Working for Clean Water

An Information Program for Advisory Groups

Nonpoint Source Pollution

Agriculture, Forestry, and Mining

What is nonpoint source pollution?

What are the effects of nonpoint source pollutants?

What are the Best Management Practices for preventing or abating pollution from nonpoint sources?

How is a nonpoint source control plan developed?

Citizen Handbook

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Nonpoint Source Pollution: Agriculture, Forestry, and Mining

The Problem

Of course you have noticed how refreshing the air is after a rainstorm. Did you ever wonder what happened to the air pollutants removed by the falling rain?

After joining other debris on the ground the pollutants flow into the sewers, lakes, and streams. Such substances of widespread origin which run off, wash off, or seep through the ground are called *nonpoint* source pollutants. Common nonpoint source pollutants include soils eroded from farms and construction sites, metals and oils removed from roads, fertilizers and pesticides washed off croplands, and acids leached from mines. Pollutants coming from distinct locations such as pipes are called *point* source pollutants. The impacts of many nonpoint source pollutants are only now being realized:

- Without controlling nonpoint source pollution the 1983 national goal of fishable and swimmable waters cannot be achieved in parts of at least 37 states.
- Two-thirds of the areawide water quality planning agencies identify nonpoint source pollutants as the main cause of their water quality problems.

Nonpoint source pollutants have many origins, including agriculture, construction, mining, septic systems, silviculture (forestry), and urban activities. Here we focus upon the major sources of the rural areas — agriculture, forestry, and mining.

Nonpoint Source Pollutants

Type	*Source*
Sediment	Construction sites Mining exploration and operations Croplands Logging roads and trails
Nutrients (e.g., fertilizers, grease, organic matter)	Croplands and livestock pens Gardens, lawns, and forests Petroleum storage areas Landfills
Acids, Salts	Irrigation fields Mines Roads and parking lots Landfills
Heavy Metals (e.g., lead, zinc)	Mining operations Vehicle emissions Landfills
Toxic Chemicals (e.g., pesticides, herbicides, fungicides)	Croplands Waste from building sites Forests Landfills
Pathogens	Domestic sewage Livestock wastes Landfills
Heat	Denuded streambanks

Planning For Nonpoint Source Pollution

Although most of the nation's water clean-up efforts have been directed at pollution from point sources, the concern for nonpoint source pollution is increasing. Section 208 of The Clean Water Act requires the control of nonpoint sources of pollution. The 1977 amendments to the Act further emphasize the role of nonpoint control programs. Since climate, land characteristics, and even the types of pollutants vary throughout the country, state and local governments and 208 planning agencies were given the responsibility to develop nonpoint source pollution control plans.

A six-step planning sequence is suggested for nonpoint source prevention and abatement:

1. Set water quality goals, criteria, and standards
2. Assess pollution relationships
3. Determine allowable pollutant loads
4. Select Best Management Practices
5. Develop and implement a management plan
6. Revise plan and conduct ongoing planning.

Information Necessary for Decision Making

- Quality and location of ground and surface waters
- Climate variations, including volume, intensity, and duration of precipitation
- Land and soil characteristics
- Landforms, including slope and topography
- Vegetative cover
- Location of waste-producing and storage areas
- Cropping, logging, mining, and ranching methods
- Management of fertilizers, herbicides, pesticides, and fire retardant chemicals
- Existing, previous, and future land uses.

Before *- Hillside eroded and worn out by farming.*

After *- Revegetated hillside after only three years.*

Nutrient and sediment pollution caused by farm animals.

Set Goals, Criteria, and Standards

In step one the basis for analysis and decision-making is established.

Although states may have already set water criteria and standards, advisory groups have much to consider such as the scope of water quality plans and guidelines for making tradeoffs.

It is important that the total environment is kept in mind in water quality planning. Areawide and community benefits and costs, rather than just private gains and losses, should be considered. Most 208 planning groups have progressed beyond this point.

Assess Pollution Relationships

Consultants or a technical staff must perform many of the tasks, but advisory groups can contribute by:

- **Helping to identify analysis objectives**
- **Questioning the analysis program to ensure that local needs are being met**
- **Giving insights into local conditions**
- **Communicating the questions of the public, and the findings of the technicians.**

Assessing and predicting nonpoint source pollution has had mixed success. The basic problems are inadequate data and a lack of knowledge about the dynamics of many pollutants. Too little data is collected during wet weather conditions. Massive data inputs such as hourly rainfall patterns for thirty years may be required. Computational procedures range from hand-calculation approaches to computer models.

