Institutional/Financial Aspects of Nonpoint Source Controls

US Environmental Protection Agency

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Institutional/Financial Aspects of Nonpoint Source Controls

BRIDGING THE GAP BETWEEN WATER QUALITY AND NONPOINT SOURCE ACTIVITIES: A CONTINUUM OF INSTITUTIONAL ARRANGEMENTS

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ABSTRACT

Successful nonpoint source control implementation requires devising institutional/legal arrangements to draw formally the various interests and agencies responsible for Best Management Practices (BMP’s) into the water quality management process. Yet, at the same time, formalize the role of the State Water Quality Management (WQM) agencies. EPA and the New England States have established an array of mechanisms by which State WQM agencies formally involve the State forester, timber industry, construction industry, and agricultural interests in activities ranging from technical assistance on BMP certification and plan review to limited inspection. Corresponding mechanisms for backup enforcement by the State WQM agency, Attorney General, and EPA vary. This presentation outlines and evaluates the experience with these mechanisms over the past 5 years, suggesting improvements, refinements, or new mechanisms for the future. The evaluation covers a continuum of measures from the voluntary to backup enforcement, and from private to public responsibilities.

INTRODUCTION

Nonpoint sources (NPS) by definition are diffuse, widespread, and subtle. Their control touches the daily lives of countless individuals, groups, and enterprises. Best management practices (BMP’s) to control nonpoint pollution must become integrated in diverse activities through a mix of informal and formal, or voluntary and contractual relationships—sometimes labeled nonregulatory and regulatory.

Nonpoint source programs include both formal and informal steps: formal standards setting, informal education and technical assistance; followed by formal inspection and enforcement. First, Federal/State water quality management agencies must formally adopt water quality standards and criteria under the water pollution control laws prohibiting discharge of pollutants into the waters of the Nation.

Then, informal, voluntary education, technical assistance, inspection, and self-policing programs may help people adapt their activities to prevent or reduce NPS pollution. Informal education and technical assistance efforts must reach the farmer in the field, the logger in the woods, and the builder on the back lot. Often, the most effective way of reaching them is through associates who share their interests, professional knowledge, or community values.

The final step, formal inspection and regulation, must be waiting in the wings as backup. Here, the State Water Resources investigator and the compliance officer become involved. If violations persist, the attorney general may prosecute. Finally, the responsible Federal or State agency must evaluate the effectiveness of the informal arrangements in carrying out the formal mandates of the laws, standards and prescribed BMP’s.

A Continuum of Formal and Informal Arrangements for Water Quality BMP’s

For successful nonpoint source control, the institutional arrangements must draw those affected by the controls into the formal water quality management process. The formal environmental agency objectives, standards, and BMP’s must be incorporated into diverse economic activities. Usually, water quality objectives and BMP’s can be best integrated into these activities through informal arrangements involving fellow workers or professionals, friends, or neighbors in whom the operator places personal confidence and trust. At the same time, the formal mandate for the public interest must be met. Social scientists have developed a body of theory on the role of informal and formal groups in the adoption of new practices (Homans, 1950; Spicer, 1952; Wilkening, 1950).
This presentation outlines and evaluates experience with informal, voluntary arrangements for providing education and technical assistance and, in some cases, inspection and compliance to carry out the mandate of the formal Federal/State standards. It suggests improvements, refinements, and conditions for success of various approaches.

The cases to be evaluated cover a continuum of measures from the informal/voluntary to the formal/contractual in the following order: agriculture, forestry, on-site waste disposal, individual home construction, oil and hazardous materials handling, and large-scale construction.

The major types of institutional arrangements bringing formal programs closer to the people are:

1. Voluntary associations. Enlist voluntary associations of the industry or activity that the formal agency is trying to reach, e.g., trade associations and lake or watershed associations.

2. Professional associations. Enlist fellow professionals. They can be presumed to be more knowledgeable and understanding of one's activities and problems, even if they have formal regulatory responsibilities.

3. State programs with local option. Involve localities, regional agencies or district. Local governments are perceived to be more responsive to local needs and activities than State or Federal agencies.

Case Evaluations

The cases to be evaluated cover a continuum of measures from the informal/voluntary to the formal/contractual, demonstrating both private and public responsibilities. The cases range, in order of increasing formality, from the Vermont Timber Harvesters and Truckers Association self-policing program, New Hampshire regulations on earth-disturbing construction and forestry activities, and Massachusetts Minimum Forest Cutting Practices Regulations, to Maine and Vermont Statewide Environmental Laws with Local Option.

Vermont Timber Truckers and Producers Association

To help implement BMP’s for forest practices recommended in the Vermont Water Quality Management Plan, 5 years ago the Vermont Timber Truckers and Producers Association set up a Committee to provide education and technical assistance and to investigate complaints. The Association, made up of over 200 loggers, truckers, mill owners and operators, landowners, and professional foresters, reflects the logger and his values, reaching out to him through his own peers. (Vt. Timber Truck. Prod. Aşăm., 1984).

Initially, the Vermont Timber Truckers and Producers Association, the Vermont Agency for Environmental Conservation, Cooperative Extension Service, and Soil Conservation Service jointly prepared a pocket handbook, Guide for Controlling Soil Erosion and Water Pollution on Logging Jobs in Vermont, and conducted workshops with loggers throughout the State. (Vt. Agency Environ. Conserv., 1979). The booklet and workshops were funded by a grant from the U.S. Environmental Protection Agency.

To follow up, the Vermont Agency of Environmental Conservation refers complaints about logging jobs polluting streams and lakes to the Vermont Timber Truckers and Producers Association. A local Association committee member visits the site with the logger to investigate the complaint. If there is a problem, the committee member encourages the logger to apply the appropriate BMP’s. If the logger does not voluntarily comply, the case is referred to a State Water Resource investigator for formal investigation, technical assistance and possible legal action. A violator risks having his job shut down and may be subject to fines of up to $25,000 a day under the laws governing turbidity and discharge of pollutants.

The process for registering complaints, followup, and reporting results is formally spelled out for the public record. The steps are clearly outlined on a Department of Water Resources form: location, nature and source of complaint; investigation and followup action by an Association committee member; results of reinspection; and action taken in case of noncompliance. Figure 1 is a copy of the Complaint Record Memo.

Two years ago, the Association, Agency of Environmental Conservation and other parties held a workshop to review the progress of the program, to emphasize the continuing mission, and to motivate those involved.

The program’s success can be measured by the voluntary adoption of BMP’s as a routine part of logging operations and by the decline in complaints. Settling basins are now installed in the course of clear-cutting. A major paper company requires filter strips and water bars as part of the job, holding back $1.00 a cord in payment to the logger until BMP’s have proved successful. The volume of complaints has fallen nearly 75% since the beginning of the program 5 years ago. Only one problem has been referred to the Attorney General. This decline in complaints occurred during a period of increased logging, increased clear-cutting, and heightened concern over water quality. The State’s Water Resources investigators find that involvement of fellow loggers in education and enforcement encouraged adoption of BMP’s. They are satisfied that adequate BMP’s have been chosen and implemented.

New Hampshire Statewide Erosion and Sediment Control Program

The New Hampshire Water Supply and Pollution Control Commission amended its dredge and fill regulations under the Water Pollution Control Statutes (RSA.149:8-a) on April 18, 1981, to require permits for timber harvesting and construction activities that significantly alter the terrain or affect water quality. (N.H. Water Supply Pollut. Control Comm., 1982). Anyone undertaking earth-disturbing activities must obtain a permit from the Commission for commercial logging or for residential or commercial construction affecting over 100,000 square feet in or adjacent to surface waters.

Under the forestry permit, an operator acknowledges familiarity with and agrees to apply BMP’s such as those outlined in New Hampshire’s pocket handbook, Timber Harvesting Practices for Controlling Erosion (N.H. Water Supply Pollut. Control Comm., 1979): State forest rangers advise operators on these practices. If voluntary efforts fail and complaints are registered, the Water Supply and Pollution Control Commission investigates and issues cease and desist orders. The Commission devotes the equivalent of one full-time-person to inspection and enforcement. As many as one or two cease and desist orders are issued per week.

Before the program began operating, (1980-83), complaints averaged five a week, but now have fallen to two a week. Of these, approximately 60 percent are resolved at or near initial contact.
Figure 1.—Complaint form used in Vermont was developed by a committee from the Vermont Timber Truckers and Producers Association. This self-policing program represents high cooperation among private industry, State, and Federal personnel.
Unlike Vermont, New Hampshire has not formalized or publicized procedures for referring violations from the State forester to the Water Supply and Pollution Commission for investigation and enforcement. Fewer than 20 percent of the complaints were made after encouragement by the foresters; approximately 80 percent came directly from the public. Some foresters have been more involved that others, as would be expected. In addition, the Cooperative Extension Foresters have limited their role to educational activities, avoiding involvement with the regulatory activities of the Commission. Without formal procedures, the State and Extension foresters may not feel comfortable taking action or reporting violations to the Commission. Split authority makes “buck passing” a concern.

