Nonpoint Source Pollution – New Initiatives for Management

Conference Proceedings

June 17-18, 1987
St. Paul, Minnesota

Sponsored by

Upper Mississippi River Basin Association
U.S. Environmental Protection Agency
U.S. Soil Conservation Service

Introduction

Nonpoint sources of water pollution are the major reason that a number of the rivers, lakes, and underground acquifers in the Upper Mississippi Region do not meet water quality standards. Sources of nonpoint pollution include agriculture, mining, urban runoff, construction, land disposal, and forestry. Pollutants associated with nonpoint pollution include sediments, nutrients, bacteria, and toxic chemicals.

Local units of government such as municipal and county governments and soil and water conservation districts possess many of the land management responsibilities needed to control nonpoint source pollution. In addition, the States in this region have taken the lead in developing nonpoint source management programs and strategies which can include stormwater management, erosion and sediment control, lake protection, animal waste management, groundwater protection, and septic system siting.

While States and local units of government have been involved in nonpoint source pollution management for some time, the impetus for this conference was a new federal initiative. In February 1987, the Water Quality Act of 1987 (P.L. 100-04) was enacted. Section 319 of the Act authorizes a national nonpoint source program under the direction of the U.S. Environmental Protection Agency.

The Conference "Nonpoint Source Pollution -- New Initiatives for Management" was sponsored by the Upper Mississippi River Basin Association in conjunction with the U.S. Environmental Protection Agency and the U.S. Soil Conservation Service to provide an opportunity for representatives of federal, state, and local government to explore new developments in the management of nonpoint source pollution. In particular, participants examined the federal role, existing state programs, opportunities for interstate cooperation, and the relationship of nonpoint source management to other environmental improvement activities such as habitat protection.

This proceedings document includes the text or outline of the speaker's presentations. Many of the presentations included slides and other visual aids which have not been reproduced in this compendium.

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Highlights of National Guidance*

Thomas E. Davenport
U.S. Environmental Protection Agency

The National Nonpoint Source Guidance developed by the Office of Water, U.S. Environmental Protection Agency, addresses the basic NPS requirements from section 319 of the Clean Water Act. The law requires states to develop an Assessment Report that describes the nature, extent and effect of NPS water pollution, the causes of such pollution, and programs and methods used for controlling this pollution. In addition to the Assessment Report, states have the option of developing a Management Report to deal with the problems identified in the Assessment Report.

In the Assessment Report, the law requires states to identify navigable waters impacted by NPS. In addition to the information required concerning navigable waters, the National Guidance requests states include information on any known wetlands impacted by NPS and any groundwater problems caused by NPS. The National Guidance also requests states use the section 305(b) waterbody system to report the state Assessment Report.

The law requires states to develop a four year Management Program to be eligible for funding under section 319. The state Management Program needs to be balanced between the priority problems the state identifies and implementation of statewide NPS programs. The National Guidance provides a detailed explanation of what is required to satisfy the Clean Water Act requirements. It is important to note that Federal funds under section 319 are not to be used as a general subsidy or for general cost sharing to support implementation of best management practices. Federal funds authorized under section 319 can be used for financial assistance to individuals only insofar as the assistance is related to costs of implementing demonstration projects.

The Guidance does the following:

- Encourages and supports nonpoint source pollution control efforts by all levels of government for the purpose of meeting water quality goals;
- Provides an institutional framework within which Federal, interstate, state, and local agencies can coordinate their efforts to identify needs and develop and implement programs for nonpoint source controls;
- Delineates appropriate roles for various Federal, interstate, state, and local agencies in which to control nonpoint source;
- Recognizes the need for all nonpoint source program efforts;
- Proposes the state maximize the use of existing institutions and systems for implementating nonpoint source programs;
- Encourages cross compliance among programs to support water quality goals;
- Encourages the design of programs which reward individuals and institutions for good performance, rather than the bad actors.
- Encourages the states to utilize existing programs and institutions to maintain water quality statewide, while designing focused water quality programs to solve specific problems; and

**At the June Conference Mr. Davenport shared preliminary drafts of EPA guidance with conference participants. Final guidance was published in July 1987.

- Provides a working partnership between Federal, state, and local agencies that will address nonpoint source pollution problems and be jointly responsible for funding, planning and implementation of nonpoint source management practices.

In the National Guidance, states are encouraged to incorporate their NPS Assessment and Management Programs into their water quality management plan in accordance with provisions of section 205(j), 208, and 303 of the Act and state requirements. Also starting November 1, 1987 and each November 1 thereafter, each state will report to its respective EPA Regional office concerning implementation progress.

The Act lists five new primary funding sources to support implementation of activities related to NPS control. The Guidance discusses these new funding sources in detail. Presently, the only funding source available is section 205(j)5. These funds are to be utilized to develop the state Assessment Report and Management Program. After these documents have been approved, 205(j)5 funds can be utilized to implement the approved programs. When 205(j)5 funds are used for implementation, match is required.

Thomas E. Davenport is the Regional Nonpoint Source Coordinator for Region V of the Environmental Protection Agency which includes Minnesota, Wisconsin, Illinois, Michigan, Indiana, and Ohio. He worked four and a half years at Illinois EPA on their WPS program and managed the Comprehensive Monitoring and Evaluation Program for their nonpoint source project. He has worked for US EPA the last three years as the Regional NPS Coordinator. He is also responsible for coordinating the Grand Calumet/ Indiana Harbour Master Plan and the Lake Michigan Toxic Reduction and Control Strategy. He is a member of the 319 work group that is developing guidance to implement the Water Quality Act of 1987.

Mr. Davenport has an M.S. in Hydrology from the University of Washington and an M.P.A. in Program Implementation from Sangamon State University.

Relationship of U.S. Department of Agriculture Activities to Nonpoint Management

Daniel A. Smith
U.S. Soil Conservation Service

It is a real pleasure for me to be here in St. Paul today to be a part of a group of experts addressing one of the most insidious problems affecting our nation's soil and water resources -- the problem of NONPOINT SOURCE POLLUTION....! How do we as planners and program managers plan to manage such a widespread and complex problem?

Having spent the past 20 years working primarily at the field and state office levels in my agency dealing with soil and water resource issues and working in our national headquarters, I approached the task of talking about USDA-wide nonpoint source policy with some trepidation. I wasn't sure the USDA even had such a document. I knew from my field experience that general directions, a lot of talk about nonpoint source pollution and some limited guidance had come from "On High" but I had never seen a finalized policy document agreed to by all parties within USDA. I was afraid to look for fear we did not have one or perhaps I had missed the boat! Yet as an SCS'er I had been working for years, directly and indirectly, on nonpoint source pollution and water quality problems. In many cases we didn't call them nonpoint source problems but indeed that is exactly what they were.

Well, I'm here to tell you that you can sleep easy tonight.... USDA does indeed have a documented Nonpoint Source Water Quality Policy. And I wasn't too far from wrong ... this policy was finalized and printed just this past December 5, 1986, only 6 months ago. ...And I'm really glad that and excited to find such a diverse and large agency such as USDA has developed this document.

Today I would like to briefly cover with you three related nonpoint source topics. They are (1) the USDA Nonpoint Source policy, (2) the Soil Conservation Service Water Quality policy, and (3) new initiatives which I believe will have a profound affect on our nation's soil resource which in turn will assist in nonpoint source pollution control.

First let's look at the USDA Nonpoint Source Water Quality policy. I'm sure many of you know that there are numerous federal laws which deal with water quality and that our national water quality goals were established by the Federal Water Pollution Control Act and its amendments, now commonly referred to as the Clean Water Act. Similarly, goals for groundwater were established by the Safe Drinking Water Act and its amendments. The Clean Water Act directs states to develop water quality management plans. This planning process identifies nonpoint sources of pollution and sets forth procedures and methods to control, to the extent feasible, such sources. The USDA has long been involved in management programs to conserve our soil and water resources. Initial efforts were directed toward "point source" problems. As progress was made in the control of point sources, it became evident that the control of nonpoint sources of pollution would be needed to reach federal and state water quality goals. These nonpoint sources include pollution from agriculture, silviculture, runoff from mining operations, construction sites, roads and urban areas, and acid deposition. With help and guidance from the U.S. Environmental Protection Agency, a Nonpoint Source Task Force effort was started for the purpose of developing federal policy to govern future nonpoint source actions. This multiagency effort resulted in a USDA policy which outlines items of agreement, areas of emphasis or promotion and a section concerning the responsibilities of the various Departmental levels ... from the Secretary of

Agriculture down through departmental staff and into agencies such as the Soil Conservation Service.

Let me cover just a few key items of agreement and areas of emphasis in the policy and not bore you with the list of administrative responsibilities.

The Department agrees that:
Nonpoint sources can be a significant pollution problem and agriculture, by virtue of its size and distribution, is a potential major source in some localities. Effort and emphasis are required by the Department to help achieve water quality goals.

The Department agrees that:
The states have the lead in developing and implementing nonpoint source management on private lands and USDA nonpoint source control activities will be coordinated with state and local agencies.

The Department agrees that:
Best Management Practices (BMP's) are the most effective, practical means of preventing or reducing pollutants from nonpoint sources in order to achieve water quality goals.

And that:
All programs that affect nonpoint source problems must be flexible in the application of best management practices.

The Department also agrees that:
Water quality data collection and research should be coordinated with other federal, state, and local agencies.

Then in order to carry out the achievement of surface water and groundwater quality goals, the Department will actively:

(1) Promote the improvement, protection, restoration, and the maintenance of water quality to support beneficial uses.

(2) Provide the opportunity for public involvement in decisions potentially affecting water quality.

(3) Suppport continued emphasis on voluntary actions by landowners in preventing and correcting nonpoint problems.

(4) Encourage the use of best management practices as the mechanism to meet federal, state, and local water quality requirements for agricultural and silva cultural lands.

(5) Use nonpoint source management strategies that contribute to the achievement of defined state water quality objectives, over realistic time frames, through the use of best management practices within defined drainage areas or groundwater basins.

(6) Use state water quality standards as a basis for attaining or maintaining designated uses of surface and groundwater resources.

(7) Provide educational, technical, and other assistance to land users, states, and local governments in the context of resource management systems.

(8) Use existing knowledge and program base information, and continue improvement of data gathering and research efforts to define and assess water quality and nonpoint source pollution problem areas.

(9) Continue to support and conduct research to identify cause-effect relationships between management practices and impacts on beneficial uses and to evaluate social costs and benefits associated with nonpoint source control.

So much for the USDA Nonpoint Source Water Quality Policy. What I particularly like about the policy is the use of words such as state, local, flexible, effective, reasonable and practical. Gosh! These words really bring joy to the hearts of those folks who must implement this policy at the field level.

Secondly, let's take a moment and look at what the Soil Conservation Service is doing in the area of water

quality policy. About a month ago, the same day I reported for duty in our national office in Washington, D.C., I learned that our Chief and our staff had just come to an agreement on a draft Water Quality Policy. Many concerned staff people had spent days and weeks bringing together the thoughts and ideas which eventually jelled into an acceptable policy. My hat went off to those people who worked to bring this together -- it is not an easy chore to get agreement from a group with such divergent backgrounds.

I'm happy to say that the SCS policy has been signed, sealed and is now being delivered! I want to tell you about some of its key features. The Soil Conservation Service will provide assistance through local soil and water conservation districts to private land and water users and agencies of local and state governments to help with nonpoint source control efforts. This assistance includes protection of both surface water and groundwater quality. The SCS policy emphasizes voluntary actions by private land and water users and recognizes the rights and responsibilities of local and state governments in defining water uses, establishing water quality standards and establishing priorities for preventive and remedial actions.

The SCS will coordinate its nonpoint source activities with appropriate state and local agencies and such efforts will be in accordance with state and local government objectives.

The SCS will integrate water quality concepts, considerations and management techniques into appropriate programs and develop technical tools necessary to quantify the environmental and economic onsite and off-site effects of soil and water conservation measures.

The SCS will also provide training in surface water and groundwater quality concepts to local SCS and Soil Conservation District personnel to a level commensurate with needs.

The nonpoint source problem is much bigger than any one state or federal agency to control. We need to work cooperatively at all levels if we are going to succeed in controlling nonpoint source pollution.

The third and final subject I wanted to cover today involves a couple of recent legislative initiatives which I believe will have quite an impact on the nonpoint source pollution problem arena. Under Title XII of the 1985 Farm Bill, the USDA has several programs which will impact cropland, soil erosion, and nonpoint source pollution. The Conservation Reserve Program... known as CRP... is a land retirement program in which acres of highly erodible land (HEL) are seeded down to permanent grass or planted to trees for a period of ten years. This program is projecting 40 million acres to be retired. Just think of the amount of eroded soil, pesticides and fertilizers that will not cause pollution problems as a result of this retirement action.

Also, under the Farm Bill is the Conservation Compliance Program. This program, which deals with highly erodible lands, requires agricultural producers to bring their highly erodible acres into conservation plans by 1990 and further requires those producers to implement their plans by 1995. So, the program doesn't just require a plan but it also requires that the plan be implemented. If the producer does not meet these requirements ... or, in other words, is not in compliance ... then he or she will lose all commodity payments and other Federal cost-share monies. I'm not sure just how many acres of eroding land this will affect but, it will certainly reach those producers who depend on commodity payments and have highly eroding acres. A third program under the Farm Bill is commonly called "Sod Buster." This program tackles those new acres of cropland coming into production ... or "sod-busted" ... that have a potential for high soil erosion. Here again, the concept of highly eroding land comes into play. These new sod-busted acres must be farmed under a conservation system ... that is, have a conservation plan and be implementing the plan ... otherwise the producer will lose all commodity payments.

As you can see, the 1985 Farm Bill provisions provide us with some nonpoint source control mechanisms as well as having a real impact on millions of highly erodible acres nationwide.

My final remarks this morning address briefly the opportunities I see coming up in the Clean Water Act of 1987. As most of you realize, the Clean Water Act extended several provisions and programs of the original law. Examples include EPA's Clean Lakes program also known as 314, SCS's Chesapeake Bay Program where BMP's are being applied to improve water quality through the control of agriculture related nonpoint sources, and the Great Lakes program where EPA, USDA and other Federal agencies work together with Canada to meet water quality goals identified in the Great Lakes Water Quality Agreement of 1978.

One new initiative under the Clean Water Act, of great interest to USDA, is the Nonpoint Source Management Program under Section 319. I want to mention a few items of this program from a USDA/SCS perspective and hopefully I won't steal too much from our next speakers' agenda. We're really excited about this new program. It's a program which provides some badly needed help to the control of nonpoint sources of pollution. First, the states have the responsibility to identify those streams which can not meet or maintain applicable water quality standards and to identify those categories of nonpoint sources which can not be expected to meet applicable water quality standards or goals. Then the states will need to develop a multiyear plan for controlling pollution from nonpoint sources. In this plan, states will identify the best management practices to control nonpoint source pollution on a watershed-by-watershed basis, taking into account the groundwater resource.

Federal grants are to be provided to those states which qualify for assistance in implementing their nonpoint source management program. Special grants are to be provided to states carrying out groundwater quality protection and contamination prevention activities, including research, planning, groundwater assessments, demonstration programs, enforcement, technical assistance, education and training.

EPA has the responsibility to collect and disseminate information pertaining to best management practices and the relationship between water quality and implementation of various management practices to control nonpoint sources of pollution.

We look forward to assist both federal and state agencies in any way possible to help in the implementation process. This program has some really exciting potential ... and it's my sincere hope that adequate funding will follow.

Well, I have rambled on long enough. Let me stop here and entertain any questions that you may have.

Again, thank you for inviting me to participate in this conference. I look forward to meeting you all and working with you the rest of the day.

Daniel A. Smith is the Program Manager in the Land Treatment Program Division of the U.S. Soil Conservation Service based in Washington, D.C. He served eighteen years with the Soil Conservation Service in the six New England states and Michigan as geologist, soil conservationist, agricultural liaison, and program manager. He served two years as SCS liaison to the Water Management Division, U.S. Environmental Protection Agency, Region 1 in Boston, Massachusetts. He also served one year as geologist with the District Engineer, USACE in Anchorage, Alaska.

Mr. Smith has B.S. and M.S. degrees in geological sciences from the University of Maine.

U.S. Environmental Protection Agency Region V Perspective and Guidance

Thomas E. Davenport
U.S. Environmental Protection Agency

It is the intent of U.S. Environmental Protection Agency Region V to work cooperatively with States to enhance and expand the existing local/State/Federal water pollution partnership to cover nonpoint source (NPS) pollution. The National Guidance, the law as well as State and Regional priorities, will define how each State's existing program will be modified or revised. The National Guidance provides a basis for us to work with States. We will be as flexible as possible when working with States on these programs, projects and ideas. New innovative concepts are encouraged.

We view the new initiative as a call for a State NPS Program. Existing programs provide a framework from which to build a comprehensive State NPS Program that will satisfy the intent of the Water Quality Act of 1987. It is important that the State Program efficiently utilize the existing Triad (local/State/Federal) structure of program delivery to maximize the extent of the program delivery. Agencies and local units of governments must negotiate their roles and responsibilities with the State Water Pollution Control Agency.

Region V expects States to comprehensively look at NPS pollution. Many existing State efforts are aimed primarily at agricultural NPS pollution; we view the new initiatives as a means to address urban, toxic, in-place pollutants, hydrologic modification and other associated NPS problems that traditionally have not been dealt with.

We acknowledge major limiting factors -- the short time frame and limited Federal funding. We encourage States to look at existing NPS projects and to concentrate their efforts on small lake watersheds in order to show what can be done to control NPS pollution within the short four year timeframe. While at the same time we are hoping States will be developing the foundation for a Statewide NPS program that will not only manage and restore NPS related water quality problems but hopefully prevent them as well.

New Initiatives — Old Problems in Nonpoint Source Management

John F. Houlihan
U.S. Environmental Protection Agency

We have discussed the "new" national requirements of the Water Quality Act of 1987 but I would like to go beyond the specific requirements of the Act and possible approach of merely developing state and local programs to qualify for limited federal funds.

We recognize that the Act contains some very short timeframes and some very naive understandings of measuring progress in implementing NPS controls. While we expect our states to try to meet those deadlines we are more concerned about the need to "institutionalize" a continuing NPS program at the state level.

If the Act is viewed only as an opportunity to get federal funding for NPS controls, then there will never be enough funds and there will be very weak state NPS programs.

The Act does give the states and locals an opportunity to develop the framework of a state management program for NPS that can be used in future years regardless of federal funding levels. While we realize that state and local budgets are as constrained, or in some cases even more constrained then the federal government's, we think that viewed from a pure use impact standpoint, there is a need for state and local levels to do more for NPS control.

Each state will have to do a better job of assessing its waters and defining use requirements or potential use impairments compared to the resource value of each waterbody.

Because of the difficulties with conventional monitoring to assess surface water impacts it is likely that ecosystem or biological assembly type analysis will have to be expanded. Similarly, the difficulties of monitoring groundwater problems and developing effective controls will require additional effort.

Certainly at the federal level, the need for additional data on groundwater transport and impacts from ag chemicals will have to be factored into the registration process and EPA must do a better job of providing NPS assessment techniques and transferring BMP effectiveness information.

I would like to step back a minute and look at NPS programs from an even broader perspective -- that of the overall environmental protection viewpoint. The new NPS legislation obviously does not exist in a vacuum. Over the last 17 years EPA and the states have focused on a variety of problems and the national attention and energy has tended to shift over time. EPA and the country have tried cleaning up the nation's waters by focusing on:

- Municipal sewage discharges.
- Industrial discharges.
- Pesticide registration of obviously harmful chemicals.
- Drinking water protection.
- More recently Superfund program for specific groundwater site cleanups.

Municipal Sewage

- $4 billion a year in federal grants in mid-70s to help build sewage treatment plants (currently $2.4 billion/year)
- "Needs" are much greater but agency is turning over more dollar responsibility to states.
- Program operates on a technological basis, not a strict water quality basis.

We have told the cities that if you build to this level of treatment (secondary) you will solve most of water quality problems (may overbuild in some situations from pure water quality standpoint).

Some cases have to go beyond technology to advanced treatment or true water quality basis.

