage crops, feedlots, and grazing. Most agricultural NPS pollution problems originate either from erosion or the migration of agricultural chemicals into the receiving waters.

The most effective control measures are:

- Revised management practices for livestock, tillage, and bulk materials
- Riparian area protection
- Operator education

FOREST HARVEST

Forest harvest activities include access roads, skid trails, chemical applications, the yarding of logs, residue management, and cutting. The primary NPS pollution problems are soil erosion and chemical leaks or spills.

The most effective control measures are:

- Road and skid trail limits (density and exposed area) and design standards
- Logging/yarding criteria
- Erosion controls
- Operator education
- Chemical application controls
- Chemical containment

OTHER NPS POLLUTION PROBLEMS

Mining, marinas, and onsite wastewater facilities can also cause NPS pollution. Mining is not addressed in this section because the activities are usually concentrated enough to be regulated in a manner similar to point sources. Mining control measures are well defined and built into DEQ's regulatory process. NPS pollution activities at marinas and port areas generally fall within the industrial or commercial categories. On-site systems such as septic tanks discharge nitrate into the groundwater, and potentially into surface water, even when they are functioning well. Bacteria can be a problem when they malfunction. Because onsite wastewater facilities are currently regulated by local and state governments, additional control measure information in this guidebook is considered unnecessary. Construction and stream/lake/estuary alteration can occur in any of the five basic NPS pollution problem categories addressed in this section.

OVERVIEW OF CONTROL MEASURES

Control measures are presented under the nine groups described below. Some involve **facilities**, such as stormwater wetlands that reduce pollutants in surface water runoff. Others involve management **practices**, such as riparian area protection or agricultural tillage concepts. Monitoring of the control measures is also discussed.

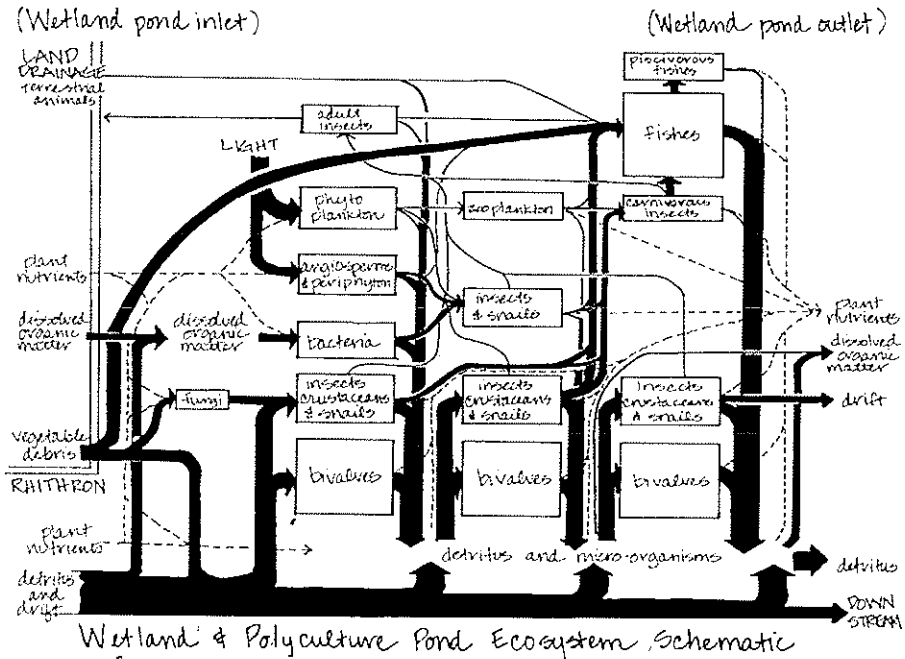
Land use and surface water planning are considered to be management **processes** that can be used to specify and implement the control measures described in this section. These management processes are discussed primarily in Section III. Each of the individual control measures

described later in this section includes a paragraph on "local implementation options," which identifies the management processes that best apply to that measure.

Public education is an important tool considered to be a prerequisite for all NPS pollution control programs. It is discussed in Section III.

PONDS AND MARSHES

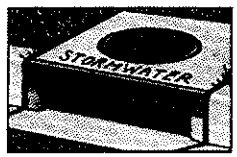
This category covers facilities that reduce the pollutant load in surface water, primarily through the settling of suspended particles (for example, eroded soil or "street dirt") and any chemicals attached to the particles (such as phosphorus and various metals). This particulate settling is the primary, and almost exclusive, pollutant removal process in the basic sediment trap facilities (such as sedimentation ponds and extended detention ponds) that pond water only infrequently. Wet ponds permanently pond water, and the pollutant removal mechanisms expand to include basic biological processes (such as nutrient removal by plants) and some physical filtering through vegetation. With ponded wetlands, the biological, physical, and chemical processes become much more complex and generally more effective.



Wetland & Polyculture Pond Ecosystem Schematic
from HBN Hynes; The Ecology of Running Waters; University of Toronto Press 1970; pg. 440

Pond and marsh facilities provide good to excellent pollutant removal for residential, commercial, agricultural, and forest harvest areas if they are adequately sized and shaped. They are most effective in removing suspended particles, nutrients, and metals attached to sediment. They are not effective for many industrial chemicals. They should be used very conservatively in industrial areas, and only if they include special design features (such as lining) and are part of a specially designed containment system.

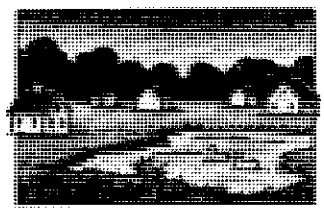
STREET AND STORM SEWER SYSTEMS



Small pollutant removal facilities include trapped catch basins, sedimentation boxes or vaults, oil-water separators, and compost treatment units. They can be very effective if applied extensively in an area, primarily in urban street and storm sewer systems. The primary removal mechanism is particulate settling, where sediment, street dirt, metals attached to the sediment particles, and petroleum particles are removed.

Adequate maintenance is a critical factor. It is an essential part of the pollutant removal process; if it is not done, the pollutants are transported into receiving waters. Materials disposal can require special disposal sites, particularly if industrial areas or spills are involved. Street sweeping, which is a maintenance activity, is included in this group; however, its effectiveness in the Northwest is questionable because of the frequency of natural washoff.

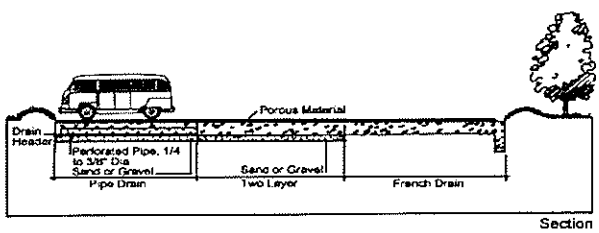
LANDSCAPE DESIGN



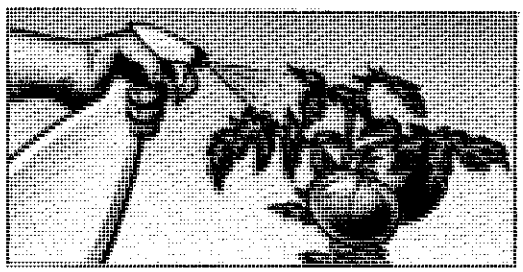
Landscape design includes features that can be included in any type of NPS pollution area, but is most easily integrated into developing urban areas. Included are vegetated swales, filter strips or riparian biofilters, contained drainage systems (particularly important for commercial and industrial areas), ponds, wetlands, and various types of erosion control during soil disturbance periods. These measures can be very effective if the design uses good hydrologic, hydraulic, and pollutant removal criteria, and if the system is adequately maintained. Erosion control for all types of NPS problem areas is the most important measure.

INFILTRATION FACILITIES

This group includes trenches, dry wells, porous pavement, ponds, wetlands, and roof drains that are designed to infiltrate surface water into the groundwater. In industrial areas, this approach is suitable only for roof drains; it is almost as limited for commercial and agricultural areas. It is portant to ensure that the areas within an industrial, commercial, or agricultural site that contain industrial chemicals are not drained into an infiltration facility. For areas where there is a low risk that industrial chemicals or high sediment loads will enter the runoff stream, infiltration can be very effective in reducing both peak flows and pollutant loads. The sorption of dissolved phosphorus onto the subsurface media is a particularly important pollutant removal function for infiltration.

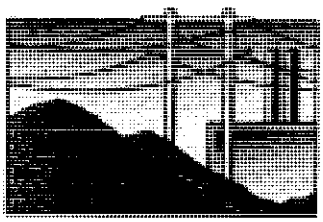


CHEMICAL APPLICATIONS



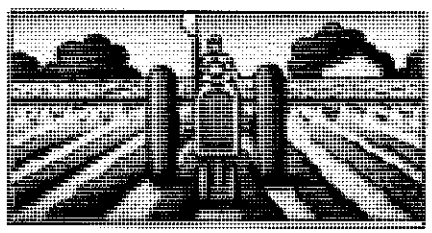
This group addresses herbicides, pesticides, and fertilizers. Detailed information is available from soil and water conservation districts and the product manufacturers. It is important to address chemical use in all urban, agricultural, and forest harvest areas. The important aspects include the method and amount, the timing of the application, storage, and equipment/container cleanup.

INDUSTRIAL AND COMMERCIAL SITES



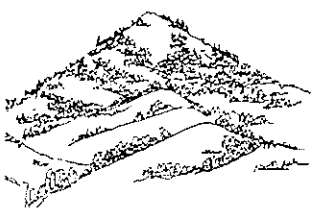
Industrial and commercial areas often require special NPS pollution control measures because of the nature of the chemicals present. The most important measures are the elimination of non-stormwater, or illicit, connections to the surface water system; lining of surface water features to protect groundwater; preventative containment features included in the site design; monitoring; and maintenance. Even with such measures, emergency response procedures and capabilities will occasionally be required and are very important when such emergencies occur.

AGRICULTURAL AREAS



A number of NPS pollution control measures are unique to agricultural activities. Most of them involve modifications to farming practices. The measures include water quality-sensitive management of bulk materials, tillage, and container nurseries. Riparian area protection is important, particularly when livestock are involved. Pond/marsh facilities can also be effective.

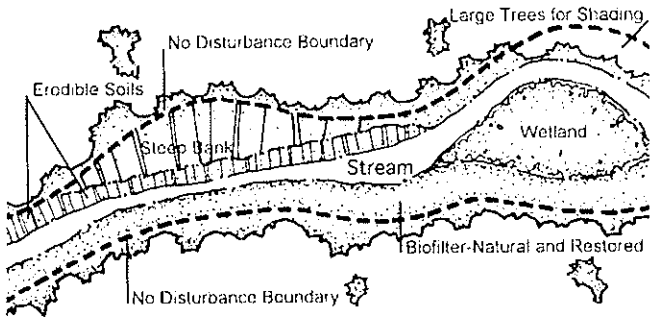
FOREST HARVEST AREAS

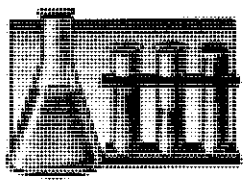


This group addresses activities associated with forest harvesting, including road and skid trail design, logging or yarding, forest residue management, and erosion control. Similar to agriculture, many of the forest harvest measures are unique to the activity and involve modifications to existing procedures.

STREAM, LAKE, AND RIPARIAN AREA PROTECTION

This group is an essential component of all NPS pollution control projects or programs. It involves equipment use limits, biofilter zones (preferably natural, but created if necessary), stream and riparian area restoration, and lake restoration.





MONITORING

Monitoring is also discussed as a control measure. Although it does not provide pollutant reduction, it is an essential program measure that documents the problems and tracks control measure performance.

EFFECTIVENESS OF CONTROL MEASURES

Table IV-1 summarizes the effectiveness of the control measure groups in relation to the types of NPS pollution problem.

Based on Montgomery Watson experience, Table IV-2 summarizes the removal efficiencies of the control measure groups.

Table IV-3 presents additional information for selected control measures. The information is adapted from the 1993 EPA document, *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.*

Table IV-4 summarizes the advantages and disadvantages of selected NPS pollution control measures.

TABLE IV-1
CONTROL MEASURE EFFECTIVENESS FOR VARIOUS SOURCES

Control Measure Group	Type of Nonpoint Source Problem				
	Residential	Commercial	Industrial	Agricultural	Forest Har.
Ponds-Marshes	●	◑	○	◑	◑
Street/Storm Sewers	●	●	○	×	×
Landscape Design	●	●	○	○	×
Infiltration	●	◑	⊘	⊘	○
Chem. App.	◑	●	●	●	◑
Industrial/Commercial	×	●	●	◑	◑
Agricultural	○	×	×	●	×
Forest Harvest	○	×	×	×	●
Stream, Lk., Rip., Pr.	●	●	●	●	●

● Good Effectiveness
◑ Moderate Effectiveness
○ Low Effectiveness
× Not Applicable
⊘ Not Recommended

Table IV-2

Removal Efficiencies of Control Measure Groups
(Assuming adequate sizing, design and application)

Control Measure Group	Pollutant Removal Efficiency (percent)					
	TSS	Total P	N	Bacteria	Oil/Grease	Metals
Ponds-Marshes	**80** ±15	**40** ±20	**30** ±15	**50** ±20	⊘	**55** ±10
Street/Storm Sewers	**30** ±10	**15** ±5	**10** ±5	¥	¥	**15** ±5
Landscape Design	**60** ±10	**45** ±20	**40** ±20	¥	**70** ±10	**45** ±15
Infiltration	⊘	**75** ±10	**40** ±10	**85** ±10	⊘	⊘
Chemical Applications	¥	Mod.	Mod.	¥	¥	¥
Commercial/Industrial	**70** ±10	**40** ±10	**30** ±10	¥	**80** ±10	**50** ±10
Agricultural	**70** ±10	**60** ±20	**50** ±20	¥	¥	¥
Forest Harvest	**70** ±10	**60** ±20	**50** ±20	¥	**25** ±10	¥
Stream, Lk., Rip., Protection	**60** ±20	**50** ±20	**45** ±20	**30** ±20	¥	¥

¥ Not applicable
⊘ Not recommended

TSS = Total suspended solids - All solid material suspended in the water, particularly soil/sediment particles if NPS pollution is involved

Total P = Total phosphorus - All of the phosphorus in the water, including the dissolved ortho component and the total particulate component (organic and inorganic)

N = Nitrogen - All nitrogen components combined, including nitrate, nitrite, organic, and ammonia

Bacteria = Fecal coliform bacteria as an indicator of waste from humans and animals

Oil/Grease = Petroleum products, generally associated with vehicles and industrial activities

Metals = All metals normally found in runoff from NPS areas, such as lead, copper, and zinc

TABLE IV-3
Effectiveness of Selected Control Measures

Control Measures	Removal Efficiency (%)						Factors	References
	TSS	TP	TN	COD	Metals	Oils/ Greases		
Wet Pond	50-80-95	50-65-90	10-55-90	10-40-90	10-40-95	⊘	• Storage volume • Pond shape • Detention time	Schueler et al., 1992; Portland - Lake Oswego- Clackamas County - USA Handbook, 1991
Marsh-Wetland	50-65-90	0-25-80	0-20-40	–	30-65-95	⊘	• Storage volume • Detention time • Pond shape • Wetland's biota • Seasonal variation	MWCOG, 1992; Portland - Lake Oswego- Clackamas County - USA Handbook, 1991
Extended Detention (Dry) Pond	45-70-90	10-25-60	20-30-60	30-30-40	20-50-60	⊘	• Storage volume • Detention time • Pond shape	Schueler and Helfrich, 1988; Portland - Lake Oswego- Clackamas County - USA Handbook, 1991
Trapped Catch Basins	10-20-30	5-10-20	5-10-20	¥	10-20-30	10-20-30	• Storage volume • Hydraulic loading • Cleaning	Portland - Lake Oswego- Clackamas County - USA Handbook, 1991
Water Quality Inlet	10-25-25	5-5-10	5-10-10	5-5-10	10-15-25	50-65-70	• Maintenance • Sedimentation storage volume	Schueler, 1987
Sedimentation Manhole	20-30-40	10-15-20	5-10-20	¥	20-30-40			Portland - Lake Oswego- Clackamas County - USA Handbook, 1991
Compost Treatment	60-80-90	0-50-80	20-35-90	–	40-60-80	40-60-80	• Hydraulic loading • Compost Mix	W.H. Pacific, Portland, OR, 1993
Swale	20-60-100	20-20-40	10-10-30	0-25-40	10-80-80	50-65-80	• Runoff volume • Slope • Soil infiltration rates • Vegetative cover • Swale length • Swale geometry	Washington State, 1988; Schueler, 1987; EPA, 1983; Seattle Metro, 1992
Filter Strip	40-65-90	30-40-80	20-40-60	0-40-80	30-45-80	50-65-80	• Runoff volume • Slope • Soil infiltration rates • Vegetative cover • Buffer length	Schueler, 1987; Seattle Metro, 1992
Infiltration Trench	50-75-100	50-60-100	50-55-100	50-65-100	50-65-100	⊘	• Soil percolation rates • Trench surface area • Storage volume	EPA, 1977; Schueler, 1987; EPA, 1983
Infiltration Pond	50-75-100	50-65-100	50-60-100	50-65-100	50-65-100	⊘	• Soil percolation rates • Basin surface area • Storage volume	EPA, 1977; Schueler, 1987; EPA, 1983

TABLE IV-4
ADVANTAGES AND DISADVANTAGES OF SELECTED CONTROL MEASURES

Control Measures	Advantages	Disadvantages
Wet Pond	• Can provide some peak flow control • Can serve large developments; most cost effective for larger, more intensively developed sites • Enhances aesthetics and provides recreational benefits • Permanent pool in wet ponds helps to prevent scour and resuspension of sediments • Provides moderate to high removal of both particulate and soluble urban stormwater pollutants	• Not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • Potential exists for affecting groundwater
Marsh-Wetland	• Can serve large developments; most cost effective for larger, more intensively developed sites • Can provide peak flow control • Can enhance aesthetics and provide recreational benefits • The marsh fringe also protects shoreline from erosion • Permanent pool in ponded wetland helps to prevent scour and resuspension of sediments • Has high pollutant removal capability, including for dissolved constituents if designed properly	• Not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately designed and maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • With possible thermal discharge and oxygen depletion, may affect downstream aquatic life unless shading provided • May contribute to nutrient loadings during vegetation die-down periods • Regulatory constraints are important concerning existing wetlands and groundwater
Extended Detention (Dry) Pond	• Can provide some peak flow control • Possible to provide good particulate removal • Can serve large development • Requires less capital cost compared to wet pond • Does not generally release warm or anoxic water downstream • Provides excellent protection for downstream channel erosion • Can create valuable wetland and meadow habitat when properly landscaped	• Removal rates for soluble pollutants are quite low • Not economical for drainage area less than 10 acres • If not adequately maintained, can be an eyesore
Conjunctive Use Flood Detention Ponds	• Designed to also provide peak flow control • Can serve large developments; most cost effective for larger, more intensively developed sites • Enhances aesthetic and provides recreational benefits if landscaped well • Permanent pool in wet ponds helps prevent scour and resuspension of sediments	• Not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately designed or maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • Off-stream types are complex and costly
Water Quality Inlet and Trapped Catch Basin	• Provide high degree of removal efficiencies for larger particles and debris as pretreatment • Require minimal land area • Flexibility to retrofit existing small drainage areas, and applicable to most urban areas	• Not feasible for drainage area greater than 1 acre • Marginal removal of small particles, heavy metals, and organic pollutants • Not effective as water quality control for intense storms • Minimal nutrient removal • Require frequent maintenance

TABLE IV-4
ADVANTAGES AND DISADVANTAGES OF SELECTED CONTROL MEASURES

Control Measures	Advantages	Disadvantages
Compost Treatment Unit	• Prefabricated compost units allow relatively inexpensive installation of unit within existing storm drainage systems • Underground units allow installation within existing street easements	• May require pretreatment (sedimentation) to prevent compost from prematurely clogging • Compost will have to be replaced and disposed of periodically • Compost mix design is complex and possibly proprietary technology • Promising, but developing technology
Swale	• Requires moderate land area • Can be used as part of the runoff conveyance system to provide pretreatment • Can provide sufficient runoff control to replace curb and gutter in single-family residential subdivisions and on highway medians • Economical	• Low pollutant removal rates for some pollutants • Leaching from swales that are integrated into fertilized lawns may increase nutrients
Filter Strip	• Can be used as part of the runoff conveyance system to provide pretreatment • Low maintenance requirements • Provides excellent urban wildlife habitat • Can effectively reduce particulate pollutant levels in areas where runoff velocity is low to moderate • Economical, particularly if the existing vegetation is preserved prior to development	• Limited feasibility in highly urbanized, developed areas where runoff velocities are high and flow is concentrated • Concentrated water flow significantly reduces effectiveness • Ability to remove soluble pollutants highly variable • Requires periodic repair, regrading, and sometimes sediment removal
Infiltration Trench	• Provides groundwater recharge • Can serve small drainage areas • Can fit into medians, perimeters, and other unused areas of a development site • Helps replicate predevelopment hydrology, increases dry weather baseflow, and reduces bankfull flooding frequency • Good pollutant removal	• Possible risk of contaminating groundwater if not properly sited and designed • Requires significant maintenance • Since not as visible as other measures, less likely to be maintained by residents • Only feasible where soil is permeable and there is sufficient depth to rock and water table
Infiltration Pond/Dry Well	• Provides groundwater recharge • Can serve large developments • High removal capability for particulate pollutants and moderate removal for soluble pollutants • When basin works, it can replicate predevelopment hydrology more closely than other options • Basins provide more habitat value than other infiltration systems	• Possible risk of contaminating groundwater if not properly sited and designed • Fairly high failure rate • Only feasible where soil is permeable and there is sufficient depth to rock and water table • If not adequately maintained, can be an eyesore • Regular maintenance activities cannot preven clogging of infiltration ponds and dry wells in some locations

EFFECTIVENESS QUESTIONNAIRE

The available NPS pollution control literature presents a wide range of information about the effectiveness of various control measures. To obtain additional information, a questionnaire was sent to 21 practitioners to ask about their experience concerning general performance. The practitioners are located as follows: 13 in Oregon, 6 in the State of Washington, 1 in California, and 1 in Washington, D.C. Some practitioners also passed the questionnaire on to colleagues. Twenty individual responses were received.

The practitioners were asked to rate the effectiveness of specific control measures. Table IV-5 summarizes the rating results for all of the control measure categories. Not all respondents rated every item on the list. The primary reason for not rating an item was unfamiliarity with it.

The respondents made some specific comments associated with the numerical rating of individual control measures. These comments affected how they rated some of the items and are presented in Table IV-5. Inclusion of a comment should not be interpreted to mean that DEQ or DLCD agrees with the comment.

The practitioners were also asked to respond to five questions about NPS pollution control measures. Appendix D summarizes the responses to those questions.

TABLE IV-5
RESULTS OF NONPOINT SOURCE CONTROL MEASURES EFFECTIVENESS RATING QUESTIONNAIRE

0	1	2	4	*Ponds and Marshes*
	2	8	6	Wet Ponds
		15	3	Sedimentation Ponds
	1	9	8	Marsh-Wetland Treatment
	4	9	3	Extended Detention Ponds
	3	4	6	Conjunctive Use Flood Detention Ponds

0	1	2	4	*Agricultural Areas*
		5	10	Livestock Management
		3	11	Bulk Materials Containment
		1	14	Riparian Area Protection
		7	7	Tillage Management
		5	5	Container Nursery Controls
		6	9	Fertilizer and Manure Management

0	1	2	4	*Street and Storm Sewer Systems*
1	7	3	1	Sedimentation Boxes
2	9	4	2	Trapped Catch Basins
2	9	5	1	Water Quality Inlets, Vaults and Tanks
1	8	3	2	Sedimentation Manholes
	4	4	4	Compost Treatment Units
3	5	6	3	Street Sweeping

0	1	2	4	*Silvicultural Areas*
	3	3	5	Road and Skidding System Design Standards
	1	5	4	Logging Method Requirements
	1	6	4	Forest Residue Management
	4	2	5	Surface/Mass Erosion Controls

0	1	2	4	*Landscape Design*
	2	10	7	Vegetated Swales
	5	7	7	Filter Strips
1	1	4	1	Contained Drainage Systems
	1	8	7	Ponds and Wetlands
	2	5	11	Erosion Control

0	1	2	4	*Stream, Lakes, and Riparian Area Protection*
	1	6	7	Equipment Use Limits
		3	12	Biofilter/Buffer Zones
	2	5	8	Stream and Riparian Area Restoration
	3	5		Lake Restoration (as per PL 92-500)

0	1	2	4	*Infiltration Facilities*
	5	10	2	Trenches
3	8	5	1	Dry Wells
5	4	6	2	Porous Pavement
	5	8	3	Infiltration Ponds/Wetlands
1	3	6	7	Roof Drain Infiltration

0	1	2	4	*Monitoring*
	2	5	4	For Complete Watersheds
	1	5	4	Water Quality-Basic (e.g. Nutrients, SS)
	1	5	3	Water Quality-Special (e.g. metals, industrial chems.)
		4	5	Aquatic Life (diversity, abundance, tissue)
	1	1	7	Sediments and Toxics

0	1	2	4	*Chemical Applications*
	1	6	8	Herbicide and Pesticide Controls
		4	11	Fertilizer Management

0	1	2	4	*Industrial and Commercial Sites*
	1		17	Eliminating Illicit Connections
		3	14	Containment of Contaminated Runoff
	1	2	14	Monitoring and Maintenance
	1	6	10	Emergency Response

Numbers in boxes indicate the number of respondents who assigned that rating

Description of Ratings
0 - not effective
1 - low effectiveness
2 - moderate effectiveness
4 - high/good effectiveness

NOTES:

- Marsh-Wetland Treatment: One comment indicated that the rating depends on the season.
- Compost Treatment Units: Several comments noted that a rating of 4 assumed that nutrient control was not an issue.
- Infiltration Facilities: Comments noted that the soil type and the level of maintenance provided would affect whether facilities such as trenches and infiltration ponds/wetlands would receive a rating of 2 or 4. It was also noted that roof drain infiltration is better for quantity than for quality.
- Landscape Design: Comments noted that dozens of erosion control measures exist; some are effective and some are not.
- Agricultural Areas: Concerns about agricultural areas were noted, specifically concerning container nursery controls and the fact that nurseries are still allowed to dump, or release the water from, ponds in the fall season.
- Lake Restoration: A comment noted that the technique used to restore the lake would affect the rating of this item. This particular respondent favored creating buffers to the lake and removing septic tanks in the drainage basin.
- Monitoring: The following comments were made:
  - Basic water quality monitoring is event based.
  - More in-depth water quality monitoring, which includes metals, chemicals, aquatic life, and toxics, is expensive, and testing should be selective.
  - One should have good reason to believe toxics are present before obligating funds.
  - Diversity and abundance are good indicators of system health, but are not related to specific best management practices and their performance.

ADDITIONAL SOURCES OF INFORMATION

The References section lists information sources of interest to the reader, including the sources used to prepare this guidebook. The following publications comprise a good basic library that will take the reader a step beyond this guidebook in understanding NPS pollution problems, sources, and controls.

- American Society of Civil Engineers. Design of Urban Runoff Quality Controls. Proceedings of an Engineering Foundation Conference on Current Practice and Design Criteria, Potosi, Missouri, 1988. *(Information source 1, below)*
- King County Department of Public Works, Surface Water Management Division. Guidelines for Bank Stabilization Projects, In the Riverine Environments of King County. Seattle, Washington, 1993. *(Information source 2)*
- Municipality of Metropolitan Seattle, Water Pollution Control Department. Biofiltration Swale Performance, Recommendations, and Design Considerations. Seattle, Washington, 1992. *(Information source 3)*
- Portland, City of, Bureau of Environmental Services. Columbia Slough Planning Study Background Report. Portland, Oregon, 1989. *(Information source 4)*
- Portland, City of; City of Lake Oswego; Clackamas County; and Unified Sewerage Agency. Surface Water Quality Facilities Technical Guidance Handbook. 1991. *(Information source 4)*
- United States Department of Agriculture, Forest Service, Pacific Northwest Region. General Water Quality Best Management Practices (for forest harvest activities). 1988. *(Information source 5)*
- United States Environmental Protection Agency. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Section 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990. 1993. *(Information source 6)*
- United States Environmental Protection Agency. Rapid Bioassessment Protocols for Use in Streams and Rivers; Benthic Macroinvertebrates and Fish. 1989. *(Information source 7)*
- Washington Council of Governments, Metropolitan Department of Environmental Programs. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. 1987. *(Information source 8)*
- Ibid. A Current Assessment of Urban Best Management Practices. 1992. *(Information source 8)*
- Washington State Department of Ecology. Stormwater Management Manual for the Puget Sound Basin; The Technical Manual. 1992. *(Information source 9)*
- Water Environmental Federation and American Society of Civil Engineers. Design and Construction of Urban Stormwater Management Systems. 1988. *(Information source 1)*

The information listed above can be obtained by contacting the following sources.

1. American Society of Civil Engineers
   345 East 47th Street
   New York, NY 10017-2398

2. King County
   Surface Water Management Division
   Department of Public Works
   Yesler Building
   400 Yesler Way, Room 400
   Seattle, WA 98104-2637

3. Municipality of Metropolitan Seattle
   Water Pollution Control Department
   821 Second Avenue
   Seattle, WA 98104-1598

4. Portland Bureau of Environmental Services
   1120 SW Fifth
   Portland, OR 97204-1972

5. United States Department of Agriculture
   Forest Service
   Pacific Northwest Region
   P.O. Box 3623
   Portland, OR 97208
   333 SW First Avenue
   Portland, OR 97204

6. EPA-EPIC
   11029 Kenwood Road, Building 5
   Cincinnati, OH 45242
   (for CZARA Guidance document)

7. U.S. Environmental Protection Agency
   Assessment and Watershed Protection Division
   401 M Street, SW
   Washington, DC 20460

8. Information Center
   Metropolitan Washington Council of Governments
   777 North Capitol Street, NE, Suite 300
   Washington, DC 20002-4201

9. Washington Department of Ecology
   Mail Stop PV-11
   Olympia, WA 98504-8711

CONTROL MEASURES

The following sheets describe the basic NPS pollution control measures according to the following categories:

- Ponds and Marshes
- Street and Storm Sewer Systems
- Landscape Design
- Infiltration Facilities
- Chemical Applications
- Industrial and Commercial Sites
- Agricultural Areas
- Forest Harvest Areas
- Stream, Lake, and Riparian Area Protection

Monitoring techniques are also described following the description of control measures.

Note: The facilities and measures described in the following section have been determined through experience to be suitable under certain conditions. However, due to state laws, rules, or policies, or local comprehensive plan policies relating to the protection of natural resource values, some of the facilities and measures may not be appropriate or permissible under certain circumstances.

PONDS AND MARSHES

WET PONDS

Description: Wet ponds appear as a depression which contains a permanent ponded pool, often behind an existing road fill or constructed embankment. Wet ponds are deeper on the average than a wetland and typically larger than a sedimentation pond. Treatment occurs through a variety of natural physical, chemical, and biological processes in the aquatic environment. Since embankments/road fills are usually utilized to establish the ponding, wet ponds are generally deeper at one end (near the embankment) than at the upstream end. They can be on-stream or off-stream with the on-stream type involving simpler, functional operation. They can be conceptualized as being in-between a wetland and a sedimentation pond. Pre-treatment is recommended.

Paramenters/Pollutants Potentially Addressed: Nitrogen, suspended sediments, metal, oil and grease (pre-treatment facilities are recommended to avoid oil and grease accumulations), BOD, bacteria and industrial chemicals in some cases (not generally recommended for industrial areas unless lining is provided).

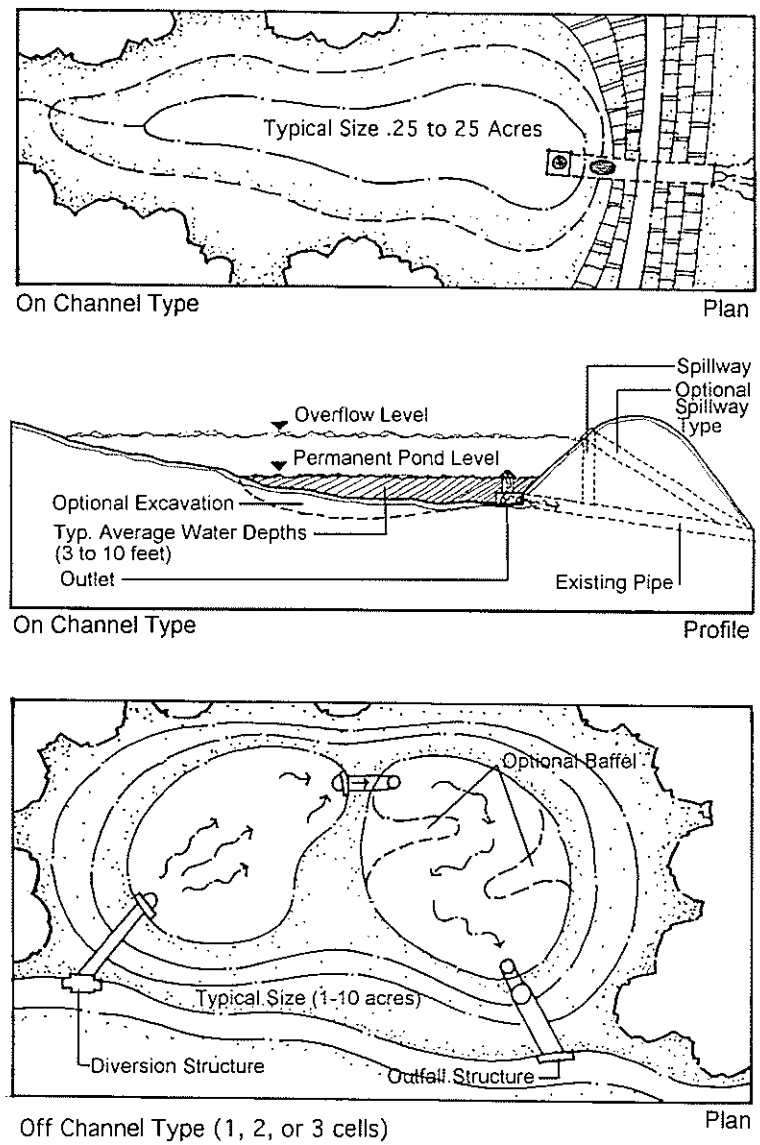
Advantages: Wet ponds are usually beneficial for wildlife and can benefit or hurt fish. They involve smaller land requirements than ponded wetlands and have relatively good water quality effectiveness if designed correctly and not overloaded. Generally wet ponds create multiple values involving habitat and passive recreation.

Disadvantages: If industrial chemicals are involved, wet ponds can affect groundwater adversely. Since ponding occurs fish passage is required if anadromous fish are involved and this can be costly, unsightly or impossible. Since ponded water is involved a risk of drowning exists but no greater than for any pond or pool. Relatively high maintenance requirements are involved and geotechnical questions must be addressed because ponded water behind an embankment could lead to slope failure. Wet ponds must be monitored to determine maintenance needs and to check on the functions and impacts.

Concept Variations: Ponded wetlands, sedimentation ponds, extended detention ponds and conjunctive use flood detention ponds are all variations of wet ponds. Extended detention ponds or other facilities which remain dry much of the time are the most noticeably different.

Maintenance Requirements: Wet pond maintenance includes periodic sediment removal; debris removal and cleaning particularly from trash racks; vegetation management around, and often within, the pond; periodic checks on hydraulic function; and periodic review of facility condition. During the first three years maintenance inspection should occur at least quarterly but can be less frequent after about three years.

Local Implementation Options: The implementation options include land use regulations which require wet ponds or one of the variations for new developments; regional facilities specified and sized in surface water management/master plans; capital improvement plans; and design-construction standards for both private and public developments. Operation and maintenance programs are required and should be defined during the design and construction process and adequately budgeted for. If a local jurisdiction has pond and marsh facilities, an integrated maintenance plan is highly recommended.



WET PONDS

SEDIMENTATION PONDS

Description: During normal dry periods a sedimentation pond is usually a dry depression behind a road fill or constructed berm. Some are designed to provide a permanent, or semi-permanent, pool of water and resemble a wet pond, though usually smaller. During storm periods, particularly intermediate level storms, a sedimentation pond is designed to provide a quiescent pool within which the settling of sediments can occur. During base flow periods, low intensity storms and the higher flood flows, sedimentation ponds are not designed to provide much settling. Sedimentation ponds can vary in size from one-fourth an acre up to twenty or more acres depending on the drainage area served. One of the most common applications is at construction sites during and immediately following construction to intercept soil particles disturbed by the construction. However, they can also serve urban, agricultural or silvicultural areas effectively. In most cases, particularly for industrial and commercial areas, a sedimentation pond should be preceded by a pre-treatment unit such as an oil-water separator and lining is usually needed. A sedimentation pond is similar to a wet pond but does not usually have a permanent pool. It is different from a sedimentation wetland or a ponded wetland because of an absence of, or less, wetland vegetation.

Paramenters/Pollutants Potentially Addressed: Sedimentation ponds can do an excellent job, if designed correctly, of removing suspended sediments and associated pollutants such as phosphorus and metals.

Advantages: The primary advantages involve less land required than for ponded wetlands, proven design standards and reduced safety problems due to the absence of a water surface during normal or low flow periods.

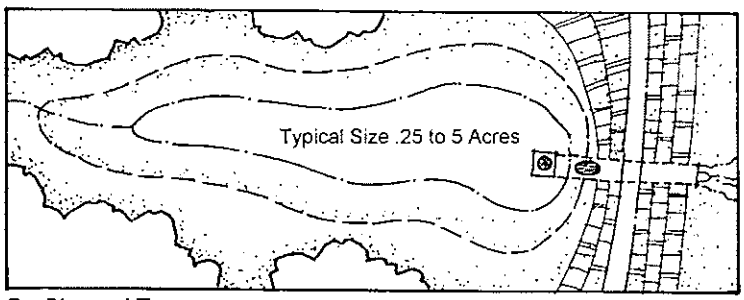
Disadvantages: The multiple use values of sedimentation ponds are less than for ponded wetlands or wet ponds due to the absence of a diverse aquatic habitat and fewer pollutants removed than with ponded wetlands and wet ponds.

Concept Variations: Extended detention ponds are very similar to sedimentation ponds but cover a considerably larger area because of the storage volume needed to reduce peak flood flows. Wet ponds are usually larger but very similar to wet sedimentation ponds. Sedimentation wetlands are wet sedimentation ponds with wetland vegetation to provide additional sediment removal functions.

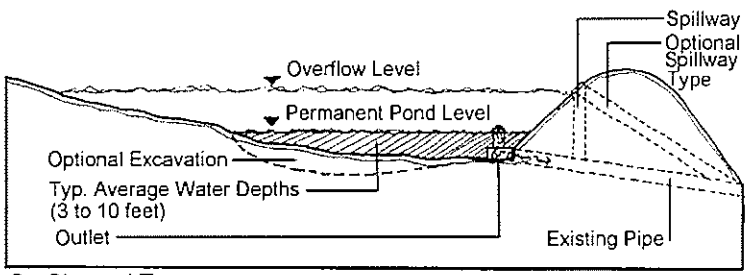
Maintenance Requirements: Sedimentation ponds require frequent periodic sediment removal, the cleaning and removing of debris, and periodic checks regarding facility condition and hydraulic function. The periodic checks should occur at least twice annually, and quarterly is recommended. For new facilities, or the ones with high sediment loads, monthly inspections are

advisable. Sedimentation ponds during the first few years of operation should be maintained two or three times per year and more often if construction areas are being served. After construction, or after the first two or three years some sedimentation ponds can be maintained on an annual basis and this should generally be done during the late spring or early fall depending on drainage area characteristics and runoff conditions.

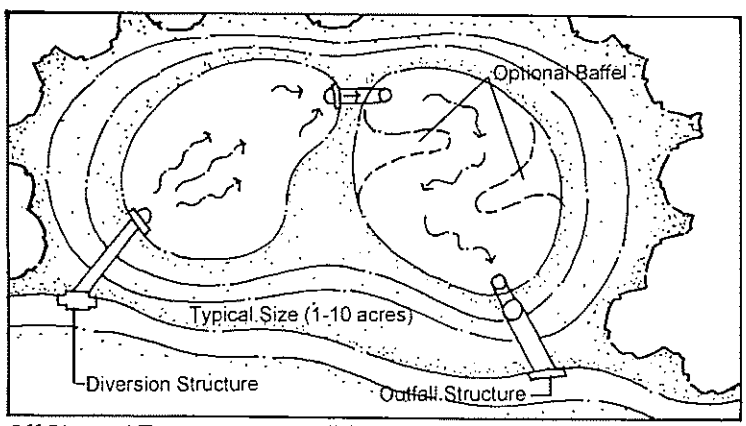
Local Implementation Options: The primary local implementation options involve land use regulations, storm water management/master plans, capital improvement plans for public regional facilities and design-construction standards. An operation and maintenance program for each facility is needed if very many facilities are involved an integrated O&M plan should be developed.



On Channel Type — Plan



On Channel Type — Profile



Off Channel Type (1, 2, or 3 cells) — Plan

SEDIMENTATION PONDS

CONSTRUCTED MARSH-WETLAND TREATMENT

Description: A marsh-wetland treatment facility, if well designed, should look very much like a natural wetland. A forebay or pretreatment unit is necessary to help protect the wetland from excessive sediment loads and other pollutants. The edges and much of the shallow area support wetland vegetation and the center area is typically open water during much of the year. The area involved may range from less than half an acre up to thirty or more acres. Such facilities are generally used as regional facilities to serve developed urban or commercial areas. Construction areas normally contribute excessive sediment loadings to wetlands, and industrial runoff may contaminate the wetland and present difficult maintenance and disposal problems. Marsh wetland facilities are usually larger and shallower than wet ponds that serve a similar-sized drainage area, and have a permanent or seasonal water surface in contrast to sedimentation ponds, which are dry.

Paramenters/Pollutants Potentially Addressed: Marsh-wetlands can remove several pollutants from stormwater, particularly those involving or attached to suspended sediments. Such facilities do a good job on nitrogen, metals, BOD, bacteria and, if infiltration or soil sorption is involved, phosphorus. Oil and grease can also be effectively removed but can contaminate the wetland. Thus such facilities should include a pre-treatment unit such as an oil-water separator. Industrial, agricultural and silvicultural chemicals can also be removed by wetlands, but wetland contamination, groundwater problems, and maintenance/disposal difficulties may result.

Advantages: Fish and wildlife benefits of marsh-wetland facilities are greater than for the others in this category. Other multiple use values such as education and passive recreation are also provided. The water quality effectiveness of wetlands can be considerable depending on the design.

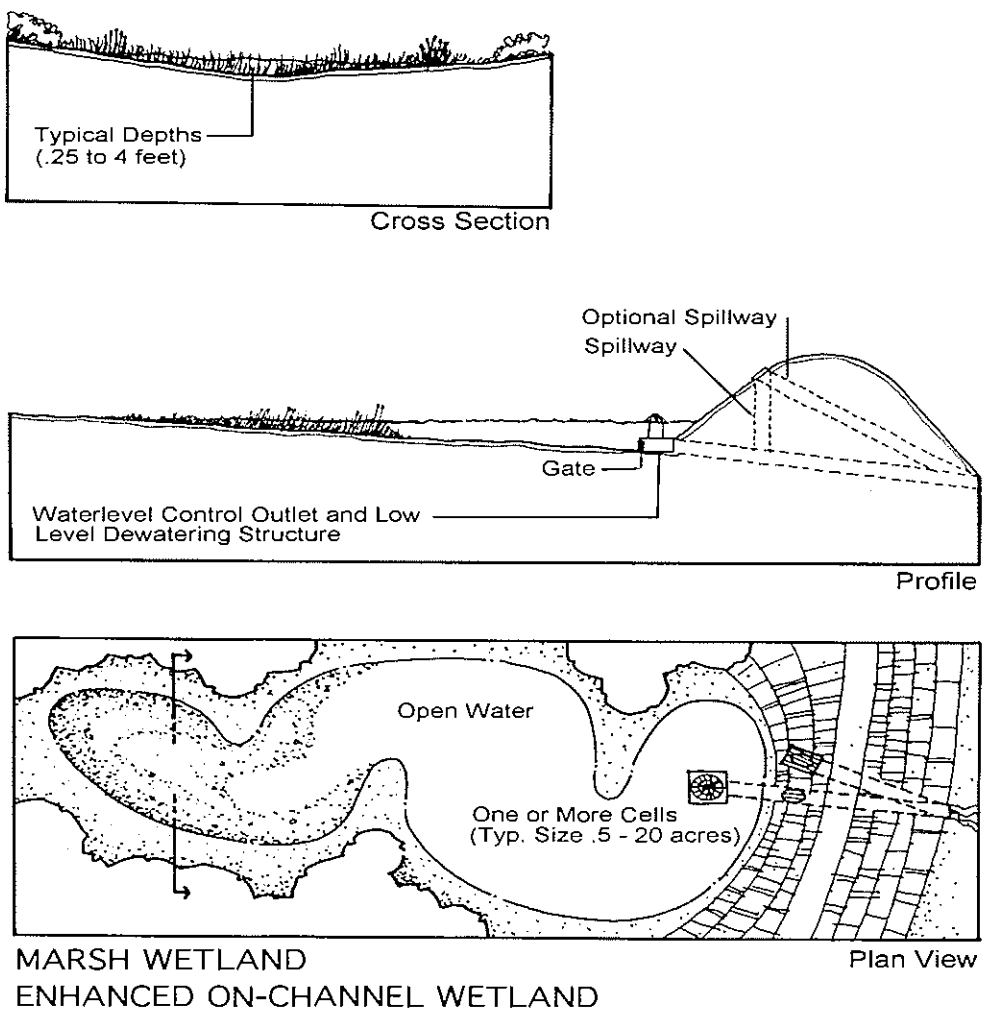
Disadvantages: Since wetlands involve a permanent or seasonal water surface, groundwater recharge is likely to occur. Therefore, the groundwater impacts must be understood prior to constructing the marsh-wetland facilities. Since a pool is involved the geotechnical stability of the constructed berm or existing road fill to be used must be evaluated for piping, seepage, and failure by a qualified geotechnical engineer. Depending on the primary pollutant to be removed, the performance and design standards vary considerably, and design is often complex. Safety must be considered in the design for example to minimize the risk of drowning.

Concept Variations: Marsh-wetland facilities are very similar to wet ponds and can be integrated into conjunctive use flood detention ponds.

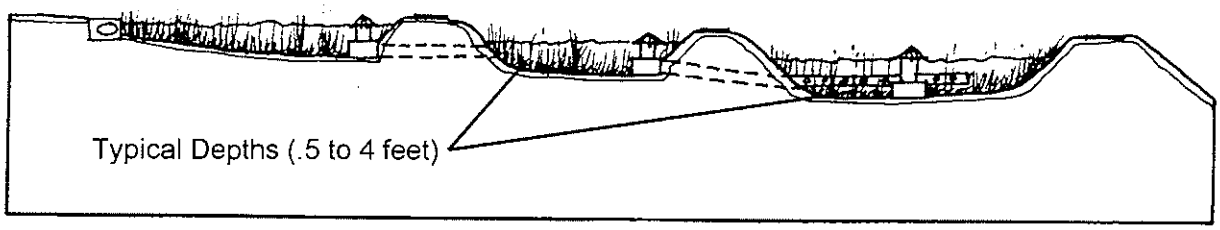
Maintenance Requirements: Maintenance requirements are relatively high and involve periodic sediment removal, debris removal and cleaning, management of aquatic, riparian and landscape vegetation, and periodic reviews of the hydraulic function and facility condition. During the

first three years wetlands should be maintained quarterly with the frequency reduced after the first three years, if justified.

Local Implementation Options: Comprehensive plans can include regional wetland facilities and land use regulations can address the use of constucted wetlands in developing areas. A more detailed presentation of regional wetlands can be made in surface water management/ master plans. Such facilities should also be included in capital improvement plans. Design and construction standards and operation and maintenance programs are required because of the complexity of this type of control measure.



MARSH WETLAND
ENHANCED ON-CHANNEL WETLAND



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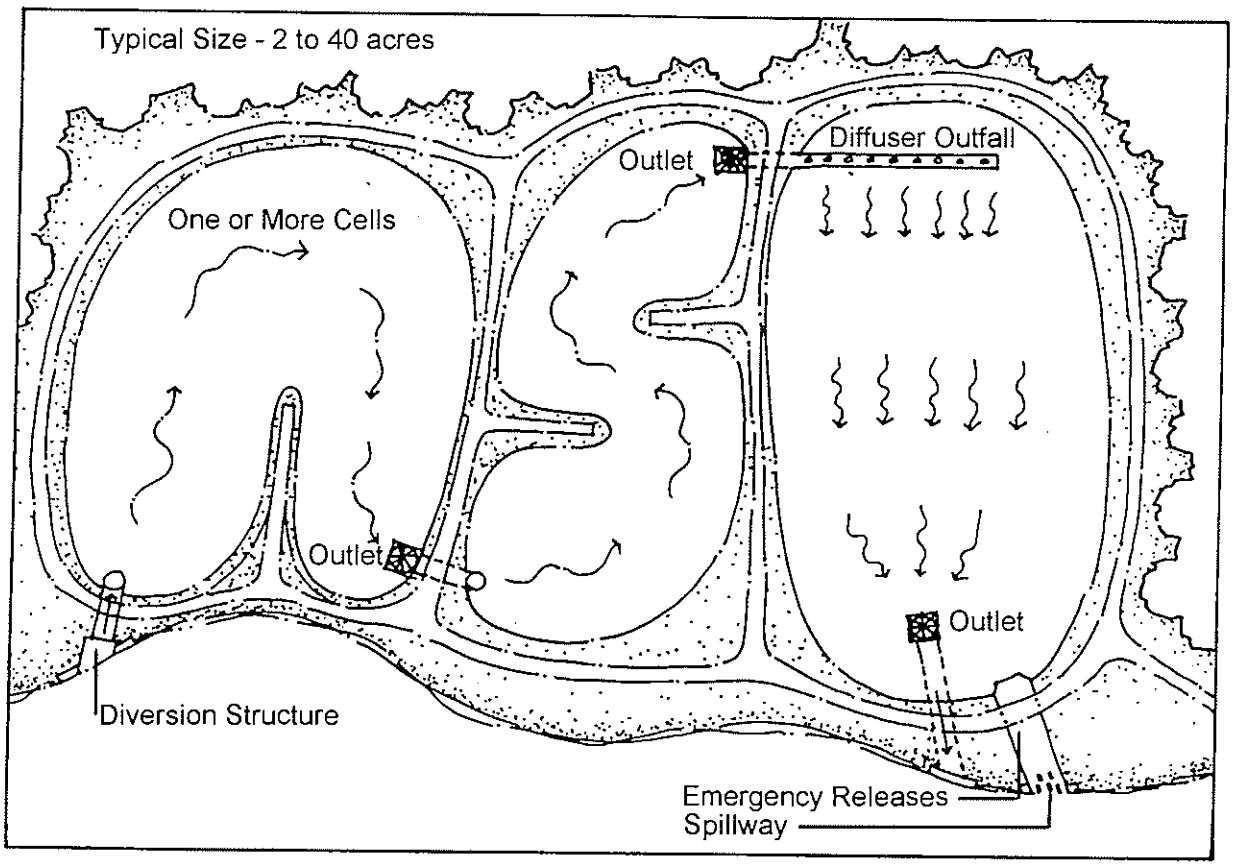


Plan

MARSH-WETLAND
OFF-CHANNEL WETLAND

EXTENDED DETENTION PONDS

Description: Extended detention ponds look very much like sedimentation ponds with the most notable exception being size. Detention ponds are usually larger, in some cases much larger, due to the area required to detain the flood volume. The size of a detention pond is directly related to the magnitude of the design flood. During low intensity storm events, the lower part of an extended detention pond fills and provides for quiescent settling of sediments. During high flows a much larger area would be inundated. The ponds will reduce peak flows and provide flood damage reductions. Extended detention ponds are generally regional public facilities serving relatively large areas since the complex design and O&M requirements are usually more involved than that justified for private construction. However, large planned unit developments may include extended detention ponds. While dry, extended detention pond areas can be used for recreational purposes such as picnicking.

Paramenters/Pollutants Potentially Addressed: The primary parameter involved is suspended sediments and the attached pollutants such as phosphorus and metals.

Advantages: Joint use recreational values and flood control benefits in addition to water quality improvement are the main advantages. Since aquatic and riparian vegetation are usually not involved, the fish and wildlife habitat value is usually less than for other types of facilities such as marshes and wetlands. Maintenance requirements are less than for wetlands but still relatively high. As such larger facilities offer advantages since the maintenance effort can be concentrated for large drainage areas. The land requirements are relatively large but much of the area required can be acquired through flood easements rather than fee-simple ownership.

