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Table of Contents

List of Tables and Graphics

Tables

Figures

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Ken Cooke, Program Manager

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Report Caveat
The Evolving Nature of Volunteer Monitoring Programs

As emphasized throughout this report, volunteer monitoring programs are continuously evolving — learning, reorganizing, expanding. Since we began researching the three southeastern statewide programs more than a year ago, we have observed changes, including shifts in their staffing, funding, quality control protocols, and educational and outreach strategies. In fact, developing a program that can be responsive to shifting political and social landscapes and technological advancements may be one of the most important lessons learned from these programs' 30 plus years of volunteer monitoring experience.

A case in point is KY WW. Its Web site is currently being redesigned and reorganized in conjunction with changes to its quality assurance protocols. It is important for the reader of this report to note that in the KY WW case study, we only cite those Web pages that are currently active; however, we have not attempted to revise the entire text to incorporate all the ongoing programmatic changes. We've concluded it is somewhat of a moving target and that if we continue to try to hit the bulls eye, we might never finalize this report.

One very exciting shift for the KY WW and its associated programs (e.g., KY Watershed Watch) that deserves mention is a recent draft document by the KY Division of Water on volunteer monitoring data uses. This document states:

> "At this time the agency will no longer preclude volunteer monitoring data as a sole source for use determinations, however, this change will require a greater emphasis on training, development of quality assurance project plans, certification of sampler participation in training and quality assurance review of sampling events" (KY DOW, 2004).

In this draft document, KY DOW defines specific modifications that KY WW must take to broaden how its volunteer monitoring data may be used. It also indicates the current trend of states to increasingly recognize the potential value of this type of data and to work with their volunteer monitoring programs to ensure that the uses of volunteer monitoring data are maximized.

EXECUTIVE SUMMARY

Background & Objectives

Volunteer monitoring has a long-standing history in the United States, and over the past two decades a growing number of states have used citizen monitors as a means of acquiring water quality data and promoting watershed stewardship and education. In United States Environmental Protection Agency (US EPA) Region 4, all the states excluding Tennessee and North Carolina currently have a statewide volunteer water quality program.

This report provides the results of research conducted by the Tennessee Water Resources Research Center on statewide volunteer monitoring programs. Its intent is to inform Tennessee decision-makers and other stakeholders so they may begin an earnest dialogue on the viability of initiating such a program in Tennessee. Our specific research objectives were to:

- compare and contrast three statewide volunteer monitoring programs in the Southeast, including surveying their volunteers on their perceptions of volunteer monitoring;
- identify Tennesseans' views on volunteer monitoring, and
- devise a set of recommendations, including if and how Tennessee should initiate and structure a statewide program.

Research Design

Our research was conducted in five phases. First, we reviewed literature on volunteer monitoring as a basis for the study. Second, we selected three southeastern, statewide, volunteer monitoring programs to analyze, compare, and contrast: Alabama Water Watch (AWW), Georgia Adopt-A-Stream (GA AAS), and Kentucky Water Watch (KY WW). As a part of these case studies, we conducted face-to-face interviews with each of the Program Managers and reviewed program Web sites and documents.

Third, we interviewed past and current volunteer monitors of the three selected programs to determine, among other things, their perceptions on the benefits and limitations of volunteer monitoring. The Social Science Research Institute (SSRI) at the University of Tennessee, Knoxville (UTK) conducted the survey through a computer-assisted telephone interviewing system. Those who were 18 years and older and who had provided both an address and telephone number to their programs were included in the samples. Following are the sample sizes (excluding incorrect and disconnected telephone numbers), response rates, and confidence levels we obtained for each of the programs:

- AWW: 269, response rate: 82 percent; margin of error is +/- 5.2 at 95 percent confidence level.
- GA AAS: 127, response rate: 73 percent; margin of error is +/- 5.7 at 95 percent confidence level.
- KY WW: 361 (drawn from KY Watershed Watch), response rate: 83 percent; margin of error is +/- 2.7 at 95 percent confidence level.

We analyzed data by and across programs and included descriptive statistics and cross tabulations to determine data patterns. In addition, we ran paired mean tests among the programs to identify significant differences in the perceived benefits and limitations of volunteer monitoring.

The fourth phase was to survey Tennesseans with a stake in volunteer monitoring. Due to the costs of obtaining a statistically valid sample for this potentially large population, we opted to obtain a sample that would give us an indication of Tennesseans' perceptions on volunteer monitoring. The survey questions were similar to those used for the three state program volunteers; however, this survey asked the volunteers to draw on their knowledge and experience with volunteer monitoring rather than only their direct participation. We distributed written surveys at the Tennessee Water Resources Symposium and at select watershed meetings across the state and via the World Wide Web. Notice of the online survey was sent to Tennessee Clean Water Network members. Eighty-seven hard and 72 electronic copies of the survey were returned.

The final phase of our research involved synthesizing and analyzing the above findings and then using them to develop a set of recommendations on if and how Tennessee should proceed on establishing a statewide monitoring program.

Case Study Synopsis

The case studies of the three programs, particularly the comparative analysis, provide valuable insights on the design and implementation of statewide volunteer monitoring programs. The bottom line is that there is no one way to structure a program; it depends on your intended outcomes. However, we found that there are certain benefits and limitations to certain structural and programmatic elements, and we drew upon these observations as we formulated our recommendations. Table ES-1 provides a thumbnail sketch of select aspects of each of the programs. KY Watershed Watch is included in this overview because KY WW staff now devotes nearly half its time to providing technical assistance to this statewide program. It is also the program from which we derived our KY volunteer monitor sample.

Survey Findings

AWW, GA AAS, and KY Watershed Watch Volunteer Survey

A typical volunteer monitor participating in one of the three programs falls into the age category of 35-64, has been involved in the program for more than two years, and has a college degree or higher. No predominant occupational background was found.

Following are highlights of their collective perceptions of volunteer monitoring.

- The benefits of volunteer monitoring far outweigh its limitations.
- The greatest benefits were related to the state programs' ability to educate and involve citizens. Greatest limitations to volunteer monitoring are a lack of sufficient funding and community support.
- Collected data is being used for multiple purposes, particularly for education and identifying ("red flagging") specific water quality problems.

In addition, volunteer monitors appear to be markedly satisfied with the support provided to them by their state programs.

Tennessee Stakeholder Survey

Tennessee respondents differed somewhat demographically from volunteers of the three programs—a situation likely primarily due to survey methodology. These respondents fell primarily in the 35-64 year age category, but as a whole were younger. There was a predominance of scientists and those in occupations related to the environment, which makes sense since our objective was to survey those with a stake in water quality. They also had a higher level of education.

Comparing Tennesseans' views to the collective views of the three programs' volunteers, we found:

- They tended to give higher ratings to both benefits and limitations of volunteer monitoring.
- They agreed that the benefits of volunteer monitoring outweigh its limitations.
- They agreed that the greatest benefits were increased awareness of water quality issues and increased community involvement.
- Although they agreed that a lack of sufficient funding could be a potential primary barrier to volunteer monitoring, they did not perceive that a lack of community support would be as much of a problem. Rather, more viewed volunteer monitoring being challenged by data credibility and related quality assurance/quality control (QA/QC) issues.

Recommendations

Our overarching recommendation is that Tennessee should become part of the national trend of initiating a statewide volunteer monitoring program. This is based on the literature, case studies, and surveys results. Nationally, particularly over the last two decades, states have continued to establish volunteer monitoring programs with United States Environmental Protection Agency's (US EPA) support. Moreover, state environmental protection departments are increasingly examining how volunteers can stretch their limited monitoring budgets and how data can be used in water quality reporting in addition to the more readily accepted and acknowledged benefits of educating citizens and fostering watershed stewardship. Locally, volunteer monitoring is also being touted as a means of meeting Clean Water Act (CWA) mandates including Phase II Stormwater requirements.

AWW, GA AAS, and KY WW clearly demonstrate that statewide programs can be sustained with proper planning, dedicated management, and a willingness to adapt to changing statewide needs and demands. From the perspective of their volunteers and from those in Tennessee who have an interest in water quality, survey results show that they believe the effort of establishing and maintaining a volunteer monitoring program is worth it: that its benefits outweigh ongoing challenges it may face.

Table ES-1: Case Study Synopsis

	AWW	GA AAS	KY WW	KY Watershed Watch
Institutional Affiliation	Auburn University, Department of Fisheries and Allied Aquaculture	GA Department of Natural Resources, Water Protection Branch, Nonpoint Source Program	KY Department of Environmental Protection, Division of Water, Program Planning and Administration Branch	KY Waterways Alliance (Nongovernmental organization)
Primary Program Delivery System*	Top-down	Community/organization-based	Community/organization-based	Basin-based, coordinated by State Intercoordinating Council
Main Funding Source	CWA Nonpoint Source Program funds (319)	CWA Nonpoint Source Program funds (319)	CWA Water Planning & Pollution Control Grant Funds (205j & 106) & State Executive Budget	Varies by basin (Federal, state & local grants; corporate/private foundations)
Monitoring	• Chemistry (field kits) • Bacteria (sample plated and results counted by volunteer) • Benthics	• Watershed/Streamwalk • Chemical (field kits) • Benthics	• Streamwalk • Chemistry (field kits) • Benthics	• Streamwalk • Chemistry (field kits and grab) • Bacteria (grab) • Benthics
Volunteer Support System	• AWW staff • Citizen volunteer trainers • Cooperative Extension	• GA AAS staff • Citizen volunteer trainers • State college and university system • Community/watershed coordinators • Cooperative Extension	• KY WW staff • Citizen volunteer trainers • State college and university system • Cooperative Extension	• KY WW staff • Citizen volunteer trainers • State college and university system • Cooperative Extension
QA/QC	• Region 4-approved Quality Assurance Project Plan • Volunteer certification	• US EPA Region 4-approved Quality Assurance Project Plan • Volunteer certification	• No approved QAPP • No volunteer certification required	• Overseen by basin level "Science Advisory Panels"
Data Management	• Microsoft Access™ database • Volunteer data entry on Web site • Real-time online graphic data feedback	• Microsoft Access™ database • Plans for volunteer data entry on Web	• Microsoft SQL Server™ • Volunteers enter data on Web	• Data provided to basin "data manager" • Sent to KY WW office to be imported into Environmental Systems Research Institute (ESRI) ArcView™
Data Uses	• Public education • Red flagging problems/remediation • Corroborate state water quality data • Basin planning • TMDL development	• Public education • Red flagging problems/remediation	• Public education • Red flagging problems/remediation	• Public education • Red flagging problems/remediation • Corroborate state water quality data • Basin planning

* A program using primarily a "top down" delivery system does not mean it does not work with groups to address local issues. The program simply does not have a predominance of groups with administrative structures to deliver the program locally.

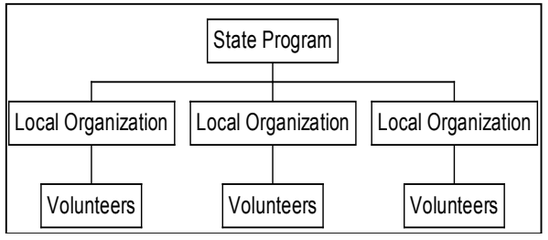
Our remaining recommendations address the structural and programmatic elements of initiating a volunteer monitoring program as well as elements that may help to increase the probability of long-term viability. Table ES-2 provides a summary of the primary topics covered in the remaining recommendations.

Table ES-2: Report Recommendations by Topic and Category

Structure	Programmatic Elements	Long-term Viability
S-1. Delivery System	P-1. Mission/Goals	V-1. Funding
S-2. Housing	P-2. Volunteer Support System	V-2. QA/QC
S-3. Membership/ Recruitment	P-3. Information Management	V-3. Volunteer Retention
S-4. Advisory Body	P-4. Outreach Strategies	

How should a Tennessee volunteer monitoring program be structured?

Recommendation S-1: The program should be administered by local organizations but should also be able to serve volunteers directly when no local oversight organization is in place**.**



Primary Basis: Tennesseans (81 percent) overwhelmingly stated that they prefer a program structure that will allow local organizations to administer a statewide monitoring program in contrast to a program that would solely provide direct support to its volunteers.

Recommendation S-2: House the state volunteer monitoring program at a land grant college or university and partner with the Cooperative State Research, Education and Extension Service (CSREES).

Primary Basis: Case studies demonstrate the following benefits to housing a program at this location including:

- Greater impartiality if not associated with a regulatory agency.
- Access to a greater range of fund-raising mechanisms.
- Options for more creative staffing.
- Greater access to state of the art resources including computer systems and laboratories.
- Cooperative Extension support of volunteer monitoring.

Recommendation S-3: Involve a diversity of citizen monitors and organizations with varying affiliation, a mix of science-associated professionals, and laypersons.

Primary Basis: Both the literature and the case studies demonstrate that a diversity of citizen backgrounds strengthens a program by providing a range of knowledge, skills, and experiences.

Recommendation S-4: Create a statewide advisory board that can provide programmatic direction and guidance.

Primary Basis: GA AAS demonstrates multiple benefits of developing a supporting body that includes a diversity of stakeholders who geographically represent the state. These benefits include having a non-volunteer reservoir of knowledge, skills, and community connections that can provide program direction and guidance, serve as regional liaisons, and assist in overcoming programmatic barriers.

What programmatic elements should be incorporated into a Tennessee volunteer monitoring program?

Recommendation P-1: Clearly define at the outset of a program its mission and goals.

Primary Basis: The literature and the case studies support the need to transparently define program mission and goals at the outset of the program in order to effectively plan how to achieve intended programmatic outcomes and to avoid public misunderstanding of the program. Moreover, citizen buy-in of a program may be increased by obtaining stakeholder input into the development of program mission and goals.

Recommendation P-2: Consider using multiple strategies for meeting volunteer training and technical needs as the program expands.

Primary Basis: The case studies demonstrate the merits of using multiple strategies for meeting volunteer needs in addition to the benefits of utilizing each of the following strategies:

- Trained citizen volunteer monitors — AWW; GA AAS; KY WW.
- Community/watershed program coordinators — GA AAS.
- State college & university system professors — GA AAS; KY WW.
- Cooperative Extension agents — AWW, GA AAS, KY WW.

Recommendation P-3: Use AWW's multi-functional database as a model for information management.

Primary Basis: The AWW case study describes multiple features of this program's database that support its adoption. These include:

- Online data entry.
- Real-time graphing that provides immediate volunteer feedback.
- QA/QC features.
- Public access to spatial displays of data.

Given the likely costs of database development, should Tennessee develop a volunteer monitoring program, it should also consider contracting with AWW to manage its data.

Recommendation P-4: Develop a recruitment/outreach initiative to garner community support to increase volunteer involvement and local buy-in.

Primary Basis: Case studies indicate that outreach activities serve as vital means to promoting volunteer monitoring and increasing stakeholder buy-in. Two key ingredients to a successful initiative appear to be involving partners and including a range of activities such as:

- Developing and distributing watershed educational materials.
- Developing and maintaining a Web site that contains transparent programmatic information and updates.
- Volunteer/community seminars/workshops.
- Organizing watershed/awareness community events.
- Involving volunteers in spearheading outreach activities

What can be done to increase the probability of long-term viability of a Tennessee volunteer monitoring program?

Recommendation V-1: Seek a mix of governmental, private sector, and nongovernmental organization (NGO) funds to support the program.

Primary Basis: Both the literature and case studies point to the need of a diverse funding portfolio. The AWW case study illustrates how this can be done by supplementing a program's primary funding (e.g., US EPA 319 funds) with funds from other entities with similar goals (e.g., US Department of Agriculture, Cooperative State Research, Education, and Extension Service). It also further underscores how the location of a program can impact its ability to acquire funds.

Recommendation V-2: Seek and implement a US EPA Region 4-approved Quality Assurance Project Plan (QAPP) that supports long-term monitoring objectives.

Primary Basis: The literature reveals that data credibility depends on the development and implementation of a sound QAPP. Without one, the use of volunteer data will be limited to primarily education. The AWW case study illustrates the benefits of a comprehensive QAPP:

- Long-term acquisition of data.
- Increased data credibility with the state environmental agency.
- Broadened use of data, including its incorporation into basin planning and corroborating agency-collected data used in state water quality reporting.
- Greater clout to the AWW Association as volunteer monitor advocates.

Recommendation V-3: Devise volunteer recruitment strategies to maintain long-term commitment of volunteers. Consider strategies that will provide multiple forms of volunteer feedback and minimize volunteer time commitment and expenditures.

Primary Basis: Both the literature and case studies suggest that a primary contributing factor to volunteer attrition is a lack of frequent and meaningful volunteer feedback and that multiple types of feedback may be required to retain volunteers. These strategies include but are not limited to:

- Conducting sessions and developing written materials on data interpretation.

- Maintaining a comprehensive Web site including data interpretative information, current events, updates on technical issues, success stories and up-to-date links.
- Providing volunteer kudos on jobs well done.

In addition, surveys indicate that financial considerations and time constraints influence volunteer retention, as well.

Conclusion

Volunteer monitoring has been heralded as a way for citizens and communities to translate knowledge into action. It educates citizens about their local environment; empowers them to make more informed decisions; reinforces the belief that government alone cannot solve all our environmental challenges; and provides information necessary to plan natural resource protection and improvement projects. Tennessee is fortunate to have neighboring states with quality statewide volunteer monitoring programs that can share the lessons they have learned as they have grown and evolved. Moreover, with shared basins, Tennessee also has an opportunity to collaborate and share resources with these programs. This partnering would allow all the programs to improve and expand on the work that has already been done, including the credible contributions volunteer monitoring can make to protecting and enhancing our natural resources.

1.0 INTRODUCTION

1.1 Background

Volunteer monitoring has been heralded as a way for citizens and communities to translate knowledge into action (Lee, 1994). It educates citizens about their local environment; empowers them to make more informed decisions; reinforces the belief that government alone cannot solve all our environmental challenges; and provides information necessary to plan natural resource protection and improvement projects. Most importantly, perhaps, is its contribution to sustainable development.

Sustainable development is predicated on certain beliefs about individual and collective responsibility for protecting our natural resources. These include the obligation, as individual citizens, to increase our understanding of the natural world and our impacts on it, be accountable for our actions, and become better stewards of the environment. As a community, we must share our knowledge with one another and collectively use this information to more effectively use our resources without compromising our children's ability to meet their resource needs. Volunteer, or citizen monitoring, has been recognized as one of the most important means to achieve these ends (The President's Council on Sustainable Development, 1996).