Usually concentrating on just three parameters of water pollution.
- Keeping oxygen demanding materials out of stream.
- Keeping ammonia toxicity below harmful levels.
- Reducing pathenogenic materials to allow human recreation.

Pesticide Registration - Controlling pollutants by removing legal uses

- EPA under the FIFRA Act passed by Congress has authority to register chemicals for various uses.
  Some chemicals like DDT and chlordane were once available for use in large quantities but EPA has restricted or eliminated uses and reduced environmental contamination.
  Pesticide labeling restrictions and licensing applicators are other methods.
  Current status:
  1. New kinds of detection equipment are showing concentrations at parts per billion range and discovering chemicals where we haven't seen them before.
  2. New chemicals flooding onto scene.
  3. Closer look at and better understanding of biological processes shows more harm from some chemicals than previously thought.

So where are we now overall?

Cleaned up majority of point sources.
Stopped the obvious pollution scenes.
- Rivers don't catch on fire routinely.
- No massive fish kills.

Program in place and working for most sources/activities for conventional pollutants.

What is left on the agenda to clean water?

One obvious answer is NPS.
Why be concerned about NPS?
Look at fundamental basis for clean water.
- Protect human health directly.
- Protect fish and wildlife.

First reason illustrates perhaps a flaw in our past efforts for NPS programs. Early efforts tied NPS controls to protecting farm fields from erosion -- that didn't work entirely, so we tried extending the threatened resource to fish and wildlife in streams and rivers. Found it very difficult to quantify effects from any one field on any one fish.

One direction is to show potential/actual groundwater problems from NPS to help illustrate why there are problems.

When you tell people their drinking water is unsafe it gets their attention fast.
- 40 communities in Nebraska have health advisories due to high nitrate levels due to NPS. Iowa is discovering its own problems with respect to pesticides.

NPS Program History/Status/Future

We have had NPS planning programs for some time:
- Mid-to-late 1970s saw 208 statewide plans;
- Tried to be a general comprehensive pollution control program but did not spend enough time on documenting true problems.
- General control strategies tied to erosion rates -- not in-stream problems.
- Looked at land problems (erosion) first, then water problems. Should have looked at water problems (fish and other use impacts) first, then traced back to land practices.
- Still had some successes
  Institution Building - Advisory committees, local/state agency support -- some state cost-shares for erosion control and water pollution were started.
  Demonstration Projects - RCWP and special ACP projects.
  BMP Testing - Building up some experience with actual BMP effectiveness.
  EPA Clean Lakes - Iowa has consistently done good job of combining implementation funds from EPA Clean Lakes with state and to get BMPs on land.

What Lies Ahead?

In EPA's current NPS strategy, Lee Thomas, the Administrator of EPA says: "Given the nature of the NPS problem, significant reductions will only come about by improving the way we all manage our activities on the land. In a sense, NPS pollution is the footprint of our entire civilization, stamped on our water resources by the strength of millions of separate private and public decisions."

What Mr. Thomas is saying is that NPS problems are not just EPA's responsibility to do something about and they are not just the agricultural sector's problems but rather they are society's problems.

All of society's institutions are going to have to work towards NPS solutions.

The federal government, itself, for example is America's largest landowner and it must address NPS pollution from its management of over 720 million acres. EPA's strategy intends to help the other major federal land-holding agencies, such as the Forest Service, Bureau of Land Management, and Corps of Engineers address NPS problems on their lands.

For example, EPA will review selected programs of other federal agencies to insure that best management practices are used on federally owned rangeland, forest land and other lands. Presently, EPA regions insure that federal agencies meet point source controls of state and local governments and we must extend that to assure compliance with NPS requirements.

We also will work closely with Department of Agriculture to continue to target some of its ongoing resource management programs for priority state NPS projects.

One example of the kind of natural coordination that can be achieved is contained in last year's Farm Bill which set up the Conservation Reserve, Sodbuster, and Swampbuster provisions. These will help insure that some policies of the federal government are not encouraging actions which are contrary to other federal policies.

Given the current national budget situation, it is not likely that we will see a large federally funded program directed at NPS implementation. Instead, EPA will rely on existing available federal and state funding to develop cost-effective, targeted programs in priority watersheds and groundwater areas.

One example of potential implementation funds allowed by the Water Quality Act is that up to 20 percent of the state revolving loan fund that will replace construction grants funding can be used for 319 implementation.

Most of our experience with past demonstration projects has shown that BMPs can result in cost-savings for the individual landowner irrespective of the benefits of reducing off-site environmental damages: The Hall County special project in Nebraska is a prime example.

- Nitrogen management.
- Irrigation scheduling.
- Saved input, kept yields same or higher.

We think that given the present economic climate facing farmers there may be significant incentive to switch to alternative practices that lower input costs. If we can get out the message that some BMPs will do this we may help solve both problems.

We also see an increased state role in providing cost-shares for erosion control/water quality programs. While we obviously favor separate attention for specific water quality concerns, we are supportive of state efforts to utilize available cost-share funds in any program to address targeted watersheds.

For example:

- Iowa has a history of combining state cost-share funds for erosion control with watershed lake projects directed at water quality improvement.
- Missouri is also creatively using some of the recently generated state erosion cost-share funding for water quality oriented projects.

There are some areas nationally that Congress has favored with limited attention and support for NPS pollution con-

trol programs because of the perceived value of the resource.

The Great Lakes area and some coastal estuaries have a small separate program to generate interest in and development of NPS control programs. In Region VII we sometimes think we should declare the Ogallala aquifer under Kansas and Nebraska as our estuary or bay program to get additional national interest.

Our Region VII NPS Strategy contains the following elements:

Environmental Problem Description

At the present time, this region believes that there are NPS water quality problems or a potential for problems in the following types of waterbodies or areas:

1. Groundwater in shallow aquifers -- occurrence of nitrates and pesticides in many areas of region.
2. Reservoirs and natural lakes -- sediment, pesticides, nutrients leading to aesthetic problems; accelerated eutrophication and fish flesh contamination throughout the region.
3. High quality coldwater streams -- sediment deposition modifying stream beds and creating aesthetic impairments and fish population reductions (trout streams in Nebraska Sandhills, as example).
4. Warmwater streams where significant use impacts are observed due to sediment and pesticides.

The predominant NPS problems in the region are from agricultural operations. However, fish flesh contamination due to chlordane in urban runoff is becoming a significant localized use impact on some urban lakes and rivers. Also, very localized water quality impacts occur due to past mining operations in some parts of the region.

At the present time, these problems are generally not considered to be immediate public health dangers, but appear to represent a long range threat to aquatic life and traditional groundwater uses. Examples of concern are the contamination of fish due to pesticide use and detections of pesticides and inorganics in some water supplies. NPS parameters do not lend themselves to conventional monitoring to assess the extent of problems, nor are criteria always available to judge the severity of some chemical's impacts, but both the region and states need to continue to pursue identification of problems and target areas for controls based on present knowledge of biological and chemical water quality conditions.

Regional Work Activity

Even before the new Water Quality Act requirements our regional goal was for each state to identify two to three watersheds needing BMP implementation assistance and begin implementation in those watersheds each year. This identification effort would come after the state has analyzed the stream segments having water quality impacts and prioritized the various point and nonpoint source problems. A parallel effort to refine problem or impact assessment for continued identification of priority watersheds should continue each year along with specific planning for watershed controls.

Regional role is in four main areas:

1. General coordination - communication and information transfer among all agencies.
   a. Routine NPS meetings to share information with state and federal agricultural agencies.
   b. Information transfer of "good" approaches and concepts of other states.
   c. Policy and direction communication to state environmental agencies.
2. Problem Assessment Assistance - professional staff assistance for problem identification.
   a. Review and transfer of headquarters initiatives to develop additional pesticide criteria for aquatic life and human health protection.
   b. Devote staff resources to current state-of-the-art water quality assessment techniques.
   c. Analysis of STORET and other water quality data with objective of documenting the impact and trends of NPS pollution.

3. Program implementation - through Clean Lakes and other federal/state program.
   a. Maintain coordination with federal agricultural agencies with implementation programs.
   b. Focus future awards of EPA Clean Lakes funds on projects involving watershed BMPs.
   c. Contact interest groups to develop innovative implementation solutions.
4. Evaluation and Oversight - review of current program effectiveness through quarterly visits and mid-year reviews.
   a. Assess technical program adequacy.
   b. Evaluation of implementation progress in specific watersheds.

We are telling state environmental agencies to identify and prioritize small watersheds needing NPS controls from their point of view and then get together with local agencies such as conservation districts and develop plans for BMPs to use any available funding source.

Ideally, we'd like to see a general soil erosion control program supplemented by a specific watershed program targeted for water quality purposes.

A targeted watershed program would focus on identifying loading goal reductions to attain or maintain water uses, critical land areas associated with the NPS loads, and BMPs designed to achieve the load reductions.

John F. Houlihan is the Nonpoint Source Coordinator for Region VII of the Environmental Protection Agency and is also the State Planning Coordinator overseeing the state of Missouri's water quality planning operations. He has worked in a variety of positions in the water quality planning area in Region VII over the last thirteen years, including water quality standards, Clean Lakes, and statewide 208 planning. Before coming to EPA Region VII in 1974, he worked as a city planner in Houston, Texas.

Mr. Houlihan received a B.S. in urban and regional planning from Iowa State University in 1973.

Nonpoint Source Initiatives in Illinois (Outline)

Richard J. Mollahan
Illinois Environmental Protection Agency

I. Illinois NPS Problem

A. 12.6 tons of soil/acre/year or 201 million tons annually from cropland areas.

B. Urban areas through undermanaged or unmanaged sprawl:
1. Construction erosion
2. Hydromodification
3. Increased stormwater runoff

C. Resource extraction (primarily past coal and oil operations)
1. Acidity
2. Salinity

D. Other NPS Problems
1. Septic tank seepage
2. Shoreline erosion
3. Land disposal
4. Rural hydromodification
5. Groundwater Contamination

E. Soil erosion/sedimentation has the most significant impact in Illinois.
78 percent of Illinois streams and 97 percent of Illinois lakes impacted based on ASIWPCA's "America's Clean Water," States NPS Assessment of 1985.

II. Strategy Development

A. Illinois Water Quality Management Plan (WQMP)
1. Established policies and recommendations for management of NPS pollution.
2. Principal thrust of effort through a voluntary effort.
3. Livestock waste NPDES Permit.
4. Emphasis on co-operative compliance through assistance and becoming aware of NPS issues.
5. IDOA and 98 SWCD's designated as lead agency for coordinated effort.
   a. Cost-share program.
   b. Administer Build Illinois $20 million/5 year watershed program.
   c. Provide technical field services.
   d. Administer the "T by 2000" Program.
   "T" program goals:
      1) 1-1-83 all Lands < 4T
      2) 1-1-88 5 percent slope or less at "T" and > 5 percent slope at 2 "T"
      3) 1-1-94 all lands at 1.5 "T"
      4) 1-1-2000 all lands at "T"
   e. IEPA 1986 mid-course review of "T by 2000" program.
   Falling behind, but 1-1-88 review will help determine if re-evaluation needed.

III. Implementation

A. Illinois SWCD's
1. Front line - direct contact with agricultural community.
2. Complaint program - $150,000 year.
3. Cost-share ($4 million FY 86-89)
4. Technical/educational efforts

B. USDA - ASCS
Cost-share program ACP ($670,000 for FY 87)

C. USDA - SCS
1. P.L. 83-566 ($334,000 for FY 87)

2. Rural Abandoned Mines Program ($200,000/yr.)

D. USDU - U of Illinois Cooperative Extension
   1. Education
   2. Technical Research

E. Illinois Farm Bureau
   Education and information distribution through TV/ radio / newspapers / Lobby efforts

F. Illinois EPA
   1. Focus on water quality aspects of NPS control.
   2. 208 Areawide Planning Agencies
      a. NIPC
      b. SWIMPC
      c. GERPDC
   3. Scope of work in contracts including NPS issues.
   4. Agency monitoring/lab analysis efforts.
   5. Volunteer lakes monitoring program.
   6. Association of Illinois Soil and Water Conservation Districts
      a. Agency link to SWCD's
      b. Work on all aspects of Agency's NPS program.
      c. Instrumental in development of Illinois' Watershed Tracking System.
   7. Management of Federal Clean Lakes Program
   8. 401/404 Permit program with Corps of Engineers
   9. Livestock waste program
   10. Draft soil erosion/sedimentation guidelines
   11. Field biologist efforts on identification of use impairment and sources of pollution.
   12. Groundwater program.

G. Illinois Dept. of Conservation
   1. Lakes and streams assessments.
   2. Soil erosion management in State parks.

H. Illinois Dept. of Energy and Natural Resources
   1. Natural History Survey
   2. Geological Survey
   3. State Water Survey
      a. Sediment sampling in most of Illinois major river basins.
      b. Mathematical modeling of sediment transport in Pool 19 on Mississippi River.
      c. Multitude of other related studies.

I. Illinois Dept. of Transportation - Water Resource Division
   1. Transportation avenues
   2. State Water Plan Task Force
   3. Groundwater strategy development

J. Abandoned Mine and Reclamation Council

K. Illinois Dept. of Public Health

L. Not-for-Profit organizations and special interest groups.

IV. Conclusion

A. Difficulty in directing different interests towards common goal.

B. Illinois NPS Assessment Report using ASIWPCA report for foundation with updating of data by field staff.

C. Review and participation in development of assessment report by Areawide Planning Commissions and AISWCD's.

Richard J. Mollahan is the Supervisor of Areawide Nonpoint Programs for the Illinois Environmental Protection Agency. He oversees nonpoint assessment and evaluation for the Division of Water Pollution Control and is primarily concerned with the impacts of sedimentation from both rural and urban nonpoint sources on the State's water resources. Mr. Mollahan also administers contracts with the Areawide Regional Planning Commissions and the Illinois Association of Soil and Water Conservation Districts.

Prior to working in the Planning Section, he worked for seven years as Project Manager in the Illinois EPA's Construction Grants Section where he was responsible for the management of Federal and State Grants. He also served as Section specialist on compliance with the National Environmental Policy Act (NEPA).

Mr. Mollahan graduated with a B.S. degree from Western Illinois University in 1975 and received a Masters degree in Environmental Studies from Sangamon State University in 1978.

Nonpoint Activities and Initiatives in Iowa

Ubbo Agena
Iowa Department of Natural Resources

I want to express my appreciation to the Upper Mississippi River Basin Association, the Environmental Protection Agency, and the Soil Conservation Service for sponsoring this meeting. The subject matter being disucssed is timely, and states should benefit by the information being presented.

I also want to make a few introductory comments regarding my presentation. First, I need to identify the state agencies having major responsibility for Iowa's environmental and natural resources programs, and the general areas of responsibility of each. This identification is necessary since these agencies will be referred to throughout my presentation.

As a result of a major reorganization of state agencies in 1986, Iowa's environmental and natural resource programs are generally now found in either the Iowa Department of Natural Resources or the Iowa Department of Agriculture and Land Stewardship.

For those familiar with Iowa's organizational structure prior to reorganization, the agencies merged to form these new agencies and the major environmental and natural resource responsibilities of each were:

Department of Natural Resources (DNR):

- Department of Water, Air & Waste Management -- environmental protection and water resource management;
- Iowa Conservation Commission -- fish and wildlife management, management of state forests, lakes, parks, and other recreation areas;
- Iowa Geological Survey -- collection and interpretation of geologic and hydrologic information; and
- Iowa Energy Policy Council -- development of state energy management policies, administration of energy conservation programs.

Department of Agriculture & Land Stewardship (DALS):

- Department of Agriculture -- administration of federal and state pesticide laws and regulations in Iowa; and
- Department of Soil Conservation -- administration of state soil conservation, mining, and mine reclamation programs.

Although the DNR and DALS have primary responsibility for administering Iowa's nonpoint pollution control programs, the participation of many federal, state, and local agencies is required for these programs to be successful. While the role of those agencies will generally not be discussed, I want to acknowledge the importance of their participation and express appreciation for their support.

This presentation will only discuss Iowa's nonpoint pollution control activities directed at protecting surface waters, since the state's groundwater protection activities are the subject of a later presentation. It should also be noted that the primary purpose for conducting many of these activities is something other than nonpoint pollution control. For example, erosion at construction sites is regulated mainly to prevent eroded sediments from causing nuisance conditions on adjacent lands, and nonpoint pollution control is a secondary benefit.

Although federal law did not require states to address nonpoint pollution until several years after the 1972 Clean Water Act was passed, efforts to address Iowa's nonpoint pollution problems began much sooner. Among the activities undertaken were:

- in 1967, the state monitored pesticide runoff from a cropland area;
- in 1971, a state soil conservation cost share program was established; and

- in 1973, the state cost share legislation was amended to authorize spending up to 10 percent of the funds in watersheds of publicly owned lakes.

Statewide nonpoint planning began in Iowa in 1975. Agencies with primary planning responsibilities were the Department of Water, Air, and Waste Management (now part of DNR) and the Department of Soil Conservation (now part of DALS). Although a number of water quality issues were addressed, major emphasis was on developing a plan to control nonpoint pollution from agricultural sources.

These planning efforts resulted in development of a State Water Quality Management Plan in September 1979. This plan described the state's point and nonpoint source pollution problems, discussed the role of various local, state, and federal agencies in the state's pollution control efforts, and presented a five-year strategy for implementing the state's pollution control programs.

Since its completion in 1979, the Plan has been used to guide the state's ongoing nonpoint planning and implementation efforts. To maintain its usefulness, several updates have been completed. The Five-Year Strategy of the Plan was revised in 1981, and the nonpoint portion was further revised in 1982. More recently, in December 1986 a total update of the state's nonpoint pollution control program was completed.

For presentation purposes, Iowa's nonpoint control activities have been grouped into the following categories:

- Agricultural crop & pasture lands
- Animal feeding operations & animal waste disposal
- Urban runoff
- Construction site runoff
- Surface mining
- Land disposal of wastes
- Floodplain construction activities

Agricultural Crop and Pasture Lands

Of these sources, runoff from agricultural crop and pasture lands is the most significant in Iowa. Factors making it the most significant include:

- 61 percent of the state's land area is used for row crops (mainly corn and soybeans) and an additional 24 percent is used for small grains, hay, or pasture;
- soil erosion on Iowa cropland averages about 10 tons per acre annually, or about twice the tolerable level;
- virtually all of the state's corn acres and about 12 percent of the soybean acres are fertilized each year; and
- herbicides are used on 98 percent of the corn and soybean acres, and 43 percent of the corn acres are treated with insecticides.

In combination, these factors create the potential for large quantities of sediment, nutrients, and pesticides to be carried into Iowa's streams and lakes. That this is in fact occurring can be seen from the results of the state's 1985 ASIWPCA assessment. This assessment found that:

- out of nearly 4,800 stream miles assessed, 3,835 were considerd severely or moderately impacted by agricultural sediments, as were 35 of 129 lakes; and
- a slightly larger number of stream miles (3,880 miles) were severely or moderately impacted by agricultural nutrients, as were 36 lakes.

Nonpoint planning for agricultural crop and pasture lands began in 1975. This planning was directed at developing a program to protect the state's surface waters, since the state's streams and lakes were known to be impacted, while little was known on groundwater impacts.

Studies completed between 1975 and 1979 better defined the nature and extent of Iowa's nonpoint problems, the factors influencing the types and amounts of pollution occurring, and the effectiveness of various control practices. These study results were used to develop an agricultural nonpoint control program, which was adopted in 1979 as part of the Statewide Water Quality Management Plan.

This control program focused on reducing sediment movement to the state's surface waters. Sediment control was considered of major importance, both because

sediment is by volume the greatest pollutant of Iowa's surface waters and because sediment control will also reduce movement of attached nutrients and pesticides to state waters. As cropland erosion is the largest source of the sediment reaching state waters, the control program identified as Best Management Practices (BMPs) a number of structural and management practices that either reduce soil erosion rates or stop eroded sediment before it reaches state waters. Structural practices identified included terraces, diversions, and sediment and water control basins, while management practices included conservation tillage, contour farming, rotations, and strip cropping.