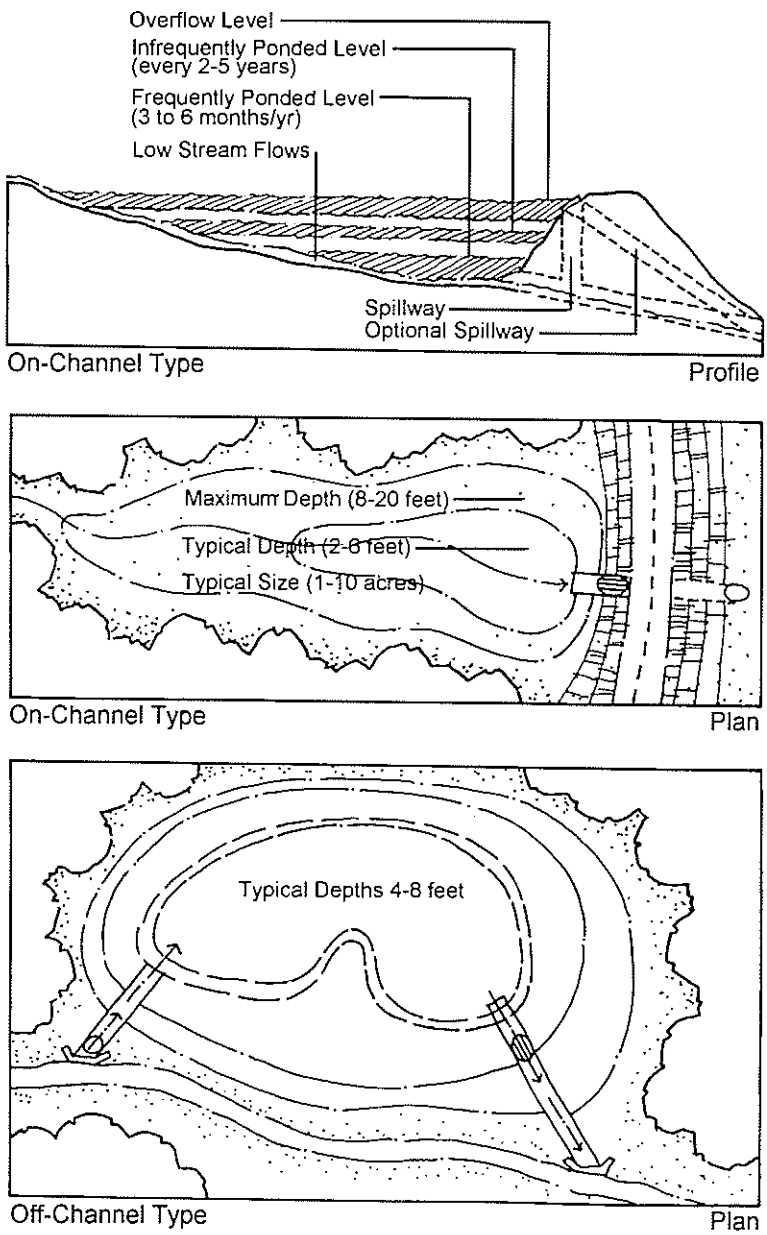
Disadvantages: The primary disadvantage is the land required. Detention ponds are also moderately complex to design correctly.

Concept Variations: Extended detention ponds are very similar to sedimentation ponds.

Maintenance Requirements: Sediment removal, debris removal and cleaning, vegetation management and a periodic check of hydraulic function and facility condition are all required during maintenance. The frequency should be three or four annually during the first two years and adjusted according to experience thereafter. Most extended detention ponds will require at least an annual maintenance under even the best conditions.

Local Implementation Options: The primary implementation options are surface water management/master plans and capital improvements plans since most facilities are regional and public in nature. They should be designated in a community's comprehensive plan and considered for new developments where appropriate through land use regulations. Design-construc-

tion standards are required since the facilities are moderately complex and the facilities should be integrated into the O&M work program.



EXTENDED DETENTION PONDS

CONJUNCTIVE USE FLOOD DETENTION PONDS

Description: A conjunctive use flood detention pond is similar to an extended detention pond, but instead of a sedimentation pool for low intensity storms, a wetland treatment area is included in the lower portion of the site. It appears as a wetland behind a road fill or constructed berm with a relatively large normally dry area surrounding the wetland. It is the most complex type of runoff facility presented in this guide book and in most cases such facilities are public and regional in nature. If well designed, a conjunctive use flood detention pond will be the largest type of pond-marsh facility due to the combination of the area required for flood detention with permanent wetland functions. A pre-treatment unit is recommended.

Paramenters/Pollutants Potentially Addressed: Suspended sediments and the associated pollutants such as phosphorus and metals are addressed with conjunctive use flood detention ponds. If correctly designed some of the nitrogen can be removed and BOD and bacteria should be reduced. Oil and grease is addressed, but such loading should be minimized by pre-treatment through an oil-water separator.

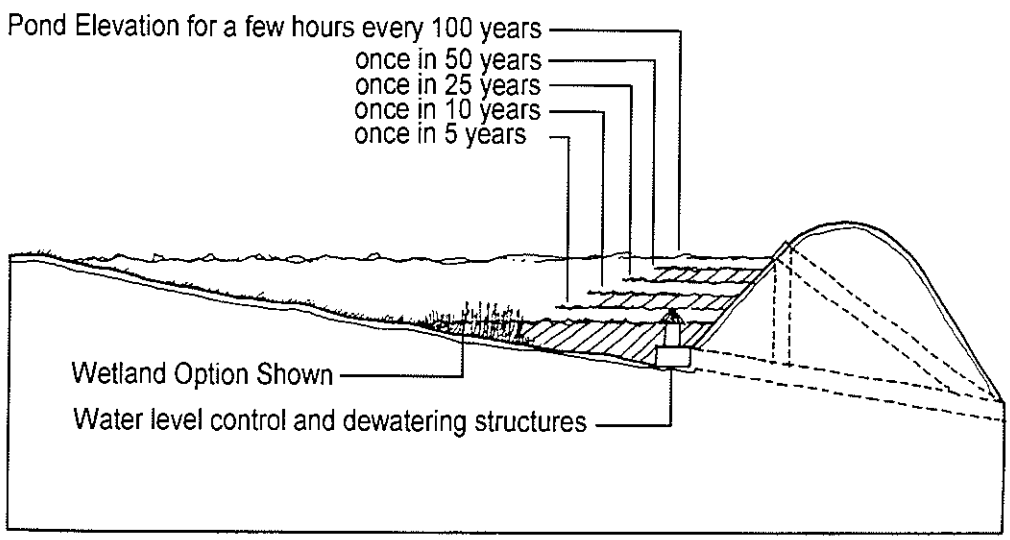
Advantages: The primary advantage involves good flood control benefits paired with good water quality benefits. In addition, such facilities can provide considerable fish and wildlife benefits, recreation, and educational uses, since a considerable dry land area is normally available in the flood detention pool. If designed correctly, such facilities can provide the same water quality benefits as wetlands, which means the values are maximized.

Disadvantages: Permitting conditions can be complex and maintenance requirements are relatively high. The land area required is large and geotechnical considerations must be evaluated thoroughly since fill instabilities during flood detention can result from improper design. Safety must be considered since a permanent pool is involved. Performance monitoring of various functions is justified, if not mandatory.

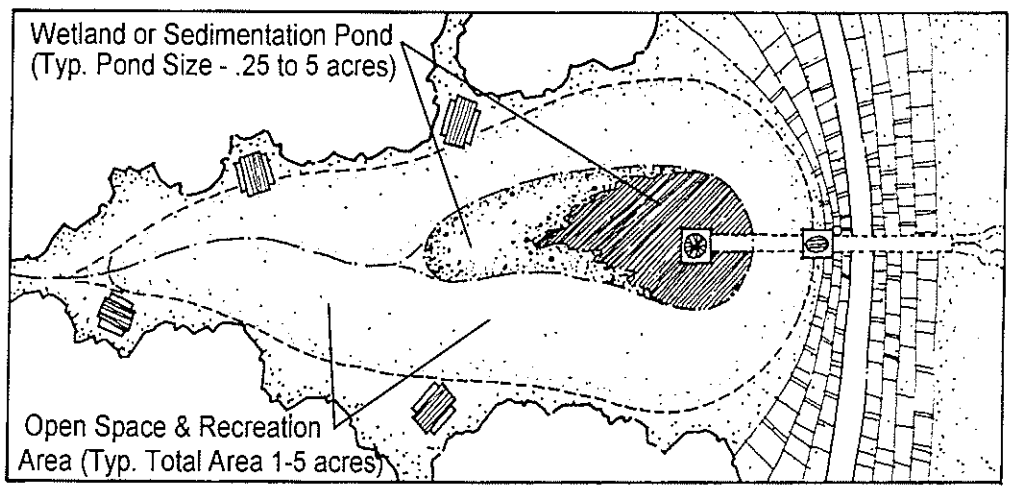
Concept Variations: An extended detention pond is similar but does not involve a wetland or permanent pool in the lower portion. The detention area will appear as a wetland, but will have a larger publicly owned area surrounding it to provide for the flood detention function.

Maintenance Requirements: These facilities require sediment and debris removal; cleaning; management of wetland, riparian, and landscape vegetation; and frequent checks on hydraulic function and facility condition. During the first three years, such facilities should be monitored; and it may be necessary to generally maintain them on a quarterly basis during this period. Maintenance frequency can be reduced after the first three years based on actual facility experience.

Local Implementation Options: Since these facilities are large and complex and usually constructed by public agencies they should be identified in the jurisdiction's comprehensive plan and originate in surface water management/master plans. Capital improvement plans and budgets are also necessary as well as design and construction standards. Of all the facilities discussed an integrated O&M plan and program are more important for this type of facility than any other.



Section View



Plan View

CONJUNCTIVE USE FLOOD DETENTION POND
WITH A WETLAND OPTION

STREET AND STORM SEWER SYSTEMS

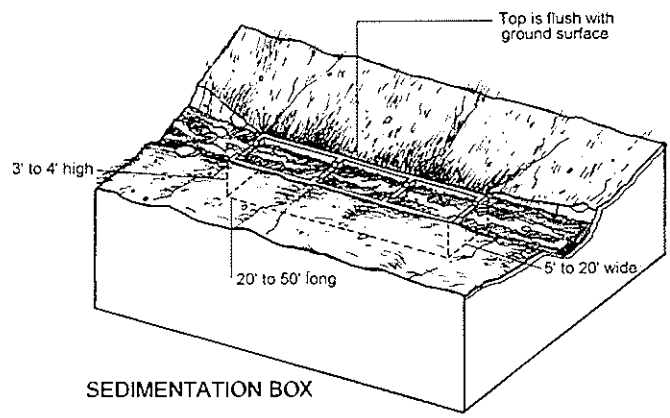
SEDIMENTATION BOXES

Description: Sedimentation boxes have recently been installed in Portland area streams and the success has been reported as good in removing suspended sediments and bed load. The facilities are rectangular concrete boxes recessed along a stream bed or ditch at an elevation which does not change the water surface profile. A number of chambers are provided which encourage bed load deposition and some settling out of sediments depending on particle size. Sizes can range from approximately 4' x 2' x 20' up to 15' x 4' x 50'. The functional concepts involved are similar to sedimentation ponds but have a completely constructed configuration and are generally smaller.

Paramenters/Pollutants Potentially Addressed: Primarily suspended solids and associated pollutants such as phosphorus and metals.

Advantages: Such facilities are relatively straightforward in design and construction and are easier to maintain than the more natural facilities such as wetlands or ponds.

Disadvantages: Permits may be required that are difficult to obtain. There may be some risk of drowning but this is expected to be minimal compared to the natural stream or ditch where construction occurs. The concept is relatively new; therefore, several variations may be necessary before the design and performance standards are established.



SEDIMENTATION BOX

Concept Variations: Water quality inlets, vaults, tanks and sedimentation manholes are very similar in function.

Maintenance Requirements: During the first two or three years such facilities should be inspected monthly and cleaned when necessary. During this period a maintenance protocol should be developed and less frequent maintenance may be appropriate after the first few years.

Local Implementation Options: The primary implementation approach involves surface water management/master plans, capital improvement plans, design-construction standards, and an integrated O&M program.

TRAPPED CATCH BASINS

Description: Trapped catch basins are simply stormwater inlets with a small recessed, sumped portion below the curb/field opening. They have a long history of use in urban areas throughout the nation but have been discontinued in favor of "self-cleaning" catch basins in the last few decades which are not effective for water quality purposes. They involve small traps or sumps below an inlet just before runoff enters a pipe (or open channel).

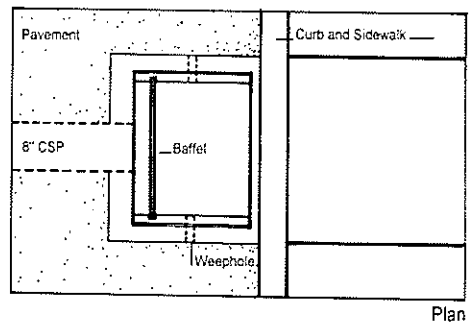
Paramenters/Pollutants Potentially Addressed: Suspended solids and associated pollutants such as phosphorus and metals.

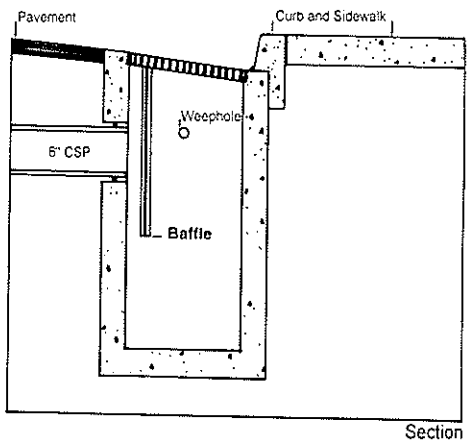
Advantages: The primary advantages are the long history of use and well developed design standards for a wide range of facility types.

Disadvantages: Trapped catch basins do not operate effectively for water quality purposes unless maintained frequently. A wide range of water quality performance information exists, but it is generally agreed that catch basins must be frequently cleaned in order to remain effective.

Concept Variations: Trapped catch basins are very similar to water quality inlets except less complex.

Maintenance Requirements: Accumulated sediments should be removed at least twice a year. More frequent cleaning may be required where heavy sediment loads are involved. When installed below construction activities, they may need to be cleaned daily during some periods. They must be thoroughly cleaned before being accepted by a jurisdiction for maintenance responsibility. Leaves and litter must be removed from the inlet grating periodically to maintain flow capacity. *The water quality values of trapped catch basins cannot be achieved unless frequent cleaning occurs.*





TRAPPED CATCH BASINS

Local Implementation Options: The implementation approach primarily involves capital improvement plans and design-construction standards. In addition, an integrated operation and maintenance program is required and the use of trapped catch basins in appropriate areas should be included in surface water management/master planning.

WATER QUALITY INLETS, VAULTS AND TANKS

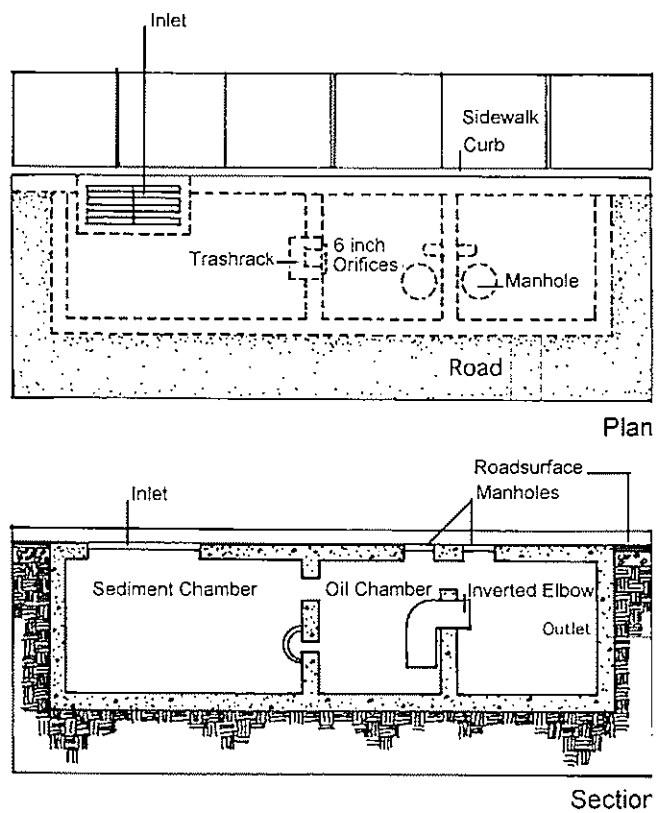
Description: Water quality inlets, vaults and tanks are underground storage facilities used to collect and store runoff, usually from urban, commercial, and industrial areas. However, they could be used in some agricultural areas such as below feed lots or manure storage areas. They are usually constructed from reinforced concrete or corrugated metal pipe. Some involve a permanent pool of water to allow for pollutant settling. Most are divided internally to control the water level, separate into removal chambers, and provide oil-water skimming.

Paramenters/Pollutants Potentially Addressed: Suspended solids and associated pollutants such as phosphorus and metals as well as oil and grease can be effectively removed by water quality inlets, vaults and tanks. Numerous design concepts exist including those which incorporate oil-water separation, so a range of pollutants can be addressed.

Advantages: The most important advantages are low land requirements, since the facilities are usually underground; the opportunity for prefabrication; and good information on performance and design.

Disadvantages: Compared to other street and storm sewer facilities, water quality inlets, vaults, and tanks require relatively high maintenance although less than that for a large wetland or marsh. In addition, the design of such facilities is often based on available hardware, rather than specific pollutant removal requirements.

Concept Variations: These facilities are very similar to sedimentation boxes and sedimentation manholes.



WATER QUALITY INLETS

Maintenance Requirements: Such facilities should be inspected at least twice a year. Maintenance may be required during both visits. The amount of accumulated material, and therefore the maintenance requirements, will vary according to annual precipitation-runoff patterns.

Local Implementation Options: The primary implementation approach involves capital improvement plans, design-construction standards, and an integrated operation and maintenance program. The facility should be evaluated and recommended if justified in jurisdictions stormwater management master plan.

SEDIMENTATION MANHOLES

Description: This facility is a concrete cylinder generally four to six feet in diameter and eight to twelve feet deep. It utilizes conventional concrete manhole structures designed and fabricated to trap sediments. They have been used extensively in the Portland area to intercept sediments prior to being discharged into a sump/dry-well. They are usually under the street or the adjoining right-of-way, and are not noticeable except for the manhole cover.

Paramenters/Pollutants Potentially Addressed: Suspended sediments and associated pollutants such as phosphorus and metals are reduced. In some cases oil and grease may also be intercepted.

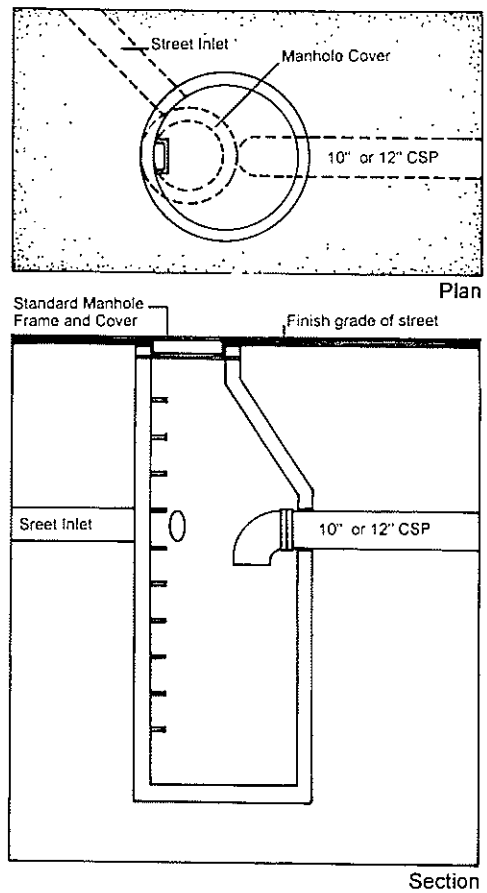
Advantages: Straightforward design, available technology and hardware, and low land requirements are advantages of sedimentation manholes.

Disadvantages: Sedimentation manholes require maintenance, although neither at the frequency of trapped catch basins nor to the degree of pond or marsh facilities. Although the design is relatively straightforward, opinions vary on water quality effectiveness.

Concept Variations: Sedimentation manholes provide the same type of function,— i.e., particle settling in quiescent water—as trapped catch basins, sedimentation boxes, and water quality inlets, vaults and tanks.

Maintenance Requirements: Twice annually as a general rule; more or less depending on pollutant loading.

Local Implementation Options: The use of sedimentation manholes should result from surface water management master planning. If included in the plan they should be included in the jurisdiction's capital improvement plans, design-construction standards, and operation and maintenance program.



SEDIMENTATION MANHOLE

COMPOST TREATMENT UNITS

Description: These facilities are rectangular, prefabricated boxes filled with leaf litter compost and intended to remove certain nutrients particularly phosphorus. Generally they are used to treat the runoff from street and highway sections or other large paved areas such as commercial parking lots.

Paramenters/Pollutants Potentially Addressed: Phosphorus, metals, and oil/grease can be effectively removed. Other parameters such as suspended sediments may be filtered out but this is not the intent of the facility and it may be counterproductive due to clogging of the compost.

Advantages: Good effectiveness for certain constituents if maintained regularly. The facilities can be installed in most highway right-of-ways.

Disadvantages: This is a relatively new and possibly proprietary technology. The maintenance requirements are uncertain. Clogging could be a problem if runoff with high suspended solids is involved.

Concept Variations: Several variations involve the type of compost and the size and layout of the facility. However, this is a relatively unique approach in NPS control involving biochemical activity to remove phosphorus and other nutrients.

Maintenance Requirements: Inspection should be made at least quarterly and maintenance operations performed when needed.

Local Implementation Options: The primary implementation option involves capital improvement plans coupled with design-construction standards and an O&M program. If such facilities are desirable in private developments, then the jurisdiction's comprehensive plan, land use regulations, and design standards would be involved.

STREET SWEEPING

Description: This street maintenance practice involves revising the schedule and type of street sweeping to remove particles from impervious surfaces. In some cases, the program may initiate street sweeping; but in most cases it involves a more frequent street sweeping schedule. The use of vacuum sweepers instead of conventional broom sweepers may also be needed. Street sweeping is generally used only in urban and suburban areas. The practice produces widely varying reductions of urban storm water pollutants.

Paramenters/Pollutants Potentially Addressed: Suspended solids is the main parameter removed. Attached phosphorus and heavy metals are also reduced.

Advantages: The primary advantages of the program is that it can be worked into existing maintenance operations and generally does not create significant adverse impacts on fish, wildlife or wetland resources.

Disadvantages: The primary disadvantages are the relatively high cost and uncertain effectiveness. Although improved stormwater quality has often been cited as the reason for more frequent street sweeping, data from various sources includes the EPA's National Urban Runoff Program do not indicate clear-cut improvements in water quality from more intensive street sweeping. This is particularly true in the Northwest, where washoff occurs frequently. However, the technique is being reconsidered and tried at certain northwest locations so new performance information specific to Oregon may be forthcoming.

Concept Variations: Street sweeping can be done with various kinds of equipment, generally involving broom sweepers, vacuum sweepers, and flush sweepers. The frequency of sweeping can also vary from two or three times per week to a few times per year. When water quality objectives are important, the range is generally form every two weeks to monthly, but this does not assure effectiveness.

Maintenance Requirements: Street sweeping is a component of urban street maintenance. More frequent sweeping for water quality objectives involves increased equipment maintenance.

Local Implementation Options: The primary implementation approach involves decisions during the surface water management planning process as to whether or not street sweeping should be emphasized. Implementation is through the jurisdiction's O&M program.

LANDSCAPE DESIGN

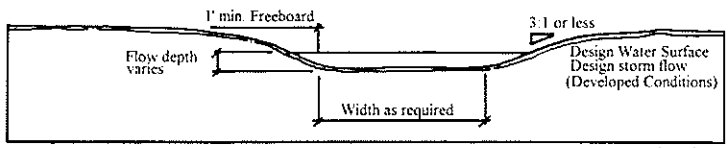
SWALES

Description: Vegetated or grassed swales are relatively flat vegetated ditches. The swale cross section is trapezoidal and the side slopes are usually at least three to one. The bottom width is at least three or four feet depending on design-runoff rates. The concept involves spreading runoff over a wide channel to provide biofiltering during low-to -medium-intensity storms. During higher flows the facility operates simply as a flood conveyance channel. Most facilities are at least 100 feet long and 15 to 20 feet wide at the top. Although they can be used to serve relatively large areas, and caused constructed as regional public facilities, they are most often used to serve private residential and commercial developments in urban areas. While they could also serve industrial, agricultural, and silvicultural areas, they are not generally used for such activities, since frequent maintenance and facility contamination could become problems.

Paramenters/Pollutants Potentially Addressed: Suspended solids and related pollutants such as phosphorus and metals are treated effectively with vegetated swales. Nitrogen can be removed. Oil and grease may be trapped, although a pre-treatment facility such as an oil-water separator is recommended if oil and grease loadings are expected to be high.

Advantages: This type of facility has been well researched in the Northwest. It is being extensively used, so the performance and design criteria are becoming well understood. The wildlife benefits can be good. In general, the water quality effectiveness is moderate to high.

Disadvantages: If an anadromous fish-bearing stream is involved, biofilters and swales can be problems due to the high width to depth ratio (shallow flow). In addition both land and maintenance requirements are relatively high.



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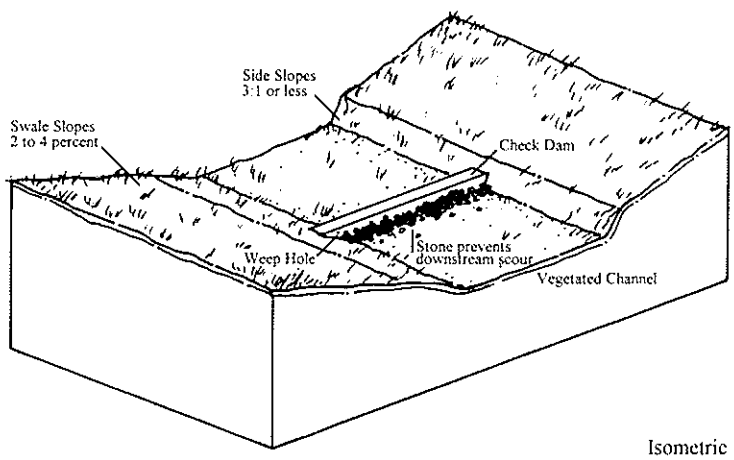


Isometric

VEGETATED SWALES

Concept Variations: The functions involved in swales or biofilters are similar to those of wetlands, but are not as complex. The same concepts are involved with filter strips.

Maintenance Requirements: Sediment should be removed whenever up to six inches accumulates at any location. Sediment must be removed in a manner to minimize damage to the vegetation. Swales should be inspected at least three or four times a year, particularly after heavy runoff, and mowed at least twice a year. In some cases, particularly during the establishment of the swale and during drought periods, watering may be worthwhile.

Local Implementation Options: Implementation should occur as the result of a surface water management/master plan and implemented through capital improvement plans, design-construction standards and O&M programs. If swales are desired in private developments, then the land use regulations of the jurisdictions should so indicate.

FILTER STRIPS

Description: Vegetated filter strips can be established along a stream, ditch, or other water body. However, their most effective and efficient implementation is to maintain buffer strips of natural vegetation. Either natural or constructed filter strips should incorporate riparian wildlife values and provide bank stabilization. Filter strips look like landscaped or natural vegetation along both sides of a waterway, lake, or wetland. Filter strips function similarly to vegetated swales, but primarily filter runoff entering the water body. Swales address the water flowing in the swale itself.

Paramenters/Pollutants Potentially Addressed: Suspended sediments are filtered out of runoff, and vegetation prevents bank erosion that would otherwise produce suspended sediments. When suspended sediments are removed, phosphorus, metals and other pollutants attached to the soil particles are removed. Oil and grease may also be removed, but if such pollutants are expected, pretreatment units such as oil-water separators should be installed above the filter. If temperature increases are possible, or if temperature reductions are needed in the watershed, filter strips should be integrated into riparian zone management, which includes an overstory to provide shading.

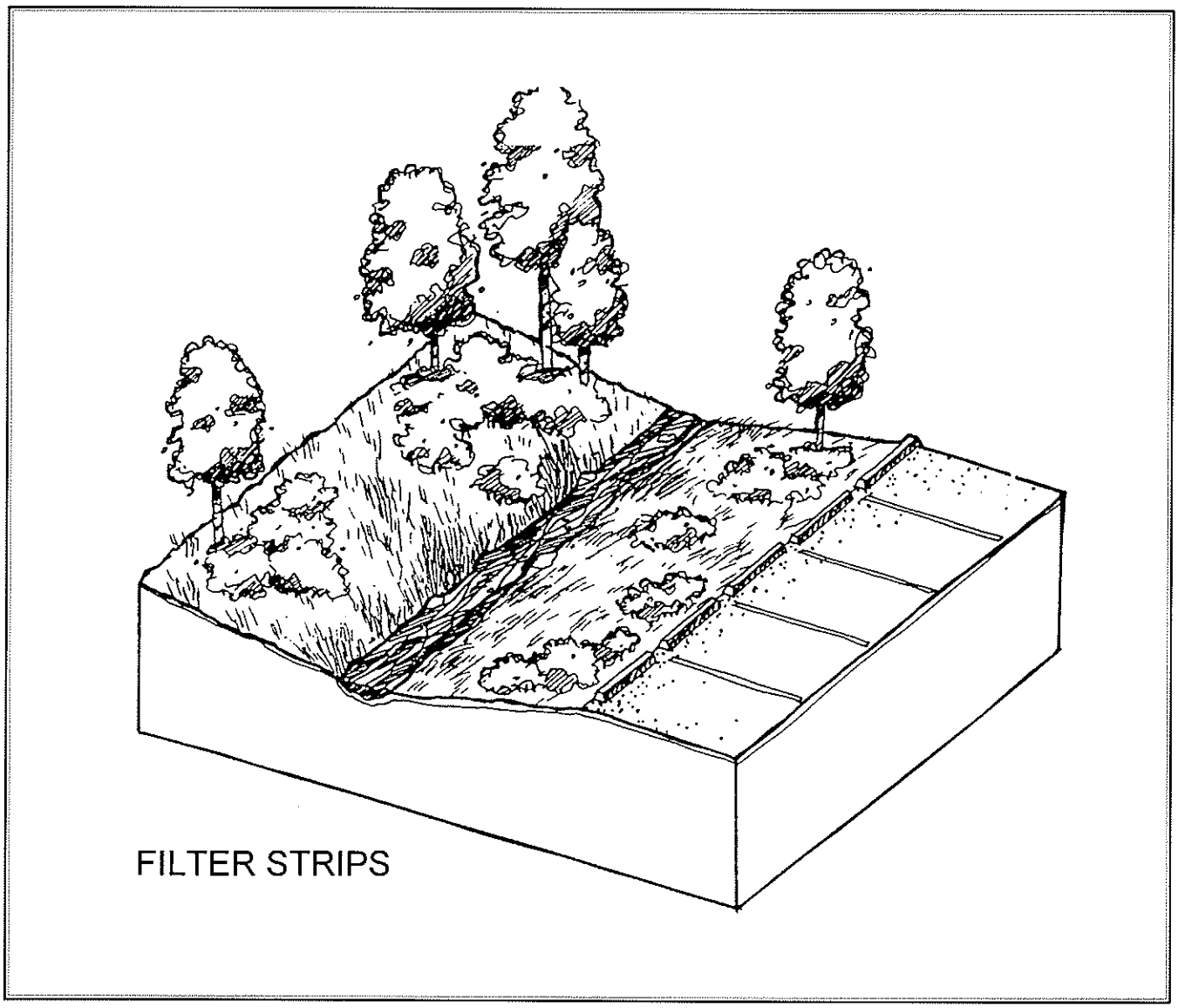
Advantages: Filter strips fit well into the landscape design of a community or site development. They can provide significant fish and wildlife benefits in addition to water quality improvement. Maintenance requirements vary but are generally low for natural filter strips. If large trees are included filter strips can also provide stream shading which helps to prevent temperature problems. Temperature is not addressed by most of the other control measures found in this guidebook. Filter strips can also be used in urban, agricultural, or silvicultural areas.

Disadvantages: Maintenance requirements can be complex and should be based on experience gained over a few years of observation. One of the most important disadvantages is disagreement concerning the ideal widths of filter strips. The necessary width varies according to the size and slope of the area draining into the filter strip and the land uses involved. In some cases the land requirements can be significant.

Concept Variations: Vegetated swales and bioengineered control measures that reduce bank erosion.

Maintenance Requirements: Filter strips in developed areas should be mowed at least twice in the summer to promote growth and pollutant uptake. The cuttings should be removed and properly disposed. For landscaped or developed filter strips, sediment accumulations exceeding six inches should be removed and curb cuts cleaned periodically to remove soil/vegetation blockages. Litter and debris should be removed. Inspections should occur quarterly. If the filter strip is natural, maintenance requirements should be minimal.

Local Implementation Options: An important local implementation option for protecting natural filter strips is the comprehensive plan and land use regulations. The requirements should be developed during surface water management/master planning. Retrofitting of waterways as required should be included in capital improvement plans and involve design-construction standards and O&M programs.



CONTAINED DRAINAGE SYSTEMS

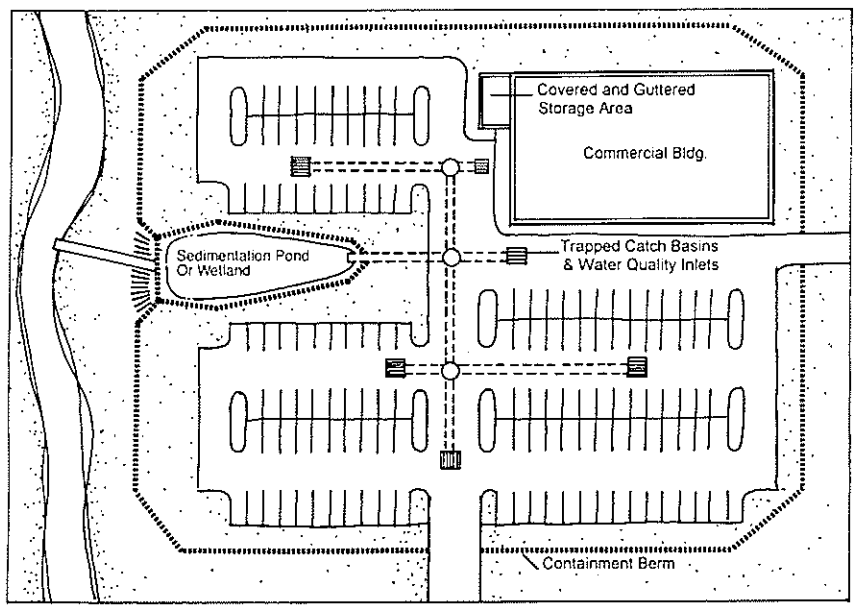
Description: In contrast to a facility concept, this is a system concept involving self containment of development site drainage. This can reduce the off-site impacts to natural or below natural conditions. Contained drainage systems can include facilities such as sedimentation ponds, marsh wetland treatment, infiltration facilities and vegetated swales to reduce the water quality and flooding impacts downstream. If infiltration is feasible, which depends on soil and geohydrologic conditions, the downstream impacts of the development can be reduced considerably.

Paramenters/Pollutants Potentially Addressed: Suspended solids and attached pollutants. Depending on the degree and type of containment, most pollutants can be reduced.

Advantages: Better planning and a system approach which can reduce the impact of a development of the watershed.

Disadvantages: Better and more costly planning and design is required. Maintenance must be done on a complete system basis, and this may cost more.

Concept Variations: Most of the facilities presented in this guidebook can be included in contained drainage systems.



CONTAINED DRAINAGE SYSTEM

Maintenance Requirements: Depends on the facilities involved. A system plan is required.

Local Implementation Options: The requirements and criteria for contained drainage systems should be included in comprehensive plans and land use regulations. The justification, recommendations, and specifics for such systems should be in the surface water management/ master plans for public systems. Capital improvement plans, design-construction standards and O&M programs are needed.

PONDS AND WETLANDS

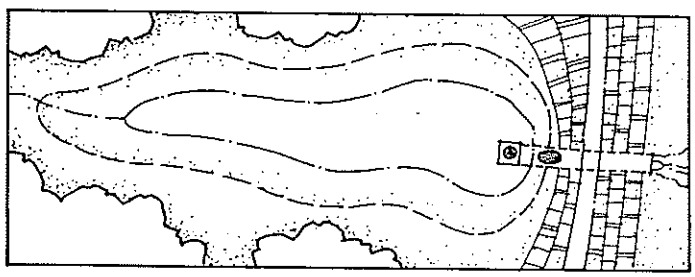
Description: These are small ponds or wetlands that have been included at the appropriate points in the design of a proposed development.

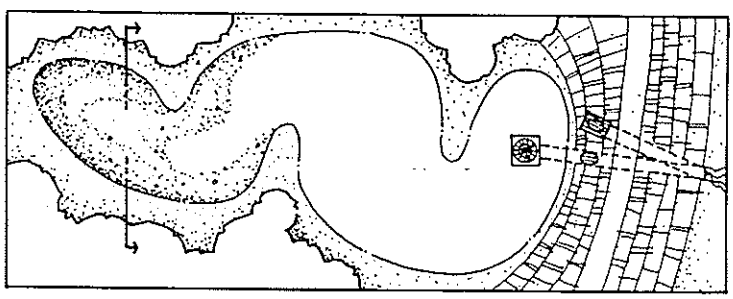
Paramenters/Pollutants Potentially Addressed: Suspended solids and associated pollutants such as phosphorus and metals.

Advantages: Such facilities can be incorporated into the landscape design as an amenity and the fish, wildlife and recreation values can be important.

Disadvantages: The disadvantages include the land requirements which on some sites can be significant, and the need for diligent periodic maintenance. Small ponds/wetlands can have disproportionately large maintenance requirements for the area served. Also, it is often tempting to design such facilities too small for private developments, and to ignore the geotechnical information requirements for design. Since ponds are involved safety considerations may also be a disadvantage for some locations.

Concept Variations: There are severa pond and wetland variations. They involve on-stream versus off-stream locations, permanent or infrequent ponding the degree to which riparian or wetlanc vegetation is utilized, and the extent tc which multiple use values for fish, wildlife, and recreation are achieved.





Maintenance Requirements: Such facilities will require cleaning and sediment removal at least twice annually. Quarterly inspections should be made tc check the hydraulic function and general condition.

Local Implementation Options: The primary implementation approaches involve comprehensive plans, land use regulations, and a recommendation based on need identified in a surface water management/master plan.

EROSION CONTROL

Description: Erosion control involves preventive measures to reduce the delivery of sediments and other materials contributed to waterways as a result of surface erosion, mass erosion, stream bank erosion and debris torrents. In general the approach involves minimizing the size, season, and duration of soil disturbance and vegetation removal. Silt fences or straw bale perimeters are a common technique. Remedial measures such as sedimentation ponds below development areas may also be involved and the early re-establishment of vegetation and/or the use of a protective mulch is often required. The important concepts are to protect existing vegetative cover and natural slope stabilizing features such as plant roots. Considerable information is available on erosion control as practiced in Oregon and Appendix C presents additional information.

Paramenters/Pollutants Potentially Addressed: Suspended solids and associated pollutants such as phosphorus and metals.

Advantages: This is probably the most important approach to reducing the water pollution from all types of construction sites and agricultural/silvicultural areas. If erosion control is not practiced in an area then considerable investment would be needed in remedial measures such as sedimentation ponds and vegetated swales to realize the same values. If erosion control is not practiced the O&M requirements will be particularly high for most of the facility types presented in this guidebook.

Disadvantages: The primary disadvantage involves the cost at the front end of the development.

Concept Variations Erosion controls vary according to the type of stabilization emphasized, soils, slopes, the degree of emphasis on prevention as opposed to remediation, and whether they are based on performance standards or design standards are emphasized.

Maintenance Requirements: Any temporary filtering practice such as silt fences need to be inspected after storms. The maintenance required for most other control measures are reduced if erosion control is effective in the watershed above the measure. Erosion control requirements must be enforced and the performance monitored.

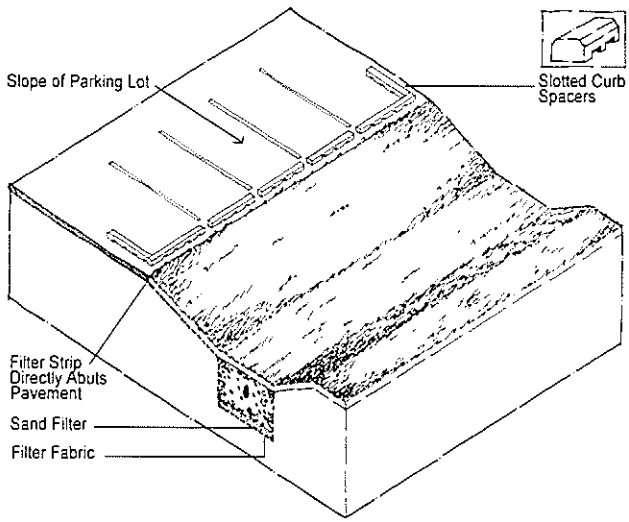
Local Implementation Options: The comprehensive plan, land use regulations, and surface water management/master plans are important for implementation. Special construction site erosion control ordinances and technical guidance handbooks are also needed.

INFILTRATION FACILITIES

INFILTRATION TRENCHES

Description: An infiltration trench involves a surface conveyance structure such as vegetated swale with a high infiltration capacity bottom. In some cases filtration is enhanced by installing a particular subsurface media. Most infiltration trenches are 5 to 20 feet wide and from 50 to 500 feet long, although any size is possible and should depend on the volume and nature of the runoff. Infiltration trenches can be used both in a regional stormwater conveyance system, and on residential lots. They can also be used effectively in commercial areas provided that the runoff is not expected to be contain hazardous or toxic materials. Infiltration trenches should not be used in industrial areas unless the trenches are completely protected from contaminated runoff. They are very similar in appearance to vegetated swales and function much the same as other infiltration facilities.

Paramenters/Pollutants Potentially Addressed: Infiltration facilities remove phosphorus and other pollutants which can be absorbed by the soil media. They will also remove suspended solids and attached pollutants such as heavy metals, but pre-treatment devices should be used to prevent suspended solids from plugging up the infiltration facility. Oil and grease can present similar problems, so oil-water separators should be used.



INFILTRATION TRENCH

Advantages: The primary advantage is good removal of pollutants such as phosphorus which are otherwise difficult to remove from stormwater. They are relatively straightforward to design but require good knowledge of subsurface conditions.

Disadvantages: The primary disadvantage is the potential effect on groundwater quality, which must be evaluated prior to design. Maintenance can also be high particularly if the runoff is fairly high in suspended solids, oil, or grease.

Concept Variations: Other infiltration facilities function very similar to infiltration trenches.

Maintenance Requirements: The primary maintenance involves sediment removal, cleaning, debris removal, mowing, and a periodic check of the hydraulic function and facility condition. Maintenance inspections should be done monthly; most maintenance activities will be required once or twice annually.

Local Implementation Options: Infiltration trenches can be implemented through land use regulations that deal with site development, and through surface water management/master plans that specify publicly owned regional facilities. Public facilities must be implemented through capital improvement plans. Design and construction standards and O&M programs are necessary.

DRY WELLS

Description: A dry well is a vertical, perforated cylinder below the ground surface used to infiltrate water into the soil or lithic zones. They can vary in depth from four or five feet up to thirty feet, which is the depth commonly used in the Portland area. The diameters are generally from a few feet up to five or six feet. Standard manhole sections that have been perforated are commonly used. Dry wells are used in many locations but particularly in urban and suburban areas. For example, there are several thousand in the East Portland-mid-Multnomah County area. Dry wells function similarly to other infiltration facilities, but utilize depth rather than length on the ground.

Paramenters/Pollutants Potentially Addressed: Dry wells can do a good job of removing many pollutants, in particular dissolved phosphorus which is difficult to remove through other types of nonpoint source control facilities. They can also remove suspended solids and associated pollutants such as metals. However, pre-treatment facilities to remove suspended sediments and oil and grease should accompany all dry well installations. Commonly used for this pre-treatment in the Portland area are "sedimentation manholes" which are smaller concrete, vertical cylinders below the surface designed to provide a quiescent zone for settling out particles.

Advantages: Dry wells generally do not affect fish and wildlife. They are usually in the public right-of-way, so land requirements are often not high. They are relatively straightforward to design if the subsurface infiltration capacity is known. They can be very effective in removing dissolved phosphorus and other parameters.

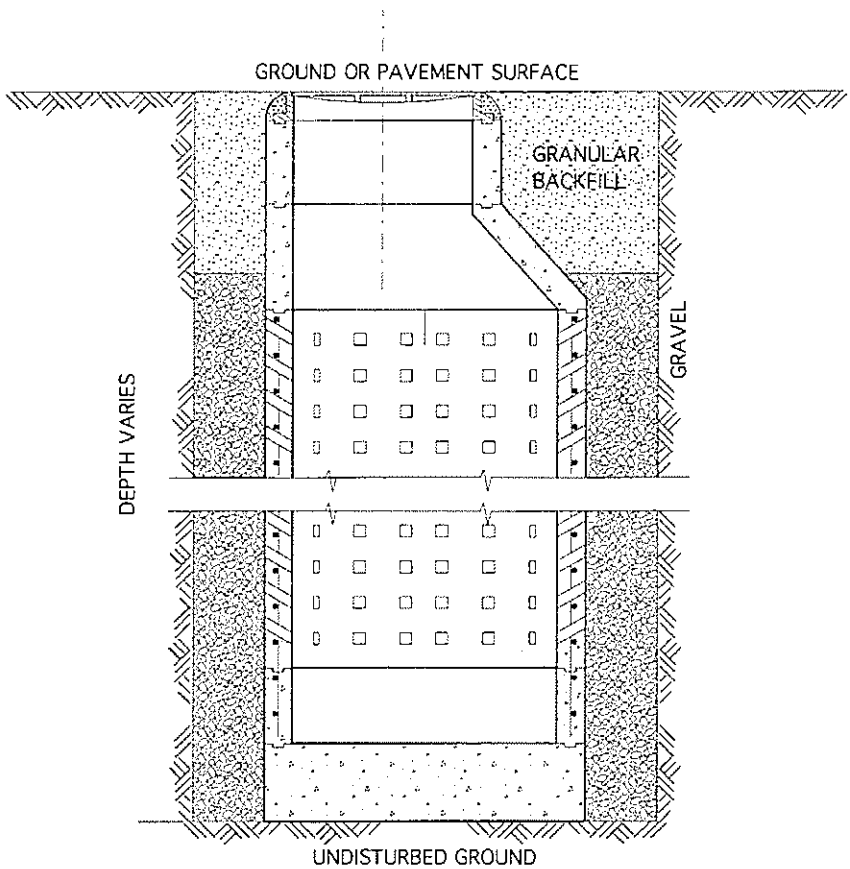
Disadvantages: Potential groundwater contamination is the primary disadvantage of dry wells. They should not be used in industrial areas. They are appropriate for most residential areas and some commercial areas. Maintenance can also be a disadvantage although the structural nature of the facility allows relatively efficient maintenance. They should not be used if groundwater sources of drinking water will be adversely affected. Coordination with well head protection planning is important.

Concept Variations: All the infiltration facilities function in a manner similar to dry wells. Dry wells which are designed for peak flow management, i.e., ten year flood flows, must have a much higher infiltration capacity than those designed for water quality management. In general, water quality dry wells are designed for flows which are expected to be exceeded once or twice per year so the design flow level is considerably less than for flood peaks. Overflow conveyance systems are required if the dry well cannot accept the 10 year flow.

Maintenance Requirements: Maintenance requirements will vary depending on the nature of the drainage area served by the dry well. If the pre-treatment facility such as a sedimentation manhole is effective, dry wells may go years without needing to be cleaned. However, they must

have a portal for maintenance access; during the first year or so, bi-monthly inspections are recommended with maintenance as required.

Local Implementation Options: The use of dry wells is a significant community issue in most locations and should be addressed in both the surface water management plan and the comprehensive plan for the area. Wellhead Protection programs of the local drinking water agencies should be considered before using dry wells or other infiltration facilities. Dry wells should be included in the capital improvement plans; density, number of installations, and the general locations should be noted. Design and construction standards are needed. A sound operation and maintenance program is required.



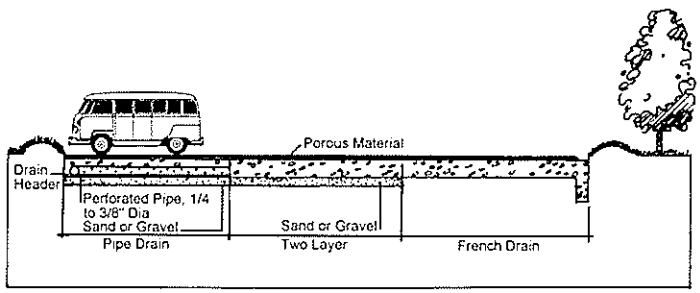
POROUS PAVEMENT

Description: Porous pavement appears the same as standard asphalt or gravel pavement but the material is designed to accept water much more readily than other similar surfaces. An infiltration gallery is usually constructed below the porous pavement to enhance the infiltration capabilities of the facility. Porous pavement is most appropriate for low-use portions of commercial parking lots, for driveways, and for low intensity use roadways. Compared to other infiltration facilities, porous pavement relies on a horizontal infiltration zone at or just below the ground surface as compared to dry wells which rely on infiltration from a vertical cylinder.

Paramenters/Pollutants Potentially Addressed: As with other infiltration facilities, porous pavement can do a good job in removing a wide range of pollutants particularly dissolved phosphorus. If much oil, grease or sediment is involved the porous pavement may plug up.

Advantages: The primary advantages are the effectiveness in removing certain pollutants such as dissolved phosphorus, and the relatively easy integration into normal urban development projects.

Disadvantages: Disadvantages include the effect on groundwater quality, the potential for clogging, and the associated maintenance requirements. Maintaining porous pavement can be particularly difficult if it serves a drainage area with a lot of disturbed soil surfaces.



Concept Variations: There are a number of types of porous pavement, primarily involving gravel or asphalt surfaces. All should have an infiltration chamber beneath the pavement surface.

Maintenance Requirements: The maintenance of porous pavement involves monthly inspections which focus on the amount of accumulated sediment and oil or grease. Resurfacing and patching are needed periodically. Accumulated sediments and oil/grease must be removed. Debris should be periodically cleaned. During storms the hydraulic function should be checked. The pavement condition should be reviewed annually.

Local Implementation Options: Porous pavement should be addressed in both surface water management/master plans and transportation plans for the jurisdiction involved. In addition, the wellhead protection plans of the local water purveyors should be considered and integrated into the planning. Where porous pavement use is designated, design-construction standards should be developed. The capital improvement plan is involved for public projects, and O&M programs are needed.

PONDS AND WETLANDS

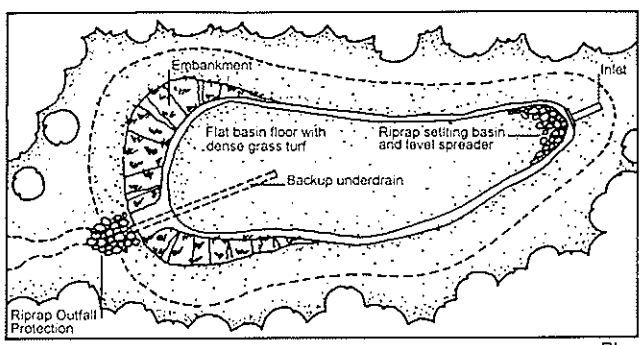
Description: Infiltration ponds and wetlands look exactly like their non-infiltrating counterparts, but they are designed to enhance infiltration into the subsurface. One difference is that they will probably be dry often. They can range from less than half an acre up to twenty or thirty acres and larger.

Paramenters/Pollutants Potentially Addressed: An infiltration pond or wetland will remove dissolved phosphorus, which is difficult to remove in conventional wetlands or ponds. Ponds or wetlands can have their water quality effectiveness enhanced considerably through infiltration, if the soil will allow adequate infiltration, and if no adverse groundwater impacts are anticipated.

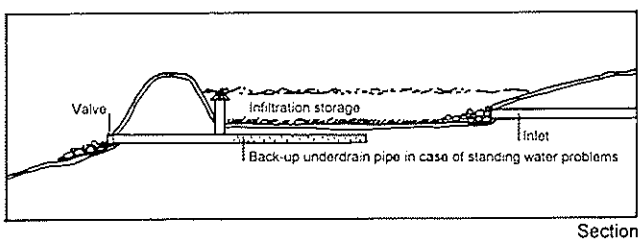
Advantages: Comprehensive and effective pollutant removal is the main advantage of infiltration ponds and wetlands.