The upsurge of volunteer monitoring programs across the nation over the past decade overwhelmingly indicates growing federal, state, and local support for such programs (US EPA, 2003a). The fifth edition of the *National Directory of Volunteer Environmental Monitoring Programs* along with prior editions of this directory chronicles this growth. A notable milestone for volunteer monitoring documented in the fifth edition is that every state now listed in this directory has a volunteer monitoring program (US EPA, 2003a). Also, in US EPA Region 4, all the states excluding North Carolina and Tennessee currently have a statewide volunteer water quality monitoring program that are at some level supported by state and/or federal funding (AWW, NDb; KY DOW, 2004a; MWF, 2004; Rivers Alive, NDa; SC DHEC, 2003; UF DFAS, 2000).

1.2 Objectives of this Study

Tennessee does not currently have a state volunteer monitoring program, although there has been some preliminary discussion within the state's nonpoint source program to initiate or sponsor one. The overarching goal of this research was to provide Tennessee policy decision makers and other stakeholders with the information necessary to move this discussion forward by determining the viability of initiating a state monitoring program and identifying actions necessary to implement it. Our specific research objectives were to:

- Compare and contrast three state-supported volunteer monitoring programs in the Southeast by focusing on:
  - administrative and programmatic structure and elements;
  - how each have evolved and lessons learned from their evolution; and
  - past and current volunteers' perceptions regarding the benefits and limitations of monitoring programs and how they believe collected data is used.

- Identify perceived potential benefits and/or drawbacks of establishing a Tennessee statewide monitoring program by surveying Tennesseans with an explicit stake in establishing such a program.

- Recommend potential ways to establish a statewide volunteer monitoring program in Tennessee based upon these findings.

2.0 RESEARCH DESIGN

This research was conducted in five phases as described below.

2.1 Phase I: Literature Review

We initially conducted a review of the literature as a basis for our analysis. Although not intended to be comprehensive, we sought to:

- Provide an overview of the evolution of volunteer monitoring.
- Identify potential perceived barriers to volunteer monitoring and how they have been addressed.
- Examine how data has been and is currently being used in light of credibility issues.
- Describe perceived benefits of volunteer monitoring.

2.2 Phase II: Program Case Studies

We first established criteria to guide us in our selection of the three volunteer monitoring programs we would examine. The program had to be: 1) state-wide and partially state-supported programs; 2) operational for five years or more; and 3) contiguous to Tennessee. We also considered prior basin partnership initiatives with our neighboring states as well as the potential for future interstate partnerships and sharing of resources should Tennessee decide to initiate a volunteer monitoring program. In addition, we considered selecting a combination of programs that would provide us with a cross-section of differing program models and delivery systems.

Based on these criteria and an initial preliminary evaluation of the programs via the World Wide Web, herein referred to as the Web, we chose to analyze and compare the Kentucky Water Watch (KY WW), Alabama Water Watch (AWW) and Georgia Adopt-A-Stream (GA AAS) programs.

To systematically and equitably evaluate each of these programs, we initially devised a generic framework of administrative and programmatic elements to be assessed. We then converted this framework into a questionnaire that was used to guide our initial assessment of each program (See Appendix A).

We drew from three primary sources of information for our analyses of the programs:

- *Program Web sites*. Each of the Web sites was extensively used in obtaining initial program information.
- *Face-to-face interviews with each of the Program Managers and, in the case of AWW with its entire staff*. Each of the interviews was a minimum of three hours long and in the case of the KY WW, we revisited the Manager for a second interview. Each of the interviews were taped with the permission of the Managers and then transcribed for analysis.
- *Program documents*. Each of the managers provided program documents including, but not limited to annual reports, grant close-out reports, training materials, and newsletters.

Other sources of information were obtained from program and volunteer staff via e-mail correspondence. In addition, we asked managers to review a draft of our overview of their programs to ensure accuracy.

2.3 Phase III: Volunteer Monitoring Program Survey

This phase involved surveying past and current volunteer monitors of the three selected statewide programs. Following is a description of how we selected the samples, designed and implemented the survey, and analyzed the data.

Methodology

We initially contacted and informed program managers about the intent of the survey. With an understanding that we would use the names, addresses, and telephone numbers only for the purposes of this survey, they released their membership databases to us. Target populations included adults (18 years of age and older) with addresses and telephone numbers listed in the program databases.

We made the decision to accept a smaller sample size, recognizing it would result in a higher rate of error for two primary reasons: 1) we were looking for general trends in responses; and 2) it was a budgetary trade-off for using a professional survey service with greater quality control.

It should be noted that the volunteer monitor sample drawn from Kentucky was from KY Watershed Watch, not KY WW. As will be discussed in detail in Section 4.0, KY WW currently serves as a "volunteer monitoring technical service provider." In this capacity, it assists groups in initiating volunteer monitoring programs and projects, with the groups sometimes taking on the name of KY WW and sometimes not. In 1997, KY WW assisted in establishing a statewide volunteer monitoring program called KY Watershed Watch that is managed by a nonprofit governmental organization (NGO). As a technical service provider, KY WW continues to dedicate more than half of its time to providing support to the implementation of this statewide monitoring program. Because of this and the fact that KY Watershed Watch is now the primary adult volunteer monitoring program conducted statewide, we chose to draw our KY volunteer monitor sample from this program.

Survey Design

We designed the survey to obtain the following information from the volunteer monitors:

- Their perceptions of the benefits and limitations of volunteer monitoring and, more specifically, of their state's program.
- Their perceptions on how monitoring data they have collected has been used.
- Their level of satisfaction with select elements of the program (e.g., training).

Our initial draft survey instrument was refined based on input from our technical advisors, survey administrator, and the AWW, GA AAS, and KY WW program managers. We kept the survey brief and simple with the intent of obtaining a better response rate and broader demographic cross-section (e.g., education, age). The survey contained 24 questions including 23 close-ended and one open-ended. There were three socio-demographic, three administrative, and 18 substantive questions.

Survey Implementation

Taking into account our survey goals, timeline, and budget, we were advised by the survey administrator at the Social Science Research Institute (SSRI) to conduct the survey by telephone. The survey administrator adapted the questionnaire for a telephone interviewing format and conducted a pre-test on it. The final instrument used is contained in Appendix B.

Pre-Survey Letter

Potential respondents were sent a letter to inform them that they might be receiving a call from the University of Tennessee for an interview. It also explained the purpose of the interview and requested their assistance in our research on volunteer monitoring. This letter is provided in Appendix C.

Interview Protocol & Data Collection

SSRI has a staff trained on how to use a computer-assisted telephone interviewing (CATI) system and how to conduct professional interview techniques including standard responses and probing methods. Telephone interviews were conducted between April 30, 2003 and July 14, 2003. Using CATI, the interviewers read questions that were displayed on a computer monitor and then directly entered their responses into a microcomputer for data storage. A supervisor was on staff for all shifts to oversee the monitors' interviews for quality control.

Sample Sizes & Response Rates

Telephone responses to the survey were high with less than 5% of the collective samples refusing to participate in the survey.

Alabama

With a database of 827 individuals, a sample of 431 individuals from AWW was randomly selected to be interviewed. Of these 431, 247 individuals completed the interview; 22 individuals refused to participate and 128 were unable to be contacted due to incorrect phone numbers or disconnected numbers. The response rate for this sample was 82 percent with a margin of error of +/- 5.2 at a 95 percent confidence level.

Georgia

The database for Georgia consisted of 225 individuals. This database was treated as both the population and the sample. Of these 225 individuals, 127 completed in the interview; 15 individuals refused to complete the interview; and 50 individuals were not contacted because of incorrect or non-working phone numbers. The response rate for this sample was 73% with a margin of error of +/- 5.7 at a 95 percent confidence level.

Kentucky

The population for Kentucky (i.e., derived from the KY Watershed Watch database) consisted of 502 individuals. Of these 502, 361 completed the interview; 12 individuals chose to refuse; and 68 were not contacted due to non-working numbers. The response rate for the Kentucky was 83 percent with a margin of error of +/- 2.7 at a 95 percent confidence level.

Data Analysis

Data from the interviews were entered directly into the Statistical Program for the Social Sciences (SPSS), Version 10 for statistical analysis. Survey results from each of the three programs were both individually and collectively analyzed. Descriptive statistics (e.g., mean, median, and mode) and cross-tabulations were used to determine data patterns. In addition, paired means tests were run among the three programs to identify significant differences in the perceived benefits and limitations of volunteer monitoring.

2.4 Phase IV: Tennessee Stakeholder Survey

This phase involved surveying Tennesseans with a stake in initiating a statewide volunteer monitoring program. Following is a description of our sample selection, survey design and implementation, and data analysis.

Sample

Determining the population of Tennessee stakeholders in volunteer monitoring is unquestionably a subjective call. Depending on the criteria used, its size could potentially be substantial and definitely beyond the survey budget of this research. Instead, we opted to obtain a sample that would give us simply an indication of Tennesseans' perceptions, recognizing that this sample is not statistically valid. Our sample size is based on the range of sample sizes obtained from AWW, GA AAS, and KY Watershed Watch. In addition, we attempted to include in this sample a cross-section of demographics including: 1) place of residence across Tennessee (i.e., East, Middle, West), 2) occupations, and 3) prior knowledge and involvement in volunteer monitoring.

To that end, our sample was primarily derived from membership of a state-wide nonprofit environmental organization and from attendees of a state-wide water-related conference. The nonprofit was the Tennessee Clean Water Network, a grassroots nonprofit organization dedicated to watershed protection. The conference was the 2003 TN Chapter of the American Water Resources Association. Attendees came from across the state and represented a range of occupations (e.g., federal, state, and local government; environmental NGOs including watershed organizations; industry and business; students: and agriculture). Other watershed associations that participated on a limited basis were the Knoxville-area Water Quality Forum, Harpeth River Watershed Association, and the Cumberland River Compact Association.

Survey Design

The Tennessee survey instrument contained questions similar to those in the survey administered to the three Southeastern state volunteer monitoring programs in order to allow for comparison. Primary differences included a rephrasing of questions to reflect the respondents' general knowledge of and experience in volunteer monitoring, not necessarily their direct participation in a formal program. In addition, given two

state-wide program models, respondents were asked to identify their preference for Tennessee. The survey provided in Appendix B contains 27 questions, including 24 close-ended and three open-ended. There were four socio-demographic, one administrative, and 22 substantive questions.

Data Collection & Responses

Data was collected in two ways. The first was through a written survey that was distributed at a conference and meetings. The second was through an on-line survey that was posted on a UTK Web site. Members of the Tennessee Clean Water Network were sent electronic mail that described the purpose of the study and contained a link to the survey. In total we received back 159 surveys—87 hard copies and 72 electronic submissions.

Data Analysis

Data from the written and online surveys were entered directly into SPSS, Version 10 for statistical analysis. Survey results from each of the three programs were both individually and collectively analyzed. Descriptive statistics (e.g., mean, median, and mode) and cross-tabulations were used to determine data patterns. In addition, paired means tests were run to identify significant differences between Tennessee stakeholders' responses and collectively those of AWW, GA AAS, and KY Watershed Watch respondents.

2.5 Phase V: Finding Analysis and Recommendation Formulation

Survey responses from each of the three state programs were analyzed and compared and contrasted with one another. This included describing general trends and significant differences among AWW, GA AAS, and KY Watershed Watch as well as providing brief interpretative summaries.

Similarly, the Tennessee survey results were analyzed and compared and contrasted to "average" findings among the three state programs. Again, general trends and significant differences between Tennessee and the mean state program results were noted and brief interpretations of these comparisons were provided.

Using information from the literature review, survey results, and the program case study findings, we developed a set of recommendations regarding the establishment of a Tennessee volunteer monitoring program. These recommendations were placed into three categorical questions:

1) How should a Tennessee volunteer monitoring program be structured?

2) What programmatic elements should be incorporated into the Tennessee volunteer monitoring program?

3) What can be done to increase the probability of long-term viability of a Tennessee Volunteer Monitoring Program?

3.0 LITERATURE REVIEW

3.1 Volunteer Monitoring Evolution and Support

The United States has a long history of volunteer monitoring. Beginning in 1890 with the Cooperative Weather Observer Program started by the National Weather Service and extending into the National Audubon Society's Christmas Bird Count, volunteers have long been considered a critical link in the gathering and dissemination of environmental information. Volunteer water monitoring is a more recent innovation, "essentially starting in the late 1960s and the 1970s as grassroots efforts by lake associations and stream conservation groups" (Lee, 1994). The passage of the Clean Water Act (CWA) in 1972 spurred the push towards citizen volunteer monitoring, as did the Izaak Walton League's promotion of the "Save Our Streams" program with its "Water Wagon" (Lee, 1994). Questions about the credibility of volunteer data were common at this point, and it was not until the 1980s that citizen data began to be recognized as valuable and usable by various state and local agencies. A major step in overcoming this hurdle was taken when the Chesapeake Bay Citizens Monitoring Program had their Quality Assurance Project Plan (QAPP) for a volunteer monitoring project approved by the United States Environmental Protection Agency (US EPA) in 1987. The EPA provided additional support for the concept of volunteer monitoring when, in its 1989 guidelines for Section 305(b) of the Clean Water Act, they "explicitly identified volunteer monitoring data as a potential source of 'evaluated' information states could use for their 305(b) reports – 'evaluated' being the category that includes less-rigorous types of information" (Mayio, 1994). In 1988 the first national volunteer monitoring conference was held at the University of Rhode Island, and that year also saw the first edition of the national volunteer monitoring directory (Mayio, 1994).

Since that time, volunteer monitoring has grown in both frequency and scope. From the initial aquatic insect counts and dissolved oxygen and pH testing, volunteer monitoring has grown to include such parameters as settleable solids, nitrate, coliform bacteria, and turbidity. In terms of numbers, the 1994 edition of the National Monitoring Directory included 517 volunteer monitoring groups. By the publication of the fifth edition in 1998, that number had grown to 772 (US EPA, 2003a). The sixth National Volunteer Monitoring Conference, held in Austin, TX in spring of 2000, saw an attendance of 200, compared to 85 who attended the first conference (US EPA, 2001). Such expansive growth has not occurred as a matter of chance. Federal, state, and local support has been critical to the evolution of volunteer monitoring programs in the United States. CWA amendments have three sections widely used to fund volunteer monitoring programs, including Section 314, the Clean Lakes Program; Section 319, the Nonpoint Source Program; and Section 320, and the National Estuary Program (Mayio, 1993). According to Alice Mayio, "These three sections allow EPA to give grants to state water quality agencies, which in turn may either use the money themselves or pass it through to local and regional governments, nonprofits, academics, and other organizations" (Mayio, 1993). Though not specifically named, volunteer monitoring programs are often the recipients of these grants, with some relying solely on EPA funding for their operating budgets. For all three grants, the state must provide matching funds, but this may be achieved by considering volunteer labor a match. Additional CWA funding may be found in Section 106 and Section 205J. Section 106 provides support for each state's base water quality program, while 205J funds are provided for state water quality management planning (Mayio, 1993).

Besides funding, the EPA has supported volunteer water monitoring programs by issuing publications including methods manuals, providing partial funding for a biannual newsletter, *The Volunteer Monitor,* sponsoring national volunteer monitoring conferences, and establishing a Web page dedicated to volunteer monitoring. A particularly noteworthy document that was published in 1996 by EPA is *The Volunteer Monitor's Guide to Quality Assurance Project Plans*. This document was intended to provide assistance to volunteer monitoring programs creating QAPPs, a necessary component if requesting funding from EPA sources. However, the document also states, "[E]ven programs that do not receive EPA money should consider developing a QAPP, especially if data might be used by state, federal, or local resource managers. A QAPP helps the data user and monitoring project leaders ensure that the collected data meet their needs and that the quality control steps needed to verify this are built into the project from the beginning" (US EPA, 1996). Such a recommendation highlights the importance EPA places on quality assurance.

EPA has also promoted volunteer monitoring as a viable means of educating the public on and involving them in watershed protection. For example, it along with a host of partners annually sponsors a World Water Monitoring Day in an effort to increase public awareness about water pollution (Year of Clean Water Primary Sponsors, 2004). As a part of their Phase II Storm Water Program, EPA also

recommends that communities, as part of the public participation and involvement component, consider initiating a volunteer water quality monitoring program. According to EPA, not only do citizens receive first-hand knowledge of the quality of local water bodies, communities are also provided a cost-effective means of collecting water quality data (US EPA, 2000).

Like EPA, the United States Department of Agriculture (USDA) Cooperative State Research, Education, and Extension Service (CSREES), (formed in 1994 by combining the former Extension Service and Cooperative State Research Service) has also played a substantial role in the promulgation of volunteer water monitoring initiatives. According to Elizabeth Herron and Kris Stepenuck in *The Volunteer Monitor*, "[T]he very mission of Extension—to bring science to the people, conduct educational outreach, and encourage "better practices"—could be lifted right out of the stated goals of most volunteer monitoring programs" (Herron, 2003). The close alignment of Extension with volunteer monitoring initiatives is also in keeping with the intention of the Extension Service as put forth in the 1914 Smith-Lever Act:

> Essentially, Extension was charged with taking practical information generated by land-grant university scientists directly to the people and encouraging citizens to adopt better practices in agriculture, home economics, and rural development (Lee, 1994).

As the country has urbanized and suburbanized, Extension has adapted to changing needs, including a greater emphasis on water quality protection. In 1990, the CSREES National Water Quality Program was initiated with the assistance of the Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA). On its Web site, CSREES states that,

> The CSREES National Water Quality Program brings university scientists, instructors, and extension educators into more effective and efficient partnerships with Federal interagency priority programs, all while addressing water quality issues in U.S. agriculture. This program provides the flexibility necessary for CSREES to bring the resources of researchers, instructors, and extension educators into national initiatives and programmatic partnerships that target evolving water quality needs (USDA, 2004a).

As part of this program, many Extension offices have become involved in volunteer water monitoring. In 1991, CSREES, along with the University of Rhode Island and the University of Wisconsin, began the Volunteer Water Quality Monitoring National Facilitation Project, the purpose of which is "…to build a comprehensive support system for Extension volunteer water quality monitoring efforts across the country (USDA, 2004b)."

In 2001 and 2002, the CSREES National Facilitation Project staff undertook a study to examine volunteer water monitoring projects aligned with Extension. According to the report, "Inquiries…were designed to learn more about existing programs in order to ascertain their strengths and needs, and to discover what coordinators considered exemplary about their program" (USDA, 2004c). The report that resulted from this inquiry provides a wealth of information regarding Extension's support of volunteer monitoring. It identified 27 US volunteer water quality monitoring programs that were either sponsored or co-sponsored by Extension. In terms of program support the following trends were reported:

- 37% of respondents reported that Extension is always a program sponsor
- 41% reported that Extension is always a collaborator
- 33% reported that Extension is always involved with training.
- 29% reported that Extension always offers advice.
- 28% reported that Extension always offers staff.
- 26% reported that Extension provides educational materials.
- Between 25 and 31% reported that Extension often sponsors or collaborates with their programs, providing staff, training, technical support or educational material.
- 60% reported that Extension provides some funding for monitoring efforts.
- 67% reported that Extension provides equipment for monitoring.
- Other reported forms of Extension support include 4-H programs, grants, assistance with capacity building and training, and building partnerships with conservation districts (USDA, 2002).