Data collection is a complex matter. If it does not exist, it will have to be collected. Advisory groups will have to support the necessary time and expense. Furthermore, such matters must not be automatically left to the analysts and technicians. Their methods and findings must be continually questioned. For example, a sediment control ordinance is central to the nonpoint source pollution plan in Lewis and Clark County, Montana. Such an ordinance should require a single technique for computing storm water runoff throughout the watershed. Different computational approaches can give vastly different estimates of runoff volumes. Various kinds and sizes of control structures are based on these calculations. As a result, costs can vary greatly because of different calculations. For similar reasons, a common storm event such as a five-year frequency storm should be used in design work throughout the area.

Determine Allowable Pollutant Loads

Streams can handle only limited amounts of various pollutants. Therefore, to maintain water quality the total amount of a substance (load) entering a body of water over a period of time must be controlled.

It is not always possible to use load analysis. However, when it is done the advisory groups should fully understand how the allowable pollutant loads are determined. Such calculations can markedly affect an area's developmental pattern, such as the type, scale, and location of industries.

Select Best Management Practices

Next is the identification of the Best Management Practices (BMPs) — the techniques for preventing or controlling nonpoint source pollution. Selection of the BMPs involves the consideration of regulations, reliability, fiscal aspects, technical matters, environmental impacts, and interagency coordination.

Develop, Implement, and Revise Plans

In the final steps plans are developed, implemented, and revised. These latter planning steps have many opportunities for citizen involvement, especially the selection of BMPs and plan implementation. The constraints of implementation have a strong bearing upon the choice of BMPs.

Nonpoint Source Plan Implementation

Considering the breadth of nonpoint source problems, and the large number of governmental agencies that must cooperate to solve them, it is not surprising that the control of nonpoint source pollution lags. The initial focus in water quality management was on point sources. The first designated planning groups were those in metropolitan areas where point sources of pollution were most obvious. As a result, facilities planning and construction often preceded comprehensive areawide planning. Later, when states began 208 planning, nonpoint source problems received more attention.

As planners gained experience with nonpoint source pollutants, perspectives changed. Nonpoint source pollution in its principal mode of transport — storm water — was underscored in the 1974 annual report of the Council on Environmental Quality, which states:

Until the storm water situation is analyzed and efficient corrective measures taken, there is little or no sense in seeking higher levels of treatment efficiency in existing secondary plants.

Although this statement is generally true, advanced waste treatment may be needed in some cases to meet water quality standards.

Areawide 208 programs are planned by state or regional units of water quality planning agencies. Nonpoint source controls for citizens, however, are administered by existing governmental institutions such as the United States Department of Interior, state environmental protection and natural resource agencies, and local conservation districts. Their effectiveness depends upon public acceptance, adequate laws, effective regulations, and sufficient resources for administration, monitoring, and planning.

In implementing water quality plans, citizens must be concerned about:

- **How pollution control programs are designed**
- **Who should be responsible for the control facilities**
- **How enforcement can be handled**
- **How to finance the program.**

Program Responsibilities

Control programs typically involve both private individuals and the government. Private citizens are expected to prevent nonpoint source pollution from their own properties. The public institutions have a broader set of functions, including:

- Jurisdiction where pollution crosses several governmental boundaries
- Review of control plans
- Inspection of construction and maintenance of facilities
- Enforcement of control practices
- Monitoring of water quality.

At least one county in Pennsylvania advocates that municipalities maintain responsibility for permanent erosion and sedimentation control facilities. This position is taken out of concern for facilities that fall into disrepair as the original owners die or go into bankruptcy.

Program Management

Planning would be best for an entire watershed, of course, but this option is seldom politically feasible. While much nonpoint source planning is done at the areawide level, it appears that plans can be effectively coordinated at the county level. Plan reviews and inspections should be handled by the local government. Unfortunately, few communities have the resources or staff for these duties. Several alternatives for plan reviews and inspection activities exist:

- Township engineer (fees paid by several municipalities)
- Conservation district
- Code enforcement agency or council of governments
- Joint watershed authority.

In addition to these kinds of arrangements, advisory groups need to examine existing opportunities for controlling of nonpoint source pollution. Such opportunities include:

- Land use controls such as zoning
- Building codes such as road width requirements
- Subdivision plan reviews
- Water and sewer permits
- Regulations such as refuse disposal.

