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Fact Sheet no.1: Nonpoint Source Pollution and Water Quality of Northwest Arkansas

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Preservation of a clean, safe, and biologically diverse environment can capture public attention as few other issues can. Indeed, recent international cooperative efforts indicate that there is an increasing global desire to pass on to future generations an environment at least equal in quality to the one we inherited.

The possibility of a threatened environment touches everyone on a very basic level. It may be natural, then, for environmental issues to have a strong emotional dimension. It should be remembered, however, that environmental issues are largely science-based subjects. It is through the objective acquisition and application of knowledge that we are able to discover how we influence our environment, and this approach will lead to acceptable solutions when needed. Sound scientific information — not emotional reactions or isolated statements presented out of proper context — should provide the basis for policy decisions that impact the environment. This fact sheet is written for Arkansas citizens to present and discuss some of the issues related to the quality of the state's water resources. This fact sheet emphasizes the situation in Northwest Arkansas because of traditionally high interest in the water resources of this rapidly developing region. Most of the points raised, however, are equally applicable to other regions of the state. It is the authors' hope that this fact sheet will provide the readers with an understanding of the issues, the challenges, and the ongoing scientific and other efforts related to maintaining the high quality of the state's waters.

Nonpoint Source Pollution

In the U.S. Environmental Protection Agency's 1989 report to Congress, agricultural nonpoint source pollution was identified as the single largest source preventing accomplishment of the nation's water quality goals. Nonpoint source pollution (NPSP) is pollution which occurs when surface runoff carries substances from the origin of the runoff into receiving streams, rivers, and lakes. Ground water can also be affected by NPSP since water moving through the soil can carry dissolved materials to underlying aquifers. Nonpoint source pollutants include eroded soil, organic material, plant nutrients, microorganisms, and pesticides. These substances may originate from commercial fertilizer, septic tank effluent, urban runoff, animal waste, and other sources. With the exception of pesticides, however, all of these potential pollutants are also present to some degree under natural conditions. Therefore, runoff and ground water in regions unaffected by human activities will contain "background" levels of pollutants. It is sometimes difficult to distinguish between these background levels and amounts present due to human influence.

In comparison to point source pollution, NPSP is very hard to predict and assess. Point source pollution originates at specific locations, and it is usually possible to determine how much of the pollution is entering the environment. Municipal sewage and industrial effluent pumped through a pipe into a river are familiar examples of point source pollution. NPSP, in contrast, originates from broad sections of the landscape. NPSP depends strongly on local weather conditions, making it difficult to predict both the occurrence and amounts of pollution entering surface and ground waters. Influential variables such as geology, soils, topography, and rain storm intensity make it even more challenging to predict NPSP. It is usually impossible to identify specific sources of NPSP because the contributing landscape often has a number of different land uses and other factors (geology, soils, etc.) which affect NPSP. Since NPSP is a natural process that cannot be prevented, the goal of zero discharge (in other words, no pollutants entering the waters) from nonpoint sources is unattainable.

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Land Use and Water Quality

As noted earlier, NPSP is a complex function of many variables. For a given location, however, amounts of NPSP are directly related to land use. The quality of water in wilderness areas is usually higher than water originating from agricultural and urban watersheds. Within an agricultural or urban area, the quality of runoff and ground water depends on how well the land is managed. The Arkansas Department of Pollution Control and Ecology (ADPC&E) incorporated this concept into an innovative regional classification system that recognizes the dependence of water quality on human activities (land use) as well as physical features. Six specific eco-regions in the state were identified based on the interaction between land use and resulting quality of regional waters. This classification system acknowledges that there are differences in water quality between regions such as the Delta and the Ozark Highlands and, more importantly, points out the importance of management both within and between eco-regions.

There is no question that materials such as animal manures, commercial fertilizers, and pesticides affect NPSP and water quality when they are applied to the land. The more important questions are: "How much NPSP is occurring?", "How important are these amounts?", and, "What can be done to minimize NPSP if these amounts are important?".

Assessing the Effects of NPSP on Water Quality

Nonpoint source pollution is a relatively new scientific area, and determining its impact on water quality is even more recent. Nationally, as well as in Arkansas, scientists are in the process of building monitoring programs and data bases to assess the effect of NPSP on water quality. NPSP effects are assessed by establishing standards for comparison, analyzing water samples from selected streams for the presence of pollutants, and comparing the results to the standards. If valid standards have been selected, this type of monitoring can indicate the degree to which the sampled waters have been impacted by NPSP. Well-designed monitoring networks can therefore help identify potential problem areas that should receive further attention. Unfortunately, monitoring is both costly and time-consuming because of the natural variability in NPSP and the need for long-term information and evaluation. In addition, even a good monitoring and assessment program has limitations because it is very difficult to attribute NPSP to a specific source when there is a diversity of upstream land uses. Typical NPSP monitoring provides an estimate only of how much NPSP is occurring at a particular monitoring station — it provides almost no information regarding the specific sources of the pollution.

The 305(b) Report and Water Quality of Northwest Arkansas

The document frequently referred to when discussing Arkansas' NPSP status is prepared by ADPC&E under Section 305(b) of the Federal Water Pollution Control Act. The Water Quality Inventory Report, commonly referred to as the 305(b) report, summarizes information gained from ADPC&E's monitoring program and provides an interpretation of the results.