The findings reported here indicate that Extension provides a range of services to support volunteer monitoring initiatives. Much of this support is in keeping with the needs identified by various program staff and administration, which led to the initiation of various programs. The following causes, presented in order of popularity, were identified as reasons for program initiation:

- Lack of watershed monitoring by state or other agencies or to create a long term, credible data set.
- To educate the public about water quality issues.
- As a youth development program.
- To create consistency in methods, data management, and coordinated use of data between basins, volunteer groups, and agencies.
- Interest by the public about why and how monitoring is done and what results mean.
- Community involvement with water resources.
- Crisis in the shellfish industry caused by poor water quality conditions.
- Concerns about drinking water quality in private wells (USDA, 2003).

The ability of Extension to aid in the monitoring of various waterbodies as well as to increase education and involvement has been closely aligned with its willingness to provide services listed above.

Extension has played a critical role in the promulgation of a number of highly regarded volunteer monitoring programs, including Rhode Island's Watershed Watch, Maine's Clean Water Program, and the Wisconsin Lakes Partnership. According to Linda Green and Jeff Schloss, Extension supports programs using a number of funding approaches, but the following themes are shared by most:

In the Fall 1993 issue of *The Volunteer Monitor*, Jeff Schloss identified other USDA agencies that could be used to effectively enhance volunteer monitoring initiatives. These agencies included:

- Soil Conservation Service
- Association of Conservation Districts
- Agricultural Stabilization and Conservation Service
- Forest Service

1. Overall program funding comes from a variety of sources, creating partnerships between the participating organizations and Extension.
2. In most programs, Extension staff members are assigned to coordinate and assist the volunteer monitoring programs.
3. Often Extension provides substantial in-kind support, such as technical assistance, training, or secretarial help (Green, 1993).

This range of support indicates that, though Extension's financial support is important to volunteer monitoring, technical and other types of support are equally significant. Because of Extension's overriding mission, statewide volunteer water monitoring programs are logical partners.

3.2 Program Implementation: Barriers and Ways to Overcome Them

Unfortunately, EPA and other federal agency support cannot guarantee a lack of barriers to the success of various citizen volunteer monitoring projects. Results found at the Shared Waters – Common Goals conference are useful in pointing out possible limitations to such programs. The Shared Waters – Common Goals conference was held in Bedford, New Hampshire, in 1993 to bring together representatives from New England to address the issue of citizen monitoring in New England watersheds. The conference was held with the belief that "[I]t is desirable to have watershed-based citizen monitoring programs in all six New England states that collect, synthesize, and deliver scientifically-credible information to water resources protection and restoration processes" (Godfrey, 1994). Conference attendees were first broken into groups based on affiliation and asked to determine what they believed to be the "most significant barriers to reaching the desired state of monitoring activity" (Godfrey, 1994). The six groups (universities; federal, state, and local government; business/utility; and citizen monitoring coordinators) identified broadly similar barriers for further discussion, with the top four barriers receiving 77 percent of the votes. These four issues were:

1. Lack of standardization of methods, quality assurance/quality control, etc. between states.
2. Lack of integration with broader purposes/policies.
3. Funding.
4. Data use and credibility concerns.

The remaining five issues that were discussed further included:

5. Lack of clarity and focus of purpose.
6. Lack of community support.
7. Need for non-volunteer support.
8. Lack of long-term commitment of volunteers.
9. Fear of regulatory reprisal (Godfrey, 1994).

The barriers identified by conference attendees were a good indication of barriers faced by many volunteer monitoring efforts across the nation. For the second part of the one-day conference, attendees were broken out into six groups with varieties of affiliations and geographic interests to discuss and determine possible solutions to these barriers. These solutions were ranked by participants and resulted in a list of recommendations to overcome these barriers. Following are the top five ranked solutions. A more expansive list is provided in the full article.

- Barrier: Standardization of Methods, QA/QC, etc.:
    - Regionalize training workshops and technical forums to create a pool of trainers.
    - Facilitate coordination and communication among those involved in methodology.
    - Define objectives of volunteer programs.
        - Create and/or update (manuals) with different (and) comparable methods with the lay monitor in mind.
        - Conduct program needs assessment including data needs.
- Barrier: Lack of Clarity and Focus of Purpose (Mission, Policy):
    - Define and promote organization's mission statement (from bottom-up; citizens).
    - Create a study design.
    - Define and discuss the stakeholders, uses of the data, and users of data and resources.
    - Involve citizens in defining mission so that it may incorporate their concerns.
    - Ensure that purpose is not clouded by agendas.
- Barrier: Funding:
    - Explore, work for, and publicize innovative ideas to fund individual monitoring programs.
    - Form a coordinated cooperative funding approach for New England groups.
    - Diversify funding sources.
    - Create benefactors by promoting citizen monitoring ideas to individual, agency, and organization funders.
    - Request that agencies allocate resources to provide citizen monitoring staff support.
- Barrier: Credibility and Trust:
    - Ask state agencies to define how they will use monitoring data.
    - Ask national volunteer monitoring NGOs to standardize their protocols.
    - Simplify types of data sought from each type of waterbody.
    - Prohibit use of data for enforcement actions by regulatory agencies.
    - Involve potential data users in program design.
- Barrier: Lack of Community Support (These solutions were not ranked.)
    - General public education:
        - Tap into cable network tie-in.
        - Foster media dealings – especially newsprint.
        - Clearly defined time commitments.
        - Contact local agencies at outset of program implementation.
        - Aim for early successes.
        - Make presentations at town meetings.
        - Become a resource for schools.
        - Become a political ally for community environmental efforts.
- Barrier: Need for Non-Volunteer Support:
    - Build technical support into permit requirements.
    - Expand network of existing support.
    - Create linkages with professional organizations.
    - Encourage technical support from educational institutions for credit.
    - Request that support be provided by companies as part of settlements/fines.
- Barrier: Lack of Long-Term Commitment of Volunteers:
    - Provide continued feedback that what they're doing makes a difference.
    - Clearly define the mission of the program so that volunteers understand it from the outset of their involvement.

    - Provide solid organization, spokesperson, volunteer privacy, and team spirit.
    - Conduct continued education and training.
    - Provide volunteer recognition.
- Barrier: Fear of Regulatory Reprisal:
    - Establish a process of compliance before regulatory action.
    - Provide financial incentives for technical assistance and solutions.
    - Ensure QA/QC program is in place and appropriately manage data access and interpretation.
    - Ensure that track record of volunteer group is fair, honest and unbiased.
    - Educate the community about the program.

The solutions identified by conference participants indicate a wide range of options that states and organizations can use to overcome some of the many obstacles they may face in establishing and managing a volunteer monitoring program. In addition, a variety of useful documents, Web sites, and organizations exist which provide guidance for overcoming or addressing these barriers. One accessible and highly useful source of information is *The Volunteer Monitor*. The variety of topics covered by this newsletter provides programmatic and technical information as well as valuable lessons learned from programs' missteps and successes. For example, in the Spring 1996 issue, the Director of the Florida LAKEWATCH program provided a practical approach for overcoming challenges with volunteer attrition based on an informal survey he conducted of former volunteers and their reasons for leaving the program (Ely, 1996).

The summer 2002 issue of *The Volunteer Monitor* is dedicated to success stories like the Lakes Lay Monitoring Program which monitors Chocorua Lake, New Hampshire. Observation and monitoring by volunteers showed that the lake, one of the most protected in the state, was being polluted by run-off, particularly phosphorus, from a nearby highway. Due in large part to volunteer efforts, work was conducted by the state Department of Transportation to mitigate pollutant impacts on the lake that included building diversion structures that limited the amount of runoff reaching the lake (Ely, 2002a). Other such success stories cited in the newsletter include sampling conducted by a watershed association in Baltimore, Maryland that brought attention to bacterial contamination in its streams and subsequently resulted in the city conducting a major overhaul of its sewer system (Markowitz, 2002) and on Sippo Lake in Ohio where a monitoring group provided valuable turbidity data that was used by the Ohio EPA to evaluate the impacts of a costly dredging project (Ely, 2002b). These and other stories demonstrate that many volunteer water monitoring programs have been capable of overcoming barriers that could deter their effectiveness including those of credibility concerns, funding, and standardization of methods.

Other sources of information for avoiding and/or overcoming pitfalls include methods manuals that provide guidance on establishing programs and protocols and proceedings from National Volunteer Monitoring Conferences that have convened volunteer monitoring experts from across the country to address issues related to building and maintaining effective volunteer monitoring programs. In addition, others in the volunteer monitoring arena that can provide valuable guidance through lessons they have learned can be contacted using the National Directory of Volunteer Environmental Monitoring that provides program contact information or through a "Volmonitor Listserver" that is available to anyone who joins it. All of these sources plus more can be accessed from the EPA's Web site (US EPA, 2003b).

3.3 Volunteer Monitoring Data: Credibility Issues and Uses

Addressing Data Credibility

A primary barrier for many volunteer monitoring programs, as indicated in the prior section, has been a perceived lack of data credibility. Although the quality of data has generally been accepted as sufficient for community education, to track water quality trends, and even in some communities as a screening tool for acute water problems, it has not commonly been accepted as sufficient for regulatory use. In particular, it has not been accepted for use in government water quality reporting (e.g., corroborative data for the 303 list or 305b report). However, this limitation in the use of collected data does appear to be shifting due to a number of factors. According to Scott Kishbaugh in his paper, "Volunteer Monitoring and Government Environmental Data Reporting: Smooth Fit or Square Peg in Round Hole?" the first, and most practical, factor is the limited resources available to most agencies charged with monitoring various waterbodies. Kishbaugh states:

> Government, whether federal, state, or local, is frequently charged with the responsibility of evaluating and reporting on the state of environmental resources, whether mandated through the Clean Water Act (305b, 303d), through the need to develop scoring systems for grant programs, or to best inform the public as to conditions necessitating management, restoration, or preservation… Given that most of these government entities are continuing to struggle to bridge broadening data gaps with limited resources, there appears to be a logical need to utilize other data sources to fill these gaps (Kishbaugh, 2000).

Especially in this time of economic downturn, many state agency budgets have been substantially cut, and the resources allocated for water monitoring often do not provide enough for adequate coverage of state waterbodies. Such a situation may lead to a case where government agencies are more willing to use volunteer data to provide more adequate coverage.

Moreover, willingness by government agencies and others to use data, according to Kishbaugh, has also been influenced by factors related to a rising confidence in the data collected. Previous perceptions, he states, of volunteer water quality and biota data are that they have been "…limited by available equipment, analytical tools, and collection, identification, and interpretation expertise" (Kishbaugh, 2000). However, with the presence of a certified QA/QC protocol, greater standardization of programs, and volunteer-collected use perception data, those perceptions are changing. The latter he highlights as an area where local volunteers may be particularly useful "since they are also local users of these resources" (Kishbaugh, 2000).

Alice Mayio, in her article "Volunteer Monitoring Data in the 305(b) Report" underscores these and other factors that are playing a critical role in shifting the volunteer monitoring data-use paradigm. Specifically, she addresses what citizen volunteer monitors can do to increase the likelihood that collected data will be used in this type of report. Section 305b of the Clean Water Act requires that states submit a report every two years that:

1. Describes the extent to which all their navigable waters are achieving the fundamental Clean Water Act goal of providing for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allowing recreational activities;
2. Estimates the extent to which control programs have improved water quality, recommends necessary future actions, and identifies waters needing action;
3. Describes the nature and extent of nonpoint sources and recommendations to control them;
4. Estimates the costs and benefits of achieving the goal of the Act; and
5. Provides an estimate of the quality of all publicly owned lakes (Mayio, 2001).

The demands of the 305(b) report are therefore fairly high, and Mayio points out that, again, there is often a lack of staff to fully cover all waterbodies. She states, "Only 25% of the nation's stream miles, 40% of lake acres, and 30% of estuarine square miles were assessed by the states in 1998, and states are under pressure to increase the amount of waters they assess each cycle" (Mayio, 2001). This being the case, she suggests that volunteer monitors should ask themselves four questions if they want their data to be considered for inclusion (as evaluated or monitored) in their state's 305(b) report. These questions are:

1. Has a Quality Assurance Project Plan been developed? A QAPP that has been previously approved by the state and/or EPA is a big plus. Without such a plan, the state won't have much confidence in, for example, the monitoring and analytical methods used, how volunteers have been trained, and how samples have been handled.
2. Are the right parameters being monitored? If good data can be collected for the parameters the state uses to determine whether designated uses are supported, the state will be more likely to use it.
3. Are the right places being monitored? The state is more likely to use your data if you are monitoring where they aren't. For example, several states have a tradition of using volunteer lake data because they do little lake monitoring of their own.
4. Is the data in an acceptable format? Perhaps nothing frustrates 305(b) coordinators more than finding useful data in an incompatible database or only in hard copy. They usually don't have the time, energy, or staff to translate data into something they can use (Mayio, 2001).

Mayio maintains that by keeping these four questions in mind, it will be more likely that citizen data will be of useable quality and format for some sort of inclusion in the state's 305(b) report. Diane Regas, Director of the EPA Office of Wetlands, Oceans, and Watersheds, has stated that she is also seeing a trend among state governments to establish procedures on how data from volunteer monitoring efforts may be incorporated into the Clean Water Act-mandated 303d lists. These lists of impaired waters must be submitted to EPA by the states every two years (BNA, 2003).

Florida's LAKEWATCH, a volunteer monitoring program founded in 1986, is an example of a program that has been able to provide the state with credible data. A 2002 report evaluating the reliability of citizen monitoring data in Florida's LAKEWATCH program found that the methods used by volunteer monitors resulted in data comparable to that collected by professional biologists (Canfield, 2002). The authors concluded that, "Volunteers should be viewed as partners, and the agencies should encourage volunteer monitoring as the primary means for obtaining good cost-effective baseline and screening data" (Canfield, 2002). They emphasize that by utilizing citizen data, agencies can boost the efficacy of limited budgets as less money would need to be expended on monitoring. They also highlight the need to encourage citizen participation by making sampling protocols fairly simple and providing feedback on collected data. The authors' conclusions are bolstered by the Florida Department of Environmental Protection (FLDEP) which estimated in 2000 that LAKEWATCH over the prior five years had provided about 18% of the total information FLDEP has on Florida lakes, with only their own agency providing more (28%) (Canfield, 2002).

More states are also now evaluating how volunteer data may be used to develop total maximum daily loads (TMDLs). These are the amounts of pollutants a water body can receive and still be in compliance with state water quality standards. A pollutant-specific TMDL must be prepared for each waterbody that has been designated as "impaired" and is identified on the state's 303d list. (Fly, 2002, p. 22). For example, data collected by volunteers monitoring Lake Champlain has been used to calculate the lake's TMDL for nutrients (Kishbaugh, 2000). In the San Lorenzo River Watershed, volunteers monitored streambed conditions and assessed sediment input from public roads to obtain data for the San Lorenzo River's sediment TMDL (Meyers, 2000).

The collection methodologies of volunteer monitoring data are increasingly being evaluated in order to improve the data's validity and broaden how it may be used. In 2002, Sarah Engel and J. Reese Voshell, Jr. evaluated the biological assessment used by the Virginia Save-Our-Streams program in a study entitled "Volunteer Biological Monitoring: Can It Accurately Assess the Ecological Condition of Streams?" It objectives were:

1. To compare the biological condition assessments made by volunteers in the Save-Our-Streams program to those made by professionals;
2. To recommend modifications to improve the volunteer method should it not compare favorably with professional protocols; and
3. To validate a modified volunteer protocol, should one be necessary (Engel, 2002).

Their study found that, under the initial protocol volunteers tended to overrate the water quality of assessed streams when compared with professional evaluations. This, they concluded, was due not to volunteer collection methods or identification mistakes, but rather to the ranking score that the Virginia Save-Our-Streams program used to classify streams as having acceptable or unacceptable water quality. The researchers modified the ranking score based on multimetric indices that allowed abundance, as opposed to simply presence or absence, of various macroinvertebrates to be calculated from volunteer samples, thus strengthening the ability of volunteers to accurately assess streams. The authors conclude that,

> [V]olunteers can reliably assess whether the ecological condition of a stream is impaired or not, if a sound protocol is developed according to scientific principles. This proven ability of volunteers should be used to the fullest extent to assess the ecological condition of the vast reaches of streams that need attention. This would provide professional biologists more time to accomplish the scientific activities that only they are qualified for (Engel, 2002).

The authors further recommend that, "Volunteers should be certified by training and testing before conducting bioassessments, and periodic recertification should be required, perhaps every 2 or 3 years" (Engel, 2002).

While not all volunteer monitoring protocols may generate data that can be used directly by government agencies for water quality reporting and other regulatory purposes, they may still be reliable enough to provide data that can be used to corroborate existing data or to support watershed planning processes. In Autumn 2001, Bill Fleming and David Henkel published a study in the *APA Journal* entitled "Community-Based Ecological Monitoring: A Rapid Appraisal Approach." In this study, the authors evaluated how community-based rapid ecological assessments may be used to monitor riparian health and as an effective educational tool, "providing a practical solution to the need for community-level knowledge of natural systems while complementing more detailed analysis by professional scientists" (Fleming, 2001). The authors looked at biological evaluations of a stream made by high-school students for the New Mexico Watershed Watch program over the course of five years. Students monitored 12 criteria (streamflow; streambed geology: composition, embeddedness, width/depth ratio, bank stability, riffle/pool ratio; vegetation: buffer width, species and structural diversity, canopy cover and shading; and aquatic insects) and used them to evaluate the condition of the stream (poor, fair, good, or excellent) though a rating scale from 1-4. The researchers found that the student groups produced consistent results over the course of the five years, due in part to the relatively stable nature of the stream, that did not seem to be affected by a different group participating each year. In 1997, watershed professionals conducted an independent survey of the site, and their resulting evaluation of 3.9 (excellent) was very close to what the students had found (3.7). A second stream was studied to determine if the rapid appraisal approach is useful for less-pristine sites, and it was found to be so. Fleming and Henkel conclude that the community-based, rapid assessment technique may be used to serve three purposes:

- To establish the biological condition of the riparian monitoring,
- To develop a framework for comparing several riparian areas within a larger watershed, and
- To compare results of appraisals made by different evaluators at the same site over time (Fleming, 2001).