Of course, neighboring municipalities may have incompatible controls such as conflicting land use ordinances. These problems are to be expected. Nonpoint source planning is a continuing process. Rarely will all the desirable arrangements be present.

Governmental nonpoint source controls are based upon two types of policies: incentives and regulations. Different approaches are favored by the various agencies, or are required by law.

Erosion caused by a single rainstorm on overgrazed range land.

Agriculture

The agricultural community believes that pollution control can be done through various non-regulatory means. Several governmental agencies and programs follow such policies in providing financial and technical services:

- Rural Clean Water Program — technical assistance and cost sharing in high priority areas
- Soil Conservation District — erosion and sedimentation control agreements with developers and farmers
- Extension Service — information for rural areas, especially of agricultural research
- Soil Conservation Service — technical advice and plans for soil and water problems
- Agriculture Stabilization and Conservation Service — cost-sharing programs for farm and forest development.

Most programs are directed towards agricultural production or erosion and sedimentation control. They are being used more effectively in controlling nonpoint source pollution.

The federal government and many states also operate regulatory programs for several nonpoint source pollutants. The National Pollutant Discharge Elimination System (NPDES) permit program now covers major agricultural pollution sources such as animal feedlots of 1,000 head or more. At the state and local levels nonpoint source regulations mainly involve erosion and sedimentation controls. Sixteen states and hundreds of communities have sediment control laws.

Mining

Mining can result in severe land disturbances that are expensive to correct. Since mining costs and environmental damages are large, few incentives exist for voluntary nonpoint source controls. An alternative is mining regulations. This has been done at both the state and local levels. All states in which coal is mined have reclamation laws.

The federal government is becoming more involved in regulating mining. The NPDES permit program controls point sources from mines such as ditches and pipes. Since 1977 pollution from coal strip mines has been subject to federal control. In most states certain mining forms — sand, gravel, phosphates, and other non-metallic minerals — are only minimally regulated.

Mining regulations should include the following elements:

- Requiring permits for mining and mining exploration
- Incorporating BMPs into permits
- Providing inspections, corrective action orders, and penalties such as stop-work injunctions for violations
- Requiring pre-mining planning for ground and surface water protection, land reclamation, and mine entrance sealing
- Requiring performance bonds, pollution control plans, and reclamation plans for every operation
- Establishing an abandoned mine pollution abatement program.

Several lessons can be learned from existing programs. Well-operated regulatory programs require substantial resource commitments. Advisory groups should sort out federal, state, and local programs that deal with nonpoint source problems from land disturbing activities. Advisory groups can help identify cost-effective BMPs keyed to local and area conditions.

Silviculture

As compared to agriculture and mining, nonpoint source problems in silviculture (forestry) are less widespread. Only a few states or areas, principally the West and Southeast, identify forestry activities as a major contributor to nonpoint source pollution. These problems are based upon many factors including:

- Land ownership patterns
- Forest managers with varying degrees of experience and knowledge of BMPs in silviculture
- Unenforced local and state regulatory programs for logging operations
- Legal-institutional-financial tools applicable to silviculture, but not fully coordinated for this purpose.

Federal lands are guided by the expertise and authority of the Forest Service and the Bureau of Land Management. These agencies provide financial and technical assistance to state and private landowners. In several regions water quality management controls are incorporated into contracts for timber sales on public lands. The large commercial forestry operations also have professional competence.

Many western states regulate silvicultural activities through various kinds of Forest Practice Acts. The other region having large private holdings, the South, has relied upon non-regulatory means such as education.

A whole range of financial, institutional, and legal tools apply to silvicultural activities. The NPDES permit program applies to four activities considered point sources: rock crushing, gravel washing, log sorting, and log storage. Other federal permits are associated with the Corps of Engineers Section 404 Regulations, the Fish and Wildlife Coordination Act, and wetland acts.

Many states depend upon voluntary compliance with forest practice standards. More effective enforcement often results from:

- A state erosion and sedimentation control law such as Pennsylvania's Clean Streams Act which can be used to monitor forestry-related erosion
- Performance bonds for correcting damage to fragile areas or streams caused by irresponsible operators
- Training, testing, and licensing forest operators
- Interagency cooperation and coordination between forestry, land use, and water quality agencies.

Although some programs are not originally forestry-oriented, many are authorized to deal with silvicultural problems. Advisory groups should identify existing laws, agencies, regulations, incentives, technical assistance, and programs that are applicable to silvicultural activities. Their collective action may be all that is necessary for dealing with nonpoint source pollution.