Disadvantages: The primary disadvantages are potential groundwater impact and the regulatory difficulty of getting all of the issues resolved. Maintenance requirements can also be considerable, especially if the drainage area produces a lot of sediment. Land requirements are also significant. Safety considerations must be evaluated.

Concept Variations: Infiltration ponds and wetlands are variations of wet ponds, sedimentation ponds, marsh-wetland treatment units, and other pond and marsh type facilities.



Plan



Section

INFILTRATION POND

Maintenance Requirements: Maintenance requirements can be significant. They involve sediment removal; cleaning; debris removal; management of wetland, riparian, and landscape vegetation; and periodic checks of hydraulic function and facility condition.

Local Implementation Options: The primary implementation approaches involve surface water management/master plans and in some case comprehensive plans. To implement the planning, public facilities of this type must be included in the capital improvement plans. Design and construction standards and O&M programs are required.

ROOF DRAINS

Description: Roof drains are the smallest type of infiltration facility presented. They are small infiltration galleries at the end of a roof drain pipe. They are particularly appropriate for residential areas where infiltration capabilities are suitable. They can also be used in industrial and commercial areas, but runoff should be sampled to ensure that industrial pollutants do not create contamination problems.

Paramenters/Pollutants Potentially Addressed: Roof drains, if extensively used, can reduce runoff velocities and therefore reduce downstream channel erosion.

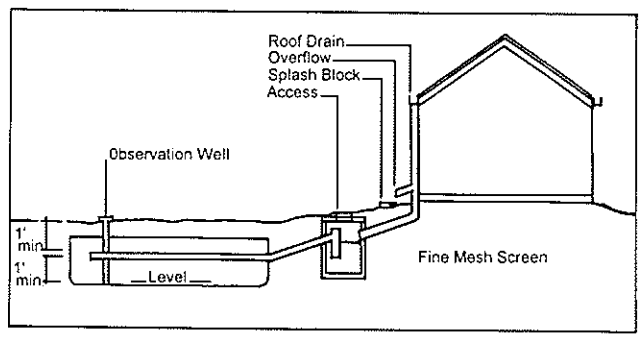
Advantages: If designed right infiltrating roof drains should have relatively low maintenance requirements and reduce the volume of runoff that downstream stormwater facilities will have to treat. They can also be relatively easily integrated into urban areas.

Disadvantages: The groundwater impacts must be anticipated. Local geohydrological evaluation is necessary.

Concept Variations: Infiltrating roof drains are a variety of infiltration facility and function in a manner similar to the rest.

Maintenance Requirements: The most unique maintenance requirement would be annual sampling of roof runoff quality from the larger commercial or industrial facilities. Inspection of the roof condition and occasional reconstruction of the infiltration media may be required.

Local Implementation Options: The primary local implementation option would be land use regulations and design-construction standards since most, if not all, of the opportunities would be in private developments.



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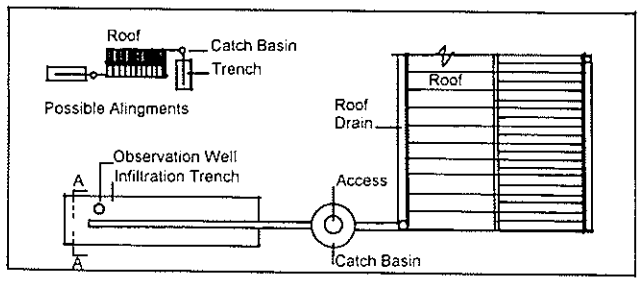
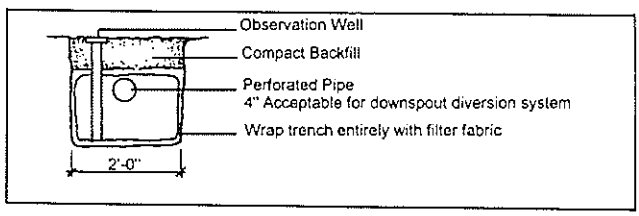


Plan View



Section A-A

ROOF DRAIN INFILTRATION SYSTEMS

CHEMICAL APPLICATIONS

HERBICIDES AND PESTICIDES

Description. Herbicides and pesticides are often used to control weeds, fungi, and insects. In many cases, herbicides and pesticides are mixed and applied with fertilizer. Overuse of pesticides can have a significant impact on water quality since many herbicides and pesticides are toxic to aquatic life.

Paramenters/Pollutants Potentially Addressed. The primary pollutants affected include potentially toxic chemicals, solids, and nutrients from fertilizers.

Advantages. Managed chemical applications save money, since the application rate and timing are calibrated to crop needs.

Disadvantages. Balancing crop requirements with application rates requires frequent crop monitoring.

Concept Variations. The primary methods include application rate controls, placement, and timing, and method of application. Application rate controls refer to balancing the crop requirements with the application rate. The method of application includes such activities as in-furrow applications or broadcasting followed immediately by soil incorporation. The principal idea is to incorporate the herbicide or pesticide into the soil immediately after application to prevent surface water contact and subsequent runoff from the exposed soils. This method has limited use since many chemicals are applied directly to the crop surface rather than incorporated into the soil. Timing of applications is important in maintaining the maximum time interval possible between chemical applications and runoff events. Timing according to the life stage of the pest can also preclude repeated applications. Integrated pest management (IPM) is an important approach to reducing the need for pesticide use.

Maintenance Requirements. The equipment must be maintained and calibrated after each use.

Local Implementation Options. Technical assistance is available through the local soil and water conservation district. Direct local requirements can be established for many source types. Instructions for pesticides are always on the container, and departure from the instructions may be illegal.

FERTILIZERS

Description. Overuse of fertilizers containing phosphorus and other nutrients can significantly increase the nutrient levels carried in surface water. Erosion of soils also contributes nutrients that were introduced to the soil by fertilizers. Phosphorus loading in surface water runoff and eroded soils increases with application rates and high phosphorus levels in the soil.

Paramenters/Pollutants Potentially Addressed. The primary constituents affected include nutrients, solids, and fecal coliform.

Advantages. The primary advantage of fertilizer management techniques is that balancing soil nutrient requirements with application rates presents a cost savings.

Disadvantages. Balancing soil requirements with application rates requires soil testing and monitoring to determine the soil condition.

Concept Variations. The primary methods available include application rate controls, placement and method of applications, and timing of application. Application rate controls refer to balancing the soil nutrient requirements with the application rate. The method of application includes such activities as in-furrow applications or broadcasting followed immediately by soil incorporation. The objective is to incorporate the fertilizer into the soil immediately following application to prevent storm water contact and subsequent runoff from the exposed soils. Timing is necessary to assure application at the time of maximum plant uptake.

Maintenance Requirements. The equipment must be maintained, calibrated, and replaced.

Local Implementation Options. Technical assistance is available through the local soil and water conservation district, and direct requirements can be established for many source types.

INDUSTRIAL AND COMMERCIAL SITES

ILLICIT CONNECTIONS

Description: Stormwater conveyance systems often receive discharges from industrial, commercial, and residential areas which carry pollutants at levels of concern. Examples include drainages from wash down areas, internal floor drains from plant complexes, sanitary sewer connections, and the infiltration of groundwater carrying pollutants from septic tanks, storage tanks, or leaky sewer systems. The EPA has concluded that illicit connections can have a significant effect on receiving water quality. EPA has targeted the elimination of such connections as one of the more important goals of the NPDES stormwater regulations. A program to eliminate illicit connections involves identification of such connections and local ordinances which require their diversion to other treatment/disposal systems. This involves water quality monitoring of the system, which can be complex and should include an inventory of industrial, commercial, and residential sources where such connections could originate. Community development records, industrial NPDES information, RCRA related permits/licenses, DEQ records, and analysis of aerial photographs can all be used as sources of such information.

Paramenters/Pollutants Potentially Addressed: Metals, oil and grease, BOD, bacteria, industrial and agricultural chemicals, nutrients, and suspended solids can all be involved. Priority pollutant scans as defined by the EPA may be appropriate if industrial/agricultural sources are suspected. In some cases, sediment sampling and/or fish tissue analysis may provide useful information to identify illicit connections.

Advantages: Eliminating illicit connections reduces pollutant loads at their source and places the remediation cost on the responsible parties. After agreement has been reached with the responsible parties, the cost to the public is minimal except for enforcement and program monitoring.

Disadvantages: The disadvantage of eliminating illicit connections is that the cost to identify connections can be high.

Concept Variations: The elimination of illicit connections is a unique aspect of nonpoint source management. A related concept is the containment of spills and runoff from industrial and commercial sites.

Maintenance Requirements: Once illicit connections have been eliminated the public agency requiring such elimination should monitor the water quality, and possibly sediments, below the former illicit connection and also periodically inspect the system to ensure that it remains "disconnected".

Local Implementation Options: Eliminating illicit connections should be part of a surface water management program. Special ordinances are generally required to establish source control programs and industrial and commercial site owners should be provided with guidance regarding the elimination of illicit connections. Work sessions with the various parties early in the process may eliminate some of the potential controversy. Inspections of the eliminated sources should be included as part of the organization's O&M program.

CONTAINMENT OF HIGH RISK AREAS

Description: The containment of contaminated, or potentially contaminated, runoff from commercial and industrial sites involves the use of containment gutters and sumps, berms, roofing of potential source areas, catchment vaults where spills can be stored and removed, emergency response programs, and storage/runoff-delay facilities. The concept involves diverting precipitation from any hazardous materials stored on a site by covering use and storage areas. In addition, the runoff from sites of concern is contained through the use of berms and runoff control facilities. The goal is to avoid contaminating runoff after fires, spills, or leakages with chemicals that would be of concern if permitted to enter the stormwater system surface or groundwater bodies. Potential contaminants are prevented from being exposed to precipitation and runoff. In case of a fire, the runoff is diverted and contained for at least a specified period such as three to six hours, or some assumed storm period or spill/release occurrence (i.e., a fire).

Paramenters/Pollutants Potentially Addressed: Nutrients, suspended solids, and industrial and agricultural priority pollutants involving categories such as solvents and fuels.

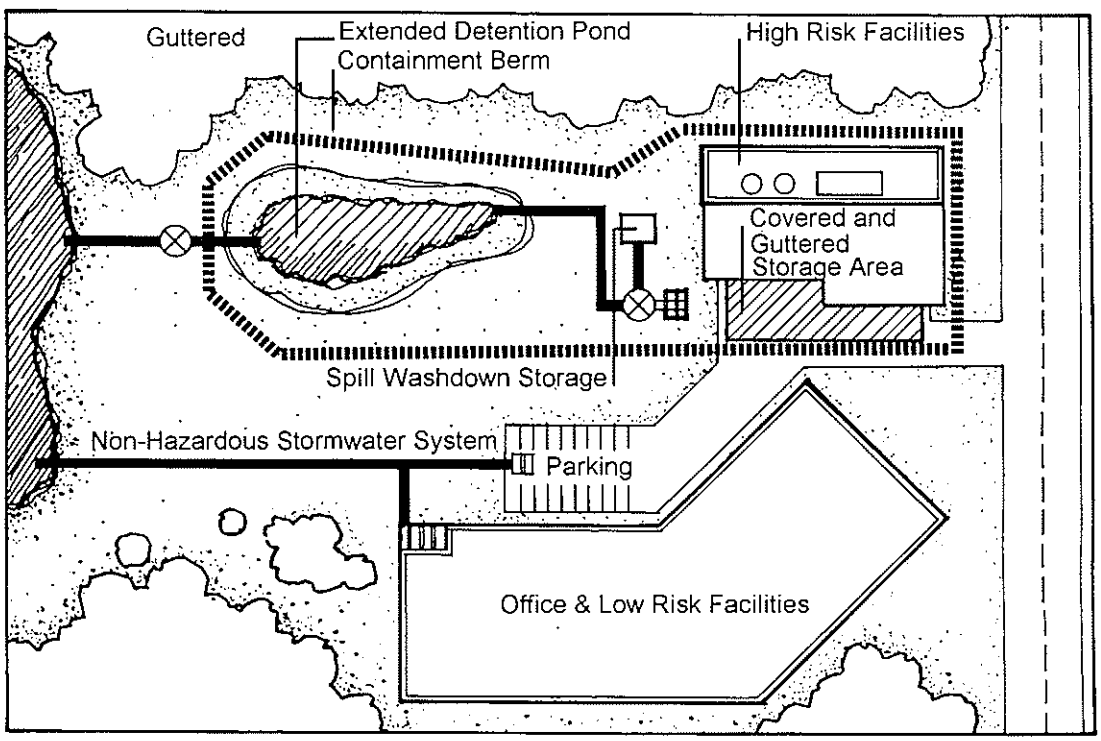
Advantages: The most important advantages of containing contaminated runoff through site planning and design are that potential problems are addressed at the source, and the responsibility for spills is placed on the owners/operators. Furthermore, difficult clean up problems associated with industrial sites such as groundwater contamination can be prevented.

Disadvantages: Containment of contaminated runoff is relatively easy if incorporated into the design of new industrial/commercial sites. The primary disadvantage is in retrofitting existing facilities since the cost associated with plant redesign and reconstruction may be high. The effect of the cost on small businesses may be significant.

Concept Variations: The main concept variation is eliminating illicit connections. However, the two concepts are not mutually exclusive; that is both are needed. Emergency response procedures are a necessary part of a containment program, but they should not be relied on exclusively. Good containment facilities can significantly reduce the risk of spills.

Maintenance Requirements: The maintenance requirements involve inspection of the site during and after construction or retrofitting, and then periodic monitoring. It is advisable to include sediment sampling in the watercourse immediately below the point of discharge of the containment site to determine if releases are occurring. Such monitoring should be done on an annual basis and after any emergency or cleanup occurrence at the site.

Local Implementation Options: Requiring the containment of contaminated runoff requires special ordinances but should also be designated in the comprehensive plan and various land use regulations/overlays that cover the area. These may include environmental zone overlays or industrial development overlays. The need for such programs should initially be identified in the surface water management/master plan and design-construction standards are needed. The jurisdictions O&M program should provide for periodic inspection and monitoring.



CONTAINMENT OF HIGH RISK AREAS

MONITORING AND MAINTENANCE

Description: All of the local programs which address nonpoint sources associated with commercial and industrial sites should include monitoring and maintenance as high priority budget items. The recommended monitoring should include priority pollutant scans, monitoring for the chemicals which may be present within and below each specific site, and tissue and sediment sampling below the site. The monitoring program should include both system-wide surface water and groundwater components and grab sample sites above and down gradient from each facility location. Sediment samples can indicate whether occasional release have occurred which would not be detected in system-wide water quality monitoring, and fish tissue sampling can provide the same type of information.

Paramenters/Pollutants Potentially Addressed: The monitoring should include nutrients and suspended solids but the more important parameters are priority pollutants, metals, oil and grease and the chemicals expected at the specific industrial site.

Advantages: Monitoring is critical to making industrial and commercial site programs work and that is its key advantage.

Disadvantages: The disadvantage of monitoring and maintenance related to industrial and commercial sites by public agencies is that the cost is continual and such programs are often the target of budget cutbacks.

Concept Variations: The primary variation to public monitoring and maintenance is to legally require the site owners to provide for monitoring and maintenance on their site, and possibly for the water systems potentially impacted by their site.

Maintenance Requirements: Monitoring equipment must be periodically updated and replaced.

Local Implementation Options: An operation and maintenance program must be defined and funded by the jurisdiction. Periodic maintenance of facilities, generally by the site owner, is essential and this can sometimes be provided by a public agency under contract.

EMERGENCY RESPONSE

Description: Emergency response involves specialized equipment and a team of specialists who are experienced with hazardous materials and responding to releases of contaminants. Such release might occur due to fires, spills, leaks, train or truck accidents, and illegal release. Emergency response may be the responsibility of the police department, the fire department, or special units of the jurisdiction. It might be provided for by an industrial park or commercial area, and for very large industrial sites by the owner/operator of the facility. The response procedures involved are too complex to present in this guidebook. They involve a notification system, a certified trained response crew, periodic recertification, transportation and material transport vehicles, cleanup procedures, personnel protection gear, special equipment/materials, the removal of contaminated materials, and safe disposal.

Paramenters/Pollutants Potentially Addressed: Primarily priority pollutants.

Advantages: Emergency response presents numerous advantages for site management. It is also a necessity for all industrial and transportation areas where chemicals are involved and for most commercial areas. The concept involves remedial action after a problem has occurred but such programs are essential.

Disadvantages: Cost is the primary disadvantage to an emergency response program. Cleanup costs are high and some of the contamination will be missed because of timing or detection constraints.

Concept Variations: The primary concept variations involve who pays the cost of such programs and provides the crews and equipment. Local jurisdictions should have at least a basic emergency response plan with designated personnel and the minimum equipment required. But much of the burden can be placed on the owners and private companies which specialize in emergency response.

Maintenance Requirements: The maintenance requirements involve periodic personnel training, equipment replacement and maintenance.

Local Implementation Options: Special local ordinances are usually required to initiate emergency response programs and performance standards are important.

AGRICULTURAL AREAS

LIVESTOCK MANAGEMENT

Description. Livestock holding areas such as barnyards, corrals, and pastures can contribute significant levels of nutrients to receiving waters. The magnitude of the effect of these sources depends on the size of the area, number and type of animal, and the location of the area with respect to receiving waters. Management practices emphasize minimizing stormwater contact, containing contaminated stormwater, runoff treatment systems, reduced livestock densities, and eliminating access to sensitive areas.

Paramenters/Pollutants Potentially Addressed. Livestock management practices are designed to control nutrients, solids, and fecal coliform.

Advantages. The primary advantages involve the simplicity of the relatively non-structural measures which can be achieved through changes in management techniques.

Disadvantages. The success of livestock practices depends on local landowner commitment. Limits on livestock densities or containment/treatment facilities, will be controversial.

Concept Variations. Variations of livestock management include minimizing storm water contact with livestock wastes, containing contaminated storm water, and treatment practices. Minimizing storm water contact can be achieved with covered manure storage areas, piped drainage systems around barnyards, and piped roof drains. Containment of contaminated storm water focuses on detaining contaminated water until it can be treated and discharged. Treatment practices include fencing, water reuse, sedimentation facilities, biofilter strips adjacent to water courses, and underground storage with land application of manure. Limits of livestock densities may also be effective in controlling overgrazing and subsequent erosion.

Maintenance Requirements. Livestock management systems require varying levels of maintenance activities. Activities could include fence repair, periodic cleaning of the storage tanks and treatment systems, and sediment removal from drainage facilities.

Local Implementation Options. The primary local role in addressing agricultural NPS involves land use regulations to protect stream corridors and local ordinances regarding management activities and livestock densities.

BULK MATERIALS MANAGEMENT

Description. Bulk materials management refers to the management of manure and other bulk materials such as silage commonly found within agricultural areas. The principal activities associated with bulk materials management are containment and land application

Paramenters/Pollutants Potentially Addressed. The pollutants controlled through these systems include solids, nutrients, and fecal coliform.

Advantages. Containing wastes to prevent storm water contact is effective in preventing pollutants from being carried into the receiving water body.

Disadvantages. The main disadvantage of bulk materials storage is that a relatively significant capital investment is usually required to install containment and land application facilities.

Concept Variations. Variations include waste management facilities such as tanks, pits, settling basins, and adequately covered storage to prevent discharges of waste to surface waters. Nutrient application practices are necessary to prevent "over-fertilization."

Maintenance Requirements. Maintenance requirements include periodic inspection and repair of pumps, piping, and storage facilities.

Local Implementation Options. Guidelines and specifications for the planning, construction, and siting of manure storage facilities are contained in the Oregon Animal Waste Installation Guidebook. Technical assistance is available through Soil and Water Conservation Districts. Local requirements could be adopted.

RIPARIAN AREA PROTECTION

Description. This involves protecting stream banks and a vegetated riparian buffer associated with surface water bodies. Riparian areas provide a natural bio-filtration system along stream banks, wetlands, and other water bodies. These areas dissipate energy, reduce erosion, and enhance sediment deposition. Riparian buffers in developed areas are established and maintained through local development ordinances. Preservation of undeveloped corridors can be achieved through land use regulations and greenspace programs.

Paramenters/Pollutants Potentially Addressed. Riparian areas remove suspended solids and associated pollutants such as phosphorus. Shade provided by riparian vegetation also improves temperature conditions within the stream.

Advantages. The primary advantages of riparian area management involves water quality, fish, wildlife and the restoration/preservation of stream side corridors.

Disadvantages. Protection of riparian areas sometimes requires removing land from agricultural use.

Concept Variations. Filter strips and vegetated swales are similar.

Maintenance Requirements. Trash and debris may need to be removed.

Local Implementation Options. The primary local implementation options involves education, land use regulation, surface water management/master plans. Local programs might also involve riparian area land purchases and green spaces programs.

TILLAGE MANAGEMENT

Description. In some areas, cultivation or tillage is the major cause of agricultural soil erosion. Tillage practices can increase soil losses through storm runoff and wind erosion. Tillage management refers to techniques used to reduce the erosive effect of water on exposed soils.

Paramenters/Pollutants Potentially Addressed. Tillage management is designed to control soil erosion and sediment which deposit in receiving waters. Pollutants which attach to soil particles including fertilizers, herbicides, and pesticides are also controlled.

Advantages. Tillage management reflects a change in farming techniques which in the long run will benefit the local farmer rather than a structural modification .

Disadvantages. Changes in tillage practices are difficult to achieve through education alone.

Concept Variations. Several variations of tillage methods are currently in use throughout the western states. Conservation tillage, which leaves some or all of the previous year's crop residue on the soil surface, is effective in controlling soil erosion. The degree of control is closely related to the percentage of the soil surface covered with residue. Contour farming, where crops are alternated with cultivated strips is also effective in capturing eroded soil particles. Several variations are available, including strip cropping, block farming, wind strip cropping, and buffer strip contouring.

Maintenance Requirements. Not applicable

Local Implementation Options. The primary implementation options involve education, land use regulations and local soil and water conservation district involvement. A tillage management plan which outlines tillage methods and practices may be designed to aid farmers in the implementation of the most effective tillage for their particular topographic and crop features.

CONTAINER NURSERY MANAGEMENT

Description. Runoff from container nurseries often contains high levels of nutrients from the application of chemical fertilizers. Water quality management techniques for these operations emphasize containment of the growing and storage areas, water reuse, and water conservation.

Paramenters/Pollutants Potentially Addressed. Nutrients, herbicides, insecticides, and suspended solids.

Advantages. The activities presented within this section may represent cost savings for the nursery operator through a more cost efficient operation.

Disadvantages. Many of the management systems require a relatively large capital investment to install.

Concept Variations. The variations used in container nurseries emphasize three concepts: containment, water use control, and water reuse. Containment is designed to separate contaminated stormwater and irrigation water from "clean" water, thereby reducing the volume of stormwater requiring treatment. Clean water diversions are achieved by installing facilities to intercept and divert water from rooftops, roadways, and upslope areas. Water use control focuses on minimizing the amount of water used for irrigation, thereby reducing the volume requiring treatment. Typical practices include increasing the frequency while reducing the volume of irrigation water applied in a single application; installing drip or microjet irrigation systems; and the use of timers and sensors to control application timing. Water reuse practices are designed to reduce water use by reusing irrigation water and contaminated stormwater. A wastewater recovery system can be installed to collect and redistribute irrigation water.

Maintenance Requirements. Container nursery management methods require varying levels of maintenance depending on the type of system. Containment and treatment facilities require periodic cleaning and inspections.

Local Implementation Options. Guidelines and specifications for the planning, construction, and siting of nursery facilities are available through the local Soil and Water Conservation District. The activity can be addressed in surface water management and water quality plans, and through water quality ordinances.

FOREST HARVEST

ROAD AND SKID TRAIL SYSTEM STANDARDS

Description: For this discussion road and skid trails for tracked or rubber tired skidders are considered to have the same types of impacts and involve the same types of controls. The road and constructed skid trails generally exert the greatest impact associated with forest harvest activities on water quality due to the soil exposure and erosion-sedimentation that results.

Forest harvest requires development of a primary and secondary road system, and the density and configuration depend on the logging method to be used. Some methods such as jammer-logging require a very dense road system while other methods such as skyline logging minimize the road density. Road and skid trail system requirements can be generally categorized as follows:

- Minimizing , and possible limits on the density of roads per square mile (e.g., feet per square mile).
- Constraints regarding the soil types and slope steepness on which roads can be constructed.
- Filter-zone strips, and in some cases no disturbance zones, along each stream (refer to the Stream, Lake and Riparian Area Protection section).
- Design and layout of skid trails to reduce the water quality impacts, and in some cases limits on the skid trail density.
- Water quality design constraints for, or prohibition of, stream crossings.
- Abandonment of forest roads and skid trails after logging is completed that are not needed for critical management purposes..
- Limits on the total width of the road prism (including the fill slope, roadway surface and cut slope).
- Road use and maintenance limitations to reduce the re-establishment of fine surface materials available for erosion, and water quality sensitive road maintenance.
- Low volume overflow sections for road fills at high risk culverts to minimize problems associated with fill blowout during major runoff events.
- Guidelines or requirements for water control structures such as cross drains, culverts, water bars, driveable dips or diversion ditches to minimize erosion on the road bed, cut bank and fill slope.
- Soil stabilization and re-vegetation for cut and fill slopes.
- Design standards which address items such as soil compaction, moisture conditions, haul/side casts, waste disposal, subgrade design and water control structures.
- Limits on landing area coverage and design:
- Limits on road surface treatment of oils and other chemicals.

Most forest harvesting operations address these considerations to one degree or another but the level of constraint and enforcement of the requirements are important to water quality success.

Paramenters/Pollutants Potentially Addressed: The parameters primarily involved in road and skid trail sources are suspended solids (eroded soil) and associated chemicals such as phosphorus or metals. Due to equipment use, maintenance oil and grease and other industrial chemicals could be involved, as well as the full range of silvicultural chemicals.

Advantages: The primary advantage is control over the major source of erosion-sedimentation from forest harvest activities. There are associated benefits such as for wildlife due to less road density and harassment potential, and the availability of riparian cover. Since water quality and stream structure benefit, fish habitat is also protected.

Disadvantages: The disadvantages include the difficulty of applying and enforcing road and skid trail constraints and the increased cost associated with such systems. This is offset if the non-market cost associated with the erosion-sedimentation, water quality and fish impacts are included in the estimate of cost.

Concept Variations: There are a number of variations to each of the items discussed above so an almost endless number of combinations are possible. In some cases more control of one type can result in less need for control of another type.

Maintenance Requirements: The primary maintenance need is to continually update the system to relax requirements which are not productive and tighten requirements when needed.

Local Implementation Options: Local governments can impact federal timber harvesting operations including road and skid trail design on U.S. Forest Service or Bureau of Land Management lands though local "water quality requirements" as provided for in Section 313 of PL 92-500. To affect state and private timber operations local jurisdictions will have to negotiate with the Oregon Department of Forestry regarding forest practices, and the Oregon Department of Environmental Quality regarding the TMDL requirements placed on state and private forestry operations. The underlying foundation for such local water quality requirements and negotiations should be included in a water quality plan and ordinance provisions, a component of a surface water management/master plan and/or the jurisdiction's comprehensive land use plan.

LOGGING METHOD REQUIREMENTS

Description: There are three major categories and five subcategories of logging systems as follows:

- Tractor Logging
  - Crawler
  - Wheel (rubber-tired)
- Cable Logging
  - Skyline (at least four variations)
  - High lead (at least two to three variations including jammer)
- Aerial (helicopter)

The differences in water quality impact of the methods above relate to the degree of suspension or conversely soil contact of a log being skidded; the degree of direct site disturbance by heavy equipment; the road system required; and the site re-entry requirements for regeneration purposes. Crawler tractor and rubber-tired skidders generally result in the greatest adverse water quality impact. Tractor and jammer logging require a high road density which can cause significant adverse water quality effects. The cable logging method with the least water quality impact is the running skyline which allows long yarding distances and therefore minimizes the road density and site damage. Helicopter logging is the least site disturbing method but is costly and subject to meteorological conditions more than the other methods, as is balloon logging. In particularly sensitive watersheds where timber harvesting is to be done but water quality is a primary concern, a preference or requirement can be placed on the logging method to be used.

Paramenters/Pollutants Potentially Addressed: A number of pollutants are affected by the logging method selected, with particular emphasis on suspended solids (sediments) and attached constituents such as phosphorus, metals or forest/road chemicals.

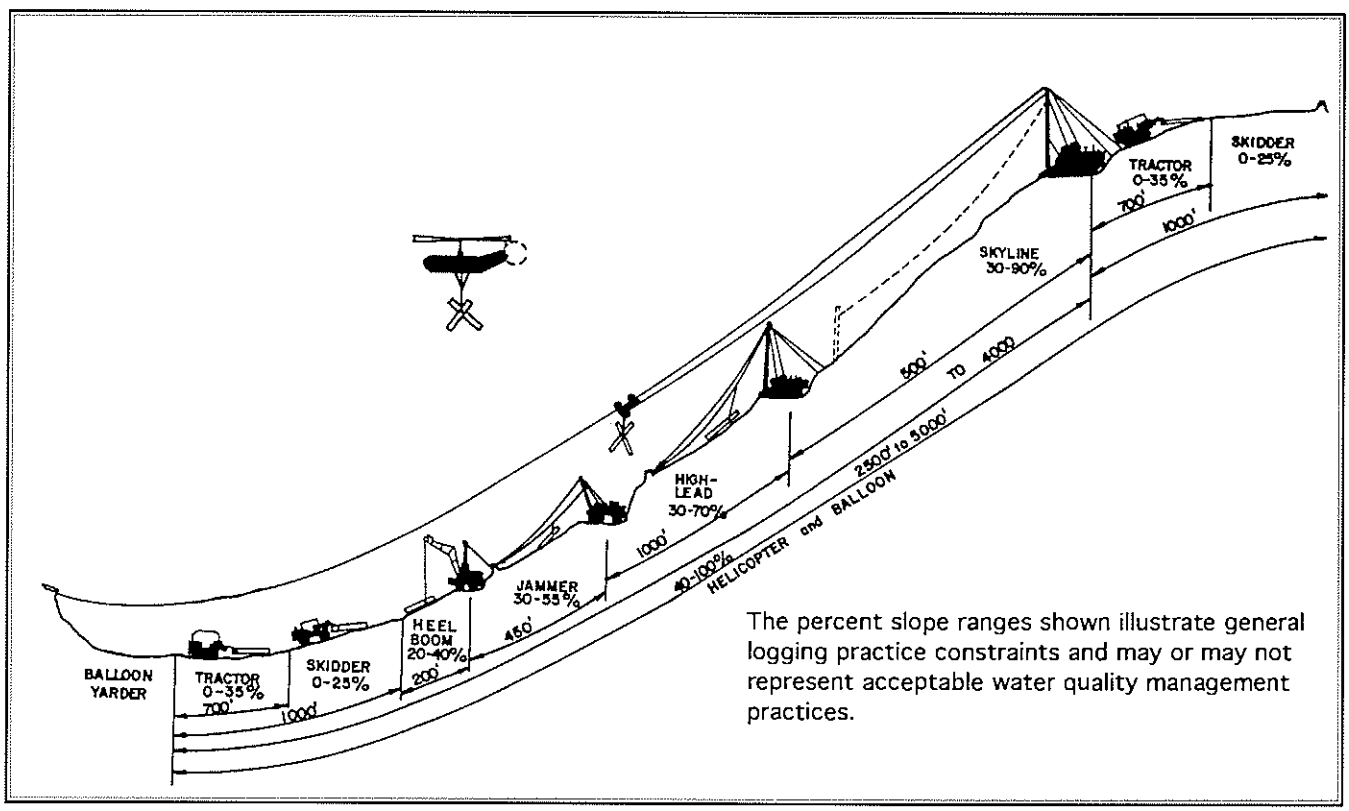
Advantages: The less impactive logging methods also result in a lower road density which benefits wildlife and can complement riparian and fish protection measures.

Disadvantages: Although the total cost of logging operations is complex to determine, in general the systems which have the least water quality impact cost more and, in some cases, such as helicopter or balloon logging, the cost can be prohibitive.

Concept Variations: There are numerous logging methods which can be substituted for the high impact skidder methods such as four variations of skyline and two to three variations of high lead. Balloon and helicopter logging can be used in particularly sensitive areas.

Maintenance Requirements: The primary maintenance requirement for a system of constraining logging methods is to maintain awareness of advances in technology that might shift the preferred system one way or the other.

Local Implementation Options: Local governments can impact federal timber harvesting operations including logging methods on U.S. Forest Service or Bureau of Land Management lands though local water quality "requirements" as provided for in Section 313 of PL 92-500. To affect state and private timber operations, local jurisdictions will have to negotiate with the Oregon Department of Forestry regarding forest practices and with the Oregon Department of Environmental Quality regarding the application of water quality standards and TMDL requirements placed on state and private forestry operations. The underlying foundation for such local water quality requirements and negotiations should be included in a water quality plan and ordinance provisions, a component of a surface water management/master plan and/or the jurisdiction's comprehensive land use plan.



FOREST RESIDUE MANAGEMENT

Description: Forest harvesting results in a large amount of residue, primarily woody debris and understory vegetation. The manner in which the residue is managed can have positive or negative effects on water quality. It is sometimes best to leave slash after logging without further disturbing the site to reduce surface erosion. The slash material can also be utilized to form skid trail barriers and retard surface erosion. Chipped residues can be distributed over landings and along right-of-ways to reduce soil erosion. The four general categories of residue management are: no treatment, rearranging or mechanically treating and leaving, removal and disposal, and burning. In general, the most water quality beneficial method is to rearrange/mechanically treat, i.e., chop or break into smaller pieces and leave in a planned pattern to reduce erosion.

Paramenters/Pollutants Potentially Addressed: If forest residue is managed to reduce erosion, suspended sediments will be reduced in the water bodies affected. In some cases, complex chemicals may leach out of the woody/vegetation debris but this is not usually a problem.

Advantages: The advantages of managing the forest residues involve erosion protection, the placement of residues so that the material isn't brought down in debris torrents or with eroded material, better conditions for growth once trees are established, better nutrient cycling, and better soil-biologic conditions.

Disadvantages: The primary disadvantage is cost to the owner/operator but this is offset by the reduction in public cost of improper residue management. The disadvantages include potential increases in revegetation costs and fine hazard.

Concept Variations: There are four basic approaches to managing residue as described above, each with a number of variations.

Maintenance Requirements: The system of controlling residue management should be continually updated as new information emerges.

Local Implementation Options: Local governments can impact federal timber harvesting operations including forest residue management road and skid trail design on U.S. Forest Service or Bureau of Land Management lands though local water quality "requirements" as provided for in Section 313 of PL 92-500. To affect state and private timber operations local jurisdictions will have to negotiate with the Oregon Department of Forestry regarding forest practices, and the Oregon Department of Environmental Quality regarding the TMDL requirements placed on state and private forestry operations. The underlying foundation for such local water quality requirements and negotiations should be included in a water quality plan and ordinance provisions, a component of a surface water management/master plan and/or the jurisdiction's comprehensive land use plan.

SURFACE AND MASS EROSION CONTROLS

Description: Surface erosion is the result of rain or flowing water detaching an exposed soil particle and then transporting the detached particle by surface flow to some downstream deposition point. The four basic physiographic factors which affect surface erosion are: soil characteristics, rainfall characteristics, topography and plant litter/cover. The primary means of protecting against surface erosion are: re-establishing vegetation or a mulch protective cover on all soils immediately after exposure; minimizing the area, duration and season of soil exposure; using logging equipment that will reduce soil disturbance; and minimizing the road density.

Mass erosion is a large failure of an entire slope or area. The types of failures include: debris movements; creep, slumps and earth flows; and dry ravel. The main methods of controlling mass surface erosion involve limits on the slopes where harvesting or road/skid trail construction can occur; protection of natural stabilization mechanisms such as large root systems; and avoidance of certain problem soils.

Paramenters/Pollutants Potentially Addressed: Suspended sediments and bed load and the attached pollutants such as phosphorus and metals are the main constituents involved.

Advantages: The primary advantages of erosion control are for water quality but major damages can occur from mass and surface erosion because of drainage way blockages, flooding and direct property damage.

Disadvantages: Avoiding problem soils and slopes can reduce the volume of wood available, and erosion controls are sometimes expensive.

Concept Variations: The type of controls appropriate for a certain area vary considerably from one region to the next. A qualified soil scientist or geotechnical engineer should recommend site-specific measures.

Maintenance Requirements: The approach to controlling surface and mass erosion should be updated periodically based on new information, particularly actual experience with various soils and slopes within the region.

Local Implementation Options: Local governments can impact federal timber harvesting operations including erosion controls on U.S. Forest Service or Bureau of Land Management lands though local water quality "requirements" as provided for in Section 313 of PL 92-500. To affect state and private timber operations local jurisdictions will have to negotiate with the Oregon Department of Forestry regarding forest practices, and the Oregon Department of Environmental Quality regarding the TMDL requirements placed on state and private forestry operations.

The underlying foundation for such local water quality requirements and negotiations should be included in a water quality plan and ordinance provisions, a component of a surface water management/master plan and/or the jurisdiction's comprehensive land use plan.

STREAM, LAKE, AND RIPARIAN AREA PROTECTION

EQUIPMENT USE LIMITS

Description: Equipment use limits involve specifying areas where equipment cannot be used, particularly during construction. Such limits can be site-specific or associated with certain environmental areas. Important areas to protect for water quality purposes are: riparian areas, steep slopes, certain soils, water zones and wetlands.

Paramenters/Pollutants Potentially Addressed: Suspended sediments and associated metals and phosphorus are the primary parameters that can be reduced through equipment use limitations.

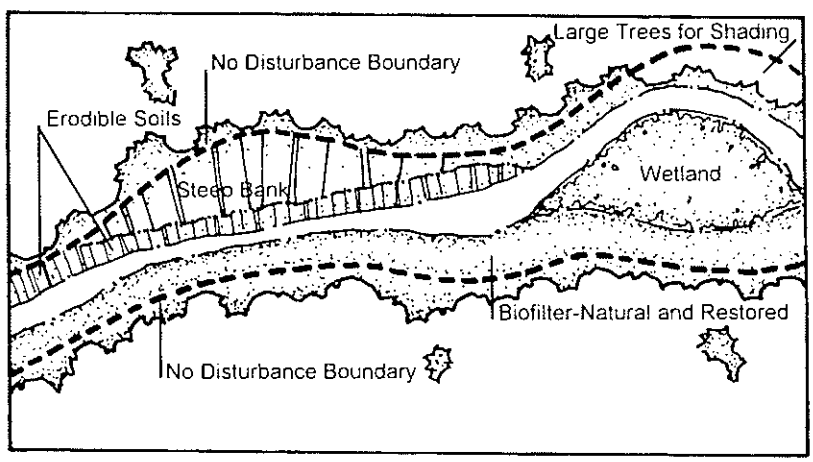
Advantages: In addition to water quality benefits, flood damages can be reduced because the potential for mass soil failures and channel erosion is reduced. Fish, wildlife, and wetland habitat also benefit from restrictions on equipment operation.

Disadvantages: The primary disadvantage is that equipment limitations can make the private development cost for the operator/owner more expensive, but this may be offset by a reduction of public resource impact costs.

Concept Variations: The primary variations are presented in the "description" above. Levels of control can range from encouragement to absolute limitations.

Maintenance Requirements: No direct maintenance requirements.

Local Implementation Options: The implementation options available to local governments depend on the type of land use/development activity involved. The most comprehensive approach involves inclusion in surface water/water quality management plans, the jurisdiction's comprehensive land use plan, and special water quality ordinances.



BIOFILTER ZONES

Description: Biofilter zones can be artificially created after construction or development activities have occurred, but are the most cost efficient if existing natural biofilters are maintained. For small ephemeral streams or drainage ways the biofilter zones can vary from 25 to 50 feet on each side. Perennial streams or lakes require a width of 50 to 200 feet. For wetlands, 75 to 200 feet is the norm. Widths vary according to the potential for channel erosion, the side slopes adjoining the buffer, and the level of protection desired.

Paramenters/Pollutants Potentially Addressed: Suspended sediments and associated phosphorus and metals.

Advantages: Fish, wildlife, wetlands, and water quality benefit from biofilter/buffer zones. Natural systems require very little maintenance and the water quality effectiveness is generally high due to filtering of runoff entering the waterway and the reduction of bank erosion due to equipment disturbances. Biofilter/buffer zones often add a valuable amenity for most site designs.

Disadvantages: The primary disadvantage is the resistance of some land owners to commit to the land needed for an effective biofilter. The completely landscaped types can require intensive maintenance.

Concept Variations: Biofilter zones can vary in width, the use of existing or landscaped vegetation, and the level of maintenance or upkeep needed. There is an infinite variation due to the different vegetation and soils involved from region to region.

Maintenance Requirements: Natural systems are generally better if low maintenance is applied. Artificial or landscaped systems may require mowing, pruning, and periodic vegetation replacement.

Local Implementation Options: The local implementation options include a surface water or water quality management/master plan, the comprehensive plan, and land use regulations. Such zones should also be addressed in the jurisdiction's Operation and Maintenance program and the budget.

STREAM AND RIPARIAN AREA RESTORATION

Description: Stream restoration can improve water quality, and the methods include constructed pool, transition zone, and riffle sections; stop log or weir structures; created meanders; and an artificially placed substrate to enhance habitat values. Riparian restoration involves various forms of "bioengineering", rock protection, or integrated methods. Vegetation plantings of species such as willows that will establish an extensive root mass quickly are effective. In association with wetland creation and stream restoration, low lying riparian areas can be designed that will maintain saturated soil (i.e., wetland) conditions for much or all of the year. This requires a careful design of the stream hydraulic system.

Paramenters/Pollutants Potentially Addressed: Suspended sediments are reduced through the reduction of bank erosion. Riparian zone protection or establishment can provide for temperature protection if vegetation is large enough to provide shade.

Advantages: In addition to water quality, fish, wildlife, and wetland values are enhanced through the protection or re-establishment of stream and riparian vegetation. The aesthetics and recreational values are also enhanced.

Disadvantages: Requires permits. The appropriate plant species can sometimes be difficult to obtain. The construction of good stream/riparian restoration projects is complex but the small size can be misleading for designers and contractors. In some cases, the costs are high. Some projects have failed because of inadequate consideration of hydraulics, hydrology, or stream geomorphology.

Concept Variations: A number of stream and riparian area restoration types are described above, and these lead to numerous alternatives.

Maintenance Requirements: Maintenance requirements may be high for some types of stream restorations, particularly if pools are involved and upstream erosion is high. This may result in frequent need to remove sediments from the stream structure. For many stream and riparian systems, though, once good restoration has been designed the maintenance requirements should be generally low, primarily involving periodic inspections. In some cases, volunteer maintenance projects may be used.

Local Implementation Options: The local implementation options include the surface water and water quality management/master plans, the comprehensive plans, design-construction standards and inclusion in an O&M program. Public expenditures must also be cited in a capital improvements plan.

LAKE RESTORATION

Description: Lakes are much less resistant to NPS pollutant effects than streams. This is because they trap pollutants such as sediment, most have periods of inadequate flushing, and the result is less assimilative capacity. Lakes can be restored through all of the nonpoint source control presented in this Guidebook.
In addition the following practices have been used:

- diversion of surface waters or discharges containing high pollutant levels
- replacement or repair of nutrient sources such as on-site wastewater systems
- phosphorus precipitation/inactivation
- aeration
- sediment removal
- dilution and flushing
- artificial circulation
- hypolimnetic withdrawal/aeration
- sediment oxidation
- food web manipulation
- algaecides/herbicides
- water level manipulation
- shading and sediment covers
- biological control (fish/insects)
- vegetation harvesting
- chemical additions (e.g., limestone)
- groundwater pumping-diversion
- special construction controls

Discussion of these measures, which are specifically for lake restoration, goes beyond the scope of this Guidebook. For those interested in more information, refer to "The Lake and Reservoir Restoration Guidance Manual" (1990) published by EPA.

Paramenters/Pollutants Potentially Addressed: All NPS pollutants.

Advantages: Fish, wildlife and wetland benefits occur, in addition to water quality. Since lakes act as pollutant traps/sinks they may act as a nonpoint source control measure, per se, and restoration may serve as an O&M program. Lake systems are extremely complex, and a solution to one problem is likely to result in another.

Disadvantages: The cost of lake restoration can be high. Little, if any, federal grant money is presently available for such work. Complex diagnostic work is usually required.

Concept Variations: The variations are many and depend on the lake and watershed characteristics, particularly the pollutant sources within the watershed.

Maintenance Requirements: High maintenance is generally required, in some cases involving the periodic removal of sediments or vegetation from a lake.

Local Implementation Options: The primary approach to implementation is inclusion in a water quality management plan and the jurisdiction's comprehensive plan. Design and construction programs will be necessary so the work must be included in a capital improvement plan. After lake restoration occurs an O&M program must be designed.

MONITORING

WATERSHED MONITORING

Description: Watershed monitoring documents the success of NPS control measures and provides the basis for modifying and improving them. Such monitoring can include a number of watershed characteristics. Two of the most important baseline conditions to evaluate are the soil and geologic types within the watershed. For soils, both the engineering classifications/characteristics and the SCS classification should be evaluated. The SCS characteristics are necessary if issues like erodibility, and septic tank suitability are important. If water control structures are to be constructed within the watershed the engineering classifications are essential. The vegetation conditions and soil disturbances can be recorded every few years through aerial photography. The pollution sources should be identified and monitored on a continuing basis; for example construction sites, commercial or industrial developments, areas where septic tanks are present, or stored chemical locations.

Stream and lake conditions should also be monitored. For streams this should include flow during water quality sampling and preferably on a continuous basis. Water quality parameters such as suspended solids, conductivity, total dissolved solids, phosphorus, nitrogen, and various metals should be tested for periodically. In addition, the stream bedload, or sediment which moves slowly along the substrate (the interface between the water and the bottom of the stream), may be of interest.

Sediment sampling should be done for baseline conditions and the laboratory tests should include metals, industrial chemicals and toxicity tests. Monitoring the aquatic life conditions for species abundance and diversity can be very useful in understanding the stream's health. Baseline condition tissue sampling and toxicity testing should be performed and if toxics are present the sampling should be continued. The instream finite increment method (IFIM) is important for baseline monitoring if low or high flow conditions are significant for fish. The fish passage barriers, stream structure, and riparian cover should also be identified and monitored. Lakes involve similar water quality monitoring. Lake morphology and depth-temperature-water chemistry relationships are particularly important.

A useful tool in understanding a watershed and its lake/stream health is aerial photography. This can involve the analysis of videotape to isolate various bands in the video spectrum that show beta carotene and chlorophyll A, which is useful in understanding lake eutrophication problems. Thirty-five millimeter photography involving both color slides and infrared slides are very useful in understanding the location and impact of pollutant sources and explaining those impacts to the public.

Paramenters/Pollutants Potentially Addressed: Monitoring needs will vary from one watershed to the next. The basic water quality parameters to evaluate are discussed next, followed by special water quality parameters. Watershed characteristics in addition to water quality that can be evaluated and monitored on a periodic basis are:

- Vegetation types and extent.
- Soil types (engineering and SCS).
- Disturbed soil areas.
- Pollutant sources.
- IFIM. barrier analysis, geomorphologic structure, and riparian cover for streams.
- Depth-temperature-water chemistry relationships for lakes.
- Aerial photography involving video and 35-mm (standard and infrared).

Advantages: The main advantage of watershed monitoring is to have a complete picture of stream and lake health, and the factors which are affecting that health. In addition to water quality, fish, wildlife and wetland values can benefit.

Disadvantages: The primary disadvantages involve cost and the diligence required to continue a sound watershed monitoring program.

Concept Variations: Since there are a number of aspects that can be included in watershed monitoring there are an almost infinite variety of specific monitoring programs ranging from basic water quality to aquatic life.

Maintenance Requirements: Watershed monitoring is basically a maintenance program. In order to be successful, watershed monitoring must first establish the baseline conditions and then periodically evaluate the trends. Some conditions such as vegetation cover and soil disturbance should be monitored annually, but in many cases the periodic updates can occur every three to five years depending on the rate of watershed change.

Local Implementation Options: Since comprehensive watershed monitoring involves a major commitment it should be identified in the jurisdiction's surface water management/master plan and the comprehensive plan. The program should be budgeted for, including equipment or contracts needed, and the work should be included in the agency's operation and maintenance program. Whenever possible, cost-sharing among various jurisdictions within a watershed should be a program objective.

WATER QUALITY-BASIC

Description: Basic water quality monitoring can involve grab sampling, periodic sampling and storm event sampling performed at instream stations or at outfall/mixing zone locations. Grab sampling is done at pre-established stations on an as-needed basis. Periodic monitoring is done at pre-established stations on a regularly scheduled basis (weekly, monthly, quarterly or annually). The parameters may change from one sampling event to another. Storm event monitoring occurs on the rising and falling stages of the hydrograph and the time to sample is often very difficult to determine. Flow should be measured at all sampling events and where frequent, periodic or storm event monitoring is to be performed automated equipment may be justified.

Paramenters/Pollutants Potentially Addressed: Basic water quality monitoring that focuses on the impacts of nonpoint sources involves the following:

- Flow.
- Temperature.
- pH.
- Conductivity.
- Total suspended solids/sediments (TSS).
- Total Phosphorus.
- Nitrogen.
- Biochemical Oxygen Demand (BOD).
- Bacteria.
- Oil and Grease.
- Various metals of concern, such as copper, lead and mercury.

Advantages: The advantage of basic water quality monitoring is that it helps determine the degree to which problems exist. The monitoring may be infrequent and involve a limited set of water quality parameters, but even such basic monitoring is more valuable than no data. In addition to establishing the need for nonpoint source control measures, basic water quality monitoring can measure the performance of the control measures and periodically check the trends and water quality health of the watershed.

Disadvantages: The cost for equipment, sampling, laboratory tests and data evaluation.

Concept Variations: The variables involving the number of parameters, the frequency of sampling, the quality or sophistication of the laboratory tests and the degree and type of analysis result in a large variety of monitoring program alternatives.

Maintenance Requirements: Monitoring can be considered a maintenance program *per se* but it also requires equipment maintenance and updated employee training.

Local Implementation Options: The need and specifics regarding monitoring programs should be identified in the surface water management/master plans, the capital improvements plans for equipment, and the operation and maintenance budgets.

WATER QUALITY-SPECIAL

Description: Various special types of water quality monitoring can be performed including the following:

- Bedload which measures the sediment movement along the stream substrate.
- Sediment toxicity monitoring including various risk analyses.
- Mixing zone analysis which evaluates the transitional impacts of discharges into a water body.
- Extending or expanding upon the monitoring performed can be accomplished through various 1-, 2-, and 3-dimensional water quality models (in effect the creation of an artificial database).

Paramenters/Pollutants Potentially Addressed: Presented in Appendix B.

Advantages: Special monitoring is advantageous when watersheds or water bodies have unique characteristics or problems which can only be understood through monitoring beyond the basic level.

Disadvantages: The disadvantages include the difficulty in determining the appropriate special monitoring elements, and the cost.

Concept Variations: The variations are limitless and depend on the type of monitoring, the parameters targeted, sampling frequencies, station locations and the use of automated equipment.

Maintenance Requirements: Special monitoring generally involves sophisticated equipment which must be periodically maintained and replaced and this includes both field and laboratory equipment.

Local Implementation Options: The types of special monitoring justified should be identified in a surface water/stormwater/water quality management plan and then presented in detail in a monitoring plan that becomes part of the organization's operation and maintenance program. Equipment purchasing needs should be identified in the capital improvements plan.

AQUATIC LIFE

Description: The most basic types of aquatic life monitoring involve abundance and diversity surveys of fish species and macroinvertebrates. EPA has identified a number of "Rapid Bioassessment Protocols for use in Streams and Rivers" (1989). The laboratory testing of fish tissue is also important, particularly if industrial, agricultural or silvicultural chemicals are suspected. Toxicity tests, including both acute and chronic bioassays, are important if specific discharges or stream conditions are suspected of having significantly adverse effects on the aquatic life in a stream or a lake. If fish in the stream are important then the instream finite increment method (IFIM) evaluation of high and low flow impacts may be useful. Analyzing fish passage barriers may also be needed. The stream structure and riparian conditions identified through fieldwork and aerial photography may be worthwhile.

Paramenters/Pollutants Potentially Addressed: Aquatic life monitoring can potentially address all of the parameters suspected of causing problems in a watershed or a water body.

Advantages: Monitoring aquatic life as opposed to water quality addresses to what degree aquatic resources are being affected by the various point and nonpoint sources in a watershed.

Disadvantages: Aquatic life monitoring is more labor intensive, requires more highly trained specialists in the field, and consequently costs more than other types of monitoring.

Concept Variations: There are a number of potential variations which depend on the type of monitoring to be performed, the station locations, the frequencies and the level to which systematic evaluation methods are used.