Under a construction permit, an applicant submits a plan for erosion/sediment control measures, runoff treatment, and flood management. Drawing on the Durham, New Hampshire, National Urban Runoff Project (U.S. Environ. Prot. Agency, 1984), the Commission has worked with builders and designers to develop design criteria for swales and vegetative surfaces to absorb runoff. Commission staff visits may lead to redesign or subsequently to enforcement. All applications are ultimately approved, and further planning or enforcement is required only for permit violations. In New Hampshire, the public can notify the State foresters of concerns and violations.

Massachusetts Minimum Forest Cutting Practices Regulations

Massachusetts has recently undergone a metamorphosis from a rarely enforced formal law on the books toward regulations perceived as more practical, more informal, and in most parties’ mutual interest. On January 1, 1984, the Massachusetts Division of Forests and Parks adopted new Minimum Forest Cutting Practices Regulations (Ma. State Forest. Comm., 1984) requiring operators to file a cutting plan. The plan includes BMP’s to protect water quality such as filter strips and road and skid trail standards. The State foresters and wardens review and approve the plans and follow up on compliance. Local conservation commissions can notify the State foresters of concerns and violations.

This type of regulatory program only recently gained acceptance as a realistic way to implement a long-standing law. The timber industry sought minimum standards applicable to all operators to assure equitable competition in the face of alleged fly-by-night operators who would bid high, disregard cutting standards, and leave landowners dissatisfied with harvesting timber. Several towns had recently adopted their own individual regulations, setting a trend toward crazy quilt regulation. For the first time, new State Wetlands Protection Regulations specified minimum cutting practices, but exempted an operator from the more lengthy and complex wetlands regulatory process if he had a State-approved forest cutting plan (Ma. Dep. of Environ. Qual. Eng., 1983). Loggers felt more comfortable in dealing with State foresters than with local conservation commissioners.

Despite past opposition to this regulatory scheme, the various parties now express satisfaction. Though site visits are mandatory only for wetlands or steep slopes, the foresters or wardens have actually been visiting most sites, educating loggers on BMP’s. Landowners and loggers are just learning of the new regulations so considerable cutting is taking place without plans. The importance of publicity that actually reaches landowners and loggers cannot be overstated.

State Programs with Local Option

Maine and Vermont have statewide minimum standards for new development. Maine gives localities the option to administer their own programs, while Vermont delegates administration to nine districts, retaining a greater degree of State control.

Maine’s statewide environmental laws, notably the Shoreland Zoning Act and the Site Location Act, provide statewide minimum standards and a framework within which localities can play as formal or informal a role as they choose. Under State Plan Act (Off., 1984), effectiveness depends on the degree of local initiative, the dedication of resources, and, above all, the will to exercise persuasion, approval/denial, and enforcement. Communities have the opportunity to adopt laws to local conditions, but, by the same token, they can remain passive participants in a local network of intergroup and personal relationships that condone lax practices and violations.

The role of local code enforcement officials is being formalized so that the responsible individual acquires a sense of professionalism and an official role beyond the network of local, often familial, relationships.

For over 10 years, State trained and certified evaluators have determined the suitability of sites for septic systems. Certification has formalized their role and set public expectations that they will follow the law. In 1984, the Maine Legislature considered requiring local code enforcement officers to become certified through training. Although the requirement did not pass in its entirety, certification is now a prerequisite to presenting cases in court. This eliminates the extra expense of hiring special legal counsel, giving towns a financial incentive to train their code enforcement officers.

Vermont’s statewide land use and development laws, Act 250 sets up the most systematic formal statewide framework for regulating land use activities (Vt. Environ. Board, 1982). A State Environmental Board sets policy and hears appeals. Nine District Environmental Boards review and pass on permit applications, including all forestry, construction, and earth-disturbing activities above 2,500 feet elevation. Although the District Boards are appointed by the Governor, they try to involve localities and bring education, technical assistance, and regulation closer to the people. Districts vary in their handling of environmental issues—a problem associated with some informal approaches.
Voluntary Associations

Voluntary associations offer the following advantages:
1. Because of close relationships and trust, often, peers can best arouse concern about water quality and suggest controls.
2. Fellow workers may be able to tailor effective yet acceptable controls.

Disadvantages are as follows:
1. Fellow workers may find it difficult to criticize or take exception to their peers' operations or practices.
2. Fellow workers may be unduly influenced by the interests of the operator or by personal relationships. Peer pressure cuts two ways.
3. A recalcitrant operator may not respect or accept his peers' advice. He may seek the authority of an official agency has a responsibility when the professional does not secure compliance.

Localities may lack the resources or expertise. Local officials can remain bound to local interests. For example, loggers, timberland owners and consulting foresters and engineers perceive a professional bond with State foresters. They accept their advice, usually voluntarily. Even though the public forester is a regulator, he is also a fellow professional.

Disadvantages are as follows:
1. Fellow professionals may be more concerned about the economic interests of the operator than about water quality.
2. Professionals may be set in conventional ways of doing their business, closing out consideration of some BMP's.
3. Professionals in one sector may be reluctant to refer failures to those in another, especially to regulators.
4. The public may not understand that the formal agency has a responsibility when the professional does not secure compliance.

Statewide Programs with Local Option

Statewide programs with local option have the following advantages:
1. State standards assure a minimum program throughout the State.
2. Mandatory provisions provide an incentive for localities to enact laws and develop programs.
3. Localities can tailor the programs to local situations, including special concerns and needs.
4. Localities can adopt higher standards than the statewide minimum.
5. Localities can informally and formally keep in closer touch with activities, problems, and violations than can distant, limited State agency staff.

Disadvantages are as follows:
1. Statewide minimum standards can reduce local standards to the lowest common denominator.
2. Local officials can remain bound to local interests rather than broader public environmental interests.
3. Localities may lack the resources or expertise.
4. States and localities may pass the buck, each feeling the other should act or take the heat.

Evaluation: Conditions for Strengths & Weaknesses

Reviewing strengths and weaknesses of these approaches can help tailor voluntary approaches for different situations.

Professional Affiliation

Professional affiliation offers the following advantages:
1. Fellow professionals respect one another.
2. Operators look to professionals in their field of activity for information and advice.
3. Professionals can often prescribe the most effective and acceptable BMP's tailored to the situations.

Disadvantages are as follows:
1. Fellow professionals may be more concerned about the economic interests of the operator than about water quality.
2. Professionals may be set in conventional ways of doing their business, closing out consideration of some BMP's.
3. Professionals in one sector may be reluctant to refer failures to those in another, especially to regulators.

The public may not understand that the formal agency has a responsibility when the professional does not secure compliance.

CONCLUSION: CONDITIONS FOR TAILORING EFFECTIVE FORMAL AND INFORMAL INSTITUTIONAL ARRANGEMENTS

With all informal/voluntary institutional arrangements, the greatest problem is involvement in and loyalty to the system, rather than to environmental quality. The formal environmental agency must clearly define ultimate responsibility under its mandate. The public must have a clear understanding of the reciprocal responsibilities of the formal public agency and the informal arrangements. If the informal arrangement fails, the public must know its rights and procedures for referral and followup action by the public agency.

Informal/voluntary arrangements appear to work most effectively when:
1. The voluntary association or group depends on environmental quality for its continued livelihood or cares intensely about the environment in its value system;
2. The voluntary association has a stake in maintaining minimum standards that eliminate unfair competition and insure equity. Fly-by-night operators using short cuts lower potential competitors' costs.
3. Professional loyalties and standards transcend individual or local interests. For example, loggers, timberland owners and consulting foresters and engineers perceive a professional bond with State foresters. They accept their advice, usually voluntarily. Even though the public forester is a regulator, he is also a fellow professional.

4. Professionals in the operator's field have specialized knowledge of BMP's tailored to his activity. The operator perceives that they have this expertise.
5. Local officials have status so that fellow citizens expect them to transcend the local web of personal relationships and loyalties. The community has come to expect the site evaluator, for example, to follow the law.
6. The State or Federal environmental agency formally states the law, standards, criteria and procedures within which the voluntary association or professional is to operate. Roles and responsibilities are clearly defined.
7. Staff of the public agency and of the informal association, profession, or locality cooperate in a relationship of mutual trust and concern for the environment.
8. The landowner and operator are fully aware of their responsibilities to submit plan applications and carry out BMP's. Education programs are tailored to reach all landowners and operators.
9. The role of associations, professionals, or local officials in environmental programs is clear not only to the public agency and to the responsible group, but also to their respective constituencies and the public. Support is essential to their public interest role. It lets the public know what is expected of the group. It makes them accountable. Further, it lets the public know what specific remedies are available should voluntary action fail.
10. Referral procedures are agreed upon, specified and widely publicized. In several cases, the public was not aware that the environmental agency would take action if the professional voluntary association failed to act.
11. Backup enforcement by the environmental agency is certain and prompt. Demonstrated investigation and enforcement action encourages voluntary BMP's. If enforcement standards are unclear and enforcement inconsistent, the voluntary program loses credibility. Violations persist, requiring more agency staff.
12. The formal agencies and parties to a voluntary program meet periodically to evaluate progress, refine the program, and reaffirm their responsibilities. Continuing publicity is essential.
REFERENCES
In 1983, the Utah Legislature provided $2.4 million for soil and water conservation practices to the Utah Agricultural Research Development Loan (ARDL) program. Loans are made at a 3 percent interest rate with a one-time 4 percent administrative fee and a maximum 12-year loan length. The Utah Soil Conservation Commission administers the program and local Soil Conservation Districts are responsible for plan approval. After 2 years of operation, over $11 million has been loaned to farmers for conservation work. The ARDL program is divided into three categories: (1) the regular ARDL program for soil and water conservation practices; (2) the watersheds program for conservation and water quality practices in special targeted areas; and (3) the emergency conservation program. This program has been successful in implementing conservation practices and improving water quality in Utah. The program is a revolving fund loan and provides operators with an incentive to install practices that benefit the public at a low cost to the taxpayers. Utah is currently the only State in the Nation operating a program of this kind.

