GAPS IN WATERSHED ASSESSMENTS IN GEORGIA: OBSERVATIONS AND SUGGESTED CHANGES

Hillary M. Smith[1], David K. Gattie[2], Matt C. Smith[3], J. Victoria Collins[4], F. Wes Byne[5]

AUTHORS: [1]Research Engineer, [2]Assistant Professor, [3]Associate Professor, [4]Research Technician, and [5]Public Service Representative, Department of Biological and Agricultural Engineering, The University of Georgia, Athens, GA 30602.
REFERENCE: Proceedings of the 2003 Georgia Water Resources Conference, held April 23-24, 2003, at the University of Georgia. Kathryn J. Hatcher, editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. The University of Georgia Watershed Group began conducting State of Georgia mandated watershed assessments (part of the National Pollution Discharge Elimination System permitting process) in 1999. Since then, the group has conducted watershed assessments for small rural communities and highly populated urban areas. Based on these experiences, the group has identified problems in the watershed assessment process ranging from inconsistent standards for conducting the studies to generating public interest. However, the largest gaps are the result of problems associated with data collection and manipulation. As a result, the UGA Watershed Group offers recommendations for improving the process of future watershed assessments.

INTRODUCTION

Watershed assessments are now firmly rooted in Georgia's water policy as one approach to help identify and manage non-point source pollution. They have three main components; watershed characterization, watershed modeling, and watershed management. Many cities and counties throughout Georgia have been required to address watershed assessments as their National Pollutant Discharge Elimination System (NPDES) permits come up for renewal or as they plan for future development. While governmental agencies provide research-based guidelines for conducting watershed assessments, gaps in the process remain. These range from indistinct water quality standards and inaccessible data to stakeholder participation in improving watershed health.

OBSERVATIONS

The UGA Watershed Group has conducted watershed assessments throughout the State of Georgia for a range of clients from rural to urban communities. While each study presented different challenges, one common problem was the conflict of watershed boundaries with political boundaries. Since cities and counties in Georgia are required to conduct watershed assessments to obtain NPDES permits with little or no State or Federal funding, it is difficult, and often times impossible, to work beyond city or county limits.

Some counties and municipalities have joined together to conduct watershed assessments on a river basin scale. For example, the Alcovy River Basin Project was managed by the Northeast Georgia Regional Development Center and encouraged cooperation of environmental engineering consulting firms, counties within the Alcovy River basin, as well as State and Federal agencies. While this project approach has proven successful, it is not yet a common practice.

Gaps in Policy

Often there are gaps in the underlying policy (including economics) that governs the watershed assessment process. Wording may convey very general requirements, which allow for firms conducting watershed assessments to formulate individual plans of action. However, loose interpretation of requirements makes it difficult to compare results across projects. Since these assessments are being conducted on a city or county scale, continuity between projects is very important in order to compare results and management recommendations for adjacent areas.

Watershed assessments are financed entirely through local funds so city and county governments are required to pay for watershed assessments with no state aid. Loose interpretation of regulations and attempts to minimize costs could lead to bare minimum watershed assessments. Such studies would not be adequate to accurately determine management alternatives designed to maintain or improve future watershed health.

Gaps in Characterization

Characterization of a watershed includes watershed delineation, water quality analysis, biological (benthic macroinvertebrate and fish) assessment, habitat assessment, and collection of existing data (land use, climate information, pesticide applications, NPDES water quality data, etc).

The Georgia Environmental Protection Division has 12 digit Hydrologic Unit Boundaries delineated (10,000 to 40,000 acre watersheds), but these watersheds are often too large for analysis, especially in urban settings where the natural watersheds have been altered into paved drainage areas with substantially changed topography. Drainage areas in urban settings can be delineated using Geographic Information System software and topographic surveys, but often must be hand delineated before they can be converted to GIS format.

Water quality analysis has been an accepted measure for characterizing watersheds for many years. However, urban watershed assessments often necessitate the use of automated samplers to collect first-flush storm events. The automated samplers, while important in the collection of composite samples, can be difficult to operate and maintain without some training, taking up time and money.