Maintenance Requirements: Aquatic life monitoring can be included as part of a maintenance program *per se*. Since aquatic life monitoring is often labor intensive rather than equipment intensive the maintenance costs for the program is usually not excessive.

Local Implementation Options: The need and type of aquatic life monitoring to be performed should be identified in a surface water/stormwater/water quality management plan and included in the organization's action programs such as an operation and maintenance program.

SEDIMENTS AND TOXICS

Description: Many types of nonpoint source contaminants are discharged into a water body on an instantaneous or short-term basis and are settled out or passed quickly through the system, so basic and many special water quality monitoring approaches may not detect problems. However, many contaminants, particularly metals and industrial/agricultural/silvicultural chemicals are partially released to the sediments. Sampling at the top, and at various depths, of the sediments can indicate problems that would otherwise be missed. Toxics are important because they can cause aquatic life and human health problems at very low concentrations. Toxics should be monitored in the water column, the sediments and fish tissue.

Parameters/Pollutants Potentially Addressed: Sediment quality is usually measured using the parameters presented in Appendix B. Toxics involve complex laboratory procedures and a wide variety of parameters that are presented in Appendix B.

Advantages: The primary advantage is the identification of problem discharges which pass through the water system undetected. The other advantage is that problems related to the aquatic food chain often originate in sediments or because of toxics.

Disadvantages: The primary disadvantage is cost.

Concept Variations: An infinite number of alternative sediment or toxic monitoring programs are possible.

Maintenance Requirements: Equipment must be maintained and replaced.

Local Implementation Options: The need and type of sediment and toxics monitoring to be performed should be identified in a surface water/stormwater/water quality management plan and included in the organization's action programs such as an operation and maintenance program.

SECTION V

SUMMARY OF FEDERAL AND STATE NPS POLLUTION CONTROL AUTHORITIES

SUMMARY OF SECTION V

- Summarizes the federal and state laws and regulations related to NPS pollution control

INTRODUCTION

This section presents the various federal and state laws that relate to nonpoint source (NPS) pollution control. The programs and processes are organized by topic so they can be referenced when dealing with a particular concern. These topics are: Water quality and resources; Oregon land use planning; hazardous materials; forest, range and agriculture; fish and wildlife; and wetlands and riparian areas. Table V-1 at the end of this section summarizes which programs apply to the various categories of NPS pollution control activity. Some programs regulate activities in several categories.

The primary federal laws and regulations related to NPS pollution control are:

- Federal Clean Water Act of 1987 (known as the Clean Water Act) - PL 92-500
- Safe Drinking Water Act of 1986 (SDWA) - PL 99-339
- Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) - PL 101-508, §6217
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or "Superfund")
- Resource Conservation and Recovery Act (RCRA)
- Various resource management laws for forest, range and water

Oregon laws and administrative rules apply to surface and groundwater quality, land use planning, hazardous materials, drinking water, fish and wildlife, agriculture, forestry, and water resources. All of these relate to NPS pollution management and are briefly discussed in this section.

The State of Oregon and the federal government administer a number of permit programs under provisions of the laws discussed above.

WATER QUALITY AND RESOURCES

OREGON WATER QUALITY STATUTES AND RULES

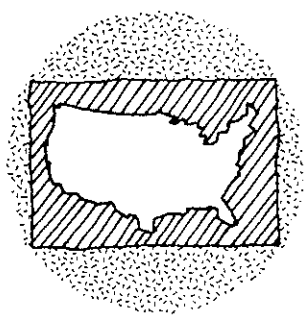
Oregon Revised Statute 468B contains the state laws pertaining to water pollution control for surface and ground waters and hazardous materials.

Oregon Administration Rules (OAR 340-41) provide a framework for the protection of water quality for the various river basins. Water quality standards have been established within this framework to protect designated beneficial uses. Exceptions to the protection of beneficial uses occur where natural conditions would exclude the beneficial use, where natural water quality exceeds standards (and natural background becomes the standard), or as specified by rule.

The Department of Environmental Quality (DEQ) is the state agency that administers federal and state environmental laws. These laws are translated into action through the Oregon Administration Rules (OARs) adopted by the Environmental Quality Commission (EQC), which is a five-member citizen commission whose members are appointed by the Governor subject to confirmation by the State Senate. In addittion to adopting rules, the Commission also establishes policy and appoints DEQ's Director. The adopted rules for DEQ pertaining to water quality are found in OAR Chapter 340, Divisions 40 through 55.

FEDERAL CLEAN WATER ACT (FCWA)

The Federal Clean Water Act (PL 92-500), as amended in 1977 and 1987, is directly related to all federal, state, and local NPS pollution control activities. Its most important NPS provisions for local governments are:



- It establishes the federal/state stormwater discharge permitting system as part of the National Pollutant Discharge Elimination System (NPDES).

- It requires total maximum daily load (TMDL) numerical limits on both point and nonpoint discharges into certain waters.

Both of these provisions are having major impacts in Oregon.

It also includes provisions that:

- Mandate facility, areawide, and watershed planning (Sections 201, 208, and 303)
- Emphasize state NPS control assessment and planning (Section 319)

Stormwater NPDES Permits

Under provisions of the Federal Clean Water Act, the Oregon Department of Environmental Quality (DEQ) administers a stormwater discharge permitting program as part of the National Pollutant Discharge Elimination System (NPDES). At present, all municipalities over 100,000 population, all industrial facilities, and all construction activities covering more than 5 acres require stormwater NPDES permits. In general, the permits require the application of Most Effective Practices (MEP), which are basically NPS pollution control measures/best management practices (BMP) for municipal, industrial, and construction activities. The industrial permits issued by DEQ can serve as a valuable resource for developing an inventory of NPS pollution sources.

TMDL Requirements

Before the enactment of the 1972 version of the Federal Clean Water Act, the states and the federal government relied on water quality standards as the basis for improving water quality. If a stream or lake did not meet the standards, the parties responsible for the pollution sources were required to clean them up. The main problem with this "water quality" approach was that it was usually difficult to determine who the responsible parties were and what part of the problem they were causing.

PL 92-500 added a "technology-based" approach in 1972. This approach requires municipal and industrial point source dischargers to provide minimum treatment facilities, regardless of the impact of the discharge on water quality. Nonpoint and point sources that still cause problems, or violations of instream state water quality standards, are to be addressed through a "water quality-based" approach. This approach involves planning, the attainment of water quality standards, and the establishment of total maximum daily loads (TMDL's) to meet

the standards. The technology-based approach worked well for point sources, but the TMDL-based water quality approach was not rigorously implemented. In 1986, a lawsuit was filed against the U.S. Environmental Protecton Agency (EPA), which resulted in an out-of-court mandate for DEQ to establish TMDL's for 13 Oregon waters.

PL 92-500 requires that:

- "...each State shall identify those waters within its boundaries for which the effluent limitations...are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters."

- "...each State shall establish for the waters identified...the total maximum daily load, for those pollutants which the Administrator (of EPA) identifies...as suitable for such calculations. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."

Section 303(d) of the act requires states to identify the quality of each body of water and compare it with its water quality standards. If the body of water does not meet water quality standards after the technology-based standards have been implemented, the water body is designated as "water quality limited."

For the segments or bodies of water designated as water quality limited, the states must establish a "total maximum daily load," or TMDL, which is the greatest amount of a pollutant that the water body can receive each day without violating water quality standards.

Both point and nonpoint sources must be taken into account. EPA's regulations establish two components for the TMDL:

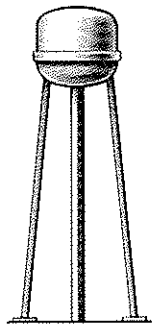
- A "waste load allocation," which is the portion of a TMDL that is allocated to point sources of pollution.

- A "load allocation," which is the portion allocated to nonpoint sources and to natural background sources of pollution.

The additional controls can be placed on nonpoint and/or point sources of pollution, and the TMDL process provides for tradeoffs between point and nonpoint pollutant loadings.

SAFE DRINKING WATER ACT OF 1986 (SDWA)

The federal Safe Drinking Water Act (PL 99-339) addresses nonpoint sources through a provision requiring states and local water agencies to establish wellhead protection zones to safeguard groundwater drinking water systems.



DEQ was designated as the lead agency for the development of Oregon's wellhead protection plan (as required under PL 99-339) in 1986. Oregon's program was initiated in 1990. It is intended to prevent the contamination of groundwater used by public water supply wells and protect drinking water supplies. Over 3,400 public water suppliers are totally or partly dependent on wells to supply community water systems. In Oregon, approximately 77 percent of the state's population uses these water supplies.

The major elements required for each state program are:

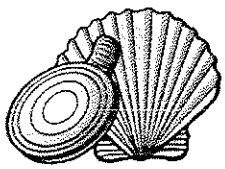
- Identification of specific duties for state and local agencies and public water suppliers
- Determination of the extent of a wellhead protection area (WHPA) around each public water supply well
- Identification of all potential sources of contamination in each WHPA
- A preventative program for management of contaminant sources
- Contingency plans for obtaining alternate drinking water supplies for each public water system in case contamination occurs
- Consideration of potential contaminant sources during the siting process for new wellfields
- Public participation

Wellhead protection will be integrated into the state's existing comprehensive groundwater protection programs, including the basin planning and the critical groundwater area program administered by the Oregon Water Resources Department and the statewide comprehensive land use planning administered by the Department of Land Conservation and Development.

COASTAL ZONE ACT REAUTHORIZATION AMENDMENTS (CZARA)

Congress reauthorized and amended the Coastal Zone Management Act in 1990. The amendments include new requirements for states with approved coastal management programs. Oregon has had an approved coastal program since 1977.

One of the amendments (Section 6217) requires that all states with coastal programs develop a Coastal Nonpoint Pollution Control Program (CNPCP) by July 1995. CNPCP's are to be developed jointly by state water quality and coastal resource management agencies. Their development and implementation is to involve state, federal, and local water quality, land use planning, and habitat conservation authorities.



The purpose of the CNPCP is to implement basic measures for controlling several types of NPS pollution in coastal areas. Among other things, state programs must contain NPS pollution control measures that conform with EPA guidance (*Coastal Nonpoint Pollution Control Program - Program Development and Approval Guidance*, EPA, 1993), and must implement additional control measures where necessary. States must also develop mechanisms to improve coordination among state and local programs responsible for land use, water quality, habitat protection, and public health.

Congress directed EPA to publish "...guidance for specifying management measures for sources of nonpoint pollution in coastal waters." EPA's guidance is at the center of the CNPCP. It contains measures for six NPS categories: agriculture, forestry, urban areas, marinas and recreational boating, hydromodification (channels, dams, shorelines), and wetland and riparian areas. States must implement the EPA measures or an alternative as effective as the measure, or justify why the measure is not in the state's program.

Local jurisdictions will invariably be involved in developing and implementing Oregon's coastal nonpoint program. The EPA guidance must be integrated into Oregon's state programs before they can be applied locally. For example, some measures in the EPA guidance for urban runoff and existing development may only apply inside urban growth boundaries (UGBs), but not rural sites, while measures for watershed protection, site development, construction activities, and roads, highways and bridges may eventually be applied in all areas.

The Oregon Coastal Program has coordinated an inventory of the programs that already implement some of the measures in EPA's guidance. The inventory will be used as the basis for developing Oregon's program. Although the CNPCP must contain NPS pollution control measures that are enforceable rather than merely voluntary or advisory, Oregon's program will also include measures such as education and technical assistance.

THE EPA ROLE

Although EPA does not have any direct role in NPS pollution management in Oregon, it does have a number of indirect roles. These include:

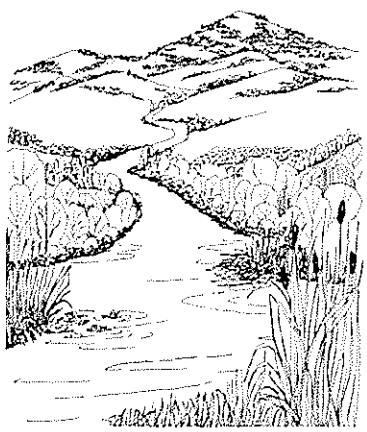
- A veto-type power in U.S. Army Corps of Engineers' Clean Water Act Section 404 permitting
- Administration of the federal review role for statewide NPS pollution assessment and planning
- Review authority for both the SDWA and FCWA regulations
- The provision of grants to the state for certain types of NPS control activities

OREGON DEPARTMENT OF WATER RESOURCES PROGRAMS

The Oregon Water Resources Department (OWRD) administers water law within the state. This function has become increasingly complex in recent years because of instream rights, water availability, and the number of protests on new applications. NPS pollution management is affected because water quality wetlands and ponds require a water right for losses due to evapotranspiration. Since the process can involve up to 2 or 3 years, a combined application for all such facilities in an entire watershed is advisable, if that approach is acceptable to OWRD for the watershed in question.

GROUNDWATER PROTECTION

Groundwater resources receive considerable protection under provisions of the SDWA, the FCWA, Oregon's drinking water laws, and the Oregon counterparts to the SDWA and FCWA. It must be demonstrated that ponded NPS pollution control facilities (such as wetlands) will not adversely affect groundwater resources. Also involved are the wellhead protection zones provided for in the SDWA.



WATERSHED MANAGEMENT PLANNING

With the passage of HB 2215, the Oregon Legislature created an opportunity for local, state, and federal agencies to work together with property owners, residents, and other interested parties to create a more cooperative approach to dealing with water quality and quan-

tity. The establishment of watershed councils allows for the melding of local people and resources with the technical expertise of federal and state agencies. The focus is on developing implementation programs that are based upon consensus and local action.

OREGON LAND USE PLANNING

Oregon has a nationally recognized land use planning program that has won numerous awards. That system establishes a program of state goals and guidelines to be used by local governments to create each community's plans and regulations. Those plans are then reviewed by the Land Conservation and Development Commission (LCDC) for compliance with the state rules. Local jurisdictions not in compliance can lose state funds and face legal action from LCDC.

Once a plan is in compliance, changes made to the plan and/or development regulations must be consistent with the state land use goals, the Oregon Revised Statutes (ORS), and associated Oregon Administrative Rules (OAR). The state goals are included as part of the Oregon laws adopted by the Oregon Legislature. In addition, the Oregon Revised Statutes contain a number of other procedural provisions regarding public hearings, zoning requirements, land division rules, and authority for special activities granted to local governments by the legislature.

ORS 197

ORS 197 establishes and provides direction to the LCDC, Department of Land Conservation and Development (DLCD), Land Use Board of Appeals, and other associated organizations. It also contains the statewide goals; provides for enforcement; and gives additional direction for activities of special interest, such as planning on federal lands, housing, destination resorts, and post-acknowledgment (for changes after the local plan has been approved by the state).

ORS 215

ORS 215 focuses on county planning responsibilities. It establishes the authority to create planning commissions, the requirement to hire a planning director, code enforcement provisions, agricultural lands zoning, hearings procedures, and special requirements for land use zones.

ORS 227

ORS 227 allows for and defines city planning. It authorizes planning commissions and establishes hearings procedures. It also provides special authority and responsibilities regarding solar access, truck routes, and wetlands.

ORS 92

ORS 92 regulates the division of land. It establishes the basis for dividing current ownerships into lots for development by creating the definitions, procedures, surveying requirements, recording standards, and other related rules.

ORS 196

ORS 196 defines wetlands, creates responsibilities for state and local agencies, and determines planning requirements for wetland and estuary management plans. It also specifies and authorizes regulations for removing materials or filling lands in or adjoining waters within Oregon.

OREGON ADMINISTRATIVE RULES

The above regulations often require further clarification or need to have administrative activities established. This occurs through the creation of rules by state commissions. The LCDC adopts Oregon Administrative Rules to clarify planning activities or to establish needed processes for conducting planning inventories, determining final plans, writing ordinances, or performing other typical planning tasks.

DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT

Many of the DLCD's activities are related to providing advice or information to local governments. While local planning activities must be consistent with state goals and rules, local governments are called upon to initiate and develop their own programs and approaches to satisfy the public's needs and interests. For example, in developing regulations for floodplains, the federal government provides model rules, information, and an insurance program that assures local governments of at least a minimum amount of flood protection. The DLCD provides an administrator who advises local planners on the rules, helps obtain the needed information, and keeps local planning offices informed about changing rules and conditions.

The DLCD has no permitting program. It coordinates with other state agencies that do issue permits, and advises local planning departments as they develop permitting systems. The DLCD also administers local planning grants. These funds are given to cities and counties that need to improve their plans or development regulations. The funds are often tied to particular programs, such as periodic review. (Every 5 to 7 years, local plans must be updated to ensure they are consistent with local issues and state standards.) They are also often tied to special priorities, such as destination resorts. (State legislation calls for more planning to foster this economic activity.) The funds are often critical for helping local governments develop new processes and projects needed to make the system work.

LAND USE GOALS

Several statewide planning goals relate to water quality and need to be considered in developing an NPS pollution control program. The way in which the goals relate to NPS pollution control activities varies with the goal language and intent.

Goal 3: Agricultural Lands

Agricultural practices can have a substantial effect on, and be dramatically affected by, water quality. However, local governments do not directly control routine farm activities through land use planning. Goal 3 addresses the protection of agricultural lands and provides for other related activities in the resource area, many of which do require local permits and may need to be evaluated for NPS pollution. For example, locating an auction yard in a resource zone could be permitted, but careful siting and design would substantially reduce the likelihood of introducing pollutants into streams from the parking or holding areas. SB 1010 (see Appendix A) provides a vehicle for local governments to affect agricultural practices regarding NPS pollution.

Goal 4: Forest Lands

The management of forest lands involves a variety of activities that directly or indirectly affect water quality. The construction of access roads, use of chemicals and fuels, and assorted human activities can have an substantial impact unless properly managed. While local governments protect forest lands, it is rare that they become directly involved with forest practices, unless the work is part of a resort or other regulated commercial or residential project. Notable exceptions exist, such as the Ashland Watershed Protection Program in Jackson County, which addressed water quality impacts from timber harvesting through Section 313 of the FCWA.

Goal 5: Open Spaces, Scenic and Historic Areas, and Natural Areas

Because this goal deals with the protection of water areas, wetlands, watersheds, and groundwater areas, a direct connection exists between local planning efforts and NPS pollution control. These important sites must be inventoried, evaluated, and then allocated for either protection or appropriate development. This has become substantially more complex as the state and federal governments have created new wetland rules. While local government still plays a key role, they are one player in a larger team.

Goal 6: Air, Water, And Land Resources Quality

Goal 6 is a clear mandate to local governments to maintain and improve the quality of the state's water resources. This goal identifies the state's interest in ensuring that developments approved in Oregon are consistent with the state and federal environmental quality rules. It endorses the importance of protecting the local carrying capacity of river basins, as well as preserving the resources from degradation or loss. This is the primary land use goal relating to NPS pollution control.

Goal 7: Areas Subject To Natural Disasters And Hazards

Goal 7 provides for the protection of the public from natural disasters such as floods. It provides local governments an easy avenue for establishing buffers and regulations that keep potentially polluting activities away from waterways and many groundwater recharge areas. Like Goal 6, this goal provides substantive authority to address NPS pollution issues.

Goal 11: Public Facilities And Services

Goal 11 calls for local governments to create public facility plans and capital improvement programs to ensure the efficient and effective delivery of public services. Like Goal 6, this provides an opportunity to guide development away from potentially hazardous areas for NPS pollution. It also allows the governments to plan for surface water facilities that protect the environment, such as sedimentation ponds or wetlands and wellhead protection areas.

Goal 15: Willamette River Greenway

This goal created the Willamette River Greenway and calls for special regulation and protection activities, including land purchase, in the vicinity of the Willamette River. Special permits and controls of agricultural, timber, mining, and other activities along the river provide useful opportunities to protect and enhance water quality.

Goal 16: Estuarine Resources

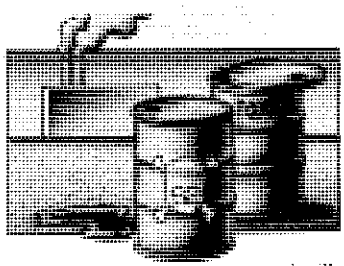
Estuaries must often absorb the effects of many pollutants used in the area and upstream. Because they act as a natural cleansing area, their protection is critical to the maintenance of water quality. The state's planning and protection efforts, as well as the federal government's coastal zone management regulations, provide important resources, guidance, and standards for preservation of these key resources.

Goal 17: Coastal Shorelands

The lands lying near coastal waters that are designated coastal shorelands have significant water-related characteristics. Many of these areas are wetlands or riparian areas that require special protection. A primary portion of Goal 17 is: "To reduce...the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands."

HAZARDOUS MATERIALS

CERCLA AND RCRA



The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or "Superfund") and the Resource Conservation and Recovery Act (RCRA) both address hazardous materials.

CERCLA's primary value for NPS pollution managers is that it provides for the identification of sites with major hazardous materials contamination and establishes a cleanup program. The cleanup may be publicly funded if no responsible parties can be legally identified, or it may be funded by one or more parties responsible for the contamination.

RCRA is a significant source of NPS industrial/commercial site information because it provides for the licensing of all handlers of hazardous materials. Also important is its program for the removal of underground storage tanks, which often present NPS water quality problems.

STATE HAZARDOUS MATERIALS LAWS AND REGULATIONS

Several Oregon laws and administrative rules address hazardous materials. Most implement and conform with the counterpart federal laws and regulations. The DEQ files concerning CERCLA and RCRA sites/licensees are an important resource for NPS pollution planners and managers. These files can be reviewed, and provide an excellent starting point for a pollution source inventory in a watershed.

FOREST, RANGE, AND AGRICULTURE

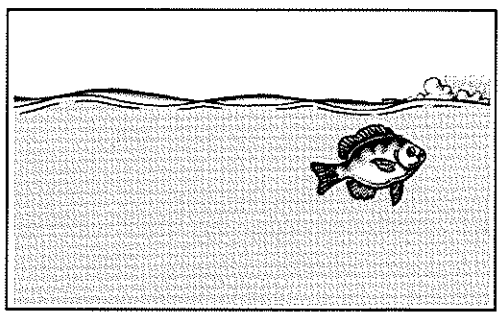
The U.S. Forest Service is governed by provisions of the National Forest Management Act of 1976 (NFMA) and all other applicable federal laws. This includes Section 313 of the FCWA, which requires that federal agencies comply with local water quality requirements. (See Appendix A.) Similar provisions exist for rangeland and the Bureau of Land Management. The most important aspect of NFMA is a requirement to develop forest plans that optimize a number of resource uses, including water quality and fish.

For agriculture, one of the most significant laws involves the establishment and funding for the Soil Conservation Service and its local partners, the soil and water conservation districts. Both of these organizations are important resources for addressing NPS pollution problems.

The Oregon Department of Agriculture (ODA) has new authority under SB 1010 (1993) regarding agricultural practices related to water quality. Local jurisdictions can have an important role in working with agricultural interests to reduce NPS pollution impacts.

The Oregon Department of Forestry governs forest practices under provisions of the Oregon Forest Management Act. Under current provisions of the Forest Management Act, it may be difficult for most jurisdictions to control NPS pollution impacts from state and private forest activities, except through cooperative efforts with DEQ in the administration of TMDL provisions.

FISH AND WILDLIFE



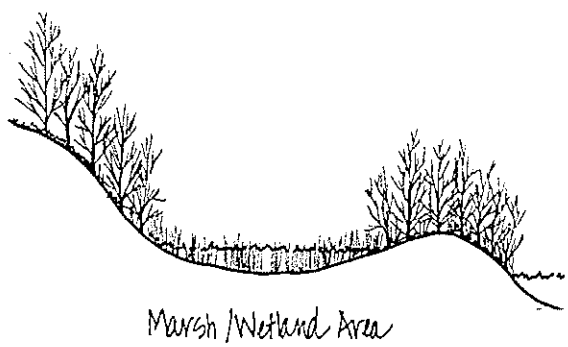
The Oregon Department of Fish and Wildlife (ODFW) administers a number of laws and administrative rules regarding fish and wildlife. Of particular importance is the agency's role as reviewer of U.S. Army Corps of Engineers Section 404 permits and Oregon Division of State Lands (ODSL) removal-fill permits (ORS 196.800-.990) involving fill operations and wetlands. The Corps of Engineers and ODSL usually include ODFW comments as conditions of the permit. This process can be used to strengthen NPS pollution management within a watershed through coordinated planning and review. It can also be a major hurdle in the permitting process for NPS water quality facilities that are large, regional in nature, and on a stream with significant fish resources.

If a local jurisdiction is planning for regional, public NPS facilities, early discussions with ODFW are advisable. (Examples of regional, public NPS facilities include stormwater wetlands, sedimentation ponds, and vegetated swales that receive runoff from a number of land owners and that are owned and maintained by public agencies.) The joint development of a "fish management plan" can help in the coordination and provide ODFW with a basis for making its decisions and comments.

WETLANDS AND RIPARIAN AREAS

WETLANDS PERMITS (SECTION 404 OF THE FCWA) AND WATER QUALITY CERTIFICATION

Section 404 permits involve a federal/state process administered by the U.S. Army Corps of Engineers. The Oregon Division of State Lands (ODSL) administers a similar process. Most fill operations in water or wetland environments require a Section 404 permit, including NPS pollution control facilities. The process requires a minimum of 60 days after the application is submitted, and it can be considerably longer before a permit is issued.



In addition to the direct authority the Corps of Engineers and ODSL have, a number of agencies review the permit applications. These agencies include EPA, DEQ, ODFW, and the U.S. Fish and Wildlife Service. Their comments usually lead to conditions of the permit. DEQ must provide a FCWA Section 401 water quality certification indicating that water quality requirements pertinent to the project will be met.

An application can be filed with either the Corps of Engineers or ODSL, and the process is automatically synchronized. The permitting organizations meet informally as the statewide interagency meeting (SWIM) committee to discuss permit applications with applicants and coordinate their activities. It is advisable to meet with SWIM as early as possible to discuss the project for which a permit will be required.

DIVISION OF STATE LANDS PERMIT

The Division of State lands inventories wetlands within the state and administers the removal-fill law (ORS 196.800-.990).

WATER RIGHTS

A water right is required for facilities that include a long-term water surface, such as ponds or wetlands. This process is very time consuming. If the watershed involved is relatively small and the issues are legally straightforward, it is advisable to apply for a watershed coverage permit (which covers a number of facilities within a watershed).

TABLE V-1
FEDERAL AND STATE AUTHORITIES RELATED TO NPS POLLUTION CATEGORIES

	NPS POLLUTION CATEGORIES				
Federal and State Authorities	Agriculture	Forest Harvest	Residential	Commercial	Industrial
FCWA (PL 92-500)					
NPDES Permits - § 402			●	●	●
TMDL - §303	●	●	●	●	●
Wetlands - §404	●	●	●	●	●
DEQ WQ Cert - §401	●	●	●	●	●
SDWA - Wellhead Protection	●	○	●	●	●
CZARA - §6217	●	●	●	●	●
LCDC and Land Use					
LCDC ORS 197	○	○	○	○	○
County ORS 215	○	○	○	○	○
City ORS 227	○	○	○	○	○
Goal 3-Agricultural Lands	●	○			
Goal 4-Forest Lands	○	●			
Goal 5-Open Sp.-Nat. Areas	○	○	●	●	●
Goal 6-Air & Water Quality	●	●	●	●	●
Goal 7-Natural Disasters	○	○	●	●	●
Goal 11-Public Facilities			●	●	●
Goal 15-Willamette River	●	●	●	●	●
Goal 16-Estuarine Resources	●	●		●	●
Goal 17-Coastal Shorelands	○		●	●	●
CERCLA and RCRA	○	○	○	●	●
NFMA		●			
ODA Authorities	○				
ODFW Authorities	○	○	○	○	○
OWRD - Water Authorities	○	○	○	○	○
ODSL Authorities	●	●	●	●	●

● = Significant regulatory relationship ○ = Moderate regulatory relationship

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GLOSSARY

Access road: A temporary or permanent road over which timber is transported from a loading site to a public road. Also known as a haul road.

Adsorption: The accumulation of substances at the interface between two phases; in water treatment, the interface is between the liquid and solid surfaces that are artificially provided.

Alignment: The horizontal route or direction of an access road.

Aquifer: A geologic formation or structure that transmits water in sufficient quantity to supply the needs for a water development; usually saturated sands, gravel, fractures, and cavernous and vesicular rock.

Bank: (1) The rising ground bordering a lake, river, or sea; or of a river or channel, for which it is designated as right or left as the observer is facing downstream. (2) An elevation of the sea floor or large area, located on a continental (or island) shelf and over which the depth is relatively shallow but sufficient for safe surface navigation; a group of shoals. (3) In its secondary sense, used only with a qualifying word such as "sandbank" or "gravelbank," a shallow area consisting of shifting forms of silt, sand, mud, and gravel.

Bathymetry: The measurement of depths of water in oceans, seas, and lakes; also information derived from such measurements.

Bay: A recess in the shore or an inlet of a sea between two capes or headlands, not so large as a gulf but larger than a cove.

Beach: The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). The seaward limit of a beach—unless otherwise specified—is the mean low water line. A beach includes *foreshore* and *backshore*.

Bed load transport: Sediment transport along the bottom of a waterbody due to currents.

Benthic: Associated with the sea or lake bottom.

Berm: 1) An earthen mound used to direct the flow of runoff around or through a best management practice (BMP) (Schueler, 1987); 2) A low earth fill constructed in the path of flowing water to divert its direction, or constructed to act as a counterweight beside the road fill to reduce the risk of foundation failure (buttress).

Best Management Practice (BMP): A practice or combination of practices that are determined to be the most effective and practicable means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals.

Biotic: Caused or produced by living beings.

BOD: Biochemical oxygen demand; the quantity of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter and oxidizable inorganic matter by aerobic biological action.

Bottom: The ground or bed under any body of water; the bottom of the sea.

Brush barrier: A sediment control structure created of slash materials piled at the toe slope of a road or at the outlets of culverts, turnouts, dips, and water bars.

Buffer area: A designated area around a stream or waterbody of sufficient width to minimize entrance of sediment or chemicals (fertilizers, pesticides, and fire retardants) into the waterbody.

Cable logging: A system of transporting logs from stump to landing by means of steel cables and winch. This method is usually preferred on steep slopes, wet areas, and erodible soils where tractor logging cannot be carried out effectively.

Channel: (1) A natural or artificial waterway or perceptible extent that either periodically or continuously contains moving water, or that forms a connecting link between two bodies of water. (2) The part of a body of water deep enough to be used for navigation through an area otherwise too shallow for navigation. (3) A large strait, as the English Channel. (4) The deepest part of a stream, bay, or strait through which the main volume or current of water flows.

Channelization and channel modification: River and stream channel engineering for the purpose of flood control, navigation, drainage improvement, and reduction of channel migration potential; activities include the straightening, widening, deepening, or relocation of existing stream channels, clearing or snagging operations, the excavation of borrow pits, underwater mining, and other practices that change the depth, width, or location of waterways or embayments in coastal areas.

Check dam: A small dam constructed in a gully to decrease the flow velocity, minimize channel scour, and promote deposition of sediment.

Clearcutting: A silvicultural system in which all merchantable trees are harvested within a specified area in one operation to create an even-aged stand.

Coast: A strip of land of indefinite width (may be several kilometers) that extends from the shoreline inland to the first major change in terrain features.

Coastal area: The land and sea area bordering the shoreline.

Coastal plain: The plain composed of horizontal or gently sloping strata of clastic materials fronting the coast, and generally representing a strip of sea bottom that has emerged from the sea in recent geologic time.

Coastline: (1) Technically, the line that forms the boundary between the *coast* and the *shore*. (2) Commonly, the line that forms the boundary between the land and the water.

Composting: A controlled process of degrading organic matter by microorganisms.

Constructed or stormwater wetland: Engineered systems designed to simulate natural wetlands to utilize the water purification functional value for human use and benefits.

Contour: An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting the points of the same elevation.

Conveyance system: The drainage facilities, both natural and human-made, which collect, contain, and provide for the flow of surface water and urban runoff from the highest points on the land down to a receiving water. The natural elements of the conveyance system include swales and small drainage courses, streams, rivers, lakes, and wetlands. The human-made elements of the conveyance system include gutters, ditches, pipes, channels, and most retention/detention facilities.

Culvert: A metal, wooden, plastic, or concrete conduit through which surface water can flow under or across roads.

Cut-and-fill: Earth-moving process that entails excavating part of an area and using the excavated material for adjacent embankments or fill areas.

Delta: An alluvial deposit, roughly triangular or digitate in shape, formed at a river mouth .

Dike: An embankment to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge: Outflow; the flow of a stream, canal, or aquifer. One may also speak of the discharge of a canal or stream into a lake, river, or ocean. (Hydraulics) Rate of flow, specifically fluid flow; a volume of fluid passing a point per unit of time, commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, gallons per day, or millions of gallons per day.

Diversion: A channel, embankment, or other man-made structure constructed to divert water from one area to another.

DO: Dissolved oxygen; the concentration of free molecular oxygen in the water column.

Ecosystem: The complex of a community and its environment functioning as an ecological unit in nature; a basic functional unit of nature comprising both organisms and their nonliving environment, intimately linked by a variety of biological, chemical, and physical processes.

Embankment: An artificial bank such as a mound or dike, generally built to hold back water or to carry a roadway.

EPA: United States Environmental Protection Agency.

Erosion: The wearing away of the land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices related to farming, residential or industrial development, road building, or timber cutting. The term erosion is usually preceded by a definitive term denoting the type or source of erosion such as mass erosion, surface erosion, or bank erosion.

Estuary: (1) The part of the river that is affected by tides. (2) The region near a river mouth in which the fresh water in the river mixes with the salt water of the sea.

Eutrophication: The alteration of lake ecology through excessive nutrient input, characterized by excessive growth of aquatic plants and algae and low levels of dissolved oxygen (USEPA, 1992).

Fecal coliform: Bacteria present in mammalian feces, used as an indicator of the presence of human feces, bacteria, viruses, and pathogens in the water column.

Fertilizer: Any organic or inorganic material of natural or synthetic origin that is added to a soil to supply elements essential to plant growth.

Fill slope: The surface formed where earth is deposited to build a road or trail.

Filtration: The process of being passed through a filter (as in the physical removal of impurities from water) or the condition of being filtered.

Gabion: A rectangular basket or mattress made of galvanized, and sometimes PVC-coated, steel wire in a hexagonal mesh. Gabions are generally subdivided into equal-sized cells that are wired together and filled with 4- to 8-inch-diameter stone, forming a large, heavy mass that can be used as a shore-protection device.

Geomorphology: That branch of both physiography and geology that deals with the form of the Earth, the general configuration of its surface, and the changes that take place in the evolution of landform.

Grade (gradient): The slope of a road or trail expressed as a percentage of change in elevation per unit of distance traveled.

Groundwater: Subsurface water occupying the zone of saturation. In a strict sense, the term is applied only to water below the water table.

Habitat: The place where an organism naturally lives or grows.

Harvesting: The felling, skidding, processing, loading, and transporting of forest products.
Heavy metals: Metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead. They can damage living things at low concentrations and tend to accumulate in the food chain.

Herbicide: A chemical substance designed to kill or inhibit the growth of plants, especially weeds.

Hydrologic modification: The alteration of the natural circulation or distribution of water by the placement of structures or other activities.

Hydromodification: Alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources.

Illicit discharge: All nonurban runoff discharges to urban runoff drainage systems that could cause or contributeä to a violation of State water quality, sediment quality, or ground-water quality standards, including but not limited to sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater system.

Impervious surface: A hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development and/or a hard surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, rooftops, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces that similarly impede the natural infiltration of urban runoff. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces.

Impoundment: The collection and confinement of water as in a reservoir or dam.

Infiltration: The penetration of water through the ground surface into subsurface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Inlet: (1) A short, narrow waterway connecting a bay, lagoon, or similar body of water with a large parent body of water. (2) An arm of the sea (or other body of water) that is long compared to its width and may extend a considerable distance inland.

Insecticide: A pesticide compound specifically used to kill or control the growth of insects .

Jetty: (United States usage) On open seacoasts, a structure extending into a body of water, which is designed to prevent shoaling of a channel by littoral materials and to direct and confine the stream or tidal flow. Jetties are built at the mouths of rivers or tidal inlets to help deepen and stabilize a channel.

Levee: An embankment or shaped mound for flood control or hurricane protection.

Littoral: Of or pertaining to a shore.

Livestock: Domestic animals.

Load: The quantity of sediment transported by a current. It includes the suspended load of small particles and the bedload of large particles that move along the bottom.

Load: The quantity (i.e., mass) of a material that enters a waterbody over a given time interval (Soil Conservation Society of America, 1982).

Local government: Any county, city, town or special district having its own incorporated government for local affairs.

Logging debris (slash): The unwanted, unutilized, and generally unmerchantable accumulation of woody material, such as large limbs, tops, cull logs, and stumps, that remains as forest residue after timber harvesting.

Macrophytes: Plants visible to the naked eye.

Manure: The fecal and urinary defecations of livestock and poultry; may include spilled feed, bedding litter, or soil.

Marsh: An area of soft, wet, or periodically inundated land, generally treeless and usually characterized by grasses and other low growth.

Marsh vegetation: Plants that grow naturally in a marsh.

Mathematical modeling: Predicting the performance of a design based on mathematical equations.

Municipal separate storm sewer systems: Any conveyance or system of conveyance that is owned or operated by the State or local government entity, is used for collecting and conveying storm water, and is not part of a publicly owned treatment works (POTW), as defined in EPA 40 CFR Part III.

NPDES: National Pollutant Discharge Elimination System. A permitting system for point source polluters regulated under section 402 of the Clean Water Act.

Nutrients: Elements, or compounds, essential as raw materials for organism growth and development, such as carbon, nitrogen, phosphorus, etc.

Organics: Carbon-containing substances such as oil, gasoline, and plant matter.

Peninsula: An elongated body of land nearly surrounded by water and connected to a large body of land.

Percolation: The downward movement of water through the soil.

Permeability: The quality of a soil horizon that enables water or air to move through it; may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Pesticide: Any chemical agent used for control of plant or animal pests. Pesticides include insecticides, herbicides, fungicides, nematocides, and rodenticides.

Pollutant: Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water (Section 502(6) of The Clean Water Act as amended by the Water Quality Act of 1987, Pub. L. 100-4).

Range: Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Range includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, wet meadows, and riparian areas.

Rapid bioassessment: An assessment of the environmental degradation of a waterbody based on a comparison between a typical species assemblage in a pristine waterbody and that found in the waterbody of interest.

Regional NPS control facilities: Regional NPS control facilities receive runoff from a number of land owners, and are owned and maintained by public agencies. Examples of such facilities include stormwater wetlands, sedimentation ponds, and vegetated swales.

Residence time: The length of time water remains in a waterbody.

Retrofit: The creation or modification of an urban runoff management system in a previously developed area. This may include wet ponds, infiltration systems, wetland plantings, streambank stabilization, and other BMP techniques for improving water quality and creating aquatic habitat. A retrofit can consist of the construction of a new BMP in a developed area, the enhancement of an older urban runoff management structure, or a combination of improvement and new construction.

Revetment: A facing of stone, concrete, etc., built to protect a scarp, embankment, or shore structure against erosion by wave action or currents.

Riparian: Pertaining to the banks of a body of water. For the purposes of this report, riparian refers to areas adjoining waterbodies, including rivers, streams, bays, estuaries, and coves.

Riparian area: Vegetated ecosystems along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody. These systems encompass wetlands, uplands, or some combination of these two land forms; they will not in all cases have all of the characteristics necessary for them to be classified as wetlands.

Riprap: Rock or other large aggregate that is placed to protect streambanks, bridge abutments, or other erodible sites from runoff or wave action.

Rubble: (1) Loose, angular, waterworn stones along a beach. (2) Rough, irregular fragments of broken rock.

Runoff: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into the receiving waters.

SCS: Soil Conservation Service of USDA.

Sediment: The product of erosion processes; the solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice.

Sedimentation: The process or act of depositing sediment.

Seepage: Water escaping through or emerging from the ground along an extensive line or surface as contrasted with a spring, where the water emerges from a localized spot.

Selection method: An uneven-aged silvicultural system in which mature trees are removed, individually or in small groups, from a given tract of forestland over regular intervals of time.

Settleable solids: Solids in a liquid that can be removed by stilling a liquid. Settling times of 1 hour (APHA/AWWA/WPFC, 1975) or more are generally used.

Shelterwood method: Removal of the mature timber in a series of cuttings that extend over a relatively short portion of the rotation in order to encourage the establishment of essentially even-aged reproduction under the partial shelter of seed trees.

Silvicultural system: A process, following accepted silvicultural principles, whereby the tree species constituting forests are tended, harvested, and replaced. Usually defined by, but not limited to, the method of regeneration.

Skid: Short-distance moving of logs or felled trees from the stump to a point of loading.

Skid trail: A temporary, nonstructural pathway over forest soil used to drag felled trees or logs to the landing.

Slash: See *logging debris*.

Slope: Degree of deviation of a surface from the horizontal, measured as a numerical ratio, as a percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second number is the vertical distance (rise), as 2:1. A 2:1 slope is a 50 percent slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90 degree slope being vertical (maximum) and a 45 degree slope being a 1:1 slope.

Soil absorption field: A subsurface area containing a trench or bed with clean stones and a system of distribution piping through which treated sewage may seep into the surrounding soil for further treatment and disposal.

Soil classification (size): An arbitrary division of a continuous scale of grain sizes such that each scale unit or grade may serve as a convenient class interval for conducting the analysis or for expressing the results of an analysis.

Soil survey: A general term for the systematic examination of soils in the field and in laboratories; their description and classification; the mapping of kinds of soil; the interpretation of soils according to their adaptability for various crops, grasses, and trees; their behavior under use or treatment for plant production or for other purposes; and their productivity under different management systems.

Species diversity: The variations between groups of related organisms that have certain characteristics in common.

Stormwater wetlands: Those wetlands that are intentionally created for the primary purpose of runoff treatment and are managed as such. Stormwater wetlands are normally considered as part of the runoff collection and treatment system.

Stream: (1) A course of water flowing along a bed in the earth. (2) A current in the sea formed by wind action, water density differences, etc.; e.g., the Gulf Stream.

Surface water: All water whose surface is exposed to the atmosphere.

Suspended sediment: The very fine soil particles that remain in suspension in water for a considerable period of time.

Suspended solids: Solid materials that remain suspended in the water column.

Tailwater: Irrigation water that reaches the lower end of a field.

Tillage: The operation of implements through the soil to prepare seedbeds and rootbeds, control weeds and brush, aerate the soil, and cause faster breakdown of organic matter and minerals to release plant foods.

Topography: The relative positions and elevations of the natural or man-made features of an area that describe the configuration of its surface.

Upland: Ground elevated above the lowlands along rivers or between hills.

Urban runoff: That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, underflow, or channels or is piped into a defined surface water channel or a constructed infiltration facility.

USDA: United States Department of Agriculture.

Vegetated buffer: Strips of vegetation separating a waterbody from a land use that could act as a nonpoint pollution source. Vegetated buffers, buffers or filter strips are variable in width and can range in function from vegetated filter strips to wetlands or riparian areas.

Vegetated filter strip: Created areas of vegetation designed to remove sediment and other pollutants from surface water runoff by filtration, deposition, infiltration, adsorption, decomposition, and volatilization.

Waste: Material that has no original value or no value for the ordinary or main purpose of manufacture or use; damaged or defective articles of manufacture; or superfluous or rejected matter or refuse.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation. The land area that drains into a receiving waterbody.

Water table: The upper surface of the ground water or that level below which the soil is saturated with water; locus of points in soil water at which the hydraulic pressure is equal to atmospheric pressure.

Wetlands: Those areas that are inundated or saturated by surface water or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions; wetlands generally include swamps, marshes, bogs, and similar areas.

Xeriscaping: A horticultural practice that combines water conservation techniques with landscaping; also known as dry landscaping.

Yarding: Method of log transport from harvest area to storage landing.

Appendix A1
CZARA

United States
Environmental Protection
Agency

Office of Water (WH-553)
Washington, DC 20460

EPA-841-N-93-006
April 1993
#28

EPA NPS News-Notes

The Condition of the Water-Related Environment
The Management and Ecological Restoration of Watersheds
The Control of Nonpoint Sources of Water Pollution

Two Coastal Nonpoint Pollution Control Guidances Issued: Management Measures and Program Development and Approval

The recently published guidance issued under the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) represents an innovative approach for controlling nonpoint pollution. First, it presents a joint program — state water quality and coastal zone management agencies are to work together to develop and implement coastal nonpoint pollution control programs. These programs are to build upon and integrate existing state and local authorities and expertise. Second, the program will employ initial "technology-based" management measures throughout the coastal management area, to be followed by a more stringent water quality-based approach, where necessary, to address known water quality problems. Finally, the state coastal nonpoint program requires some insurance, in the form of state enforceable policies and mechanisms, that nonpoint source controls are actually implemented. Section 6217, applicable in the 29 states and territories with approved coastal zone management programs, include several of the Great Lakes states. As reported in *News-Notes #26*, EPA and NOAA have made two guidance documents available to assist states and others in meeting the new program requirements. The first document, "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters," is EPA's technical guidance on ways to reduce or prevent nonpoint pollution in coastal waters. The second document, "Coastal Nonpoint Pollution Control Program — Program Development and Approval Guidance," was developed by EPA and NOAA to provide a road map for states to develop the coastal nonpoint programs required by section 6217 in a timely and resource-efficient manner.

Management Measures Guidance

Congress required EPA, in consultation with NOAA and other federal agencies, to develop guidance specifying the best available, economically achievable, management measures to control nonpoint pollution in coastal waters. The measures reflect the greatest degree of pollutant reduction achievable through the application of best available technology, siting criteria, operating methods, or alternatives.

The guidance includes a chapter for each of five major categories of nonpoint pollution: agriculture, forestry, urban (including new development, septic tanks, roads, bridges, and highways), marinas and recreational boating, and hydromodification. Also included is a chapter describing ways that wetlands and riparian areas can be used to prevent pollution from a variety of sources. Each chapter contains the management measures with which state programs must conform. In addition, each chapter describes management practices that may be used to achieve the measure, activities and locations for which each measure may be suitable, and information on the cost and effectiveness of the measures and/or practices.

The management measures are described in terms of management systems rather than individual BMPs. Many of these systems include actions that reduce the generation of pollutants — a pollution prevention approach — as well as actions to keep pollutants from reaching surface or ground coastal waters. Measures range from traditional activities, such as erosion control, to more comprehensive strategies, such as watershed planning, to help minimize urban runoff.

Agriculture

The primary agricultural nonpoint pollutants are nutrients (particularly nitrogen and phosphorus), sediments, animal wastes, pesticides, and salts. The guidance proposes the following measures:

Sediment/erosion control—The goal of this measure is to minimize the delivery of sediment from agricultural lands to receiving waters. Land owners have a choice of one of two approaches: (1) apply the erosion component of the USDA Conservation Management System through such practices as conservation tillage, strip cropping, contour farming, and terracing or (2) design and install a combination of practices to remove settleable solids and associated pollutants in runoff for all but the larger storms.

Confined animal facility control (e.g., feedlots) measure—The management measure for all new facilities and existing facilities over a certain size is to limit discharges from confined animal facilities to waters of the United States by storing wastewater and runoff caused by all storms up to and including the 25-year, 24-hour frequency storm. For smaller existing facilities, the management measure is to design and implement systems that collect solids, reduce contaminant concentrations, and reduce runoff to minimize the discharge of contaminants in both facility wastewater and runoff caused by all storms up to and including 25-year, 24-hour frequency storms. This measure also specifies management of stored runoff and solids through proper waste utilization and use of disposal methods that minimize impacts to surface/groundwater.

Nutrient management — This measure calls for development and implementation of comprehensive nutrient management plans including a nutrient budget for the crop, identification of the types and amounts of nutrients necessary to produce a crop based on realistic crop yield expectations, and an identification of the environmental hazards of the site.

Pesticide management — This measure is designed to minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application, preventing backflow of pesticides into water supplies, and improving calibration of pesticide spray equipment. A key component of this measure is use of integrated pest management (IPM) strategies.

Livestock grazing — The goal of this measure is to protect sensitive areas including streambanks, wetlands, estuaries, ponds, lake shores, and riparian zones. Protection is to be achieved with improved grazing management that reduces the physical distance and direct loading of animal waste and sediment caused by livestock by restricting livestock access to sensitive areas through a range of options.

Irrigation — This measure promotes an effective irrigation system that delivers necessary quantities of water yet reduces nonpoint pollution to surface waters and groundwater. The measure calls for uniform application of water based on an accurate measurement of crop water needs and the volume of irrigation water applied. The measure also recognizes that conflicting state water laws will take precedence over the measure.

Forestry

The impacts associated with silvicultural activities vary depending on site characteristics, climatic conditions, and the forest practices employed. Pollutants commonly associated with forestry include sediment, nutrients, pesticides, and temperature variations in surface water. The forestry measures include

Preharvest planning — The objective of this measure is to ensure that silvicultural activities, including timber harvesting, site preparation, and associated road construction, are conducted in a way that takes into account potential nonpoint pollution of surface waters. It requires a preharvest planning process to address key aspects of forestry operations relevant to water quality.

Streamside special management areas — This measure establishes areas along surface waters that are managed to protect the adjacent water body, including the protection of trees that shade the water and moderate water temperatures.

Road construction/reconstruction — The purpose of this management measure is to reduce sediment from road construction or reconstruction. This is to be accomplished by following the preharvest plan layouts and designs for the road system, incorporating adequate drainage structures, and properly installing stream crossings.

Other forestry management measures include measures for road management, timber harvesting, site preparation and forest regeneration, fire management, revegetation of disturbed areas, forest chemical management, and wetland forest management.

Urban

Urbanization has many impacts on coastal waters. The major pollutants found in urban runoff include sediment, nutrients, oxygen demanding substances, road salts, heavy metals, petroleum hydrocarbons, pathogenic bacteria, and viruses. The urban measures include a range of preventative and remedial activities.

New development management — The new development management measure is intended to mitigate the effects of new development on water quality. This measure specifies that runoff from new development be managed so as to meet two conditions:

(1) The average annual total suspended solid (TSS) loadings after construction is completed are reduced by 80 percent or are no greater than pre-development loadings; and

(2) To the extent practicable, post-development peak runoff rate and average volume are maintained at levels that are similar to pre-development levels.

Watershed protection/site development — The purpose of these measures is to encourage comprehensive planning for development on a watershed scale and for small-scale site development as well, including planning and designing to protect sensitive ecological areas, minimize land disturbances, and retain natural drainage and vegetation whenever possible.

Construction erosion and sediment control — A sediment and erosion control plan should be developed and approved prior to land disturbance. This measure applies to construction sites of less than 5 acres. (Sites greater than 5 acres are addressed through NPDES stormwater regulations. See *News-Notes*, #27.)

Construction site chemical control — This measure addresses limiting the application, generation, and migration of chemical contaminants (i.e., petrochemicals, pesticides, nutrients) and providing proper storage and disposal.

Existing development — This measure addresses reduction of pollution loadings from previously developed areas. Watershed management programs should be developed to identify sources, specify appropriate controls (such as retrofitting or the establishment of buffer strips), and provide an implementation schedule.

New onsite sewage disposal systems (e.g., septic tanks) — The measure specifies that new onsite disposal systems (OSDS) are to be designed, installed, and operated properly and to be situated away from open waterbodies and sensitive resources such as wetlands and floodplains. Protective separation between the OSDS and the groundwater table is to be established.

In addition, management measures have been specified for the following: existing onsite disposal systems; pollution prevention; siting roads, highways, and bridges; construction projects for roads, highways, and bridges; construction site chemical control for roads, highways, and bridges; operation and maintenance measure for roads, highways, and bridges; and runoff systems for roads, highways, and bridges.

Marinas

Marinas, by their nature, are located on the water's edge. Pollutants from boats or marina maintenance area runoff are often not buffered. Potential impacts include dissolved oxygen deficiencies and high concentrations of toxic metals in aquatic organisms. In addition, construction of new marinas can lead to destruction of sensitive ecosystems. The marina measures focus on siting, design, and operation.

Marina flushing — The measure requires that marina siting and design allow for maximum flushing of water through the site.

Water quality assessment — This measure specifies that water quality be considered in the siting and design of both new and expanding marinas.

Habitat assessment — Marinas should be designed and located to protect against adverse impacts on shellfish resources and other important habitat areas as designated by local, state, or federal governments.

Stormwater runoff — This measure, which applies to runoff from the marina site only, specifies implementation of runoff control strategies that include the use of pollution prevention activities and the proper design of hull maintenance areas. At least 80 percent of suspended solids must be removed from stormwater runoff coming from hull maintenance areas.

Sewage facilities — To prevent the discharge of sewage directly to coastal waters, new and expanding marinas are to install pumpout, pump station, and restroom facilities where needed.

Additional marina management measures include shoreline stabilization, fueling station design, solid and fish waste management, liquid materials management, petroleum control, boat cleaning, public education, maintenance of sewage facilities, and boat operation.