Unreclaimed strip mine waste and garbage dump.

Best Management Practices

Identifying Best Management Practices (BMPs) is one of the most important tasks in nonpoint source planning. These control techniques include the most effective and practical means of preventing or abating nonpoint source pollution. The selection of BMPs involves assessment of nonpoint source problems, examination of alternatives, and public participation.

Although nonpoint source BMPs generally are less expensive than are wastewater treatment facilities, they can demand significant finances and manpower. For example, the cost of controlling acid mine drainage in Pennsylvania has been estimated at more than a billion dollars.

In past 208 plans the BMPs approved by the United States Environmental Protection Agency (EPA) were ones that were determined to be the most cost-effective. Although the EPA relies upon previous experience for feasibility and cost-effectiveness, innovative approaches are encouraged. The magnitude of nonpoint source problems and the cost of conventional remedies, especially in mining, have sparked new interest in alternative approaches.

Control methods and strategies are of two kinds: nonstructural measures and structural modifications. Structural solutions involve the construction of physical devices for delaying, blocking, or trapping pollutants such as sediment. Nonstructural approaches use an array of techniques that are less physically-oriented, such as work schedules, zoning ordinances, and farming practices.

Timely application of soil nutrients avoids nonpoint source pollution.

Agriculture

In more than two-thirds of the river basins in the nation, agriculture is the most widespread cause of nonpoint source problems. The regions most affected by this pollution are the Central, Southwest, and Island regions. Many activities cause these problems.

Crop production can degrade water quality by contributing to soil erosion by water and wind; by using fertilizers in such amounts or at times that they run off into surface waters or leach into groundwaters; by using fungicides, herbicides, and pesticides improperly so that they drain into watercourses, and by allowing irrigation water polluted by chemicals, sediment, and dissolved salts to flow into surface waters or to evaporate on the land.

Livestock can break down stream banks, disturb stream bottoms, and destroy vegetation. Animals can supply wastes and sediment that promote the unwanted growth of aquatic plants in lakes and streams.

Structural techniques for managing agricultural pollution include:

- Cropland control devices such as erosion barriers, and sedimentation basins
- Direct runoff control techniques such as diversion barriers, storage ponds, and drip irrigation systems.

Categories of nonstructural methods include:

- Control of nutrient losses through fewer but more timely fertilizer applications, crop rotations, and control of fertilizer breakdown
- Reduction of pesticide use through genetic breeding, crop rotations, changed planting times, and integrated pest management systems
- Erosion and runoff controls such as tillage techniques, cultivation timing, crop rotations, and changed land uses.

Mining

The impacts of mining extend far from the sites of operations. Although less than two percent of the land surface in any state is disturbed by mining, the impacts on waterways are much greater.

More than 13,000 miles of streams and 181,000 acres of lakes and reservoirs have been affected by pollution related to strip, open pit, and underground mines. Sediment, acid, and chemicals that are leached from surface mines and mine wastes pollute both ground and surface waters. The Surface Mining Control and Reclamation Act of 1977 attempts to remedy some of these problems.

Nonpoint source control programs in mining are aimed at minimizing site erosion, saving and replacing topsoil for continued vegetative growth, restoring area landforms to pre-mining conditions, and protecting nearby ground and surface waters from pollutants.

Specific Best Management Practices for controlling pollution from active and abandoned mines exist, but they may be very expensive. Preventive techniques are more effective than are measures for dealing with abandoned operations. Principal approaches to the prevention and abatement of pollution from mines include:

- Keep polluting materials away from watercourses
- Rapidly stabilizing the land surface through topsoil reuse, mulching, and revegation
- Neutralizing or preventing toxic substances from forming.

Silviculture

High-quality waters in forested areas historically have been used for water supply and fishing purposes. Water quality degradation in these areas often is due to silvicultural practices.

Silvicultural activities involve the cultivation, harvest, and transport of timber. In certain areas these activities significantly influence the water quality of streams and lakes. The types of pollution associated with silviculture include: pesticides, herbicides, fertilizers, and fire-retardant chemicals; sediment and nutrient losses associated with erosion of harvest sites, log landings, logging roads, and skid trails; organic matter and woody debris in watercourses; thermal damage from increased water temperatures where trees along streams have been removed.