In 1976, the Utah legislature provided $250,000 and began the Rangeland Development Fund; over the next several years this fund continued to provide low interest loans to applicants for making range improvements.

This fund was expanded in 1983 to $2.48 million to include cropland conservation measures. This program is under the direction of the Utah Soil Conservation Commission and staff support is provided by the Utah Department of Agriculture. The Soil Conservation Service in Utah agreed to provide technical assistance to begin conservation measures under the direction of the local soil conservation districts.

The program was expanded because of Federal budget cuts and a growing need for conservation in the State. The Utah Soil Conservation Commission lobbied the legislature for a 20-year plan that would result in an $80 million revolving loan program. Approximately half of the initial request was met by the legislature and they have demonstrated a continuing commitment by providing an additional $1.9 million in fiscal year 1985 and $2 million for FY 86. In addition to these appropriations, the legislature chose the loan program as a vehicle to assist farmers damaged by flooding, allocating an additional $3.6 million for emergency measures.

The loans are available to all farmers and ranchers in the State for use on private and State lands. Loans are made at a 3 percent interest rate and carry a one-time 4 percent administrative fee. The maximum life of a loan is 12 years and conservation practices must be maintained at operator's expense for the full life of the loan.

Early in the program it was recognized that local soil conservation districts 'represent' a valuable and underutilized resource. These district supervisors are most aware of the resource needs for their respective areas. Rather than add to State staff for program administration, the Commission turned to these local districts.

The districts pooled their resources through the Utah Association of Conservation Districts and created a framework to assist in the administration of the program. The State is divided into six zones, each comprised of six or seven districts. Loan funds are allocated to the zones by the Commission based on resource needs as demonstrated by loan applications received and annual plans and reports. The zones then allocate funds to the local districts. The districts are responsible for receiving and processing applications, as well as approving plans and monitoring projects. A local supervisor monitors each project (Fig. 1).

To assist the zones and districts, the Utah Association employed three regional coordinators. These coordinators provide staff support for the loan program and district educational and resource activities. The State did not increase its staff. The 4 percent administrative fee is distributed as follows: 1 percent to the State for program administration; 1 percent to the district in which the loan originates; and 2 percent to the Utah Association for the regional coordinators.

The program's early success was due to two critical factors. First, the program was decentralized and resources were determined at the local level. This gives the program grass roots support and uses the potential of the local districts as resource managers. The second critical factor was the support of the Soil Conservation Service (SCS). The State SCS and local officers totally supported the program and agreed to provide technical assistance. SCS participated in the development of program guidelines and is an ongoing partner.

Conservation practices eligible for funding under the program are essentially the same as those eligible under the Agriculture Stabilization and Conservation Service, Agricultrue Conservation Program (ACP). These practices were adopted by the Commission with only slight modifications. It was felt that the broadest set of practice's should be available for selection as local districts determine which activities are necessary and appropriate for their areas.

In addition to the regular program, the Commission recognized that special needs may exist across the State. To meet these needs, the Commission established the priority watersheds program and energy conservation program and made special funding set-asides. Later, the emergency program was added to meet the needs of farmers and ranchers damaged by flooding.

The ARDL watershed subprogram was set up to meet special conservation needs in priority areas. Projects under...
under this program are designed to control water pollution, erosion, or flooding. The strategy behind these projects is to improve the entire watershed and to develop a coordinated approach to watershed improvements. The guidelines require the Commission to designate priority watersheds and focus attention on these areas.

The Upper Weber and Upper Provo River drainages provide most of the drinking water needs for residents of the Wasatch Front (Utah's most populated area). These rivers are also the main channels for heavy spring runoff experienced along the Front. As the headwaters and source of Utah's most important water resources, the high watersheds have been recognized by the Utah Soil Conservation Commission, Utah Department of Health, and Soil Conservation Service as being the most critical areas for improvement in the State.

The Commission has established watershed funds for use exclusively in these designated areas. To meet the technical demands resulting from these projects, funds have also been set aside from the watershed grant fund. The purpose of these funds is to provide program coordination and assistance for project implementation within the priority areas.

This designation and special funding is intended to provide many benefits within the priority area. Targeting will offer the opportunity for extensive and coordinated use of conservation measures. The priority areas have major conservation, water quality, and flood control needs that cannot be adequately addressed through the regular program.

Early in 1984 the Utah Soil Conservation Commission appointed a subcommittee known as the Priority Watershed Committee to look at these problems and to help develop solutions. The Committee consists of representatives from Wasatch, Summit, Morgan, and Kamas Valley soil conservation districts.

The main goal of the Committee is to begin projects that will meet the needs of the watershed and to facilitate other projects. The Committee has met with several other agencies and discussed developing joint projects. Wasatch, Morgan, and Summit Counties have been involved in streambank improvements and other watershed treatments. In addition, the Weber Basin Water Conservancy District has begun projects in this area. The Priority Watershed Committee is coordinating these efforts of many agencies involved in watershed protection, providing funding as well as guidance for priority projects. The Committee has also assisted in providing technical assistance for many watershed improvement projects.

The priority watershed program has gained the support of the Soil Conservation Service, Utah Division of Wildlife Resources, local counties, and State and local water quality agencies. The following projects have been approved for funding:

- Streambank improvements: $75,500
- Animal waste control: $59,000
- Range improvements: $103,500
- Irrigation water management for water quality: $218,900
- Total: $455,900

These projects have resulted in multiple benefits to the watershed area. Water quality has been improved through the control of animal wastes and sediments; streambank erosion has been controlled by placement of riprap; and streamside vegetation and runoff waters have been reduced through increased infiltration of water into improved rangelands.

Perhaps most important, the Committee has provided a mechanism for coordinated action to avoid duplication and ensure that projects do not have a detrimental effect on the environment or downstream users. This Committee is beginning to become a force in the watershed area for dealing with critical needs in a coordinated manner. Through its contacts, the Committee will provide technical assistance for projects, assist in obtaining permits, and set priorities for program implementation.

The Commission set aside 5 percent of the total program funding for energy conservation projects. This program is administered by a special subcommittee with representatives from Utah State University Extension Service, Utah Energy Office, and Utah Power and Light. Projects approved to date include conservation tillage, hydroelectric generation, and irrigation water management programs.

In 1983, Utah experienced the devastation of a 100-year flood. Although much of the reported damage occurred within developed communities, farmers and ranchers across the State suffered large losses. Most land in Utah adjacent to streams is currently in agricultural use. Utah Lake and the Great Salt Lake are swallowing large portions of pasture and cropland. Again in 1984, flood damaged many acres of quality agricultural lands. Thousands of acres of crop and pastureland have literally been washed away and many more acres have been covered with water, gravel and sediment. Diversion structures, canals, irrigation systems, fences, and farm roads were destroyed during these periods of high runoff.

The Utah Department of Agriculture documented over $71 million in physical damages, crop, and livestock loss during 1983. During 1984 the Department recorded nearly $13 million in agricultural damage.

The Utah legislature provided $3.6 million in 1983 and 1984 in low interest loans to farmers and ranchers for flood damage and prevention. These loans were used to restore irrigation structures, diversions, level land, clear debris, restore land fertility, rebuild fences and roads, stabilize streambanks, and install measures to reduce the risk of future flooding.

These emergency loans were channeled through the Utah Department of Agriculture to the Utah Soil Conservation Commission. Local soil conservation districts assessed and reported damage to the Department and made requests for emergency money based on these assessments.

The sum of $1,972,500 was loaned to repair irrigation diversion systems, canals, laterals, fences, debris removal, clearing, and releveling. Of that amount, $700,200 was dedicated to streambank protection and stabilization and for measures to prevent or reduce the risk of damage from future flooding.

SUMMARY AND CONCLUSIONS

The Utah ARDL program is still evolving. The State and the Commission have only 2 years of experience with the expanded program. Yet, early signs are positive. To date, over $11 million has been put into conservation projects across the State. These projects have protected soil and water resources, improved water quality, and reduced the risk of damage caused by flooding.

Perhaps the greatest achievement of this program is the revival of the local soil conservation districts. These districts, in their role as natural resource managers and water quality management agencies, have great potential for protecting and improving water quality.

The local districts have the support of area landowners, are locally elected, and understand the problems of their areas. Through the loan program the districts have a meaningful function. They have been given a reason to evaluate the resources in their areas and to set priorities for implementation. Several districts have become in-
volved with county planning agencies and are working cooperatively on resource issues. The districts are gaining an understanding of how they might affect the resource base and many are undertaking broad programs to benefit the land, water, and the people living there.