Hydromodification

Hydromodification activities include channelization and channel modification, dams, and streambank and shoreline erosion. Results of hydromodification frequently include habitat impacts, sedimentation, and temperature impacts. The following are the hydromodification management measures:

Channelization and channel modification — The measure requires physical and chemical characteristics of surface waters to be considered when planning hydromodification activities. A measure for instream and riparian habitat restoration for channelization and channel modification is also included.

Dams — Three management measures for dams relate to construction, operation and maintenance. The measures include an erosion and sediment control measure, a chemical and pollutant control measure, and a measure for the protection of surface water quality and instream and riparian habitat.

Streambank and shoreline erosion — Eroding streambanks and shorelines should be stabilized where streambank and shoreline erosion is a nonpoint source problem. Vegetative measures such as marsh creation and vegetative bank stabilization are the preferred methods.

Wetlands

Wetlands and riparian areas provide a number of benefits including nonpoint pollution control. Changes to hydrology, geochemistry, substrate, or species composition may impair the ability of a wetland or riparian area to function properly. The measures are

Protection of wetlands and riparian areas — The purpose of this measure is to maintain the water quality benefits of wetlands and riparian areas to prevent them from becoming a source of nonpoint pollution.

Restoration of wetlands and riparian areas — This measure promotes the restoration of pre-existing wetland and riparian areas where the restoration of such systems will have a significant nonpoint source pollution abatement function.

Engineered vegetated treatment systems — This measures promotes the development of artificial wetlands or vegetated treatment systems to serve a nonpoint source pollution abatement function.

Program Development and Approval Guidance

The management measures guidance will be implemented through state coastal nonpoint programs. These programs will for the first time bring together the land use management expertise of state coastal zone management agencies and the water quality expertise of the state 319 agencies to address this important water quality problem. States are to build on existing Clean Water Act section 319 nonpoint source management programs and the coastal zone management programs approved under section 306 of the Coastal Zone Management Act.

The program guidance describes requirements for each state program to be approved by EPA and NOAA. States must address such issues as where the program will operate geographically, how the management measures should be selected and implemented, and how the program should be coordinated with other state, local, and federal programs. If EPA and NOAA disapprove of a state program, reductions in that state's 319 and 306 grants will occur.

Geographic scope — Where do the state programs apply?

As directed by section 6217(a), the geographic scope of each state coastal nonpoint program must be sufficient to ensure implementation of management measures to "restore and protect coastal waters." In the guidance, this area is known as the "6217 management area." As required by the statute, NOAA has reviewed the existing state coastal zone management boundaries and has made recommendations to the states on the area necessary to control nonpoint source pollution from land and water uses that have a significant impact on a state's coastal water. A state may respond to this recommendation by either modifying the coastal zone

Two Coastal Nonpoint Pollution Control Guidances Issued: Management Measures and Program Development and Approval (continued)

boundary to implement NOAA's recommendation or by identifying other state authorities to implement the coastal nonpoint program throughout the 6217 management area. For example, a state may have a forest practices act that ensures implementation of the forestry management measures throughout the 6217 management area. Such state authorities must be networked into the state coastal nonpoint program.

Implementation of management measures

State programs must include management measures "in conformity" with those specified in EPA's management measure guidance. In general, the presumption is that states will implement all the management measures for the source categories (e.g., agriculture, forestry) specified in EPA's management measures guidance throughout their 6217 management area. However, states have the opportunity to exclude certain nonpoint source categories or subcategories in limited situations. States may exclude certain sources if they can demonstrate either (1) the source is neither present nor reasonably anticipated in an area, or (2) that sources do not, individually or cumulatively, present significant adverse effects to living resources or human health. Exclusions will likely need to be demonstrated on a watershed or local basis.

States will also have some flexibility adopting either the measure specified in EPA's guidance or an alternative measure to better meet local conditions. However, states must demonstrate that alternative measures are as effective as EPA measures in controlling coastal nonpoint pollution.

Coastal nonpoint programs must also provide information on how the state will implement the measure. States will need to ensure the implementation of management measures through the use of enforceable policies and mechanisms. These can range from traditional regulatory activities to innovative incentive programs. Incentive programs must be backed by state authorities to ensure implementation of the management measures.

Other program requirements

In addition to implementing the technology-based management measures specified in EPA's guidance document, states must also describe their process for implementing additional management measures needed to attain or maintain water quality standards or designated uses in coastal waters. These additional management measures will be determined by the states.

States are expected to provide technical assistance to local governments in implementing the additional measures. Opportunities for public participation throughout the development and implementation of state coastal nonpoint programs are also required.

Schedule

States have until July 1995 to submit programs to EPA and NOAA for review and approval. The federal agencies have until January 1996 to review the programs. Once approval is granted, the states have three years (until January 1999) to implement the technology-based management measures. EPA and NOAA have provided a two-year monitoring period (until January 2001) for states to assess the effectiveness of the measures. States then have an additional three years (until January 2004) to implement additional measures where necessary to attain or maintain water quality standards.

EPA and NOAA are committed to the successful implementation of CZARA. The agencies welcome questions on the program and will continue to provide programmatic and technical assistance during the development of state coastal nonpoint programs to states, local governments, and other interested parties.

Congress passed section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (codified as 16 USC s. 1455b) to give special protection to coastal waters in light of increasing beach closures, shellfish harvesting prohibitions, and the loss of biological productivity.

For more information or for copies of the documents, contact NPS Control Branch, WH-553, U.S. EPA, 401 M St., SW, Washington, DC 20460. The management measures are also available on the NPS BBS. See page 24 for more information.

[The management measures guidance (EPA 840-B-92-002) and the program development and approval guidance may be ordered free from EPIC, 11029 Kenwood Road, Bldg. 5, Cincinnati, OH 45242. For further information, contact Stuart Tuller at EPA, (202) 260-7112; or Marcella Jansen at NOAA, (202) 606-4181.]

Appendix A2
PL 92-500 §319

(c) Notwithstanding any other provision of this Act, any point source of a discharge having a thermal component, the modification of which point source is commenced after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972 and which, as modified, meets effluent limitations established under section 301 or, if more stringent, effluent limitations established under section 303 and which effluent limitations will assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in or on the water into which the discharge is made, shall not be subject to any more stringent effluent limitation with respect to the thermal component of its discharge during a ten year period beginning on the date of completion of such modification or during the period of depreciation or amortization of such facility for the purpose of section 167 (or both) of the Internal Revenue Code of 1954, whichever period ends first.

FINANCING STUDY

SEC. 317. (a) The Administrator shall continue to investigate and study the feasibility of alternate methods of financing the cost of preventing, controlling and abating pollution as directed in the Water Quality Improvement Act of 1970 (Public Law 91-224), including, but not limited to, the feasibility of establishing a pollution abatement trust fund. The results of such investigation and study shall be reported to the Congress not later than two years after enactment of this title, together with recommendations of the Administrator for financing the programs for preventing, controlling and abating pollution for the fiscal years beginning after fiscal year 1976, incuding any necessary legislation.

(b) There is authorized to be appropriated for use in carrying out this section, not to exceed $1,000,000.

AQUACULTURE

SEC. 318. (a) The Administrator is authorized, after public hearings, to permit the discharge of a specific pollutant or pollutants under controlled conditions associated with an approved aquaculture project under Federal or State supervision pursuant to section 402 of this Act.

(b) The Administrator shall by regulation establish any procedures and guidelines which the Administrator deems necessary to carry out this section. Such regulations shall require the application to such discharge of each criterion, factor, procedure, and requirement applicable to a permit issued under section 402 of this title, as the Administrator determines necessary to carry out the objective of this Act.

(c) Each State desiring to administer its own permit program within its jurisdiction for discharge of a specific pollutant or pollutants under controlled conditions associated with an approved aquaculture project may do so if upon submission of such program the Administrator determines such program is adequate to carry out the objective of this Act.

SEC. 319. NONPOINT SOURCE MANAGEMENT PROGRAMS.

(a) STATE ASSESSMENT REPORTS.—

(1) CONTENTS.—The Governor of each State shall, after notice and opportunity for public comment, prepare and submit to the Administrator for approval, a report which—

(A) identifies those navigable waters within the State which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or the goals and requirements of this Act;

(B) identifies those categories and subcategories of nonpoint sources or, where appropriate, particular nonpoint sources which add significant pollution to each portion of the navigable waters identified under subparagraph (A) in amounts which contribute to such portion not meeting such water quality standards or such goals and requirements;

(C) describes the process, including intergovernmental coordination and public participation, for identifying best management practices and measures to control each category and subcategory of nonpoint sources and, where appropriate, particular nonpoint sources identified under subparagraph (B) and to reduce, to the maximum extent practicable, the level of pollution resulting from such category, subcategory, or source; and

(D) identifies and describes State and local programs for controlling pollution added from nonpoint sources to, and improving the quality of, each such portion of the navigable waters, including but not limited to those programs which are receiving Federal assistance under subsections (h) and (i).

(2) INFORMATION USED IN PREPARATION.—In developing the report required by this section, the State (A) may rely upon information developed pursuant to sections 208, 303(e), 304(f), 305(b), and 314, and other information as appropriate, and (B) may utilize appropriate elements of the waste treatment management plans developed pursuant to sections 208(b) and 303, to the extent such elements are consistent with and fulfill the requirements of this section.

(b) STATE MANAGEMENT PROGRAMS.—

(1) IN GENERAL.—The Governor of each State, for that State or in combination with adjacent States, shall, after notice and opportunity for public comment, prepare and submit to the Administrator for approval a management program which such State proposes to implement in the first four fiscal years beginning after the date of submission of such management program for controlling pollution added from nonpoint sources to the navigable waters within the State and improving the quality of such waters.

(2) SPECIFIC CONTENTS.—Each management program proposed for implementation under this subsection shall include each of the following:

(A) An identification of the best management practices and measures which will be undertaken to reduce pollutant loadings resulting from each category, subcategory, or particular nonpoint source designated under paragraph (1)(B).

taking into account the impact of the practice on ground water quality.

(B) An identification of programs (including, as appropriate, nonregulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects) to achieve implementation of the best management practices by the categories, subcategories, and particular nonpoint sources designated under subparagraph (A).

(C) A schedule containing annual milestones for (i) utilization of the program implementation methods identified in subparagraph (B), and (ii) implementation of the best management practices identified in subparagraph (A) by the categories, subcategories, or particular nonpoint sources designated under paragraph (1)(B). Such schedule shall provide for utilization of the best management practices at the earliest practicable date.

(D) A certification of the attorney general of the State or States (or the chief attorney of any State water pollution control agency which has independent legal counsel) that the laws of the State or States, as the case may be, provide adequate authority to implement such management program or, if there is not such adequate authority, a list of such additional authorities as will be necessary to implement such management program. A schedule and commitment by the State or States to seek such additional authorities as expeditiously as practicable.

(E) Sources of Federal and other assistance and funding (other than assistance provided under subsections (h) and (i)) which will be available in each of such fiscal years for supporting implementation of such practices and measures and the purposes for which such assistance will be used in each of such fiscal years.

(F) An identification of Federal financial assistance programs and Federal development projects for which the State will review individual assistance applications or development projects for their effect on water quality pursuant to the procedures set forth in Executive Order 12372 as in effect on September 17, 1983, to determine whether such assistance applications or development projects would be consistent with the program prepared under this subsection; for the purposes of this subparagraph, identification shall not be limited to the assistance programs or development projects subject to Executive Order 12372 but may include any programs listed in the most recent Catalog of Federal Domestic Assistance which may have an effect on the purposes and objectives of the State's nonpoint source pollution management program.

(3) UTILIZATION OF LOCAL AND PRIVATE EXPERTS.—In developing and implementing a management program under this subsection, a State shall, to the maximum extent practicable, involve local public and private agencies and organizations which have expertise in control of nonpoint sources of pollution.

(4) DEVELOPMENT ON WATERSHED BASIS.—A State shall, to the maximum extent practicable, develop and implement a management program under this subsection on a watershed-by-watershed basis within such State.

(c) ADMINISTRATIVE PROVISIONS.—

(1) COOPERATION REQUIREMENT.—Any report required by subsection (a) and any management program and report required by subsection (b) shall be developed in cooperation with local, substate regional, and interstate entities which are actively planning for the implementation of nonpoint source pollution controls and have either been certified by the Administrator in accordance with section 208, have worked jointly with the State on water quality management planning under section 205(j), or have been designated by the State legislative body or Governor as water quality management planning agencies for their geographic areas.

(2) TIME PERIOD FOR SUBMISSION OF REPORTS AND MANAGEMENT PROGRAMS.—Each report and management program shall be submitted to the Administrator during the 18-month period beginning on the date of the enactment of this section.

(d) APPROVAL OR DISAPPROVAL OF REPORTS AND MANAGEMENT PROGRAMS.—

(1) DEADLINE.—Subject to paragraph (2), not later than 180 days after the date of submission to the Administrator of any report or management program under this section (other than subsections (h), (i), and (k)), the Administrator shall either approve or disapprove such report or management program, as the case may be. The Administrator may approve a portion of a management program under this subsection. If the Administrator does not disapprove a report, management program, or portion of a management program in such 180-day period, such report, management program, or portion shall be deemed approved for purposes of this section.

(2) PROCEDURE FOR DISAPPROVAL.—If, after notice and opportunity for public comment and consultation with appropriate Federal and State agencies and other interested persons, the Administrator determines that—

(A) the proposed management program or any portion thereof does not meet the requirements of subsection (b)(2) of this section or is not likely to satisfy, in whole or in part, the goals and requirements of this Act;

(B) adequate authority does not exist, or adequate resources are not available, to implement such program or portion;

(C) the schedule for implementing such program or portion is not sufficiently expeditious; or

(D) the practices and measures proposed in such program or portion are not adequate to reduce the level of pollution in navigable waters in the State resulting from nonpoint sources and to improve the quality of navigable waters in the State;

the Administrator shall within 6 months of the receipt of the proposed program notify the State of any revisions or modifications necessary to obtain approval. The State shall thereupon

have an additional 3 months to submit its revised management program and the Administrator shall approve or disapprove such revised program within three months of receipt.

(3) FAILURE OF STATE TO SUBMIT REPORT.—If a Governor of a State does not submit the report required by subsection (a) within the period specified by subsection (c)(2), the Administrator shall, within 30 months after the date of the enactment of this section, prepare a report for such State which makes the identifications required by paragraphs (1)(A) and (1)(B) of subsection (a). Upon completion of the requirement of the preceding sentence and after notice and opportunity for comment, the Administrator shall report to Congress on his actions pursuant to this section.

(e) LOCAL MANAGEMENT PROGRAMS; TECHNICAL ASSISTANCE.—If a State fails to submit a management program under subsection (b) or the Administrator does not approve such a management program, a local public agency or organization which has expertise in, and authority to, control water pollution resulting from nonpoint sources in any area of such State which the Administrator determines is of sufficient geographic size may, with approval of such State, request the Administrator to provide, and the Administrator shall provide, technical assistance to such agency or organization in developing for such area a management program which is described in subsection (b) and can be approved pursuant to subsection (d). After development of such management program, such agency or organization shall submit such management program to the Administrator for approval. If the Administrator approves such management program, such agency or organization shall be eligible to receive financial assistance under subsection (h) for implementation of such management program as if such agency or organization were a State for which a report submitted under subsection (a) and a management program submitted under subsection (b) were approved under this section. Such financial assistance shall be subject to the same terms and conditions as assistance provided to a State under subsection (h).

(f) TECHNICAL ASSISTANCE FOR STATES.—Upon request of a State, the Administrator may provide technical assistance to such State in developing a management program approved under subsection (b) for those portions of the navigable waters requested by such State.

(g) INTERSTATE MANAGEMENT CONFERENCE.—

(1) CONVENING OF CONFERENCE; NOTIFICATION; PURPOSE.—If any portion of the navigable waters in any State which is implementing a management program approved under this section is not meeting applicable water quality standards or the goals and requirements of this Act as a result, in whole or in part, of pollution from nonpoint sources in another State, such State may petition the Administrator to convene, and the Administrator shall convene, a management conference of all States which contribute significant pollution resulting from nonpoint sources to such portion. If, on the basis of information available, the Administrator determines that a State is not meeting applicable water quality standards or the goals and requirements of this Act as a result, in whole or in part, of significant pollution from nonpoint sources in another State, the Administrator shall

notify such States. The Administrator may convene a management conference under this paragraph not later than 180 days after giving such notification, whether or not the State which is not meeting such standards requests such conference. The purpose of such conference shall be to develop an agreement among such States to reduce the level of pollution in such portion resulting from nonpoint sources and to improve the water quality of such portion. Nothing in such agreement shall supersede or abrogate rights to quantities of water which have been established by interstate water compacts, Supreme Court decrees, or State water laws. This subsection shall not apply to any pollution which is subject to the Colorado River Basin Salinity Control Act. The requirement that the Administrator convene a management conference shall not be subject to the provisions of section 505 of this Act.

(2) STATE MANAGEMENT PROGRAM REQUIREMENT.—To the extent that the States reach agreement through such conference, the management programs of the States which are parties to such agreements and which contribute significant pollution to the navigable waters or portions thereof not meeting applicable water quality standards or goals and requirements of this Act will be revised to reflect such agreement. Such management programs shall be consistent with Federal and State law.

(h) GRANT PROGRAM.—

(1) GRANTS FOR IMPLEMENTATION OF MANAGEMENT PROGRAMS.—Upon application of a State for which a report submitted under subsection (a) and a management program submitted under subsection (b) is approved under this section, the Administrator shall make grants, subject to such terms and conditions as the Administrator considers appropriate, under this subsection to such State for the purpose of assisting the State in implementing such management program. Funds reserved pursuant to section 205(j)(5) of this Act may be used to develop and implement such management program.

(2) APPLICATIONS.—An application for a grant under this subsection in any fiscal year shall be in such form and shall contain such other information as the Administrator may require, including an identification and description of the best management practices and measures which the State proposes to assist, encourage, or require in such year with the Federal assistance to be provided under the grant.

(3) FEDERAL SHARE.—The Federal share of the cost of each management program implemented with Federal assistance under this subsection in any fiscal year shall not exceed 60 percent of the cost incurred by the State in implementing such management program and shall be made on condition that the non-Federal share is provided from non-Federal sources.

(4) LIMITATION ON GRANT AMOUNTS.—Notwithstanding any other provision of this subsection, not more than 15 percent of the amount appropriated to carry out this subsection may be used to make grants to any one State, including any grants to any local public agency or organization with authority to control pollution from nonpoint sources in any area of such State.

(5) PRIORITY FOR EFFECTIVE MECHANISMS.—For each fiscal year beginning after September 30, 1987, the Administrator may give priority in making grants under this subsection, and shall give consideration in determining the Federal share of any such grant, to States which have implemented or are proposing to implement management programs which will—

(A) control particularly difficult or serious nonpoint source pollution problems, including, but not limited to, problems resulting from mining activities;

(B) implement innovative methods or practices for controlling nonpoint sources of pollution, including regulatory programs where the Administrator deems appropriate;

(C) control interstate nonpoint source pollution problems; or

(D) carry out ground water quality protection activities which the Administrator determines are part of a comprehensive nonpoint source pollution control program, including research, planning, ground water assessments, demonstration programs, enforcement, technical assistance, education, and training to protect ground water quality from nonpoint sources of pollution.

(6) AVAILABILITY FOR OBLIGATION.—The funds granted to each State pursuant to this subsection in a fiscal year shall remain available for obligation by such State for the fiscal year for which appropriated. The amount of any such funds not obligated by the end of such fiscal year shall be available to the Administrator for granting to other States under this subsection in the next fiscal year.

(7) LIMITATION ON USE OF FUNDS.—States may use funds from grants made pursuant to this section for financial assistance to persons only to the extent that such assistance is related to the costs of demonstration projects.

(8) SATISFACTORY PROGRESS.—No grant may be made under this subsection in any fiscal year to a State which in the preceding fiscal year received a grant under this subsection unless the Administrator determines that such State made satisfactory progress in such preceding fiscal year in meeting the schedule specified by such State under subsection (b)(2).

(9) MAINTENANCE OF EFFORT.—No grant may be made to a State under this subsection in any fiscal year unless such State enters into such agreements with the Administrator as the Administrator may require to ensure that such State will maintain its aggregate expenditures from all other sources for programs for controlling pollution added to the navigable waters in such State from nonpoint sources and improving the quality of such waters at or above the average level of such expenditures in its two fiscal years preceding the date of enactment of this subsection.

(10) REQUEST FOR INFORMATION.—The Administrator may request such information, data, and reports as he considers necessary to make the determination of continuing eligibility for grants under this section.

(11) REPORTING AND OTHER REQUIREMENTS.—Each State shall report to the Administrator on an annual basis concerning (A)

its progress in meeting the schedule of milestones submitted pursuant to subsection (b)(2)(C) of this section, and (B) to the extent that appropriate information is available, reductions in nonpoint source pollutant loading and improvements in water quality for those navigable waters or watersheds within the State which were identified pursuant to subsection (a)(1)(A) of this section resulting from implementation of the management program.

(12) LIMITATION ON ADMINISTRATIVE COSTS.—For purposes of this subsection, administrative costs in the form of salaries, overhead, or indirect costs for services provided and charged against activities and programs carried out with a grant under this subsection shall not exceed in any fiscal year 10 percent of the amount of the grant in such year, except that costs of implementing enforcement and regulatory activities, education, training, technical assistance, demonstration projects, and technology transfer programs shall not be subject to this limitation.

(i) GRANTS FOR PROTECTING GROUNDWATER QUALITY.—

(1) ELIGIBLE APPLICANTS AND ACTIVITIES.—Upon application of a State for which a report submitted under subsection (a) and a plan submitted under subsection (b) is approved under this section, the Administrator shall make grants under this subsection to such State for the purpose of assisting such State in carrying out groundwater quality protection activities which the Administrator determines will advance the State toward implementation of a comprehensive nonpoint source pollution control program. Such activities shall include, but not be limited to, research, planning, groundwater assessments, demonstration programs, enforcement, technical assistance, education and training to protect the quality of groundwater and to prevent contamination of groundwater from nonpoint sources of pollution.

(2) APPLICATIONS.—An application for a grant under this subsection shall be in such form and shall contain such information as the Administrator may require.

(3) FEDERAL SHARE; MAXIMUM AMOUNT.—The Federal share of the cost of assisting a State in carrying out groundwater protection activities in any fiscal year under this subsection shall be 50 percent of the costs incurred by the State in carrying out such activities, except that the maximum amount of Federal assistance which any State may receive under this subsection in any fiscal year shall not exceed $150,000.

(4) REPORT.—The Administrator shall include in each report transmitted under subsection (m) a report on the activities and programs implemented under this subsection during the preceding fiscal year.

(j) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out subsections (h) and (i) not to exceed $70,000,000 for fiscal year 1988, $100,000,000 per fiscal year for each of fiscal years 1989 and 1990, and $130,000,000 for fiscal year 1991; except that for each of such fiscal years not to exceed $7,500,000 may be made available to carry out subsection (i). Sums appropriated pursuant to this subsection shall remain available until expended.

(k) CONSISTENCY OF OTHER PROGRAMS AND PROJECTS WITH MANAGEMENT PROGRAMS.—The Administrator shall transmit to the Office of Management and Budget and the appropriate Federal departments and agencies a list of those assistance programs and development projects identified by each State under subsection (b)(2)(F) for which individual assistance applications and projects will be reviewed pursuant to the procedures set forth in Executive Order 12372 as in effect on September 17, 1983. Beginning not later than sixty days after receiving notification by the Administrator, each Federal department and agency shall modify existing regulations to allow States to review individual development projects and assistance applications under the identified Federal assistance programs and shall accommodate, according to the requirements and definitions of Executive Order 12372, as in effect on September 17, 1983, the concerns of the State regarding the consistency of such applications or projects with the State nonpoint source pollution management program.

(l) COLLECTION OF INFORMATION.—The Administrator shall collect and make available, through publications and other appropriate means, information pertaining to management practices and implementation methods, including, but not limited to, (1) information concerning the costs and relative efficiencies of best management practices for reducing nonpoint source pollution; and (2) available data concerning the relationship between water quality and implementation of various management practices to control nonpoint sources of pollution.

(m) REPORTS OF ADMINISTRATOR.—

(1) ANNUAL REPORTS.—Not later than January 1, 1988, and each January 1 thereafter, the Administrator shall transmit to the Committee on Public Works and Transportation of the House of Representatives and the Committee on Environment and Public Works of the Senate, a report for the preceding fiscal year on the activities and programs implemented under this section and the progress made in reducing pollution in the navigable waters resulting from nonpoint sources and improving the quality of such waters.

(2) FINAL REPORT.—Not later than January 1, 1990, the Administrator shall transmit to Congress a final report on the activities carried out under this section. Such report, at a minimum, shall—

(A) describe the management programs being implemented by the States by types and amount of affected navigable waters, categories and subcategories of nonpoint sources, and types of best management practices being implemented;

(B) describe the experiences of the States in adhering to schedules and implementing best management practices:

(C) describe the amount and purpose of grants awarded pursuant to subsections (h) and (i) of this section;

(D) identify, to the extent that information is available, the progress made in reducing pollutant loads and improving water quality in the navigable waters;

(E) indicate what further actions need to be taken to attain and maintain in those navigable waters (i) applica-

ble water quality standards, and (ii) the goals and requirements of this Act;

(F) include recommendations of the Administrator concerning future programs (including enforcement programs) for controlling pollution from nonpoint sources; and

(G) identify the activities and programs of departments, agencies, and instrumentalities of the United States which are inconsistent with the management programs submitted by the States and recommend modifications so that such activities and programs are consistent with and assist the States in implementation of such management programs.

(n) SET ASIDE FOR ADMINISTRATIVE PERSONNEL.—Not less than 5 percent of the funds appropriated pursuant to subsection (j) for any fiscal year shall be available to the Administrator to maintain personnel levels at the Environmental Protection Agency at levels which are adequate to carry out this section in such year.

SEC. 320. NATIONAL ESTUARY PROGRAM.

(a) MANAGEMENT CONFERENCE.—

(1) NOMINATION OF ESTUARIES.—The Governor of any State may nominate to the Administrator an estuary lying in whole or in part within the State as an estuary of national significance and request a management conference to develop a comprehensive management plan for the estuary. The nomination shall document the need for the conference, the likelihood of success, and information relating to the factors in paragraph (2).

(2) CONVENING OF CONFERENCE.—

(A) IN GENERAL.—In any case where the Administrator determines, on his own initiative or upon nomination of a State under paragraph (1), that the attainment or maintenance of that water quality in an estuary which assures protection of public water supplies and the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife, and allows recreational activities, in and on the water, requires the control of point and nonpoint sources of pollution to supplement existing controls of pollution in more than one State, the Administrator shall select such estuary and convene a management conference.

(B) PRIORITY CONSIDERATION.—The Administrator shall give priority consideration under this section to Long Island Sound, New York and Connecticut; Narragansett Bay, Rhode Island; Buzzards Bay, Massachusetts; Puget Sound, Washington; New York-New Jersey Harbor, New York and New Jersey; Delaware Bay, Delaware and New Jersey; Delaware Inland Bays, Delaware; Albemarle Sound, North Carolina; Sarasota Bay, Florida; San Francisco Bay, California; and Galveston Bay, Texas.

(3) BOUNDARY DISPUTE EXCEPTION.—In any case in which a boundary between two States passes through an estuary and such boundary is disputed and is the subject of an action in any court, the Administrator shall not convene a management

Appendix A3
EPA Guidance Manual For Stormwater Permit Applications
Preface -- WPCF 1991

Oregon Departments of Environmental Quality and Land Conservation and Development

PREFACE

Water quality problems have occupied an increasingly prominent role in the public's awareness and in environmental legislation over the past several decades. Since 1956, the trend in water pollution control legislation has been toward greater Federal authority in setting and enforcing discharge standards. In 1972, Congress passed significant amendments to the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act or CWA) which provide that the discharge of any pollutant to navigable waters of the United States from a point source is unlawful except in accordance with a National Pollutant Discharge Elimination System (NPDES) permit.

Efforts to improve water quality under the NPDES program have traditionally focused on reducing pollutants in discharges of industrial process wastewater and municipal sewage. At the onset of the program in 1972, industrial process discharges and municipal sewage outfalls were easily identified as being responsible for poor, often drastically degraded water quality conditions. However, as pollution control measures were developed for these discharges, it became evident that more diffuse sources (occurring over a wide area) of water pollution were also major causes of water quality problems. The growing awareness of the magnitude of these diffuse sources of water pollution has only occurred in the past two decades.

For years, many environmental lawmakers and much of the public alike assumed that runoff from urban (and suburban) areas was essentially "clean"water. However, during the past 20 years or so, this view has changed. We now recognize that rainfall picks up a multitude of pollutants as a result of falling on and draining off streets and parking lots; construction and industrial sites; and mining, logging, and agricultural areas. The pollutants are dissolved into and are carried off by the runoff as it drains from these surfaces and areas. Through natural processes or manmade systems, the runoff is

channeled into and transported by gravity and flows through a wide variety of drainage features. The runoff then scours accumulated pollutants out of gutters, catchbasins, storm sewers, and drainage channels. The runoff (and accumulated pollutants) eventually ends up in surface water bodies such as creeks, rivers, estuaries, bays, and oceans.

Many recent studies have shown that runoff from urban and industrial areas typically contains significant quantities of the same general types of pollutants that are found in wastewaters and industrial discharges and often causes similar water quality problems. These pollutants include heavy metals (e.g., chromium, cadmium, copper, lead, mercury, nickel, zinc), pesticides, herbicides, and synthetic organic compounds such as fuels, waste oils, solvents, lubricants, and grease. These pollutants can (and do) cause problems for both human health and the aquatic ecosystems supported by the diverse receiving water bodies.

Comprehensive and reliable assessments of water quality are extremely difficult to perform and verify. However, several national-scale assessments have been made. For the purposes of these assessments, runoff from urban and industrial areas has been considered as a diffuse source or "nonpoint"source of pollution. Legally, however, most urban runoff is discharged through conveyances such as separate storm sewers or other conveyances which are point sources under the CWA and are, therefore, subject to the NPDES program.

To provide a better understanding of the nature of storm water runoff from residential, commercial, and light industrial areas, EPA provided funding and guidance to the Nationwide Urban Runoff Program (NURP), which was conducted from 1978 through 1983. The NURP study provided insight on what can be considered background levels of pollutants for urban runoff. However, NURP concluded that the quality of urban runoff can be adversely impacted by several sources of pollutants that were not directly evaluated in the study, including illicit connections, construction and industrial site runoff, and illegal dumping.

Other studies have shown that many storm sewers contain illicit discharges of non-storm water, and that large amounts of wastes, particularly used oils, are improperly disposed of in storm sewers. Removal of these discharges presents opportunities for dramatic improvements in the quality of storm water discharges.

More recently, the EPA performed a general assessment of water quality based on biennial reports submitted by the States. In a document entitled "National Water Quality Inventory, 1988 Report to Congress," it was reported that pollution from diffuse or nonpoint sources such as runoff from urban areas and industrial sites was cited as the leading cause of water quality impairment in 37 states.

As a result of these studies, it became clear that the point source discharge of urban runoff would have to be regulated in some manner. The appropriate means of regulating storm water point sources within the NPDES program has been a matter of serious concern since implementation of the NPDES program in 1972. Each attempt to devise a workable program has been the focus of substantial controversy, in view of the large number of storm water sources, the nature of storm water runoff, and the realities of program priorities and resources.

EPA promulgated its first storm water regulations in 1973. Since that time, the history of the storm water permit application rulemaking has been long and complex. While EPA was evaluating the appropriate means to regulate storm water discharges, Congress was examining the storm water issue in the course of the reauthorization of the CWA. The CWA was amended on February 4, 1987, when Congress passed the Water Quality Act of 1987 (WQA).

The central provision of the WQA which governs storm water discharges is Section 405. Section 405 of the WQA added a new subsection "p"to existing Section 402 of the CWA. Section 402(p) of the CWA adopted a phased approach to control pollutants in storm water discharges. It established phased permit application requirements, permit issuance deadlines, and permit compliance conditions for different categories of storm water discharges.

Section 402(p) of the CWA requires the EPA to establish final regulations governing storm water discharge permit application requirements under the NPDES program. The permit application requirements pertain to storm water discharges associated with industrial activity; discharges from large municipal separate storm water systems (systems serving a population of 250,000 or more); and discharges from medium municipal separate storm water systems (systems serving a population of 100,000 or more, but less than 250,000). In response to this requirement, the EPA published in the November 16, 1990, Federal Register the regulations for NPDES permit application requirements for the above-mentioned storm water discharges. This manual provides guidance to the cities in how to fulfill these requirements for a municipal application.

Appendix A4
PL 92-500 §313

district court of Guam, and in the case of the Virgin Islands such actions may be brought in the district court of the Virgin Islands. In the case of American Samoa and the Trust Territory of the Pacific Islands, such actions may be brought in the District Court of the United States for the District of Hawaii and such court shall have jurisdiction of such actions. In the case of the Canal Zone, such actions may be brought in the District Court for the District of the Canal Zone.

FEDERAL FACILITIES POLLUTION CONTROL

SEC. 313. (a) Each department, agency, or instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants, and each officer, agent, or employee thereof in the performance of his official duties, shall be subject to, and comply with, all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution in the same manner, and to the same extent as any nongovernmental entity including the payment of reasonable service charges. The preceding sentence shall apply (A) to any requirement whether substantive or procedural (including any recordkeeping or reporting requirement, any requirement respecting permits and any other requirement, whatsoever), (B) to the exercise of any Federal, State, or local administrative authority, and (C) to any process and sanction, whether enforced in Federal, State, or local courts or in any other manner. This subsection shall apply notwithstanding any immunity of such agencies, officers agents, or employees under any law or rule of law. Nothing in this section shall be construed to prevent any department, agency, or instrumentality of the Federal Government, or any officer, agent, or employee thereof in the performance of his official duties, from removing to the appropriate Federal district court any proceeding to which the department, agency, or instrumentality or officer, agent or employee thereof this subject pursuant to this section, and any such proceeding may be removed in accordance with 28 U.S.C. 1441 et seq. No offcer, agent, or employee of the United States shall be personally liable for any civil penalty arising from the performance of his official duties, for which he is not otherwise liable, and the United States shall be liable only for those civil penalties arising under Federal law or imposed by a State or local court to enforce an order or the process of such court. The President may exempt any effluent source of any department, agency, or instrumentality in the executive branch from compliance with any such a requirement if he determines it to be in the paramount interest of the United States to do so; except that no exemption may be granted from the requirements of section 306 or 307 of this Act. No such exemptions shall be granted due to lack of appropriation unless the President shall have specifically requested such appropriation as a part of the budgetary process and the Congress shall have failed to make available such requested appropriation. Any exemption shall be for a period not in excess of one year, but additional exemptions may be granted for periods of

not to exceed one year upon the President's making a new determination. The President shall report each January to the Congress all exemptions from the requirements of this section granted during the preceding calendar year, together with his reason for granting such exemption. In addition to any such exemption of a particular effluent source, the President may, if he determines it to be in the paramount interest of the United States to do so, issue regulations exempting from compliance with the requirements of this section any weaponry, equipment, aircraft, vessels, vehicles, or other classes or categories of property, and access to such property, which are owned or operated by the Armed Forces of the United States (including the Coast Guard) or by the National Guard of any State and which are uniquely military in nature. The President shall reconsider the need for such regulations at three-year intervals.

(b)(1) The Administrator shall coordinate with the head of each department, agency, or instrumentality of the Federal Government having jurisdiction over any property or facility utilizing federally owned wastewater facilities to develop a program of cooperation for utilizing wastewater control systems utilizing those innovative treatment processes and techniques for which guidelines have been promulgated under section 304(d)(3). Such program shall include an inventory or property and facilities which could utilize such processes and techniques.

(2) Construction shall not be initiated for facilities for treatment of wastewater at any Federal property or facility after September 30, 1979, if alternative methods for wastewater treatment at such property or facility utilizing innovative treatment processes and techniques, including but not limited to methods utilizing recycle and reuse techniques and land treatment are not utilized, unless the life cycle cost of the alternative treatment works exceeds the life cycle cost of the most cost effective alternative by more than 15 per centum. The Administrator may waive the application of this paragraph in any case where the Administrator determines it to be in the public interest, or that compliance with this paragraph would interfere with the orderly compliance with conditions of a permit issued pursuant to section 402 of this Act.

CLEAN LAKES

SEC. 314. [(a) Each State shall prepare or establish, and submit to the Administrator for his approval—

[(1) an identification and classification according to eutrophic condition of all publicly owned fresh water lakes in such State;

[(2) procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes; and

[(3) methods and procedures, in conjunction with appropriate Federal agencies, to restore the quality of such lakes.]

(a) ESTABLISHMENT AND SCOPE OF PROGRAM.—

(1) STATE PROGRAM REQUIREMENTS.—Each State on a biennial basis shall prepare and submit to the Administrator for his approval—

(A) an identification and classification according to eutrophic condition of all publicly owned lakes in such State;

Appendix A5
HB 2215

67th OREGON LEGISLATIVE ASSEMBLY–1993 Regular Session

B-Engrossed
House Bill 2215

Ordered by the Senate July 9
Including House Amendments dated April 19 and Senate Amendments dated July 9

Ordered printed by the Speaker pursuant to House Rule 12.00A (5). Presession filed (at the request of Governor Barbara Roberts for Strategic Water Management Group)

SUMMARY

The following summary is not prepared by the sponsors of the measure and is not a part of the body thereof subject to consideration by the Legislative Assembly. It is an editor's brief statement of the essential features of the measure.

Encourages formation of voluntary partnerships among local, state and federal interests for watershed management. Allows creation of local watershed councils. Directs Strategic Water Management Group to assist in creation of pilot watershed action programs using August 11, 1992, report as framework and guide.

Requires Strategic Water Management Group to report annually on implementation of program to appropriate legislative committee. Requires report on pilot projects to 1997 Legislative Assembly.

Sunsets December 31, 1997.

1 A BILL FOR AN ACT

2 Relating to coordinated watershed management.

3 Be It Enacted by the People of the State of Oregon:

4 SECTION 1. (1) The Legislative Assembly finds that:

5 (a) The long term protection of the water resources of this state, including sustainable
6 watershed functions, is an essential component of Oregon's environmental and economic
7 stability and growth;

8 (b) Each watershed in Oregon is unique, requiring different management techniques and
9 programs;

10 (c) Management techniques and programs for the protection and enhancement of
11 watersheds can be most effective and efficient when voluntarily initiated at the local level;

12 (d) Cooperative partnerships between affected private individuals, interested citizens and
13 representatives of local, state and federal agencies may improve opportunities to achieve the
14 protection, enhancement and restoration of the state's watersheds; and

15 (e) The establishment of such cooperative partnerships should be encouraged by local
16 individuals, local organizations and representatives of state agencies.

17 (2) The Legislative Assembly declares that:

18 (a) Voluntary programs initiated at the local level to protect and enhance the quality and
19 stability of watersheds are a high priority of the state and should be encouraged;

20 (b) State agencies are encouraged to respond cooperatively to local watershed protection
21 and enhancement efforts and coordinate their respective activities with other state agencies
22 and affected federal agencies to the greatest degree possible; and

23 (c) State agencies responding to local watershed protection and enhancement efforts are
24 encouraged to foster local watershed planning, protection and enhancement efforts before

NOTE: Matter in boldfaced type in an amended section is new; matter [*italic and bracketed*] is existing law to be omitted. New sections are in boldfaced type.

initiating respective action within a watershed.

SECTION 2. The Strategic Water Management Group, in cooperation with the Governor's Watershed Enhancement Board, shall initiate a watershed management program using as a framework and guide the report titled "Proposal: A Watershed Management Strategy for Oregon, Final Report and Recommendations of the Strategic Water Management Group Policy Work Group" and dated August 11, 1992. The program shall include pilot watershed council projects. The pilot projects shall focus state resources on the achievement of sustainable watershed health within the selected basins.

SECTION 3. Local government bodies are encouraged to form voluntary local watershed councils in other watersheds following the process described in the report titled "Proposal: A Watershed Management Strategy for Oregon, Final Report and Recommendations of the Strategic Water Management Group Policy Work Group" and dated August 11, 1992. The Strategic Water Management Group is authorized to work cooperatively with any local watershed council that may be formed. Requests from local watershed councils for state assistance shall be evaluated on the basis of whether the requesting organization reflects the interests of the affected watershed and the potential to protect and enhance the quality of the watershed in question.

SECTION 4. (1) The Strategic Water Management Group shall report annually to the appropriate legislative committee on the implementation of the management program under section 2 of this Act. The report shall include but need not be limited to:

(a) An explanation of the effectiveness and workability of the partnership process described in the report referred to in section 2 of this Act;

(b) A description of any modifications to the process that have been instituted as part of the pilot projects; and

(c) Recommendations concerning the need for future legislative action.

(2) On or before January 1, 1997, the Strategic Water Management Group shall submit a report on the pilot projects undertaken under section 2 of this Act to the Sixty-ninth Legislative Assembly.

SECTION 5. Sections 1 to 4 of this Act are repealed on December 31, 1997.

Appendix B1
Water Quality Parameters and EPA Methods

Physical Properties		
Conductance	EPA 120.1	Specific Conductance
Hardness	EPA 130.2	Titrimetric, EDTA
pH	EPA 150.1	Electrometric
Residue-Filterable	EPA 160.1	Gravimetric, 180° C
-Nonfilterable	EPA 160.2	Gravimetric, 105° C
-Total	EPA 160.3	Gravimetric, 105° C
-Volatile	EPA 160.4	Gravimetric, 550° C
-Settleable Matter	EPA 160.5	Imhoff Cone
Turbidity	EPA 180.1	Nephelometric
Metals		
Mercury	EPA 245.1	Cold Vapor AA
As,Cd,Pb,Se,Tl	EPA 200 series	Graphite Furnace AA
Others by ICP	EPA 200.7	Plasma Emission
Inorganic, Nonmetallic		
Acidity	EPA 305.1	Titrimetric
Alkalinity	EPA 310.1	Titrimetric, pH 4.5
Bromide	EPA 320.1	Titrimetric
Chloride	EPA 325.3	Titrimetric
Chlorine Residual	EPA 330.5	Spectrophotometric, DPD
Corrosivity, Langelier	SM 203	Calculation (calcium, alkalinity)
Cyanide, Total	EPA 335.2	Titrimetric, Spectrophotometric
Fluoride	EPA 340.2	Ion Selective Electrode (ISE)
Iodide	EPA 345.1	Titrimetric
N-Ammonia	EPA 350.1	Colorimetric, Automated Phenate
-Nitrate	EPA 353.2	Colorimetric, Automated
-Nitrite	EPA 354.1	Spectrophotometric
Oxygen, Dissolved	EPA 360.2	Titrimetric, Modified Winkler
P-Total	EPA 365.3	Colorimetric, Ascorbic Acid
-Ortho	EPA 365.3	Colorimetric, Ascorbic Acid
Silica	EPA 370.1	Colorimetric
S-Sulfate	EPA 375.1	Colorimetric, Automated
-Sulfide	EPA 376.2	Colorimetric, Methylene Blue
-Sulfite	EPA 377.1	Titrimetric
Tannin & Lignin	SM 513	Spectrophotometric
Organics, General		
BOD-5	EPA 405.1	Membrane Electrode
COD	EPA 410	Titrimetric
Oil & Grease	EPA 413.1	Gravimetric
Phenols, Total	EPA 420.3	Distillation, Spectrophotometric
Surfactants (MBAS)	EPA 425.1	Colorimetric
Organics, Specific		
*** See Organics Price List for EPA water/wastewater (500- & 600-series) methods ***		
Miscellaneous		
Digestion-Suspended Metals	EPA 200.0	0.45 u, Nitric/Hydrochloric
-Total Metals	EPA 200.0	Nitric/Hydrochloric
-Total Rec. Metals	EPA 200.0	Nitric/Hydrochloric
Extraction	EPA 200.0	APDC-MIBK
Archiving at 4° C		
Special Packages		
Ion Chromatography Anion (7)	EPA 300.0	
Oregon Primary Drinking Water (As,Ba,Cd,Cr,Pb,Hg,Se,Ag,nitrate)		
Sample Kit (includes bottles, preservative, refrigerant, shipping container)		

EPA methods from Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, Revised 1983).
SM methods from Standard Methods for the Examination of Water and Wastewater, 16th Edition.

Characteristics		
Corrosivity	EPA 9040	Electrometric
Reactivity	EPA SW-846	
Toxicity (Extraction Only)	EPA 1311	TCLP - Extraction Only
	EPA 1311	- Extraction & 8 Metals
Metals		
Mercury, Liquid Waste	EPA 7470	Cold Vapor AA
Mercury, Solid or Semisolid Waste	EPA 7471	Cold Vapor AA
As,Cd,Pb,Se,Tl	EPA 7000 series	Graphite Furnace AA
Others by ICP	EPA 6010	Plasma Emission
Hexavalent Chromium	EPA 7196	Colorimetric
Miscellaneous		
Chloride	EPA 9252	Titrimetric, Mercuric Nitrate
Cyanide, Total & Amenable	EPA 9010	Colorimetric
Nitrate	EPA 9200	Colorimetric, Brucine
Oil & Grease, Total Recoverable	EPA 9070	Gravimetric
Phenolics	EPA 9067	Distillation, MBTH
Sulfate	EPA 4035	Colorimetric, Automated
Sulfide	EPA 9030	Titrimetric
Properties		
Cation Exchange Capacity	EPA 9080	Ammonium Acetate
	EPA 9081	Sodium Acetate
Conductance, Specific	EPA 9050	Conductimetric
pH, Water	EPA 9040	Electrometric
pH, Soil	EPA 9045	Electrometric, 1:1 Slurry
Soil Analyses		
Grain Size	ASTM D421/D422	Sieve, Hydrometer
Saturated Salts	ASA/SSSA	Water Extract, ICP
Soil Lime Requirement	ASA/SSSA	Adams and Evans Method
Organics, Specific		
*** See organics price list for EPA 8000-series methods ***		
Extractions and Digestions		
Multiple Extraction Procedure	EPA 1320	
Extraction for Oily Waste	EPA 1330	Soxhlet, THF
Acid Digestion, Total Recoverable or Dissolved Metals	EPA 3005	For Flame AA or ICP
Acid Digestion, Total Metals	EPA 3010	For Flame AA or ICP
Acid Digestion, Total Metals	EPA 3020	For Graphite Furnace AA
Dissolution for Oils, Greases, and Soils	EPA 3040	Solvent Extraction
Acid Digestion of Sediments, Sludges, and Soils	EPA 3050	Acid/Hydrogen Peroxide

EPA methods from Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition.
ASTM methods from 1989 Annual Book of Standards, Section 4, Volume 4.08.
ASA/SSSA methods from Methods of Soil Analysis, Part 2 - Chemical and Microbiological Properties, Second Edition, 1982.

Drinking Water		
Halogenated Volatiles	EPA 502.1	Purge & Trap, Hall GC
Volatiles	EPA 502.2	Purge & Trap, Capillary GC
Volatiles & Unsaturated	EPA 503.1	Purge & Trap, PID GC
EDB and DBCP	EPA 504	Microextraction, ECD GC
Organohalide Pesticides & Aroclors	EPA 505	Extraction, ECD GC
Polychlorinated Dioxins/Furans	EPA 513	High-Resolution GC/MS
Chlorinated Herbicides	EPA 515	Extraction, ECD GC
Volatiles, including TTHM	EPA 524.2	Purge & Trap, Capillary GC/MS
Base/Neutrals and Acids	EPA 525	Extraction, GC/MS
Water/Wastewater		
Volatiles	EPA 601	Purge & Trap, Hall GC
	EPA 602	Purge & Trap, PID GC
	EPA 601/602	Purge & Trap, Hall/PID GC
Phenols	EPA 604	Extraction, FID GC
Organochlorine Pesticides & PCBs	EPA 608	Extraction, ECD GC
Chlorinated Hydrocarbons	EPA 612	Extraction, ECD GC
Polychlorinated Dioxins/Furans	EPA 613	Extraction, GC/MS
Polychlorinated Dioxins/Furans	EPA 1613	High-Resolution GC/MS
2nd Column Confirmation[a]	EPA 1613	High-Resolution GC/MS
Organophosphate Pesticides	EPA 614	Extraction, FPD GC
Chlorinated Herbicides	EPA 615	Extraction, Hall GC
Volatiles[b]	EPA 624	Purge & Trap, GC/MS
Volatiles[b]	EPA 1624	Isotope Dilution GC/MS
Base/Neutrals and Acids[b]	EPA 625	Extraction, GC/MS
Acid Organics Only	EPA 625	Extraction, GC/MS
Base/Neutrals Only	EPA 625	Extraction, GC/MS
Base/Neutrals and Acids[b]	EPA 1625	Isotope Dilution GC/MS
Hazardous Wastes (SW-846)		
Halogenated Volatiles	EPA 5030/8010	Purge & Trap, Hall GC
Non-Halogenated Volatiles	EPA 5030/8015	Purge & Trap, FID GC
Volatiles	EPA 5030/8021	Purge & Trap, PID GC
Phenols	EPA 3550/8040	Extraction, FID GC
Organochlorine Pesticides & PCBs	EPA 3550/8080	Extraction, ECD GC
Polynuclear Aromatic	EPA 3550/8270	Extraction, Full Scan GC/MS
Hydrocarbons (PAHs)		Extraction, SIM GC/MS
Chlorinated Hydrocarbons	EPA 3550/8120	Extraction, ECD GC
Organophosphorus Pesticides	EPA 3550/8140	Extraction, FPD GC
Chlorinated Herbicides	EPA 3550/8150	Extraction, Hall GC
Volatiles	EPA 5030/8260	Purge & Trap, GC/MS
Base/Neutrals and Acids	EPA 3550/8270	Extraction, GC/MS
Acid Organics Only	EPA 3550/8270	Extraction, GC/MS
Base/Neutrals Only	EPA 3550/8270	Extraction, GC/MS
Polychlorinated Dioxins/Furans	EPA 8280	Extraction, GC/MS
Tetra's Only	EPA 8280	Extraction, GC/MS
2,3,7,8-TCDD/TCDF (2)	EPA 8280	Extraction, GC/MS
2nd Column Confirmation[a]	EPA 8280	GC/MS
Polychlorinated Dioxins/Furans	EPA 8290	High-Resolution GC/MS
Tetra's Only	EPA 8290	High-Resolution GC/MS
2,3,7,8-TCDD/TCDF (2)	EPA 8290	High-Resolution GC/MS
2nd Column Confirmation[a]	EPA 8290	High-Resolution GC/MS
Pulp & Paper		
Polychlorinated Dioxins/Furans	NCASI 551	High-Resolution GC/MS
Tetra's Only	NCASI 551	High-Resolution GC/MS
2,3,7,8-TCDD/TCDF (2)	NCASI 551	High-Resolution GC/MS
2nd Column Confirmation[a]	NCASI 551	High-Resolution GC/MS
Chlorinated Phenols (aqueous)[a]	EPA 1653	Isotope Dilution GC/MS
Chlorinated Phenols (solids)[a]	EPA 1655	Isotope Dilution GC/MS

TCLP Compounds - Aqueous Leachate/Nonaqueous Filterable Phase		
Volatiles	EPA 5030/8240	Purge & Trap, GC/MS
Base/Neutrals and Acids	EPA 3550/8250	Extraction, GC/MS
Appendix VIII Compounds		
Volatiles	EPA 5030/8260	Purge & Trap, GC/MS
Base/Neutrals and Acids	EPA 3550/8270	Extraction, GC/MS
Polychlorinated Dioxins/Furans	EPA 8280	Extraction, GC/MS
Tetra's Only	EPA 8280	Extraction, GC/MS
2,3,7,8-TCDD/TCDF (2)	EPA 8280	Extraction, GC/MS
2nd Column Confirmation	EPA 8280	GC/MS
Appendix IX Compounds		
Volatiles	EPA 5030/8260	Purge & Trap, GC/MS
Base/Neutrals and Acids	EPA 3550/8270	Extraction, GC/MS
Polychlorinated Dioxins/Furans	EPA 8280	Extraction, GC/MS
Tetra's Only	EPA 8280	Extraction, GC/MS
2,3,7,8-TCDD/TCDF	EPA 8280	Extraction, GC/MS
2nd Column Confirmation	EPA 8280	GC/MS
Stack Emissions and Ambient Air		
Volatiles, Tenax Tubes	EPA TO-1	GC/MS
Volatiles, Charcoal Trap	EPA TO-2	GC/MS
Volatiles	EPA TO-3	Cryogenic Trap, FID/ECD GC
Pesticides & PCB's, PUF	EPA TO-4	ECD GC
N-Nitrosodimethylamine, Thermosorb-N Cartridge	EPA TO-7	ELCD GC
Dioxins and Furans, PUF	EPA TO-9	High-Resolution GC/MS
Organochlorine Pesticides, PUF Low-Vol	EPA TO-10	ECD GC
Nonmethane Volatiles	EPA TO-12	Cryogenic Trap, FID GC
PAH's, PUF Hi-Vol	EPA TO-13	GC/MS
	EPA TO-13	High-Resolution GC/MS
PCB's, PUF Hi-Vol	EPA TO-13	GC/MS
	EPA TO-13	High-Resolution GC/MS
Volatiles, Summa Canisters	EPA TO-14	GC/MS
Volatiles, Tedlar Bags	EPA TO-14	GC/MS
Dioxins and Furans	EPA 23	High-Resolution GC/MS
Chlorinated Hydrocarbons	CARB 103	ECD GC
Nonmethane Hydrocarbons	CARB 104	FID GC
Dioxins and Furans	CARB 428	High-Resolution GC/MS
PAH's, PUF Hi-Vol	CARB 429	GC/MS
	CARB 429	High-Resolution GC/MS
PAH's, MM5 Train	CARB 429	GC/MS
	CARB 429	High-Resolution GC/MS
PCB's, PUF Hi-Vol	CARB 429	GC/MS
	CARB 429	High-Resolution GC/MS
PCB's, MM5 Train	CARB 429	GC/MS
	CARB 429	High-Resolution GC/MS
Dioxins and Furans, PUF Hi-Vol	CARB 429	High-Resolution GC/MS
Dioxins and Furans, MM5 Train	CARB 429	High-Resolution GC/MS

Drinking Water methods from Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Wate September, 1986.