All harvesting techniques, especially clearcutting where an entire stand of trees is taken down, have potential for soils disruption and sedimentation. However, the erosion of roads and trail systems is the greatest source of sediment from logging. The BMPs for reducing sediment from these sources involve:

- Constructing roads and skid trails to minimize erosion
- Protecting streamside management zones from the destruction of ground cover and soil disturbances. BMPs may require the transportation of logs by aerial cables rather than skid trails, and the prohibition of tracked and wheeled vehicles from the zone.

In addition to mitigation measures associated with roads and trails, other BMPs for silvicultural activities involve:

- Schedules of logging operations
- Controls of fertilizers, herbicides, and pesticides.

An extensive array of BMPs is available. With the exception of certain irrigation problems, technologies exist for abating or preventing most types of nonpoint source pollution. Yet, nonpoint source pollution has been identified as a major deterrent to reaching the 1983 national water quality goals.

Aerial transport of logs.

Who Me?

As compared to the readily identifiable point sources of pollution, nonpoint sources often are widely dispersed. It is difficult for citizens to locate them, and to realize their overall magnitude. Citizens may erroneously regard their own agricultural runoff and other nonpoint source pollutants as minor contributions to water problems. Many individuals do not take responsibility for instituting the appropriate BMPs without the encouragement or prodding of regulatory agencies.

Advisory groups can help in the major educational effort that is needed regarding nonpoint source pollution.

Pines planted on eroded slope.

Future Planning

Nonpoint source planning, especially under federal programs, is changing. The 208 grants program is gearing down. Subject to work needs and funding levels, the grants may end after fiscal year 1983. Of course, this is not the end of nonpoint source planning, but it does mean changed directions and organization.

During this final stage of the 208 program, a major emphasis is being placed on prototype projects for financial and technical solutions to various kinds of problems. This planning takes an applied problem-solving focus, rather than the more comprehensive orientation of the past. Advisory groups can continue their participation in identifying problems, developing alternatives, and evaluating results. They can help push plans towards implementation — making sure that problems are being solved.

In the future nonpoint source planning will become more a part of the overall planning process, rather than programs with special grants and separate organizations. Advisory groups can have major inputs into this restructuring effort. Since nonpoint source planning will have more of a local focus, and local funds may provide the main support, advisory groups should see that program changes fit local needs. Various options exist such as cost sharing and legislation. Through evaluation of these opportunities, advisory groups can influence the future planning for nonpoint source pollution.

Examples

Nonpoint Source Pollution in the USA

Agriculture

Connecticut
Agricultural erosion statewide has been determined to be over 12 tons/acre/year (acceptable levels are generally 3 to 5 tons/acre/year). This problem is especially noticeable in Lake Waramug and the Housatonic River, impairing recreation and water supply uses.

Delaware
Rural nonpoint pollution sources (agriculture, animal wastes, and rural septic systems) are causing coliform and nitrate problems in groundwater drinking supplies in Sussex County. Water quality standards violations have been documented (60-100 mg/L nitrates; the standard is 10 mg/L nitrates).

North Carolina
The Chowan River has had severe algal blooms which affected the fishery resources, ruined beaches, and resulted in objectionable odors and deposits of decaying algae. About 85 percent of the nitrogen input is from nonpoint sources, with agricultural areas accounting for 50 percent of the total.

Louisiana
Lake Providence and Round Lake have deteriorated due to sedimentation and pesticide residues from agricultural nonpoint sources; private and commercial fishing have been banned by the state in Lake Providence because pesticide levels in the fish violate standards.

Nebraska
Eastern and central parts of the state are adversely affected by sediment, animal wastes, and agricultural chemicals, causing violation of standards for nitrates, turbidity, fecal coliform, and total dissolved solids. Over 1.5 million acres have been identified as nonpoint sources of pollution.

North Dakota
In the Souris River nutrients and suspended solids from agricultural activities have violated water quality standards. They are exceeded 80 percent of the time, and nonpoint sources account for 90 percent of the pollutant load. The area has experienced major duck kills. The state has identified 10,000 acres as high priority for treatment.

Wyoming
Eutrophication of the Flaming Gorge Reservoir is being caused by phosphorus loadings, 78 percent of which comes from nonpoint sources. The Big Horn River is similarly affected, as is the Yellowtail Reservoir where nonpoint sources contribute 99 percent of the phosphorus load. Sources of phosphorus are agricultural fertilizers, septic tanks, feedlots, and erosion.