Volunteer Monitoring Strengths and Limitations

All data has its strengths and limitations given its intended use and, as has been pointed out, volunteer monitoring data is no exception. In 2001, Gary Kohlhepp of the Michigan Department of Environmental Quality's (DEQ) Surface Water Quality Division (SWQD) directly addressed the pros and cons of volunteer data in a staff report. The report is entitled "The Use of Michigan Volunteer Monitoring Data: Benefits and Constraints" and was based on the experience that the SWQD had working with volunteer groups monitoring wadable streams in 1998, 1999, and 2000. A number of benefits were identified, including:

- Volunteer data can serve as a valuable screening tool for SWQD biologists.
- Volunteer data can be used for attainment decisions in some circumstances.
- Working with volunteers provides a valuable opportunity to educate the public about water quality issues.
- Data collected by volunteers can spur local decisions and action to protect water quality.
- Volunteers can monitor watersheds more frequently than SWQD and can quickly inform us of pollution incidents.
- The volunteer monitoring program is good public relations for SWQD (Michigan DEQ, 2001).

A number of constraints were also identified, including:

- High school students are not as reliable as adult volunteers in providing reliable, high-quality data.
- Volunteer data alone should not be used for nonattainment decisions.
- A few volunteers do not appear to be thorough in collecting benthic invertebrates.
- Whether groups will continue to monitor over the long haul remains to be seen.

These benefits and constraints appear to be in keeping with the opinions given in interviews conducted for this study. Of note are the further recommendations made in the report on ways these benefits can be capitalized upon and expanded. For example, Kohlhepp working with existing groups or specially formed volunteer monitoring groups says, "Existing groups generally have access to a reasonably large pool of volunteers, can do more in the way of outreach and linking monitoring with other activities, and seem likely to stick with projects over a longer time period" (Michigan DEQ, 2001). Additionally, he stresses the importance of making the training accessible to more volunteers and making sure that each volunteer understands and

can perform the basic monitoring activities. Finally, Kohlhepp asserts that, "a successful volunteer monitoring program requires the participation of a district staff and the watershed biologists" (Michigan DEQ, 2001). These steps, he feels, can promote and provide a volunteer monitoring program that will be useful to the state.

Michael Heiman examines the benefits of citizen volunteer data in a different light. In "Science by the People: Grassroots Environmental Monitoring and the Debate Over Scientific Expertise," Heiman focuses on the potential of volunteer monitoring for bringing needed attention to issues that may be subjected to over-rigorous examination by traditional scientific endeavors. He states, "[T]his science by the people has provided the background of routine environmental monitoring necessary for public agencies and community groups to uncover environmental contamination and mismanagement, while also helping to assure that more voices are heard in science policy and resource management" (Heiman, 1997). He points out the potential weaknesses of science in making broad generalizations without reference to local conditions. In terms of addressing this weakness, volunteer monitors may have an advantage over traditional scientific monitoring as they have more knowledge of and experience with local conditions, as well as a greater stake in the actions taken as a result of this monitoring.

Heiman points out that lay monitoring may have a number of impacts beyond the obvious one of providing a more complete data set. He states, "Lay participation in science challenges professionals to recognize the political and economic arena where science is conducted and applied, while pushing scientists and agency personnel to admit to the low level of confidence in the science backing many of the conclusions reached" (Heiman, 1997). This admission may lead to more exhaustive attempts to provide adequate data to reach sound conclusions, as well as allowing local groups to bring their concerns to the realm of the political. Heiman states that, "[T]he burden of proof in politics is less than that in science because, with politics, one tries to change public opinion rather than prove one's case beyond the shadow of a doubt." This lower burden of proof may allow volunteer monitors to bring issues to the public's attention before traditional scientific investigation may make a conclusive proof. In this way, issues may be addressed before they have reached a crisis point. Heiman states that:

> Lay environmental monitoring…helps provide an empirical basis for the community challenge to the imposition of risk assessment and assignment – as routine monitoring gives voice to local concerns about environmental disruption, helping people focus on risk avoidance rather than prioritization (Heiman, 1997).

The ability of citizen science groups to assist with risk assessment in local environmental factors is one of their greatest advantages.

In terms of volunteer water monitoring, Heiman points out that,

> [D]ata quality is strongest when the individuals collecting the data are the first to use it, while professional monitors often do not collect representative data because they do not have any personal stake or interest in the information. Indeed, with a much denser spatial and temporal matrix of sampling sites than possible for most public agencies and with a track record of good quality control, many states…rely upon volunteer monitoring to meet the biennial water quality reporting requirements of Section 305(b) of the Clean Water Act (Heiman, 1997).

The key to using such data in state reports is the ability of the volunteer groups to assure data quality and thus credibility. However, besides using citizen data for such reports, Heiman states that, "The main value of community-initiated science…is through the basic education provided, enabling residents and workers to test and defend – rather than just trust – their own common sense." This conclusion is in keeping with much of the other research done on volunteer monitoring.

3.4 Monitoring Benefits to Volunteers

Volunteer monitoring programs have been shown to provide a number of benefits to states and localities; however, these benefits would not be possible without the commitment of the volunteers themselves. Perhaps the greatest volunteer benefit identified is that of education. As noted by Ann Robinson, "Monitoring helps build a better informed and more responsible citizenry. A monitoring program gets people out to the water bodies in their area over and over again, thereby developing in them a greater knowledge of - and commitment to - their landscape (Robinson, 1997). This finding is substantiated by Kohlepp of the Michigan DEQ who likewise found through

his work with volunteer monitors that one of the greatest benefits of this experience is the water quality education it provides (Michigan DEQ, 2001).

The influence of the monitoring experience on the volunteer appears to extend beyond education. In an article entitled “The Stewardship Factor: A (Slightly) Dissenting View,” Steven Hubbell notes that in a survey administered to volunteers:

- 20 out of 31 respondents reported that participation had increased their stewardship behavior a great deal, while one-third reported that it had influenced them somewhat;
- Over half of respondents indicated that their involvement had influenced others, and
- Many mentioned gaining an increased awareness of watershed issues (Hubbell, 2002).

These responses clearly indicate that one of the benefits gained by many volunteer monitors is a change in how they view and treat their local environment and this, in turn, appears to create a “ripple effect” among those with whom they interact. Finally, Heiman notes that providing volunteer access to research and technical skills, “…changes how people conceive of themselves as actors in the scientific enterprise and, more fundamentally, helps them recognize that change is even possible” (Heiman, 1997). In short, the experiences gained in participating in volunteer monitoring efforts provides citizens with an expanded education, a clearer understanding of the impacts of their actions, and an empowered view of their ability to promote change.

3.5 Conclusion

In summary, the literature review has shown that volunteer water quality monitoring has matured since its inception, and its uses have broadened. With increased emphasis on data credibility, the potential for citizen data to be used by states in water quality reports as corroborating data, for basin planning, and for the development of TMDLs continues to improve. Moreover, its use may allow for greater coverage of monitored waterbodies, resulting in a monetary saving for state and local agencies. Finally the literature is replete with examples of one of volunteer monitoring’s most enduring uses — that of educating and empowering community members to bring water quality issues to the forefront and to take action to address them.

4.0 SOUTHEAST VOLUNTEER MONITORING PROGRAM CASE STUDIES

Each of the assessed state programs assessed provides valuable information, insights, and lessons on how a statewide volunteer monitoring program may be successfully administered. Following are descriptions of the Georgia Adopt-A-Stream (GA AAS), Alabama Water Watch (AWW) and Kentucky Water Watch (KY WW) programs. We begin by examining how these programs were conceived and how each has evolved, noting administrative changes that have occurred to accommodate growing pains, partnerships that have formed, and shifts in programmatic emphases.

This is followed by a description of the program's current *administration,* including its structure, staffing, budgets, and volunteer recruitment and management and *citizen involvement and program outcomes,* including types of monitoring conducted, training, data quality control and management, and program outcomes.

The information provided in the following program narratives was primarily obtained through three- to four-hour interviews with program managers and their staffs. Where noted, we supplemented the information and insights they shared about their programs with information provided in the program Web sites, reports, and newsletters. A draft of each of program overview was reviewed by its respective program manager for completeness and accuracy.

4.1 Georgia Adopt-A-Stream

Program Inception

The GA AAS program was initiated in 1993 under the purview of the GA Environmental Protection Division in response to recommendations by the US EPA Region 4 office. These recommendations stemmed from a biannual review conducted by Region 4 of GA EPD's use of 319 funds, which determined that the GA EPD needed to allocate a greater percentage of these funds to nonpoint educational outreach activities. As described in the literature review, in the early 1990's, EPA was increasing its advocacy of volunteer monitoring as one approach to involving citizens in addressing NPS pollutant issues.

After conducting a feasibility study, the GA EPD chose to establish a statewide volunteer monitoring program as a means of meeting Region 4's charge to devote a higher percentage of its 319 funds to community educational outreach activities. In addition, it initiated an environmental education program using Project WET (Water Education for Teachers) as its principal component. Project WET is an interdisciplinary water education curriculum for students aged five to 18 that can be conducted by both formal and informal educators.

Program Mission

The goals of GA AAS were conceived by GA EPD at the inception of the AAS program. They are to: "1) increase public awareness of the State's nonpoint source (NPS) pollution and water quality issues, 2) provide citizens with the tools and training to evaluate and protect their local waterways, 3) encourage partnerships between citizens and their local government, and 4) collect baseline water quality data" (Rivers Alive, NDa). Concise and transparent, these goals have provided direction for the program as it has grown and evolved.

Evolution of Program

GA AAS began under the direction of one full-time staff member. Before determining the overall structure and direction of the program, the program manager evaluated other state programs and visited local monitoring programs throughout the state. She then initiated multiple pilot projects at the school, community, and county levels. As the sole manager without support staff, she was making all the contacts, coordinating all the planning meetings, conducting all the trainings, and maintaining all the documentation. In her words, "…it took most of the first year for me to learn that I couldn't do everything myself" (Hawks, 1996)."

Realizing that she needed additional guidance and assistance, the manager, within the first year of the program, formed the AAS Advisory Board which proved to be a "critical step" for the program. The board is comprised of 20 representatives from business, universities and schools, environmental groups, and municipal associations. According to the current coordinator, beyond seeking a diverse stakeholder representation, the program also seeks board members who can provide a balanced statewide geographic representation and/or can contribute certain knowledge, skills,

or other resources to meet current programmatic needs. Board members are asked to serve for two years with an option to renew at the end of their term. As a part of their commitment, they meet four times per year and attend one weekend retreat. Most board members hold positions that allow them to meet or travel during work hours.

With the assistance of the advisory board, the AAS state manager devised the initial program structure. Following other state models, it was agreed that the program should encourage local group involvement and community partnership support and that it should be accessible to all who wanted to be involved with stream protection. A group interested in participating would be encouraged to seek out local partners to support its efforts, and the state in return would provide training, technical assistance and media assistance. Programmatically, it would consist of a simple three-level structure to accommodate a range of interests and skill levels. Level I would consist of simple visual surveys and litter pick-ups and levels II and III would involve more advanced biological, chemical, and/or habitat improvement activities.

In addition to having the support of the advisory board, the manager was able to obtain guidance from two professors from North Georgia College who had been conducting summer stream monitoring workshops for teachers and were willing to assist with training. It soon became evident that they alone could not conduct all the workshops needed to establish a statewide program, so together they devised a concept to establish regional training centers (RTCs) across the state.

In year two of the program, the GA EPD sought and received additional 319 funds from US EPA Region 4 to establish five college-based RTCs that would assist with both training and data management. Those selected to participate were: 1) Columbus State University; 2) Darton College; 3) Georgia College; 4) Savannah State University; and 5) North Georgia College and State University (NGCSU). Two staff positions in Atlanta were funded to serve as the sixth training center for the Atlanta metro region. This was a two-year $100,000 contract that was intended to establish the centers with the understanding that thereafter the centers would need to obtain other sources of funding to sustain themselves.

By 1996, with the program in its third year, a second person was hired to assist in the overall coordination of the GA AAS program. Although the initial manager left in May of 1997, this time period was still highly productive for the program. With the support of the RTCs, the GA AAS conducted 198 Level I and II training workshops involving 2,455 participants and 15 Train-the-Trainer workshops preparing 142 participants (GA DNR, 1994).

The RTCs had made important contributions to expanding the GA AAS program. However, as their 319 funding ended, some were finding it difficult to obtain additional fiscal support either internally through their schools or externally. To maintain their involvement, albeit to a lesser degree, the GA EPD was able to secure in 1998 an additional grant under the 104b3 wetland program. The one-year grant was for approximately $85,000, with NGCSU named as its subcontractor. It continued to involve the schools formerly involved with the exception of Dalton College, which no longer participated, and with the inclusion of Valdosta State University. Under this grant, RTC accomplishments included conducting regional forums at each center, conducting two statewide workshops, developing wetland-specific AAS training materials, conducting six wetland demonstration projects, establishing three AAS wetland training centers at three of the RTCs and conducting 63 Level I and II workshops.

The program's fifth year, 1999, proved to be a pivotal period for GA AAS in three primary ways. First, changes in staffing occurred. Two new program managers were hired in 1998, replacing two that had left the program. Second, the GA EPD contracted with the University of Georgia's Carl Vinson Institute of Government to conduct a two-fold assessment of GA AAS. The first part of the assessment was directed at evaluating the program's overall effectiveness (O'Looney, 1999a). The second was to evaluate the currently participating groups' levels of activity (e.g., public outreach, best management practices, incident reporting, and field monitoring), changes in their attitudes, knowledge, skill and behavior as a result of participating in AAS, and any recommendations they might have for programmatic improvement (O'Looney, 1999b).

Third, in conjunction with this self-assessment, the new staff along with GA EPD management conducted a review of the future direction of the program. This included beginning to address both the increasing role of "community programs" in their statewide network and the reduced level of participation of the college-based RTCs. Although still serving as technical points of contact and conducting training, not all the RTCs were participating at the level originally envisioned, due to a lack of ongoing funding.

"Community programs" in the GA AAS program are defined as "local Adopt-A-Stream Programs with elevated responsibilities to serve as contacts for individual AAS programs at the local level." They are also those generally sponsored by a city, county, or nonprofit organization. In December 1998, GA AAS held its first meeting with AAS community program coordinators across the state to address the key roles in the statewide AAS network. GA AAS managers identified expectations it held for the AAS community programs while community program coordinators discussed how the state program could assist in start-up and maintenance of local programs (Droszcz and Harbert, 1999a).

A key administrative point addressed in this meeting would ultimately allow for overall state program growth, that being the need to ensure that all community program coordinators were quality assurance/quality control (QA/QC) certified trainers. Both the state and local programs would benefit from this. For the state program, local QA/QC certified trainers would reduce the state staff training workload so that more time could be allocated to other important objectives such as increasing program coverage throughout the state, improving training materials, and enhancing data management. At the local level, community programs would be able to offer better technical support and increase volunteer involvement by offering more workshops (Droszcz and Harbert, 1999a). Since 1999, community program coordinators have taken on more of these responsibilities, and many of these potential benefits have played out.

In contrast, both the role and level of support provided by the RTCs have somewhat diminished. Because they no longer receive funding directly from GA AAS, the involvement of the colleges now primarily depends upon two factors: 1) whether the RTC meets an academic or community service need of the college; and 2) the RTC's ability to secure ongoing financial support. Savannah State College has been particularly successful with acquiring funding for maintaining the operation of its RTC, including funding a full-time professor to conduct regional training and manage a local AAS program.

Current Program Structure

Figure 4.1 illustrates the current structure of the program. The governance of the program ultimately flows down from US EPA Region 4, which provides the funding for the GA AAS program. The program is conducted through the Georgia Department of Natural Resources (DNR), EPD, Water Protection Branch, NPS Program, Implementation and Outreach Unit. The unit manager is responsible for managing 319 funds allocated to GA AAS, providing close out reports to US EPA Region 4, and overseeing AAS program managers. GA AAS staff members are full-time DNR employees and must, therefore, comply with all applicable departmental human resource policies and procedures.

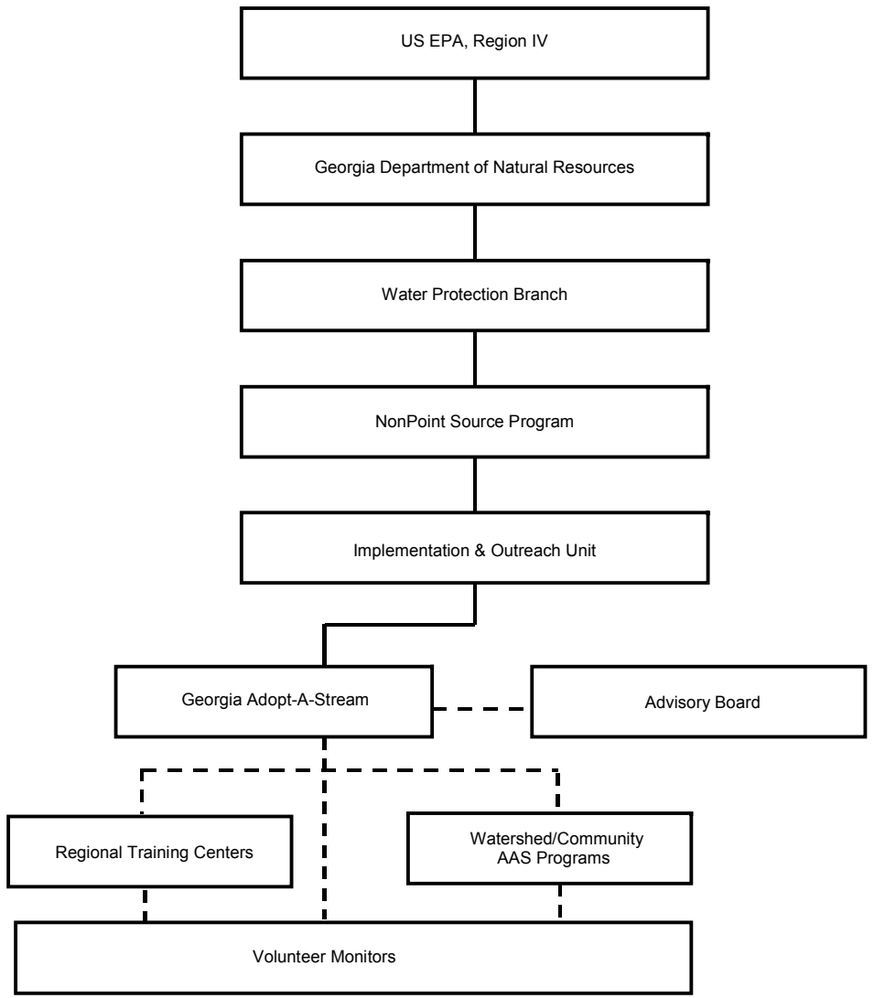
GA AAS staff, in conjunction with its EPD management, has established programmatic policies and procedures. The 20-member advisory board "advises" AAS staff on program direction, growth, technical issues, and training. However, it does not set policy and is not fiscally accountable for the program.