The Soil Conservation Commission is supporting the development of the districts, seeing them as the alternative to Federal funding. Staff support has been provided to the local areas and the loan program emphasizes local control. Other State grant programs are being applied to district programs and additional resources are being sought from the legislature to support this program.

The response of landowners to the program has also been positive. Because the program is a loan, some of the reluctance to accept grants has been removed. Farmers feel more responsible for the project, heightening their sense of achievement. While there has been an overwhelming response to the program and applications exceed available funds, some practices are still undersubscribed. Some of the soil conservation and water quality practices with a low economic return, such as terraces or animal waste control systems, do not receive much attention. These practices often require the additional incentive of an ACP cost share used in conjunction with a loan. The State set-asides are used to balance out the funds used for any particular type of project.

The State has also tried to minimize the paperwork required for processing loans. State regulations are less cumbersome than those for the Federal ACP; however, some landowners are still reluctant to fill out the required forms and many balk at the financial statements.

Overall, the program has succeeded in getting conservation on the ground. There are administrative problems in processing loans, and set-asides have not proven extremely successful in attracting desired projects. Currently, the Commission is exploring alternatives such as varying the interest rate for different practices to encourage some desired applications. Many other changes are due as the program matures, but the groundwork has been laid for a successful, long-term program that will enhance the natural resource base of the State of Utah.

ARDL APPLICATION PROCESS

I. First District Board Meeting
   A. Applicant completes application form.

B. Soil Conservation District (SCD) Board reviews application. Checks for completeness, preliminary indication of credit made, and application screened to determine if request complies with ARDL program.

C. Application will be approved or disapproved for planning. The applicant will be notified in writing by the SCD Board as to decision and given a financial statement form to fill out and send to the Soil Conservation Commission (SCC).

D. Technical assistance is assigned by the SCD Board to develop conservation plan for the approved applications.

E. SCD Board assigns a supervisor to track application progress and planning.

II. Interim
   A. Individual applicant sends financial statement and supporting data as required on the financial data request form to the Soil Conservation Commission (SCC) within 15 days.

B. SCD Board sends copy of completed application form to the Zone Coordinator (ZC) and ZC in turn forwards application to the SCC.

C. Technical assistance agency develops plan with the individual.

D. SCC investigates applicant's credit and repayment ability. Upon finding negative information, the SCC will notify the SCS Field Office and SCD Supervisor and the applicant.

III. Second District Board Meeting
   A. Completed conservation plan is presented by the applicant to the full SCD Board for final approval and funding (provided funds are available). SCD Board will notify applicant in writing if final plan receives approval for funding, pending final determination by the SCC. Work cannot begin on projects until loan contracts are signed.

   B. SCD Board sends copy of final plan to the ZC and ZC forwards plan to the SCC.

IV. Post Project Approval
   A. Security agreement and repayment schedule is developed between the State and the individual. (Applicant will be responsible for a portion of loan initiation fees beyond the 4 percent administrative fee.)

   B. The SCC will notify the SCD Board, SCS Field Office and ZC when final contracts are completed and project is ready to begin.

V. Practice Installation and Certification
   A. Technical Assistance (TA) agency will design and monitor practice installation.

   B. SCD Board representative monitors implementation of project and follows up on loan activities as necessary.

   C. TA agency will certify to the State that the practice is or is not installed according to standards and specifications.
DEVELOPING NONPOINT SOURCE CONTROL STRATEGIES FOR BIG STONE LAKE: TWO APPROACHES

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ABSTRACT
Big Stone Lake, a hypereutrophic lake located on the Minnesota-South Dakota border, suffers from algae blooms, excessive weed growth, and sedimentation. The South Dakota Department of Water and Natural Resources, with support from the Minnesota Pollution Control Agency, completed a Diagnostic-Feasibility Study that identified nonpoint source pollution from agricultural land use practices in the lake's 2,936 km² watershed as the major source of pollution to the lake. Institutional barriers often present a greater task for nonpoint source projects than the technical factors involved in addressing nonpoint source problems. The Big Stone Lake Project provides an interesting case study because its initiation involved and required the cooperation of two regional EPA offices, two States, five counties, and a multitude of State and local agencies. The large size of Big Stone Lake's watershed has also required innovative approaches to identifying and prioritizing nonpoint source pollution strategies. A computer model will be used to target nonpoint source control projects within subwatersheds.

INTRODUCTION
"In recent years there have been complaints of increasing growths of rooted aquatic plants (weeds) and nonrooted, generally small, scum-forming plants (blue-green algae) in the lower or southern end of Big Stone Lake, especially in the vicinity of Ortonville, Minnesota ... " This excerpt is from a report requested by the governors of South Dakota and Minnesota after a meeting of their representatives at Milbank, South Dakota, in 1967 (S. Dak.-Minn. Comm. 1967). As can be seen from this nearly 20-year-old report, concern for eutrophication of Big Stone Lake by South Dakota and Minnesota is not new. What is new is the coordinated effort by both States to solve many of the problems contributing to the lake's degradation.

The information presented here is meant to provide an understanding of the management philosophies of the two States involved in the project and to show how institutional differences have been meshed to develop this joint restoration effort.

Basin Description
Big Stone Lake is located on the border of South Dakota and Minnesota (Fig. 1). Big Stone is a large, hypereutrophic, warm water lake with a surface area of 5,002 ha (12,360 acres), a shoreline length of 96.4 km (59.9 mi), and an average depth of 2.4 m (8 ft). Big Stone Lake was formed about 8,000 years ago by a glacial lake filling the Whetstone River area. In 1939, the lake became a reservoir when a concrete dam replaced the natural outlet following the diversion of the Whetstone River into the lake for flood control. This diversion increased the watershed of Big Stone Lake from 1,78,588 ha to 295,367 ha (729,841 acres) and significantly increased problems of nutrient enrichment and sedimentation. Of the 295,367 ha, two-thirds lie in South Dakota and one-third in Minnesota (Fig. 2).

Water quality of Big Stone Lake is best described as hypereutrophic. Growth of blue-green algae dominated by Aphanizomenon is the primary factor limiting recreational use of the lake from early July to October. Algal density is usually the principal factor limiting water transparency, which typically ranges from over 4 m during the spring zooplankton pulse to less than 0.5 m in August. Water transparency is occasionally limited by resuspension of sediment in the shallow areas adjacent to major tributary inlets. These and many other shallow areas are covered by extensive aquatic macrophyte growth during the summer (S. Dak. Dep. Water Nat. Resour. 1983). Water quality degradation over the past 20 years has led to a significant decline in sport fishing and water-based recreational use of the lake, which has been an important regional resort and vacation area for the past 100 years.

The major sources of pollution to Big Stone Lake arise from agricultural land use in the watershed. Erosion from cropland and runoff from animal feeding operations are major sources of nutrient and sediment loadings to Big Stone Lake. Rapid runoff characteristics and streambank erosion in some subwatersheds also contribute to lake pollution loadings. Water quality monitoring on tributary streams has shown unacceptable loads of both nutrients and sediment. While nonpoint source pollution from intensive agricultural land use is the major source of pollutants to Big Stone Lake, other sources such as the municipal sewage facilities at Browns Valley, Minnesota, and Sisseton, South Dakota, contribute to water quality degradation (S. Dak. Dep. Water Nat. Resour. 1983).
STATE NONPOINT STRATEGIES AND PROGRAMS

Although the public has been interested in restoring Big Stone Lake for at least 20 years, efforts have been limited by differences in program priorities and organizational philosophies on either side of the lake.

The South Dakota Strategy and Program

In 1976, designated by the Governor as the statewide management agency responsible for the "formulation of implementable water quality management plans," the South Dakota Department of Water and Natural Resources (SDDWNR) began developing a methodology for preparing a comprehensive 208 management plan. Serious consideration was given to a variety of methods. Finally, the SDDWNR decided not to prepare an all-encompassing State plan, but rather to target areas for intensive efforts; and, as individual plans were prepared, more areas would be added, eventually encompassing all problem areas of the State. As a rural State with agriculture as the primary industry, agricultural nonpoint source problems were expected to be prominent.

Having selected this management approach, SDDWNR, then the Department of Environmental Protection, solicited potential candidates for water quality study areas from planning districts, soil conservation districts, lake associations, and various other public and private
groups. Each group was asked to submit recommendations to the appropriate planning districts, which then submitted their top three choices to SDDWNR. Selections were based mainly on available data, public support, and perceived problems. All of the original selections were rural watersheds with lake or stream problems resulting from nonpoint source pollution.

The SDDWNR collected the preliminary data necessary to prepare individual plans. Soil conservation districts were contracted to assist with water sample collection, compilation of land use data, and dissemination of public information. The SDDWNR evaluated the data and prepared reports and plan recommendations. South Dakota used the 208 program to fund promotion of best management practices (BMP’s) on selected critical areas.