Water/Wastewater methods from Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Ac 40 CFR Part 136, in Federal Register, Friday October 26, 1984.

Hazardous Waste methods from Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition.

EPA air methods from Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. June, 1988.

CARB air methods from State of California Stationary Source Test Methods. Vol. III. Methods for Determining Emissions of Tox Air Contaminants from Stationary Sources. September, 1989.

Appendix B2
EPA Streamwalk Manual

EPA 910/9-92-004

United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle WA 98101

Alaska
Idaho
Oregon
Washington

Water Division

March 1992

EPA

Streamwalk Manual

Introduction

The Environmental Protection Agency (EPA) Region 10 office in Seattle was asked by several groups and agencies to create a standardized, easy to use screening tool for monitoring stream corridor health. We responded by forming a workgroup composed of several citizens and agency representatives to develop both a monitoring checklist and a data management system. We decided to call it Streamwalk.

Streamwalk is designed to be used by lay people, people who are interested in learning more about their streams and rivers. We anticipate the data people collect will be used as a screening tool to focus attention on areas that might be of concern, and to help direct further evaluation by experts. If all goes as we hope, and enough good data is collected, we should be able to make comparisons and evaluate trends, over time, for rivers or streams.

Our objectives in developing Streamwalk are to:

- *develop a screening tool to identify potential problem areas*
- *provide a standardized data collection method so regional and trend comparisons can be made*
- *focus experts' limited resources on suspected problem areas*
- *encourage citizen commitment to protecting streams*
- *educate people about the relationship between streams and watersheds*

Federal Recycling Program

Who's In Charge?

You are. Although EPA is heading up the development of Streamwalk, we visualize this as a self-driven grass roots tool. We are not proposing a high level of federal involvement. We hope you will use this to develop a locally organized long term citizen stream monitoring program, or to get together with an existing stream monitoring organization or agency. Organizing with others offers training and consistency.

We see a limited role for EPA. We have updated this Streamwalk manual based on your suggestions. Currently we are serving as the central repository for Streamwalk data collected in our region (although anyone with a PC can take care of their own data management). We are able to provide copies of our data management system (DBASE III, IBM). Eventually we expect to cooperate with state and local organizations to collect and interpret the data. We also expect to keep information on which parts of streams have been walked with the site designation so that anyone can call us to find out if they are the first or repeating a Walk.

Before the Streamwalk

1. We encourage you to contact local groups involved in environmental issues in your area. This serves two purposes: one, these groups may be able to provide you with information and background on your Streamwalk site; and two, you may be able to piggyback on some an existing program. Examples of groups to contact include: Izaak Walton League, Adopt-A-Stream Foundation, Sierra club, Audubon Society, even local fishing clubs, and local governtments' environmental programs.

2. Choose the general area for your Streamwalk. You may wish to collect data along a familiar stream, one that is close to your residence or place of work, one that does not cascade down a steep mountain side, or a favorite. You may decide to do a series of streams in a watershed to collect baseline data, or to concentrate your efforts in areas suspected of being polluted. It is recommended that streamwalks be done four times a year (once each season) at your site.

3. Find a USGS topographic (topo) map of your area. These "topo" maps are excellent because they show buildings, elevations, waterways and roads. We recommend a 7 1/2 minute quad map (1:24,000 scale where 11 inches = 4 miles). They are available at local sporting goods stores. The cost is approximately $4.00. You may also find a copy to photocopy at your local library.

   Topo maps must be used to select and identify sites. We will use this data when we enter your information into our data management system. For this reason we will need to know the longitude and latitude of your site. Help in defining longitude and latitude is on page 9.

4. Now, select your specific Streamwalk site and find it on the topo map. It will be easier for future streamwalkers to locate your site if it is near clear landmarks (roads, highways and tributaries), especially those marked on the topo map. For purposes of Streamwalks, you will be characterizing 100 feet in either direction from your site. You may do as many sites on the stream as you wish, just be sure that sites are at least 200 feet apart.

5. Finally, pull out a copy of the Streamwalk survey data form. It is best if you have gone through the manual and form before you begin your Walk. You will use your map and one survey data sheet per Streamwalk site.

Data Collection Behaviors

Now you are ready to begin your Walk. Please, consider the following Streamwalk-related precautionary tips:

- Get the permission of landowners to cross any private land, posted or not. **Do Not Enter Areas Without Permission.** It is recommended that you use public access points (such as city/county/state parks and campgrounds).
- Only record what your see, not what you have previously seen. For example if you think fish are present but you can't see them mark your sheet "no fish present"
- ***Always*** work with someone.
- Do not put yourself in danger to gather survey information.
- Be careful of ticks, poison oak, nettles, insects. Bring repellent. Wear long pants and boots: wind breakers help to block nettles.
- Watch out for irate dogs.
- The water is not safe to drink.
- Do not walk on unstable banks; your footsteps could speed erosion.
- Be alert for spawning areas (redds) in the stream. Do not walk on them. They will look like a round or elliptical area of clean gravel about 1-3 feet long. During fall through spring, when redds are evident, try not to walk in the stream. In the summer, if you are careful, the stream bed might be the easiest route for conducting your streamwalk.
  Be aware that the stream bed can be very slippery and uneven, sometimes at unpredictable times and places.
- Do not attempt to walk across streams that are swift and above the knee in depth. These can be dangerous.
- Be careful of streamside vegetation - disturb it as little as possible.
- ***If for any reason you feel uncomfortable about the stream conditions or surroundings, please stop your streamwalk. You and your safety are much more valuable than any of the objectives of the streamwalk!***

The following is a recommended list of items to have along on your Streamwalk:

- Photocopies of topo map of stream to be walked
- Comfortable rubber boots
- Snag and thorn-proof clothing that is appropriate for the weather
- Clip board with waterproof cover
- Streamwalk data forms
- Two pencils
- Folding ruler or tape measure
- Camera and film in waterproof bag
- Leather gloves
- Whistle
- If you are away from urban or residential areas, the following are also recommended for safety:
  Extra clothes in a waterproof bag
  Fire starter (candle and cheap lighter)
  Small first aid kit, Flashlight and extra batteries

Documentation

Survey data sheets
Please keep your original data sheet and topo map. You may want to use the information you have generated to note trends and changes. The information may be of also be of use to your local environmental organization or government. If you want to participate in the EPA program, we request that you send a copy of the cover sheet and your completed data survey forms to EPA.

Photos
Pictures taken during your Streamwalk can be of great value. It is a good idea to keep your camera, unless it is waterproof, inside a zip-type plastic bag until ready to take a picture. For easy identification of the site, we recommend that you place a sheet identifying the date and site in a visible location for your picture. As these photos may be of use in future stream analysis, we ask that you save them with your copy of the survey data sheet.

Submitting information
Send **copies** of your Streamwalk data survey form(s) with a the cover sheet to:

Streamwalk
c/o Grover Partee
EPA Region 10
1200 Sixth Avenue, WD-139
Seattle, Washington 98101

Now it's Time to Begin:

The Streamwalk Site Survey Data Sheet

Instructions

Below are directions on how to fill out the Streamwalk Survey Data Sheet. Please read these thoroughly before you begin your Walk. If, while conducting your Streamwalk, you are not able to determine what the response to a question should be, or if the question itself is unclear, just leave that space blank - but don't stop your Walk. **Remember** this is ***not*** a test, there are no right or wrong answers.

Cover sheet
You only need to complete one cover sheet for each data collection trip. Please attach this to the one or more site surveys that you complete. The information is requested for our study of who is involved in Streamwalks. You do not need Streamwalk training to participate!

Stream Characterization: Site Survey Data Sheet
You must give the stream name, county and state of your site. preferably as it appears on the topo map. Note: there are some streams that are unnamed, in these cases it is ***very*** important that you indicate the stream, lake or water body into which your stream flows and the name and number of the topo map. Without clear information on which stream you have walked, your data will be useless.

Your site should be given a number in the order that it is surveyed. If it serves your purposes, you may also use a description and/or name, For clarity sake, you may want to name the site for a nearby landmark such as a bridge or large tree.

In order to integrate your information with the EPA Geographic Information System to produce maps we **must have the longitude and latitude** of your site(s). Computing this may present a challenge. Please see page 9 for some methods by which this can be done.

Description

1. *Weather*
The concern with weather relates to amount of rainfall which potentially can affect flow, clarity and amount of water in a stream. Weather/rainfall reports are available in the daily newspaper or by calling the local weather service. Definitions of weather conditions established by the Weather Service are:
Rain - 1/3" in 24 hours - light steady rainfall.
Showers - 1/3" - 1" in 24 hours, intermittent and variable in intensity.
Storm - 1" or more rain in 24 hrs, usually accompanied by winds.

2. *Stream water measurements*
This information will give a description of the stream water at your site. Please indicate if your response is estimated or measured. Remember, it is best to estimate if taking measurements will disturb habitat, require that you wade in deep water or disturb stream banks. Do not attempt to cross in high flows. If it feels even mildly unsafe, do not try it at all. Remember, this is a screening tool, not the last word.

3. *Water Clarity*
The clearness of the water is observed to determine if sediment pollution is entering the stream. Cloudy water can be a result of natural processes or of land use in the surrounding watershed. Sediments can adversely affect habitat conditions such as food, health of fish, and breeding environment for macroinvertebrates. In some areas grey or white water can be a result of natural processes such as glacial sources for streams.

4. *Water flow: Pools & Riffles*
The variety of flow in relation to depth creates habitat to support fish and invertebrate life. This variety can be seen by looking for pools and riffles. Pools are deeper than adjacent areas. They provide feeding, resting and spawning areas for fish. Riffles and/or runs are flows swift in comparison to surrounding areas. Riffles are shallow and fast water, runs are deep and fast water and pools are slow and deep water.

5. *Stream channel cross-section shape*
Please check the box which matches the shape of the stream channel. If you are unable to see the shape of the bottom and banks, please estimate. You can base your estimate on the flow of water. The slower the water in the middle of the stream, the flatter the bottom.

6. *Stream bottom (substrate)*
Indicate the most common type of material on the stream bottom.

Silt/clay/mud: This substrate has a sticky, cohesive feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments behave like ooze.

Sand (up to .1 inch): Sand is made up of tiny particles of rock. It feels wonderful underfoot.

Gravel (.1 - 2 inches): A gravel stream bottom is made up of stones ranging from tiny quarter inch pebbles to rocks of about 2 inches.

Cobbles (2 - 10 inches): The majority of rocks on this type of stream bottom are between 2 and 10 inches. The average size is about that of a grapefruit.

Boulders (greater than 10 inches): Most of the rocks on the bottom will be large, greater than 10 inches.

Bedrock: This kind of stream bottom is solid rock.

7. *Width of Streamside Corridor*
The streamside corridor, riparian area or zone of influence are terms that describes the ***natural*** vegetated area on either side of the stream. It, along with the stream, forms the habitat of the river. It includes vegetation that shades the water, holds the soil in place, adds nutrients to the stream in the form of leaves and during flooding, and provides habitat for streamside wildlife. Estimate as best you can width of the corridor at your site. **Indicate with an "x" on the bar graph the width.** ***Note:*** *Left and right are based on looking down stream.* If the vegetation is pasture, lawn barked or landscaped, this is not a natural state so mark "o"

8. *Streamside vegetation*
A description of the presence and type of streamside vegetation provides much information about the stream due to its important role in molding the stream environment. Vegetation acts as a filter for sediment and pollution coming in from the near land. It provides habitat for the many creatures that are dependent on and influence the stream. Branches, logs and leaves enter the stream from this region. Vegetation also provides shade, which keeps the water cool. On the data sheet mark all the categories that apply.

Conifer: A cone bearing, evergreen tree or shrub (e.g. a pine tree)
Deciduous: A tree which sheds it's foliage at the end of the growing season
Small trees or Shrubs: Either conifers or deciduous bushes less than 20 feet high.
Grasses: Any of numerous plants with narrow leaves,jointed stems and spikes or clusters of inconspicuous flowers.

9. *Overhead canopy (stream cover)*
This is the amount of vegetation that overhangs the stream. It focuses on several important values of streamside vegetation: offering protection and refuge areas for fish and other organisms, shading the stream and keeping the water cool, and providing "launching" areas for insects that might fall into the river. Estimate as best you can, about how much of the river is overhung by vegetation, whether it be grasses, shrubs or trees. Please check the category that is appropriate for the current condition of your site. For example, if in the winter there are no leaves on the trees in your segment you might check 0 - 25%. However, in the summer when the trees have leaves, you might check 50 - 75%.

10. *Artificial bank protection*
This category includes such streamside modification as riprap (a retaining wall built of rocks or concrete) and bulkheads. It may also include placed wrecked auto bodies, refrigerators, and washing machines. People in the past have thought that such modifications helped stabilize stream banks. Unfortunately, not only do they drastically degrade habitat for streamside and in stream dwellers, they can cause bank erosion in flood conditions. Mark the category(ies) which best describe the condition of the stream bank within your 500 foot segment.

11. *Presence of logs or woody debris in stream*
Logs and woody debris (not twigs and leaves) can slow or divert water to provide important fish habitat such as pools and hiding places. So please mark the general amount of logs and woody debris in the stream.

12. *Organic debris in stream*
The presence of other organic matter in the stream can be both good and bad. If there are dumped grass clippings, it is not good for stream health. On the other hand, naturally falling leaves and twigs can be beneficial.

13. *Fish in stream*
Can you see any fish? Mark it down! If you know what kind of fish it is, note that in the space next to the question. If you think there are fish, but you cannot see them mark ***no***.

14. *Adjacent land uses:*
Adjacent land use has a great impact on the quality and state of the stream and riparian areas. Enter a "1" if the land use is present and a "2" if it is **clearly** impacting the stream. If you cannot determine the type of housing, industry or development, please make your best estimate.

Conditions

This section is designed to get information about potential problem conditions at your Streamwalk site. Enter a "1" if the condition is present and "2" is it is severe.

13. *Stream banks*

Natural plant cover degraded: Indicate if streamside vegetation is trampled, missing, or replaced by landscaping or cultivation.

Banks collapsed/eroded: Note if banks or parts of banks have been washed away or worn down.

Banks artificially modified: Indicate if banks have been artificially modified by construction or placement of rocks, wood or cement supports or lining.

14. *Stream Channel*

Mud/silt/sand on bottom/entering stream: Excessive mud or silt entering the stream and clouding the water can interfere with fishes' ability to sight potential prey. It can also clog fish gills and smother fish eggs in spawning areas on the stream bottom. Mud/silt/sand can be an indication of poor construction practices in the watershed; where runoff coming off the site is not adequately contained. It can also be a perfectly normal occurrence, especially if, for example, a muddy bottom is found along a very slow-moving segment or a wetland. Use your best judgement.

Artificial Stream modifications: Please note if the stream water has been dammed, dredged, filled, or channelized through culverts or if other large scale activities such as log removal are apparent.

Algae/scum floating/covering rocks: Evidence of algae (very tiny plants that can color the water green or can resemble seaweed) or scum in the water can point to a problem such as an upstream source adding too much nutrient (fertilizer) to the water.

Foam or sheen: This is a bit of a tricky category because this type of thing can be naturally occurring or a problem. For example, an iridescent sheen on the water might be from rotting leaves or it might be from some upstream pollutant. If you are not sure, mark it on the checklist. Try your best.

Garbage or junk in stream: This is your chance to point out very straightforward problems: litter, tires, hot water heaters, car bodies, and garbage dumps.

15. Other

Organic Debris or garbage: The purpose is to determine if the stream is being used as a dump site for materials which would not be present naturally. Debris can be anything from a pop can to vegetation brought from somewhere other than the stream corridor

Livestock in or with unrestricted access to stream: Are livestock present or is there an obvious path that livestock use to get to the water from adjacent fields? Is there streamside degradation that is caused by access?

Actively discharging pipes: Are there pipes with visible openings dumping fluids or water into the stream? Please note, even though you may not be able to tell where they come from or what they are discharging.

Other pipes: Are there pipes which are entering the stream? Please mark even if you cannot find an opening or see matter being discharged

Ditches: Are there ditches, usually draining the surrounding land - which lead into the stream.

Data Management

EPA has developed a computerized database system (dBase III+) for keeping track of Streamwalk data. At present, the system simply provides a means to "capture and preserve" the information. It will produce lists of stream segments identified and surveyed, survey dates and results including conditions noted as severe and a few other such listings. As more data comes in to our office, we will develop more informative out-puts. We hope to produce maps which can indicate problem areas and which use colors to indicate severity and/or to differentiate causes (Geographic Information System).

Again, please send copies of your completed Survey Data Sheet to :

Streamwalks
c/o Grover Partee
EPA Region 10
1200 Sixth Avenue WD-139
Seattle, Washington 98101

EPA is planning to enter data collected during Streamwalks into the database. Eventually we will ask local organizations to compile data and send us summary reports. Those who have questions about the database or who wish to maintain their own database may obtain copies of the structure and programs by contacting **Grover Partee** *(see above)*.

For More Information or To Provide Feedback

Please write:

Streamwalk
Susan Handley
U.S. EPA Region 10
1200 Sixth Avenue, WD-139
Seattle, Washington 98101

or call:

Gretchen Hayslip, Biologist
(206) 553-1685

Grover Partee, Data Management
(206) 553-6697

Susan Handley,
Program Implementation
(206) 553-1287

Instructions for Defining Longitude and Latitude of Streamwalk Site

Note: *Latitude and longitude are defined in degrees, minutes and seconds. There are 60 seconds in a minute and 60 minutes in a degree. The symbols are as follows: o = degree, ' = minute and " = seconds*

Method 1:
Mathematical Determination

1. Look at the right hand corner (upper or lower) under the map name (last digits of number) to find the width scale of the map:
   If 7.5 width enter **450** If 15 width enter **900**
2. What is the width of your map east to west _____ mm
   (exclude borders) (Longitude factor)
3. Divide #1 by #2 (to nearest whole) _____ sec/mm
4. What is the length of your map north to south _____ mm
5. Divide 450 by #4 (Latitude factor) _____ sec/mm
6. Enter the Longitude for the edge closest to your site
   [ ]° [ ]' [ ]"
   (east - west, noted at bottom of map)
7. Measure in millimeters from site to that edge _____ mm
8. Multiply #7 by #3 (to the nearest whole)
9. Convert #8 to minutes and seconds by dividing by 60, do not use a calculator so any remainder will be in seconds
   [ ]' [ ]"
10. (a) If closest edge is east, add #6 to #9
    (b) If closest edge is west, subtract #9 from #6

The Answer for #10 is the Longitude of the Site

11. Enter the Latitude for the edge closest to your site
    (north -- south) [ ]° [ ]' [ ]"
12. Measure (in millimeters) from the site to the edge mm
13. Multiply #12 by #5 (to the nearest whole)
14. Convert #13 to seconds
    [ ]° [ ]"
15. (a) If closest edge is south, add #14 to #11
    (b) If closest edge is north, subtract #14 from #11

The Answer for #15 is the Latitude of the Site

Method 2:
Grid

EPA has limited transparent grids available to assist you in determining latitude and longitude. To receive a grid, please contact **Susan Handley, (206)553-1287**. You will need to have the following information to receive the correct grid:

- Name and number of the topo map to be used
- Latitude nearest the site

The grid is a clear plastic sheet which you can place on the map. There is a six step process to define the latitude and longitude.

Method 3:
Local Resource

We are currently training people who will be available to assist you with the determination of latitude and longitude. If Methods #1 or #2 will not work for you, please contact us for assistance.

Algae: A chlorophyll containing plant ranging from one to many cells in size, that lives in fresh or salt water.
Anadromous: Fish that return from salt water to fresh water to spawn (e.g., salmon, steelhead).
Aquatic Insect: Insect species whose larval and/or juvenile forms live in the water.
Aquifer: Any underground geological formation containing water.
Bedrock: Unbroken solid rock, overlain in most places byu soil or rock fragments.
Benthic: Bottom-dwelling. The plant and animal life whose habitat is the bottom of a sea, lake, or river.
Channelized: The straightening and deepening of streams. Channelization reduces the ability of the stream to assimilate waste and disturbs fish breeding areas.
Clarity: The clearness of the water in the stream.
Conifers: A cone-bearing Evergreen tree or shrub (a pine tree for example).
Cover: Overhanging or instream structures (such as tree roots, undercut streambanks, or boulders) that offer protection from predators, shelter from strong currents, and/or shading.
Current: The velocity (speed) of the flow (of water).
Deciduous: A tree which sheds its foliage at the end of the growing season.
Ecosystem: The interacting system of a biological community (plants, animals) and it's non-living environment.
Effluent: The wastewater from a municipal or industrial source that is discharged into the water.
Erosion: The wearing away of the land surface by wind or water.
EPA: Environmental Protection Agency.
Filling: The process of depositing dirt and mud in marshy areas (wetlands) or in the water to create more land. Filling disturbs natural ecological cycles.
Gradient: The slope or steepness of the stream.
Groundwater: The supply of freshwater under the earth's surface in an aquifer or soil.
Habitat: The specific environment in which an organism lives and depends on for food and shelter.
Headwaters: Small creeks at the uppermost end of a stream system, often found in the mountains, that contribute to larger creeks and rivers.
Mass Wasting: Downward movement of dry soil and rock caused by gravity (often called slides or avalanches).
Monitor: To measure a characteristic, such as streambank condition, dissolved oxygen, or fish population, over a period of time using uniform methods to evaluate change.
Non-point Source Pollution: "Diffuse" pollution, generated from large areas with no particular point of pollutant origin, but rather from many individual places. Urban and agricultural areas generate nonpointsource pollutants.

Nutrient: Any substance, such as fertilizer, phosphorous, and nitrogen compounds, which enhances the growth of plants and animals.
Point Source Pollution: A discharge of water pollution to a stream or other body of water, via an identifiable pipe, vent, or culvert.
Pool: An area of relatively deep slow water in a stream that offers shelter to fish.
Quality Control (QC): The system of checks that are used to generate excellence, or quality, in a program (a monitoring program for example. QC asks if we are doing things right).
Quality Assurance (QA): Quality Assurance is the larger system to see that QC is maintained. QA asks if we are doing the right things (in our case are we monitoring the right things to detect changes in water quality).
Reach: A stream section with fairly homogeneous characteristics.
Redd: Shallow depression in the streambed gravel in which a female salmonid deposits her eggs.
Riffle: A shallow, gravely area of streambed with swift current. Used for spawning by salmonids and other fishes.
Riprap: A sustaining wall built of rocks.
Riparian Area: An area, adjacent to and along a watercourse, which is often vegetated and constitutes a buffer zone between the nearby lands and the watercourse.
Run: A stretch of fast smooth current, deeper than a riffle.
Runoff: The portion of rainfall, melted snow, or irrigation water that flows across ground surface and eventually returned to streams. Runoff can pick up pollutants from the air or the land and carry them to streams, lakes, and oceans.
Salmonid: Fish that are members of the family Salmonidae; includes salmon, trout, char, and whitefish.
Sediment: Fine soil or mineral particles that settle to the bottom of the water or are suspended in the water.
Stormwater Runoff: Water that washes off the land after a rainstorm. In developed watersheds it flows off roofs and pavement into storm drains which may feed directly into the stream; often carries concentrated pollutants.
Substrate: The material that makes up the bottom layer of the stream, such as gravel, sand, or bedrock.
Stream Corridor: A perennial or intermittent stream, it's lower and upper banks.
Stream Mouth: The beginning of a stream, where it empties into a lake, ocean, or another stream.
Suspended Sediments: Fine material or soil particles that remain suspended by the current until deposited in areas of weaker current. They create turbidity and, when deposited, can smother fish eggs or alevins. Can be measured in a laboratory as "Total Suspected Solids" (TSS).

Glossary

Topographic: The configuration of a surface area including its relief, or relative elevations, and the position of its natural and man-made features.

U.S.G.S.: U.S. Geological Survey.

Wetlands: Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development. They also can be identified by unique plants which have adapted to oxygen-deficient (anaerobic) soils. Wetlands influence stream flows and water quality.

Zoning: To designate, by ordinances, areas of land reserved and regulated for specific uses, such as residential, industrial, or open space.

Streamwalk Cover Sheet

Date:		
Investigator(s):		
Are you a stream resource professional?	❑ Yes ❑ No	
Have you completed a training class?	❑ Yes ❑ No	
Affiliation:		
Phone:		
Address:		
Stream name:	*County:*	*State:*
Map used: (eg: Bellevue South, Washington, 7.5 x 15 - 1:25000)		

Instructions:
Complete one **Cover Sheet** for each "walk." During the walk, complete one **Site Survey Data Sheet** *(both sides, please)* at each site. ***Streamwalk*** uses the term "sites" to designate unique *(ie: non-overlapping)* sections of the stream about 500 feet long. Your entries for each site should reflect, to the best of your ability, the whole site.

Return to:

Site Survey Data Sheet
(Complete One Sheet per Site)

Stream name:
County: *State:*
Investigator(s):
Site (name, description or number):

Latitude: ____ ° ____ ' ____ " N *Pgs 12-13*

Longitude: ____ ° ____ ' ____ " W

Weather *Page 6, #1*

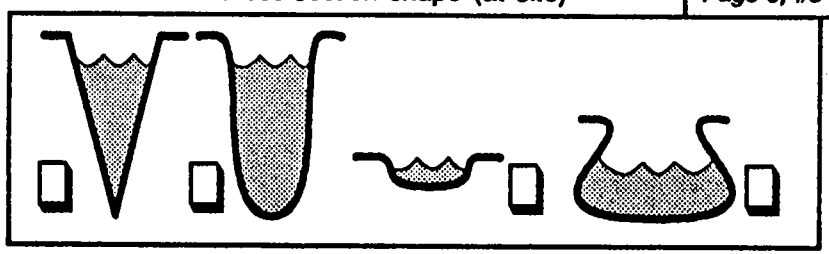
- ❑ Storm
- ❑ Rain
- ❑ Showers
- ❑ Overcast
- ❑ Clear

Stream Description *Page 6, #2*

1. Depth: ____ feet ❑ measured *(at site)* ❑ estimated
   Width: ____ feet ❑ measured *(at site)* ❑ estimated

Clarity - does water appear *Page 6, #3*
- ❑ Clear
- ❑ Cloudy

2. Pools *and* riffles *and/or* runs present ❑ *Page 6, #4*
3. Stream/bank Cross-section shape (at site) *Page 6, #5*



Site Survey Data Sheet
(Complete One Sheet per Site)

4. Stream bottom *(check those most common)* *Page 7, #6*
   - ❑ **Silt/Clay/Mud**
   - ❑ **Sand** (up to .1")
   - ❑ **Gravel** (.1 - 2")
   - ❑ **Cobbles** (2 - 10")
   - ❑ **Boulders** (over 10")
   - ❑ **Bedrock** (Solid)

5. Width of Streamside Corridor in feet (at site). **Left** looking downstream ____ Feet
   Width of Streamside Corridor in feet (at site). **Right** looking downstream ____ Feet *Page 7, #7*

6. Streamside vegetation *Page 7, #8*

	None/Sparse	Occasional	Common
Conifers	❑	❑	❑
Deciduous	❑	❑	❑
Small trees and Shrubs (<20')	❑	❑	❑
Grasses	❑	❑	❑

Vegetation appears natural ❑ or **cultivated** ❑

7. Extent of Overhead canopy *Page 8, #9*
   ❑ 0-25% ❑ 25-50% ❑ 50-75% ❑ 75-100%

8. Extent of Artificial Bank Protection *Page 8, #10*
   ❑ 0-25% ❑ 25-50% ❑ 50-75% ❑ 75-100%

9. Presence of Logs or Large Woody Debris in Stream *Page 8, #11*
   ❑ None ❑ Occasional ❑ Common

10. Presence of Other Organic Debris in Stream *Page 8, #12*
    ❑ None ❑ Occasional ❑ Common

11. Any fish present? *Page 8, #13*
    ❑ Yes ❑ No

Other Comments?

Site Survey Data Sheet
(Complete One Sheet per Site)

Adjacent land uses: Check "1" if present, "2" if clearly impacting stream:

Page 8, #14

1	2	**Residential**
❑	❑	Single family housing
❑	❑	Multi-family housing
❑	❑	Commercial development
❑	❑	Light industry
❑	❑	Heavy industry

1	2	**Roads, etc**
❑	❑	Paved roads or bridges
❑	❑	Unpaved roads

1	2	**Construction underway on:**
❑	❑	Single family housing
❑	❑	Multi-family housing
❑	❑	Commercial development
❑	❑	Light industry
❑	❑	Heavy industry
❑	❑	Road/bridge construction

1	2	**Agricultural**
❑	❑	Grazing land
❑	❑	Feedlots or animal holding areas
❑	❑	Cropland

1	2	**Other**
❑	❑	Mining or gravel pits
❑	❑	Logging
❑	❑	Recreation

Site Survey Data Sheet
(Complete One Sheet per Site)

Conditions (Check "1" if present, "2" if impact seems severe):

Page 9, #13

1	2	**Stream banks**
❑	❑	Natural streamside cover degraded
❑	❑	Banks collapsed/eroded
❑	❑	Banks artificially modified
❑	❑	Garbage/junk adjacent to stream

Page 9, #14

1	2	**Stream channel**
❑	❑	Mud/silt/sand in or entering stream
❑	❑	Artificial stream modifications *(dams, channels, culverts, etc.)*
❑	❑	Algae or scum floating or coating rocks
❑	❑	Foam or Sheen
❑	❑	Garbage/junk in stream

Page 9, #15

1	2	**Other**
❑	❑	Organic debris *(garbage, grass clippings, etc.)*
❑	❑	Livestock in or with unrestricted access to stream
❑	❑	Actively Discharging Pipe(s)
❑	❑	Other Pipe(s) Entering
❑	❑	Ditches entering

Other Comments?

Appendix C1
Example Erosion Control Ordinance

Oregon Departments of Environmental Quality and Land Conservation and Development

EXAMPLE/DRAFT
EROSION AND NONPOINT SOURCE CONTROL ORDINANCE*

PURPOSE

The purpose of this ordinance shall be to ensure that development or land alteration does not create downstream sedimentation, water quality, flooding, or drainage problems; and provides adequate drainage systems and soil protection for the site being developed. To this end, the following points shall serve as a basis for evaluating all development proposals.

All development proposals shall strive for maximum retention of the morphological features, water bodies, wetlands, native vegetation, and natural qualities of the site; and development shall seek to enhance these natural features and qualities.

All development proposals shall take into account and be judged by the application of current principles of land-use planning, soil science, soils and geotechnical engineering, hydrology, civil engineering, environmental design, architecture, and landscape architecture. Such current understanding includes but is not limited to:

1. Planning of development to fit the topography, soils, geology, hydrology, native vegetation and other conditions existing on the proposed site;

2. Orienting development to the site so that grading and other site preparation is kept to an absolute minimum;

3. Shaping of essential grading to complement the natural land forms and minimizing the padding and/or terracing of building sites;

4. Developing tracts in workable units on which construction can be completed within one construction season so that large areas are not left bare and exposed during the winter-spring period;

5. Accomplishing all paving and establishing the stormwater management systems as rapidly as possible after grading;

6. Establishing the erosion and sedimentation control systems at the earliest possible and most effective time, before, during and after grading;

7. Landscaping of areas around structures, and blending them with the natural landscape;

8. Transferring from natural to post-development water conveyance and storage systems quickly; and

9. Minimizing disruption of existing plant and animal life.

10. Minimizing the total widths of the road prism which includes the paved surfaces, sidewalks, ditches and cut and fill slopes.

* Adapted from ASPO (1975)

APPLICATION

The provisions of this ordinance shall apply to all public and private development, grading, excavation or land alteration activities that disturb or expose more than two (2) acres of soil, other than for agricultural tillage. This includes private development for residential, commercial or industrial purposes; and public roads/streets, sewers, water and wastewater facilities, buildings, and stormwater systems. It also applies to all land and native vegetation disturbance within 50 horizontal feet of the top of bank of any wetland, stream, lake, river or estuary. All activities to which this ordinance applies must be approved by the city/county[1] before any development, grading, excavation or land alteration occurs.

The implementation of the plans approved under the provisions of this ordinance, and the construction, maintenance, replacement, and upgrading of the facilities required is the responsibility of the applicant/contractor until all construction is completed and approved and vegetation/landscaping is established.

APPROVAL STANDARDS

The approval of a development shall be based on:

- maximum implementation in the grading and erosion control plan of the practices and facilities specified in the erosion control handbook provided to the applicant by the city/county;
- conformance to the provisions of this ordinance;
- a grading and erosion control plan which provides assurance to the maximum extent possible that the disturbed area erosion loss will be no more than one (1) ton per acre;
- minimum soil exposure for the development site;
- minimum road prism widths;
- maximum protection against landslides and slope failures;
- water management systems proposed for the development which equal or exceed the controls and standards specified in this ordinance;
- adequate provisions for maintenance during construction and permanent maintenance, including the necessary easements and rights of way if public maintenance is involved; and
- no development proposed for areas with any of the limiting factors present that are specified in this ordinance.

GRADING AND EROSION CONTROL PLAN

A grading and erosion control plan shall be submitted with each application and shall include the following:

1. All information and reports required by this ordinance.

2. Details and contours of the property, including drainage areas which affect the property.[2]

3. Location of any existing buildings or structures on the property where the work is to be performed, the location of any existing building or structures on land of adjacent owners which are within 100 feet of the property or which may be affected by the proposed grading operation, and proposed locations of structures relative to adjoining topography and property.

4. The direction of drainage flow and approximate grade of all streets (not to be construed as fulfilling the requirements for final street design).

5. The dimensions, elevations, and finish contours to be achieved by the grading, including all cut and fill slopes, proposed drainage channels, and related construction.

6. Detailed plans and locations of all surface and subsurface drainage systems including walls, dams, sedimentation ponds, nonpoint source control facilities, detention storage, and other protective devices to be constructed with, or as a part of, the proposed work. A map must be included that shows the drainage area and the complete existing and proposed drainage system, including major and minor waterways, outfalls, pipes, channels, ditches and natural streams, ponds, lakes, wetlands, and estuaries which may be affected by the proposed development, and the estimated runoff of the area served by the system.

7. A description of methods to be employed in storing or disposing of soil and other material including the location of the disposal site.

8. A schedule showing when each stage of the project will be completed, including the total area of soil surface which is to be disturbed during each stage, and estimated starting and completion dates. The schedule shall limit to the shortest possible period the time that soil is exposed and unprotected[3]. The existing natural vegetation ground cover shall not be destroyed, removed, or disturbed more than 30 days prior to grading or construction of the required improvements[4].

9. A revegetation component which emphasizes the use of native vegetation.

10. The boundaries of the clearing limits must be shown on the grading and erosion control plan, and shall be clearly flagged in the field prior to construction. During the construction period, no disturbance beyond the flagged clearing limits shall be permitted. The flagging shall be maintained by the applicant/contractor for the duration of construction.

Erosion control measures utilized for any construction site must be designed to achieve a disturbed area erosion loss of no more than 1 ton per acre per year, based on the Soil Conservation Service (SCS) Revised Universal Soil Loss Equation.

The grading and erosion control plan shall be prepared by a professional engineer registered in the state of Oregon.

The city/county may require that grading and erosion control operations and/or project designs be modified if delays occur which incur weather-generated problems not considered at the time approval was granted.

The city/county may make on-site inspections at any point during the development period to ascertain compliance with the approved grading and erosion control plan and the applicable provisions of this ordinance.

SPECIAL REQUIREMENTS AND DESIGN STANDARDS

Project Engineer

The applicant shall retain a professional engineer registered in the state of Oregon to serve as the project engineer.

It shall be the responsibility of the project engineer: to prepare a grading and erosion control plan; to incorporate into the grading and erosion control plan all recommendations contained in the soils and geotechnical, and water management reports; to include a slope stabilization and revegetation component; to implement and be responsible for all of the provisions of the grading and erosion control plan; to inspect and certify all grading and soil exposing operations; to submit to the city/county monthly status reports on the implementation of the grading and erosion control plan, and the status of erosion and sedimentation related to the development; to act as coordinating agent if the need arises for liaison between other professionals, the applicant, and the city/county; to prepare any revised plans; and to submit to the city/county as-graded grading plans upon the completion of the project.

Prior to and during grading operations, all necessary reports, compaction data, and soils, geotechnical and hydrology/hydraulic recommendations shall be submitted by the project engineer to the city/county.

If, in the course of fulfilling their responsibilities, the project engineer, the soils and geotechnical engineer, or the hydrologist discovers that the work is being accomplished to a substantially lesser standard than required by this ordinance or by the approved final grading and erosion control plan, the discrepancy, if not corrected within five (5) days, shall be reported immediately, in writing, to the project engineer and to the city/county. Recommendations for corrective measures, if applicable, shall be submitted.

If the project engineer, the soils and geotechnical engineer, or the hydrologist of record is changed during the course of the work, the work shall be stopped until a replacement has agreed to accept the responsibility for certification of the work within the area of his/her technical competence.

Soils and Geotechnical Report

Any area proposed for development grading, excavation or land alteration activities, other than for agriculture purposes, shall be investigated to determine the soil and geotechnical characteristics, and a soils and geotechnical engineering report shall be submitted with every application. This report shall include data regarding the nature, distribution, strength and erodibility of existing soils; the soil classifications according to engineering and Soil Conservation Service (SCS) criteria; fault zones; active and inactive slide/slope-failure areas; conclusions and recommendations for grading procedures; design criteria for corrective measures; and opinions and recommendations covering the adequacy of the site(s) to be developed.

The investigation and subsequent report shall be completed and presented to the city/county by a professional engineer registered in the state of Oregon and experienced and knowledgeable in the practice of soil mechanics and geotechnical engineering.

Recommendations included in the soils and geotechnical report shall be incorporated into the design plans and specifications.

Any area within the site which presents one or more of the following limiting factors shall not be subjected to development unless the engineer can demonstrate conclusively to the city/county that these limitations can be overcome in a manner that will prevent hazard to life; hazard to property;

adverse affects on the safety, use, or stability of a public way, drainage channel, stream, lake or estuary; and adverse impact on water quality, wetlands and other environmental considerations.

1. Water table within _____[5] of the ground surface at any time of the year;
2. Natural slopes greater than _____[6] percent;
3. Soils with a high shrink-swell potential;
4. Soils with classification of _____[7]

Temporary spoil or fill storage piles should be located on stable areas of the site, and these areas should be designated on the grading and erosion control plan for the project. These temporary piles should not be located at the top of, or on, slopes. If the site is situated entirely on sloping ground, either the spoils should be removed from the site or measures applied to mitigate the instability of the slope caused by the pile. The measures could include limiting the height and slope of the piles, providing temporary drainage, protecting the pile against saturation from rainfall and surface water or groundwater, and providing erosion control. The spoils or fill storage piles should not be located in a manner that will block natural surface water or groundwater. If site conditions are such that this is not possible, provisions should be made to provide temporary culverts, drainage trenches, drainage blankets under the fill pile, or other measures to prevent blockage of water and the saturation of the pile and underlying soil.

Water Management Report

Any area covered by this ordinance and proposed for development grading, excavation or land alteration activities, other than for agricultural tillage purposes, shall be investigated to determine its hydrologic, geohydrologic, and hydraulic characteristics, and a water management report shall be submitted with every application. This report shall include an adequate description, as defined by the city/county, of the hydrology related to the site (including geohydrology), all waterways within and affected by the development, potential nonpoint sources of water pollution, conclusions and recommendations regarding the effect of the proposed development on the expected runoff from the 2, 5, 10, 25, 50 and 100 year recurrence interval storms, the pollutant loading during the two year and six month recurrence interval storms, the flows and hydraulic profiles for these recurrence intervals at key on-site and downstream locations, options and recommendations covering the surface water and groundwater management systems proposed, and the mitigation of on-site and down gradient effects.

The investigation and subsequent report shall be completed and presented to the city/county by a qualified engineer, experienced and knowledgeable in hydrology, geohydrology and hydraulics.

Any area in which the investigation indicates that the proposed development, including the water management systems required by this ordinance, will result in hazard to life or limb; hazard to property; adverse affects on the safety, use or stability of a public way, drainage channel, stream, lake, or estuary; and unacceptable levels of adverse impact on the water quality, wetlands, and other environmental considerations either on-site or down gradient shall not be subjected to development.

Vegetation And Revegetation

The applicant shall include a slope stabilization and revegetation component in the grading and erosion control plan which shall include a complete description of the existing vegetation, the vegetation to be removed and the method of disposal, the vegetation to be planted, and slope stabilization measures to be installed. Native vegetation must be used to the maximum extent possible.

Vegetation shall be removed only when absolutely necessary, e.g., for buildings, filled areas or roads. Topsoil which is removed during construction shall be conserved for later use on areas requiring vegetation or landscaping, e.g., cut and fill slopes.

Vegetation sufficient to stabilize the soil shall be established on all disturbed areas as each stage of grading is completed according to the current erosion control handbook[8] available from the city/county. Areas not contained within lot boundaries shall be protected with native, fire-resistant species of perennial vegetal cover after all construction is completed. New plants shall be protected and watered until permanently established.

All disturbed soil surfaces shall be stabilized or covered within twelve (12) weeks after disturbance. If the planned impervious surfaces (e.g., roads, driveways, etc.) cannot be established, a temporary treatment adequate to prevent erosion shall be installed on those surfaces.

Construction shall be scheduled to minimize soil disturbance.

The applicant shall be fully responsible for any destruction of native vegetation proposed for retention. He/she shall carry the responsibility both for his/her own employees and for all subcontractors from the first day of construction until the notice of completion is filed. The applicant shall be responsible for replacing such destroyed vegetation.

The use of qualified personnel experienced and knowledgeable in the practice of revegetation is required.

Hydrologic, Hydraulic and Nonpoint Source Controls

1. Interceptor ditches shall be established above all cut slopes of more than five feet vertical height and the intercepted water conveyed to a stable channel or natural drainageway with adequate capacity;

2. Curb, gutter, ditch, and pavement design shall be such that water on roadways is prevented from flowing off the roadway in an uncontrolled fashion;

3. Natural streams, lakes, estuaries and drainageways shall be bioengineered, riprapped or otherwise stabilized below drainage and culvert discharge points for a distance sufficient to convey the discharge without channel erosion;

4. Runoff from areas of concentrated impervious cover (e.g., roofs, driveways, roads) shall be collected and transported to an acceptable discharge point in a conveyance system that has sufficient capacity to accept the discharge without accelerated erosion;

5. Stored or waste material from construction, including soil and other solid materials, shall not be deposited within the 100-year floodplain;

6. Hydrologically related structures in major waterways (major waterways defined as draining an area of 40 acres or more) shall be designed for the 100-year recurrence interval; in minor waterways (minor waterways defined as draining an area of less than 40 acres) they shall be designed for the 25-year recurrence interval; open channels/ditches and culverts that serve only the areas developed shall be designed for the 25 year recurrence interval; storm sewers shall be designed for the 10 year recurrence interval;

7. With the exception of unavoidable road crossings, approved drainage structures, and recreation and open space uses which do not involve the destruction of vegetal cover; development shall be prohibited within the 100-year recurrence interval floodway for major waterways, and the 25-year recurrence interval floodway for minor waterways. For minor waterways a uniform no-development setback of 25 feet on each side of the waterway can be utilized instead of the 25-year floodway;

8. Sedimentation ponds, or the equivalent, designed according to the current erosion control handbook available from the city/county, shall be constructed and maintained downstream from each development, unless sediment catchment facilities are otherwise provided that accomplish the same purposes; and erosion control practices as described in the erosion control handbook shall be applied to the maximum extent possible during site development;

9. The fully-developed water management systems for each phase of the project shall be completed and made operational within _____[9] after the start of each phase of construction.

10. Alterations of major waterways are prohibited except for approved road crossings and drainage structures;

11. Natural or improved open channel characteristics shall be preserved or provided for in major waterways. Only minor waterways shall be permitted to be enclosed in conduits, except for culverts at road crossings;

12. The city/county may require the applicant to install flow, groundwater, and water quality monitoring devices within any development and pay for monitoring before and during construction; such monitoring shall be to determine and document the function and results of the erosion control practices and facilities employed at the site;

13. Nonpoint source control facilities that significantly reduce the downstream water quality and sedimentation impacts from the site after development shall be designed and installed according to the criteria found in the current water quality facilities handbook available from the city/county.

DEVELOPMENT STANDARDS

The following shall apply to all construction for which this ordinance is applicable:

1. No grading, filling, clearing, or excavation of any kind shall be initiated until the final grading and erosion control plan is formally approved by the city/county.

2. Fill areas shall be prepared by removing organic material, such as vegetation and rubbish, and other material which is determined by the soils and geotechnical engineer to be detrimental to proper compaction or otherwise not conducive to stability; no rock or similar irreducible material with a maximum diameter greater than eight inches shall be used as fill material in fills that are intended to provide structural strength.

3. All retaining walls or facings with a total vertical projection in excess of three feet shall be designed as structural members keyed into stable foundations and capable of sustaining the design loads.

4. Fills shall be compacted to at least 95 percent of maximum density, as determined by AASHO T99 and/or ASTM D698.

5. Cut slopes shall be no steeper than two horizontal to one vertical; subsurface drainage shall be provided as necessary for stability.

6. Fill slopes shall be no steeper than two horizontal to one vertical; fill slopes shall not be located on natural slopes or steeper than 2:1, or where the fill slope toes out within 12 feet horizontally of the top of an existing or planned cut slope.

7. Tops and toes of cut and fill slopes shall be set back from property boundaries a distance of at least three feet plus one-fifth of the height of the cut or fill, but need not exceed a horizontal distance of 10 feet; tops and toes of cut and fill slopes shall be set back from structures a distance of six feet plus one-fifth the height of the cut or fill, but not exceeding 10 feet.

8. Roadways shall be designed to create the minimum amount of land coverage and the minimum disturbance to the soil;

9. Existing vegetation of the deep-rooted perennial variety shall be preserved to the greatest extent possible, particularly near roads; road alignment should follow natural terrain to the extent possible.

10. Variations in road design and road construction shall be considered that keep grading and cut-fill slopes to a minimum.

11. Roads in residential developments that contain slopes greater than 5% shall not exceed two lanes with a traveled way which shall not exceed _____ in width between the back of the curbs.

12. One-way streets shall be permitted and encouraged on slopes greater than 5% and where public safety will not be jeopardized. The traveled way shall not exceed _____ in width between the back of the curbs.

13. The maximum horizontal distance of disturbed soils surface for roadways, including road surface, ditch, cut slope and fill slope in residential developments, that contain slopes greater than 5%, shall not exceed 75 feet.

14. The facilities shown on the grading and erosion control plan must be constructed in conjunction with all clearing and grading activities, and in such a manner as to insure that sediment and sediment laden water do not enter the drainage system, roadways, or violate applicable water quality standards.

15. The facilities shown on the grading and erosion control plan are the minimum requirements for anticipated site conditions. During the construction period, these facilities shall be upgraded as needed for unexpected storm events and to ensure that sediment and sediment-laden water do not leave the site. The facilities shall be inspected daily by the applicant/contractor and maintained as necessary to ensure their continued functioning. The facilities on inactive sites shall be inspected and maintained a minimum of once a month or within the 24 hours following a storm event.

16. Stabilized construction entrances shall be installed at the beginning of construction and maintained for the duration of the project. Additional measures may be required to insure that all paved areas are kept clean for the duration of the project.

MAINTENANCE

The owner of any property on which grading or other work has been performed pursuant to a grading and erosion control plan approved or a building permit granted under the provisions of this ordinance shall continuously maintain and repair all graded surfaces and erosion prevention devices, retaining walls, drainage structures or means, and other protective devices, plantings, and ground cover installed or completed; unless other arrangements for such maintenance and repair has been approved by the city/county.

REQUEST FOR WAIVER OR REQUIREMENTS

If the applicant intends to request waiver of any of the provision of this ordinance, he/she must submit a request, in writing, with the grading and erosion control plan. The request shall itemize each requirement for which a waiver is sought and shall state the reason(s) for which each waiver is requested and the impacts of approving the waiver.

FOOTNOTES

1 Name of the local development approval organization(s).

2 The contour interval and scale required should be specified, based on the local availability of maps.

3 Usually two to four months during the dry weather season.

4 The minimum prior disturbance period can vary from 15 days to 60 days, depending on local conditions.

5 The local jurisdiction should establish a minimum depth to water table distance based on local conditions -- the minimum depths are normally four to six feet.

6 The maximum, developable slope for local conditions will usually vary from 15% to 30%, depending on the soils in the area.

7 The soil classifications that are particularly unsuitable for construction due to erodibility should be listed.

8 This ordinance assumes that the city/county will provide applicants with an "erosion control handbook" that provides the specific details needed in a grading and erosion control plan.

9 The permanent water management systems should be available as soon as possible, and a maximum time should be stated -- usually between three weeks and four months depending on the type of development and local soil and water conditions.

Appendix C2
Unified Sewerage Agency Environmental Protection and Erosion Control Rules

Oregon Departments of Environmental Quality and Land Conservation and Development

Chapter 5
ENVIRONMENTAL PROTECTION, EROSION PREVENTION, AND SEDIMENT CONTROL RULES

5.01 General Policy

5.02 Erosion Control

5.03 Air Pollution

5.04 Maintaining Water Quality

5.05 Fish and Wildlife Habitat

5.06 Control of Noise Levels

5.07 Natural Vegetation

5.08 Historical and Archaeological Areas

5.09 Pesticides, Fertilizers

5.10 Contaminated Soils

5.11 Enforcement

Chapter 5 - ENVIRONMENTAL PROTECTION, EROSION PREVENTION, AND SEDIMENT CONTROL RULES

PHILOSOPHY STATEMENT: This section contains Erosion Prevention Techniques and Sediment Control Measures. In order to meet the high water quality requirements of the Tualatin River Basin, the use of Erosion Prevention Techniques shall be emphasized, rather than Sediment Control Measures. This shall be especially important on larger construction sites immediately before and during the rainy portion of the year. Erosion prevention techniques are those designed to protect soil particles from the force of rain and wind such that they will not be dislodged and therefore will not erode. These techniques include such things as ground cover, and matting. Sediment control measures are designed to capture soil particles after they have been dislodged, and the measures attempt to retain the soil particles on-site. These measures include such things as silt fences and settling basins. Both erosion prevention techniques and sediment control measures have their appropriate uses, however, numerous case studies have shown that sediment control measures have been relied on too heavily, and that they have proven to be less effective in preventing soil movement than erosion prevention techniques.

5.01 General Policy

It is the policy of USA to require temporary and permanent measures for all construction projects to lessen the adverse effects of construction on the environment. The contractor shall properly install, operate and maintain both temporary and permanent works as provided in this section or in an approved plan, to protect the environment during the term of the project. In addition, these erosion control rules apply to all properties within the USA boundary, regardless of whether that property is involved in a construction or development activity.

Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any federal, state, or local authority.

5.02 Erosion Control

5.02.1 Application and Purpose

It is the Agency policy to reduce the amount of sediment and other pollutants reaching the public storm and surface water system resulting from development, construction, grading, excavating, clearing, and any other activity which accelerates erosion.

The provisions of Section 5.02 shall apply to all parcels and all land within the Boundary of the Agency.

5.02.2 Definitions

A. Erosion

Erosion is the movement of soil particles resulting from the flow or pressure from storm water, irrigation water, other water, or wind.

B. Land development

Land development shall have the meaning of Oregon Administrative Rules, Section 340-41-006(22), Adopted December 14, 1989.

C. The property or the site

The property or the site shall mean the subject real property.