The AAS RTCs currently located at the state universities in Columbus, Milledgeville, Americus, and Savannah are administratively autonomous from the GA AAS Program. Support for the RTC coordinator's involvement in AAS is either provided by the universities or is covered under separate grants obtained by the RTC. Memorandums of Understanding between the GA EPD and the participating universities define the RTCs programmatic responsibilities to GA AAS.

The GA AAS watershed/community programs are, like the RTCs, administratively autonomous from the state-level GA AAS program. No GA EPD staff is employed to conduct the program at the community level. Local municipalities (city/county governments), nonprofits (watershed associations and Keep America Beautiful chapters), and utilities primarily comprise the entities managing the local AAS programs. Each is responsible for funding and acting as the fiscal agent for its AAS program, including hiring staff to coordinate the program and setting management policies. In the case of some of the watershed associations, volunteers coordinate the program.

The overall effectiveness of GA AAS relies on transparent roles and responsibilities of each entity involved in its operation. Following is a summary of each, beginning with the state office.

Figure 4.1
Georgia Adopt-A-Stream Program Organizational Chart



KEY
Denotes administrative relationship
Denotes supportive relationship

State AAS Office

The GA EPD AAS office's role is to plan and implement a statewide citizen-based monitoring program that emphasizes education and the building of local partnerships. This office is also charged with ensuring that the supporting 319 funds are appropriately managed. Specific tasks include:

- Managing the program budget.
- Coordinating and participating in meetings with the AAS board four times per year.
- Conducting local watershed and community groups AAS program "start-up" training including how to administer the GA AAS program model either through "start-up" workshops or by providing one-on-one consultations.
- Coordinating network meetings where community/watershed coordinators come together to obtain statewide program updates, provide feedback to the state office and share experiences and problem solve.
- Developing and updating all program promotional materials.
- Developing partnerships for volunteer outreach activities (e.g., Rivers Alive).
- Developing and updating all training manuals and workshop formats.
- Conducting train-the-trainer workshops, as needed.
- Conducting Level I and II volunteer training workshops, as needed. The number conducted depends on volunteer demand and the availability of workshops being conducted by the RTCs and community/watershed programs.
- Conducting water quality awareness/issue-based workshops (e.g., "Reduce Nonpoint Source Pollution in Your Home" workshop).
- Maintaining the AAS Web site and publishing a bimonthly newsletter.
- Coordinating, in conjunction with interested partners, a statewide annual conference.
- Developing and maintaining the water-quality-data-management system.
- Promoting riparian buffer restoration.

It should be emphasized that the GA AAS staff work closely with their advisory board to provide overall direction for the program. For example, in 2002 they made an intentional effort to increase their program's presence in the southern half of the state, and with the assistance of the board and key local coordinators, they met this goal. Five new community programs were established, and six monitoring workshops were conducted.

Regional Training Centers (RTCs)

The RTCs are affiliated with state universities and currently include: Columbus College and State University; North Georgia College and State University; Savannah State University; and Georgia Southwestern State. Each has one to two professors who are the GA AAS contacts. At minimum, their responsibilities include to:

- Provide program information to citizens interested in joining GA AAS.
- Maintain an inventory of program resources including manuals for volunteers.
- Provide technical assistance to both the state office as well as to volunteers.

The four RTCs serve as vital links in the AAS statewide network. However, the current level of involvement of each is influenced by ongoing institutional and fiscal support and by the professional and personal interests of the professors serving as the AAS contacts. The Savannah State RTC conducts a vibrant local AAS program with ongoing grants secured by the local RTC Coordinator (see Highlight box). The Columbus College & State University College RTC continues to serve as a key AAS training center. The RTC Coordinator is also an active AAS board member and promoter of the program. Georgia Southwestern State currently serves more in a science advisory capacity, providing technical assistance on quality assurance plans, training manuals, and monitoring protocols. Likewise, North Georgia College and State University serves in a science advisory capacity in addition to serving as an AAS training center.

HIGHLIGHT
Savannah State University
Adopt-A-Stream
Coastal Regional Training Center

Dr. Joseph Richardson is at the helm of the AAS Coastal Regional Training Center that currently serves 11 counties along the Georgia coastline. Funding is provided through two primary grants from the:

- Coastal Management Program of the Georgia Department of Natural Resources and the
- National Oceanic and Atmospheric Administration.

In addition to housing a resource library complete with videotapes and maps, the center conducts a range of AAS workshops including quality assurance recertification and train-the-trainer (Savannah State University, 2001).

Watershed/Community Programs

The primary role of a GA AAS watershed/community program is to coordinate the efforts of local volunteers, provide a support structure for them, and bring local resources to bear, including knowledge of local water issues which can enhance the volunteers' ability to protect their adopted waterbodies. Watershed/community programs are generally sponsored by a city, county, or nonprofit and have a level of funding that provides a degree of program stability.

Currently, there are 45 watershed/community programs including 32 government organizations (i.e., city, county, state extension, federal, eight watershed organizations, three River Keepers, one Keep America Beautiful affiliate, and one utility). Following are some key responsibilities of these programs:

- Develop programmatic mission and goals, incorporating community needs and desires.
- Identify key community partners that can provide technical assistance, financial support, clerical support, etc.
- Hire a part-time program coordinator or share following responsibilities among partners.
  - ✓ Set and manage a budget.
  - ✓ Provide local publicity for the program.
  - ✓ Assist with coordination of workshops including scheduling dates and trainers and preparing and managing materials and supplies.
  - ✓ Request partner support for community and volunteer group events.
  - ✓ Develop a working relationship with local leaders and agencies concerned about water issues.
  - ✓ Maintain a list of volunteers, including streams adopted.
  - ✓ Store equipment and supplies and keep track of those loaned out.
  - ✓ Compile volunteer results quarterly and submit to partners and the state AAS office.
- Create local maps to assist volunteers in selecting waterbody sections to be adopted.
- Determine and coordinate community outreach projects (e.g., participation in the Annual River Clean-up Week) (Rivers Alive, NDb).

Over the past four years, GA AAS staff has been strongly encouraging the watershed/community program coordinators to become certified to conduct AAS workshops. Currently about half are qualified to do so, which has increased the number and geographic range of workshops conducted.

Funding

GA AAS has been funded since its inception through US EPA Region 4 319 funds at a level to support two full-time statewide coordinators. The current annual budget is approximately $100,000. In 1995 it received a $100,000 grant to establish the RTCs and in 1996, $85,000 to develop the wetland component of its program. The former was obtained through the EPA Region 4's NPS (319) program and the latter through the 104b3 Wetland Program. At the local level, municipal government, nonprofits and/or supporting community partners provide and/or raise funds to support the community/ watershed AAS programs.

It is relevant to point out that GA AAS is managed out of a regulatory agency that manages the National Pollutant Discharge Elimination System (NPDES) program and conducts enforcement. For that reason, GA AAS does not accept monetary support from the private sector. It has, however, received ongoing support from the Environmental Education Alliance, a nonprofit organization for professionals in the field of environmental education, which provides support for monitoring equipment and supplies for volunteers.

Quality Assurance & Quality Control

US EPA recommends that EPA-funded volunteer monitoring programs have approved Quality Assurance Project Plans (QAPPs). In response to this request and an internal programmatic goal of collecting "quality baseline water quality data," GA AAS submitted its project plan to Region 4 in December 1995 and received approval in April 1996. This plan follows EPA's quality assurance plan guidelines, containing detailed descriptions of the controls that are in place to produce data that will meet AAS's data quality objectives. These include requirements for training and certification of volunteers, sampling protocols including inspection and testing of sampling kits, and data handling and tracking procedures. In 2003, this plan was updated to reflect changes in sampling protocols and data management. Select aspects of it are discussed in the following sections on training, monitoring protocols, and data tracking and management.

Levels of Volunteer Involvement

A range of AAS activities—some quality controlled and others not—are offered to the volunteer who wants to become involved in the GA AAS program. This array of activities has been strategically devised in order to capture the interests of a diverse community of citizens. For example, some activities can engage those highly interested in the science of water and solving local water quality problems while others are more suited for those interested in educating others on NPS issues and maintaining trash-free waterways.

Standard GA AAS activities include:

- Identification and registration of a waterbody. Registration involves completing a form that requests information on the site location, sampling goals, local partners involved, and supplies needed, and providing a map of the adopted site.
- Compilation of a "who to call list." This list includes names and numbers of agencies that volunteers can call if there are suspect activities or conditions that may potentially impact their waterbodies.
- Implementation of a "watershed survey."
- Completion of four "visual surveys" per year and at least one outreach activity and one clean-up. Survey protocols are available for streams, wetlands, and lakes.
- Basic and/or advanced chemical testing of the adopted waterbody.
- Biological assessment that includes inventorying the macroinvertebrate community.

Volunteer Training & Support Materials

Workshops and manuals are available for all AAS assessment activities. Volunteers can access the manuals and workshop presentations from the GA AAS Web site (Rivers Alive, NDa); however, they are encouraged to attend the workshops, particularly if they are going to conduct chemical and biological monitoring.

All workshops are taught by certified AAS trainers. To receive certification, trainers must be QA/QC-certified volunteers, have successfully completed an eight-hour train-the-trainer workshop and have made a commitment to conduct one co-training with another trainer and two additional workshops per year. In addition, they must be recertified on an annual basis to maintain their trainer status. Currently, state AAS staff, a majority of the RTC coordinators, and about half the community/watershed coordinators are certified AAS trainers. At year-end 2002, there were 51 certified trainers (Harbert, 2003a).

Notification of upcoming workshops is provided on the AAS Web site, in the GA AAS newsletters and in community/watershed program newsletters and Web sites. Following is a summary of the three primary workshops conducted for volunteers.

- *Getting Started with Georgia Adopt-A-Stream – 4 hours:* In the first half of this workshop, volunteers learn about how to register a stream, wetland or lake they plan to monitor; how to use maps to delineate and assess their watershed; methods for estimating watershed land uses and impervious surfaces. In the second half, they learn how to conduct watershed and visual stream assessments and how to measure stream flow. (This workshop is often shortened to 1.5 hours and combined with the "Chemical Monitoring" workshop.)

- *Chemical Monitoring Workshop for Quality Assurance – 2.5 hours:* Volunteers learn about basic stream water chemistry and how to conduct chemical tests using hand-held field equipment. Volunteers are given a field and written test to assess their ability to collect accurate and precise data. Those who collect data within 10% accuracy and pass the written test with a score of 80% or better are considered QA/QC volunteers for one year. QA/QC data is maintained in the state data base.

- *Biological Monitoring Workshop for Quality Assurance* – 5 hours: Volunteers learn how to assess the health of a creek by evaluating its macroinvertebrate community. This involves both the collection and identification of benthics. Volunteers who identify the macroinvertebrates with 90% accuracy and pass the written test with a score of 80% or better are considered QA/QC-certified volunteers for one year.

- *Wetland Monitoring* -- 4 hours: Volunteers learn how to monitor soils, vegetation and hydrology.

- *Adopt-A-Lake Workshop:* Level I - Volunteers learn how to conduct watershed assessments, "lake walks," "fish watches," and basic monitoring. Level II – Volunteers learn more advanced monitoring including how to measure chlorophyll a and dissolve oxygen, conduct depth profiles of temperature, identify fish, and estimate sediment loads.

All QA/QC volunteers must renew their certification annually. Volunteers can do this by participating in the second half of the regular chemical and biological workshop.

Adopt-A-Lake and Adopt-A-Wetland workshops are conducted on a less frequent basis than the others. Adopt-A-Lake is a collaborative initiative with the Georgia Lake Management Society. Adopt-A-Wetland workshops are generally conducted at the RTC wetland training centers. Specialized estuary monitoring training is provided through the AAS Coastal Regional Training Center and newly formed UGA Extension Service AAS Adopt-A-Wetland program.

GA AAS also provides workshops for teachers based on its teacher's guide for grades K-12. The guide covers four main topics – NPS pollution, watersheds, biological, and chemical monitoring. All activities are correlated with educational standards making it easier for teachers to integrate the activities into their curriculum.

Monitoring Protocols

GA AAS monitors streams, rivers, lakes, wetlands, and estuaries. Appendix D identifies physical, chemical, and biological parameters typically evaluated by AAS volunteers along with recommended protocols and monitoring kits. QA/QC protocols require all chemical tests to be conducted twice and if the results are not within 10% of one another to rerun them. Also, monitoring kits must be annually inspected and recertified.

Varying levels of AAS assistance are available to obtain monitoring equipment and supplies. "Active" monitoring programs (e.g., those collecting chemical data on a monthly basis) can apply for free replacement reagents through a program sponsored by the Environmental Education Alliance and GA AAS. International Paper has provided funding to the Alliance to obtain monitoring equipment for local and regional AAS education programs in southern Georgia. Additionally, the state, some RTCs and community/watershed programs loan monitoring equipment to the volunteers.

Data Tracking and Management

In 2001/02, a new state AAS database was developed by one of its advisory board members. It is a relational database developed on Access that can track, among other things, newsletter mailing lists, QA/QC collectors, QA/QC workshop trainers, AAS group information, monitoring site locations, and chemical, physical, and biological QA/QC data.

Under the AAS QA/QC plan, only data collected by a "QA/QC volunteer" may be submitted to the AAS database. Field data forms containing QA/QC data may be submitted by volunteers to their local RTC or community/watershed coordinator or sent directly to the state AAS office. Some local programs keep databases for data collected by their volunteers.

Prior to entering monitoring data into the AAS state database, it is reviewed for outliers. Questionable data is typically discussed with the monitor. Volunteers currently do not have the option to enter or view data on-line. However, they are notified that their data has been received and entered into the database by the state office staff and can request information on how the data is being used.

Volunteer Recruitment & Retention Strategies

GA AAS "recruits" volunteers through their Web site, written materials, community/ watershed programs and through the media they receive through ongoing outreach events.

Retaining volunteers requires the use of multiple strategies. Communication and feedback is important to many who donate their time to a cause. Here are some of the key ways that GA AAS communicates with their volunteers:

- *A bimonthly 4-page newsletter* goes out to all volunteers. The newsletter provides bite-size articles on the latest water quality issues particularly relevant to Georgia; highlights activities being conducted by Community/Watershed Programs and RTCs; features volunteers' special efforts; maintains a listing of workshops; provides information on grant and other funding sources; and provides year-end summaries.

2002 Volunteer Awards Categories

- Volunteer of the Year
- Excellence in Data Collection
- Red Flag Award (given to a person who demonstrates environmental awareness & an understanding of water related policy and a desire to act when a problem is detected)
- Extraordinary Volunteer Watershed Effort
- Outstanding Outreach & Partnership
- Adopt-A-Stream in Action: Photograph & Video of the Year

- A *comprehensive Web site* (Rivers Alive, NDa) that includes, but is not limited to: the citizen and community "how-to" guides on becoming involved in the AAS program; AAS "happenings;" resource, material and funding links; and teacher materials.
- *Annual conference* for all volunteers. Conferences have been held since 1993. Over the past three years, AAS has partnered with the Environmental Education Association in order to provide a larger scale, more diverse conference.
- *Volunteer awards* are presented to volunteers at the annual conference.
- *Feedback on data interpretation and use* can be requested from the state office.

Program Outcomes

Volunteer monitoring programs can provide a range of significant outcomes, from organizing activities that directly protect and improve water quality to generating data used to impact waterway usage. For the Georgia AAS Program, partnerships are the underpinnings and springboard for many of its substantive outreach/watershed improvement programs. We will discuss these along with how volunteer data is currently being used within the state.

Partnerships and Outreach Activities

State and local partnerships form the basis for many of the GA AAS outreach activities; the annual Georgia river cleanup event is a prime example of this. Initiated in 1992 by the GA DNR as a statewide event, GA AAS along with the Keep Georgia Beautiful and Help the Hooch programs, soon became lead organizers. Throughout the 90's, the river cleanup continued to grow, with sponsorship and support taking place primarily at the local level. By 1998, volunteer numbers (3600) had doubled from the prior two years and the number of bags of trash collected had jumped from approximately 1,000 to 47,453 (Droszcz,1999b). Equally important, organizers across the state formed an organization called "Rivers Alive" to manage the annual cleanup. With Keep Georgia Beautiful Foundation acting as its fiscal sponsor, fund-raising could now occur at the state-level to assist local groups.

Since 1999, the benefits of the formation of this statewide partnership continue to be apparent. The number of volunteers for the 1999 cleanup nearly doubled over the prior year to 6,500 (Rivers Alive, NDc). And ever since, the numbers and support have

continued to climb. In 2002, there were 130 cleanup sites organized by local community groups, with 17,000 volunteers participating. And to help make it happen, the Rivers Alive nonprofit raised $77,500 through 21 corporate sponsorships (Rivers Alive, NDd).

The annual river cleanup has offered AAS volunteers a clearly defined and visible way to improve the health and aesthetics of Georgia rivers. Other AAS partnerships have likewise provided volunteers with access to resources – knowledge, skills, and tools – to help improve the health of their watersheds and stream and river corridors. In 2001, AAS spearheaded *Corridors: Citizen Riparian Network.* The initiative is comprised of move than 30 governmental and nongovernmental groups. The Network has provided technical information, assistance, and funding opportunities for preserving, enhancing, and restoring stream banks and buffers along waterways. Its Web site has been supported through corporate sponsorships and can be accessed through the AAS Web site (Rivers Alive, NDa).

GA AAS has also joined into two established partnerships worthy of note. The first is a group of organizations with the Environmental Education Alliance of Georgia at its helm which annually organizes a statewide environmental education conference. Until recently, the AAS staff organized and conducted an annual statewide conference for its volunteers. However, by teaming up with the Environmental Education Alliance and others, AAS is now able to offer a conference of a much broader scope and scale to its volunteers than it had been able to previously conduct. The second partnership is with the *Community Watershed Network.* Formed in the mid-90's and located in metro Atlanta, this local collaborative promotes and supports community watershed initiatives by conducting a series of how-to workshops and providing resources and support. In 2003, GA AAS began using this model along with its own community programming to organize local partnerships in other parts of the state (Harbert, 2003a).

2002 Community Watershed Network: Workshop Series

- "*Empowering Underserved Communities,"* March 12, 2002 (Droszczt, 2002).
- *"Great Idea…Now How do I Pay for it,"* Funding Options for Community Watershed Groups, May 14, 2002 (Harbert, 2002).
- "*Atlanta's water resources cannot survive on science alone: Integrating water resource programs through creativity and collaboration in Nancy Creek and beyond,* September 10, 2002 (Harbert, 2002).

Workshops are sponsored by GA AAS, Upper Chattahoochee Riverkeepers, DeKalb County Parks and Recreation, Peavine Watershed Alliance, City of Atlanta Dept. of Public Works, Fulton Co. AAS, Gwinnett Co. AAS, Clayton Co. Water Authority and National Wildlife Federation.