To encourage use of these practices, the control program called for:

- comprehensive public information and education programs;
- early BMP implementation in high priority lake and stream watersheds;
- greater funding for state and federal cost share programs; and
- development of additional financial incentive programs, including a summer construction set-aside program, low interest loan programs, and tax incentives.

Since 1979, state efforts have been directed at improving and updating the original control plan and at implementing its recommendations. Progress made in implementation includes:

- state cost share funding has increased significantly;
- state no-interest and low-interest loan programs have been established;
- a summer construction set-aside program has been authorized; and
- accelerated BMP implementation projects have been initiated in 19 lake watersheds.

A number of funding sources are being used in these lake projects, including USDA's RCWP, ACP,and RC&D Programs, EPA's Clean Lakes Program, DALS's Publicly Owned Lakes cost share program, and DNR special project funds. These projects all involve implementing needed soil conservation practices in the lake watershed and several include other practices, such as using Integrated Pest Management on croplands or constructing sediment control basins in lake inlets.

Additional planning activities conducted since 1979 include:

- a Clean Lakes Classification Study was completed;
- a report was prepared assessing the pollution potential of agricultural chemical usage in Iowa and identifying recommended chemical management BMPs;
- studies were conducted on the farm level economic impacts associated with use of various erosion control practices on Iowa farms; and
- several studies were completed assessing the impacts of agriculture on Iowa's groundwaters.

Many of these activities were conducted through contract with a state university or other state agency, and all were at least partially supported by EPA water quality planning funds. The results of some of these studies have already been factored into the state's nonpoint activities. For example, the Clean Lakes Classification study is being used to develop Clean Lakes project applications, and the groundwater assessment results were used to develop a proposed state groundwater protection strategy.

In the 1986 control program update, some changes were made in the strategy for dealing with nonpoint pollution from crop and pasture lands. Major program features now include:

- sediment control will continue to receive major emphasis;
- nutrient and pesticide management BMPs will routinely be used to supplement the sediment control efforts; and
- in selecting BMPs, both surface and ground water impacts will be considered

The revised strategy calls for efforts to be directed toward three major program goals. These are:

- achieve rapid BMP implementation in watersheds of high priority lakes and streams;
- accelerate the use of BMPs on crop and pasture lands statewide; and
- conduct or support needed research or studies.

For each of these goals, the strategy identifies specific activities the state should conduct. Recommended activities include:

Rapid BMP Implementation in High Priority Watersheds:
- annually review and update stream and lake priority lists;
- prepare and submit project applications (or assist others to do so) as implementation funds become available;
- use financial incentive and public information programs to encourage voluntary participation in implementation projects;
- if voluntary means fail, consider using the mandatory provisions of state soil conservation law to achieve BMP implementation; and
- encourage counties and other local governmental units to conduct nonpoint control projects for waters of local or regional importance.

Accelerate BMP Use Statewide:
- support increased funding for state and federal soil conservation programs;
- encourage landowners to convert highly erodible lands to trees or other permanent vegetation, and publicize the available technical and financial assistance programs (such as USDA's Conservation Reserve Program);
- encourage greater emphasis on nonpoint pollution control in programs and projects administered by various federal and state agencies; and
- support and participate in demonstration projects which inform people about the state's soil and water resource problems and about control programs and practices.

Support Needed Research and Studies
- support research on the water quality impacts of nonpoint pollution, including:
  - studies to determine effects of different concentrations and durations of pollutant exposure on fish and other aquatic life;
  - studies to better determine the health impacts associated with low pesticide concentrations in water;
  - improved methods for assessing and quantifying nonpoint pollution impacts;
- support research on the impacts of various BMPs on ground waters; and
- support studies which evaluate the effectiveness of current control programs and seek to develop improved implementation methodologies.

Animal Feeding Operations and Animal Waste Disposal

Animal production is a major component of Iowa's agricultural economy. Its importance is illustrated by the fact that Iowa leads the nation in hog production, and ranks among the top ten states in cattle and calves, sheep, turkeys, and in milk production.

Although recent trends are toward fewer but larger animal production facilities, Iowa still has a large number of small feeding operations. For example, in 1985 hogs were found on 43,000 (or 39 percent) of Iowa's farms.

For environmental protection purposes, large animal feeding operations are normally considered as point sources of pollution, while small operations and animal waste disposal are considered as nonpoint sources. However, Iowa has chosen to address both through one set of rules, rather than setting up separate control programs for each.

Iowa first adopted rules to control pollution from animal feeding operations in 1969. The rules have been revised several times since, with the latest revision scheduled to become effective in July 1987. These rules:
- incorporate, but go beyond, rules adopted by the US EPA;
- establish minimum waste control requirements for all type feeding operations;
- require certain operations to obtain construction and/or operation permits from the DNR; and
- provide land disposal guidelines.

Requirements applying to small feeding operations include:
- as a minimum, settleable solids must be removed before wastes are discharged to state waters;
- confinement (totally roofed) operations are prohibited from discharging any wastes to state waters;

- if ordered to do so, operations must correct any pollution problems identified through DNR investigations; and
- the land disposal guidelines apply.

With regard to waste disposal, the rules require that wastes be land applied in a manner that does not cause surface or ground water pollution. To assist livestock producers in selecting suitable disposal practices, land disposal guidelines are given in an appendix to the rules. Producers are encouraged, but not required, to follow these guidelines. Topics addressed in these guidelines include:
- nutrient application rates;
- application methods and timing of applications; and
- field conditions considered suitable for conducting waste disposal operations.

At this time, Iowa does not plan to make major changes in its programs for dealing with nonpoint pollution from animal feeding operations. However, it is anticipated future efforts may give greater emphasis to protection of the state's trout streams, since recent studies have shown these streams are being degraded by waste discharges from nearby animal feeding operations and by habitat destruction caused by animals having direct access to the streams.

Urban Runoff

Nonpoint pollution from urban runoff is not considered a major problem in Iowa, since only a small percentage of the state's land area is devoted to urban areas. Even if industrial sites, highways, airports, and similar facilities area included, urban uses cover only about 4 percent of the state's land area.

A 1980 study determined that urban runoff was unlikely to have major statewide water quality impacts, but recognized that localized impacts might occur. As a result of this study and other evaluations, the state has concluded that a statewide urban runoff control program is not currently needed. However, cities have been encouraged to address urban stormwater through site development ordinances, and many cities have done so.

Perhaps the greatest concern in Iowa at this time relative to urban runoff is the recent finding of high chlordane levels in the flesh of fish collected downstream of several of the state's urban areas. Since only limited monitoring has been completed, the extent of this problem is not clear.

Future state activities in the urban stormwater area are expected to include:
- continue to encourage cities to include urban stormwater management provisions in construction site ordinances;
- expand the monitoring of chlordane contamination in fish, base future actions on the monitoring results; and
- determine what actions the state must take to comply with the urban stormwater control requirements of the 1987 Clean Water Act.

Construction Site Runoff

Since only a small amount of Iowa land is subjected to construction activities at any given time, construction site runoff is not a significant statewide nonpoint pollution concern. However, it is recognized that unless runoff is properly controlled, such runoff can cause localized water quality problems.

Although not a major water quality concern, several actions have been taken in Iowa to control construction site runoff. In 1971, concerns about excessive sediment movement from construction sites prompted passage of legislation setting limits on sediment movement from construction sites. To inform contractors on practices which could be used to comply with these limits, in 1975 the Department of Soil Conservation published a handbook on erosion control for construction sites.

Amendments to the sediment control law in 1981 changed the procedures for compliance, but left the basic sediment limits in place. County soil conservation districts are responsible for administering its provisions, unless this responsibility has been delegated to a qualified local unit of government. A 1983 evaluation found the sediment control law was working effectively in the more urbanized counties, but had little application in rural areas.

At present, Iowa is not planning to make any major changes in its approach to dealing with construction site runoff.

Surface Mining

A number of minerals are mined in Iowa, including coal, gypsum, limestone, clay, sand, and gravel. Statewide, registered mine sites include about 31,000 acres, and an additional 27,500 acres are included in abandoned mine sites.

As a result of previous (pre-1968) coal mining, an estimated 11,400 acres of abandoned coal mine lands are found in Iowa. To determine the pollution hazards of these lands, several monitoring studies were conducted during the mid-1970's. These studies confirmed the pollution potential of abandoned coal mine sites, since site runoff was found to severely degrade water quality in a receiving stream.

Iowa first began requiring active coal mines to reclaim mined areas in 1968, when a state reclamation law was passed. More recently, the DALS has assumed responsibility for administering the federal Surface Mining Control and Reclamation Act. This Act requires active coal mines to comply with a number of environmental requirements, including obtaining NPDES permits for any water discharges, conducting mining operations in a manner which minimizes environmental hazards, and reclaiming all mined areas.

Efforts to reclaim abandoned coal mine lands are being carried under two programs: the Abandoned Mined Lands Program (AML) administered by the DALS, and the Rural Abandoned Mines Program (RAMP) administered by the U.S. Soil Conservation Service. Together, the AML and RAMP activities are expected to reclaim about 25 percent of Iowa's abandoned coal mine lands by 1990.

Non-coal mines in Iowa must register with the DALS and must conduct mining operations in accordance with DALS rules. Among other provisions, these rules require:

- bonds be obtained to assure site reclamation;
- erosion of overburden areas be minimized during mining;
- upon closure, overburden areas be graded and vegetated to a stable condition; and
- NPDES permits be obtained for water discharges.

In addition, mining of sand and gravel from streambeds must also be approved by the DNR.

At present, no major changes are planned in the state's mine regulation programs. However, further evaluations of the state's regulatory programs for non-coal mining are planned, and these evaluations may identify areas where program changes are needed.

Land Disposal of Wastes

Land disposal may involve either burial of wastes in a landfill or application of wastes on (or near) the land surface. In Iowa, municipal and industrial solid wastes are generally disposed of by burial in landfills, while many municipal sewage sludges and a few industrial wastes are land applied.

Although surface water pollution occasionally results from landfilling of wastes, landfills are most commonly considered to represent a pollution hazard to groundwaters. Consequently, the state's efforts to regulate landfills will not be discussed here, since this presentation addresses only those nonpoint sources which represent significant surface water concerns.

In contrast to waste burial in landfills, the application of wastes on or near the land surface creates potential hazards for both surface and ground waters. To minimize these hazards, Iowa has taken several actions to regulate land application of municipal and industrial wastes.

In 1978, the DNR adopted rules governing the land application of municipal wastewater sludges. These rules included a provision which allowed "low rate" land application of sludges without a permit if specified conditions were met relative to the composition of the sludge, the

maximum amount of disposed of on a given land area, and the conditions under which disposal was conducted. These rules also allowed the DNR to issue permits for "high rate" land disposal of sludges, provided plans for the proposed disposal system are approved by the DNR.

In 1981, the DNR amended these rules by adding provisions to allow land application of industrial or other wastes under specified conditions. These conditions included requiring plans for the proposed disposal be approved by the DNR and a permit authorizing the disposal be obtained.

In 1986 a study was initiated to determine what changes, if any, were needed in DNR's rules to make them compatible with those of the US EPA. This study has now been put on hold, pending revision of EPA's sludge disposal rules in accordance with requirements of the 1987 Clean Water Act.

Since the 1987 Clean Water Act includes new requirements relative to the land disposal of sludges and other wastes, Iowa will undoubtedly need to modify its rules and control programs in the future. However, since EPA has only recently begun revision of its rules, the extent to which DNR's rules and progams must be modified cannot be accurately determined at this time.

Floodplain Construction Activities

A variety of construction related activities are conducted in or near Iowa's waters, including channel changes, dredging, placement of fill or riprap, and construction of such facilities as docks, piers, and bridges. These activities may affect a wide range of water bodies, including rivers, streams, lakes, and wetlands.

To ensure that both the interests of neighboring landowners and the public are protected, Iowa has established a program to regulate floodplain construction activities. Under this program, most major construction activities must submit plans to and receive approval from the DNR before construction begins. DNR rules specify the conditions under which approval must be obtained and the criteria to be used in determining whether a project should be approved. These criteria include evaluating the potential impacts of the project on:
- streambank and streambed erosion;
- aquatic life and habitat; and
- neighboring landowners and the public.

The DNR's rules also designate a small number of waters as "protected streams" and impose additional restrictions on construction activities affecting these streams.

In addition to its state control program, DNR also participates in the Corps of Engineers Section 404 permit program by issuing Section 401 water quality certifications for projects. This certification, which is required before a Section 404 permit can be issued, is issued only if the DNR determines the project is consistent with the state's water quality standards.

At present, no major changes are planned in the state's approach to regulating floodplain construction activities.

Ubbo Agena is an Environmental Engineer with the Environmental Protection Division of the Iowa Department of Natural Resources. He began working for the State of Iowa in 1970, first in the area of feedlot regulation. Since 1975 he has worked in water quality planning with emphasis on agricultural related problems.

Mr. Agena received a B.S. in Agricultural Engineering from Iowa State in 1966 and a M.S. in Agricultural Engineering from Oklahoma State in 1967.

Minnesota's Strategy for Controlling Nonpoint Source Pollution

Michael Robertson
Minnesota Pollution Control Agency

Introduction

Good Morning. I am pleased to be able to speak to you today. First of all, because Minnesota has established a strategy and program framework for controlling nonpoint source pollution. And it's always exciting to talk about an initiative that has successfully come together as a result of the cooperative efforts of many organizations.

And second, it is a pleasure to have representatives from states that share our great national treasure -- the Mississippi River. Minnesota's history and economy are intimately tied to the Mississippi. The search for its source caught the imagination of early explorers. Our first industries grew up along side its banks. And today, we are rediscovering its beauty and recreational potential.

The Mississippi River and its tributaries reflect the progress that we have made in environmental protection during the last 20 years ... and the challenges that remain for today and the future.

Our environment looks and is cleaner than it was when the Minnesota Pollution Control Agency was established 20 years ago. That progress is the result of the cooperative efforts of many state agencies, local governments, and the concerned and interested citizens of Minnesota, who value their water resources.

Background

Up to now, the bulk of our work in protecting water quality has been at cleaning up point source discharges by setting water quality standards, enforcing NPDES permit limitations, and vigorously promoting construction and upgrading of wastewater treatment facilities. One of the most ambitious of these projects is the ten-year building plan to separate the Twin Cities sanitary and storm sewers. That project is in its second year of construction.

Minnesota is committed to continuing the work on point source so that all communities and industries discharging to state waters will be in compliance with the Clean Water Act.

Last year, our Water Quality Division analyzed stream data collected during the past 12 years to determine the status of Minnesota's surface waters. The data clearly showed that pollution coming from point sources is declining.

The Problem

That same 12-year trend analysis also showed that nonpoint source pollution continues to degrade water quality and that the majority of use impairments are caused by nonpoint source pollution either by itself or in combination with point sources.

In addition, lake studies indicate that 90 percent of our state lakes are vulnerable to damage from nonpoint sources of pollution. Currently 9 percent of state lakes do not support recreational uses, primarily as a result of degradation from nonpoint sources of pollution.

Assessment

To give us a better handle on just where and what kind of water quality problems nonpoint source pollution is creating in Minnesota, we are currently assessing water quality, land use, and topographic data on a statewide basis. This task has been made much easier through the development of the aquatic ecoregion concept by the U.S. EPA laboratory in Corvallis, Oregon.

Ecoregions are defined by land use, soil composition, land surface, and natural vegetation. They provide a mechanism to segregate land and water information so that a clear understanding of their relationships can be reached.

The land in Minnesota falls into seven ecoregions. MPCA staff is in the process of analyzing land and water data within these seven areas. This delineation of data is helping us to identify areas where nonpoint source problems are likely to occur.

The charts on our exhibit will show you some of the data that is emerging from this work. As general areas of nonpoint source concern are outlined, we will be able to work on specific locations to more thoroughly define nonpoint source problems.

The combined results from our lake monitoring, 12-year stream data analysis, and ecoregion work, along with the continued improvement in wastewater treatment, indicate that the primary threat to the Mississippi and Minnesota's other water resources will be from nonpoint source pollution.

Issues Team

Last year, the Governor established an interagency team to develop recommendations for state and local programs to protect and improve the water quality of Minnesota's lakes, rivers, and groundwater through control of nonpoint source pollution.

The interagency team, which I chaired, was made up of representatives from 13 agencies with program responsibilities related to nonpoint source pollution. The team built on the work started under 208 water quality management planning. The team's final report, presented in November 1986, concluded that achievement of Minnesota's water quality goals will require a comprehensive water quality protection program through a coordinated local, state, and federal partnership.

Through the interagency team recommendations, a two-tiered nonpoint source pollution control strategy has been established for Minnesota.

Existing Programs

The first tier involves the implementation of best management practices on a statewide basis in order to protect water resources from further degradation by nonpoint sources of pollution. This tier incorporates and coordinates already existing resource protection programs.

One of these is the Reinvest in Minnesota (RIM) Reserve Program administered by the Soil and Water Conservation Board and soil and water conservation districts. This state program was established to convert marginal cropland to permanent grass or trees.

It has met with great success; requests for inclusion in the program far exceeded the dollars available the first year. This spring, the state legislature included $9 million for the biennium for the RIM Reserve Program and expanded the program to allow for the restoration of wetlands that were drained for crop production. We expect that the RIM Reserve Program will provide many benefits for water quality protection across the state.

The USDA Conservation Reserve Program (CRP) has also been a huge success in Minnesota. State landowners have enrolled 1.3 million acres in the CRP, which puts us in the top five states in the country for number of acres retired. The Soil Conservation Service anticipates that another 300,000 acres will be enrolled during the next spring sign up period.

The retirement of nearly two million acres of highly erodible lands from intensive production should significantly contribute to water quality protection and improvement.

Some of the other existing resource protection programs that will be part of the overall strategy for nonpoint control include:

- the MPCA feedlot program;
- the state cost-share program administered by the soil and water conservation districts; and

- local adoption and enforcement of state rules for septic tank installation and shoreline development.

This first tier also includes water quality planning now being undertaken at the local level. These plans include assessment of existing and potential water quality problems, and identification of opportunities for resource protection and enhancement.

Minnesota's philosophy is that prevention of water problems through sound planning and management is better public policy than allowing water problems to develop. Therefore, water management plans are being required over the seven-county metropolitan area and encouraged across the state.

Clean Water Partnership

The second tier of the nonpoint source strategy is the establishment of special projects through the Clean Water Partnership to address high priority water quality problems cause by nonpoint source pollution. This program was recently established by the legislature.

The Clean Water Partnership will assist local units of government in protecting surface and groundwater from nonpoint sources of pollution. The MPCA will provide technical assistance and award grants for 50 percent of eligible project costs. Projects will involve two phases: diagnostic studies and implementation.

The diagnostic phase will include water quality sampling, data analysis and computer modelling to identify realistic project goals and objectives and choose the best management practices, incentives, and protection measures necessary to achieve those goals.

The implementation phase will include the installation of the selected management practices for water quality protection, such as grassed waterways and sedimentation basins; education and information efforts to reach the population whose actions can affect water quality; and enforcement of local ordinances designed to protect water resources.

We are excited about the Partnership since we think it establishes the authority and mechanism for Minnesota to implement the new federal Nonpoint Source Management Program established by Section 319 of the Water Quality Act of 1987.

The Partnership builds on existing local water planning efforts and focuses on practical and realistic water quality improvements. There are several prototypes for the kind of locally led projects we foresee being funded under the Clean Water Partnership already in existence in Minnesota.

One of these projects is on Big Stone Lake, which lies at the headwaters of the Minnesota River, a prime tributary of the Mississippi. The project is especially significant because it is a joint effort between Minnesota and South Dakota. You can see some of the ongoing work of that project in the Big Stone exhibit here today.

Program Foundation

The success of this new strategy to control nonpoint source pollution will depend upon the strength of its foundation. And that will need to have several elements present:

1. There must be ongoing research and monitoring data and information so that water quality trends and facts guide program implementation;

2. Information and education efforts must be integrated into water quality programs so that the general public and individual land managers understand the problems and have factual information on management solutions.

3. A combination of financial and technical assistance and regulatory incentives must be available so that individual land managers adopt management practices necessary to control critical pollution problems.