D. Visible or measurable erosion

Visible or measurable erosion includes, but is not limited to:

1. Deposits of mud, dirt, sediment or similar material exceeding 1/2 cubic foot in volume on public or private streets, adjacent property, or into the storm and surface water system, either by direct deposit, dropping, discharge, or as a result of the action of erosion.

2. Evidence of concentrated flows of water over bare soils; turbid or sediment laden flows; or evidence of on-site erosion such as rivulets on bare soil slopes, where the flow of water is not filtered or captured on the site using the techniques in this Chapter.

3. Earth slides, mud flows, earth sloughing, or other earth movement which leaves the property.

5.02.3 Erosion Prohibited

Visible or measurable erosion which enters, or is likely to enter, the public storm and surface water system, is hereby prohibited, and is a violation of these rules. The owner/permittee of the property, together with any person who causes such erosion, from which the erosion occurs shall be responsible.

5.02.4 Erosion Control Permits

A. Except as noted in Section 5.02.4.C, no person shall cause any change to improved or unimproved real property that causes, will cause, or is likely to cause a temporary or permanent increase in the rate of soil erosion from the site

without first obtaining a permit from the Agency or City and paying prescribed fees. Such changes to land shall include, but are not limited to, grading, excavating, filling, working of land, or stripping of soil or vegetation from land.

B. No jurisdiction shall issue a permit for construction, land development, grading, excavation, fill, or the clearing of land without first verifying in writing that the Agency or City has issued an Erosion Control Permit covering such work, or the Agency or City has determined that none is required. No public agency or body shall undertake any public works project without first obtaining an Erosion Control Permit covering such work, or receiving a determination from the Agency or City that none is required.

C. No Erosion Control permit (from the Agency or City) is required for the following:

1) For work of a minor nature provided all the following criteria are met:

a) The land development does not require a development permit or approval from the local jurisdiction having land use decision authority, and
b) No land development activity or disturbance of land surface occurs within 100 feet of a sensitive area defined in Section 6.08.1, and
c) The slope of the site is less than 20 percent, and
d) The work on the site involves the disturbance of less than 500 square feet of land surface, and
e) The excavation, fill, or combination thereof involves less than 20 cubic yards of material.

2) Permits and approvals for land division, interior improvements to an existing structure, and other approvals for which there is no physical disturbance to the surface of the land.

3) A permit shall not be required for activities within USA which constitute accepted farming practices as defined in ORS 215.203.

4) Exception from the permit requirement does not exempt the property from the requirements of Section 5.02.03.

5.02.5 Permit Process

A. Applications for an Erosion Control Permit

Application for an erosion control permit shall include an Erosion Control Plan which contains methods and interim facilities to be constructed or used concurrently and to be

operated during construction to control erosion. The plan shall include either:

1) A site specific plan outlining the protection techniques to control soil erosion and sediment transport from the site to less than one ton per acre per year as calculated using the Soil Conservation Service Universal Soil Loss Equation or other equivalent methods established by Board rule. An Erosion Control Information Form (Appendix B) of the Plans - Technical Guidance Handbook, shall be filled out on all Private Developments, Public rights-of-way and Public Works construction sites.

2) Techniques and methods contained and prescribed in the Erosion Prevention and Sediment Control Matrix and Methods, hereby included as Appendix V, or the Erosion Prevention and Sediment Control Plans - Technical Guidance Handbook, City of Portland and Unified Sewerage Agency, Revised, February 1994.

B. Site Plan

A site specific plan, prepared by an Oregon registered professional engineer or soils engineer, shall be required when the site is:

1) greater than 5 acres (1200-C permit required)

2) greater than 1 acre and has slopes greater than 20 percent

3) contains or is within 100 feet of an Agency or City identified wetland or a waterway identified on FEMA floodplain maps,

4) greater than 1 acre and contains highly erodible soils.

5.02.6 Maintenance

The applicant shall maintain the facilities and techniques contained in the approved Erosion Control Plan so as to continue to be effective during the construction or other permitted activity. If the facilities and techniques approved in an Erosion Control Plan are not effective or sufficient as determined by the Agency or City site inspection, the permittee shall submit a revised plan within 3 working days of written notification by the Agency or City. Upon approval of the revised plan by the Agency or City, the permittee shall immediately implement the additional facilities and techniques of the revised plan. In cases where erosion is occurring, the Agency or City may require the applicant to install interim control measures prior to submittal of the revised Erosion Control Plan.

5.02.7 Inspection

The permittee shall call the Agency or City prior to the foundation inspection of a building for an inspection of the erosion control measures for that property. On a site development project the erosion control measures shall be installed prior to the start of any excavation work.

5.02.8 Physical Erosion

No person shall drag, drop, track, or otherwise place or deposit, or permit to be deposited, mud, dirt, rock or other such debris upon a public street or into any part of the public storm and surface water system, or any part of a private storm and surface water system which drains or connects to the public storm and surface water system. Any such deposit of material shall be immediately removed using hand labor or mechanical means. No material shall be washed or flushed into any part of the storm and surface water system without erosion control measures installed to the satisfaction of the Agency or City, and any such action shall be an additional violation.

5.02.9 Permit Fee

The Agency or City shall collect a reasonable fee for the review of plans, administration, enforcement, and field inspection to carry out the rules contained herein.

5.03 Air Pollution

5.03.1 Dust

Dust shall be minimized to the extent practicable, utilizing all measures necessary, including, but not limited to:

A. Sprinkling haul and access roads and other exposed dust producing areas with water.

B. Applying dust palliatives on access and haul roads. -

C. Establishing temporary vegetative cover.

D. Placing wood chips or other effective mulches on vehicle and pedestrian use areas.

E. Maintaining the proper moisture condition on all fill surfaces.

F. Prewetting cut and borrow area surfaces.

G. Use of covered haul equipment.

5.03.2 Fumes, Smoke, and Odors

A. Tires, oils, paints, asphalts, coated metals or other such materials will not be permitted in combustible waste piles, and will not be burned at the construction site.

B. Open burning shall not be permitted unless approved by the Department of Environmental Quality and the prevailing wind will carry smoke away from nearby built-up areas or communities.

C. Open burning shall not be permitted within 1,000 feet of a residence or built-up area or within 250 feet of the drip line of any standing timber or flammable growth.

D. Open burning shall not be permitted during a local air inversion or other climatic conditions that may result in a smoke pall hanging over a built-up area or community.

E. Open burning shall not be permitted when climatic and moisture conditions are contributing to high danger of forest or range fires as determine by local, state, or federal authorities.

5.04 Maintaining Water Quality

5.04.1

Construction between stream banks shall be kept to a minimum.

5.04.2

Pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials shall not be discharged into or near rivers, streams, or impoundments.

5.04.3

The use of water from a stream, or impoundment shall not result in altering the temperature of the water body enough to affect aquatic life.

5.04.4

All sediment laden water from construction operations shall be routed through stilling basins, filtered or otherwise treated to reduce the sediment load.

5.05 Fish and Wildlife Habitat

5.05.1

The construction shall be done in a manner to minimize the adverse effects on wildlife and fishery resources.

5.05.2

The requirements of local, state, and federal agencies charged with wildlife and fish protection shall be adhered to by the entire construction work force.

5.06 Control of Noise Levels

Construction noise shall be minimized by the use of proper engine mufflers, protective sound reducing enclosures,and other sound barriers. Construction activities producing excessive noise that cannot be reduced by mechanical means shall be restricted to locations where their sound impact is reduced to a minimum at the edge of the work area.

5.07 Natural Vegetation

5.07.1

As far as is practicable, the natural vegetation shall be protected and left in place. Work areas shall be carefully located and marked to reduce potential damage. Trees shall not be used as anchors for stabilizing working equipment.

5.07.2

During clearing operations, trees shall not be permitted to fall outside the work area. In areas designated for selective cutting or clearing, care in falling and removing trees and brush shall be taken to avoid injuring trees and shrubs to be left in place.

5.07.3

Where natural vegetation has been removed, or the original land contours disturbed, the site shall be revegetated, and the vegetation established, as soon as practicable after construction has commenced, except where construction of sewers will be followed by paving.

5.08 Historical and Archaeological Areas

When burial sites, buried camp areas, or village sites, and other distinctive archaeological or historical items are uncovered, or other items suspected of being of historical or archaeological significance are encountered, the contractor shall report the matter to the Agency and City and the state liaison officer. Construction operations shall be stopped until the appropriate authorities can examine the area and give clearance to proceed with the work. Under the Natural Historical Preservation Act, State liaison officers shall be notified when historical or archaeological items are unearthed.

5.09 Pesticides, Fertilizers

5.09.1

The use of pesticides, including insecticides, herbicides, defoliants, soil sterilants, and so forth, and the use of fertilizers, must strictly adhere to federal, state, county, and local restrictions. Time, area, method, and rate of application must be cleared with the local authorities and their requirements followed.

5.09.2

All materials defined in Section 5.09.1 delivered to the job site shall be covered and protected from the weather. None of the materials shall be exposed during storage. Waste material, rinsing fluids, and other such material shall be disposed of in such manner that pollution of groundwater, surface water, or the air does not occur. In no case shall toxic materials be dumped into drainageways.

5.09.3

All personnel shall stay out of sprayed areas for the prescribed time. All such areas should be fenced, appropriately signed, or otherwise protected to restrict entry.

5.10 Contaminated Soils

In the event the construction process reveals soils contaminated with hazardous materials or chemicals the Contractor shall stop work immediately, ensure no contaminated material is hauled from the site, remove his work force from the immediate area of the contaminated area, leaving all machinery and equipment, and secure the area from access by the public until such time as a mitigation team has relieved them of that responsibility. Contractor shall notify the Agency and City and an emergency response team (911) of the situation upon its discovery. No employees who may have come in contact with the contaminated material shall be allowed to leave the site until such time as the emergency response team releases them.

5.11 Enforcement

Failure to comply with any provision of this Chapter or with any term of an Erosion Control Permit, shall be deemed a violation of this ordinance and subject to enforcement action pursuant to applicable Agency and City ordinance.

Also see Appendix V - Erosion Prevention and Sediment Control Matrix and Methods

Appendix V

EROSION PREVENTION AND SEDIMENT CONTROL MATRIX AND METHODS

Establishing Primary Access Point

As one of the initial activities at the start of any earthwork, a gravel driveway shall be established. The driveway shall meet the following:

1) The driveway shall begin at curb line, or at the edge of the street or pavement if no curb, and be of sufficient length to allow construction and delivery vehicles to unload material and have access without needing to frequently drive over muddy areas.

2) The rock surface must be kept clean and free of mud, either from mud or dirt dropping or washing onto the surface, or from mud or soil "pumping" through the crushed rock from the action of vehicles. If contaminated such that significant mud will be washed or transported onto the streets, then the crushed rock shall be replaced or covered with an additional thickness of crushed rock, or restrict entry if possible.

3) The responsibility for design and performance of the driveway remains with the applicant. It is suggested the driveway be a minimum of 20' x 20', 8" thick, and be made of 2" minus or larger crushed rock, or 3/4" minus crushed rock with a geotextile fabric installed between the subbase and rock.

4) Tires and equipment shall be washed or otherwise cleaned prior to entering public right of way when the vehicle or equipment has entered a muddy area.

Additional Access

Construction and delivery vehicles and equipment shall use the primary access point (the gravel driveway). Vehicles and equipment shall not access the property from any other point (shall not "hop the curb"), unless required due to the physical layout of the parcel, and not simply due to convenience.

If it is necessary to access the site at other than the primary access point:

1) A second temporary or permanent crushed rock access point shall be established if there is an ongoing need to access the property at a second point. Large or difficult properties may require more than one permanent access point.

2) If there is only a one time or infrequent need to access the property at other than an established access point, then the

vehicle or equipment may "hop the curb." Each time the vehicle or equipment re-enters the street any mud, dirt, or other such debris that falls or is deposited on the street shall be immediately cleaned using hand labor or mechanical means. "Immediate" shall mean within five minutes of the mud, dirt, or debris being deposited on the street. Mud, dirt and debris shall not be allowed to accumulate to be cleaned up at the end of the day or "later". Under no circumstance shall mud, dirt or debris be washed into the storm and surface water system, without first mechanically cleaning and then protecting downstream facilities.

3) Under no circumstance shall vehicles or equipment enter a property adjacent to a stream, water course, or other storm and surface water facility, or a wetland such that it would not be possible to avoid contaminating or depositing mud, dirt, or debris into the water or wetland.

Silt Barriers

Silt barriers shall be installed concurrent with grading, and will be inspected prior to "footing" inspection. They shall be installed downhill of all graded, filled, and stripped areas, and across the path of concentrated flows. They shall be designed and installed to capture erosion on site. Silt barriers can be:

1) Hay bales
2) Silt fence
3) Gravel filter system, such as the early installation of sidewalk base rock. A gravel filter is permitted only when slopes are less than 5 percent.
4) Bio-Filter Bags

Exceptions to Silt Barrier Requirement

Silt barriers are not required as described above on a site, or on portions of a site:

1) where a "community" Erosion Control Plan is in effect.

2) Where there are no concentrated flows and the slope being protected has a grade of less than 2 percent.

3) Where flows are collected through the use of temporary or permanent grading or other means such that the flows are routed to an approved settling pond, filtering system, or silt barrier.

4) Where there are no concentrated flows, slopes are less than 10 percent, and where the run-off passes through a grassed area which is either owned by the applicant, or approved for such use in writing by the owner of the grassed area. The grass area shall be at least equal in area to the area being protected.

Community Plan

Any individual or group may submit a plan to control erosion from multiple lots, and this shall be referred to as a "Community Erosion Control Plan", or "Community Plan". In such case, the group of lots will be evaluated as if they were one lot.

If an individual lot in a Community Plan is sold to new owners, the new owner may either join the Community Plan (with the approval of the other "community" owner or owners), or will need to submit their own Erosion Control Plan if erosion potential still exists on the parcel. If a lot is sold and the new owner does not join the Community Plan, then the Community Plan must be revised to prevent erosion from entering the withdrawn property.

Protection Measure Removal

The erosion control facilities and techniques shall remain in place and be maintained in good condition until all disturbed soil areas are permanently stabilized by installation of landscaping, seeding, mulching, or otherwise covered and protected from erosion. A final erosion control inspection shall be required prior to transitioning into new ownership.

Miscellaneous

Filter systems may not be used on catch basins in public streets as a part of single family erosion control plans.

Plastic sheeting should generally not be used as an erosion control measure in single family house construction. Plastic sheeting may be used to protect small, highly erodible areas, or temporary stockpiles of material. If used, the path of concentrated flow from the plastic must be protected.

Appendix C3
City of Troutdale
Erosion Control and
Water Quality Standards

Oregon Departments of Environmental Quality and Land Conservation and Development

1.040 Flood Hazard and Hillside Overlay District Definitions

.02 Appeal. A request for a review of the Director's interpretation of any provision of this ordinance or request for a variance from requirements of Chapter 4 - Flood Hazard.

.04 Area of Shallow Flooding. A designated AO or AH zone on the Flood Insurance Rate Map (FIRM). The base flood depths range from one to three feet; a clearly defined channel does not exist; the path of flooding is unpredictable and indeterminate; and, velocity flow may be evident. AO is characterized as sheet flow and AH indicates ponding.

.05 Floodplain or flood-prone area. Any land area susceptible to being inundated by water from any source.

.06 Area of Special Flood Hazard (100 Year Flood Plain). The land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year. Designation on maps always includes the letters A or V.

.07 Base Condition. Condition of property at time of adoption of this ordinance.

.08 Base Flood. The flood having a one percent change of being equaled or exceeded in any given year. Also referred to as the "100-year" flood. Designation on maps always includes the letter A or V.

.09 Conservation Easement. An easement applied to environmentally sensitive lands which prohibits most forms of development, and which assures that native vegetation will be maintained or enhanced. Conservation easements usually affect privately owned land, and are enforceable by the City of Troutdale. Trails and limited public facilities may be permitted under carefully

controlled conditions within conservation easements.

10. Development. Any artificial change to improved or unimproved real estate, including but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation, vegetation removal, drilling, stream alteration or channeling, or other activities that adversely affect flood hazard potential or water quality within the area of special flood hazard.

11. Escarpment. A steep slope (25% or greater) separating a gently sloping surface (less than 10 percent slope) from a stream or river channel, and resulting from water and/or wind erosion. The "top of the escarpment" is land immediately above the line where the slope breaks downward to a creek or river.

.12 Flood or Flooding. A general and temporary condition of partial or complete inundation of normally dry land areas from:

(a) The overflow of inland or tidal waters and/or

(b) The unusual and rapid accumulation of runoff of surface waters from any source.

.14 Flood Insurance Rate Map (FIRM). The official map on which the Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

.16 Flood Insurance Study. The official report provided by the Federal Insurance Administration that includes flood profiles, the Flood Boundary-Floodway Map, and the water surface elevation of the base flood.

.18 Floodway. The channel of a river or other water-course and the adjacent land areas that must be reserved in

order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

.20 Lowest Floor. The lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area, is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non--elevation design requirements of the Flood Hazard regulations.

.22 Manufactured Home. A structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For flood plain management purposes the term "manufactured home" also includes park trailers, travel trailers, and area of special flood hazard.

.24 Manufactured Home Park or Subdivision. A parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

.26 New Construction. Structures for which the "start of construction" commenced on or after the effective date of this code.

.27 Slopes. Steep Slope areas include all areas in the City where the slope of the land is 25 percent or greater. Constrained Slope areas include all undeveloped areas where the slope of the land is from 15 to 24 percent. Such slopes are depicted generally on the City of Troutdale "Slopes Map," on file in the Community Development Department.

.28 Start of Construction. Includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufacture home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundation or the erection of temporary forms nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

.29 Stream Bank, Top of. The land area immediately above regularly confining a waterbody, including a stream, river or wetland. The bank has a notably steeper slope than the surrounding landscape. The top of the bank is the first major break in the slope between the toe of the bank at waterline and the surrounding landscape. The top of the bank does not include the entire canyon created by a stream or river, nor does it usually include the entire drainage area of a wetland. The top of the stream bank, as well as the location of the 100-year floodplain and floodway (if known), are depicted generally on the "City of Troutdale Flood Plain and Stream Corridor Map," on file in the Community Development Department.

.30 Structure. A structure is that which is built or constructed, an edifice or building of any kind, or any piece of work articially built up or composed of parts

joined together in some definite manner. In addition to buildings, the definition of "structure" includes such artificial constructs as parking lots, fences, roads, utilities and storage tanks.

.32 Substantial Improvement. Any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either:

(a) before the improvement or repair is started, or

(b) if the structure has been damaged and is being restored, before the damage occurred. For the purpose of this definition "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure.

The term does not, however, include either:

(c) any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions, or

(d) any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

.34 Variance. A grant of relief from the requirements of Chapter 4-Flood Hazard which permits construction in a manner that would otherwise be prohibited by the standards of the FH District.

.36 Vegetation, Approved. Vegetation which typically does

not require irrigation or fertilization, because it is adapted to natural soil, water and climatic conditions. The list of approved vegetation species is based on the "Portland Plant List' (May 26, 1993) and is on file in the Community Development Department. In contrast, invasive and nuisance vegetation can crowd out approved vegetation species or can be harmful to humans and animals.

1.060 Erosion Control and Water Quality Definitions

02. Excavation. Any act by which soil or rock is cut into, dug, quarried, uncovered, removed, displaced or relocated.

04. Developer. The owners of property or their agents or contractors, or their successors and assigns, who have undertaken or are proposing development which is regulated by Section 5.600.

06. Development. See Section 1.020.40.

08. Erosion. Detachment and movement of soil, rock fragments, refuse, or any other material, organic or inorganic.

10. Fill. Placement of any soil, sand, gravel, clay, mud, debris, refuse, or any other material, organic or inorganic.

12. Mulch. Application of plant residue, netting, plastic sheeting or other suitable materials to the land surface to conserve moisture, hold soil in place and aid in establishing plant cover.

14. Site. The "site" means the lot, or contiguous lots under the same ownership, that are subject to a development permit or erosion control plan.

16. Sediment. Any material that is in suspension, is being transported, or has been moved from its site of origin by water, wind, or gravity as a result of erosion.

18. Stockpile. On-site storage of any soil, sand, gravel, clay, mud, debris, vegetation, refuse or any other material, organic or inorganic, in a concentrated state.

20. Surface Water Management System. All natural and constructed facilities used to regulate the quantity and quality of surface water, including drainage easements, culverts, storm drains, catch basins, drainage ditches, natural drainageways, stream corridors, rivers, ponds, wetlands and impoundments.

22. Wetland. Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar wet areas. Wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. (ORS 196.800)

1.070 Scope and Compliance

A parcel of land may be used, developed by land division or otherwise, and a structure may be used or developed by construction, reconstruction, alteration, occupancy or otherwise only as permitted by this code. The requirements of this code apply to the person undertaking a development or the user of a development and to the person's successors in interest.

1.080 Consistency with Plan and Laws

Actions initiated under this code shall be consistent with the adopted Comprehensive Plan of the City of Troutdale and with applicable state and federal laws and regulations as these plans, laws and regulations may now or hereafter provide.

4.300 HILLSIDE AND EROSION CONTROL OVERLAY DISTRICT

4.310 Purpose. The purpose of this overlay district is to promote the public health, safety, and general welfare. Provisions under this section are designed to:

A. Restrict or prohibit uses, activities or development which is damage-prone or damage-inducing to the land or to water quality;

B. Require uses vulnerable to landslides, including public facilities which serve such uses, to be protected at the time of initial construction;

C. Allow the development of land only for those uses which are suitable on steep slopes;

D. Maintain land and water quality by minimizing erosion and sedimentation, and by restricting or prohibiting development, excavation and vegetation removal in areas with constrained or steep slopes.

E. To comply with Statewide Planning Goals 6 (Air, Water and Land Resources Quality) and 7 (Natural Hazards).

4.311 Findings of Fact.

A. Hillsides within the City of Troutdale represent the abrupt and noticeable changes in slope that mark the edges of the Beaver Creek Canyon, the Sandy River and Arata Creek.

B. Hillsides are environmentally sensitive areas. If they are not well managed, irreversible damage may occur.

C. Development, excavation and vegetation removal on slopes of 25 percent or greater will cause erosion and

stream sedimentation, and may increase the probability of landslides.

D. Unless development, excavation and removal of vegetation on slopes of from 15 to 24 percent are carefully managed and regulated, the probability of erosion, stream sedimentation and landslides will increase.

E. Coverage by native plant species and trees is important to maintenance of land and water quality, both for the development site and the City as a whole.

F. Fertilizers, pesticides and irrigation contribute to water pollution. Introduced plant species are more likely to require fertilizers, pesticides and irrigation than are native plant species.

4.312 Areas of Application. The Hillside and Erosion Control Overlay District shall apply to land on slopes of 15 percent or greater or unconstrained slopes within 30 feet of the top of escarpments associated with rivers or streams. .

A. Delineation of Boundaries.

The Hillside and Erosion Control Overlay District shall be mapped generally by the City, and shall consist of Steep Slope and Constrained Slope areas.

1. Steep Slope areas include all areas in the City where the slope of the land is 25 percent or greater.

2. Constrained slope areas include all areas where the slope of the land is between 15 and 24 percent.

3. These areas are associated primarily, but not exclusively, with the Beaver Creek Canyon, the Sandy River, and Arata Creek.

4. Specific determination of Steep Slope and Constrained Slope areas shall be made at the time of a development proposal by the applicant for alteration or development for the respective properties within the Hillside and Erosion Control Overlay District based on the topographic map and field survey.

5. Areas subject to the restrictions and prohibitions of this overlay district are indicated on the map entitled "City of Troutdale Slope Map" on file in the Community Development Department.

   a. Where development, excavation or vegetation removal is proposed for areas with 15 percent or greater slope, an on-the-ground topographical survey shall be prepared for the entire site. The survey shall show trees or tree clusters and 2 foot contours, and shall be provided by the property owner or applicant for development approval.

   b. Areas with 15 to 24 percent slopes, and areas with 25 percent or greater slopes, shall be specifically indicated on the required survey maps.

B. Warning and Disclaimer of Liability.

The degree of landslide protection required by this ordinance is considered reasonable for regulatory purposes and is based on common engineering and scientific practices . Landslides may occur on rare occasions in areas outside of the delineated Steep Slope

and Constrained Slope boundaries. This Ordinance does not imply that areas outside the Hillside and Erosion Control Overlay District boundaries or land use permitted within such boundaries will be free from significant mass movement or landslide damage. This Section shall not create City liability for damage resulting from reliance on the provisions of this Section or any administrative decision lawfully made thereunder.

4.313 Permitted Uses.

A. Uses Permitted - Steep Slope (25% or greater) or unconstrained slopes within 30 feet of the top of escarpments associated with rivers or streams.

1. Open space and trails as designated by the "Parks Plan," provided they are constructed consistent with standards on file in the Community Development Department.

2. Removal of refuse and unauthorized fill.

3. Removal of nuisance or invasive plant species, or planting of approved vegetation species on the Portland Plant List kept on file at the Community Development Department.

4. Removal of dead or dying trees that are an imminent danger to public safety as determined by the Director.

5. Construction of roads and public utilities necessary to support permitted development on slopes of 15 percent or less, subject to construction standards on file in the Public Works Department.

6. Expansion of existing roadways and public utility facilities.

B. Prohibited uses on slopes of 25 percent or greater, unless specifically permitted under Section 4.314:

1. Man-made structures.

2. Vegetation removal.

3. Road construction.

4. Excavation.

C. Uses Permitted - Constrained Slope (15 to 24 percent).

1. Open space.

2. At a reduced density and intensity, any use in the underlying district provided the standards of Section 4.314 are met.

3. Removal of nuisance or invasive plant species, or planting of approved vegetation species on the Portland Plant List and kept on file at the Community Development Department.

4.314 Hillside Development Standards.

A. Standards.

1. The property shall front on a publicly dedicated street or roadway with a right-of-way width and street improvement standard acceptable to the City. The parcel can be adequately served by municipal water supply and sanitary sewer systems . Development of individual sewage disposal systems shall not be permitted within the Hillside and Erosion Control Overlay District.

2. Where slopes are 25 percent or greater, or on unconstrained land within 30 feet of the top of escarpments associated with rivers or streams, grading, approved vegetation removal, site preparation and construction shall be prohibited, except where necessary to provide access or utilities to buildable lots with slopes of 15 percent or less.

   a. Land with slopes of 25 percent or greater shall be conserved and maintained as open space. This may occur through private ownership, through private conditions, covenants and restrictions, through conservation easements enforceable by the City or other public or private nonprofit agency, or where approved by the City Council, dedication to the City or donation to other appropriate public or private nonprofit agency.

   b. Disturbed areas shall be replanted in approved vegetation and tree cover.

3. Where development is proposed on slopes of 15 percent or greater:

   a. The impervious surface area of any residential lot or commercial or industrial site (including driveways, sidewalks, structures, swimming pools, and any other area not covered by vegetation) shall not exceed 30 percent of the constrained (15%-24%) slope area;

   b. Development shall not result in cuts or fills in excess of three (3) feet except for basement

construction unless specifically approved by the Director.

c. At least half the constrained slope area shall remain in, or be planted in, approved vegetation. The existing tree canopy shall be retained wherever possible, and shall be considered in meeting this standard.

d. If development is proposed on constrained or steep slope areas, a mitigation plan for disturbed areas on constrained or steep slope areas shall be prepared and implemented. This plan shall provide for the replanting and maintenance of approved plant species designed to achieve pre-disturbance conditions.

4. The applicant's engineering plans shall certify that runoff and sedimentation from the site will not increase more than 10% above conditions present on the site as of January 1, 1994.

5. The applicant's engineer shall provide a construction erosion control plan and water quality plan, consistent with the provisions of Section 4.600 and consistent with the City's NPDES program.

B. Submission Requirements. For the purpose of minimizing landslide hazards, and where development is proposed on slopes of 15 percent or greater, the Director shall require submission of the following special reports, prepared by professionals in their respective fields:

1. Hydrology, Geology and Soils Report. This report shall include information on the hydrological activities of the site, the effect of hydrologic

conditions on the proposed development, and any hydrological or erosion hazards. This report shall also include geological characteristics of the site, its suitability for development, its carrying capacity, and any geological hazard that might present a hazard to life and property, or adversely affect the use or stability of a public facility or utility. Finally, this report shall include information on the nature, distribution and strength of existing soils; the adequacy of the site for development purposes; and an assessment of grading procedures required to impose the minimum disturbance to the natural state. The report shall be prepared by a professional engineer registered in Oregon.

2. Grading Plan. The grading shall be specific to a proposed physical structure or use and shall include information on terrain (two foot contours), drainage, direction of drainage flow, location of proposed structures and existing structures which may be affected by the proposed grading operations, water quality facilities, finished contours or elevations, including all cut and fill slopes and proposed drainage channels. Project designs including but not limited to locations of surface and subsurface devices, walls, dams, sediment basins, storage reservoirs, and other protective devices shall form part of the submission. The grading plan shall also include a construction phase erosion control plan and a schedule of operations and shall be prepared by a professional engineer registered in Oregon.

3. Vegetation Report. This report shall consist of a survey of existing vegetative cover, whether it is native or introduced, and how it will be altered by the proposed development. Measures for re-

vegetation with approved plant species will be clearly stated, as well as methods for immediate and long-term stabilization of slopes and control of soil erosion. The vegetation report shall be prepared by a landscape architect, landscape designer, botanist or arborist with specific knowledge of native plant species, planting and maintenance methods, survival rates, and their ability to control erosion and sedimentation. The applicant will be responsible for replacing any native plant species that do not survive the first two years after planting.

4. Design Standards. The required reports shall include design standards necessary for the engineer and landscape expert to certify that development on slopes of 15 percent or greater, when combined with impacts from development of lesser slopes, will not increase runoff, sedimentation to affected streams or wetlands, erosion, or landslide potential more than 10% above base conditions. These requirements shall be incorporated as conditions into the final decision approving the proposed development.

C. Residential Density Allowance and Transfer Provisions.

1. Slopes of between 15 and 24 percent: the maximum residential density allowed in constrained slopes areas shall be 70 percent of the density otherwise permitted in the underlying residential zoning district. The remaining 30 percent of the otherwise permitted density may be transferred to buildable portions of the site (i.e., areas where slopes are less than 15 percent and outside of the 100-year floodplain).

2. Slopes of 25 percent or greater: density may be transferred to buildable portions of the site (i.e., where slopes are less than 15 percent and outside the floodplain) at a rate of one unit per steeply-sloped acre.

3. The net increase in density as a result of density transfer shall not exceed 50% of the base density that would otherwise be allowed on buildable portions of the lot. Single-family residential lot sizes on buildable land may be as small as 5,000 square feet to allow for density transfer.

4. Exception: Each lot-of-record, that has received planning approval from either Multnomah County or the City of Troutdale, may have one dwelling unit, provided that the siting, engineering, erosion control, water quality and re-vegetation standards of Section 4.314 have been fully satisfied. No new lot shall be approved for development which is exclusively on slopes of 25% percent or greater.

4.315 Approval Procedure - Type 1.

A. The Director shall approve new development for a single-family or two-family dwelling under the Type 1 procedure within the Hillside and Erosion Control Overlay District only if the proposed use or structure meets all of these conditions:

1. That development standards are met as prescribed under section 4.314;

2. That adequate protection is utilized to minimize landslide and erosion hazards, consistent with Section 5.600;

3. That the applicant provides assurances that development impacts will be minimized on slopes greater than 25 percent, provided however, that a property owner shall not be denied the right to construct a single-family home on a residentially zoned, lot-of-record, approved by Multnomah County or the City of Troutdale prior to January 1, 1994.

4. Notwithstanding the provisions of Section 6.200, Variance, an adjustment of up to 50% from any dimensional standard in the underlying zoning district may be approved under Type 1 procedure, where necessary to avoid construction on slopes of 25 percent or greater or to meet the standards of Section 4.314.

5. That it is in conformance with the provisions of the Troutdale Development Code .

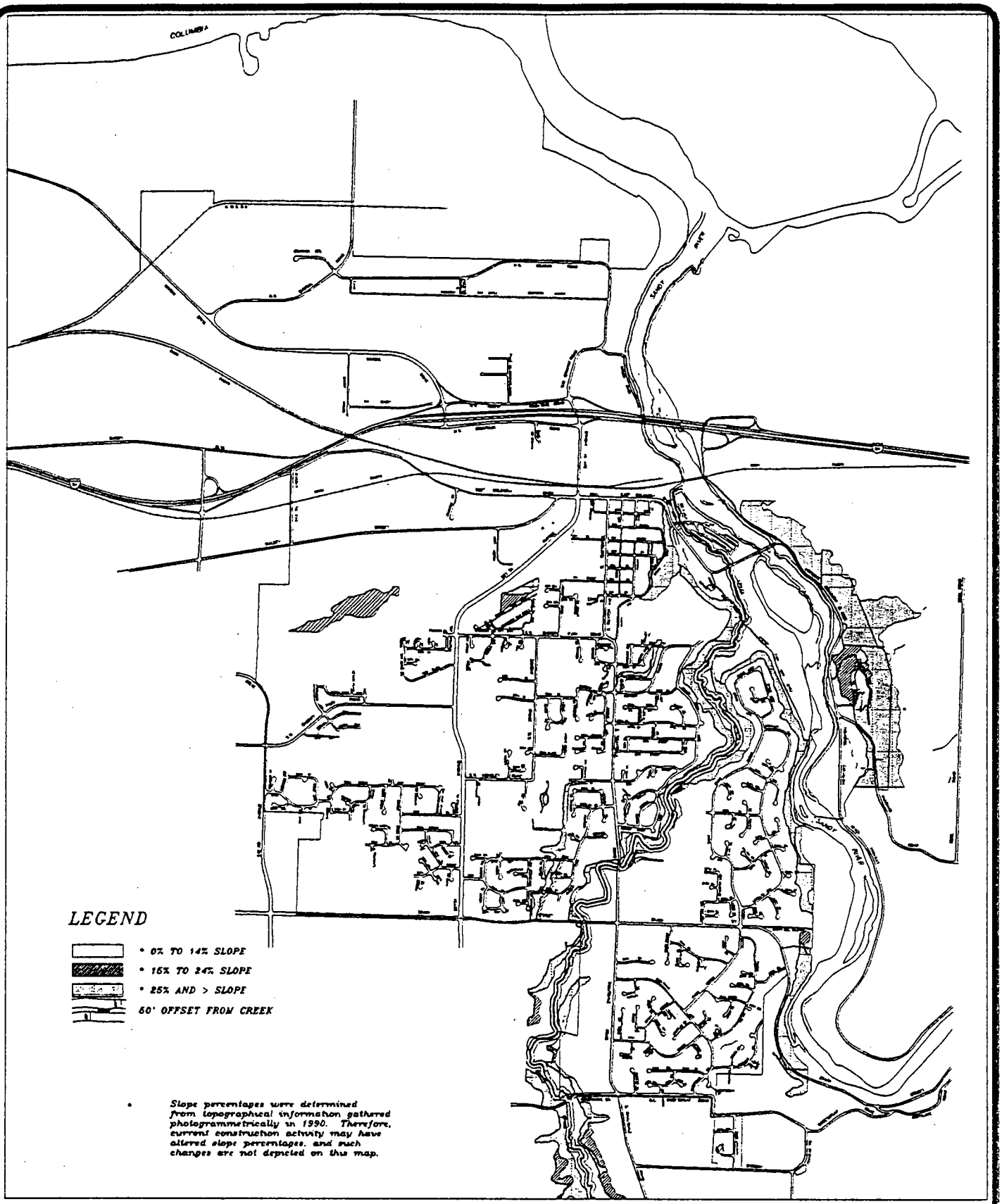
B. The Director shall determine the final boundaries of constrained slope and steep slope areas based on topographical information provided by an engineer or surveyor registered in Oregon. The applicant shall be responsible for submitting such information.

4.316 Approval Procedure - Type 3. The Planning Commission shall approve new developments for more than one single-family or two-family dwelling within the Hillside and Erosion Control Overlay District under a Type 3 procedure provided that the proposed use or structure meets all of these conditions:

A. That development standards are met as prescribed under Section 4.314;

B. That adequate protection is utilized to minimize landslide and erosion hazards, consistent with Section 5.600;

C. That it is in conformance with the City's Comprehensive Plan, and Troutdale Development Code, provided, however, that policies in the Comprehensive Plan will not be used to discourage needed housing, or to unreasonably increase cost or review time.



FILE NAME: *SLOPE*
TITLE BLOCK: *TB8X11*
EXTERNAL REFERENCES: *TROUTBAS;*
PLOT DATE: *07-05-94*
BY: *J.M.*
PREVIOUS REVISION DATE: *06-01-94*

CITY OF TROUTDALE
GATEWAY TO THE COLUMBIA RIVER GORGE
1907

DEPARTMENT OF PUBLIC WORKS

CITY OF TROUTDALE

SLOPE MAP

MULTNOMAH COUNTY, OREGON

JULY 1994

5.600 EROSION CONTROL AND WATER QUALITY STANDARDS.

5.610 Purpose. The purpose of these standards is to reduce the amount of sediment and pollutants reaching the public storm and surface water system resulting from development, construction, grading, excavating, clearing, and any other activity which accelerates erosion or increases water pollution. The objective is to control erosion and pollution at its source in order to maintain and improve water quality and reduce downstream impacts.

5.611 Applicability. An erosion control and mitigation plan shall be required and approved by the Director under any of the following circumstances:

A. Prior to final plat approval for any subdivision, in accordance with Chapter 7.100.

B. Prior to Site Orientation and Design Review, in accordance with Chapter 8.050.

C. Prior to approval of any building or grading permit that results in:

1. Disturbance of 1,000 square feet or more of land surface area.

2. Land or native vegetation disturbance within 50 horizontal feet of top of bank of any wetland, stream or river.

3. Disturbance of land or vegetation affecting 500 square feet or more of land area on slopes of 25 percent or greater.

D. Farming activities are exempt from the provisions of Section 5.611.C.1, provided that the specific land area has been cultivated within the last three years.

E. Upon a finding that visible or measurable erosion has entered, or is likely to enter, the public storm and surface water system. As used in this section, "visible or measurable erosion" shall include the following:

1. Depositions of soil or sediment exceeding one cubic foot in volume on a public or private street, adjacent property, or into the surface water management system either by direct deposit, dropping, discharge or as a result of erosion.

2. Flows of water over bare soils, turbid or sediment laden flows, or evidence of on-site erosion such as rivulets or bare soil slopes, where the flow of water is not filtered or captured on the site.

3. Earth slides, mud flows, earth sloughing, or other earth movement which leaves the property of origin.

F. Single Family Lot Exemption - Standard Erosion Control Plan.

Standard Erosion Control Plan Option. In lieu of compliance with TDC 5.614 the developer may choose to follow the requirements of the Standard Erosion Control Plan, approved by the Planning Commission and on file in the Community Development Department in the following circumstances:

a. The lot is 20,000 square feet or less.

b. No portion of the lot exceeds 5% slope.

Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any

federal, state, or local authority. See also Troutdale City Code, Chapter 12.09.

5.612 Approval Standards. The Director shall make the following affirmative findings prior to approval of an erosion control plan:

A. The project has been designed to minimize disturbance of natural topography, native vegetation and soils, consistent with applicable provisions of Sections 4.300 (Hillside Preservation) and 4.600 (Flood Hazard).

B. The site design maximizes the preservation of healthy trees, understory shrubs and ground cover.

C. The plan complies with the applicable technical guidelines, as determined by the Public Works Director. In the case of erosion control standards, the City of Gresham *Erosion Control Plans Technical Guidance Handbook*, April 1991 Edition, shall be the recognized authority. In the case of water quality facilities, the *Stormwater Management Manual for the Puget Sound Basin*, February 1992 Edition, shall be the recognized authority.

5.613 Erosion Control Plan Submission Requirements. The required erosion control plan shall include a narrative description and scaled drawings which address:

A. The physical characteristics of the site, including a map of existing topography at 2 foot contour intervals, the location of water areas, and a narrative description of soil characteristics. The requirement for a 2 foot contour map may be waived by the Director where this information is not readily available, and erosion potential is minor.

B. The nature of the proposed development, including any phasing plans, which may affect soils or create soil erosion. Areas of excavation, grubbing, clearing, stockpiling, or vegetation removal shall be specifically identified.

C. Specific erosion control measures and practices to be used to demonstrate compliance with Section 5.614.

5.614 Erosion Control Plan Standards. In addition to compliance with relevant portions of the City's Hillside and Flood Hazard Overlay Districts, the required Erosion Control Plan shall comply with the following standards:

A. Control Measures. Specific methods of soil erosion and sediment control shall be used during construction to minimize visible and measurable erosion. In no case shall soil erosion and sediment transport from the site exceed the rate of one ton per acre per year. These methods shall include all of the following:

1. The land area to be grubbed, stripped, used for temporary placement of soil, or to otherwise expose soil shall be confined to the immediate construction site only.

2. The duration of exposure of soils shall be kept to a minimum during construction. Exposed soils shall be covered by mulch, sheeting, temporary seeding or other suitable material following grading or construction, until soils are stabilized. During the rainy season (November through May), soils shall not be exposed for more than seven consecutive (7) days. All disturbed land areas which will remain unworked for 21 days or more during construction, shall be mulched and seeded.

3. During construction, runoff from the site shall be controlled, and increased runoff and sediment resulting from soil disturbance shall be retained on-site. Temporary diversions, sediment basins, barriers, check dams, or other methods shall be provided as necessary to hold sediment and runoff.

4. A stabilized pad of gravel shall be constructed and maintained at all entrances and exits to the construction site. The stabilized gravel pad shall be the only allowable entrance or exit to the site.

5. Topsoil removal for development shall be stockpiled and reused on-site to the degree necessary to restore disturbed areas to their original or enhanced condition, or to assure a minimum of six inches of stable topsoil for re-vegetation. Additional soil shall be provided if necessary to support re-vegetation.

6. The removal of all sediments which are carried into the streets, or on to adjacent property, are the responsibility of the developer. The applicant shall be responsible for cleaning and repairing streets, catch basins, and adjacent properties, where such properties are affected by sediments or mud. In no case shall sediments be washed into storm drains, ditches, drainageways, streams, or wetlands. See also Chapter 12.09 of the Troutdale Municipal Code, related to public facilities.

7. Any other relevant provision of the April 1991 edition of the City of Gresham *Erosion Control Plans Technical Guidance Handbook*, required by the Director.

B. Restoration of Vegetation. In addition to compliance with native vegetation removal and enhancement provisions

of Sections 4.300 and 4.600 of this code, the developer shall be responsible for re-vegetating public and private open spaces, utility easements, and undeveloped rights-of-way in accordance with an approved Schedule of Installation.

1. If the vegetation existing prior to site development is non-native or invasive, it shall be replaced with native or non-invasive plant species.

2. Temporary measures used for initial erosion control shall not be left in place permanently.

3. Work areas on the immediate site shall be carefully identified and marked to reduce potential damage to trees and vegetation.

4. Trees shall not be used as anchors for stabilizing working equipment.

5. During clearing operations, trees and vegetation shall not be permitted to fall or be placed outside the work area.

6. In areas designated for selective cutting or clearing, care in falling and removing trees and brush shall be taken to avoid injuring trees and shrubs to be left in place.

7. Stockpiling of soil, or soil mixed with vegetation, shall not be permitted on a permanent basis.

C. Schedule of Installation. A schedule of planned erosion control and re-vegetation measures shall be provided, which sets forth the progress of construction activities, and mitigating erosion control measures.

D. Responsible Person. The developer shall designate a specific person to be responsible for carrying out the Erosion Control Plan.

E. Reference Authority. The April 1991 edition of the City of Gresham *Erosion Control Plans Technical Guidance Handbook* shall be the primary guide for the City of Troutdale in establishing and reviewing erosion control techniques, methods and requirements. The Director and Public Works Director may also develop regulations and procedures in accordance with the Handbook to implement erosion control measures as needed.

5.615 Plan Implementation Requirements. An approved Erosion Control Plan shall be implemented and maintained as follows:

A. Plan Approval Required Prior to Clearing or Grading. No grading, clearing or excavation of land requiring an Erosion Control Plan shall be undertaken prior to approval of the Erosion Control Plan. Erosion control measures shall be installed prior to any stripping or excavation work.

B. Implementation. The developer shall implement the measures and construct facilities contained in the approved Erosion Control Plan in a timely manner.

1. During active construction, the developer shall inspect erosion control measures daily during rainy periods. In all cases, the developer shall be responsible for maintenance, adjustment, repair and replacement of erosion control measures to ensure that they are functioning properly without interruption.

2. Eroded sediment shall be removed immediately from pavement surfaces, off-site areas, and from the surface water management system, including

storm drainage inlets, ditches and culverts. See also Troutdale Municipal Code, Chapter 12.09. In the event that sediment is inadvertently deposited in a wetland or stream, the developer shall immediately contact the Director and coordinate remedial actions with the City.

3. Water containing sediment shall not be flushed into the surface water management system, wetlands or streams without first passing through an approved sediment filtering facility or device.

4. When required by the Director, the developer shall maintain written records of all site inspections of erosion control measures which shall be provided to the Director upon request.

5. In addition, the developer shall call for City inspection, prior to the foundation inspection for any building, to certify that erosion control measures are installed in accordance with the erosion control plan.

C. Dust Control. Troutdale is especially susceptible to wind erosion. Therefore, the Director may require that additional dust control measures be included in the Erosion Control Plan. Such control measures may include, but are not limited to, the following:

1. Sprinkling access and haul roads and other exposed dust producing areas with water.

2. Applying dust palliatives to access and haul roads.

3. Establishing temporary vegetative cover.

4. Placing wood chips, gravel or other effective mulches on vehicle and pedestrian use areas.

5. Maintaining the proper moisture condition on all fill surfaces.

6. Pre-wetting cut and fill surface areas.

7. Using covered haul equipment.

D. Correction of Ineffective Measures. If the facilities and techniques approved in the Erosion Control Plan are not effective or sufficient to meet the purpose of this section, based on an on-site inspection, the Director may require a revised plan.

1. The revised Erosion Control Plan shall be provided within 5 working days of written notification by the Director.

2. The developer shall implement fully the revised plan within 5 working days of approval by the Director.

3. In cases where serious erosion is occurring, the Director may require the developer to install interim control measures immediately, before submittal of the revised Erosion Control Plan.

E. Additional Standards. The following additional standards shall apply:

1. Construction between stream banks shall be prohibited, unless absolutely necessary to construct required public facilities.

2. Pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials shall not be discharged into or near rivers, streams, or impoundments, and shall be properly stored and disposed.

3. Discharge of water into a stream, wetland or impoundment shall not result in altering the temperature of the water body enough to affect aquatic life.

4. All sediment-laden water from construction operations shall be routed through stilling basins, filtered, or otherwise treated to reduce the sediment load.

F. Storage. All erodible or toxic materials delivered to the job site shall be covered and protected from the weather and stored according to appropriate health and safety guidelines.

1. Such materials shall not be exposed during storage.

2. Waste material, rinsing fluids, and other such material shall be disposed of in such manner that pollution of groundwater, surface water, or air does not occur.

3. In no case shall toxic materials be dumped into drainageways or onto land.

G. Contaminated Soils. Where the construction process reveals soils contaminated with hazardous materials or chemicals, the Contractor shall stop work immediately; ensure that no contaminated material is hauled from the site; remove the work force from the contaminated area; leave all machinery and equipment; secure the area from access by the public until such time as a mitigation team has relieved them of that responsibility; notify the City of the situation upon its discovery; and prohibit employees who may have come in contact with the contaminated material from leaving the site until released by the Emergency Response Team.

H. Duration of Maintenance. Continuing maintenance after development pursuant to the Erosion Control Plan, including re-vegetation of all graded areas, shall be the responsibility of the developer, subsequent developers or property owners.

1. Erosion control measures shall be maintained during construction and for one year after development is completed.

2. The Director may, upon a finding that soils are completely stabilized, reduce this period.

5.616 Special Water Quality Treatment Facilities. Beaver Creek and the Sandy and Columbia Rivers are vitally important to Troutdale's recreational-based economy and to the quality of life of Troutdale residents. Special water quality detention and treatment facilities may be required for major developments draining to Beaver Creek, or the Sandy or Columbia Rivers, designed in accordance with the *Stormwater Management Manual for the Puget Sound Basin* (Washington Department of Ecology, February 1992).

A. Applicability. The Director shall require water quality treatment or detention facilities for developments which qualify under any of the following:

1. The development involves 10 acres or more.

2. The development occupies one acre or more of steep slope or constrained slope area.

3. The development will cause degradation of water quality in the receiving stream without detention or treatment.

4. The development involves paved parking areas (exclusive of single family and two-family

residences), fuel storage or dispensing areas, vehicle wash areas, or vehicle maintenance or dismantling areas.

B. Responsibility and Treatment Options. Water quality facilities for major developments shall be required for purposes of minimizing water quality impacts on Beaver Creek and the Sandy River, prior to deposition into natural drainageways.

1. Water quality facilities shall be designed and constructed by the developer, to ensure that stormwater runoff is treated on site, prior to discharge.

2. Treatment may include infiltration devices, grassy swales, treatment ponds or other methods approved by the City, consistent with the *Stormwater Management Manual for the Puget Sound Basin*, February 1992.

C. Placement of Water Quality Facilities. Placement of water quality facilities shall be limited as follows:

1. The water quality facilities shall not be constructed within an existing or created wetlands unless a mitigation plan is approved by the City and the Oregon Division of State Lands.

2. The water quality facility shall not be placed on land with slopes of 15% or greater, within 50 feet of the top of the bank of a stream, or within a defined floodway area.

3. The water quality facility may be constructed within the 100 year floodplain, provided that the area is (a) outside the area covered by the 25-year flood event, and (b) the water quality facility

effectively and exclusively uses native plant species.

4. Where the approval authority determines that a more efficient and effective regional site exists within the sub-basin, the water quality facility may be constructed off-site.

D. Water Quality Facility Standards. The design and functions of required water quality control facilities shall be determined based on the recommendations of the *Stormwater Management Manual for the Puget Sound Basin*.

1. The preliminary subdivision plat, site plan, or permit application shall include plans and a certification prepared by a professional engineer registered in Oregon that the proposed stormwater quality control facilities have been designed in accordance with the *Stormwater Management Manual for the Puget Sound Basin.*

2. The plan shall specifically consider source control of pollution (oil and water separators), runoff treatment, streambank erosion control, wetland impacts, impacts on water quality sensitive areas, and off-site analysis and mitigation (Minimum Requirements 1-14, pp. I-2-5 through I-2-14).

3. A long-term (20-year) operation and maintenance plan shall be required. This plan shall document how and by whom the water quality facility will be maintained.

4. If the water quality facility is dedicated to the City, maintenance of the facility shall be the responsibility of the developer for at least two

years after the facility has been constructed and approved by the City.

If the facility is not dedicated to the City, then it shall be the continuing responsibility of the developer.

5. In all cases, runoff from impervious areas used for repair, cleaning, refueling, storing or servicing of vehicles and machinery shall be treated on site to remove oil, grease and other chemicals.

5.617 Security. Except as provided by Section 5.617.B, after an Erosion Control Plan or Water Quality Facility is approved by the Director and prior to construction or grading, the applicant shall provide a performance bond or other financial guarantee in the amount of 120% of the value of the erosion control and water quality measures necessary to stabilize the site and maintain water quality. Any financial guarantee instrument proposed other than a performance bond shall be approved by the City Attorney.

A. Duration. The financial guarantee instrument shall be in effect for a period of at least one year (or two years in the case of a water quality facility), and shall be released when the Director determines that the site has been stabilized (or the water quality facility is operating as designed). All or a portion of the security retained by the City may be withheld for a period of up to five years beyond the one year maintenance period, if it has been determined by the Director that the site has not been sufficiently stabilized against erosion (or the water quality facility is not operating as intended).

B. Exemptions. Individual lots zoned for single family and two family residential use prior to the effective date of this Section, and individual lots subject to the standard

erosion control plan stated in 5.614 shall be exempt from the security requirements of Section 5.617.

C. Conflict. Due to the immediate threat to the public health, safety and welfare posed by failure to comply with the strict provisions of the erosion control measures required under this Section, the provisions of Section 5.617 shall supersede the more general provisions of Troutdale Municipal Code Sections 17.050-070, where conflicts exist.

5.618 Penalties. Each violation of any provision of this Section, or any failure to carry out the conditions of any approval granted pursuant to this Section, shall be unlawful and a civil infraction subject to the enforcement provisions of Troutdale Municipal Code, Section 17.110, Abatement and Penalty.

A. Additional Penalties. In addition to those penalties available under Troutdale Municipal Code, Section 17.110, the Director may enforce the following additional penalties:

1. Issue a stop work order where erosion control measures are not being properly maintained or are not functioning properly due to faulty installation or neglect.

2. Refuse to accept any development permit application, revoke or suspend any development or building permit, or deny occupancy of the subject property until erosion control measures have been installed properly and maintained in accordance with this Section.

B. The owner of the property from which the erosion occurs, together with any person or parties who cause such erosion, shall be responsible for mitigating the impacts of the erosion and for preventing future erosion.