In short, both ephemeral and enduring partnerships have been a key to the GA AAS Program. Short-term partnerships, for example, have been formed on an ongoing basis to conduct workshops that meet the needs of volunteers on a regional and statewide basis while enduring partnerships have been the basis for the formation of local AAS programs and volunteer outreach opportunities.

Data Use

The data generated by GA AAS volunteers are "owned" by the volunteers and can be used on a local level to protect and improve their communities' waterways. Most have used the data to educate the community, follow trends in water quality, and provide "red flags" for acute water quality problems. Annually, GA AAS awards volunteers who demonstrate an exceptional willingness to "follow through" on a water quality problem when it is detected. For example, the 2003 "Red Flag Award" went to a volunteer who had been collecting fecal coliform data for two years and submitting it, along with land use information, to the Georgia Water Protection Branch for review (Droszcz and Harbert, 2003b). Although this data, along with any other volunteer monitoring data, is not currently used to generate the state's water quality reports (305b and 303d reports), it is evaluated to determine areas that may require further monitoring. In addition, there has been some discussion at the state level of possibly using the QA/QC data for river basin planning.

4.2 Alabama Water Watch

Program Inception

AWW was initiated in 1992 under the auspices of the Alabama Department of Environmental Management (ADEM). At that time, EPA 319 funds were available for non-point source programs, and ADEM was interested in using those funds for a citizen-based water monitoring program. Rather than conducting the monitoring program in-house, ADEM approached Auburn University's Department of Fisheries and Allied Aquaculture and the state's Cooperative Extension Services about the possibility of housing and jointly managing such a program. The decision to approach

the two was, in part, based on Auburn's reputation in water science and on the Cooperative Extension's statewide system that ADEM envisioned could be used to deliver the program. The Department of Fisheries accepted the offer, but, at the time, Extension chose to decline.

Program Goals and Objectives

The goals of AWW from its outset have been to: "foster the development of statewide Citizen Volunteer Water Quality Monitoring" by (AWW, NDa):

- Educating citizens about water issues in Alabama and the world.
- Training citizens to measure water quality conditions at sites of concern, and establish a monitoring program.
- Challenging citizens to "make a difference" and potentially improving both water quality and policy by collecting data for long-term water quality trend analysis and helping to identify specific problems that need attention.

Objectives to achieve these goals include to:

- Develop workbooks and other training materials customized for monitoring and understanding water resources in Alabama.
- Train and equip citizens who are committed to a) systematically measuring basic physical, chemical, and biological parameters of water at a specific site and b) sending their data to a central database for statewide coordination and sharing.
- Provide workshops and seminars that meet citizen group and statewide program needs.
- Maintain a Quality Assurance Program that implements EPA-approved protocols for "keeping the data credible."
- Communicate the progress and findings of AWW to citizens, teachers, government agencies, and policy makers through regular reports, newsletters, seminars, workshops, and the media.
- Provide technical and moral support for the development of the Alabama Water Watch Association (AWWA), a statewide affiliation of citizen monitoring groups that have formed a nonprofit with the goal of ensuring that the state's water quality meets or exceeds state and federal standards.

These very specific and concise goals and objectives have provided direction as AWW has grown and evolved.

Program Evolution

The AWW program was developed under the direction of two staff members from Auburn University's Department of Fisheries. They devised AWW's implementation plan based on input from ADEM, an examination of how other states had developed their programs (e.g., Texas, Minnesota, Wisconsin, and Michigan) and the use of EPA volunteer monitoring guides. One factor especially debated in the initial stages of the program was whether it was feasible for volunteer monitors to collect "quality assured" data and, if so, how. By 1994, two decisive steps addressed this issue. First, an experienced full-time quality assurance officer was hired to oversee a quality assurance protocol and analyze data. Second, a QAPP was submitted to US EPA, Region 4 for approval.

During 1994, volunteer participation continued to expand. Citizens enthusiastically responded to the program, in particular lake associations, and by the end of the second year, the staff was managing about 20 active groups. Moreover, two original staff members were conducting about 20 workshops per year. As a way to reallocate some of the workload and provide volunteers with an opportunity for another level of involvement, Train-the-Trainer workshops were initiated in March 1995. This shift in training responsibility met with such success that currently certified citizen trainers are conducting 90 percent of the approximately 50 workshops conducted annually across the state.

AWW volunteers continued to show avid support to the program in 1995 by forming the AWWA, a nonprofit organization, intended to represent citizen volunteers from across the state and serve as a clearinghouse for soliciting and distributing corporate donations and grants to monitoring groups. AWWA would maintain a Board of Directors comprised of citizen monitors who would represent major watersheds of the state, including the Alabama, Cahaba, Upper Coosa, Middle Coosa, Lower Coosa, Coastal Plains Streams, Mobile, Tallapoosa, Tennessee, and Black Warrior and would over the course of the next several years establish the following measures to support AWW:

- Provide AWW citizen trainers with travel reimbursement and training materials.
- Provide active citizen monitors (those who sample at least nine months/year) with chemical reagents and replacement glassware during annual recertification sessions (AWWA receives an annual Legacy, Inc. grant for this purpose).

- Provide food for the AWW/AWWA annual volunteer meeting and picnic.
- Provide partial printing costs of the Stream/Reservoir/Bay Series Reports that highlight citizen monitoring groups.
- Represent citizen concerns and water issues at quarterly meetings with ADEM (AWW, NDb).

Funding to carry out these measures has come from a number of organizations, including Legacy, Inc., Cahaba River Society, Alabama Rivers Alliance, Charles Stewart MOTT Foundation, and Curtis and Edith Munson Foundation. AWWA has also since formed a Citizen Advisory Council that meets quarterly with ADEM to address citizen concerns and water issues. According to the AWWA Web site, “ADEM Directors and Branch Chiefs make a special effort to attend these meetings, offering a great opportunity for AWW monitors to address particular issues of concern and put names with faces of citizen monitors and ADEM officials” (AWW, NDb). As a result, ADEM has responded faster to monitoring concerns and brought the Association closer to achieving its mission “to promote the maintenance of water quality meeting or exceeding the goals of the Clean Water Act through monitoring, education, and action.”

By 1996, there were upwards of 50 active AWW groups, resulting in yet another hurdle to overcome. According to Tina Laidlaw in an article published in *The Volunteer Monitor*, “[R]apid program growth had left [the staff] little time to strengthen their personal contacts with the volunteer monitors. Many new groups were being trained at Water Watch workshops, then left on their own to conduct monthly sampling” (Laidlaw, 1996). In our interview with Program Manager Bill Deutsch, he stated, “We sensed that we were moving forward and generating new interest, but with groups falling through the cracks behind us. We needed someone who could really get a grasp on people's names and needs." This realization, in conjunction with an EPA request for an increase in financial support, allowed for the hiring of the program’s first full-time volunteer monitor coordinator, whose duties included making “house calls” to member groups and being a resource for monitors who needed answers to monitoring and other questions, as well as acting as a liaison between AWW and ADEM. A second position funded at this time was that of education coordinator, a position that was filled out of Troy State University. The education coordinator’s position was utilized to address in-classroom teacher needs as well as to edit the program newsletter, though recently the newsletter editing has reverted to Auburn.

In 1997 the original volunteer monitor coordinator left the program, and with the new hire some responsibilities were shifted. In the second incarnation, the coordinator’s duties included conducting on-site training sessions for volunteers, updating annual reports, and developing monitoring site maps, among others. In 1998, as the program continued to grow and the amount of data submitted by volunteers increased, another staff position, referred to as the “data quality—in-coordinator,” was created to process data, maintain the statewide database, and create data graphs and charts that would allow for interpretation.

By 1999, work had begun on creating and publishing a series of reports focusing on site-specific AWW citizen volunteer monitoring of various state waterbodies. These reports include information of interest on the waterbodies, general descriptions of monitoring activities, specific monitoring results (including data trends and interpretations,) and the significance of ongoing volunteer monitoring efforts. Most of the staff contributed to producing these reports. However, the additional workload the reports generated for the volunteer monitor coordinator eventually led to the addition of another position, titled the “special projects coordinator.” The duties were split, with the volunteer monitor coordinator responsible for workshops, training, and handling volunteer monitor requests (technical assistance, kit refills), and the special projects coordinator responsible for conducting GIS mapping, managing the AWW listserve, and designing technical and educational outreach reports.

1999 also proved to be a critical year in the strengthening of program partnerships and funding diversity. First, the Extension service was brought on as a partner, agreeing to fund 30 percent of the program manager’s position. Second, Auburn’s College of Agriculture agreed to supplement the remainder of this position, freeing up funds (previously allocated to support this position) to cover other staffing and project needs. Two years later, Extension was further incorporated into the program when it set up an Extension Team Project called Community Based Water Monitoring. As a part of this project, Extension agents could participate in AWW at one of four different levels. They can:

1. Promote AWW by distributing information on it including how to become involved and its benefits.
2. Serve as resource contacts, with the Extension office becoming a resource center, housing test kits and refill reagents for local monitoring groups.

3. Coordinate workshops.
4. Progress through the AWW training levels to become a certified trainer.

In the first year of offering this opportunity to Extension agents, 19 became certified monitors.

By 2000, AWW was in the midst of the challenges of updating an expanding database. Having gone through several iterations of redesigns including one by an out-of-state consulting firm, the AWW Manager described this period as "…four to five years process of hitting the wall….as…moving through a very high-risk and expensive mine-field of getting data out to people via the Web." In 2001, a "data quality-out coordinator" position was created and filled. The purpose of this position was to maintain the statewide database and create data reports. With the assistance of an independent database consultant, the coordinator began intensively developing an AWW Database Manager in Microsoft Access that was launched in October of 2002.

Staffing has continued to shift and expand as the number of volunteer groups has grown. In 2001, a program assistant was hired to coordinate workshops (including the *AWW Conference and Annual Meeting*), provide ongoing contact with citizen groups, and update Web-based calendars. Also, some of the original data quality coordinator duties were shifted to the program assistant, including grant management and fiscal oversight and distribution of equipment. By 2002, the number of volunteer groups had grown to approximately 75. A volunteer monitor coordinator was hired to fill this vacated position, with responsibilities to include supporting monitors and trainers as well as maintaining the AWW Web site and assisting with the Extension Team Project. Also a noteworthy trend in the program has been the increasing reliance on the other AWW staff members as well as on the AWWA board members and citizen trainers to meet the ongoing needs of its citizen monitors. AWW marked a major milestone in 2002 as staff and volunteers celebrated its tenth anniversary.

Program Structure

Administratively, AWW is currently housed in the Department of Fisheries and Allied Aquacultures and the International Center for Aquaculture and Aquatic Environments at Auburn University as shown in Figure 4.2. The program is ultimately accountable to both the EPA and the ADEM, with the program manager working directly with ADEM and in some situations with EPA. AWWA, as the nonprofit arm of the organization, serves as a liaison organization between AWW and the monitoring groups. According to the 1994 AWW quality assurance protocol, US EPA Region 4 is identified as AWW's "Program Manager," ADEM as its "Project Manager" and the Auburn AWW program manager as its "Project Coordinator."

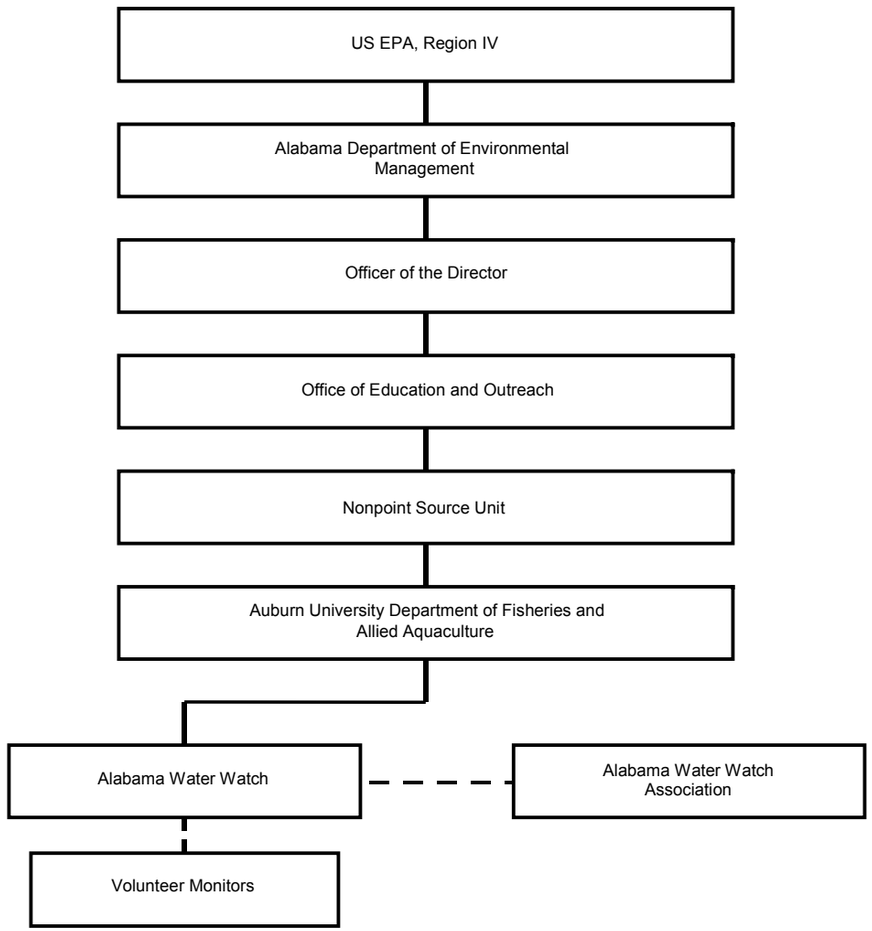
From a programmatic perspective, the state office works directly with both local monitoring groups as well as ADEM. State AWW office responsibilities that directly affect monitoring activities are to:

- Assist with AWW program start-up. This may include conducting training workshops, putting local groups in touch with certified trainers, and providing individual assistance.
- Develop and update training materials, technical documents, and workshops.
- Coordinate and/or implement training workshops, including conducting train-the-trainer workshops to ensure there is sufficient trainer support throughout the state.
- Manage, analyze, and interpret incoming data.
- Coordinate statewide meetings (annual meeting and picnic) and local data interpretation and outreach sessions.
- Oversee and implement QA/QC data protocols.

Administratively, the state AWW office is charged with ensuring that the supporting 319 funds are managed correctly. In addition, AAW staff:

- Manage the overall program budget including the administration of grants.
- Ensure that their US EPA Region 4-QAPP is followed.
- Produce and promote the AWW waterbody report series.
- Maintain the monitoring database.
- Maintain the AWW Web site and publish a semi-annual newsletter.

Figure 4.2
Alabama Water Watch Program Organizational Chart



In part, the program's efficacy stems from its ability to provide technical support to local programs, while acknowledging that the local organizations "own" the data. This system allows the state program to maintain its connection to both the organizations that house and fund it without suffering from conflicts of interest that might occur when the desires of the local groups and the state are in conflict. Though the structure of the program is inherently top-down, by placing the ownership of the data in the hands of the local organizations and by utilizing AWWA as a liaison between volunteers and state Department of Environmental Management, a buffer is created that protects the integrity of the AWW in its relation to ADEM.

Funding

Since its inception, AWW has received primary funding from the US EPA Region 4, 319 funds that are managed by ADEM. The current annual budget is approximately $320,000, which includes both a budget of around $192,000 (60 percent), as well as Auburn match requirements of approximately $128,000 (40 percent). 319 funding has fluctuated between $130,000 per year to about $190,000 per year. Match funds are typically provided by citizen hours collected from workshops and monitoring activities. Since 1999, Cooperative Extension and Auburn University have provided, respectively, one-third and two-thirds of the program manager's salary. Funds raised from sales of BIO-ASSESS, an environmental game developed by AWW with the use of 319 funds, are cycled directly back into the program.

The supportive AWWA has received funding from a number of sources, including the Charles Stewart Mott Foundation, Curtis and Edith Munson Foundation, Cahaba River Society, and Alabama Rivers Alliance. AWWA is also responsible for funds provided by Legacy, Inc., which are raised by the sale of specialty license plates. Grants obtained by the AWWA help cover AWW expenses, including:

- Travel and training materials for citizen trainers.
- Chemical reagents and replacement glassware for active citizen monitors who sample at least nine months/year (supported by annual Legacy, Inc. grant).
- Food for the AWW/AWWA annual meeting and picnic.
- Partial printing of the stream/reservoir/bay series reports highlighting citizen monitoring groups.

Quality Assurance & Quality Control

With quality control as its hallmark, AWW, within three years of program inception, received EPA Region 4 approval of its chemical monitoring QAPP (AWW, 1994), and in 1999 it received approval for its bacteriological monitoring QAPP (AWW, 1999). Its emphasis on quality control is reflected in the sizeable portion of program resources—upwards of 30 to 40 percent—that are directed toward developing and implementing a comprehensive quality assurance program. Recent updates are being made to its chemical monitoring QAPP to reflect programmatic changes that include modifications to the data tracking and management protocols.

AWW's chemical and bacteriological QAPPs provide detailed descriptions of the controls AWW has instituted to ensure that volunteer data is credible, reliable, and usable. These plans also take into account the program's intentional selection of parameters and field kits that are "do-able" for volunteers. Key aspects of AWW's quality assurance controls are highlighted in the following sections on volunteer levels of involvement, training requirements, and data tracking and management. The "AWW Quality Assurance Plan for Chemical Monitoring" may be accessed in its entirety from the AWW Web site.

Levels of Volunteer Involvement

A range of AWW activities are available to interested volunteers who complete the required training. Some are quality controlled activities while others are not. These activities include:

- Water chemistry monitoring.
- Streamwalks that are seasonal visual assessments of a stream habitat and its watershed.
- Bacteriological monitoring.
- Bioassessment of the stream macroinvertebrate population.
- Becoming a water chemistry, bacteriological and/or bioassess trainer.
- Becoming a QA officer that would qualify the volunteer for conducting recertification sessions that provide a refresher on techniques and procedures.

Community outreach activities are not formally incorporated into AWW; however, they are encouraged. Such activities include stormdrain stenciling, using collected data to inform community members about the conditions of their waterways, and spearheading and/or conducting watershed remediation and restoration based on problem areas identified from monitoring.

Volunteer Training & Support Materials

AWW offers training workshops by certified trainers on how to conduct chemical, bacteriological and benthic monitoring as well as to prepare active volunteer monitors for becoming AWW workshop trainers. AWW QAPPs currently require that monitors who plan to submit chemical and bacteriological data to the AWW database successfully complete the respective training workshops, including demonstrating a proficiency in conducting the protocols and properly managing collected data. Following is a description of the workshops along with QA/QC certification requirements (AWW, NDd).