Silviculture

Oregon
Eight priority areas with water quality problems related to silviculture (Southwest part of North Coast Basin, Yamhill River, South Fork of Umpqua River, part of Goose/ Summer Lakes Basin, Crooked River, Malheur River, and Umatilla River) have been identified. Water quality problems involve erosion and sedimentation, excessive debris, high water temperatures, and algal growths.

Washington
Six priority areas having water quality problems (Willapa Bay, Kaloma River, part of Skykomish River, part of Snohomish River, Newaukum River, Deschutes River) are identified. These water quality programs involve sediment, temperature, and wood debris.

Maine
A survey of 350 sites indicates that 10 percent have sedimentation problems causing localized stream impacts; 25 percent have excessive erosion. Spraying pesticide for spruce bud worm control on 23 million acres has resulted in fish kills.

California
Paralleling a trend in other states, Californians are increasingly concerned about herbicides and pesticides used in forestry operations. In a referendum in Mendocino, California, residents voted by a 2 to 1 majority to ban the use of 2, 4, 5-T and Silvex biocides.

Mining

Pennsylvania
The Commonwealth of Pennsylvania estimates that 2,600 miles of its streams are continuously in violation of water quality standards, and another 1,200 are intermittently in violation — all a result of acid coal mine drainage. About 76 percent of the stream miles that are degraded are due to abandoned mines alone or in combination with other sources.

California
California has identified about 200 miles of its streams affected by inactive mining operations. Although the extent of polluted streams is small, important areas are affected. Some abandoned mines are located in park lands, and others are in watersheds that provide water supplies to portions of the San Francisco metropolitan area.

Case Study

Erosion and Sediment Controls

Helena, Montana

Adapted from Water Quality Management Accomplishments Compendium I. *Document Number EPA-440/3-77-026. Washington, DC: U.S. Environmental Protection Agency, December 1977. 95 pp.*

In June, 1977, voters of Lewis and Clark County, Montana, approved a sediment control ordinance to deal with serious water pollution in their area. The ordinance and its approval were achieved as a result of public participation and technical assistance provided under a water quality management program demonstration project.

These actions began when, in response to the 1972 Federal Water Pollution Control Act Amendments, the Montana legislature requested the Montana Department of Natural Resources and Conservation to head up a study of sediment control problems and legislative issues. The study yielded three major findings: (1) erosion is a serious water pollution problem in Montana; (2) existing enabling legislation provides sufficient authority to address erosion; (3) any sediment control program should be locally administered and enforced.

The Montana Conservation District laws permit local conservation districts to develop soil conservation ordinances, subject to adoption by local referendum. The ordinances are administered locally and enforced through Conservation District Courts. This enabling legislation had never been used prior to the demonstration project.

Lewis and Clark County was selected for this pilot program because it was willing to participate, and its land use patterns and erosion problems are a typical example of Montana conditions. Most of the land in the county is equally divided between federal and private ownership. Agriculture is the primary industry. Most operators raise livestock. Accordingly, the largest land use in the county is rangeland, which accounts for 65 percent of the acreage, followed by forests with 25 percent of the total.

The major sources of erosion and sedimentation are: (1) subdivision development in the urbanized area (the county does not include the incorporated cities of Helena and East Helena); (2) irrigated agriculture; (3) overgrazed rangeland.

Technical Assistance and Public Involvement

The combination of technical staffing and public involvement in the form of two policy advisory committees permitted state and local officials to work with citizens towards implementation of a sediment control ordinance.

Technical staff members were hired through the 208 funded demonstration project. They included: (1) a program manager hired by the Lewis and Clark County Conservation District; (2) a water quality specialist hired by the Montana Department of Health and Environmental Sciences; (3) a sedimentologist hired by the Department of Natural Resources and Conservation.

Two policy advisory committees (PAC) at the state and local levels were established to assist the Conservation District in developing land management practices and the sediment control ordinance. Both the 25-member state PAC and the 60-member local PAC addressed the following subjects: irrigated cropland, dry cropland, rangeland, forest land, construction and subdivisions, information/education, and financing/cost-effectiveness.

The public involvement process emphasized the following advantages of sediment control: (1) good conservation practices pay rewards; (2) stewardship of the soil resource is necessary for future generations; (3) prevention of soil erosion is less costly than remedial measures; (4) local control and administration of erosion and sediment control regulations is efficient; (5) accelerated soil erosion and the resulting sediment may violate state water quality standards.