In the 1992 305(b) report, a significant portion of the stream miles in the Ozark Highlands region of Northwest Arkansas was assessed as exceeding the standard for primary contact activities (for example, swimming, wading, and water skiing). This finding raises several valid questions regarding the degree to which the waters have been impaired, the extent of impairment, and the specific causes of impairment. Any monitoring program, however, will have limitations due to resource constraints and the inherent complexity of NPSP. These limitations must be understood and overcome, to the greatest degree possible, to effectively control NPSP.

One limitation of the monitoring program is the number of monitoring sites currently being operated. As discussed previously, monitoring is expensive. As a result, it has been necessary to monitor only a relatively small number of sites and to then extrapolate the results to larger regions. This type of assessment should be replaced with actual monitoring data to best understand the extent and amount of pollution occurring.

Another limitation of the monitoring program is the method being used to determine whether water is suitable for human bodily contact. The concentration of fecal coliform bacteria is currently the only water characteristic being used to assess the suitability of water for primary and secondary (incidental) contact activities. The presence of fecal coliforms implies potential pollution from human or animal waste. Fecal coliform bacteria are used as indicators of pathogens, and their presence in water has been related to human illnesses. The fecal coliform criterion is very common and has been used for several years in numerous states

and countries. As recognized in the 305(b) report, however, the fecal coliform testing procedure can also detect the presence of bacteria naturally present in soil. As a result, current fecal coliform testing methods do not indicate whether the bacteria originated from animal/human waste or soil, and this leads to uncertainty as to which pollution sources should be focused on to improve water quality. Refined testing procedures will be required before the specific origins of fecal coliform bacteria can be identified.

The 1992 305(b) report assesses water quality in the Boston Mountains and Ouachita Mountains eco-regions as being exceptionally high (near background levels), because the land use in these regions is primarily forest. The water quality of the Ozark Highlands region is second to that of the Boston Mountains and Ouachita Mountains eco-regions, but still high. Elevated fecal coliform and nitrate levels in some of the waters indicate that some water quality degradation has occurred, but this can be expected because of the relatively intense agricultural and suburban land use in the region. If we had a more extensive and better supported NPSP monitoring program, and if we were able to look 10 years into the future, this is *likely* what we would find regarding water quality of the Ozark Highlands: (1) most of the fecal coliform bacteria found in the waters will be identified as coming from animal wastes, (2) management practices such as applying animal wastes and commercial fertilizers when the likelihood of runoff is low will have significantly improved the quality of the waters, and (3) the stream miles evaluated as unsuitable for human contact will be substantially reduced because management practices will have improved and assessment monitoring will have been expanded.

Programs to Maintain High Water Quality

Many state and federal agencies are concerned with NPSP. Scientists at the University of Arkansas are studying impacts of NPSP with many of the investigations focusing on animal wastes. These studies have been undertaken to both assess the effects of NPSP on water quality and develop new technology that will help land owners and animal producers manage their resources in such a way as to prevent excessive NPSP and maintain the generally high water quality of the region. Some studies of this nature have recently been completed and indicate that the impact of land application of animal wastes can be markedly reduced simply by timing the application to avoid severe rain storms. Other studies are being conducted to assess the water quality effects of buffer zones, export of animal waste to the Delta for use in row crop production, incorporation of the waste, and other management options. Economic studies are also underway to identify management practices that protect water quality without causing undue economic hardship on agricultural industries.

Two very active state programs are being administered by the Arkansas Soil and Water Conservation Commission (ASWCC) and ADPC&E. ASWCC has a vigorous program for getting environmentally sound management practices implemented on agricultural lands, and ADPC&E is monitoring the state's waters as described earlier. Other state agencies such as the University of Arkansas Cooperative Extension Service are involved in disseminating the latest technology to the public. Federal agencies such as the USDA Soil Conservation Service and the Agricultural Stabilization and Conservation Service are also instrumental in providing direct technical and financial support to agricultural producers, and the U.S. Geological Survey is involved in ground and surface water monitoring activities.

Although management options for dealing with NPSP are being developed, institutional mechanisms for implementing this technology need improvement. For example, cost-sharing programs have traditionally focused on supporting production practices, and only recently has the shift been made to supporting practices that protect water quality. Changing the tax laws is another approach that might accelerate implementation of environmental technology. Voluntary adoption and dissemination of new technologies that protect water quality will require agricultural producers to be convinced that the adoption of these technologies is in their best interest. Dissemination of information on the relative profitability of management options and the importance of agriculture's role in water quality protection will be essential. The successful design of environmentally sound management practices must be coordinated with the institutional mechanisms developed to promote adoption. Successful NPSP programs will emphasize management, control at the source by implementation of appropriate technology, and, perhaps most of all, informal planning sessions between the agricultural producer and the resource manager to produce field-by-field farm plans that protect water quality.

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Summary

Nonpoint source pollution is a function of land use and can be managed by implementation of appropriate management practices. Arkansas is similar to other states in that there are areas where NPSP can be reduced. Management practices to reduce NPSP must be implemented as they are developed and shown to be effective and practical. There is a need for developing and evaluating innovative management practices. Practices aimed at reducing bacteria in water from animal wastes should receive high priority, because bacteria have traditionally received little attention in the context of NPSP. A substantial number of programs are currently being conducted to evaluate the quality of Arkansas' waters and to develop management practices that will maintain high water quality for future generations. However, significantly increased efforts and resources are necessary to deal with critical NPSP issues in a timely, effective manner. More detailed and comprehensive research and monitoring data are needed. Most importantly, unity of effort among the University of Arkansas, state and federal agencies, relevant industries, environmental groups, and concerned private citizens must be established and maintained.✦

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