Another problem with water quality sampling are standards. The standards for water quality criteria in Georgia are often set without regard to natural water quality of streams. This is especially evident with dissolved oxygen and fecal coliform bacteria criteria. Dissolved oxygen is believed to be lower than Georgia's standard in many streams in the Southern part of the state due to naturally slow flow and high organic content. Fecal coliform bacteria can occur in even "pristine" streams with little disturbance by man, thanks to natural processes of wilderness creatures.

Bioassessments are holistic assessments of ecological integrity that provide a view of stream quality over time. The fish and benthic macroinvertebrate communities present in streams are good indicators of pollution as sensitive organisms will not be present in historically polluted water. An important concept in bioassessment is that of the reference site. A reference site is generally in the same watershed as study sites, and is minimally impacted by human activities. The results from study sites are compared to the reference site to determine if the study stream has comparatively good stream health. However, reference sites are difficult to choose, because they must be "pristine" and have similar attributes to non-reference sampling sites. There is also an ongoing debate on how effective comparing results to reference site results. If the reference site is poorly chosen, the results of the bioassessment could be skewed.

By far, data collection presents the biggest challenge in characterization. Information necessary for conducting a watershed assessment includes soils, land cover, existing water quality (especially from NPDES permitted discharges) and maps. Data for large watersheds and river basins are available from the GA EPD and some are available for smaller areas at local regional development centers. However, these data are often not adequately site specific for the watershed models used in the watershed assessment process or must be converted to digital form to be useful.

The final problem with characterizing a watershed deals with continuity. While the State of Georgia has hundreds of water-related projects going on, there is no centralized database and that includes water quality, bioassessment, stream flow, and other related data. This gap in project continuity result in much of the work required for watershed assessment being repeated and makes correlating data very difficult.

Gaps in Modeling

Using models to predict the effects of future pollution on watersheds is an important part of planning for growth and new development in communities. However, the models that are available are often insufficient to conduct reproducible planning and management studies. The models require vast amounts of input data, which can be difficult to collect. Since all the inputs are required to run the model, assumptions are necessary, introducing subjective bias into the modeling process. Even with assumption-based errors, models are fairly good at predicting effects of pollution in that they usually produce expected results.

Another problem with current models is the availability of technical support from the developers of the models. Most of the models used by UGA's Watershed Group are developed by academic researchers who do not have the resources for efficient technical support, as would a software corporation.

The main problem with models is the incapability of simulating management practices on the watershed scales used in watershed assessments. Performance of individual management practices can be anticipated (or simulated by the model) at a local scale. However, models have yet to be developed that can simulate individual or groups of localized management practices.

Gaps in Watershed Management

The watershed management plan formulated for each area assessed is an essential tool for city and county planners as they prepare for development with the health of their environment in mind. A watershed management plan offers recommendations to city and county officials that will alleviate current water quality problems and will help prevent future problems. These recommendations are usually general, and tailored by city and county officials to meet the specific needs of their particular area.

Watershed management plans include developing programs to encourage public involvement in watershed-based decisions, ongoing water quality monitoring, and bioassessments. The importance of watershed management plans is echoed in policy governing wastewater treatment plant NPDES permits. Cities and counties are required to develop, adopt, follow, and document progress of the plans in order to receive NDPES permits.

Gaps that arise in watershed management often are due to difficulties engaging pubic interest in the watershed assessment process that makes implementing watershed management plans very difficult for city and county managers. Funding creates another gap in developing and implementing watershed management plans. Often, cities and counties lack the funds to implement the necessary management practices to improve watershed health. Although there are state programs that can augment funding, they are often inadequate.

RECOMMENDATIONS

From experiences conducting watershed assessments throughout the State of Georgia, the UGA Watershed Group has developed recommendations to address the gaps discussed in this paper.

Policy

The key component to improving watershed assessment policy is establishing standards that will facilitate continuity across projects. Of particular importance are, water quality sampling protocol, testing, and reporting, and bioassessment sampling, identification, and reporting. These components are crucial in the development of watershed management plans, as they indicate progress of implemented management measures. Having standard sampling protocol, testing, and reporting of water quality and bioassessments would allow the EPD, researchers, and planners to compare management measures and their success or failure for all watershed assessments.

Characterization

Many of the gaps in characterizing watersheds can be alleviated by improving the availability of data on a local level as well as a statewide level. Much of the data have yet to be converted to digital form. Of course, converting wastewater treatment plant water quality data and delineating urban watersheds would be labor intensive, but in the long run, it would save time and money on future local and state environmental projects.