Best Management Practices

The sediment control ordinance incorporates Best Management Practices developed by: the Soil Conservation Service for agriculture; the Montana State Forestry Committee for silviculture, and the Lewis and Clark County Conservation District for subdivision construction. These Best Management Practices are based on site-specific soils, climate, and use characteristics.

Financing of Best Management Practices

Since financing of Best Management Practices depends on local acceptance of the sediment control ordinance, it would have been premature for the pilot program to specify funding sources before the referendum had passed. The Lewis and Clark County study nonetheless identified potential funding sources at all levels of government.

Agricultural Stabilization and Conservation Service cost-sharing and Small Business Administration low-interest loans were identified at the federal level. Two possible state sources were proposed: an appropriation from the state legislature for operating costs, and grants or low-interest loans from the Montana coal severance fund according to the state's 1975 Renewable Resources Act. The Lewis and Clark County Conservation District was also authorized to levy a property tax of 1½ mills, part of which might be applied to support the operating expenses.

Most of these funding sources cover only part of the cost of the Best Management Practices. Local ranchers, farmers, and developers help pay for the sediment and erosion controls. This willingness to cooperate by the various parties led to the passage of the Lewis and Clark County sediment control ordinance.

Implementation

The primary means of complying with these practices is through a Conservation District-approved erosion and sediment control plan. Erosion and sediment control plans are optional for agricultural activities, as long as standards are met or exceeded and no erosion problems occur. However, they are mandatory for most construction and subdivision activities. In addition, logging operators must either prepare erosion and sediment control plans, or give the Conservation District notice before starting forestry activities.

Any land occupier, Conservation District supervisor, or state and county water quality official may file a complaint alleging that accelerated erosion or sediment damage has taken place. If a violation of the ordinance is verified by the Conservation District, the land user is given an opportunity for voluntary compliance. If the violation is not corrected, the District Supervisors are authorized to issue stop work orders and/or impose fines of up to $500 per day.

Significance

Increased public awareness of nonpoint source pollution and support for Best Management Practices to improve water quality are crucial in developing a water quality management program. The case of Lewis and Clark County illustrates this point. The county possessed the enabling legislation for establishing sediment and erosion controls, but it lacked a widespread local commitment to solve this nonpoint source problem.

Public participation and technical assistance funded by the 208 program were the missing links. The water quality management program enabled concerned state and local officials to work with citizens, and build consensus for implementing Best Management Practices designed for local conditions.

Wire dams holding silt in gully.

Publications

Forest Harvest, Residue Treatment, Reforestation and Protection of Water Quality. Washington, DC: U.S. Environmental Protection Agency, April 1976. 273 pp. Order #2815A.

Methods and Practices for Controlling Water Pollution from Agricultural Nonpoint Sources. Washington, DC: U. S. Environmental Protection Agency, October 1973. 83 pp. Order #2117.

Methods for Identifying and Evaluating the Nature of Nonpoint Sources of Pollutants. Washington, DC: U.S. Environmental Protection Agency, October 1973. 261 pp. Order #0002.

Water Quality Management Guidance for Mine-Related Pollution Sources (New, Current, and Abandoned). Washington, DC: U. S. Environmental Protection Agency, December 1977. 198 pp. Order #4301.

These EPA publications are helpful in monitoring and evaluating nonpoint sources of pollution. They give the impacts of various agricultural, silvicultural, and mining activities on water quality. Specific best management practices for control of these pollution sources are described in detail. Policy aspects are not discussed in depth. They may be obtained from U.S. Environmental Protection Agency, Library Services, Mail Drop 35, Research Triangle Park, NC 27711.

Institutional Basis for Control of Nonpoint Source Pollution Under the Clean Water Act — With Emphasis on Agricultural Nonpoint Sources. Washington, DC: U.S. Environmental Protection Agency, November 1979. 165 pp. Order #37175.

Written in layman's language, this document discusses nonpoint source pollution history, policy, and regulatory arrangements. The first part gives insights into federal planning provisions for nonpoint source controls, legal aspects, EPA regulations, and court decisions. The second half of the document gives synopses of agricultural laws, agency and program arrangements, and funding sources for nonpoint source controls in selected states. Extensive footnotes and references are provided. It is available from the Forms and Publications Center, U.S. Environmental Protection Agency, Mail Drop 41, Research Triangle Park, NC 27711.

Nonpoint Sources of Pollution Fact Sheets. Sheet Numbers 1-6. Washington, DC: U. S. Environmental Protection Agency, November 1978. 6 pp. Order #36852.