4. Programs used for resource management must be coordinated.

5. And adequate funding must be available.

Let me briefly highlight some of the work that we have been doing to establish this foundation.

-- Recently, the state departments of Health and Agriculture have been conducting a monitoring study, which indicates that pesticides applied to fields under normal farming practices are migrating into groundwater. The pesticides were found in low concentrations and do not exceed the Department of Health's drinking water limits; however, the frequency of their detection in the survey and the number of compounds detected were higher than anticipated and raise concerns which must be addressed.

-- The MPCA and other agencies have provided funds to the USDA - Agricultural Research Service for the development of a computer model to predict sediment and nutrient movement through a watershed. The model, AGNPS, should be an excellent tool for pinpointing critical areas in watersheds and designing abatement plans.

-- The exhibits here today from Minnesota are a good cross section of the material that has been developed to inform the public about nonpoint source pollution. One example of this is the MPCA publication, "The Land-Use Connection." We printed 10,000 copies of this booklet and most of them were gone within five months. There is a strong interest in this kind of basic water quality information.

So we have established our nonpoint source program framework and we are committed to implementing this new strategy.

Federal Role

I want to assure the states sharing the Mississippi with us that Minnesota does not take its water quality protection responsibilities lightly. But over 12,000 lakes, 90,000 miles of rivers and streams, 2.5 million acres of wetlands, and more than a trillion gallons of water underground make water quality protection in Minnesota a massive job.

This highlights the need for federal involvement, cooperation, and funding to support our new nonpoint management initiatives.

We are very enthusiastic about the Nonpoint Source Management Program established in the Water Quality Act of 1987 and proud of the role Minnesota congressmen had in its development.

We are concerned that EPA's administration of section 319 will require all states to fit some national mold. Several midwestern states have established state programs to meet their particular needs and we hope EPA will recognize the value of these initiatives.

While we are still waiting for the program guidelines, we hope they will reflect the legislative intent for a flexible program to meet individual state needs.

Conclusion

The support and involvement of federal, state, and local governments in control of nonpoint source pollution is critical. We here in Minnesota are confident that the combination of our new strategy for nonpoint control, together with federal assistance in section 319, will eventually lead to the same water quality improvement that we have achieved through control of point source pollution.

Michael Robertson is the Deputy Executive Director of the Minnesota Pollution Control Agency where he is responsible for the management of the agency's day-to-day operations and legislative programs. He served as the Assistant Executive Director from 1981 to 1985 and was responsible for legislative and congressional relations and was a member of the Executive Management team. From 1980 to 1981 Mr. Robertson was the Director of the Legislative Commission on Waste Management, a joint House/Senate Commission created to oversee the implementation of the Waste Management Act of 1980. From 1977 to 1980 he was the Administrative Assistant for the Minnesota State Senate Agriculture and Natural Resources Committee.

Mr. Robertson received a B.A. from St. John's University in Collegeville in 1972 and a J.D. from William Mitchell College of Law in St. Paul in 1979.

Missouri's Approach to Nonpoint Source Management in Response to the Federal Clean Water Act Reauthorization

John Howland
Missouri Department of Natural Resources

With the understanding that future nonpoint source control activities are to be directed at significant pollution problems which cause non-attainment of state water quality standards and the goals of the Act, it is essential that we consider a few water quality standards concepts.

The term "standards" means different things to different people. Some believe the term is synonymous with "goal" and believe the state should adopt high standards. Others believe that standards are numeric values which establish safe limits for human consumption. Within the context of Missouri Water Quality Standards regulation, desired beneficial uses serve as standards and numeric criteria are adopted which, if not exceeded, serve as a measure of use attainment.

The state may take a number of administrative or legal actions when contaminants are found to exceed water quality criteria. Appropriate actions range from education of the owner of the contaminant source to assessment of penalties and, where necessary, clean up costs. Requests for enforcement action are developed by staff of the Water Pollution Control Program and approved by the Clean Water Commission. Forthcoming legal action is then taken by the Missouri Attorney General.

Exceedence of a specific numeric criteria value does not necessarily mean that a water body is not suitable for a designated beneficial use. For instance, the states of Missouri and Illinois have a number of water quality parameters for which our numeric criteria are different. It is not uncommon for one state's criteria to be exceeded by the same water (in this case the Mississippi River) which meets the other state's established limits. Because of the built in margin of protection between numeric criteria values and acute toxicity or human health values, criteria exceedences caused by runoff may have little to do with use non-attainment.

For the purposes of this discussion, particularly as related to the new Clean Water Act, I will describe two generic nonpoint source categories. Type 1 problems are those which involve specific pollutants which directly exceed criteria and cause a loss of designated use. Type 2 problems are indirectly caused by runoff and nonpoint pollution, but do not fit well in traditional water quality standards. Examples are shown in the following table.

Clearly the term "nonpoint source problem" means many things to different people. If a turbidity increase following a hard rain constitutes a problem, then our problems are great in number. If, however, a problem must be related to chronic criteria exceedences and subsequent loss of beneficial uses, then the universe of "problems" is orders of magnitude smaller.

In an effort to comply with requirements of the new Clean Water Law, Missouri will emphasize those water bodies in the state which are not expected to attain designated uses without additional action to control pollutants from nonpoint sources.

Several existing programs within the Missouri Department of Natural Resources are uniquely designed to address certain

Example of Pollution	Type	WQ Numeric Criteria	Designated Use	Description of impairment
Acid mine drainage	1	6.5-9 pH	Aq. life	Absence of fish, toxicity.
Alachlor in groundwater	1	.15 ug/l	Drinking	Unsafe for consumption.
Landfill leachate containing chromium	1	50 ug/l	Aq. life	Absence of fish toxicity.
Chlordane in fish	1	N.A.	N.A.	Fishing/ consumption advisories.
Nitrate in groundwater	1	10 mg/l	Drinking	Unsafe for consumption.
Sedimentation in reservoir	2	None	Drinking Water	Water suitable for consumption, but quantity is diminished.
Sedimentation in stream	2	None	Aq. life	Habitat is changed, but water quality is not.
Turbidity following runoff	2	None	All	None
Nutrients in streams and lakes	2	None	Aq. life Drinking	Only a problem in significant plant growth (eutrophication)

elements of nonpoint source control strategies. With help from the special sales tax passed by Missouri voters in 1984 to fund parks improvements and soil conservation, the Department of Natural Resources is working to stop this loss of productive topsoil. The majority of the funds is to help farmers and landowners with the cost of implementing conservation tillage, strip cropping, terraces, diversions, grade stabilizations, and other conservation measures.

Lands mined for coal, barite, limestone, sand, gravel, clay, and tar sands must be reclaimed after mining operations have ceased. The Department of Natural Resources inspects mining operations before and after the mining to ensure that these lands are restored. The department is also responsible for reclaiming abandoned coal-mined lands that pose health, safety, and environmental hazards. Water quality impairments from abandoned coal-mined lands currently pose an extreme problem at a number of locations.

Groundwater contamination from agricultural, urban, and mining sources is a major concern of the Department of Natural Resources. The state agency recently developed a groundwater protection strat-

egy that defines groundwater problems in the state and recommends actions for protecting groundwater supplies.

The groundwater that supplies water to much of rural Missouri is threatened by the improper construction of private wells and the improper siting of these wells near septic tanks. The recently enacted water well drilling act, which is being administered by the Department of Natural Resources, places requirements on the construction of new wells. In addition, Natural Resources' geologists can help find appropriate sites for both public and private water wells. However, education of landowners and management of surface pollutants still present a void which needs to be filled.

Land application of sludge and wastewater to agricultural lands takes often-overlooked resources and uses them beneficially. The Department of Natural Resources has developed guidelines for the safe application of sludge and wastewater.

Landfills are becoming obsolete as a solution to waste disposal, however, a number of abandoned or "closed" landfills and dumps are generating leachate which is contaminating surface and groundwater. Federal and state waste management programs can address some of these problems, but others have no easy solution.

Considering the new requirements of the Federal Act amendments, it is the state's intent to proceed with a nonpoint source assessment based on existing data. Most of our problems have been well identified and documented in various reports. The next step, however, will be to group the problems into appropriate categories including, but not limited to, acid runoff from mines, groundwater contamination by chemical applications, groundwater contamination by feedlots and septic tanks, water supply reservoirs, and multi-purpose reservoirs with impaired uses. Prioritization within each category will be based on 1) clear-cut evidence of impaired uses and 2) the "flexibility" or likelihood of demonstrating improved water quality following implementation of controls.

At the time of this conference, it appears that the main focus of the Department of Natural Resources' nonpoint source management efforts will be on land treatment in watersheds above small reservoirs, land treatment and best management practices on mined lands causing acid problems, and animal waste management in areas of polluted groundwater.

The short time frame of Section 319, coupled with Congress' desire to see results, will cause the state to be very selective in its identification of control project sites. However, our existing programs and experience in working with landowners and the regulated community place us in a good position to demonstrate water quality improvements. On the other hand, the chance for measuring success, in all likelihood, will be directly related to future funding by federal and state programs.

John Howland has been the Chief of the Water Quality Planning Section in the Water Pollution Control Program for the Missouri Department of Natural Resources since 1979. From 1976 to 1979 he was the Statewide Water Quality Management Plan Coordinator for the Department of Natural Resources and from 1973 to 1976 he was an Aquatic Biologist with the Missouri Clean Water Commission. He currently serves as Co-chairman of the DNR Ground Water Strategy Task Force and was the past Chairman of the Water Monitoring Committee of the Association of State and Interstate Water Pollution Control Administrators. He recently served on US EPA's National Nonpoint Source Task Force which authored a National Nonpoint Source Policy. He was the Coordinator of the Large Rivers Toxics Study from 1980 to 1982 and was a past member of U.S. EPA's Standing Work Group on Monitoring and Wasteload Allocations.

He received a B.S. in Biology in 1971 from Kansas State University and a M.S. in Aquatic Biology in 1973 from Colorado State University.

Wisconsin's Nonpoint Source Water Pollution Abatement Program

Michael T. Llewelyn
Wisconsin Department of Natural Resources

I. Introduction

The Wisconsin Nonpoint Source Water Pollution Abatement Program was formally established by the Wisconsin Legislature in 1978, although nonpoint source research had been underway in the Wisconsin Department of Natural Resources (DNR) for several years.

One of the first accomplishments of the program, commonly called the Nonpoint Source Control Program, was an extensive analysis of the state's land areas, types of land management and water resources data. This process revealed a major portion of the state where intensive nonpoint source controls would most likely be needed. This critical "U" shaped zone contains 40 percent of the state's land area and 130 of 330 watersheds in Wisconsin.

While vast rural areas are located in the critical zone, it also includes most of the state's major urban areas, including Milwaukee, Madison and Green Bay. It was thus necessary for the Wisconsin program to address urban problems and controls as well as the more widespread and better understood agricultural practices.

II. Program Concepts and Elements

With that introduction, I'm going to quickly mention the major concepts and elements of Wisconsin's Nonpoint Source Control Program. All of these topics are discussed in more detail in the 1986 Special Report, Nonpoint Source Pollution: where to go with the flow, which has been distributed at the conference.

1. The Wisconsin program is - foremost - A WATER QUALITY PROGRAM. It utilizes the technical assessment and leadership expertise of the Wisconsin Department of Natural Resources. Rural aspects are coordinated with the state agricultural agency.

2. It is a COMPREHENSIVE nonpoint source program that deals with all categories of nonpoint sources and also requires that all critical sources on a participating farm or in a municipality be controlled.

3. We operate within carefully selected WATERSHEDS called Priority Watershed Projects. In addition, we focus our resources only on those areas that directly contribute pollutants to water bodies.

4. Priority Watershed Projects are LONG-TERM PROJECTS - the assessment and planning takes at least one year, and the cost-share agreement signing and practice installation process requires 8 years.

5. These projects truly are COOPERATIVE EFFORTS, with DNR administration; joint DNR/local government agency planning, local agency implementation, and federal and state technical assistance.

The participation and cooperation of other state agencies such as agriculture and transportation is increasing.

6. The program relies on VOLUNTARY PARTICIPATION in projects by landowners and operators and municipalities.

7. The Wisconsin program is a STATE SPONSORED program using general tax revenues. There are three types of appropriations:

1) Cost sharing funds for the installation of Best Management Practices (BMPs) at rates of 50 to 70 percent.

2) Funding for local implementing agencies to pay for project management, technical assistance and educational programs.

3) State level planning and administration.

Here are some additional facts about our program:

1. Less than 20 percent of the funding goes for state and local administration.

2. From 1979 through 1987, almost 36 million dollars has been appropriated for the 29 watershed projects underway.

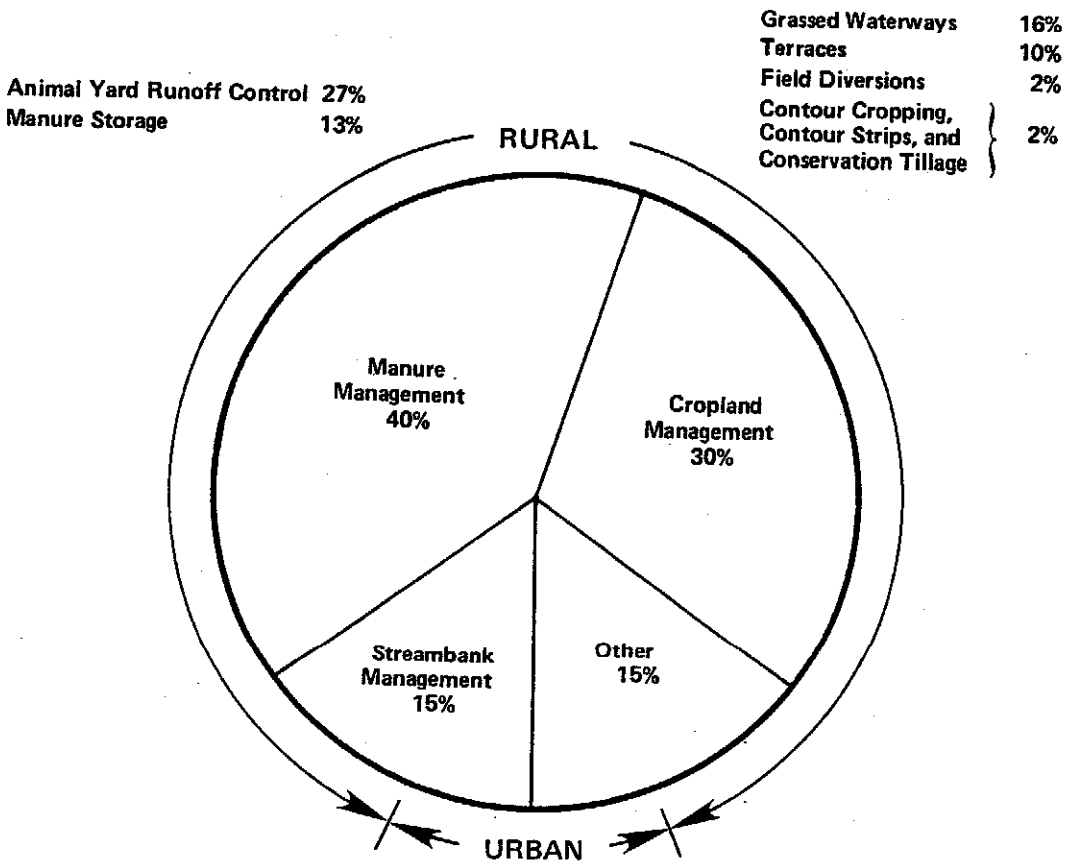
3. The table below shows the distribution of funds by Best Management Practice. The urban expenditures are indicated on the bottom. That portion will increase as the five new Milwaukee River Basin Watersheds and other urban projects reach the implementation stages.

4. Fourteen categories of BMPs are eligible for cost sharing in watershed projects. These are shown on page 29 of the special report I mentioned earlier. Some of these practices are used primarily in urban or rural areas while a few, such as shoreline protection, have wider application.

III. Program Highlights

1. Introduction

This section of the conference program is also aimed at discussing initiatives in nonpoint source control. In addition to the innovative and effective format of the Wisconson Nonpoint Source Control Program, Wisconsin continues to improve its program by developing new techniques



and expanding the scope of the Priority Watershed Projects. I'll quickly run through some of these program highlights and I encourage people interested in more details to contact me later.

2. Project Status

The first thing I want to emphasize is the number of current watershed projects - 29 are active with the first two scheduled for completion this year. A total of 9 are in the planning stage, 8 are now signing cost share agreements with project participants, and 12 have advanced to the implementation phase. The map shows the location of the projects in the critical "U" zone I mentioned earlier.

3. Small-Scale Watersheds Projects

Not shown on the project location map is a new feature of the Wisconsin program, which we call SMALL-SCALE WATERSHED PROJECTS. While a project should be a hydrologic unit that encompasses approximately 10 square miles or less, the actual scale is what is needed to meet the extent of the nonpoint source problems.

4. Door County Priority Watershed Project

Another innovative Priority Watershed project is being conducted in northern Door County, a peninsula that juts northward into Lake Michigan. This highly scenic recreational area is also home to many farms and fruit orchards, but unfortunately is also characterized by little or no soil layer over highly fractured dolomite bedrock. These conditions mean that surface water and pollutants quickly enter the groundwater system - the source of nearly all drinking water.

A vastly expanded watershed approach is being used to deal with this critical and complicated situation. Many pollutant sources (from manure to septic systems to petroleum storage tanks), the unusual physical characteristics, and the future of land development have been studied by Door County, University of Wisconsin-Green Bay, DNR and other agencies to come up with a plan to protect this sensitive land and its precarious water supply.

The Upper Door County Priority Watershed Project Plan has been prepared and the project has moved into the cost agreement signing stage.

5. Demonstration Projects

An integral part of the Wisconsin program has been some demonstration projects to show the use of control practices and encourage participation in the projects. In the past, these demonstration projects have been in agricultural areas, but we now are funding a project in the City of West Bend to demonstrate the integration of several urban runoff control practices. Several wet detention basins are being built, along with a dry detention basin and three infiltration ponds. The demonstration area is also drained with grass swales. The project was designed to result in significantly reduced water pollutant discharges to Quas Creek, a trout creek in southeast Wisconsin. The controls were also designed to provide flooding protection.

6. State Construction Project Compliance

Along with increasing participation in the Priority Watershed Projects, we are actively working to ensure that state-level construction projects - which often are of a large magnitude - are carried out using accepted pollutant control practices.

The Wisconsin Department of Transportation has agreed that future road projects will be subject to this principle, and is now working with DNR on specific details, such as training and increased cooperation.

DNR will also work with the Department of Administration to conduct all state construction projects under the provisions of the Wisconsin Model Construction Site Erosion Control Ordinance developed by the DNR and the League of Wisconsin Municipalities, as directed by the State Legislature in 1984.