- *Water Chemistry:* Six-hour sessions that introduce citizens to the AWW program and teaches them how to monitor and evaluate physical and chemical features of water. Six water quality parameters, measured with a customized test kit, form the core of the citizen data. The basic parameters are:
  - pH
  - Temperature
  - Total alkalinity
  - Total hardness
  - Dissolved oxygen
  - Turbidity

  Volunteers who wish to become QA/QC certified are asked to sign a "Volunteer Commitment Statement" that provides in writing their commitment to collecting data that is accurate and objective.

- *Recertification:* One-hour sessions where the QA officer conducts side-by-side water monitoring with the volunteer monitor to ensure sampling techniques and equipment meet QA/QC requirements. During this workshop expired reagents are replaced to maintain the test kits at optimum performance.

All water chemistry monitors are required to attend this recertification session after their first year of monitoring. Thereafter, as long as the monitors retain their "active" monitoring status (i.e., submitting six samples per year), they are only required to attend the recertification session biannually.

- *Bacteriological Monitoring:* Three-hour sessions where citizens are introduced to AWW and are trained in coliform testing and related water quality standards. Specifically, monitors are trained in:
  - Biological testing.
  - Water quality standards.
  - Plate techniques.
  - Bacterial counts including total coliform and *E. coli.*
  - Site selection.

  Bacteriological monitoring recertification is not currently required.

- *Stream Bioassessment*: Four-hour sessions that introduce citizens to AWW and teach the principles and practice of using stream macroinvertabrates in evaluating a stream's water quality.

- *Training the Trainers*
  - *Water Chemistry Monitoring*
  - *Bacteriological Monitoring*
  - *Stream Bioassessment*
  - *Quality Assurance Officers*

  Specific requirements must be met to become a certified trainer. The individual must have: met the training requirements to be an AWW monitor; actively monitored (i.e., regularly submit data forms) for a period of one year; and interned with a certified trainer at two workshops, the first one to serve as an assistant trainer and the second as the primary trainer. Trainers are also responsible for coordinating workshops logistics and maintaining communication with the AAW program office.
- *Trainer Refreshers*: All trainers are required to attend trainer refresher courses at least once every two years to keep their certifications active.

Manuals are available for all AWW monitoring workshops. Bacteria, bioassessment, and water chemistry data forms used by the volunteer monitors are available on the AWW Web site. Notification of upcoming workshops is also provided on the AWW Web site and in the AWW newsletter. In conjunction with Auburn University's Office of Outreach Information Continuing Education Units (CEUs), AWW offers continuing education credits for nine certification workshops and for the annual *AWW Technical and Public Information Conference*. To receive credit, citizen monitors must fill out an official Auburn University CEU registration form for each attended workshop.

Monitoring Protocols

AWW protocols encompass the monitoring of streams, reservoirs and coastal areas. Appendix E identifies the chemical, bacteriological, and macroinvertebrate parameters currently monitored under standard AWW protocols. It also identifies specific monitoring equipment used by AWW. As a part of the AWW QAPP, precision and accuracy of the test kits have been evaluated in the Department of Fisheries onsite water chemistry laboratory using American Public Health Association standard methods.

Volunteers typically purchase monitoring equipment for their own use. However, kits are also available for loan from the state AWW office as well as from select field offices of the Alabama Cooperative Extension, Natural Resource Conservation Service, Soil Conservation District, and from local museums. Additionally, a goal of AWW is to provide test kit chemical refills free of charge to active monitors. Legacy, Inc., Partners in Environmental Education, provides a grant to the AWWA to cover part of the cost for chemical refills for monitors who have submitted at least nine data reporting forms in a year to the AWW program office.

Data Tracking & Management

The AWW QAPP (AWW, 1994) includes specific steps for tracking data from the field to the AWW database, which minimizes error and allows for citizen monitor feedback:

1. The volunteer first records data on a field sheet that has three carbonless copies: the white sheet (original) and yellow copy are mailed to Auburn University's Department of Fisheries after each sampling, with the yellow being filed for ADEM until requested; the pink copy is sent to the monitor's organization; and

the gold copy is kept by the field monitor in the event of loss in the mail and to facilitate questioning about reported data.

2. Data sheets are screened by a QA/QC officer for errors or problems such as missing data, dates, times, incorrect units, or other errors. The QA officer is to be aware of "typical water quality ranges of the different physiographic regions in the State from research data." The volunteer monitor is contacted to resolve most errors. If extreme readings are found, the volunteer monitor will be requested to test the parameter again using another test kit and to contact another monitor to test the parameter.
3. A QA officer marks that the data sheets have been checked and submits them for data entry.
4. Each data sheet is assigned a reference number and "flagged" if data is collected from uncertified monitors and/or test kits. All received data is combined but can be categorized as needed.
5. Data entered into the computer is printed and checked against the "raw" data sheet and corrections made.
6. A second check is done of the raw data sheets against a printout of the corrected data.
7. The data is marked as ready for analysis.

Volunteers can now also submit data to a newly designed AWW database manager in Microsoft Access that allows volunteers to not only enter and access data online, but also to graph multi-year data in real-time. Other functions will soon include the use of the Arcview GIS to spatially view data along with the viewing of thousands of photographs including aerials.

AWW QAPPs are currently being updated to reflect volunteer online data entry. Following are some of the key changes.

- Each monitor has a unique User identification and password.
- Before data is submitted, the monitor must click on a box signifying that his/her certification is current and that fresh chemicals have been used.
- Select parameters have built-in limits and a red warning appears if the value entered is outside the acceptable range.
- A confirmation page is provided to show the data the monitor has entered and allow for its editing.
- The field data form is to be kept by the monitor for reference purposes.
- A help line is offered for any problems with online data entry.

Volunteer Recruitment & Retention Strategies

AWW recruits volunteers through word of mouth, public meetings, the AWW Web site, and promotion by Extension agents. It retains its volunteers by providing interpretative feedback on collected data, keeping them updated on current events and technical issues, and providing social gatherings and technical conferences. More specifically, these strategies include such outlets as:

2003 Volunteer Awards Categories

- Manic Mayfly
- Trainer of the Year
- QA/QC Officer of the Year
- Fresh Faces Award
- Tried and True
- Super Student Award
- AWWA Plank Award
- Special Achievements Award
- Midge Award
- Outstanding Service Award

- *The AWW newsletter* that is produced three to four times a year and posted on the Web site. Hard copies are available at the request of volunteers.
- *A comprehensive Web site* (AWW, NDb) which includes, but is not limited to: an AWW program overview; AWW publications including its newsletters; listings of AWW workshops and trainers; information on ordering supplies; and program news and events.
- *An online interactive database* that can be accessed through the AWW Web site.
- *An annual social gathering* for volunteers. Held since 1993, the meeting provides an opportunity for volunteers and program staff to come together to review the past year's accomplishments.
- *An annual technical meeting* for volunteers that includes updates on monitoring techniques, technological advances (e.g., Web site data entry), and watershed protection issues.
- *Volunteer awards* are given to volunteers and monitoring groups at the annual meeting.

Program Outcomes

Each volunteer monitoring program has particular emphases that result in its own unique set of outcomes. Like many other volunteer monitoring programs, AWW has developed a strong set of partnerships to further its mission. However, it has been particularly noted for the special attention that it has placed, since its outset, on collecting quality-controlled data. As a result, AWW has been able to broaden the scope of how data

may be used and ultimately the benefits it provides to the state. Following is a summary of these two significant AWW outcomes.

Partnerships

AWW has formed a number of strong partnerships that have enhanced its ability to address the needs of both program volunteers and the program itself. Perhaps the greatest partnership formed has been that between AWW and the AWWA. This partnership has allowed AWW to connect with both volunteers and ADEM at a level that would not otherwise have been possible. According to Bill Deutsch, the AWWA is the primary partnership for fulfilling the AWW mission and goal — AWW provides technical support to AWWA, and AWWA continues to help organize monitors and promote clean water action plans. The Citizen Advisory Council meetings arranged by AWWA provide an outlet for AWW volunteers and ADEM staff to share concerns and needs, thus strengthening the relationship between the program and the state environmental office. The AWW/AWWA partnership also provides another "level of activity" by which volunteer monitors may be involved in the AWW program.

The partnership between AWW and Cooperative Extension is another that has provided benefits to both programs. At the most basic level, the relationship fostered between the two has allowed Extension agents the opportunity to fulfill certain job requirements, while the financial support provided to AWW by Extension has given them an additional secure source of funding. On a broader scale, Extension's ability to reach potential stakeholders who might not otherwise be familiar with the AWW program has provided AWW with a measure of needed publicity and an opportunity to diversify its volunteer base. In return, Extension's association with AWW provides it with another level of community involvement through a program that meshes well with its overall goals.

Data Use

Data collected by AWW volunteers have had three major outlets, namely:

- *Environmental Education*: Using the data to instruct in a classroom setting, for curriculum development, or for after school programs and adult education.
- *Restoration and Remediation Work.*
- *Influence Policy:* Revision/creation of local ordinances and other water protection policies and the identification of impaired and improved waterbodies (i.e., addition and/or removal of waterbodies from the state's 303d list that identifies waterways not meeting state water quality standards).

These three avenues provide for the use of AWW data in such a way that both volunteers and the state benefit from its distribution.

Environmental Education

A basic precept of AWW has been that by increasing the knowledge of volunteers and community groups, it will effectively increase the stake participants have in both the program and the waterbodies they monitor. The data generated by the volunteers have formed the basis for this education. According to the Web site, "Since the inception of the AWW program in late 1992, monitors have sampled 1,500 sites on 550 waterbodies and submitted 25,000 chemistry and 6,000 bacteriological data forms. All data received is analyzed, summarized, charted, graphed, and presented to the monitors, policy makers, media, and other interested citizens through the semi-annual Alabama Water Watch newsletter, video presentations,…[and] through a report series for each waterbody monitored" (AWW, NDe).

Evidence of the importance of educational outreach to the community may be seen in the reaction of program participants to AWW educational outreach initiatives. AWW, for example, has produced glossy, information-filled reports on select waterbodies. As a result of the positive response by the volunteers to these reports, AWW has increased the number of volumes of these reports it has produced. AWW also sponsors an annual *Technical and Public Information Conference* for interested volunteers and members of the public. Topics covered at these meetings have included such issues as "How Your Group Can Interpret and Use Your Data and Mercury in Alabama's Environment," among others. The annual picnic also provides an outlet for education, as it informs local volunteers of the highlights of the past year's program outcomes, initiatives, and monitoring activities. Finally, citizen data interpretation sessions are "regional meetings where AWW personnel and citizen monitors can enhance communication, share data, and interpret water quality data from several sites tested. As well, citizens are able to express concerns about sites in their area and to discuss future monitoring plans" (Deutsch, 2002). By taking these steps to expand the knowledge

of volunteers and community groups, AWW effectively increases the stake that participants have in both the program and the waterbodies they monitor.

Restoration/Remediation Work

AWW volunteers "own" their data, meaning that they can use their data to benefit the communities in which they monitor. Many of the groups have used the data to "red flag" water quality problems that can be resolved on a local level (e.g., sewer line breaks). It has also been used in conjunction with remediation/restoration work done by Cooperative Extension Services.

Influence Policy

Data has also been used by the state in generating the water quality impaired waterbody list (i.e., 303(d) list) and the state water quality inventory report (i.e., 305(b) report), primarily in a corroborative fashion rather than as the sole source data. Additionally, AWW was recently contacted by two engineering firms that have contracted with the state to prepare total maximum daily load plans (i.e., pollutant-specific reduction plans for impaired waterbodies) and wish to include citizen data in the process. AWW's rigorous QA/QC protocol has proven invaluable to the willingness of the state to use citizen monitoring data in complying with its water quality reporting requirements.

4.3 Kentucky Water Watch

Each state's approach to implementing volunteer monitoring is to some degree unique, with each offering valuable approaches and insights that cannot be obtained elsewhere. The KY WW program is no exception to this. While providing a statewide volunteer monitoring program to interested citizens and community/school groups since 1985, KY WW's primary role has shifted to one of a "volunteer monitoring technical service" provider. In this role, it offers assistance to citizen-based water monitoring efforts being initiated by nongovernmental organizations (NGOs) and others across the state of Kentucky.

Of these efforts, KY WW currently dedicates more than half its time to providing technical and programmatic support to a statewide volunteer monitoring program managed by an NGO and conducted at the basin level known as KY Watershed Watch. In essence, it is one of KY WW's primary "customers." Along with the KY WW program, we include in the following overview an extended review of the programmatic and administrative structure of KY Watershed Watch. We include this for three principal reasons. First, KY Watershed Watch is now an extensive part of the loosely formed network of volunteer monitoring programs across Kentucky that has been established, in part, through the services provided by KY WW. In short, KY Watershed Watch*ers* comprise a significant portion of the statewide pool of volunteer monitors supported by KY WW. Second, its relationship to KY WW provides a prime example of how it implements its "technical service provider" program model. Third, its volunteers are those we surveyed as a part of this study.

Initiation

Conceived in April 1985 by the Commissioner of the Department of Environmental Programs under the newly elected governor, Martha Layne Collins, the intent of KY WW was to provide more on-the-ground citizen involvement in stream protection. With support of the Natural Resource and Environmental Protection Cabinet and using the North Carolina Clean Streams program as a model, the Commissioner quickly turned KY WW into a reality. By October 1985, a program manager was hired and its program structure began to take shape.

Program Mission & Goals

The mission set forth by KY WW was direct – "to help you [Kentucky citizens] protect the streams, rivers, lakes and wetlands near and dear to your heart" (KY DOW, 2004a). In order to accomplish this, goals included:

- Assisting local community groups in developing information concerning the quality of water resources close to them.
- Providing information to the Kentucky DOW about stream segments not covered by the existing Kentucky Ambient Water Quality Monitoring Network.
- Focusing attention on the condition of Kentucky's water resources in order to educate the public at large about the condition of streams and rivers.
- Testing the feasibility of using volunteer assistance in operating a statewide water quality monitoring network.

These aspirations still hold true, but how KY WW has chosen to approach accomplishing them has markedly shifted as the program has matured and expanded.

Program Evolution

KY WW was designed to be administered out of the KY Division of Water (DOW) Program Planning and Administration Branch and has since remained within this branch. The initial program emphasis was on community education and outreach, with the program manager devoting about half of his time to developing and conducting school-based water quality education programs. This emphasis included providing teacher training as well as in-class programs. For the younger grade levels, KY WW often included "Ollie Otter," the water quality mascot, who would engage students in entertaining and informative presentations. At the high school level, the emphasis was on supporting student science projects and conducting stream water quality monitoring within intermediate and advanced science classes. The "Stream Inter-link Project," for example, designed and conducted by KY WW emphasizes the application of technology in the collection, analysis, and sharing of data among KY WW high school students (KY DOW, 2004b). KY WW has also maintained a strong presence at the college level, in part, because it could be used to fulfill community service requirements established within the Kentucky Community and Technical College System (KCTCS) and regional universities.

Although students were by far the largest constituency participating in monitoring activities in the early years of KY WW, the program also encouraged adult volunteers to organize at the local level and form their own KY WW groups. To facilitate this, KY WW provided "start-up" support including conducting "how-to" workshops and providing fund-raising ideas and templates for items such as articles of incorporation, letterhead and logos. It also provided educational and outreach opportunities for adults including assisting civic and other community groups in coordinating workshops and speakers and focusing on events that would bring Kentuckians "down to the water's edge." Such events included helping to organize group stream floats, stream walks, or shoreline clean-ups.

With an early emphasis on student involvement and an increasing one on adults, KY WW continued to build its volunteer base. By 1998, it reported involving 327 volunteers, 220 teachers and 32,600 students (US EPA, 1998). However, its support of adults in volunteer monitoring was about to be markedly advanced with the inception of the KY Watershed Watch Program – a nonprofit statewide program involving adults in more advanced sampling. KY WW would provide technical consulting services to the start-up of this program as well as eventually dedicate more than half of its staff time to its ongoing maintenance, marking a shift in KY WW in two key ways. First, there would be less emphasis on promoting KY WW, per se, and more on promoting and supporting basin/regional volunteer monitoring programs that would retain their own identity. Second, there would be a broadening of the scope of the types of monitoring conducted, resulting in the production of data with more wide-ranging uses.

The formation of *Watershed Watch* in 1997 was a product of timely events and shared organizational interests. The state of Kentucky at the time was establishing a program known as the Watershed Management Framework (WMF) that provided a formalized approach to managing eight designated water basins across the state. As a part of the WMF approach, basin assessments would be conducted on a five year cycle with the assistance of River Basin Teams. These teams were to consist of state and local governmental and NGO representatives and were to request input from local grassroots organizations.

The Kentucky River Basin was one of the initial basins to participate in the WMF. Within this basin there was an environmental NGO, the Cumberland Chapter of the Sierra Club, which had been actively working in watershed protection and was interested in water monitoring. During this time, this Chapter had also received approximately $36,000 from a court settlement. A long-time member of and legal counsel for the Cumberland Chapter, Hank Grady, saw the nexus of these events—the WMF initiation, the Chapter's interest in establishing a water monitoring program, and its timely receipt of additional funds—-as a perfect opportunity to establish a monitoring program that would support the genuine involvement of citizens in the WMF. KY WW was sought to help design the program. To broaden and strengthen this partnership, the Kentucky Waterways Alliance and the Kentucky River Authority were also invited to participate in the establishment of this program.

The original intent of this program was to establish an initiative that would specifically be compatible with the WMF 5-year cycle. Spearheaders of KY Watershed Watch worked with the WMF staff to devise such a program, resulting in a program strategy whereby volunteers would collect data only during the "data collection" phase of the WMF 5-year cycle. KY Watershed Watch would, in essence, move from one basin to the next corresponding to the WMF "data gathering" time frames and organize citizens on a basin level to be a part of this process.

Once the decision had been made to establish KY Watershed Watch and to kick it off in the Kentucky River Basin, it gained momentum with the financial support of the KRA and the KY DOW. The KWA allowed it to use its federal tax exempt number for grants received from the Virginia Environmental Endowment, a regional environmental NGO known as PRIDE (Personal Responsibility in a Desirable Environment), Walmart, and others. In its first year of implementation, over 120 volunteer water quality monitors were trained and over 60 sites in the Kentucky River Basin were sampled (Howell, 2000).

By 2001, an Interbasin Coordinating Committee (ICC) was established to coordinate KY Watershed Watch activities across the state along with those of the Steering Committees within each of the eight participating basins. Interestingly, once the program structure was set and each of the basins had participated in the "scoping and data gathering" phase of the WMF cycle, each Basin Steering Committee made the decision to continue to operate beyond this designated period. This collective decision among all the basin steering committees essentially transitioned the KY Watershed Watch from a program that originally was envisioned to be a series of temporary data-gathering efforts to an ongoing citizen-based water monitoring initiative.