Soil conservation district employees were responsible for BMP promotion. Although not State employees, soil conservation district staff activities in areas of water quality and nonpoint source pollution were directed by SDDWNR staff. As is evident, the 208 planning process for South Dakota was not only managed, but many elements were actually conducted by the SDDWNR from project initiation through the preparation of final evaluations and reports. Assistance was provided by other agencies.

This somewhat independent management philosophy has since carried over into all lake projects in the State. The application of this philosophy to the Big Stone Lake Restoration Project occurred naturally, considering past project management. Although the Big Stone Lake project did not evolve through the 208 process, it had the same attributes as other State projects: local support, serious water quality problems, and extensive baseline data. The drawback with this approach is that instead of going through the 208 planning process as a targeted water quality study area, Big Stone Lake and its associated watersheds went from preliminary baseline data into a Phase I Study.

In preparing the Phase I grant application, SDDWNR used existing staff, secured matching funds, stationed a fulltime employee in the watershed, and purchased the required monitoring equipment. The fulltime coordinator collected, compiled, and evaluated all the data required for a Phase I report, and prepared major sections of the report, the remainder of which were prepared by SDDWNR headquarters staff. Almost all of the agencies previously mentioned, as well as the local agricultural agencies and the South Dakota Department of Game, Fish and Parks collected data.

Once the Phase I report and Phase II application were completed and submitted to U.S. EPA, preparations were made for implementing the Phase II grant award. As with the Phase I, the project coordinator assumed responsibility for finalizing the matching fund commitments, modeling feedlots for implementation, and selecting a model with which to identify necessary BMP’s. After the grant was awarded, SDDWNR continued to actively participate in the project through the coordinator, with direct assistance from headquarters staff.

The Minnesota Strategy and Approach

The Minnesota Pollution Control Agency (MPCA) is the Minnesota water quality management agency. Minnesota’s nonpoint water pollution effort began in 1976 with the development of the Minnesota Water Quality Management Plan (208 Plan) led by the MPCA. Its purpose was to identify significant water quality problems caused by nonpoint sources of pollution and to set forth effective programs to address those problems. Unlike South Dakota, the Minnesota 208 plan was not a blueprint for action in individual watersheds; rather, it summarized existing management policies and programs as well as recommended future policies and actions. The plan recognized that a continuing nonpoint program would involve three functions: (1) continued study of nonpoint source issues, (2) preimplementation activities that would lead to putting recommended programs into operation, and (3) actual implementation of management programs.

In 1983, the MPCA initiated a study to identify major barriers to implementation of integrated water quality and land management in Minnesota. The four barriers identified were: (1) a poor understanding by the public of the existence and economic significance of water quality problems resulting from land management, (2) poor understanding of available solutions to nonpoint pollution, (3) government fragmentation of water quality and land management, and (4) the limited funds available to solve the problems (Richfield, 1983).

Minnesota then delineated three strategies to address these problems. First, MPCA completed an information strategy to develop public awareness of the economic and recreational impact of nonpoint pollution. Second, Minnesota initiated meetings with other State and Federal agencies to encourage inclusion of water quality management in their existing programs, to encourage their assumption of new water quality activities, and to provide technical support. Third, MPCA helped organize and apply for U.S. EPA Clean Lakes funds for two watershed projects where nonpoint problems adversely affect water uses, to demonstrate successful approaches to nonpoint source management. These projects are intended to demonstrate technical solutions to nonpoint control, the viability of an integrated land and water management approach, the importance of cooperation in overcoming fragmented resource management, and actual implementation costs, thus providing an accurate assessment of the control effectiveness of project funds. Big Stone Lake is one of Minnesota’s nonpoint demonstration projects.

Minnesota’s involvement in the Big Stone Lake project is based on a program approach developed through the U.S. EPA Clean Lakes Program. MPCA provides funding and technical support, while contracting with a local unit of government to lead the effort locally. This approach allows local project control and decision-making to best meet the local needs and conditions while providing technical oversight.

In the case of Big Stone Lake, the Upper Minnesota River Watershed District is the grantee. The watershed district, a local unit of government whose purpose is developing and coordinating water management programs, is a five-member board of managers with taxing authority keyed to hydrologic boundaries. The unique form of local government is a natural local leader for this project although initially State sponsorship was sought. The watershed district was experienced, having sponsored a U.S. Army Corps of Engineers project to modify the Big Stone Lake outlet, by which more of the Whetstone River will bypass Big Stone Lake, reducing nutrient and sediment loading from the Whetstone River.

In addition to the technical review, the Big Stone Project has benefited from other ongoing nonpoint program activities. The MPCA instituted a feedlot permit program in the early 1970’s, designed to eliminate and prevent pollution hazards from livestock and poultry operations. The Minnesota Feedlot Computer Model, developed by the USDA Agricultural Research Service in cooperation with the MPCA, determines the pollution hazard, and prioritizes cost-share funds for cleanup of feedlot problems. This program, in cooperation with local soil and water conservation district activities, has solved most of the feedlot problems contributing to the Big Stone Lake from the
Minnesota watershed. Three serious existing problems are now receiving attention from the MPCA enforcement staff. Identifying the sources of nonpoint source pollutants and tracing their path through a watershed is a complex and time-consuming process. To more efficiently identify and trace nonpoint pollution, the MPCA funded and joined with several conservation agencies to develop two computer water quality models (AGNPS I and II). The Agency used one of the subwatersheds from Big Stone Lake to verify and test these models. The Upper Minnesota River Watershed District will use this information and these models to prioritize problems and assist in designing the implementation program at Big Stone.

The MPCA actively solicited project support from State and Federal agencies already engaged in nonpoint control, and is coordinating the considerable support received. Important to that effort was a meeting organized by MPCA staff, attended by local representatives of the Watershed District, SDDWNR, the Minnesota Soil and Water Conservation Board, University of Minnesota Agricultural Extension Service, Minnesota Water Resources Board, the Soil Conservation Service, and the Agricultural Stabilization and Conservation Service. The meeting resulted in additional support and interest for this project.

The Minnesota Soil and Water Conservation Board (SWCB) will target several subwatersheds to receive an intensive communications program over a 2-year period. The program will communicate to farm operators the economic and social implications of soil erosion, nutrient loss, and degraded water quality. The SWCB is also expected to directly provide additional implementation funds through two State programs for erosion control and water management.

THE COORDINATED TWO-STATE APPROACH

Big Stone Lake and its contributing watershed lie in two U.S. Environmental Protection Agency regions, two States, five counties, one watershed district, and a multitude of other local governments and governmental agencies. This project represents an extreme case of fragmented political boundaries and consequent limits to water quality protection. The same organizational complexity which once threatened this project is now recognized as a project asset, flexible in overcoming obstacles to water quality improvement.

Initially, both States were concerned about the other's management philosophy although both States recognized that any improvement in water quality would require involvement by both South Dakota and Minnesota. Although both States expressed an interest in the restoration of Big Stone Lake, they had to overcome several barriers and differences in approach at the regional, State, and local level. These differences centered on several areas:

1. Project evaluation criteria
2. Pollution control standards
3. Approaches to pollution problems
4. Project management approaches
5. Clean Lake project prioritization criteria
6. The strengths and weaknesses of the two agencies.

A smaller project, involving a more easily defined and straightforward solution, would have eliminated several of these barriers and differences. The enormity and nature of the lake's problems also complicated joint efforts, making it difficult to complete the Phase I report within the budgetary constraints.

The MPCA and Region V EPA had more experience with engineering approaches to lake problems and attempted to apply these criteria to a nonpoint source control project focusing on best management practices. SDDWNR, on the other hand, emphasized direct implementation during the planning process and felt that the emphasis on planning could delay the project's implementation. Staff changes at both agencies and regions during the Phase I project and during the interim period between the completion of the Phase I and implementation of the Phase II project also complicated the development of a cooperative working relationship.

The solution involved developing greater flexibility on the part of Region V EPA and the MPCA to allow consideration of nonpoint source control project developed on a limited budget. This also required SDDWNR and Region VIII to agree to accept some of the stricter standards and procedures implemented by Region V. Both EPA regions had to agree to allow some activities, considered as "planning" in more traditional Clean Lakes projects, to receive funding under the Phase II effort. Further, staff from both State agencies had to sell the need for a different approach to the rest of their agencies and to other State programs.

While both SDDWNR and the MPCA could have eventually resolved these differences and overcome the barriers to a cooperative effort, the time required would have jeopardized the project's momentum and reduced chances for FY 1984 Clean Lakes funding.

Both EPA regions played a crucial role in speeding up the negotiation process, cutting through red tape, finding solutions to the problems that emerged, and helping the State agency staffs sell the project to the rest of their agencies. Because many of the differences emanated from different approaches by the two EPA regions, decision-making at the regional level was necessary for a compromise solution. In other instances, where the differences arose from differing State approaches, EPA intervention helped avoid lengthy rulemaking processes and overcome bureaucratic barriers that could have slowed the negotiation process. In areas where the two regions and States continued to differ, the EPA regions helped the States work out solutions that converted these differences to variations in emphasis, rather than barriers to cooperation.