7. Urban Projects

While mostly rural watersheds dominated the earlier watershed selections, the Sixmile-Pheasant Branch Creek

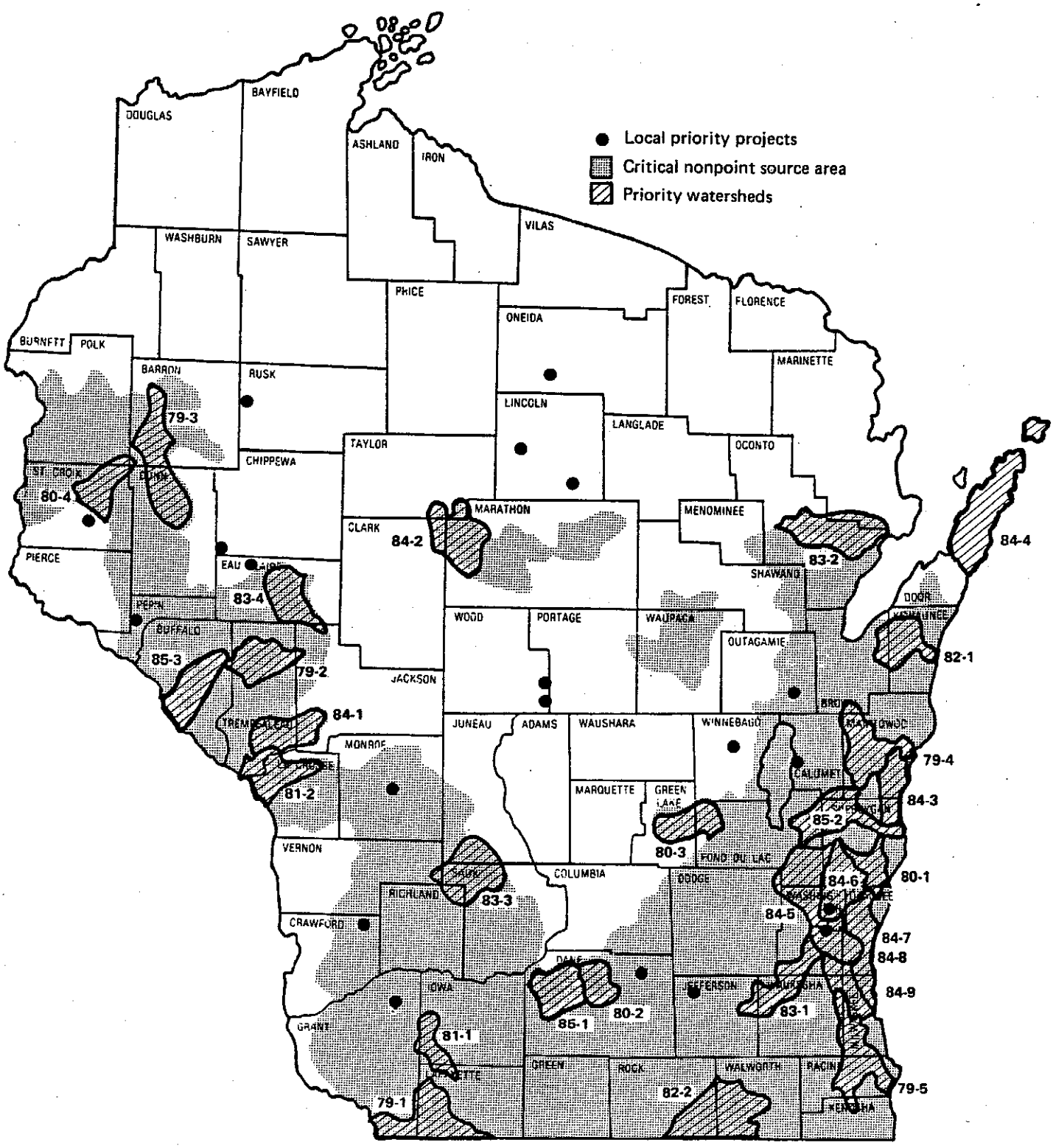


Figure 1. Location of nonpoint source abatement projects and identification of the critical nonpoint source areas.

Priority Watershed Project, selected in 1980, involves portions of the capitol city and suburbs as well as agricultural and urbanizing areas. A condition of this project was that the City of Madison adopt a citywide construction erosion ordinance. This was a cost share condition for the construction of detention basins in devel-oping areas wanted by the City to decrease the sediment load entering Lake Mendota. This approach will be used in future urban projects.

In Milwaukee, a $1.7 billion effort to update the Milwaukee Metropolitan Sewerage District facilities spawned special legislation in 1984 to designate the Milwaukee River Basin - 5 watersheds covering over 800 square miles in 7 counties - for nonpoint source management in conjunction with the point source effort.

This recognizes that point source control alone could not meet water quality objectives. This most comprehensive basin effort will deal with virtually all elements of natural resource management. This includes rural and urban nonpoint sources, point sources, groundwater, abandoned landfills, stormwater and flooding, and fish, wildlife and endangered species, and habitat preservation and management.

The schedule for the five watersheds differ but all assessment data for rural areas has been collected and some is now being analyzed. Urban data collection is ongoing. The first watershed plan should be completed in early 1988.

8. Technical Advances

Major techical advances have been made by program staff members in developing computer models to evaluate pollutant soruces and control practices in both urban and rural areas.

The Wisconsin Source Loading and Management Model evaluates urban runoff pollutant sources and the costs and effectiveness of practices such as wet detention basins, grass swales, catch basin cleaning, street cleaning, and paved area and roof runoff infiltration.

The Wisconsin Nonpoint Model is used to estimate sediment loads in a watershed, identify fields where sediment originates and evaluate agricultural management practices such as minimum tillage, contour strip plowing and grassed waterways.

A third model, the Wisconsin Barnyard Runoff Model, was developed to estimate the relative phosphorus load from individual barnyards. It evaluates barnyard runoff control practices including diverting clean water away from barnyards and containing and filtering contaminated water.

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Mr. Llewelyn graduated from the University of California-Santa Barbara in 1974 with a Bachelor of Arts in Political Science and from the University of Wisconsin-Madison in 1979 with a M.S. in Water Resources Management.

Big Spring Groundwater Project and Legislative Initiatives in Iowa

Bernard E. Hoyer
Iowa Department of Natural Resources

A few years ago, a conference on nonpoint source pollution would not have included a single reference to groundwater, much less a paper such as this one. Nonpoint problems related to surface water, documentation of nonpoint groundwater contamination was almost nonexistent. Groundwater contamination was thought of as a point-source problem. Spills or improper waste disposal practices were considered examples of potential sources of contamination. Often contamination was described simply as a well problem (not merely a point source, but a point of contamination) caused by a combination of factors including improper well placement, faulty construction or poor maintenance. Without a doubt, point sources can contaminate groundwater and such factors can create point contamination of a well and the water which that well yields.

However, recent research has documented nonpoint source groundwater contamination by both nitrate and pesticides. The widespread, accepted nitrogen-fertilization and weed-control practices of Iowa's intense row-crop agriculture have been interpreted as a cause of systematic contamination of Iowa's most susceptible aquifers. Such interpretations have generated broad interest within the agricultural community, the environmental community and the public. In Iowa an opinion poll found that 83 percent of the public believed more needed to be done to protect groundwater from contamination (Hoyer, et al, 1987). A majority (63 percent) agreed with most natural resource professionals and volunteers that agricultural chemicals are the most important threat to groundwater. The agricultural community generally agrees and believes that more needs to be done. Such opinions provide strong impetus for political action. In January, the Iowa Groundwater Protection Strategy 1987 which had been mandated in 1985 was presented to the Governor and General Assembly. In May, the Groundwater Protection bill passed the General Assembly and was signed into law by the Governor.

The research results and demonstration activities associated with Big Spring and the agricultural region which recharges Big Spring have been a focal point for much of the interest in groundwater contamination from agricultural chemicals. Research at Big Spring documented nonpoint, agricultural contamination; an ongoing demonstration program is designed to reduce contamination via a voluntary program, and the cooperative process which developed the research and demonstration programs has evolved proposed solutions which have served as a paradigm for the state to address its groundwater protection efforts in relation to agriculture. "Big Spring" represents research; and "Big Spring" represents demonstration of best management practices; "Big Spring" represents a paradigm for agricultural policy. Throughout the problem definition stage of research, the early "policy" stage of developing the demonstration project in the Big Spring Basin, and the development of statewide policy, cooperation has been the most important element.

"Big Spring" as Research

In November 1981, research focusing on the effect of agriculture on groundwater in a karst region was begun in the Big Spring area, northwest of Elkader in Clayton County, Iowa. Big Spring discharges from the Galena aquifer along the bluffs of the Turkey River. It is Iowa's largest spring and acts as the water supply for a trout hatchery. Water quality research in karst aquifers generally is considered extremely difficult

because such aquifers are known to be highly variable. However, dye tracing studies (Heitmann, 1980) had established a framework for understanding the hydrogeology and partially documented the groundwater basin which influenced the spring. Engineering controls at the hatchery combined with resident observers allowed discharge to be constantly monitored and water quality sampling to be properly conducted. Thus, the Big Spring study area allowed a quantitative evaluation of groundwater discharge and chemical contaminants through time, and allowed them to be related to a finite agricultural area. Thus the area afforded an opportunity to develop a quantitiatve evaluation of agricultural chemicals resulting from recharge of both surface flows to sinkholes and normal infiltration.

Geological Survey Bureau (formerly the Iowa Geological Survey) of the Iowa Department of Natural Resources began research with financial support from the U.S. Department of Agriculture-Soil Conservation Service, the Environmental Protection Division of IDNR (formerly the Iowa Department of Water, Air and Waste Management) and the U.S. Environmental Protection Agency. The Fish and Wildlife Division of IDNR (then the Iowa Conservation Commission), University Hygienic Laboratory, Cooperative Extension Service, U.S. Geological Survey and the U.S. Department of Agriculture-Agricultural Stabilization and Conservation Service provided substantial assistance through services. Activities included widespread water quality sampling of the area; establishment of a network of wells, streams, title lines and springs for repetitive sampling; establishment of a gage at Big Spring; hydrologic evaluation of the Galena aquifer; geologic mapping; land use mapping; and a survey of farming practices including fertilizer and pesticide usage. Local resident cooperation was outstanding.

The groundwater basin was determined to be 103 square miles. The landscape consists of rolling hills that are intensively used for agriculture. About 90 percent of the basin is used for row crop production. Annually about 60 percent of the basin is planted to corn while the remaining 30 percent is in a corn rotation with alfalfa, oats or pasture. Six percent is timbered. Towns are very small and located along the periphery of the basin. Dairy and beef cattle and hogs are raised extensively throughout the area. The basin is a very productive agricultural area.

Early results at Big Spring (Hallberg et al., 1983) confirmed earlier research (Hallberg and Hoyer, 1982) that geologic conditions control the contamination of aquifers by nitrate. In areas of the basin where the Galena aquifer was unconfined or confined only by a thin increment of overlying silty shales or Quaternary deposits, nitrate concentrations were elevated and commonly equalled or exceeded the public drinking water standard of 45 mg/l. Nitrate concentrations averaged about 35 mg/l but ranged from less than 1 to 280 mg/l. In areas where the aquifer was confined and buried by thicker clayshales, no nitrate was detected. The importance of nitrate infiltration to the aquifer was further verified by the analysis of gaging records and repetitive water quality sampling at Big Spring. Most nitrate was found to enter the aquifer with normal infiltration recharge, not through runoff to sinkholes (Table 1). Meager historic records of nitrate were compared with current records and revealed a striking increase in nitrate concentrations in the aquifer after 1968. Concentrations had about tripled in fifteen years. The increase was roughly proportional to the increased use of nitrogen fertilizers used in the basin over the same period of time. This increased nitrogen fertilization is a combined result of increased corn acreage and increased fertilizer rates (Hallberg et al., 1983; Hallberg et al., 1984). Similar nitrate leaching increases have been reported in tile lines before from agronomic research (Gast et al., 1978; Kanwar et al., 1983) but not in aquifers. Detailed Big Spring conclusions supported those made in the earlier research relating groundwater nitrate to agricultural practices. These conclusions had implications throughout the state because Iowa, like the Big Spring Basin, is so intensely used for crop production that agricultural management practices could be responsible for nitrate increases in

Table 1. Recharge mechanisms to the Galena aquifer in the Big Spring basin. (Modified from Hallberg et al., 1983; Hallberg et al., 1984; unpublished data).

	1982		1983		1984	
	Conduit	Infiltration	Conduit	Infiltration	Conduit	Infiltration
Water Total Discharge (Acre-feet)	3,360 9%	34,080 91%	4,502 11%	36,871 89%	2,050 6%	30,565 94%
Nitrate Nitrogen (lbs.)	52,000 6%	821,000 94%	57,000 5%	1,093,000 95%	35,000 4%	806,000 96%
Atrazine (lbs.)	2.3 16%	11.9 84%	14.5 47%	16.7 53%	13.2 33%	26.8 67%

aquifers throughout the state. Elevated nitrate concentrations are evident across Iowa in both municipal and private supplies (Hallberg, 1985). Contamination is most likely in unconfined, karst bedrock aquifers, in bedrock aquifers where overlying drift cover is thin, in alluvial aquifers, and in shallow drift aquifers.

Big Spring analysis revealed that besides being a significant environmental issue, nitrate losses to groundwater could be a major economic issue as well. Of course there are many sources of nitrate, but most have been relatively constant especially if compared to nitrogen fertilizers through the period of interest. Measured as a percentage of commercial fertilizer applied, nitrogen losses as nitrate equalled more than one-third of the nitrogen applied. Current practices seem to overload the system resulting in such losses (Hallberg, 1986). The net effect is nitrate concentrations at Big Spring which average at or near federal drinking water standards for public water supplies (Table 2). Such losses of nitrogen fertilizer tend to be substantiated by recent agronomic research. Blackmer (1987) reported 61 percent of fertilizer-N was lost in a single year from corn plots and over a long-term basis, recoveries of fertilizer-N is less than 50 percent.

Conclusions about pesticides from Big Spring were equally significant. Pesticides were anticipated to be detected in the Galena aquifer only for brief periods of time, if at all, after summer rains delivered runoff to sinkholes. Unfortunately, pesticides were found in groundwater far more widely and persistently than anticipated. The herbicide atrazine, in particular, was routinely found in Big Spring analyses after the winter of 1981-82 and found in wells throughout the same area as nitrate concentrations were elevated. Its geographic distribution clearly suggested normal infiltration as the mechanism for aquifer contamination, a conclusion fully supported by analysis of Big Spring flow (Table 1). Concentrations normally have proven to be very low, usually less than 1 ug/l. Higher concentrations of atrazine and several other herbicides are generally found only in association with wet periods of time. Other commonly used pesticides are present in the record at Big Spring intermittently throughout the year in detectable quantities. Although the record from Big Spring for the infiltration of pesticides other than atrazine may be equivocal, their occurrence in other localities indicate that various pesticides used in Iowa can infiltrate and persist throughout the year in groundwater (Libra et al., 1984; Kelley, 1985; Kelley and Wnuk, 1986; Detroy, 1986). Furthermore, the record at Big Spring suggests that although pesticide concentrations are very low, they may be increasing. Flow weighted

Table 2. Summary of annual monitoring data from Big Spring. (Modified from Hallberg et al., 1983; Hallberg et al., 1984; Hallberg, 1985.)

	Water Year			
	1982	1983	1984	1985
Mean Discharge (cfs)	51.4	56.9	44.9	35.0
Total Discharge (inches)	6.8	7.5	5.9	4.6
Flow-weighted Mean NO_3 Concentration (mg/l)	39	46	43	31
Flow-weighted Mean Atrazine Concentration (ug/l)	0.2	0.3	0.5	0.7

mean concentrations of atrazine have risen three consecutive years (Table 2) and peak concentrations of all other products have risen each year (Table 3). Thus, pesticides, like nitrate, may be present in any aquifer receiving significant amounts of surficial recharge over the past 10 to 20 years. A summary of Iowa studies has determined that 39 percent of wells tested for pesticides in Iowa have had detectable residues. It is estimated that approximately 785,000 people in Iowa are drinking water which contains detectable pesticide residues for at least a portion of the year (Kelley et al., 1986). In addition there is now data suggesting that nitrate contamination may be an indicator of potential pesticide contamination. In wells where nitrate exceeded 45 mg/l, 72 percent were shown to contain detectable pesticide residues (Hallberg et al., 1987). Further, 21 percent of the wells which contain one detectable pesticide contain multiple pesticide residues (Kelley et al., 1986). Such data makes sense when one considers that nitrate and pesticides are widely and uniformly used across Iowa, and they can leach to the same susceptible aquifers.

"Big Spring" as Demonstration

The linking of agricultural management practices to groundwater contamination was immediately treated seriously by state, federal, local, and private organizations in the state. Various agencies had supported the original research efforts, but after the first year of results from Big Spring became known, a group of thirteen public and private organizations formed the Iowa Consortium on Agriculture and Groundwater Quality (originally named the Ad Hoc Karst Committee) to consider appropriate responses to the evolving issue. The Consortium, which included groups mentioned earlier in this paper as well as the Division of Soil Conservation (then the Iowa Department of Soil Conservation) within the Iowa Department of Agriculture and Land Stewardship, Agricultural Experiment Station, Northeast Iowa Water Resource District (then the Northeast Iowa Conservancy District), and the Iowa Fertilizer and Chemical Association, formed to facilitate interagency information exchange and coordinate activities. The group identified problems, potential solutions, current agency activities, information and research needs, and made recommendations about proceeding towards groundwater protection. Cooperation had begun with the original contamination research and it continued to grow through this process.

One of the recommendations of the Iowa Consortium on Agriculture and Groundwater Quality was the development of a project to demonstrate a voluntary, nonregulatory approach to reducing groundwater contamination. This project, called the Big Spring Basin Demonstration Project, would

Table 3. Maximum pesticide concentrations and percent pesticide detections from Big Spring discharges, Clayton County, Iowa in northeastern Iowa studies, 1981-1985 (Modified from Hallberg, 1985 and Kelley et al., 1986).

Common Name Active Ingredient	Typical Trade Name	Maximum Concentration ug/l (ppb) Big Spring Basin WY-82	WY-83	WY-84	WY-85	Percent Detections from all samples
Herbicides						
atrazine	Aatrex, Atrazine	2.5	5.1	10.0	6.1	98
alachlor	Lasso	0.2	0.6	4.0	5.0	20
cyanazine	Bladex	0.7	1.2	1.7	4.6	22
metolachlor	Dual	---	0.6	4.5	4.6	7
metribuzin	Sencor/Lexone	---	---	---	3.6	<1
2, 4-D	2, 4-D	NA	NA	NA	0.2	<1
Insecticides						
fonofos	Dyfonate	---	0.1	0.3	0.4	2

utilize the information gained by Big Spring research as background data from which to evaluate results. The program would: 1) emphasize development of best management practices (BMP), 2) use education programs to reduce contamination, and 3) evaluate the water quality benefits of the practices, their economic effect on farms and the overall success of a nonregulatory approach. The project proposed a basic paradigm of BMP research, farm manager education, and evaluation. The project was begun with partial funding in 1986 and with recent Iowa legislation, the project is fully funded.

The Big Spring Basin Demonstration Project is a cooperative, interagency program designed to demonstrate and document economically viable techniques to protect groundwater from the nonpoint source contamination of agricultural chemicals. The goal is to develop and implement management practices which will balance efficient agricultural production with the protection of groundwater, soil and surface water resources. The seven year program is being conducted throughout the 103 square mile Big Spring Basin because previous research and the area's geology provide a unique opportunity to measure and assess groundwater quality in relation to agriculture. The basin functions as a large, natural, outdoor laboratory. Throughout the project agricultural activities and groundwater will be monitored within the basin. The Big Spring Fish Hatchery, where most of the basin's groundwater discharges from the aquifer, receives special monitoring attention. But water quality monitoring is conducted in wells, tile lines, and surface streams too. Groundwater protection is expected to occur as more efficient ag-chemical management leads farm managers to voluntarily employ alternative management practices in their farming operations. Agency participants believe the adoption of better chemical management practices should result in more efficient, economical crop production as well as groundwater protection. Successful ag-chemical management research, combined with special educational programs, form the core of the Demonstration Project. Research plots are designed to document basic nitrogen movement and alternative management practices and to demonstrate their potential to area farm managers. Drawing upon research results, education programs are assisting farm managers to employ efficient fertilizer

and pesticide management techniques within their farming systems. These programs are combined with special assistance in the areas of soil conservation, and nutrient and pesticide management. An 1100 acre watershed within the basin has been singled out as a focal point for demonstrating BMP and as a mechanism for gaining real-world, practical experiences and reactions from farmers. The project includes economic analyses of management practices, a careful evaluation of surface water and groundwater quality, and an evaluation of how effective educational programs have been at implementing the nonpoint source groundwater protection strategy. The merging of groundwater concerns with existing programs of soil and surface water protection is noteworthy. The entire project is estimated to cost 6.8 million dollars.

For the Big Spring Demonstration Project a voluntary approach was the only approach seriously considered. It represents a test area, not state policy, and regulatory approaches for a demonstration area are clearly inappropriate. But it also represents the most desirable approach as identified by members of the Consortium on Agricultural and Groundwater Quality. And furthermore, there is evidence that it might work.

