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FOR ENGINEERING AND SCIENCE

Community/Expert Involvement in Developing a Total Maximum Daily Load (TMDL) Model

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Description

This in-depth case looks at the conflicts that arise in managing and reducing pollution in a community that is reluctant to be involved with government agencies. Ethical issues arise in the case as a result of the consulting engineer's dual role (as paid consultant and unpaid advisor to different groups), the community's suspicion and fear of regulators, the controversial data used to initiate the development of the model, and the bureaucratic nature of the process in which the TMDL was developed. The case was created by Kathryn A. Neeley, University of Virginia; Joseph R.

Body

and Teresa B. Culver. Used by permission.

Since the passage of the Clean Water Act, most efforts to improve water quality have been directed toward the management of point sources of pollution. As those sources have been brought under control, attention has turned to non-point sources, especially agricultural ones. A technology known as Total Maximum Daily Load (TMDL) modeling is being used to develop a comprehensive view of all pertinent activity in a given watershed and of how much pollution a given body of water can absorb without violating water quality standards. Once a TMDL is developed, a management plan is created in which the requirement to reduce pollution is distributed among the various sources of pollution, both point and non-point. Because the non-point sources typically are not subject to regulation, their participation in the management plan is voluntary. This means that community involvement is crucial to the development and implementation of the model and management plan. The courts and litigation have played a prominent role in spurring the development of TMDLs, which are often developed under the time pressures created by the strict schedules established by court orders or consent decrees.

This case describes the development of a TMDL for nitrate in a low-flow creek and river system that flows through a predominantly agricultural region and has a single point source (a poultry processing plant) discharging wastewater into it. The dominant culture of the local community is Mennonite, which means that it is not particularly open to outsiders and reluctant to get involved with government agencies. The case participants include two environmental engineers who were involved in the TMDL and interacted extensively with the community. One was a university researcher who headed the research team that created the model for the watershed; the other was an independent consulting engineer who played a dual role as (1) a paid consultant to the point source and (2) an unpaid expert advisor to the local Citizens Advisory Group.

Other significant parties involved in the situation were the poultry processing facility (point source) which had a business relationship with the large number of poultry farmers in the community. (Poultry farming and other agricultural activities originate almost all of the non-point source pollution in the watershed.) The state agencies charged with maintaining water quality and carrying out court orders

pertaining to the environment also played an important role in the case, as did the Citizens Advisory Group, which was made up of about a dozen citizens, many but not all Mennonites, who provided a focus for the expression of community concerns and who acted as intermediaries between the citizens and the state regulators. Ethical issues arise in the case as a result of the consultant's dual role and from a number of other factors including the community's suspicion of regulators, the uncertainty in the data and the science on which the need for the TMDL project was base[d], and the bureaucratic nature of the process in which the TMDL was developed.

Contents

Part I: Consultant Conflict of Interest

The consulting environmental engineer (referred to in the remainder of this case as "the consultant") worked as a paid consultant to the poultry processing plant, which is the point source of pollution in the watershed. This consultant, who is one of few environmental engineers in the watershed and the only one working as an independent practitioner, volunteered to work with the local Citizens Advisory Group to help them interpret the complex technical and organizational dimensions of TMDL development. For example, the consultant interpreted the environmental data that were used to determine the need for their particular TMDL and to understand the sophisticated modeling that a TMDL entails. The consultant also helped them understand the legal context of the TMDL program, the scientific and technical knowledge that gave rise to the TMDL program, and the role of EPA and state regulators.

The members of the Citizens Advisory Group, who were an informally selected sub-

set of the community, worked most closely with the consultant, whose services were highly valued by both the Advisory Committee and the community at large. The state regulators also saw the participation of the consultant as an asset to the process as he played an important and constructive role as an intermediary or liaison between the state and the community. Both the point source and the Citizens Advisory Group were aware that the consultant was providing advice to both parties.

- Was it proper for the consultant to take the voluntary position with the Citizens Advisory Group?
- Were there any pitfalls in the dual role that the consultant should have been on the look out for?

Part II: Expert Communication with Non-Experts

The nitrate TMDL was not the first to be undertaken in this particular watershed. One had previously been developed for fecal coliform bacteria. The community did not dispute the need for the coliform bacteria study, given that the concentrations of bacteria were almost continually above the water quality standard, often hundreds of times higher than recommended levels. In contrast, there were only a few small violations of the nitrate-nitrogen water quality standard, out of a fairly small total number of monitoring samples. Furthermore, the risks from elevated nitrate levels are poorly understood. Only a small percentage of the human population (the infants) is typically sensitive to high nitrates, and even then the response of each infant to nitrates is highly variable. The "acceptable" level of nitrate-nitrogen in drinking water has been set to be protective of the most sensitive individual. In addition to the uncertainty in what was an acceptable level of nitrate-nitrogen, there is always uncertainty in any computer modeling predictions. In this case, the relatively small set of nitrate-nitrogen measurements upon which the performance of the computer model was based only compounded the problem of model uncertainty.