The resulting merger of the two different approaches has led to a stronger project. The resulting cross-fertilization has allowed each State to learn from the other's approach, management style, and legislation. The fact that some differences remain has allowed greater flexibility on the local project level. For example, for some measures that both States felt important, one EPA region had a greater likelihood of approving and funding than the other. In other cases, one or the other of the two States might be better equipped to implement a certain required measure. By allowing differences to remain, the local project benefits from the strengths of each State agency and both regions.

This project has provided the following lessons:

1. Geographic and political fragmentation should not bar project initiation. Addressing these problems is as important to improving water quality as are the technical issues.
2. Many of the differences between States and other governmental units, while barriers at first, can work to the advantage of a project because the different groups bring different sets of experiences, skills, and tools to the project.
3. In this project, misunderstood communications between States and between the States and local units of government impeded the project. When open, effective communications were established, cooperation overcame philosophical and political causes for disagreement.
4. For the two States to agree, they needed to develop...
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procedures to work out how and where these differences would be resolved.

5. Projects involving more than one State and region require a high degree of flexibility on the part of the parties involved.

6. NPS projects require more planning and coordination than more traditional Clean Lakes projects; the parties involved either have to accept a less rigidly defined project or allow for a greater planning effort.

7. Active involvement by EPA can facilitate and expedite negotiations between States in their attempts to address interstate pollution problems.

8. Nonpoint source projects need strong local cooperation: Although the MPCA typically does not get involved in a project until this is developed, the SDDWNR actively helped develop the local cooperation during the Phase I study by involving them in the process. This played a key role in the project's success.

CONCLUSION

Institutional barriers often present a greater task for nonpoint source control projects than do the technical factors involved. The Big Stone Lake Project provides a case study because its initiation involved and required cooperation of two regional U.S. EPA offices, two States, five counties, and a multitude of local units of governments and government agencies. This same organizational complexity that once threatened this project is now recognized as a project asset allowing the programs the flexibility necessary to overcome obstacles to water quality improvement.

REFERENCES


Nonpoint source pollution is adversely affecting water quality in the Tennessee Valley. In a recent survey of water quality in the region over half of the 10 most water quality problems resulted from nonpoint sources (Clark et al. 1980); three additional problems have been identified since that survey (Tenn. Valley Author. 1984a). The types of water quality impacts that can be attributed to nonpoint sources in the Tennessee River watershed include siltation and filling of reservoirs, bacteria contamination, accelerated eutrophication of reservoirs, low dissolved oxygen, and elevated levels of metals.

Although many of the nonpoint-source-related water quality problems in the Tennessee Valley have a very interesting history, the primary objectives of this paper are to examine the Tennessee Valley Authority’s (TVA) role in protecting its reservoirs from nonpoint source pollution and describe TVA’s efforts to resolve existing problems and improve the overall nonpoint source management throughout the region. This discussion is based only on activities in TVA’s water resources programs.

TVA was created by Congress in 1933 as a corporate agency of the Federal government. Not part of any Federal cabinet department, it is an independent agency that operates with a certain degree of the autonomy and flexibility of a private corporation. TVA planned, built, and now manages a unified water control system of 40 dams and reservoirs that regulate the entire length of this Nation’s fifth largest river plus key stretches of its principal tributaries. TVA water resources activities are supported by annual appropriations from Congress (Tenn. Valley Author. 1985).

TVA follows a stewardship philosophy in management, resulting in the maximum beneficial uses today and in the future. Also, TVA promotes the economic growth and development of the region while ensuring the enhancement of the Valley’s natural resources. Water pollution resulting from nonpoint sources can affect not only water use in the TVA region and TVA’s ability to manage the reservoir system, but can also hinder or preclude regional development.

Although it is not a regulatory agency for controlling pollution, TVA does not depend on the Valley State regulatory agencies to carry the entire burden of improving water quality in Valley reservoirs. Several nonregulatory TVA activities help the Valley States keep TVA reservoirs clean and suitable for beneficial uses.

**STEWARDSHIP**

TVA is a steward for the water resources of the Tennessee Valley and four specific water resources activities that help the agency fulfill that role: (1) controlling nonpoint source pollution emanating from properties under TVA’s custody or control, (2) reservoir water quality management planning, (3) septic tank suitability analysis for reservoir shorelines, and (4) reservoir release improvements.

**Controlling Nonpoint Source Pollution from TVA Properties**

TVA has fee-owned lands and flowage easement rights along its reservoirs. Fee-owned lands located above the normal maximum pool are managed under short-term renewable license or long-term land use agreements for multipurpose uses that include agriculture, recreation, wildlife, and silviculture.

Since 1981 TVA has been recognized by the State of Tennessee and the U.S. Environmental Protection Agency (EPA) as the management agency for controlling nonpoint source pollution emanating from properties under TVA custody or control. This recognition is pursuant to Section 208(c) of the Clean Water Act of 1977 and its implementing regulations, 40 CFR 35.152(f-3). A memorandum of understanding between TVA and the State of Alabama for similar recognition in that State is being finalized and agreements are being pursued with the five other Valley States.

As a recognized management agency TVA has developed provisions to be included in deeds, easements, leases, and licenses requiring the use of best management practices (BMP’s) for controlling erosion and sedimentation resulting from land disturbing activities. Special procedures now used in issuing agricultural licenses ensure that TVA lands are suitable for row crops and that State-approved BMP’s are followed to protect water quality and the long-term agricultural capability of the land. In addition, TVA has developed BMP’s for timber harvesting activities on TVA lands.

**Reservoir Water Quality Management Plans**

TVA reservoirs, like large settling basins, are particularly vulnerable to nonpoint source pollution. The beneficial effects of reservoirs on water quality are well documented as are the consequences of uncontrolled nonpoint source pollution (Churchill, 1957; Clark et al. 1980). Improving and protecting water quality in the TVA reservoir system is the major reason behind TVA’s involvement in nonpoint source pollution control. The cornerstone of TVA’s efforts is the Reservoir Water Quality Management Plan.

Through its reservoir water quality management planning process TVA has an active role in defining water quality problem areas, identifying corrective actions, and implementing appropriate management actions. These plans help States carry out their regulatory programs and
guide TVA itself in operating and managing the reservoir system.

The reservoir management planning process includes the following five phases:
1. Identifying water quality problems and management issues.
2. Developing a data base appropriate to the problems and needs identified.
3. Identifying cause and effect relationships and using those relationships to predict changes in water quality that would result from applying alternative pollution control strategies and further development.
4. Developing a management plan that synthesizes the information into recommendations for correcting existing use impairments and preventing future water quality problems.
5. Implementing the management plan recommendations.

By the end of 1985 TVA will have completed management plans for five reservoirs, and be well into the implementation phase (Tenn. Valley Author., 1984b). Three other reservoirs will have management plans in one of the other four phases.

**Septic Tank Soil Suitability Analysis**

Soil conditions along the reservoir shorelines of many TVA reservoirs are unsuitable for conventional septic tank soil absorption systems. Because of this, many conventional systems are failing and may be contributing bacteria and nutrients to TVA reservoirs. In 1985 TVA is attempting to document the extent of water quality degradation resulting from failing septic tank systems along reservoir properties. To combat this nonpoint source TVA is providing guidance to local and State health departments and land developers on the capabilities of shoreline properties to handle onsite sewage disposal systems. This guidance is a conceptual plan that identifies shoreline properties suitable for conventional or alternative onsite systems and also properties not suitable for any type of onsite system. In the latter case these properties must be sewered or remain undeveloped. This analysis is performed using soil survey information digitized on TVA's Geographic Information System. The soil suitability analyses are performed by an experienced soil scientist and environmental engineer familiar with the soil requirements for conventional and alternative onsite systems. Conceptual plans have been completed for two TVA reservoirs (Sagóna, '1985); another is scheduled to be completed in 1985.

**Réserveoir Release Improvements**

Nonpoint sources contribute to the natural dissolved oxygen-depletion processes occurring in TVA's deep, thermally stratified reservoirs. The primary result of this dissolved oxygen depletion is almost 300 miles of stream below TVA dams that are low in dissolved oxygen. One way of dealing with this condition is to increase the dissolved oxygen at the point of release, the dam. In 1981 TVA began a 3-year experimental program designed to study and test alternative methods of enhancing dissolved oxygen levels in reservoir releases. This program has been very successful (Tenn. Valley Author. 1984c). The implementation phase will probably continue for at least another 3 years.

To complement the reservoir release improvement program, in 1985 TVA initiated a basin rehabilitation project for the South Fork Holston River. One of the purposes of this project is to reduce point and nonpoint source contributions in the watershed above two TVA reservoirs experiencing dissolved oxygen depletion. The results of this project will help TVA determine the degree of improvement that could be expected from improved reservoir quality.

**RESOURCE ENHANCEMENT**

An adequate supply of water capable of supporting a variety of beneficial uses is essential to economic growth and future development that may be in the public interest. The resolution of nonpoint source-related water quality problems will aid TVA's efforts to promote natural resource-based economic development.

Three activities that support TVA's resource enhancement role include: (1) Identification of nonpoint source problem areas, (2) serving in a facilitator role to resolve nonpoint source pollution problems, and (3) conducting demonstrations of solutions to nonpoint source problems.