In the Big Spring Basin, Kapp (1986) and Padgitt (1985) found considerable room for improvement in nitrogen management practices. They found that farmer's yield goals were too high by an average of 15 bushels of corn per acre. Therefore they overfertilize seeking to attain an unrealistic goal. In 1984, they found that 60 percent of all the basin's farmers did not take credits for the nitrogen contribution of manure and that they underestimated the nitrogen value of alfalfa by 50 percent. In total, basin farmers were averaging about 80 pounds of nitrogen per acre of corn above current Cooperative Extension Service recommendations. This represents a potential savings of about $12 per acre. Thus, an economic incentive exists for better agricultural chemical management. Significantly, Padgitt (1986) found that people could accept voluntary reductions in the fertilizers and pesticides because it would be cost effective. Surveyed farmers felt that capturing the nutrient value from manure outweighed the costs of managing the manure.

Additionally, rural people were found to be extremely concerned about the purity of their water. They are dependent on groundwater for their families, livestock and business. Padgitt (1986) found that they believed that environmental efforts should not be sacrificed in order to promote economic growth. Furthermore, unlike the situation of soil erosion, they accepted the fact that groundwater contamination was a problem and that it was a problem on their own farms. Previous studies have often indicated that farmers felt that soil erosion was their neighbor's problem, not their own. They felt they were not personally contributing to it. Pagitt suggested that questionnaire answers reflected groundwater concerns almost of an alarmist nature. Actually, this suggests that if appropriate management practices can merge groundwater protection with soil and surface water protection, perhaps traditional nonpoint programs will benefit incidently as a result of the farm manager's greater concern for protecting groundwater.

Such interest is the result of publicity. Public awareness began about the time that Big Spring study results were first released in June 1983. Newsprint and electronic media immediately showed interest in the results and began running stories detailing water quality problems and health concerns, as well as possible methods for reducing contamination. Coverage was probably somewhat higher in northeast Iowa, but news coverage has been widespread throughout the state. The Extension Service, farm groups, professional societies and civic groups also began including groundwater quality as a common agenda item at informational gatherings.

Finally, enthusiasm for the demonstration project has been great. This enthusiasm exists among the agricultural research community, Extension Service, soil conservation agencies, and environmental agencies. It exists locally among farmers in the basin, throughout Iowa, and even among interested parties nationally. Such enthusiasm is a pre-

requisite for the success of a voluntary program.

The Demonstration Project has completed its first year and some early indications suggest that it is working. Kapp (1986) reports that in the Big Spring Basin during 1986, nitrogen use on corn after corn is down by about 15 pounds per acre since 1984 and recently Kapp has reported that he expects it to drop another 10 pounds per acre in 1987. Furthermore, on fields where corn follows alfalfa, the use of nitrogen is down about 7 pounds per acre. Integrated pest management scouts are being used, and farmer awareness and cooperation remains. As evidence, long-term management agreements with farmers in the special 1100 acre demonstration watershed have been made without any problems. Continuation of such changes and farmer cooperation, combined with production changes resulting from the Conservation Reserve Program, may result in the expected improvements in Big Spring Basin water quality.

"Big Spring" as a Paradigm for Legislative Initiatives

In 1985, the Iowa General Assembly mandated development of a groundwater protection plan. The Iowa Groundwater Protection Strategy 1987 was delivered to the Governor and General Assembly in January 1987. It contains a discussion of contaminant sources, program evaluations, and policy recommendations to guide legislation and program development. Prevention, public education, and reliable information punctuate all Strategy recommendations. There is an emphasis on acquiring information about contaminants and their behavior in surface and subsurface environments. This includes a strong monitoring program for a wide variety of contaminants in aquifers which supply municipalities and private wells throughout the state. Such recommendations for all contaminant sources reflect the successes Iowans achieved by developing an understanding of the problem of agricultural contaminants at Big Spring and elsewhere in the state. It also reflects the need to increase our understanding of the distribution of agricultural contaminants and to measure changes in the future from which Iowans can measure the success or failure of their prevention program.

The Strategy recognizes agricultural chemicals, along with hazardous waste sites, as the most important sources of groundwater contamination in Iowa. Some people have suggested that the most significant aspect of the Strategy is the simple recognition of nonpoint source agricultural chemicals as a major issue. Nationally, some people have been amazed at that recognition. Such surprise presumes that the agricultural community will deny the problems existence. In Iowa, that has not happened.

Several other aspects of the Strategy are much more notable. The Strategy placed emphasis on the prevention side of a groundwater protection strategy. A reaction or enforcement program was not emphasized at this time, although it should be noted that the State already has considerable regulatory powers through its administrative part of the Federal Insecticide, Fungicide, and Rodenticide Act. This fits with the perceived major problem which can be affecting susceptible aquifers all across Iowa, a nonpoint problem. All nonpoint problems must be addressed at the source; cleanup is nearly unthinkable for such a problem. The Strategy recognizes the important role of data and information to public policy and its development. It recognizes a state role in assessing the impact of groundwater contamination including the potential impact on human health. It also recognizes that a substantial financial investment by the state is necessary to adequately conduct the required programs. The Strategy outlines $230 million over a ten-year time period. Perhaps of most significance, the Strategy was developed under an atmosphere of considerable public concern, but not an environment of crisis.

The nonregulatory controls for agchemicals proposed for the Big Spring Demonstration Project has been carried on into state policy through recent legislative actions. Evidence of potential increased efficiencies, economic gains, and the spirit of cooperation towards voluntary prevention of agricul-

tural chemical contamination has carried over beyond Big Spring. The approach has sound scientific and economic bases and it fits the perceived problem as serious, but not yet a crisis. The proposals for action are moderate, but include serious investments of people and money. Legislation passed in 1986 resulted in development of the Integrated Farm Management Demonstration Program. This program used Oil Overcharge Funds to sponsor statewide demonstrations of energy and chemical efficient agriculture which can protect groundwater and the environment. In the autumn of 1986, the Governor proposed expanding the use of Oil Overcharge Funds for groundwater protection programs, especially research and education on best management practices of agricultural chemicals.

The Groundwater Protection Act passed by the seventy-second Iowa General Assembly with broad support is a comprehensive attempt to address groundwater protection. It emphasizes prevention, public awareness, and reliable problem assessments which were emphasized in the Strategy. The legislation also directly addresses adequate funding for programs and it provides mechanisms for continued funding. In fact, it has been criticized as being a taxation and appropriations bill rather than an environmental piece of legislation. Various fees are initiated, while others are increased. Each is directed to special accounts which were established to be drawn upon for specific program activities. Oil Overcharge Funds were also appropriated. Two special accounts were established in the bill which are utilized to address agricultural chemical contamination. The Oil Overcharge Account was appropriated $17.5 million to be spent over five years on groundwater programs. Approximately $12.5 million of this account is related to nonpoint, agricultural chemical contamination. The Agricultural Management Account will receive annual income of about $3.5 million. Money to this account is collected from fertilizer fees, and pesticide licensing and registration fees. Such significant financial resources are positive evidence that the voluntary approach is supported as policy. If the approach can work at Big Spring, it can work elsewhere in Iowa.

It is difficult to describe all the programs included in the groundwater bill in a brief paper. Even those related solely to the agricultural chemical issue must receive abbreviated attention. A brief listing does provide a picture of Iowa's policy emphasizing the prevention part of groundwater protection. Some of the important program elements that the legislation authorized or directed which are related to the issue of agricultural chemicals are itemized below:

1. Collection of pesticide use data so that reliable information is available for refined problem assessment and as a measure of change in chemical management.

2. Stricter pesticide user certification requirements so that all commercial and farm users of restricted pesticides are better trained in the use of pesticides and more knowledgeable about potential problems with their use.

3. Strengthening of reportable disease programs which will require reporting of methemoglobinemia and pesticide poisonings along with cancer and birth defects so that more reliable information on possible environmentally linked problems may be available for future policy development.

4. Established Center for Environmental Health to perform epidemeological research related to groundwater quality.

5. Established Leopold Center for Sustainable Agriculture to conduct research on best management practices so that economically and environmentally acceptable practices may be developed to prevent contamination.

6. Established financial incentives for innovative conservation practices or conservation easements to be developed around sinkholes and/or agricultural drainage wells to minimize impacts of agriculture around these mechanisms of recharge.

7. Provides for financial incentives to plug abandoned wells so that these

mechanisms for contamination may be closed.

8. Provides for statewide testing of private water supplies so that important information needed for problem assessment is gained and so that the public becomes better informed on contamination problems.

9. Provides for statewide monitoring of groundwater quality so that groundwater problems may be better understood and the preventative program may be evaluated.

10. Requires reporting of water quality results so that federal and state agencies as well as the public are better aware of the available contaminant information.

11. Provides full support for Big Springs Basin Demonstration Project so that its contribution to BMP development, institutional coordination, and groundwater protection may be realized and evaluated.

12. Maintenance of Agricultural-Energy Management Program and its Integrated Farm Management Program demonstrating efficient agriculture to prevent contamination and educate farm managers.

It is important for this conference to note that there is considerable momentum in the program for merging interests of nonpoint groundwater concerns with nonpoint surface water concerns. The Big Spring Demonstration project has attempted to do that by addressing cost efficient agriculture and best management practices within the total context of the local soil conservation district and the county extension program. Better management must protect both resources. This is clearly the intent of proposed development of innovative programs to minimize hazards in watersheds draining to sinkholes or drainage wells. Such programs might include conservation easements, support for forest and prairie development, or financial assistance in crop rotations, pasture or strip-cropping. Establishment of less intensive agriculture or more efficient agriculture will improve both surface and groundwater. There are differences between protection of groundwater and surface water, but there is no need to set them in opposition to each other.

Iowa has set a course using voluntary controls for agricultural chemicals. Such a course without the support of a research and education system would be a do-nothing approach. However, with those program elements, it is an active approach with a potential for successes. If this approach could be merged with complementary policies within the U.S. Department of Agriculture programs, especially programs such as the price support programs and the Conservation Reserve Program, real progress might be made in groundwater protection as well as other nonpoint programs. Federal policies may have a significant impact on the success of groundwater protection (Johnson, 1987; Batie, 1987).

The approach has been criticized by some for a lack of "standards" and/or a lack of enforcement. Standards were debated by the General Assembly, as they had been in development of the Strategy, but their acceptance is not universal, especially for pesticides, and their role needs to be defined in terms of clean-up or as an early warning indication of contamination. An activity directed at setting standards by Iowa government would only detract leading people away from the prevention program outlined. Iowa's approach has been to let the U.S. Environmental Protection Agency or other states with more resources, experience or interest pioneer the standards issue. Iowa has chosen at this time to support very adequately positive elements of a prevention program for which there was broad support and enthusiasm. It should be noted that the approach is not cast in stone. Regulatory approaches could and should be implemented if the voluntary approach fails or if research shows that health implications require immediate action. However, all the steps taken through the voluntary approach -- research, education, evaluation -- would prove helpful in the event that more regulation were needed. Such research may help identify ways to better regulate agricultural chemicals. If the Iowa program does not go far enough, it has not

lost time, because research and education need to be established anyway, and too often are overlooked under a regulatory approach. Also, it should be noted that much regulatory power already exists, such as state licensing of pesticide products.

Iowa found enthusiasm for prevention of groundwater contamination and is in a position to move forward on this new issue. Curiously through serendipity it may help society address the better known nonpoint source issue of surface water quality.

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Interstate Relationships in Nonpoint Source Management: The Chesapeake Bay Experience

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To understand the Chesapeake Bay experience in managing nonpoint sources, it is first necessary to share with you some of the reasons why we need to control nonpoint sources to the Bay. Going back to about 1978, Maryland lobbied for a multi-year research program to be carried out by EPA to evaluate the Bay's problems and, as much as possible, their causes. This research was done from 1979 to 1983 at a cost of $27 million.

The research concluded that several problems were partially caused by nonpoint sources pollution. Nutrients, primarily nitrogen and phosphorus, have increased to such an extent that large algal blooms are occurring, cutting down on the light penetration to the lower waters of the Bay. Also, plant growth on the leaves of the grasses in the Bay has also contributed to the decline and substantial disappearance of the grasses. The research also concluded that the disappearance of the grasses was not related to pesticides as originally suspected, but instead was related to algal blooms and the lack of light penetration.

Another problem was the increasing area of low dissolved oxygen in the middle part of the Bay. This was attributed to the large algal build up and subsequent decomposition.

A fourth area of concern was toxics. The research established that there are some localized areas around Baltimore, Maryland and Norfolk, Virginia, both heavily industrialized areas, where toxics have built up in the sediments. Toxics do not appear to be in excessive levels in areas outside of these localized areas. This suggests a need to control nonpoint sources of toxics in these urban areas.

In this brief overview, I'd like to explain what the Bay region states and Federal agencies have done in response to these problems and then to conclude with some of the lessons we've learned from our experience.

The first thing we did in response to the research findings was to sign an Agreement in December 1983. The Environmental Protction Agency, Maryland, Pennsylvania, Virginia, and the District of Columbia are parties to the Agreement. It is a voluntary Agreement. It is not confirmed by an act of Congress and is not confirmed by acts of our respective legislatures. Basically, it creates an Executive Council and an Implementation Committee to have the parties work together to oversee the effort to restore and protect the Bay.

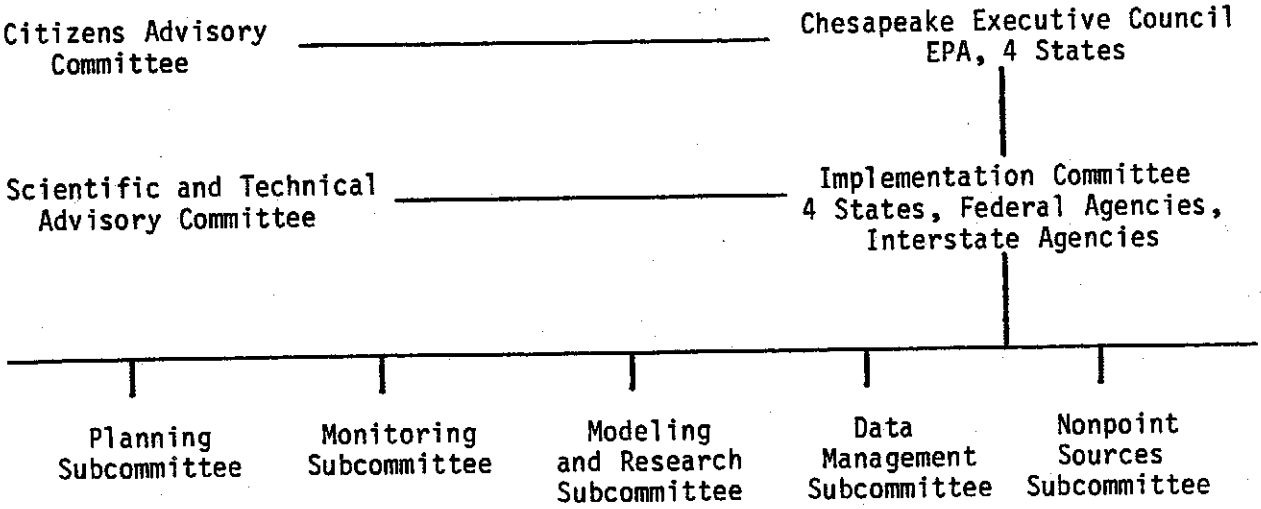
At the same time that the Agreement was entered, each of the states, as well as several federal agencies, announced a package of their respective initiatives to clean up the Bay. An additional activity we've done since 1983, is to revise these initiatives on a year-to-year basis and to constantly re-evaluate how well we're doing at implementing them. We've added some and we've ended some.

A third thing we've done collectively is to prepare a Chesapeake Bay Restoration and Protection Plan. It includes goals and objectives and individual initiatives or abatement programs to meet the respective goals and objectives. It is organized so that a reader can compare what's going on in a given subject area from one state to the next.

We have, as another part of our interstate effort, an ongoing comprehensive monitoring program designed and

Illustration 1

Structure



implemented by federal agencies and the states for water quality and living resources. We also have a coordinated effort of research and modelling. And, finally, we've agreed on our data being maintained and kept in one centralized regional office, the Chesapeake Bay Liaison office.

This illustrates the structure that we have in place (Illustration 1). The Chesapeake Executive Council includes usually two or three cabinet members from each of the four states and the Regional Administrator of EPA. Initially it was chaired by the Regional Administrator of EPA. We have recently decided to have the chair rotate every other year to a state. It is currently chaired by Governor Baliles of Virginia. The Council meets quarterly.

The work of the Council is carried out by an Implementation Committee. These are usually deputy or assistance secretaries in the respective departments of a state government, or program directors within the federal agencies. There are also several interstate agencies that sit on the Implementation Committee. The Implementation Committee oversees the nitty-gritty details of doing research, the monitoring, the program evaluation, the review of programs, whether things are getting done or not. Reporting to the Implementation Committee we have 5 Subcommittees: one for doing the Plan and revising it annually; one for overseeing our monitoring program; one for modelling and research efforts; one for data management; and a nonpoint sources Subcommittee.

In addition to these groups, which are basically federal and state officials, we have a Citizens Advisory Committee of roughly thirty people who advise the Council directly on the Bay cleanup effort. We also have a Scientific and Technical Advisory Committee that makes its input through the Implementation Committee on the merits of particular scientific and technical issues. For example, they have recommended that we probably ought to be taking out nitrogen at sewage plants in the upper Chesapeake Bay and have suggested that biological nutrient removal technologies are less expensive than chemical removal technologies.

Having what is basically a fairly clean-cut structure and having defined the roles of each of the Subcommittees, the Committee and the Council have been able to involve a large number of people

in the Bay cleanup with a minimum of duplication of effort or wheel spinning.

Now I would like to talk about some some examples of federal/interstate cooperation specifically in the area of nonpoint sources pollution control. The nonpoint source Subcommittee has developed and is currently implementing a tracking system for the implementation of best management practices. The agricultural BMPs are usually implemented by efforts of each soil conservation district. However, we also have regulatory agencies for our stormwater and sediment control programs. For example, we want to be able to keep track of how many acres we're placing under good management practices and then complement this with monitoring results to see if the waters are indeed getting better. We also call on the Nonpoint Subcommittee to refine and oversee the use of runoff models. A great deal of technology transfer is going on among the Bay states. Pennsylvania is looking into co-generation of energy using manure. Some best management practices for nutrient management have been added to Pennsylvania's programs and are also included in Maryland's program. Stormwater control, which is a regulatory program in Maryland, is being picked up on by some of the other states. An interstate effort is ongoing to utilize a small amount of the federal funds for the construction of demonstration implementation projects for nonpoint source abatement. If our objective is to reduce phosphorus loads say in the spring from agricultural lands, we work cooperatively to figure out how to best utilize the available state and federal appropriations. Finally, we have an active speakers bureau where perhaps 150 or so people who are actively involved in this Bay cleanup effort go and visit various groups and talk about what we're doing.

I want to briefly describe some of the innovative aspects of our nonpoint source management programs in the Chesapeake Bay region. First of all, we have an intensive agricultural cost sharing program in Pennsylvania, Maryland, and Virginia. What I think is innovative in Maryland is that we have appropriated $22 million of State funds to get BMPs on farms in the State. We've also formalized our enforcement procedure. When the voluntary program doesn't work, we roll over to an enforcement effort.

I've already mentioned that Pennsylvania has put a great deal more emphasis on fertilizer and manure application rates as part of their agricultural runoff control program. They now added this and now it is as important or more important than the traditional soil conservation techniques that they have been promoting.

In Maryland, we are using state funds, as well as some of the federal implementation project funds we receive, to retrofit stormwater demonstration projects. We also have a new regulatory program whereby new development is required to control stormwater so that its downstream impact on stream banks and water quality is not any greater than it was before construction.

Virginia is using TV spots which show what the runoff looks like with and without no-till, using rainfall simulators. The spots have been very favorably received in Virginia. In Maryland, we are carrying on an educational program for protecting non-tidal wetlands. We have a regulatory program that deals with tidal wetlands. Perhaps Maryland's most unique program is a Critical Areas Commission which regulates land use and land management within a thousand feet of the Bay and its tributaries to see that the land management buffering capacity of this area is realized as much as possible. We do allow some development in these areas, but only under strict criteria which have to be followed and implemented by the local governments in their actions on zoning and building permit requests. The Critical Areas Commission has oversight authority if the local government doesn't do their job.