C. Upon request of the City Administrator or at the direction of the City Council, the City Attorney may

institute appropriate action in any court to enjoin development of a site or building project which is in violation of this Section, or to require conformance with this Section.

Appendix C4
City of Troutdale
Flood Hazard and
Water Quality Overlay District
(Example of Riparian Protection)

Oregon Departments of Environmental Quality and Land Conservation and Development

4.600 FLOOD HAZARD AND WATER QUALITY OVERLAY DISTRICT

4.610 Purpose. To promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions or degradation of water quality in specific areas by provisions designed:

A. To protect human life and health;

B. To minimize expenditure of public money and costly flood control projects;

C. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

D. To minimize prolonged business interruptions;

E. To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets, and bridges located in areas of special flood hazard;

F. To help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;

G. To ensure that potential buyers are notified that property is in an area of special flood hazard; and,

H. To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

I. To maintain and improve water quality.

J. To minimize erosion and loss of native vegetative cover.

K. To maintain wetlands within floodplain areas, because wetlands help to maintain water quality and maintain flood storage capacities.

L. To avoid any increase in base flood elevations as a result of development.

4.611 Methods of Reducing Flood Losses and Maintaining Water Quality.

In order to accomplish this purpose, this section includes methods and provisions for:

A. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

B. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

C. Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;

D. Controlling filling, grading, dredging, and other development which may increase flood damage; and

E. Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or may increase flood hazards in other areas.

F. Maintaining and reintroducing approved vegetation, which minimizes erosion and helps to maintain and improve water quality.

4.612 Applicability.

A. This section shall apply to all areas of special flood hazard and water quality impact, including all areas within 50 feet of the top of the banks of Arata, Salmon and Beaver Creeks, and the Sandy River, within the jurisdiction of the City of Troutdale.

B. Delineation of Boundaries.

The Flood Hazard and Water Quality Overlay District shall be mapped generally by the City. However, the applicant for alteration or development within this overlay district shall be responsible for precisely defining the following, based upon site-specific field surveys or Corps of Engineers data:

1. 100-year floodplain boundaries.

2. Floodway boundaries.

3. The name, location and dimensions of affected streams or rivers and the tops of their banks.

4. The area enclosed by a continuous line, located 50 feet from the tops of streams and river banks.

4.613 Basis for establishing the Areas of Special Flood Hazard and Water Quality Impact.

A. Maps and Studies Adopted by Reference. Areas subject to the restrictions and prohibitions of this overlay district are indicated on the map entitled "City of Troutdale Flood Plain and Stream Corridor Map" on file in the Community Development Department.

1. The description of flood-prone areas on this map are based on the areas of special flood hazard identified by the Federal Insurance Administration in a scientific and engineering report entitled "The

Flood Insurance Study for the City of Troutdale dated September 30, 1988. If FIRM maps are revised in the future, these revisions will define areas of special flood hazard.This 1988 study, with accompanying Flood Insurance Maps is hereby adopted by reference and declared to be part of this ordinance.

2. This map is also based on the City's interpretation of the location of streams, rivers and their banks, and the best topographical information available.

B. Topographic Survey. Where development, excavation or vegetation removal is proposed within this overlay district, an on-the-ground topographical survey shall be prepared for the entire site. The survey shall show trees or tree clusters, existing roads, utilities and structures, with 2 foot contours. The survey maps shall be provided by the property owner or applicant for development approval.

4.614 Interpretation. In the interpretation and application of this ordinance, all provisions shall be:

A. considered as minimum requirements;

B. liberally construed in favor of the governing body; and,

C. deemed neither to limit nor repeal any other powers granted under State statutes; and

D. definitions shall be as specified in Section 1.040.

4.615 Warning and disclaimer of liability. The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural

causes. This ordinance does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damage. This ordinance shall not create liability on the part of the City of Troutdale, any officer or employee thereof, or the Federal Insurance Administration, for any damages that result from reliance on this ordinance or any administrative decision lawfully made hereunder.

4.616 Permit Required.

A. Alteration within Floodplain. A permit shall be obtained before vegetation removal, excavation, construction or development begins within any area of special flood hazard established in Section 4.613. The permit shall be for all structures and all development including fill, vegetation removal, excavation and other activities that may adversely affect water quality or increase flood hazard.

B. Uses Permitted - Floodway or Within 50 Feet of Top of Bank:

1. Open space and trails as designated by the "Parks Plan," provided they are constructed consistent with standards on file in the Community Development Department.

2. Removal of refuse and unauthorized fill.

3. Removal of nuisance or invasive plant species, or planting of approved vegetation species on the Portland Plant List kept on file at the Community Development Department.

4. Removal of dead or dying trees that are an imminent danger to public safety as determined by the Director.

5. Construction of public utilities necessary to support permitted development outside the floodplain, subject to construction standards on file in the Public Works Department.

6. Expansion of existing roadways and public utility facilities.

C. Prohibited uses within Floodway or 50 feet from top of bank, unless specifically permitted under this Chapter:

1. Man-made structures.

2. Vegetation removal.

3. Road construction.

4. Excavation.

D. Uses Permitted within Floodplain, outside of Floodway and 50 feet beyond the top of bank:

1. Open space and trails as designated by the "Parks Plan," provided they are constructed consistent with standards on file in the Community Development Department.

2. Removal of refuse and unauthorized fill.

3. Land planned for residential, public or commercial use at the time of adoption of this section: any structure permitted in the underlying district may occupy up to 30% of the floodplain area, provided the standards of this Code are met.

4. For land planned for industrial use at the time of adoption of this section: any use or structure

permitted in the underlying district may be permitted anywhere within the floodplain area, provided the standards of this Code are met.

5. Removal of nuisance or invasive plant species, or planting of approved vegetation species, included on the Portland Plant List kept on file at the Community Development Department.

4.617 Application for Permit. Applications for a Flood Hazard permit shall be made and may include, but are not limited to:

A. Plans in duplicate drawn to scale showing the nature, location, dimensions, and elevations of the area in question.

B. Existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing.

C. Elevation in relation to mean sea level, of the lowest floor (including basement) of all structures;

D. Elevation in relation to mean sea level to which any structure has been floodproofed;

E. Certification by a registered professional engineer or architect that the floodproofing methods for any nonresidential structure meet the floodproofing criteria in Section 4.629;

F. Submission Requirements. Except for single-family residences on existing lots, where development is proposed within the floodplain, the Director shall require submission of the following special reports, prepared by professionals in their respective fields:

1. Hydrology and Soils Report. This report shall include information on the hydrological activities of

the site, the effect of hydrologic conditions on the proposed development, and any hydrological or erosion hazards. This report shall also include characteristics of the soils on the site, suitability for development, its carrying capacity, and erosion or slumping characteristics that might present a hazard to life and property, or adversely affect the use or stability of a public facility or utility. Finally, this report shall include information on the nature, distribution and strength of existing soils; the adequacy of the site for development purposes; and an assessment of grading procedures required to impose the minimum disturbance to the natural state. The report shall be prepared by a professional engineer registered in Oregon.

2. Grading Plan. The grading plan shall be specific to a proposed physical structure or use and shall include information on terrain (two-foot intervals of property), drainage, direction of drainage flow, location of proposed structures and existing structures which may be affected by the proposed grading operations, water quality facilities, finished contours or elevations, including all cut and fill slopes and proposed drainage channels. Project designs including but not limited to locations of surface and subsurface devices, walls, dams, sediment basins, storage reservoirs, and other protective devices shall form part of the submission. The grading plan shall also include a construction phase erosion control plan and a schedule of operations and shall be prepared by a professional engineer registered in Oregon.

3. Vegetation Report. This report shall consist of a survey of existing vegetative cover, whether it is native or introduced, and how it will be altered by the proposed development. Measures for re-

vegetation with approved plant species will be clearly stated, as well as methods for immediate and long-term stabilization of slopes and control of soil erosion. The vegetation report shall be prepared by a landscape architect, landscape designer, botanist or arborist with specific knowledge of approved plant species, planting and maintenance methods, survival rates, and their ability to control erosion and sedimentation. The contractor for installation and maintenance will be responsible for replacing any approved plant species that do not survive the first two years after planting.

G. Approval Standards. The required reports shall include design standards necessary for the engineer and landscape expert to certify that limited development within the floodplain, when combined with impacts from adjacent development, will not increase runoff, sedimentation to affected streams or wetlands, or erosion potential more than 10% above base conditions. These requirements shall be incorporated as conditions into the final decision approving the proposed development.

1. The impervious surface area of any residential lot or commercial or industrial site (including driveways, sidewalks, structures, swimming pools, and any other area not covered by vegetation) shall not exceed 30 percent floodplain area;

2. Development shall not result in cuts or fills in excess of three (3) feet except for basement construction unless specifically approved by the City.

3. Except for land planned for industrial use at the time of adoption of this section, at least half the

floodplain outside the floodway shall remain vegetated and undisturbed. The existing tree canopy shall be retained wherever possible, and shall be considered in meeting this standard.

4. If development is proposed within floodplain areas, a mitigation plan for disturbed areas shall be prepared and implemented. This plan shall provide for the replanting and maintenance of approved plant species designed to achieve pre-disturbance conditions.

5. The applicant's engineering plans shall certify that runoff and sedimentation from the site will not increase more than 10% above conditions present on the site as of January 1, 1994.

6. The applicant's engineer shall provide a construction erosion control plan and water quality plan, consistent with the provisions of Section 5.600.

7. Assurances and penalties for failure to comply with mitigation, engineering, erosion and water quality plans required under this section shall be as stated in TDC 5.617 and 5.618, respectively.

4.618 Use of Other Base Flood Data. When base flood elevation data has not been provided in accordance with Section 4.613 the City of Troutdale may obtain, review, and reasonably utilize any base flood elevation and floodway data available from a federal, State or other source, in order to administer the Flood Hazard Overlay District section.

4.619 Information to be Obtained and Maintained.

A. Where base flood elevation data is provided through the Flood Insurance Study or required as in Section 4.618,

the developer shall obtain and record the actual elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially improved structures, and whether or not the structure contains a basement.

B. For all new or substantially improved floodproofed structures:

1. Verify and record the actual elevation (in relation to mean sea level).

2. Maintain the floodproofing certifications required in Section 4.619.

3. Maintain for public inspection all records pertaining to the provisions of this ordinance.

4.620 Alteration of Watercourses. Alterations and relocations of the water courses of Arata, Salmon or Beaver Creeks or the Sandy River are prohibited, except to accommodate projects identified in the City of Troutdale Public Facilities Plan.

A. The City shall notify adjacent communities and the U.S. Army Corp of Engineers and other affected agencies prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Insurance Administration.

B. The City shall require that the developer maintain the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.

4.621 Interpretation of FIRM Boundaries or Tops of Banks. Make interpretations where needed, as to exact location of the

boundaries of the areas of special flood hazards (for example, where there appears to be a conflict between a mapped boundary and actual field conditions). The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in Section 4.622.

4.622 Variance Procedures.

A. The Planning Commission shall hear and decide appeals and requests for variances from the requirements of this code.

B. The Planning Commission shall hear and decide appeals when it is alleged there is an error in any requirement, decision, or determination made by the City of Troutdale in the enforcement or administration of this code.

C. Those aggrieved by the decision of the Planning Commission, or any taxpayer, may appeal such decision to the City Council, as provided in Chapter 16.

D. In passing upon such applications, the Planning Commission shall consider all technical evaluations, all relevant factors, standards specified in other sections of this ordinance, and:

1. The danger that materials may be swept onto other lands to the injury of others;

2. The danger to life and property due to flooding or erosion damage;

3. The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

4. The importance of the services provided by the proposed facility to the community;

5. The necessity to the facility of a waterfront location, where applicable;

6. The availability of alternative locations for the proposed use which are not subject to flooding or erosion damage;

7. The compatibility of the proposed use with existing and anticipated development;

8. The relationship of the proposed use to the Comprehensive Plan and flood plain management program for that area;

9. The safety of access to the property in times of flood for ordinary and emergency vehicles;

10. The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and

11. Impacts on water quality or native vegetation.

12. The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water systems, and streets and bridges.

E. Upon consideration of the factors of Section 4.622 (D) and the purpose of this ordinance, the Planning Commission may attach such conditions to the granting of variances as it deems necessary to further the purpose of this ordinance.

F. The City of Troutdale shall maintain the records of all appeal actions and report any variances to the Federal Insurance Administration upon request.

G. Conditions for Variances.

1. Generally, the only condition under which a variance from the elevation standard may be issued is for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing items 1-11 in Section 4.622 have been fully considered. As the lot size increases the technical justification required for issuing the variance increases.

2. Variances may be issued for the reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in this section.

3. Variances shall not be issued within a designated floodway if any increase in flood levels during the base flood discharge would result.

4. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, native vegetation and water quality, to afford relief.

5. Variances shall only be issued upon:

a. A showing of good and sufficient cause;

b. A determination that failure to grant the variance would result in exceptional hardship to the applicant.

c. A determination that the granting of a variance will not allow or result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public or conflict with existing local laws and ordinances.

6. Variances as interpreted in the National Flood Insurance Program are based on the general zoning law principle that they pertain to a physical piece of property; they are not personal in nature and do not pertain to the structure, its inhabitants, economic or financial circumstances. They primarily address small lots in densely populated neighborhoods. As such, flood variances from the flood elevations should be quite rare.

7. Variances may be issued for nonresidential buildings in very limited circumstances to allow a lesser degree of floodproofing than watertight or dry-floodproofing, where it can be determined that such action will have low damage potential, complies with all other variance criteria except Section 4.622 (F) [1] and otherwise complies with Sections 4.624-4.625.

8. An applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor elevation below the base flood elevation and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation.

4.623 Provisions for flood hazard reduction. In all areas of special flood and water quality hazards, the following standards are required:

4.624 Anchoring.

A. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

B. All manufactured homes must likewise be anchored to prevent flotation, collapse or lateral movement, and shall be installed using methods and practices that minimize flood damage. Anchoring methods may include, but are not limited to, use of over-the-top or frame ties to ground anchors (Reference FEMA's "Manufactured Home Installation in Flood Hazard Areas" guidebook for additional techniques).

4.625 Construction Materials and Methods.

A. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

B. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

C. Electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or otherwise elevated or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

D. No construction materials or methods may be used within the floodplain that would impair or damage water quality or native vegetation.

4.626 Utilities.

A. All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

B. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharge from the systems into flood waters; and,

C. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

D. Utility and road placement shall occur outside the Floodplain, and 50' beyond the top of stream or river bank, unless the utility or road is necessary to serve permitted development, and there is no reasonable alternative.

4.627 Subdivision, Planned Unit Development, Commercial, Industrial, Multi-Family and Public Development Proposals.

A. All proposals shall be consistent with the need to minimize flood and water quality damage;

B. All proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood and water quality damage;

C. All proposals shall have adequate drainage provided to reduce exposure to flood damage and maintain water quality;

D. Where base flood elevation data has not been provided or is not available from another authoritative source, the

developer shall provide this information prior to submittal for subdivisions and other proposed developments .

4.628 Review of Building Permits. Where elevation data is not available either though Flood Insurance Study or from another authoritative source (Section 4.618), applications for building permits shall be reviewed to assure that proposed construction will be reasonably safe from flooding. The test of reasonableness is a local judgment and includes use of historical data, high water marks, photographs of past flooding, etc., where available. Failure to elevate at least two feet above grade in these zones may result in higher insurance rates.

4.629 Specific Standards. In all areas of special flood hazards where base flood elevation data has been provided as set forth in Section 4.613, Basis for Establishing the Areas of Special Flood Hazard or Section 4.618, Use of Other Flood Data, the following provisions are required:

A. Residential Construction.

1. New residential and substantial improvements of any residential structure shall either have the lowest floor, including basement, elevated to the level of the base flood elevations.

2. Fully enclosed areas below the lowest floor that are subject to flooding are prohibited, or shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria:

a. A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade.

c. Openings may be equipped with screens, louvers, or other devices provided that they permit the automatic entry and exit of floodwaters.

B. Nonresidential Construction.

New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall have the lowest floor, including basement, elevated to the level of the base flood elevation; or together with attendant utility and sanitary facilities, shall:

1. Be floodproofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water.

2. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;

3. Be certified by a professional engineer registered in Oregon or an architect that the design and methods of construction are in accordance with accepted standards of practice for meeting provisions of this subsection based on their development and/or review of the structural design, specifications and plans. Such certifications shall be provided to the official as set forth in Section 4.619 (B).

4. Nonresidential structures that are elevated, not floodproofed, must meet same standards for space below the lowest floor as described in Section 4.629 A (2).

5. Applicants floodproofing nonresidential buildings shall be notified that flood insurance premiums will be based on rates that are one foot below the floodproofed level (e.g. a building constructed to the base flood level will be rated as one foot below that level).

4.630 Manufactured Homes. All manufactured homes to be placed or substantially improved within Zones A1-30, AH, and AE shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is at or above the base flood elevation and be securely anchored to an adequately anchored foundation system in accordance with the provisions of Section 4.624.

4.631 Floodways.

A. Encroachment Prohibited. Prohibit encroachment, including fill, new construction, substantial improvements, and other developments.

B. Exception: Utilities necessary to serve permitted development, and single family homes on legally-approved lots of record, may be permitted where a professional engineer registered in Oregon certifies that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge, and that water quality will not be adversely affected.

4.632 Encroachments. The cumulative effect of any proposed development shall not increase the water surface elevation of the base flood . On-site flood storage capacity shall not

decrease as a result of development, vegetation removal or excavation.

4.633 Wetlands.

A. Prohibitions. Development, vegetation removal and excavation shall be prohibited on, or within 25 feet of, wetlands located within, or partially within, the Flood Hazard and Water Quality Overlay District.

B. Exceptions. Utilities necessary to serve development outside the floodplain may be permitted, provided that the design and re-vegetation standards of this section are met.

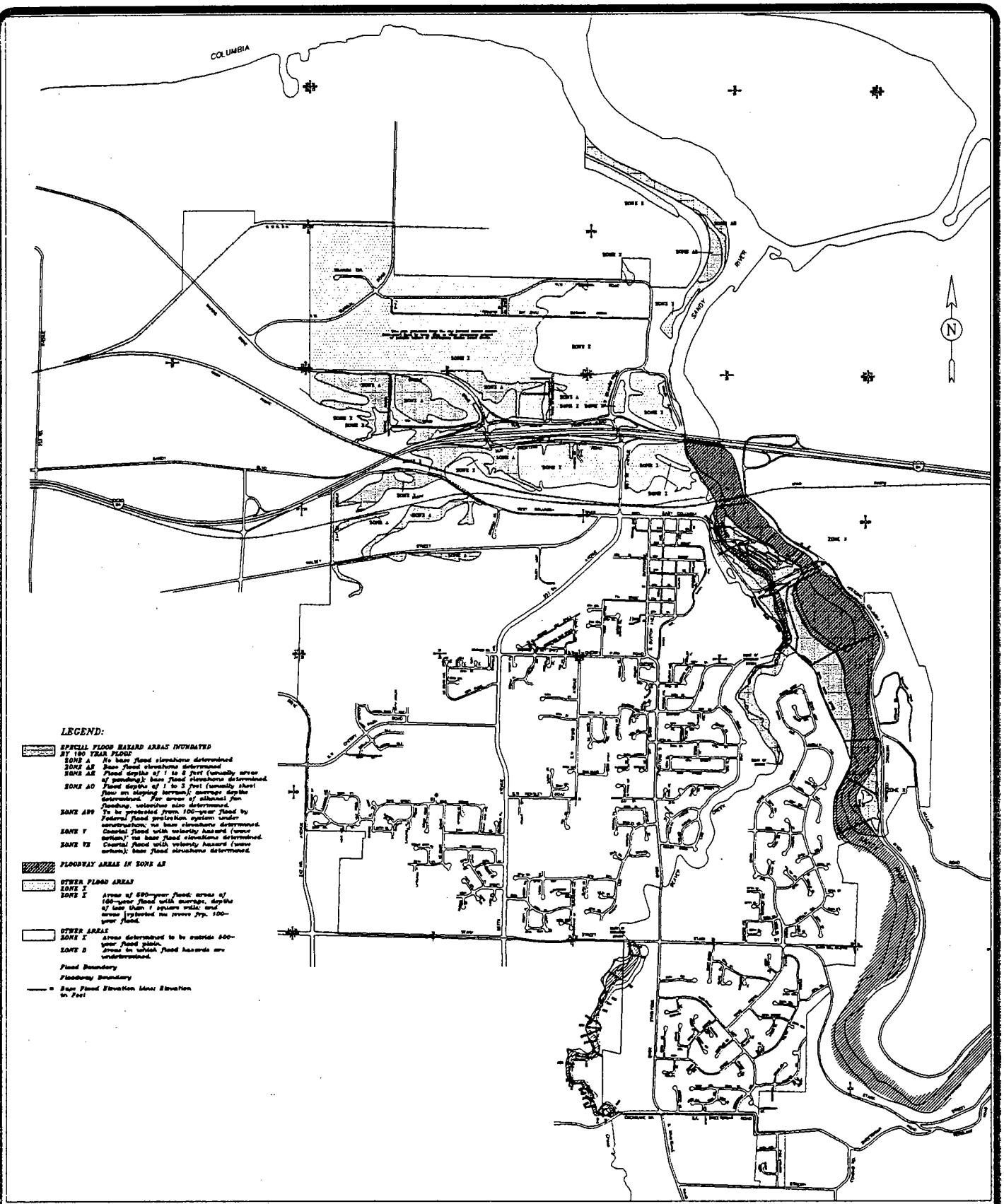
4.634 Residential Density Allowance and Transfer Provisions.

A. Floodplain. Floodplain areas outside Floodway and 50 foot stream bank setback: residential density allowed in this portion of the floodplain shall be 70 percent of the density otherwise permitted in the underlying residential zoning district. The remaining 30 percent of the otherwise permitted density may be transferred to buildable portions of the site (i.e., areas entirely outside the 100-year floodplain and 50 foot stream setback).

B. Floodway and Stream Bank Setback. Areas within the Floodway and 50 foot stream bank setback: density may be transferred to buildable portions of the site at a rate of one unit per acre.

C. Maximum Density Increase. The net increase in density as a result of density transfer shall not exceed 50% of the base density that would otherwise be allowed on buildable portions of the lot. Single-family residential lot sizes on buildable land may be as small as 5,000 square feet to allow for density transfer.

D. Exception. Each lot-of-record, that has received planning approval from either Multnomah County or the City of Troutdale, may have one dwelling unit, provided that the siting, engineering, erosion control, water quality and re-vegetation standards of this Section have been fully satisfied. No new lot shall be approved for development which is exclusively within the Floodway or stream bank setback area.



FILE NAME: *FLOOD*
TITLE BLOCK: *TB8X11*
EXTERNAL REFERENCES: *TROUTBAS;*
PLOT DATE: *06-01-94*
BY: *J.M.*
PREVIOUS REVISION DATE: *NONE*

CITY OF TROUTDALE
GATEWAY TO THE COLUMBIA RIVER GORGE
1907

DEPARTMENT OF PUBLIC WORKS

CITY OF TROUTDALE

FLOOD MAP

MULTNOMAH COUNTY, OREGON

JUNE 1994

Appendix D
Questionnaire Concerning Effectiveness

APPENDIX D

Responses to Five Questions Regarding Nonpoint Source Control Measures by 20 Questionnaire Respondents[1]

1. **QUESTION: Please list the measures which you believe are the most effective in controlling nonpoint, and the pollutants that the measures primarily address.**

It's important to realize that effectiveness of controls is relative. If the concentration of pollutants coming in is high - more likely to get good removal rates than if concentrations are low. Also, many controls are seasonal in their effectiveness.

Stormwater ponds and wetlands; limiting impervious cover; sand filters.

Ranked in the following order: 1) public education, 2) land-use controls, 3) riparian buffers, 4) drainage controls/standards, 5) strict erosion control, and 6) BMPs are effective to some degree, facilities and designed measures are site specific.

Reduction of impervious surface/sq.ft. of usable residential/commercial space; riparian area/wetland protection (sediment, temperature, general urban nonpoint); maintenance of septic systems and constructed drainage systems (bacteria, nutrients, general urban nonpoint); livestock management (bacteria, nutrients); retrofitting of existing detention ponds (general urban nonpoint); general urban nonpoint (metals, organic pollutants, suspended solids, bacteria).

Vegetated swales (economical and easy to fit into site; address most pollutants; high effectiveness). Non structural source control, illicit connection/discharge controls.

Oil-water separators must be maintained properly. Integrated landscaping including ponds and marshes, bio-filtration swales and landscaping with native species to reduce turf area and increase infiltration and reduces runoff, reduce soil erosion. Constructed wetlands and pond-marsh systems-nutrients. Leaf compost filtration facilities (oil/grease, heavy metals, debris).

Sedimentation pond (suspended sediments), vegetated swales (suspended sediments, oil/grease), erosion control (suspended sediments).

Most effective: 1) land-use planning and zoning to reduce generation of pollutant loads and locate development in least sensitive areas (e.g. away from streams and wetlands; 2) source control, especially for industrial land uses; 3) infiltration BMPs when feasible for all pollutants; 4) wet ponds and sand filters for particulates.

Preventative source controls tailored to the specific problem; preventative erosion controls; treatment measures are a step down but the most effective potentially seems to be constructed wetlands, wet ponds, and infiltration (if failure can be avoided in the latter cases).

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1 All decipherable comments are presented. Inclusion does not imply that DEQ, DLCD or Montgomery Watson agree with the comment.

Detention basins (TSS/heavy metals- particulate); landscape controls such as grassy swales, bio-filters (TSS, PAHs); land-use controls: minimizing directly connected impervious surfaces, use of buffer strips, staying out of steep areas (TSS, PAHs, copper).

2. **QUESTION: Which measures require the most research and development regarding performance or design (i.e. currently appear to be unpredictable and/or have poor defined design criteria).**

Leaf compost filters are still in testing phase - no design criteria yet.

Street/sewer system BMP's like CB's, sed MH's, vaults - we still don't know how effective they are.

Lack of performance information for buffers.

Water quality inlets, infiltration basins, dry extended detention ponds, filter strips and infiltration trenches.

All structural BMPs, most research has not gone on long enough nor is it rigorous enough.

Infiltration systems, and reduction of impervious surface/sq.ft. of usable space.

Seems like almost all structured controls need ongoing research and development.

The leaf compost filters need to be monitored for urban/industrial run-off and there is currently no O&M manual and track record. The constructed wetlands must be defined carefully and maintenance is an issue.

Street sweeping and water quality inlets/catch basins.

Biofiltration swales; vegetative filter strips; wet ponds/constructed wetlands (esp. long term effectiveness at removing nutrients); compost/peat/etc. filtration; infiltration due to clogging and poor site evaluation for soils, water table.

Infiltration (siting); source controls (demonstration of actual effectiveness and how to get them used more).

Need guidance where oil/grit separators should be used (these are commonly cited for use in inappropriate locations: residential developments); infiltration devices are not allowed in Santa Clara Co. except in very limited cases (roof drains).

3. **QUESTION: Which measures do you believe (a) are the most predictable regarding performance, and (b) have well defined design criteria.**

Elimination of sources obviously most predictable. Also, in agricultural areas: CAFO controls, fencing. In forestry areas: reducing roads, putting roads 'to bed' after logging.

Swales and erosion control have most well-defined criteria.

None.

Stormwater ponds.

Swales, wet-ponds/wetlands, some infiltration facilities.

Riparian area protection, livestock management, septic system maintenance and retrofitting of old dry ponds to extended ponds.

Structural: swales, ponds, infiltration.
Source: source identification and elimination.

Oil-water separators, grassy swales, detention ponds, sumps and infiltration basins.

Sedimentation ponds and sedimentation manholes.

Sediment ponds; sand filters; wet ponds/ constructed wetlands (for TSS removal, not nutrients).

All are lacking but vegetated swales and wet ponds are probably best documented.

Detention basins; media/sand filtration.

4. QUESTION: Please discuss any control measures that you believe are of particular interest to local governments. Include performance or design information if appropriate and available.

All depends on specific site/basin problems.

Those that do not commit public works to high O&M costs; and those that do not involve a failure loop that commits agencies to high replacement/repair costs.

Reduction of impervious surface/sq.ft. of usable residential/commercial space; riparian area/wetland protection (sediment, temperature, general urban nonpoint); maintenance of septic systems and constructed drainage systems (bacteria, nutrients, general urban nonpoint); livestock management (bacteria, nutrients); retrofitting of existing detention ponds (general urban nonpoint); general urban nonpoint (metals, organic pollutants, suspended solids, bacteria).

We need more innovation in how we design the buildings and other elements of the urban environment to reduce pollutants and improve the environment as a whole.

Oil-water separators must be maintained properly. Integrated landscaping including ponds and marshes, bio-filtration swales and landscaping with native species to reduce turf area and increase infiltration and reduces runoff, reduce soil erosion. Constructed wetlands and pond-marsh systems-nutrients. Leaf compost filtration facilities (oil/grease, heavy metals, debris). The leaf compost filters need to be monitored for urban/industrial run-off and there is currently no O&M manual and track record. The constructed wetlands must be defined carefully and maintenance

is an issue. Oil-water separators, grassy swales, detention ponds, sumps and infiltration basins.

Marsh-wetland treatment.

Infiltration BMPs; filtration BMPs (sand, compost, peat).

Should be concentrated more on source controls, including land-use planning measures.

Sand filters are of interest. Multi-purpose detention basins are also of interest (flood water quality and recreational uses). Controls relating to land-use are strongly suggested by State regulators (San Francisco Bay Reg Board Recommendation for New Dev. Controls).

5. QUESTION: Please briefly describe the approaches to public involvement in local nonpoint source control programs which you have found to be effective.

Direct community involvement in stream restoration projects.

Involving residents in substantive ways; and empowering citizens to be involved.

Participation in developing watershed plans; and participation in hands-on projects: detention pond retrofitting and stream clean-up, etc.

One-on-one personal contact.

School outreach and education programs. Work with local "friends" group to clean-up streams, plant riparian buffers, etc. Involve service groups, i.e. scouts, church groups, neighborhood associations in storm drain stenciling and stream restoration efforts.

Public education: provide information to all residents in the affected area on the hows and whys of pollution prevention.

"Business Partners for Clean Water" - a program to educate business owners with focus on source control; "Stream Teams" - direct public involvement in cleaning up, re vegetating, monitoring, and "careful taking" of streams; volunteer monitoring of lakes and streams.

Oil recycling, household hazardous waste collection events, recycling are all well accepted. Adopt-A-Creek programs (citizen volunteers to assess creek condition, collect water/sediment samples, perform trash removal) becoming more popular.

Appendix E
Surface Water Management Plan Report Outline

Oregon Departments of Environmental Quality and Land Conservation and Development

Surface Water Management Plan
Report Outline (Example)

SUMMARY (very brief)

Table of Contents

1. INTRODUCTION

Purpose, Goals and Objectives
Description of the Planning Approach and Methods
Description of the Planning Area
Contents and Products

2. PUBLIC PARTICIPATION IN THE PLANNING

Approach to Public Involvement and Education
Public Values and Expectations
Surface Water Management Implications

3. STUDY AREA AND WATERSHED CHARACTERISTICS

(The level of information in the following sections varies according to the local issues, the needs of the planning methods, the types of measures to be implemented, and the available information base. In general a one-half to two page summary per section with a map, if possible, is sufficient.)

Overview
History
Development and Land Use
Facilities and Utlities
Related Planning/Plans
NPDES Requirements
Permit and Regulatory Contraints
Geology and Soils
Vegetation
Wetlands (brief description)
Hydrology (summary of the surface water and groundwater conditions)

Water Quality (summary of the monitoring program, data, conditions and implications)
Fish
Wildlife

4. **FIELD CONDITIONS**

The Piped System
Open Channels
Flood Reduction Detention Basins
Ponds and Lakes
Wetlands
Opportunity Sites
    Detention Facilities
    Water Quality Facilities
    Source Controls

5. **WATER QUALITY CONDITIONS**

Summary
Monitoring Program
Data and Analysis
NPDES Requirements
Pollutant Loading Analysis and/or Water Quality Modeling
Evaluation and Conclusions

6. **POLLUTION SOURCE INVENTORY**

Stored, Applied or Transported Materials (Industrial, Commercial, Agricultural, Silvicultrual, Mining, CERCLA/RCRA sites)
Existing or Potential Erosion Areas (surface, mass and channel erosion)
Problem Soil Areas
Extensive Impervious Surfaces
On-site Wastewater Systems

7. **HYDROLOGY** (assuming a quality-quantity plan)

Hydrologic Characteristics
Overview of the System

Drainage and Flooding History
Model Analysis (possibly as a separable sidebar or "brief")
    Selection
    Adaptation
    Calibration
    Existing System Evaluation
Conclusions

8. TECHNIQUES AND OPTIONS CONSIDERED

Water Quality Facilities
Drainage and Flood Control Facilities (assuming this is included)
Erosion and Sedimentation Reduction
Management Practices
Land Use Requirements and Related Institutional Changes
Design Standards/Criteria
Operation and Maintenance
Financing (summary)
Implementation (schedule, permitting and responsiblities)

9. FINANCING

Source of Funds
Cost of Service
Revenue Requirements
Rate Analysis
Rate Recommendation and Modeling Results

10. ALTERNATIVES EVALUATION

Analysis of Water Quality Management Practice and Pollutant Loading
    Reduction Options
Hydrologic - Hydraulic Modeling of Options
Financing
Implementation

11. RECOMMENDED PLAN

Pollutant Reduction Facilities
- Ponds and Marshes
- Street and Storm Sewer Systems
- Infiltration Facilities

Flow Management Facilities
- On-site/Source Controls
- Conveyance
- Detention
- Appurtenant Features

Pollutant Source Controls
- Landscape Design
- Chemical Applications
- Industrial and Commercial Sites
- Agricultural Areas
- Silvicultural Areas

Erosion and Sedimentation Controls

Stream, Riparian and Lake Management

Other Water Quality Management Practices

Capital Improvements Plan

Public Education Program

Land Use Requirements and Institutional Changes

Design Standards

Operation and Maintenance

Financing

Implementation

REFERENCES

Appendix A - Results of Public Involvement Program

Appendix B - Existing Facilities and/or Practices

Appendix C - Wetlands

Appendix D - Water Quality Information

Appendix E - Hydrologic Information

Appendix F
APA Newsletter

ENVIRONMENT & Development

AMERICAN PLANNING ASSOCIATION

NOVEMBER 1993

A Planner's Guide to Nonpoint-Source Pollution Control

By Mark S. Dennison

Nonpoint-source (NPS) water pollution—pollution that enters our rivers, lakes, and bays from diffuse sources such as farm fields and traffic arteries—has been a particularly complex and difficult environmental management problem. After the nation made noticeable strides toward regulating point-source pollution (such as emissions from factory drain pipes), Congress built NPS provisions into its 1987 amendments to the Clean Water Act. Since then, federal, state, and local regulators, water-quality managers, and government planners have invested considerable time, money, and effort in developing programs to manage water-quality problems caused by NPS pollution. This year's reauthorization of the Clean Water Act is certain to include additional mandates for controlling nonpoint-source pollution.

This issue of *Environment & Development* explains the current intergovernmental system for managing NPS pollution, provides a review of information sources on the subject, and looks at new controls contained in proposed amendments to the Clean Water Act.

NPS Pollution as a National Priority

The nation's primary water protection law is the Clean Water Act, whose main objective is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The focus during the program's first 15 years was on regulating point-source pollution. After considerable success in restoring many polluted streams, lakes, and other water bodies to acceptable water quality, the 1987 Amendments to the Clean Water Act initiated a movement toward control of pollution from more diffuse sources.

Nonpoint-source pollution is a major and extremely difficult problem. Recent studies by the U.S. Environmental Protection Agency and state water-quality agencies indicate that most of the remaining water-quality impairments to the nation's rivers, streams, lakes, estuaries, coastal waters, and wetlands result from these pollutants.

EPA and the states together have developed nonpoint-source pollution management programs. In addition to controls under Clean Water Act Section 319, several other federal, state, and local programs supplement and interface with the act's NPS pollution program. A review of the act and these other NPS programs appears below.

Sources and Impacts

Nonpoint-source pollution often starts far from the waters that are eventually contaminated. It begins when rainwater and snowmelt run over the land and carry away pollutants that occur naturally or are caused by human effects on surface water or groundwater.

Water runoff that enters and is discharged by pipes, ditches, canals, tunnels, and other conduits is considered a point source, subject to Clean Water Act permit requirements. But diffuse runoff is generally treated as a nonpoint source. It is harder to identify, isolate, and control than traditional discharge sources.

Clean Water Act section 319(a) is the principal federal control for nonpoint-source pollution. It requires states to identify waters affected or threatened by non-point sources and to trace the sources affecting them. The states have told the federal EPA that wildlife and recreation are most severely affected. Rivers, streams, lakes, estuaries, coastal waters, and wetlands are all experiencing major effects.

Agriculture is the single largest source of nonpoint-source pollution problems. Siltation and nutrients cause the greatest share of NPS impacts on U.S. surface waters. Table 1 shows the leading nonpoint sources, pollutants, and impacts.

TABLE 1. LEADING SOURCES, POLLUTANTS, AND STATE-DESIGNATED USE IMPACTS RELATED TO NONPOINT SOURCE POLLUTION[1]

Waterbody Type (# States Reporting)	Leading Sources[2]	Leading Pollutants	Uses Impacted
Rivers (40 states)	Agriculture Unknown	Siltation Nutrients	Wildlife Recreation
Lakes (33 states)	Agriculture Unknown	Nutrients Siltation	Recreation Wildlife
Estuaries (13 states)	In-place contaminants Urban	Nutrients Pathogens	Wildlife Recreation
Coastal Waters (7 states)	Waste storage tanks Petroleum activities	Oil and grease Metals, pesticides Pathogens, inorganics	Shellfish Recreation, high quality Industry, navigation
Great Lakes (2 states)	In-place contaminants Unknown	Priority organics Pesticides	Fisheries Wildlife
Wetlands (3 states)	Agriculture Hydrologic modification	Siltation Metals	Wildlife Recreation, high quality
Groundwater (9 states)	Not available	Pesticides Unknown toxicity Priority organics	Drinking

[1] Listed sources, pollutants, and uses impacted are not necessarily linked. The number of states reporting is the maximum number that may have contributed data under each of the information columns. For example, while 40 states reported the river mileage impacted by nonpoint sources, only 33 states reported pollutant information in a quantitative manner.

[2] Leading sources, pollutants, and uses impacted determined by the number of miles of acres affected. Top two, with ties, are listed.

Silt is the major pollutant affecting rivers and streams. Nutrients, pathogens, metals, and pesticides are also present in varying degrees. Nationally, the greatest adverse impacts from siltation are found in Missouri; from nutrients, in North Dakota; from pathogens, in Virginia; from metals, in Colorado; from pesticides, in Iowa; from habitat modification, in Montana; and from organic sediments, in North Carolina. The sources responsible are (in order of impact) agriculture, surface mining, streambank modification, on-site wastewater systems, subsurface mining, petroleum activities, channelization, flow regulation/ modification, and urban runoff.

Nutrients (primarily nitrogen and phosphorus) are the greatest cause, and siltation the second major cause, of NPS pollution of lakes and ponds. Again, agricultural use constitutes the largest source, followed by on-site wastewater systems, contaminants created on the site, petroleum activities, flow regulation/ modification, streambank modification, atmospheric deposition, urban growth, highway maintenance and runoff, recreation, and urban runoff.

Oil and grease are the primary NPS pollutants fouling coastal waters. Metals, pesticides, other inorganics, and pathogens (disease-causing agents) are major NPS pollutants, while nutrients, siltation, and dissolved oxygen from nonpoint sources affect coastal waters to a lesser degree. Waste storage and storage tank releases account for the greatest share of nonpoint-source pollution of coastal waters, followed by impacts from mining and urban sources.

Nutrients are the greatest problem for estuaries, although pathogens cause the greatest damage. Dissolved oxygen, oil and grease, salts, highly toxic organic chemicals, and metals rank high as nonpoint-source polluters of estuaries. Contaminants produced on site are the biggest identified source of nonpoint-source pollution of estuaries, followed by on-site wastewater systems and petroleum activities. Urban runoff is also a large source of estuary pollution.

An understanding of the various types of water bodies, types of pollutants, and sources of nonpoint-source pollution enables states to create effective pollution-control programs. When establishing planning measures to reduce the adverse impacts of NPS pollution, local governments should review the information in the state's nonpoint-source assessments.

Federal NPS Regulatory Programs

Several different agencies and laws govern control of nonpoint-source pollution. Clean Water Act Section 319 provides the primary framework for integrating all the various federal programs into state nonpoint-source management programs. EPA and state water-quality agencies have directed construction of sewage treatment plants and established water-quality criteria and standards, national point-source pollution-control programs, wetland regulatory programs, and drinking water quality standards. The U.S. EPA implements and oversees many different programs (see sidebar) aimed at protecting and restoring water quality. Unfortunately, it is not possible to describe each of these programs in much detail here, but here is a limited summary of some of them.

Section 319 Management Programs

Recognizing the many nonpoint sources of pollution and their interrelation with other aspects of water pollution control, Congress assigned EPA the role of establishing and coordinating a national nonpoint-source control program through Section 319 of the Clean Water Act.

States must develop NPS management programs under Section 319. Specifically, these programs must:

- Identify the best management practices (BMPs) that will reduce pollutant loadings from nonpoint sources identified in state assessment reports;
- Identify programs to achieve implementation of BMPs including nonregulatory or regulatory programs for enforcement, technical assistance, education, training, technology transfer, and demonstration projects;
- Provide a schedule of annual milestones for the management program;
- Include certification by the state attorney general that the state laws provide adequate authority to implement the state's management program;

U.S. EPA Water Quality Programs

Clean Lakes Program
Great Lakes Program
Chesapeake Bay Program
National Estuary Program
(Clean Water Act Section 320)
Wellhead Protection Program
National Pollutant Discharge Elimination System
(Clean Water Act Section 402)
Stormwater Program
(Clean Water Act Section 402(p))
Pesticides Program
(Federal Insecticide, Fungicide, and Rodenticide Act)
Coastal Nonpoint Source Control Program
(Coastal Zone Management Act Section 1455b)
Wetlands Protection Program
(Clean Water Act Section 404)
Rural Clean Water Program
Municipal Pollution Control Programs

- Identify sources of federal and other financial support for nonpoint-source control activities;
- Identify federal programs and projects that the state will review for consistency with the state nonpoint-source management program.

Other Programs

Clean Lakes Program. This program was created in 1976 to protect and restore publicly owned freshwater lakes. Clean Lakes Program regulations were issued in 1980, and more than 400 cooperative agreements have been awarded to states for the classification, assessment, study, and restoration of lakes. These agreements are subject to General Grant Regulations and Clean Lakes Regulations. Four types of cooperative agreements are available under the program. Under the regulations, all lake projects must be consistent with a state's water quality management plan to ensure that EPA and the states coordinate programs under the Clean Water Act, Resource Conservation and Recovery Act, Safe Drinking Water Act, and other EPA programs.

Clean Lakes Program guidance specifies that the watershed approach is the key element in successful management of nonpoint-source pollution, groundwater protection, water quality-based

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permitting, stormwater permitting, estuarine protection and cleanup, and wetlands protection. Many states have used the Clean Lakes Program as a nonpoint-source management tool. A number of projects have included BMPs to prevent pollutants originating in the watershed from entering lakes.

NPDES Permit Program. The Clean Water Act requires that point-source discharges be authorized by a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits are generally issued by states with EPA-approved NPDES programs. Most states have approved programs, but in those without such authority, EPA regional offices oversee issuance of the permits. Due to limited resources, efforts to control point-source pollution through the NPDES permit program have focused primarily on controlling pollution discharges from publicly owned treatment works and industries. Under Clean Water Act Section 402(p), the NPDES permit program also addresses stormwater discharges (see "Ready or Not, Stormwater Deadlines Loom," May 1992).

Rural Clean Water Program. This program provides financial and technical assistance to agricultural landowners and operators to test policies and procedures for controlling agricultural nonpoint-source pollution in 21 project areas. To aid in the development of best management practices, the Agricultural Stabilization and Conservation Service uses Rural Clean Water Program water-quality data to evaluate the practices.

Wellhead Protection Program. The 1986 Amendments to the Safe Drinking Water Act established a Wellhead Protection Program to protect groundwaters that contribute to public drinking-water supplies. Under Section 1428 of this act, each state was required to prepare a Wellhead Protection Program for approval by EPA. To assist states, EPA has provided numerous technical assistance documents and has held national wellhead conferences and workshops. Those portions of the state wellhead-protection programs that are linked to state NPS management programs can be used to support Section 319 activities to protect groundwater. If properly targeted, control efforts to protect wellfields can complement nonpoint-source efforts to prevent surface water degradation.

Municipal Pollution Control Programs. These programs manage efforts to assist communities in constructing new or upgraded municipal wastewater facilities needed to comply with federal surface water discharge standards, as well as to protect groundwater. Under Title VI of the 1987 Clean Water Act Amendments, the State Revolving Fund program was developed to provide capitalization grants to states to establish such funds. States may then provide financial assistance to municipal wastewater facilities, as well as for "expanded uses," including nonpoint-source management. The EPA's Municipal Technology Branch, which operates these programs, has established the Expanded Uses Council to provide further guidance and coordination of assistance for expanded uses. For further information on Municipal Pollution Control Programs, contact the Municipal Technology Branch at 202-260-7356.

National Estuary Program. EPA administers the National Estuary Program under Clean Water Act Section 320 to assist state, regional, and local governments in developing comprehensive conservation and management plans for geographically targeted, high-priority estuarine waters. These plans recommend priority corrective actions to restore estuarine water quality, fish populations, and other designated uses of estuarine waters.

Pesticides Program. EPA hereby controls pesticides that may threaten ground and surface waters. EPA has developed a pesticides and groundwater strategy pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act, which requires states to implement EPA-approved plans to reduce and eliminate groundwater contamination from pesticide use.

Coastal NPS Pollution Control Programs. To combat nonpoint pollution of coastal waters, the Coastal Zone Act Reauthorization Amendments of 1990 require that each state with a federally approved Coastal Zone Management Program develop a Coastal Nonpoint Pollution Control Protection Program to implement coastal land-use management measures. EPA has published national guidelines on "management measures" to control coastal nonpoint sources (840-B-92-002, January 1993).

Management measures are "economically achievable measures" to control pollutants from new and existing nonpoint sources that reflect the "greatest degree of pollutant reduction achievable" through application of the best available NPS control measures and methods. States must submit their proposed programs to the Secretary of Commerce and the EPA administrator by July 1995. Following approval, the states must implement their programs through changes in approved Section 319 state management plans for controlling nonpoint-source pollution and in state coastal zone management programs. If a state fails to submit an approvable program, the Secretary of Commerce may withhold a percentage of any Coastal Zone Management Act Section 306 grant money, and

TABLE 2. EPA's WATERSHED MANAGEMENT CASE STUDIES

TMDL Case Study	Location	Feature
#1	Denver Metro—South Platte River Segment 15, Colorado	Revision of TMDLs to meet Water Quality Standards
#2	South Fork of the Salmon River, Idaho	A phased TMDL for clean sediment developed using quantified goals based on a narrative standard
#3	West Fork of Clear Creek, Colorado	A seasonal TMDL using narrative standards for certain parameters
#4	Nomini Creek Watershed, Virginia	Use of GIS and watershed models to identify areas of critical nonpoint pollution
#5	Albemarle/Pamlico Estuary, North Carolina	A nutrient screening approach that uses GIS technology to model watersheds within a large, multibasin area
#6	Lower Minnesota River, Minnesota	A TMDL undergoing assessment as part of a basinwide river assessment project
#7	Sycamore Creek, Michigan	A watershed analysis that links dissolved oxygen problems to sediment loads and established NPS load allocations

Because the Total Maximum Daily Load (TMDL) process is one of the most powerful tools available for doing comprehensive watershed management, the Watershed Management Section is making available a series of TMDL case studies. The case studies address a variety of watershed problems that are transferable to a number of regions. So far, seven TMDL case studies are available.

NPS Pollution Information Sources

Alliance for Environmental Education, *Compendium of Educational Materials on the Water Environment* ($9.95; call 703-253-5812).

Long Island Regional Planning Board, Hauppauge, New York, *Nonpoint Source Management Handbook.*

Metropolitan Washington Council of Governments, *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs.*

Metropolitan Washington Council of Governments, *A Current Assessment of Urban Best Management Practices—Techniques for Reducing Non-Point Source Pollution in Coastal Areas* ($30; call 202-962-3200).

Nonpoint Source Electronic Bulletin Board System (free user's manual; fax your request to NPS News-Notes at 202-260-1517).

North Carolina State University Water Quality Group, Raleigh, *Summary Report: Evaluation of the Experimental Rural Clean Water Program* (call 919-515-3723).

Northeastern Illinois Planning Commission, Chicago, *Best Management Practice Handbook for Urban Development.*

Northern Virginia District Planning Commission, Annandale, *Northern Virginia BMP Handbook: A Guide to Planning and Designing Best Management Practices in Northern Virginia* ($30; call 703-642-0700).

Puget Sound Water Quality Authority, Seattle, *Managing Nonpoint Pollution—An Action Plan Handbook for Puget Sound Watersheds.*

Rutgers University, Cook College Department of Environmental Resources and New Jersey Agricultural Experiment Station, *Watershed Management Strategies for New Jersey.*

Tahoe Regional Planning Agency, Tahoe, Nevada, *Water Quality Management for the Lake Tahoe Region, Handbook for Best Management Practices.*

U.S. EPA, *Funding of Expanded Uses Activities by State Revolving Fund Programs: Examples and Program Recommendations.*

U.S. EPA, *Guide to Federal Water Quality Programs and Information* (U.S. EPA-230-B-93-001).

U.S. EPA, *NPS News-Notes* (free newsletter—to be put on the mailing list, fax request to 202-260-1517).

EPA may withhold portions of any Section 319 grant under the Clean Water Act.

Local planners and water-quality managers need to review the various regulatory programs and integrate these management measures into the local planning process. Measures implemented through local government ordinances can be a valuable way to manage nonpoint-source pollution. Public education and nonpoint-source pollution awareness programs can also help communities implement voluntary water-quality initiatives.

NPS Funding Sources

State and local governments that need money to implement NPS pollution control measures can tap into a variety of sources. The largest source of EPA funding for such measures comes from the Clean Water Act Title VI program, which provides grants for state water pollution control revolving funds. Under this program, EPA is empowered to make capitalization grants available to states to establish a revolving fund for a number of purposes, including Clean Water Act Section 319 NPS management programs. The most significant federal funding source for these state programs is the Section 319 appropriation. Several states have used this provision to fund NPS pollution-control programs. Local governments should contact state authorities to determine how they may use this available funding source.

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Clean Water Act Reauthorization

Planners need to follow the approaching reauthorization of the Clean Water Act—which is likely to occur before the end of this year—because proposed amendments would direct EPA to publish guidelines specifying minimum elements of state NPS pollution management programs. The environmental regulatory trend is clearly focused on control of nonpoint sources of pollution. In his Earth Day address in April, President Clinton presented several environmental initiatives that entailed substantial budget commitments, including allocation of funding for states and communities to restore and maintain clean water. His package of new environmental investments includes a Drinking Water State Revolving Fund ($599 million) and the new Clean Water State Revolving Fund ($1.2 billion) for fiscal year 1994. States and local governments can use such funding through sound environmental planning and nonpoint-source control mechanisms.

On June 15, 1993, Senators Max Baucus (D-Mont.) and John Chafee (R-R.I.) introduced S. 1114, the Water Pollution Prevention and Control Act of 1993, a bill to amend and reauthorize the Clean Water Act. Sen. Baucus told the Senate that the goal is "to restore the quality of all of our nation's waters. . . . We want to achieve environmental progress through the use of sound science and sound economics, and we want to give state and local governments the resources to match their responsibilities. . . . To accomplish this . . . [the bill] would establish new programs for controlling nonpoint-source pollution and watershed planning. It would improve programs for controlling municipal pollution from combined sewer overflows and stormwater discharges."

Several other bills with proposed amendments to the Clean Water Act were introduced this summer. Rep. James Oberstar (D-Minn.) introduced H.R. 2543, the Nonpoint Source Water Pollution Prevention Act of 1993, which would exclusively address improvements to the NPS pollution-control provisions contained in Section 319. On July 1, Sen. George Mitchell (D-Me.) introduced S. 1198, the Lakes Assessment and Protection Act of 1993, which aims to ensure that lakes enjoy the same water-quality protection as rivers and streams. Mitchell also introduced S. 1199, the Coastal Protection Act of 1993, which would amend the Clean Water Act to add certain new features to protect the marine environment.

Water-quality managers and environmental regulators must also keep a watchful eye on the reauthorization. The amendments to the act are certain to include new water-quality control mandates, as well as funding and guidance on nonpoint-source pollution controls.