New research will also help close some characterization gaps. For several years, researchers and policy makers have been supporting changing water quality standards to more accurately reflect background water quality, especially for fecal coliform bacteria and dissolved oxygen. Since these two parameters often contribute to streams partially or not supporting designated uses (and therefore making it a prime candidate for extensive and expensive environmental work) developing background levels could help de-list some streams in Georgia.

The final recommendation for improving watershed characterization is to further research of the reference site concept. This is important because the entire outcome of the bioassessment relies on the selection of the reference site. Research should be done that reevaluates the importance and applicability of using a reference site. While UGA's Watershed Group uses the reference site approach, results are also analyzed using raw data only. This is particularly beneficial when analyzing for the impact of land use on stream integrity. Another option for improving the bioassessment process would be to develop a regional database of reference site data that could make finding a reference site for every new watershed assessment unnecessary.

Modeling

There are several measures that should be taken to improve the process of watershed modeling and include continued research and improvement of existing models and the development of new models. Watershed models are making their way out of research institutions and moving toward local regional development centers, engineering departments, and utility departments. Unfortunately, many of the watershed models available are difficult to use in that capacity. Continual improvement of model user interfaces would greatly increase the usability of the models for local governments. Improving technical

support ranks right behind usability in importance for researchers and local governments alike.

Finally, continued development of the simulation component of watershed models is necessary if they are to be used as true management tools. Researchers and local planners need to be able to look at an entire watershed and simulate localized management practices they plan to implement to make the most efficient and effective decisions for the improvement of their environment.

Management

A watershed management plan utilizes all of the data collected and the results of the model to develop recommendations to improve watershed health. Local governments should address public education, since getting the public at large is often very difficult. A government's encouragement of environmental groups in their area and development of public education programs will greatly increase interest in watershed related issues. Funding is always a problem and is difficult to address. There are some funding options that don't involve dipping into the local funds, but they are often difficult to obtain. Local governments should look at the implementation and maintenance of watershed management practices as an investment that will save money and the environment in the future.

CONCLUSIONS

Watershed assessments are important environmental studies that directly affect the growth potential of cities and counties in the State of Georgia. It is therefore, important for problems associated with watershed assessments to be addressed to make them more cost effective and efficient at reaching the goal of improving watershed health. The problems and solutions mentioned in this paper are the major pit-falls identified by the UGA Watershed Group and, by all means, do not encompass all of the potential problems that arise while studying watersheds.

While there is no single solution to watershed assessment problems, a good start would be to follow the example of the Alcovy River Watershed mentioned previously and treat watershed assessments as what they are, studies of entire watersheds; watersheds that know no political boundaries. City, county, and State governments should seriously consider working together to improve streams on a watershed scale, which will lessen the impact of the gaps in watershed assessment.

LITERATURE CITED

Board of Natural Resources, 2001. "Water Issues White Paper." State of Georgia, Atlanta, GA.

Georgia Department of Natural Resources. 2002. "List of Waters (Partially or Not Supporting Their Designated Uses)." Environmental Protection Division (EPD), Atlanta, GA.

Georgia Department of Natural Resources. 1999. "Planning for Domestic Wastewater Systems." Environmental Protection Division, Water Resources Branch, Atlanta, GA.

Georgia Department of Natural Resources. 2001. "Rules and Regulations for Water Quality Control". Chapter 391-3-6. Environmental Protection Division (EPD), Atlanta, GA.

Northeast Georgia Regional Development Center, Team Alcovy website. <http://www.negrdc.org/Alcovy_Web/index.html>

Smith, H.M., D.K. Gattie, M.C. Smith, F.W. Byne. 2002. Watershed Assessment for Statham, Georgia. <http://watershed.engr.uga.edu/statham.html>

Smith, H.M., M.C. Smith, D.K. Gattie, F.W. Byne. 2002. Watershed Assessment for Valdosta, Georgia. <http://watershed.engr.uga.edu/valdosta.html>

Winger, P.V., P.J. Lasier, K.J. Bogenreider. 2000. "Bioassessment of Streams in Valdosta, Lowndes County, Georgia, June 2000". Athens, GA.