Finally, I wanted to summarize some of the management principles we've learned from our experience. First, we recommend a voluntary Agreement rather than a formalized Agreement. Secondly, a cycle of (a) research, analysis, and reporting, followed by (b) a period of some decisionmakng by the governments involved, and then (c) implementation appears to be

both necessary and desirable. Thirdly, it is important in working on Federal/ interstate nonpoint issues to have both formal and informal communication, and to compromise.

We need to get the results of what we're doing to the users. We have a very extensive educational program to do this.

We need to build in accountability. We've tried to do that with the structure we have. For example, the chairs of the Subcommittees are actually Implementation Committee members so we have that link between those two levels of the structure we've put in place.

Work on taking advantage of momentum when attention is being given to a water body needing improvement, move promptly because you may not always have that momentum, get people involved, and give them something to do. Also, use the political structure, know the role and interest of your Legislature, your Governor, and your county commissioners or county executives, create a piece of the action for them that is appropriate, and that gives them some visibility which they certainly welcome. This is not only true for our elected officials but for everyone. We have prepared a Baybook that can be used to promote implementation of best management practices by homeowners or small businesses with land. We are creating institutions whereby the private sector can make contributions to a trust fund, and then a board of trustees reviews projects proposals and uses these funds to undertake selected projects.

Finally, use human nature. Realize that conservation districts want to be somewhat competitive with each other. Farmers pride themselves on their operations. If they see another farm looking better, they hopefully will go back and spruce up their own farm. Neighborhood associations compete with each other for getting out the word on cleaning up areas.

Thank you for this opportunity to share our Chesapeake Bay experiences with you. I wish you well in managing nonpoint sources of water pollution in the Upper Mississippi Basin.

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Mr. McElroy has degrees in Civil Engineering from the University of Virginia and a M.S. in Sanitary Engineering from the University of North Carolina, School of Public Health.

Coordination of Upland Erosion Control and Habitat Improvement Projects

Lyle W. Asell
U.S. Soil Conservation Service

I. Erosion and sediment damages
   A. Familiar with problems caused by sediment
      1. Muddy water
      2. Lakes fill up
      3. Fish populations and fishing
      4. Farmland, crops, fences, road ditches are damaged or buried.
   B. Costs - offsite study
      1. $10 million annually recreation, fish and wildlife
      2. $8 million annual transportation
      3. $1 million annually municipal water
      4. $13 million annually sediment and impaired drainage cropland

      $32 million

II. Where we've been
   A. Iowa = Agricultural state, diversified
   B. 75 percent cropland - 2/3 of state in corn or beans
   C. Publicly owned land no buffer - sediment control usually begins on private lands

III. SCS is always coordinating with someone
   A. Individual farmer - contractor, etc.
   B. Water quality projects
      (All involve coordinating interests of funding groups and those of farmers)
      1. DNR - DSC
      2. EPA
      3. Cities
      4. Drainage districts
      5. County Conservation Boards
      6. Watershed Boards
   C. We know they work
   D. Policy on P.L. 566 - 75 percent
   E. May not be able to cleanup Mississippi
   F. We can prevent future Elk River Deltas 50,000 ac - 1950's vs 1970

IV. Browns Lake - backwater in pool 13, outlet of Smith Creek
   A. Jackson County - 680 acre Browns Lake
      Quick tour - The way it looked last week - 3,050 ac ws
   B. Upland - roughly 50 percent cropland, most on 5-14 percent slopes, about 1/3 controlled.
   C. Mid Point - mainly woodland and pasture, dendritic drainage, valleys and steep 14-40 percent slope, limestone outcrops
   D. Bottom - little cropping, Smith Creek Delta

Proposal

A. Strip Cropping, Conservation Tillage, Contouring, Terraces, Basins on cropland - (state cost share and farmers.) Installation costs $357,000.

B. 16 grade stabilization structures and 1 wetland at lower end. (EMP) Intallation costs $385,000, Total = $742,000

C. About 90 percent control - No detailed studies made - heavy FSA workload. Similar watershed - Whiskey Hollow, 85 percent control.

D. Other benefits - soil resources, wildlife habitat, water quality.

1. Analysis in North Cedar Creek shows:
   A. Each ton of erosion in uplands is equal to $.67/ton in terms of recreation on the trout stream.
   B. Each ton of erosion on woodlands in the uplands is equal to $1.30/ton in terms of lumber and firewood production.

C. Each ton of erosion on cropland in the uplands is equal to
   $.99/ton - depletion
   $.79/ton - ephemeral gully
   $.66/ton - annual sheet and rill erosion damage
   Each ton of animal waste eroded to stream is equal to $3.41/ton in terms of water impurement.
D. Each ton of streambank erosion is equal to $1.65/ton in terms of recreation benefits to trout streams lost.

We do have opportunities to reduce erosion and control some sediment damage through the 1985 Food Security Act. As you're well aware, it has some fairly massive conservation provisions that will stretch our resources to implement. Without a doubt, it will have a positive impact; however, it is not the total solution. Again, in Smith Creek, 28,000 tons are eroded annually with 11,200 tons delivered to Browns Lake. Delivery from gullies are fairly efficient so some structural measures will be necessary to control them and strain out sediment from uplands.

One positive impact coming from CRP is the interest by farmers to do something for wildlife. They are willing to modify seeding plans, plant trees or shrubs or locate CRP areas that maximize wildlife benefits. This interest is usually stimulated by working with them through the planning process; unfortunately, we often have time for only the essentials, so the opportunity is lost.

Conservation easement provision of the FSA may also have application where FmHA has inventory farms. Draft rules are out and should be reviewed in light of multiple resource benefits.

You're all familiar with the various stages of project planning.
1. Wild enthusiasm
2. Disenchantment
3. Total confusion
4. Search for the guilty
5. Punishment of the innocent
6. Promotion of non-participants

If we do things right we can avoid most of these stages.

I've been around projects in Soil Conservation for 21 out of my 29 years and feel that there are a few basics we always need to look for.

Most important in any good relationship, to be successful, you must have communication. Communication is more than setting around talking to each other; there must be an understanding of the other parties objectives, what they want to do and what they can do. We all have more rules to live by than we care to. However, we need to have an understanding of what those rules are and how they effect us and those we are working with.

In Federal Service we're also very much aware of the problems with budgets and the need to set our priorities as individual agencies and as cooperating groups. There are definite opportunities to coordinate and cooperate on some projects, but not all. Where we can cooperate, we should. Where we can't, we should know before committing a lot of time. Is there a need for some kind of a group to develop criteria to serve as a basis for decisions on cooperative projects?

For my standpoint, I prefer simplicity, I don't like long hairy analysis so that you plan a project for 10 years before you decide it can't be done. Are there some ways we could establish rules on expediting projects up to a certain funding level?

I think we need to look at what level of protection is desired. Smith Creek for example, we provided approximately 90+ percent level of protection. In many respects that is probably unrealistic. What level is acceptable? Is it 80 percent, 75 percent, 50 percent? When you're pricing out a project like that, it makes a lot of difference.

How can we use technology to help us in our assessment and in developing priorities? We will soon have the capabilities of digitalizing soils rapidly and gathering erosion information over laid over soils, this could provide us with a very handy tool in analyzing alternatives.

How do we value the backwater areas along the Mississippi? It's hard to replace an acre of marsh land. I don't think we can put it in terms of acre feet of volume of water stored in those areas.

What role can private groups play in this whole arena? We've seen in the Conservation Reserve program where they have supplied additional funds to participants as an incentive to seed warm season grasses. We use a lot of volunteer assistance in SCS anymore. Is there a potential for a volunteer to gather some of the data that we need in coming up with some of these decisions?

It always comes down to what is the problem or opportunity, how bad do you want it fixed, and who will pay for it. The mission of the SCS is resource protection, primarily soil. We feel, there are opportunities to control erosion and benefit other resources along the Mississippi at the same time.

Lyle W. Asell has been the Area Conservationist for twenty counties in Southeast Iowa since 1983. From 1981 to 1983 he was the Southern Iowa RC&D Coordinator at Creston. From 1972 to 1981 he was a Biologist on the Water Resources Planning Staff. Prior to that he served in Lucas County as District Conservationist, and in both Montgomery and Jasper Counties as Soil Conservationist.

Mr. Asell graduated from Iowa State University in 1966 with a B.S. in Fish and Wildlife Biology.

The Whitewater Conservation Project

Arthur S. Hawkins, Jr.
U.S. Fish and Wildlife Service

Abstract

In 1987, the U.S. Fish and Wildlife Service initiated a pilot project to pool its resources with those of other public and private organizations interested in reducing soil erosion and sedimentation. The Service is collaborating with the three Soil and Water Conservation Districts that overlap the Whitewater Watershed in Southeastern Minnesota to 1) assist farmers in developing conservation plans that specify erosion control measures and implementation deadlines; 2) promote retirement of marginal, erodable lands through the Conservation Reserve, the Reinvest in Minnesota Program or long-term conservation easements; and 3) encourage adoption of Best Management Practices leading to the establishment of wildlife cover while measurably reducing sediment delivery from the 40 square mile target drainage area. The Soil Conservation Service, the Geological Survey, the Minnesota DNR and the University Extension Service, as well as other organizations are joining forces to make the pilot project a success. If significant improvements are documented, additional resources will be sought to expand the cooperative effort to other erosion-prone watersheds along the Upper Mississippi River.

Introduction

The Upper Mississippi River National Wildlife and Fish Refuge is the longest, most intensively used and perhaps the most difficult to manage refuge in the continental United States.

It runs 260 miles, from near Wabasha, Minnesota and Nelson, Wisconsin to just north of the Quad Cities in Iowa and Illinois. It encompasses about 200,000 acres of wooded islands, running sloughs and backwater marshes. About half the land we manage is owned by the Corps of Engineers, and we are legally mandated to coexist with navigation. There are about 280 boating accesses to the refuge, an average of over one per mile of river, and we administer only 10 percent of them. With an estimated annual visitation of three million and a permanent staff of 30, you can imagine how thin we're stretched.

Superimposed on an already complex situation, is the pervasive problem of soil erosion and sedimentation. During the 1970's, an interagency Great River study lead by the Soil Conservation Service estimated that the backwater marshes, created in the 1930's when the Locks and Dams were built, had a life expectancy of from 50 to 200 years. This was especially bad news for migratory waterfowl. Many species have been displaced from traditional habitats to the river corridor, especially in farming areas like Iowa, where 99 percent of the state's original wetlands have been drained.

The number one priority in our refuge master plan, which is just being completed, is water quality. Water quality is directly threatened by erosion and sedimentation. Water quality degradation eliminates essential habitat for aquatic plants and animals. The Fish and Wildlife Service is responsible for maintaining habitats. Our refuge master plan consequently calls for increased funding and staffing for off-refuge work in farming areas surrounding the refuge to stem the tide of sediment at its source. Through 1989, the FWS is providing $50,000/year and half of my time to develop a pilot erosion and sedimentation control project on Southeast Minnesota's Whitewater Watershed.

Valley History

I'd like to start out with a little historic background on the Whitewater. Two hundred years ago, the first explorers, soldiers and colonists to make their way up the Mississippi and its tributar-

ies saw this country as it had existed for eons. They saw magnificent bluffs and wooded valleys; pure, free-flowing streams with peaceful Indian villages on the banks. The Dakota called this tributary, Minneiska, meaning Whitewater.

The Dakota couldn't have foreseen the coming transformation of their land. It would take little more than a century for agricultural and industrial technology to do its work. They must have been impressed by the marvels, but I wonder if they had the same queasy intuitive feelings we do about future consequences.

The process began simply enough, with the addition of some new grazing animals and crops that went a step beyond the corn and squash first domesticated by the Dakota's ancestors.

The land clearing, known today as deforestation in the tropics, was done with axes and cross-cut saws. Eventually, most of the prime timber was cut clear up to the Canadian Border. The saw logs were floated down the St. Croix and the Mississippi. Huge brush fires finished off the region's original primeval forest. After the woodland was cleared, wheat became the crop of choice. It was grown both for local milling and for export to the big cities that were springing up everywhere. Soon, the steam engine revolutionized wheat farming with the development of the threshing machine. Farms grew and markets expanded. Marginal lands were opened up to increase production. And the proud Dakota were relegated to the reservations.

By the late 1800's, Winona had become the third largest city in Minnesota. Logs were floated here, processed at lumber mills, and shipped to growing industrial centers for construction of homes and businesses. Grain came down to Winona in wagons from the nearby Whitewater Valley to be shipped by barge or rail to the cities to feed an exploding population.

The settlers -- our ancestors -- were hard-working, religious people. Their biblical mandate was to be fruitful, multiply, and subdue the earth. Well, they did. And we can't blame them for overdoing it. Environmental ethics and laws came later. After they learned some hard lessons.

Pastures and then croplands climbed the steep slopes of the Whitewater Valley. Gradually, the Valley was transformed like the more level plains surrounding it. The town of Beaver and others like it grew and prospered on the banks of the Whitewater. They were becoming trade centers for local farmers by the late 1800's.

By 1912, changing land use was affecting runoff on the Whitewater. The towns along its banks were being innundated several times each year. Eventually, 15 feet of fresh sand and silt was deposited over the bottomlands. Only the lofts of the barns could be seen protruding from the dirt. Towns like Beaver and Whitewater Falls had to be completely abandoned.

The connections were becoming obvious, even though it took 20 years for the full story to be published. Gullies had followed land clearing and cropping up the steep sidehills. Runoff and flooding had increased, driving families out -- a kind of personal tragedy we can only imagine, since few of us depend, to the extent they did, on an individual farm for an entire living.

During the 1930's and 40's most farms in the Whitewater Valley were abandoned. They were acquired by what is now the Minnesota Department of Natural Resources with Pittman Robertson funds using federal excise tax money from sporting goods. This enabled the farmers to relocate away from the floodplain. The dustbowl speeded this process, where eroded soils could no longer support crops.

Changes

Out of the despair of the dustbowl came a fresh vision for the future, a new conservation ethic. It was characterized by people like Dick Dorer. He was a militant steward on a crusade to protect the natural resources of southeastern Minnesota. After Whitewater State Park was established to protect the picturesque upper reaches of the river, Dorer and others worked to create the Memorial

Hardwood Forest and the Whitewater Wildlife Management Area, giving permanent protection to the lower Valley.

The Weaver Bottoms, a vast marshy backwater where the Whitewater empties out onto the Mississippi's floodplain, became part of the Upper Mississippi River National Wildlife and Fish Refuge. The refuge was one of the Izaak Walton League's first major conservation victories.

Gradually, the conservation program began to pay off. The forests returned to the steep sidehills.

Impoundments were created to capture additional runoff on the Whitewater's floodplain.

Wood ducks and other waterfowl species now thrive in the Dorer Pools.

The Whitewater became a blue-ribbon trout stream, with its own state fish hatchery and some of the best trophy trout fishing in the state.

Furbearers like beaver, muskrats and mink are again abundant and commercially important.

Wild turkeys are making a comeback in the Whitewater Valley and white-tailed deer are flourishing, along with an abundance of migratory songbirds that follow the Mississippi Flyway each year from their wintering grounds in the tropics.

Changes in farming practices following the dustbowl era have been largely responsible for the gradual return of the Whitewater Valley to a natural, healthy state. Conservation farming on upland fields, where runoff originates, is essential.

Grade stabilization structures have been established over the years to slow runoff and catch sediment. The grassy buffer and contoured fields around them help keep the small catch basins from filling up with soil.

Bill Sillman started out surveying farms for conservation practices in the 1930's. He worked 38 years with SCS to see that the practices got established. As the first District Conservationist in the Whitewater Valley, he pioneered environmental education techniques to teach the children of farmers the devastating consequences of soil erosion.

Unfortunately, many important lessons have been forgotten in recent years. Some say we are witnessing the twilight of the family farm. Consolidation of farms by corporate interests more concerned with immediate profit than conservation for future generations has become increasingly common.

Contour strips have been taken out to make room for big machinery. There has been a tendency to maximize production at any cost.

Results of this erosion of values are now becoming painfully obvious. Lands that could be expected to replace an annual loss of 5 tons per acre per year of eroded topsoil are now losing sometimes 40 or even 80 tons per year.

Streambank erosion is again doing terrible damage to once-pristine trout waters, when there's no reason water can't be provided for livestock in ways that protect the water and all the living things that depend on it.

Lessons for the Future

The devastating and costly effects of flooding on the Whitewater and other Upper Mississippi tributaries are again reminding us of the consequences of increasing agricultural production at any cost.

The little town of Elba, the only settlement surviving today on the Whitewater's banks, is once again threatened. Recent high flows are eating away the dike that protects it. One more good flood, and Elba could be history too.

Today, a huge volume of silt can be seen from the air, emptying at the mouth of the Whitewater into the Weaver Bottoms. The fine sediments cut off light needed by submerged plants and fill in the marsh.

But an even more severe sedimentation problem in recent years has developed on

the opposite side of the Weaver Bottoms, where sandy bedload from the Mississippi River has been spilling through side channel openings during high flows. It has spread across the Bottoms, forming sterile deltas.

Together, these fine and coarse sediments are choking off the Mississippi's backwater marshes that are so critical for fish and wildlife habitat. Eventually, mud flats appear, stranding fishing boats.

This eliminates shallow water areas that recently supported Saggitaria - arrowhead - or duck potato, which produces tubers on its roots that are preferred food of 10,000 tundra swans that stop to refuel each fall on the Weaver Marsh before continuing to Chesapeake Bay for the winter. Wild celery plants also produce a starchy tuber. This food source attracted 20,000 canvasback ducks to Weaver Bottoms two years ago. The canvasback has been on the decline and feeding and staging areas on the Mississippi are irreplaceable.

The filling in of backwater areas threatens to eliminate hundred of thousands of hours of outdoor recreation opportunities each year if something isn't done soon. There is also the related issue of sediment-transported contaminants that can render the fish caught unfit to eat.

The Locks and Dams that were built as stepping stones for navigation during the 1930's aggravate sedimentation problems by slowing the Mississippi's current, allowing much of the material entering the backwaters to settle out. Before the reservoirs were created, the swift current kept much of the sediment moving, flushing it away downstream. On the other hand, before the dams were built, there was far less rich, marshy backwater habitat for fish and waterfowl. Our objective on the refuge is to develop the management capability to extend the life of the Weaver Bottoms and other backwaters decades, perhaps even centuries, beyond their normal life expectancy.

Here are changes in vegetation on the Weaver Bottoms over the past fifty years, mapped by St. Mary's and Winona State Colleges during the Great River interagency studies, conducted in the late 1970's. Marsh plants marked in green flourished soon after Lock and Dam 5 was completed, just downstream from Weaver, backing up additional water. The plants were scoured out by major floods in the late 1960's, and turbidity from wave action has prevented their return.

Here are the main elements of a project recommended by the Great River Environmental Action Team to restore habitat in the Weaver Bottoms and prevent further degradation. It is the first pilot effort to make large-scale improvements to degraded backwaters on the Mississippi, or any other river of this size, that we know of.

The Whitewater Connection

The Corps of Engineers is presently completing the project shown on the map, at an actual cost savings due to the increased storage capacity for dredging over the next 40 years. Previously dredged material will be taken from the yellow areas to fill the green breaks in the natural levee following the river and also to create several large habitat islands to break wind fetch and provide waterfowl nesting cover.

Here are the anticipated improvements. Notice that the last objective calls for monitoring off-site impacts. This is the tie-in to the Whitewater Project, which is designed to protect our investment on the Mississippi.

Here are some shots of the Weaver Bottoms project under construction. Riprap is hauled by truck to stabilize low cross-dikes designed to be overtopped in a flood. Here a dredge borrows sand and pipes it under the main channel to fill a closing structure. Openings were left to allow boat passage.