**Identification of Nonpoint Sources**

Three years after its creation in 1936 TVA conducted a survey of water pollution in the Tennessee River (Scott, 1941). Since that time water quality monitoring and assessments have continued to be a key component of TVA's water resources programs. Although the emphasis of the monitoring program has shifted from time to time, the primary objective remains: to identify problem areas and evaluate the effectiveness of corrective actions. Traditional TVA ambient monitoring programs have been only partially effective in identifying nonpoint source-related problems; therefore, TVA has recently turned to intensive surveys of suspected problem areas with rainfall event sampling for targeted water quality parameters (Milligan et al. 1984; Carriker and Mullins, 1963).

The diffuse nature of nonpoint source pollution coupled with its seasonal and hydrologic variation make source identification technically difficult and expensive. TVA uses aerial photography and stereoscopic interpretation techniques to reduce costs and improve the extent of coverage and accuracy of nonpoint source identification. These techniques are not new. However, their extensive use in identifying nonpoint sources is new.

TVA uses color infrared photography and personnel trained in the characterization of nonpoint source pollution from aerial photographs to identify animal waste runoff and failing septic tanks. In cooperation with the Soil Conservation Service (SCS) district conservationist, aerial photography and county soil survey information is also used to estimate soil erosion rates from individual farm fields.

Results of all TVA monitoring and data analysis are made available to the State regulatory agencies. TVA data complements the State's monitoring programs and helps to prioritize problem areas. When nonpoint source problems are identified, the Valley States initiate appropriate regulatory or voluntary cleanup actions and often TVA cooperates in the problem resolution process.

**Catalyst for Solving Water Problems**

When a nonpoint source water quality problem is identified, TVA works cooperatively with State and other Federal agencies to solve the problem. TVA uses the data collected during the problem identification phase to focus public attention on priority problems and issues. TVA encourages public involvement in controlling nonpoint sources. One approach that has been effective in correcting some of the more complex water quality problems in the Tennessee Valley has been the formation of an interagency task force to plan and direct cleanup activities. Federal agencies such as SCS, Agricultural Stabilization and Conservation Service (ASCS), U.S. Geological Sur-
vey, and EPA, along with the State regulatory agencies have worked cooperatively with TVA on nonpoint source pollution problems.

Demonstration of Solutions to Nonpoint Source Problems

Often the correction of a nonpoint source problem cannot proceed because cost-effective corrective techniques are not available. In the case of high-priority problems TVA develops and implements projects to demonstrate effective and economical solutions. TVA demonstrations also serve as an education tool to encourage participation in water quality improvement efforts. On one such project that involved reclamation of abandoned mineral mine lands, TVA developed a minimal land reclamation technique that controls offsite erosion at a low cost of $2,470/hectare ($1,000/acre) (Muncy, 1981). This demonstration encouraged the State's legislature to provide funding to the county governments to complete the project. The end result was the control of erosion from over 242 hectares (600 acres) of abandoned mine lands, erosion that was adversely affecting downstream water supplies and contributing to the siltation of TVA reservoirs.

In another project TVA is working with SCS, ASCS, and farmers to control animal waste runoff in a major tributary watershed. While helping farmers install animal waste systems TVA is developing information on the amount of cost-share necessary to stimulate landowner interest and identify the animal waste treatment components with the most water quality benefits. Through this demonstration animal waste treatment system designs have been improved and educational material on operation and maintenance of animal waste systems has been developed.

CONCLUSION

TVA's role as a steward for the water resources of the Tennessee Valley and its mission of resource enhancement dictates an active involvement in helping control nonpoint source pollution. The lack of direct regulatory responsibility for pollution control should not discourage water resources agencies in working cooperatively with others to resolve nonpoint source pollution problems. The fact that TVA is not burdened with regulatory responsibilities provides more opportunities and flexibility in dealing with nonpoint sources.

REFERENCES

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ABSTRACT

Federal, State, and local agencies are carrying out an aggressive watershed protection program to prevent degradation of two new multipurpose reservoirs in the Raleigh-Durham-Chapel Hill area of North Carolina. The U.S. Army Corps of Engineers impounded the B. Everett Jordan Lake and Falls of the Neuse Reservoirs in 1981 and 1983 for flood control, recreation, and water supply. With a drainage area of almost 6,500 km², the reservoirs have a combined surface area of 10,000 ha, and represent a potential raw water source of 200 million gallons per day. An interagency strategy was developed in response to growing public demands for water supply protection amidst accelerating urban development and evidence of excessive nutrients in the reservoirs. The strategy is preventive in focus - none of the intended uses has yet been impaired. Phosphorus removal will be required from all new wastewater discharges, and from selected existing facilities in the watersheds. The North Carolina General Assembly will consider a statewide ban on the sale of phosphate-containing laundry detergents during its 1985 session. Cities and counties have enacted land use controls and a $2 million a year State-funded cost-share program is helping farmers finance much-needed agricultural BMP's in critical portions of the watersheds. Initial success of the overall strategy appears to support the principles of EPA's proposed National Nonpoint Source Policy.

The B. Everett Jordan and Falls of the Neuse Reservoirs lie in North Carolina's piedmont physiographic province (Fig. 1). The U.S. Army Corps of Engineers impounded the lakes in 1981 and 1983 for flood control, recreation, and water supply. With a combined drainage area of 2,500 square miles, they represent a potential raw water source of 200 mgd for the Research Triangle area of Raleigh, Durham, and Chapel Hill, North Carolina.

Local officials and the general public recognizing the reservoirs' value to the region have demanded increased protection during an unprecedented period of economic growth and development. Although a great deal of public and editorial attention has focused on possible water quality effects of urbanization, none of the intended uses of either lake have yet been impaired. The Falls/Jordan watershed efforts described here represent an important public commitment to preventive—rather than corrective—action.

Efforts begun in 1983 have resulted in several accomplishments:

• Phosphorus removal is now required at all new wastewater plants in the 2,500 square-mile watershed and at selected existing facilities.
• The North Carolina House of Representatives approved a ban on the sale of phosphate detergents (to be considered by the State Senate in 1986).

Cities and counties have enacted aggressive and controversial land use controls for new development restricting sewer extension policies, impervious surface coverage, gross density, industrial siting, underground chemical and petroleum storage, and vegetated stream buffer requirements.

The North Carolina General Assembly created a State-funded cost-share program for agricultural conservation practices, and provided a two million dollar biennial appropriation for use by 15 counties in the State's designated Nutrient Sensitive Watersheds.

THE WATERSHEDS

Table 1 highlights several features of the Falls and Jordan watersheds. Both lakes are shallow, with mean depths of 12 and 16 feet, respectively. Wastewater treatment plant effluent equals or exceeds the volume of natural streamflow entering the lakes during low flow periods. Both watersheds are large and heavily populated, containing about 10 percent of North Carolina's total population (Div. Environ. Manage. 1983).

Figure 2 depicts gross land use and phosphorus loading. Approximately 63 percent of the land is forested, and 28 percent is in agricultural use (tobacco, corn, poultry, dairy, and hog production). The relatively small proportion (9 percent) of urbanized land is replacing forested and agricultural areas at an increasing rate. The largest fraction of phosphorus input (55 percent) comes from municipal wastewater plants, none of which removed phosphorus before the current initiative (Div. Environ. Manage. 1983).

Falls and Jordan Lakes are two of the most highly enriched water bodies in North Carolina, but their quality tends to be typical of mainstream piedmont reservoirs in the southeastern United States. Low Secchi depths are due to high algal biomass and inorganic sediment; pH and dissolved oxygen data reflect the high productivity, photosynthesis, and thermal stratification of hot summer conditions. Phosphorus and chlorophyll a concentrations, which clearly exceed "acceptable" levels for northern conditions, tend to be higher than those in southeastern U.S. reservoirs.
INSTITUTIONAL/FINANCIAL ASPECTS OF NONPOINT SOURCE CONTROLS

PUBLIC CONCERN
A high and sustained public concern expressed by local governing bodies, newspaper editorialists, and radio/TV features was an important factor behind the Falls/Jordan watershed protection effort. The reservoirs' recent impoundment occurred during a period of unprecedented growth in the Research Triangle area. A proliferation of new subdivisions, office parks, and shopping centers had heightened the public's awareness of potential water quality effects on their new reservoirs.

Chronology
The period from impoundment to active protection encompassed several activities in the following order:

**Construction/Impoundment.** Jordan and Falls Reservoirs were filled in 1981 and 1983, respectively.

**Call for Action.** A resounding call for action, as described above, received a quick and positive election year response from cabinet level state officials.

**Steering Committee.** The Secretary of North Carolina's Department of Natural Resources and Community Development (NRCD) created a Steering Committee of mayors and county board chairmen from each of the 16 political jurisdictions in the Falls and Jordan watersheds.

**Nutrient Sensitive Designation.** The North Carolina Environmental Management Commission classified the Falls and Jordan watersheds "Nutrient Sensitive," providing an explicit regulatory mechanism for point source phosphorus control.

**Point and Nonpoint Tradeoffs.** The Secretary of NRCD proposed a basic tradeoff: "If you (local governments) take certain actions to reduce nonpoint runoff in your jurisdictions, then we (State government) might not have to require phosphorus removal at your treatment plants . . ."