The cumulative result of this set of circumstances was that the citizens were very uneasy about making decisions regarding an acceptable nitrate management plan based on the results of modeling.

- How should the research team have addressed this concern?

Part III: Expert Recommendation of Allocations

After the research team completed the calibration of the TMDL model, they presented 8 feasible allocation scenarios that would allow the watershed to meet the water quality goals. Their report also included an appendix that listed a number of extreme scenarios utilized in the model to establish upper and lower bounds. These extreme scenarios were not technically feasible in that they called for 100% reduction of various sources of pollution, a degree of reduction that is not attainable. To reduce the levels of nitrate-nitrogen, the research team recommended a scenario that called for a 35% reduction of the nitrogen discharged from the point source, which would be regulated, and voluntary reductions from the non-point sources ranging from 20-50%, depending upon the agricultural process involved.

At a subsequent meeting, the consultant recommended to the Citizens Advisory Group that they endorse one of the technically infeasible scenarios included in the appendix, which called for 0% reduction from the point source and 100% on the part of the non-point sources. The reasons stated by the consultant were that this scenario provided the greatest degree of flexibility and local control and the least amount of regulatory intervention in choosing how to manage the pollutants. He also argued that the point source was being unfairly singled out and that it had already decreased the amount of nitrates it released by a significant amount. The scenario that the consultant recommended gave the members of the community full responsibility for eliminating the pollution and gave none to the point source. The Citizens Advisory Group accepted the consultant's recommendation.

- In making a recommendation based on grounds other than technical feasibility, was the consultant acting ethically?

Part IV: Graduate Student Responsibility

A graduate student working on the research team attended the meeting at which the consultant persuaded the Citizens Advisory Group to accept the extreme scenario that gave them all the responsibility for reducing the nitrate levels. The graduate student was concerned that the interests of the citizens were not being protected. It seemed to the student that the consultant was unable to fairly represent the interests of both the point source and the farmers. In addition, the student worried that the farmers were unduly concerned with flexibility and retaining local control over the specific measures that they would use to reduce the nitrogen loads. From the student's point of view, it seemed that the citizens overlooked the fact that they were taking on the whole burden for remediation.

- What, if anything, should the student have done about these concerns?

Part V: State Government's Role in Choosing Management Plan

Following the recommendations of the researchers and the Citizens Advisory Group, the State Department of Environmental Protection (DEP) decided to accept the recommendation of the research team for a more balanced allocation of responsibility for reducing the loads, one in which the point source would have significant responsibility. Their main reason for rejecting the scenario the consultant advocated was that the 100% reductions it assumed were not technically feasible. The point source agreed to this decision with the understanding that their discharge permit would not be subject to re-examination before its expiration in 5 years. The Citizens Advisory Group also grudgingly gave their support to the DEP's decision with the understanding that they would have the option of using one of a limited number of similar scenarios if it later became clear that one of the other, relatively balanced alternatives would be more effective or less costly. The EPA approved the scenario the DEP recommended.

- Was the DEP's action proper?
- Were the interests of the public served by their decision?

Part VI: Decision Making in the Face of Uncertainty

One major factor in the decisions made by the citizens and the state was the deadline established by a court order related to the TMDL process. This meant that time pressures played a significant role in those decisions and the technical work on which they were based. After the EPA approved the recommended scenario, further research regarding nitrate leaching into the ground water called into question the plan's ability to protect ground water quality. The head of the university research team believed that the citizens would likely have chosen a different scenario if they had known about the effects of leaching, especially since the citizens seemed more concerned with ground water than surface water since the former was a significant source of drinking water in the community. The research team leader also felt that the pressure to meet the court ordered deadlines had caused the process to move forward without complete information.

- In light of time pressures like those described here, how should scientists and engineers go about meeting their moral responsibilities?

Contributor(s)

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Resource Type

Case Study / Scenario
Hypothetical / Fictional Case

Topics

Communicating Science and Engineering
Conflict of Interest
Ethics and Society
Governance
Research and Practice
Risk

Discipline(s)

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Research Ethics
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