The last several slides in my presentation today illustrate some of the things we hope to accomplish up the Whitewater Watershed. The slides are borrowed from the SCS files in the District Offices, since our project is

just beginning and it will be next year before we can document some results. Gene Kalmes, chairman of the Winona County Soil and Water Conservation Board is here today with some of the other Supervisors. The Boards in Winona, Olstead and Wabasha Counties are developing a memorandum of understanding to guide pilot project implementation. Our Fish and Wildlife Service Cooperative Agreement will provide reimbursement up to $40,000 this year for the Boards' expenses in targeted farm conservation planning, reduced input minimum tillage demonstrations, and other expenses associated with monitoring and practice establishment. Another agreement with the U.S. Geological Service is being developed to establish basic monitoring needed to evaluate the Whitewater Project's success.

Conservation tillage is an important part of the strategy for erosion and sedimentation control. However, it has to be done right to avoid contaminant problems. This specialized planter puts the seed right in with the stalks of last year's crop and the residue helps slow runoff. Here, Charles Loggins, Winona County's second District Conservationist -- he has been there 13 years -- is inspecting crop residue to make sure the protective cover is adequate.

The University of Minnesota's Agricultural Extension Service has entered into a contract with the Districts to provide conservation tillage demonstration sites in the Whitewater area, where inputs are carefully regulated and outputs are monitored to help local farmers objectively evaluate results and compare methods. Data obtained will be incorporated into a systematic educational program involving field days and tours, town meetings, and publications. If additional funding and cooperation from other agencies can be obtained, we hope to also obtain data on chemical movement into groundwater.

Here are some nice contour strips on Gene Kalmes' farm, and conservation plans will call for re-establishment in areas where contouring has been removed. There may also be some terracing, grade stabilization and pond creation, and tree planting. Whenever possible, practices will use ASCS cost-sharing to facilitate implementation. The next sign-ups for the Conservation Reserve and the State Reinvest in Minnesota Programs are expected to significantly increase an already substantial acreage of marginal, erodable land being set aside under rental agreements. This series of old slides reflects what happened after the dust bowl, during the soil bank years.

The Whitewater River itself needs bank restabilization and restoration of trout habitat on many degraded stretches. Livestock need to be fenced out of these areas. Chemical contaminants in runoff should be regularly monitored.

Although our project is being set up to look for changes in sediment discharge resulting from a range of erosion control strategies prescribed through farm conservation planning, we would like to incorporate contaminant analysis through an arrangement with the State Pollution Control Agency or the Environmental Protection Agency.

This is the closing of a sinkhole. These are not as common in the Whitewater Watershed as they are in watersheds to the south of us, but we have the same fractured limestone that allows seepage of agricultural runoff to contaminate groundwater. We are fortunate to have the Land Stewardship Project based in Winona County. They are doing water quality educational programs and are establishing conservation demonstration farms in the five-county surrounding area. We are hopeful that some of these farms will be located in the Whitewater Watershed.

Our Steering Committee, comprised mainly of local farmers and agency or organizational representatives that have a stake in soil and water conservation, will be meeting in July to set work priorities for the rest of this year. We are all interested in permanently establishing practices that will sustain profitable, productive farming while maintaining a quality natural environment with all the associated human benefits.

We are confident that improvements throughout the Watershed will cumulatively yield lasting benefits for Weaver Bottoms and other Mississippi River Backwaters. If we can show significant improvement on the Whitewater by 1990, we will attempt to apply what we've learned here to other cooperative watershed projects. Eventually, perhaps, the changes we are seeking will become pervasive enough to really get erosion and sedimentation under control.

Arthur S. (Tex) Hawkins is Fish and Wildlife Conservationist at the Upper Mississippi River National Wildlife and Fish Refuge in Winona, Minnesota. He has been with the U.S. Fish and Wildlife Service for ten years, mostly working for the Minnesota Valley National Wildlife Refuge and Recreation Area. Prior to that, he spent seven years as Regional Naturalist with the Minnesota Department of Natural Resources.

He served as a Peace Corps volunteer where he conducted Costa Rica's first field survey of tropical dry forest wildlife and promoted the establishment of conservation programs. He has served as guest instructor for the Costa Rican National Park Service, led master planning teams through the U.S. FWS International Affairs Office and at Braulio Carrillo National Park in Costa Rica, and served as guide for the U.S. FWS Inter-american Refuge Management Training Course.

Mr. Hawkins has degrees in wildlife biology and mass communications from the University of Minnesota. He conducted field research with the Kleberg Foundation and Texas A&M University in the early 1970's.

The Importance of Habitat Restoration in Nonpoint Pollution Control

Don Roseboom
Illinois State Water Survey

The Upper Mississippi River and its associated backwater lakes are heavily impacted by nonpoint pollution. Sediment delivery from large streams and rivers fills the lakes with sand and silt, while increased nutrient levels cause dissolved oxygen levels in the remaining water to rapidly decrease during summer months. These symtoms of river impairment are severely impacting the Illinois River, a major river system of the upper Mississippi River system. While literally billions of dollars are spent on controls of point pollution sources and storm water overfalls in Chicago and river cities, nonpoint pollution is rapidly destroying the water bodies, which point pollution expenditures are designed to protect.

Nonpoint pollution expenditures are aimed at relatively small watersheds (10,000 to 20,000 acres), which lie above lakes and drinking water impoundments. Cost justification of applied nonpoint pollution practices is often based upon losses of real estate value of lake side property and the increased cost of drinking water production. However, the vast majority of nonpoint pollution sources and land do not lie above lakes and impoundments in Illinois. If nonpoint pollution controls are to gain the same levels of effectiveness that point pollution controls have achieved, then low-cost practices must be developed which can be applied over an extremely broad area. Will the practices applied to the 20,000 acre watershed above a lake be effective in controlling sediment delivery to large streams and the backwater lakes of major rivers of larger watersheds? Results from a five year study of a 62,000 acre Court Creek watershed in western Illinois indicate that such practices will not significantly reduce the delivery of sediment or nutrients to major river systems.

In Court Creek, the greatest increases of sediment in the streams came from unstable stream channels without protective riparian areas. Bank erosion during 1986 contributed 80 percent of the sediment yield from the watershed. The most unstable banks occur in downstream reaches of the stream valleys, which would lie under lake water when dams are constructed. Stream channelization occurs most frequently in these larger stream valleys, since the valley is wide enough to allow effective rowcrop cultivation. In smaller stream valleys, pastures are the dominant land use. In most cases the stream length in the larger valleys is shortened -- some reaches were shortened by 25 percent since 1940.

Channel erosion of floodplain rowcrop fields is very severe in the larger stream valleys. In a larger flood event (peak flows of 3,000 cubic feet per second) 20,000 to 30,000 tons of sediment will leave the watershed. One large bank erosion site can deliver 1,000 to 2,000 tons of soil during a single flood. The eroded bank soils enter the stream directly (100 percent delivery) when high velocity flood waters are likely to transport the sediment long distances. Aerial photographs reveal the loss of an entire rowcrop field since 1940. An average of 2,000 tons of soil per year for 40 years were delivered to the stream from this one bank site. As a result of this massive bank erosion problem, the dense sand particles have filled the deeper pools and covered the instream structure, while finer grain silt and clay particles were transported downstream.

The Illinois Department of Conservation (IDOC) is funding demonstration projects in the Illinois River basin (1) to decrease sediment delivery from Illinois River tributaries and (2) to restore instream and riparian habitat.

The Watershed Planning Program of the Division of Planning has begun stream restoration projects on Court Creek, which are designed to reduce bank erosion and sediment delivery to the Illinois River through methods which increase the extent of wooded stream corridors.

In the Court Creek watershed, the amount of sediment delivered from the 97.5 square mile watershed was compared with the amount of soil eroded from 10 large bank erosion sites along a 3-mile length of stream. During the 5 major storms of 1986, the bank erosion from 10 sites equalled 20 percent of the sediment delivered from the entire watershed (see Table 1). On one site 1,960 tons of soil were eroded during one storm. If only the clay and silt portions of the bank soils are measured, then bank erosion of silt and clay from the 10 sites equalled 16 percent of the watershed sediment yield during 1986. These major bank erosion sites occurred where streams had been channelized to maximize the size and uniformity of floodplain rowcrop fields. Unfortunately when stream length reduction occurs as the result of channelization, the speed of floodwaters is increased and massive bank erosion often results.

If there are 50 severe bank erosion sites in the entire watershed (a very conservative estimate), then the 10 monitored bank erosion sites would represent 20 percent of the bank erosion in the watershed. An estimate of the bank erosion contribution for the entire watershed can therefore be made by multiplying the contribution of the monitored sites by five. Since eroded bank soil from only 10 sites represents over 20 percent of the sediment yield in a 61,760-acre watershed, bank erosion could contribute all the sediment delivered to the streams from the entire watershed. However, sand represents a large percentage (15 to 40 percent) of eroding bank soils. Much of the sand transported by a stream is not sampled with a DH-59 sediment sampler. Sand is largely transported along the stream bottom as bedload, which lies below the sampling depth of the DH-59.

Table 1

Contribution of Eroded Bank Soils to the Stream Yield of a 62,000 Acre Watershed

	Soil (tons)	Silt and Clay (tons)*	Phosphate (lbs.)	Ammonia (lbs.)	Kjeldahl Nitrogen (lbs.)
Watershed Yield - 1986	28,129	28,129	79,555	6,948	109,862
Contribution from 10 Sites	6,424	4,648	9,358	704	8,929
Percent of Yield from 10 Sites	22.8	16.5	11.8	10.1	8.1
Percent of Estimated Yield from Bank Erosion	100	82.5	56.4	50.5	40.5

* Suspended sediment sampled was over 90 percent silt and clay.

This sand bedload is responsible for destruction of instream habitat for fish and macroinvertebrates in Illinois River tributaries. Sand fills the deep pools and covers the rocky rubble and woody structure, where gamefish such as smallmouth bass and channel catfish dwell and feed (Roseboom et al, 1986). The loss of this habitat in most of Court Creek and many other Illinois streams is responsible for decreasing populations of gamefish. Fishery biologists can select sites within any stream that will reflect the effects of good and bad instream habitat on gamefish populations. While point pollution will often destroy the fish populations of entire stream segments, nonpoint pollution will destroy portions of the stream populations by covering the habitat within segments of the stream. The proportion of poor instream habitat within the stream system determines gamefish populations within the stream, if water quality is not critical and fish populations are in balance.

Particle size analyses of eroding bank soils at the 10 selected sites allows the determination of sand inputs. Over 1770 tons of sand were eroded from only 10 sites. If these 10 sites represent 20 percent of the bank erosion, then bank erosion will contribute 8,800 tons of sand to the bedload. If the stream cannot transport these inflows of sand, then the deeper pools will fill and habitat will be buried. This loss of instream habitat is common in central and western Illinois streams with sand beds. Stream channel width at severe bank erosion remains constant while the stream channel erodes into the prime farmland along the floodplain. However, the prime farmland is replaced on the opposite bank with a sand and gravel bar. This process has been observed in the channelization floodplain segments of Court Creek where stream channels have moved 80 feet in four years.

If only the silt and clay portions of eroded bank soils are compared with the 1986 stream sediment yield, the 10 monitored bank erosion sites contribute 16.5 percent of the sediment yield from the entire watershed. If these 10 sites represent 20 percent of the bank erosion in the entire watershed, then bank erosion of silt and clay is equal to 80 percent of the soil transported by Court Creek during 1986. These eroded bank soils of clay and silt are delivered to the stream when high-velocity floodwaters are likely to transport silt and clay long distances offsite. This finding is very important if sediment delivery to the Illinois River is to be reduced from tributaries.

However, the high percentage of eroded bank soil introduced into the stream does not indicate that bank erosion is the only source of sediment in the watershed, only that the process of sedimentation is occurring as the streams overflow their banks onto the floodplain. Observations of sand deposits on stream border regions and silt deposits in floodplain rowcrop fields were always made after overbank streamflows, just as deposits of silt were visible in roadside ditches along row crop fields in the upland plain.

As a result of chemical analyses of the eroding stream bank soils, the contribution of bank erosion to the total phosphorus, total ammonia, and Kjeldahl nitrogen stream yields could be determined. Given the extent of bank instability found during stream surveys of Court Creek and its three tributaries, these 10 sites are not estimated to contribute more than 20 percent of the total bank erosion occurring during major storms. If the 10 monitored bank erosion sites represent 20 percent of the bank erosion in the watershed, bank erosion will contribute 56 percent of the total phosphate yield, 50 percent of the total ammonia yield, and 40 percent of the Kjeldahl nitrogen yield. This finding is extremely important if the eutrophication of Illinois rivers and lakes is to be limited by land management practices.

In Illinois and other midwestern states, the extent and severity of bank erosion on water quality has only recently been discerned. Evans and Schnepper (1977) estimated that over 40 percent of the sediment in Spoon River in western Illinois resulted from bank erosion along the Spoon River. Leedy (1979) estimated that over 50 percent of the annual sediment yield of Illinois streams resulted

from stream bed erosion. Using stream cross-sectional data, Lee et al. (1982) estimated that 50 percent of the sediment yield from the Blue Creek watershed in western Illinois came from the eroding stream bed. Through the use of an approved SCS field survey technique, Davenport (1983) estimated that only a small percentage of the sediment yield from the Blue Creek watershed resulted from bank erosion. Vagt (1982) estimated that 50 percent of the annual sediment yield in northern Illinois streams resulted from bank erosion. Hamlett et al. (1982) estimated that stream channel contributions of sediment to an Iowa stream represent between 25 and 50 percent of stream sediment yield. Sharpley and Syers (1979) found that stream bank erosion and resuspension of stream sediment contributed the major portion of annual sediment and phosphate stream yields.

Wilkin and Hebel (1982) estimated that only a small fraction of soil eroded from upland row crop fields actually reached an Illinois stream. The vast majority of instream sediment resulted from floodplain and valley bluff erosion. Only one very broad row-cropped floodplain with pooled floodwaters had evidence of sediment deposition. However, forested floodplain areas had very strong evidence of deposition. The forested floodplain had sedimentation rates of 10 to 20 tons per acre per year. Unfortunately, most floodplain areas were row-cropped with no forested areas positioned to decrease sediment levels in runoff. The active floodplain row crop areas had estimated erosion rates of 15 to 60 tons per acre per year.

In Knox County, the floodplains of streams no longer serve only as the sedimentation basins described by Fehrenbacher et al. (1977); instead the floodplains have become primary sources of stream sediment. Wilkin and Hebel (1982) and Jackson and Wilkin (1980) have identified the active floodplain as the principal source of instream sediment and nutrients. Fehrenbacher et al. state that the floodplains were forested bottomland during the thousands of years of alluvial soil development from sedimentation. Wilkin and Hebel found sedimentation occurring in forested floodplains and forested stream border bluffs. These conclusions have led to the present Court Creek project, which restores the wooded stream borders as the means of reducing soil erosion, decreasing the delivery of sediment to larger rivers and lakes, and increasing stream habitat.

The Illinois State Water Plan (Illinois State Water Plan Task Force, 1984) has determined that erosion and sediment control, flood damage mitigation, and aquatic and riparian habitat are critical water resource issues to Illinois residents. Lead Illinois agencies for each critical issue are the Illinois Department of Agriculture (erosion and sediment control), the Illinois Department of Transportation - Division of Water Resources (flood damage mitigation), and Illinois Department of Conservation (aquatic and riparian habitat). The State Water Plan describes the unquantified link between soil erosion and water quality as a difficulty in assessing the improvement of water quality by erosion control methodology. The Court Creek study is designed to illustrate the links between water quality and soil erosion in those watersheds, where high-velocity floodwaters destroy floodplain fields and stream habitat. Such watersheds are common in the Illinois River basin.

In the Illinois State Water Plan (Illinois State Water Plan Task Force, 1984), the Illinois Department of Conservation states that the losses of riparian habitat are a major cause in the aquatic resource degradation of Illinois streams. Techniques of stream restoration or renovation have been applied successfully in other states (Nunnally, 1978; Keller, 1976) in place of channelization. These methods promote runoff within the stream channel while retaining much of the woody vegetation and stream meanders. Drainage is enhanced by removal of trees, which are or soon will be large obstructions to floodwaters in the main stream channel.

Stream maintenance includes the removal of large trees on the stream bank, when such trees will soon be eroded into the stream channel. Such trees can be placed as tree retards along the eroding

stream bank to divert streamflow into the center of the stream bed. The conversion of a potential flow obstruction into a low-cost tree retarder is an old soil conservation technique (Lester, 1946), which has received added emphasis as a Palmiter river restoration technique (Willeke and Baldwin, 1982). The removal of eroding trees from the bank and from the stream channel should follow guidelines established by the Illinois Department of Conservation (IDOC, 1982) and the American Fisheries Society (1983).

George Palmiter has been hired by IDOC to test the application of tree retards in protecting stream banks along a three mile demonstration area of Court Creek. A series of three floods occurred during the fall construction period. Over that portion of the stream where construction had been completed, little or no bank erosion was observed. A more complete evaluation of the Palmiter techniques will be made during those floods, which occur after Palmiter finishes construction in 1987.

The floodplain farmers along the Palmiter 3-mile Demonstration area of Court Creek have given the Knox County Soil and Water Conservation District the conservation easements along a 30 foot border on both sides of the stream. Once the tree retards have collected sediment in their branches, willow cuttings and bald cypress seedings will be placed in the deposited sediment along the lower bank. Tree retards are viewed as low cost temporary structures, which will reduce erosion so that the willows and cypress can be established along the toe of the eroding bank. Additional trees as walnut, green ash, American plum, and gray dogwood will be planted along the upper banks. In this manner a wooded stream border will increase stream stability and increase game habitat. The tree retards introduce woody structure into the deeper waters along the eroding banks. Such woody structure has been covered by the sand eroded from stream banks. The loss of woody structure in deep waters is the primary cause in the declining gamefish populations of smallmouth bass and channel catfish in Court Creek and many Illinois River tributaries.

In the Court Creek watershed, major bank erosion sites and complete blockages of streamflow resulted when large trees were uprooted and fell into the stream. Even streamflows resulting from a 3-inch rainstorm did not dislodge these trees. Such occurrences are the major reason that floodplain landowners do not readily accept "green belts" of trees along streams. Only with an annual stream maintenance program will stream borders of woody vegetation be accepted by landowners.

The development of a locally supported stream maintenance program is essential to the success of any stream stabilization practice utilizing riparian woody vegetation in agricultural floodplain areas. The effectiveness of the watershed demonstration efforts in promoting widespread application of such practices will largely depend upon the development of methods to foster locally funded stream maintenance programs.

Under the Watershed Planning Program of IDOC, the Knox County Soil and Water Conservation District has formed a stream maintenance crew. The stream crew is working upstream of Palmiteer Demonstration area on a 19,000 acre tributary - North Creek. Since the fall of 1986, the crew has selectively removed major logjams along a 4 mile stream segment. In addition, 2000 trees have been planted along the North Creek stream border, after the District received permission from agricultural landowners.

In conjunction with a joint effort between IDOC and the Soil Conservation Service (SCS), the District crew has performed two Conservation Field Trials on North Creek. These Trials utilize large size cuttings of willow to protect severe bank erosion sites. In one site 130 cuttings were placed with a hand auger along 240 feet of bank in July of 1985. In the second site this spring, 620 cuttings were placed along 800 feet of bank with a Caterpillar high-hoe and 6 foot ram. The ram allowed penetration of a rock layer, so that the lower 6 feet of the 12 foot long cuttings could be placed in the bank. The method is more expensive than the Palmiter method, since more trees are required to protect the same length of eroding bank.

The technique, utilizing willow cuttings as bank protection, has been successfully applied by the SCS along major streams and rivers in California and Arizona. During the fall floods of 1986, no erosion was found along the first trial site on North Creek, although upstream and downstream bank erosion sites lost thousands of tons. The durability of the bank protection should increase with time since dormant cuttings of willow will regrow roots and branches along the bank. Therefore a wooded stream border is rapidly established at severe erosion sites. At the same time more desirable trees - American plum, green ash, walnut, and red cedar - have been planted on the upper portions of the banks.

Bank sloping at certain severely eroding sites may be necessary, however, more expensive alterations of the technique will only be attempted if less expensive methods have failed. The purpose of these demonstration projects is the development of low cost methods, which can be widely applied over a region as large as the Illinois River basin. Only in this fashion can local landowners and local government support such projects. Indeed even state and federal agencies do not have the funding necessary if structural techniques are to be applied over such a large area effectively.

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