**State-Local Action Plan.** State and local officials agreed to a semi-formal "action agenda", setting basic goals and responsibilities for the participants.

**Implementation.**

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**Table 1.** Selected hydrologic and morphometric features of the Falls and Jordan Lake watersheds, North Carolina (Div. Environ. Manage. 1983).

<table>
<thead>
<tr>
<th></th>
<th>Falls</th>
<th>Jordan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Area (ac)</td>
<td>12,500</td>
<td>14,300</td>
</tr>
<tr>
<td>Volume (ac-ft)</td>
<td>154,000</td>
<td>235,000</td>
</tr>
<tr>
<td>Mean Depth (ft)</td>
<td>12.3</td>
<td>16.4</td>
</tr>
<tr>
<td>Streamflow (cfs)</td>
<td>Mean annual</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>7Q10</td>
<td>17</td>
</tr>
<tr>
<td>WWTP Flow (cfs)</td>
<td>16</td>
<td>143</td>
</tr>
<tr>
<td>Watershed (sq mi)</td>
<td>770</td>
<td>1690</td>
</tr>
<tr>
<td>Population</td>
<td>150,000</td>
<td>460,000</td>
</tr>
</tbody>
</table>

**Table 2.** Generalized summertime water quality data, Falls and Jordan Lakes, North Carolina (Correale, 1985).

<table>
<thead>
<tr>
<th></th>
<th>Surface</th>
<th>Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Secchi (ft)</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>9.3</td>
<td>6.5</td>
</tr>
<tr>
<td>D.O. (% sat.)</td>
<td>130</td>
<td>0</td>
</tr>
<tr>
<td>Total P (µg/L)</td>
<td>80</td>
<td>350</td>
</tr>
<tr>
<td>Chi a (µg/L)</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Temperate lakes, have not resulted in algal mat formation, and do not represent nuisance conditions in Falls and Jordan Reservoirs. Table 2 displays generalized water quality data representing surface and bottom conditions typical of hot summer periods.

In addition to nutrients, watershed protection strategies have focused on sediment loads; and the possible presence of toxic materials. The North Carolina Environmental Management Commission classified both reservoirs as public water supply sources but will not authorize the potable use of Jordan Lake until more data are gathered about trace metals and synthetic organic chemicals present in the watershed (Environ. Manage. Comm. 1983). Local officials and the general public have consistently demanded assurances that the potential 200 mgd water supply will be safe for consumption. To date, no synthetic organic chemicals have been measurable in either Falls or Jordan Lake (Div. Environ. Manage. 1985a).

**LAND USE**

2460 sq mi

- Agriculture 28%
- Urban 9%
- Forest 63%

**PHOSPHORUS LOADING**

1,800,000 lbs/yr

- Municipal WWTPs 24%
- Agriculture 55%
- Urban NPS 15%
- Forest 6%

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Figures 2.—Gross land use and phosphorus loading, Falls and Jordan Lake watersheds (combined data), North Carolina (Div. Environ. Manage. 1983).
THE STATE-LOCAL ACTION PLAN

As noted in Table 3, basic targets of the Action Plan were agricultural and urban runoff, point source phosphorus, and hazardous materials leaks and spills.

One of the most significant accomplishments to date has been the passage of a $2 million biennial state cost-share program which provides up to 75 percent funding for agricultural best management practices (BMP's). (The Orange Water and Sewer Authority, serving Chapel Hill, also offers up to 50 percent of the remaining costs, thereby reducing the private share to 12.5 percent of total BMP cost in certain portions of the Jordan watershed.) Another area of substantial progress has been the adoption of aggressive land use controls by nearby cities and counties.

LOCAL LAND USE GUIDELINES—MANAGING THE TYPE AND LOCATION OF NEW DEVELOPMENT

The Triangle J Council of Governments developed a threetiered set of recommendations for the type and location of new development in the watersheds based on the principle of providing greater protection to areas closest to the lakes (Triangle J, 1984). The three tiers correspond generally to distance from the reservoirs:
- Water Quality Critical Areas—Land within one mile of the shoreline.
- Limited Industry Areas—Land beyond the Critical Areas, but within public water supply portions of the watershed.
- Basinwide Guidelines—All land throughout the Falls and Jordan watersheds.

Water Quality Critical Areas. The strictest and most controversial recommendations applied to the Critical Areas within 1 mile of each lake. The primary goal was to minimize urban runoff and the risk of chemical spills by maintaining the patterns of low intensity rural residential development that already existed. Accordingly, the guidelines called for a 6 percent limit on impervious coverage; no new industrial development whatsoever; and no municipal sewer extensions into the Water Quality Critical Areas.

Limited Industry Areas. Beyond the Critical Areas, but within water supply portions of the watersheds, the guidelines were less restrictive, and focused on special safeguards for industries that use, produce, store, or transport specified amounts of certain hazardous materials. Before receiving a local development permit in a Limited Industry Area, the applicant would have to provide detailed information on materials present on site, special plans for containing and cleaning up any spills, and compliance with siting and monitoring standards for chemical storage tanks.

Basinwide Guidelines. Beyond the Water Quality Critical and Limited Industry Areas, certain recommendations applied to new development throughout the 2,500 square mile watershed. These included controlling ½ inch of runoff from all impervious surfaces (preferably through natural infiltration), maintaining 50-foot vegetated buffers along all streams, and adopting 12 and 30 percent impervious limits for secured and unsecured areas, respectively.

Nearby cities and counties have made substantial progress incorporating these often unpopular guidelines into local zoning ordinances and subdivision regulations. Details of local programs in the Falls and Jordan watersheds are reported elsewhere (Triangle J, 1985).

OTHER ACCOMPLISHMENTS

In addition to aggressive local development controls and the agricultural cost-share program, other accomplishments are notable:

- Phosphate Detergent Ban. The North Carolina House of Representatives passed legislation banning the sale of household detergents containing more than 0.5 percent phosphorus in the Falls and Jordan watersheds. The detergent ban has been widely supported by citizens and local governments, but is vigorously opposed by industry groups led by the Soap and Detergent Association. The legislation will be considered by North Carolina’s Senate in 1986.

- Expanded Toxics Program. Concern about the possible presence of toxic chemicals in the water of Falls and Jordan Lakes highlighted a state-wide need for additional chemical- and biological monitoring of North Carolina’s waters. In response, the General Assembly appropriated funds to expand the State’s water quality monitoring network and analytical capability for toxic substances.

- Increased Public Awareness. An important result of the Falls/Jordan initiative has been the greater awareness, support, and commitment to a sophisticated menu of water quality issues by the general public and elected officials of the Research Triangle area.

FACTORS FOR SUCCESS

In terms of substantial State and local efforts focused on a complex problem and an action-oriented commitment by a wide range of agencies and interest groups, the Falls/Jordan watershed project has been more successful than other initiatives in North Carolina and elsewhere. Several factors contributed to these accomplishments:

- Common Perception of a Problem. The overall reservoir strategy has been preventive. To date, none of the intended uses of either lake have been impaired by water quality problems. Nevertheless, watershed efforts drew strength from a sustained and widespread sense of public urgency, due in part to the general awareness that Raleigh would soon depend solely on Falls Lake for its water supply, and that the region’s spectacular economic growth included some unwanted side effects: unsightly commercial development, traffic congestion, and water pollution. Much of the urgency to “do something” was expressed in the deliberations of local policy boards and in editorials of local newspapers.

- Effective Political Leadership. A quick and incisive response by Governor James B. Hunt, Jr. and Natural Resources Secretary Joseph W. Grimsley created an ad hoc steering committee of mayors and county board chair-
men from 16 jurisdictions in the watersheds, and mobilized the resources of state and local government into a working partnership. The clear commitment of key State and local leaders provided the administrative momentum for overcoming traditional bureaucratic barriers.

**Expertise in Place.** Technical work and policy recommendations for the Falls/Jordan strategy were drafted by existing State, Federal, and local staff well versed in the array of land use–water quality issues. Most of the technical information on nutrient loading, sediment sources, and hydrology had been developed previously by the North Carolina Division of Environmental Management, the USDA Soil Conservation Service, county Soil and Water Conservation Districts, and the Triangle J Council of Governments. Given the top level political commitment for action, it remained only to organize relevant technical information into a coherent policy framework and implementation program.

The **208 Experience.** Many key agencies and individuals at both the State and areawide levels had developed their water quality management expertise and familiarity with nonpoint pollution issues through EPA’s 208 process. In some ways, Falls and Jordan became the “main event” for which earlier 208 exercises were the warmup.

**CONCLUSIONS**

A comprehensive program for protecting the 2,500 square mile watershed of two multipurpose reservoirs is being accomplished by State and local governments in central North Carolina. The preventive strategy includes phosphorus removal at selected treatment plants; a phosphate detergent ban; State-funded cost-share program for agricultural BMP’s; local development restrictions on impervious coverage, density, industrial siting, hazardous materials storage, and utility extension policies. State and local political leaders effectively mobilized existing expertise and public concern about the effects of rapid economic growth on the region’s two new reservoirs.

**REFERENCES**