These sheets provide brief introductions to nonpoint source problems, programs, legislation, best management practices, and citizen action. They may be obtained from the Forms and Publications Center, U.S. Environmental Protection Agency, Mail Drop 41, Research Triangle Park, NC 27711.

Audiovisual Materials

Slide-tape presentations on nonpoint source pollution

Twelve slide trays and tapes cover an introduction to selected nonpoint sources of pollution, agriculture, construction, mining, silviculture, and legal/institutional considerations. Specific areas, especially BMPs, are discussed in detail. The programs are long (2-3 trays of slides per program), but technical matters are covered. Policy considerations are minor. The materials are available from either the regional or national EPA offices (Water Planning Division).

Other slide-tape programs and films are available from conservation districts, agricultural extension services, the Soil Conservation Service, and state agencies in agriculture, mining, and forestry.

Need More Information?

Glossary

Acid Mine Drainage — water with an acidic pH from working or abandoned mines.

Best Management Practice (BMP) — technique which deals most effectively with a given problem.

Coliform — bacteria found in the intestinal tracts of humans and other animals; indicator of fecal pollution.

Computer Modeling — the programming of a computer to use related data to solve a problem or simulate a system; such programs predict events such as stormwater runoff and pollution loading.

Cost-Effectiveness Analysis — determination of whether a project or practice is worth the funding; both monetary and nonmonetary factors are involved.

Detention Basin — small basin for collecting stormwater runoff until the particulates picked up by rain water have settled.

Erosion — the wearing away of land surface by water or wind.

Eutrophication — nutrient enrichment of a body of water producing excessive growths of aquatic plants that deteriorate the water environment.

Five-Year Frequency Storm — storm of a certain degree of severity that is expected to occur on an average of every five years.

Leaching — process by which substances are dissolved and carried away by water, or are moved into a lower layer of soil.

Nonpoint Source Pollutant — a contributing factor to water pollution that can't be traced to a specific spot, such as agricultural fertilizer runoff.

Nonstructural Methods — nonphysical approaches to pollution controls such as land use controls, construction activity schedules, and zoning ordinances.

Pathogen — disease-causing organism.

PCBs — polychlorinated biphenyls; a group of extremely persistent chemicals used in electrical transformers and capacitors.

Point Source Pollution — pollution that is discharged from a single location such as a pipe.

Silviculture — a phase of forestry dealing with the establishment, development, and harvesting of trees.

Structural Methods — construction of physical entities for delaying, blocking, or trapping pollutants.

Suspended Solids (SS) — tiny pieces of solid pollutants in sewage that may cause cloudiness and require special treatment to remove.

Total Dissolved Solids — the total amount of dissolved organic and inorganic material contained in water.

Turbidity — cloudy condition in water due to suspended silt or organic matter.

Watershed — the land area that drains into surface waters.

Wetlands — low-lying lands which frequently have standing water on them such as swamps, marshes, and meadows. Wetlands essentially are pollutant traps in natural environments.

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Working for Clean Water is a program designed to help advisory groups improve decision making in water quality planning. It aims at helping people focus on essential issues and questions by providing trained instructors and materials suitable for persons with non-technical backgrounds. These materials include a *citizen handbook* on important principles and considerations about topics in water quality planning, an *audiovisual presentation*, and an *instructor guide* for elaborating points, providing additional information, and engaging in problem-solving exercises.

This program consists of 18 informational units on various aspects of water quality planning:

- Role of Advisory Groups
- Public Participation
- Nonpoint Source Pollution: Agriculture, Forestry, and Mining
- Urban Stormwater Runoff
- Groundwater Contamination
- Facility Planning in the Construction Grants Program
- Municipal Wastewater Processes: Overview
- Municipal Wastewater Processes: Details
- Small Systems
- Innovative and Alternative Technologies
- Industrial Pretreatment
- Land Treatment
- Water Conservation and Reuse
- Multiple Use
- Environmental Assessment
- Cost-Effectiveness Analysis
- Wastewater Facilities Operation and Management
- Financial Management

The units are not designed to make technical experts out of citizens and local officials. Each unit contains essential facts, key questions, advice on how to deal with the issues, and clearly-written technical backgrounds. In short, each unit provides the information that citizen advisors need to better fulfill their role.

This program is available through public participation coordinators at the regional offices of the United States Environmental Protection Agency. □

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This project is dedicated to the memory of Susan A. Cole.