KY WW continued to expand its technical support services to other volunteer monitoring efforts across Kentucky. In 2000, it was approached by PRIDE to assist with *Project Clean Streams,* a newly-formed program designed to train teachers in water quality assessment and stream monitoring (Center for Rural Development, ND). KY WW has supported this program through its involvement in semiannual teacher workshops. It has also provided volunteer monitoring technical services for a host of other organizations including the Kentucky Federation of Farm Bureaus, Soil Conservation Districts, Kentucky Telephone Pioneers, Rotary Clubs, and corporate citizens such as Toyota Motor Corporation.

Program Structure

With the exception of the hiring of a program assistant in 1992, Water Watch's administrative structure has changed minimally over the past 15 years. The governance of the program, as shown in Figure 4.3, is structured within the Natural Resources and Environmental Protection Cabinet, Department of Environmental Protection, DOW. The KY WW Manager reports directly to the Program Planning and Administration Branch manager, who reports to the DOW Director. The branch manager is responsible for submitting federal and state year-end grant reports and ensuring that the grant monies are managed appropriately.

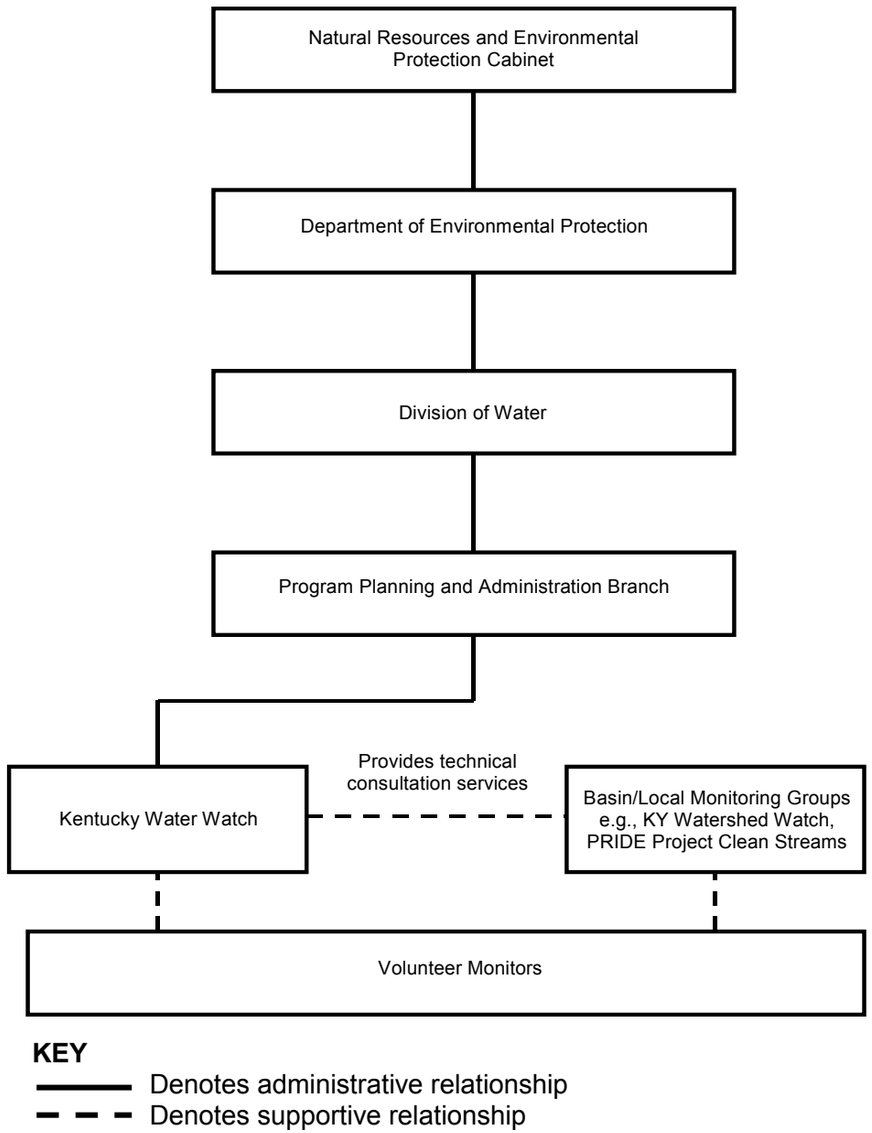
In contrast with the program's administrative structure, its programmatic approach to supporting volunteer monitors across the state has substantially shifted. Whereas in its formative years KY WW was providing direct support to its volunteers, it now primarily provides technical services to groups/organizations that conduct, or are interested in conducting, volunteer monitoring. Its largest "customer" is KY Watershed Watch*,* with approximately 60% of KY WW staff time being devoted to the support and maintenance of this program.

Another primary "customer" is PRIDE, which conducts the student-based Clean Stream Program. In addition, KY WW provides technical consultations to businesses, government agencies, community and civic groups, and colleges. In some cases, groups have retained the KY WW name and its baseline monitoring activities and, in other cases, groups have maintained their own organization/corporate identity and have, with the technical assistance of KY WW*,* adopted a set of monitoring protocols specific to their group's sampling goals.

As a technical service provider, KY WW support services may include, but are not limited to:

- "Start-up" guidance during the formative stage of a group.
- Assistance in determining appropriate monitoring protocols.
- Customization of KY WW standard training materials, as needed.
- Implementation of volunteer and train-the-trainer workshops.
- Assistance with promotional materials.
- Coordination of community educational and outreach workshops.
- Assistance with Web site including on-line data entry.
- Management of volunteer monitoring data.
- Assistance with program plans including strategic and QA/QC plans.

Figure 4.3
Kentucky Water Watch Program Organizational Chart



Individuals who contact KY WW and are interested in monitoring a waterbody will receive support either directly from KY WW or be directed, if deemed appropriate, to a volunteer monitoring program located in their vicinity. For example, KY WW staff would link an adult interested in advanced monitoring with the nearest *Watershed Watch* Program contact*;* whereas, if a teacher within the PRIDE service region is enquiring, it may be more appropriate to recommend involvement in *Project Clean Streams.* If the interested teacher is not located within the PRIDE service region, KY WW would directly provide the needed support.

Funding

KY WW has an annual budget of roughly $81,000, with approximately half going towards salaries and the remainder being used to support training workshop and monitoring supplies, travel, and overhead. Roughly sixty percent of funding is provided through two CWA grant sources—205j, Water Pollution Prevention Planning and 106, Water Pollution Control and Abatement Programs—and the remainder through the State Executive Budget.

Quality Assurance and Quality Control

KY WW does not currently have a US EPA-approved QAPP. However, it does cover QA/QC measures in training workshops and consultative services. For example, it has assisted KY Watershed Watch in establishing scientific advisory panels in each of the participating basins responsible for developing monitoring plans that include quality control procedures.

Monitoring Levels of Involvement

KY WW draws from a baseline set of “tried and true” monitoring activities in devising monitoring plans for groups or individuals interested in monitoring. Categorically, they include:

- Basic chemistry involving the use of colorimetric field kits.
- Basic benthic community assessment.
- Habitat assessment.
- Fecal coliform bacteria counts.
- Advanced chemical monitoring using “portable field labs” or certified labs.
- Still and videotaping of stream site.

Although the protocols may be packaged in different configurations or adapted depending on the monitoring objectives of the "customer," by working from a baseline set of protocols, KY WW can retain some consistency in how waterbodies are being monitored across the state. More detailed information about these methodologies is provided in Appendix F.

KY WW generally does not provide equipment or supplies for volunteer groups. However, it does provide information on vendors and will assist groups in identifying potential sources of funding for the purchase of equipment and supplies. It also has an all-in-one supply monitoring assemblage referred to as the "treasure chest' that includes KY WW educational materials, supplies and equipment that may be purchased by school and other community groups interested in conducting streamwalks and basic chemistry and benthic assessments.

Volunteer Group Training & Support Materials

Groups interested in starting up a volunteer monitoring program in Kentucky are recommended to take the following steps:

- Contact the KY WW office via phone, e-mail, or mail.
- Schedule an "overview program" that includes a review of program options.
- Set up a meeting to discuss what "mix" of activities that best suits the group.
- Schedule training.

Workshops are conducted by either the KY WW Manager or trained instructors participating in an established volunteer monitoring program (e.g., KY Watershed Watch). The instructors must have completed a train-the-trainer course and are evaluated by the quality of data collected by their workshop participants. Standard workshop materials are available that cover the basic KY WW monitoring activities and can be tailored to meet volunteer monitoring group needs.

Volunteer Recruitment and Retention Strategies

The KY WW Program "recruits" individuals and groups to become volunteer monitors through a combination of means including:

- Maintaining an informative Web site that includes a question/comment submittal page.
- Maintaining a toll-free telephone number.
- Using KY WW and related listserves.

In addition, through the network of volunteer monitoring groups KY WW has helped to set up across the state, word of mouth has become a major means of volunteer monitoring promotion.

Data Tracking & Management

Field data may be sent by volunteers via mail to the state office to be archived in the KY WW database or submitted directly online (KY DOW, NDa). Online data by a school or any other group first requires that information be provided by the "sampling supervisor." This person is responsible for overseeing the collection of the data at the sampling site. Data is currently stored on a secure SQL server.

Program Outcomes

By moving towards a programmatic structure that primarily provides consultative services to groups interested in water monitoring in Kentucky, KY WW has achieved three notable outcomes. First, it has fostered diverse volunteer monitoring programs and partnerships across the state, in short a loosely formed network of "independent" volunteer monitoring programs. Although these programs may have varying outward appearances with many of the sponsoring organizations retaining their own identities, KY WW does promote using standard monitoring protocols to ensure some level of data consistency among programs. Second, KY WW has established itself as a common link among these volunteer monitoring groups and is therefore in a position to be able to more readily distribute volunteer monitoring information and news and to foster communication among the groups. Third, as a service provider, KY WW retains the ability to promote statewide opportunities for community outreach. Two it currently promotes are:

- *Kentucky Rivers Month:* An effort to encourage groups to coordinate recreational events to focus community attention on the positive benefits of local waterways. As a part of this event, sponsors are provided promotional assistance by KY WW*,* upon request.

- Annual *Shoreline Clean-up:* An effort to encourage groups to coordinate a litter pick-up along a waterbody during the month of May as a part of Keep America Beautiful month. KY WW offers groups assistance in coordinating cleanups including providing promotional flyers, certificates of appreciation for volunteers, and how-to handbooks (KY DOW, 2004c).

As a technical service provider, KY WW also strives to ensure three outcomes: first, providing high quality services and products; second, "customer" satisfaction; and third assuring that each of the programs "succeed," in essence, that they grow and ultimately accomplish their mission. It is by supporting these programs that Water *Watch* can accomplish its mission of protecting Kentucky's waterways.

KY WW has a particularly high stake in ensuring that two programs it supports do well: Project Clean Streams which involves students and KY Watershed Watch comprised primarily of adult volunteers. Both monitoring programs serve a significant portion of the volunteer monitors across the state, have wide-ranging partner support, and have been supported by KY WW since their inception.

Project Clean Streams is a high-quality and well-funded student-based stream monitoring program conducted throughout 38 counties in Kentucky. Since the inception of this program in 2000, KY WW has partnered with PRIDE to provide semiannual training to more than 300 teachers who have now involved more than 21,000 students in water quality monitoring (CRD, ND). It has also provided technical assistance on *Project Clean Stream* monitoring protocols that include:

- Stream condition photo documentation.
- Habitat assessment.
- Physical & chemical testing.
- Fecal coliform analysis (grab samples taken and sent to labs for analysis).
- Benthic macroinvertebrate assessment.
- Trash impacts analysis.

PRIDE
Personal Responsibility in a Desirable Environment
http://www.kypride.org/

Initiated in 1997 by Congressman Harold Rogers and the late James Bickford, the former KY Secretary of Natural Resources & Environmental Protection, the mission of PRIDE is:

> "to unite volunteers [in southern and eastern Kentucky] with the resources of federal, state and local governments in order to clean the region's waterways, end illegal trash dumps and promote environmental awareness and education, while renewing pride in the region."

Since 1997, more than $66 million in federal funds have been secured for PRIDE through grants from the National Oceanic & Atmospheric Administration. Types of projects funded throughout the 38-county service area include:

- Illegal dump removal.
- Annual stream clean-ups.
- Straight pipe removal & failing septic tank repair.
- Water quality monitoring programs—student-based Project Clean Streams, and for adults, the Watershed Watch Program.

Once data is collected and analyzed, students can submit and view it on the PRIDE Web site.

As a technical service provider, KY WW currently maintains its greatest investment in *Watershed Watch,* with over half of its staff time currently devoted to maintaining and growing this program. In addition, many former KY WW volunteers are now participating as KY Watershed Watchers. Its administrative and programmatic structure along with its relationship to KY WW provides yet another instructive volunteer monitoring program model of how a state can conduct volunteer monitoring. Thus, the remainder of this overview will be dedicated to a discussion of the implementation of *Watershed Watch.*

Kentucky Watershed Watch

KY Watershed Watch currently serves as the primary volunteer monitoring program for the state of Kentucky conducted at the basin level and is geared towards involving adults. By placing an emphasis on educating volunteers on watershed issues and collecting high quality data, it also advocates volunteer involvement in the KY WMF basin planning process.

Program Structure

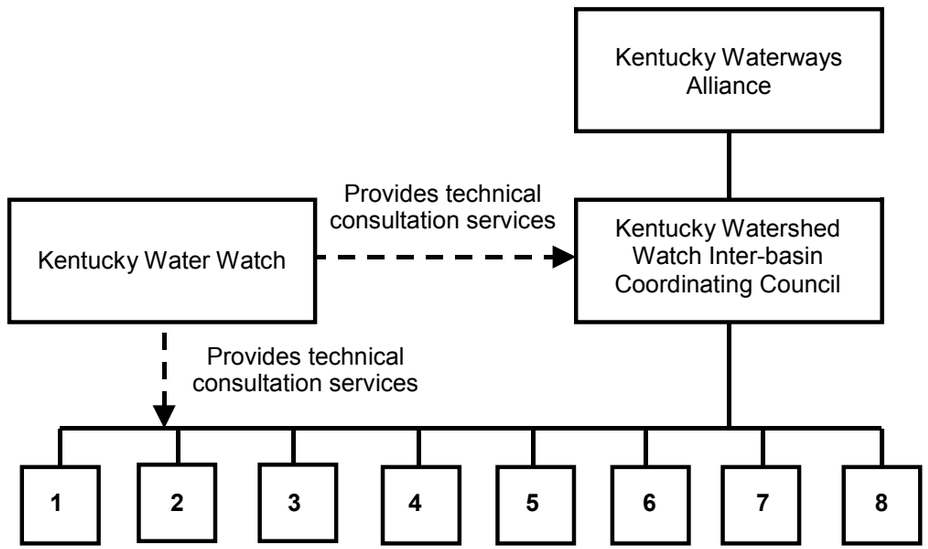
KY Watershed Watch is governed at the state level by the ICC comprised of one representative each from the Kentucky Waterways Alliance, Cumberland Chapter of the Sierra Club, KY WW, and each of the Local Watershed Steering Committees. Its mission is:

> "to coordinate a statewide effort to improve water quality by fully implementing the interim and long-term goals of the Clean Water Act…establish a support structure for regionally responsive, financially sustainable, scientific and legally defensible citizen monitoring of watershed health across the Commonwealth… [and] help establish methods to measure actual improvements in the water quality across the Commonwealth" (KY DOW, NDb).

The ICC currently operates under the auspices of the Kentucky Waterways Alliance as shown in Figure 4.4. As an incorporated nonprofit, the Kentucky Waterways Alliance manages ICC funds including submitting and receiving its grants. ICC responsibilities include to:

- Serve as a clearinghouse for scheduling, information, and coordination among the various local watershed projects.
- Research and develop monitoring protocols applicable to Kentucky waterways and assist local projects in developing monitoring protocols applicable to that region.
- Coordinate, where possible cooperative purchasing, lab and work contracts, and material acquisition that can benefit the local projects.
- Coordinate system-wide fund raising and assist with developing financial support for the local projects.
- Ensure proper accounting for income and disbursements.
- Develop and provide a basic set of uniform promotional and training materials to the local projects.
- Develop and offer advanced scientific, organizational and advocacy training to individual basins and on an inter-basin basis.
- Develop standardized data management and reporting protocols to ensure understandable and comparable data among the local projects.
- Coordinate inter-basin meetings of leadership from the local projects as needed.
- Assist Local Watershed Steering Committees with self-evaluation andimprovement in matters of financial management and organizational development.
- Develop strategies to retain existing volunteers and recruit new volunteers to the monitoring projects.
- Provide direct organizational support in new local watershed areas for the first year of operation.
- Develop recommended response strategies to water quality problems indicated by volunteer reports and monitoring data.
- Publish an annual report on the project statewide, which will document volunteer participation, data gathered, water quality issues identified within each basin, and actions taken in response to issues identified (KY DOW, 2000).

Figure 4.4
Kentucky Watershed Watch Program Organizational Chart



KEY
Denotes administrative relationship
Denotes supportive relationship

1 Upper Cumberland River Basin
2 Tradewater Lower Green River
3 Upper Green River
4 Kentucky Basin
5 Salt (and minor Ohio River tributaries)
6 Licking River
7 Four Rivers
8 big Sandy/Little Sandy

At the basin level, Watershed Watch is managed by Local Watershed Steering Committees. These are comprised of representatives from colleges and universities, government and NGOs and others within the basin that are interested in protecting local waterways through monitoring. Community colleges and state universities have played a key role in many of the Local Watershed Steering Committees, with a number of faculty members serving as Committee officers. In addition, many of the Steering Committee members also serve on the River Basin Teams formed under the KY WMF.

General responsibilities of local basin steering committees include to:

- Provide general direction and oversight of projects in their watershed and obtain the resources to carry them out.
- Convene a Scientific Advisory Panel.
- Plan, schedule, and conduct volunteer training workshops in the watershed.
- Coordinate distribution of materials, equipment, and supplies to the volunteers.
- Coordinate unified sample collection efforts, ensuring delivery of collected samples to selected laboratories.
- Provide data interpretative feedback, technical support, and information on watershed issues to the volunteers.
- Help develop response strategies when water quality problems are indicated by volunteer reports and data collected.
- Conduct a year-end *Watershed Protection Conference* for the volunteers and other interested parties.
- Coordinate activities with the Inter-basin Coordinating Committee and select a delegate and alternate to serve on that committee.

Watershed Watch
Local Watershed Steering Committees
Associated Academic Institutions

Upper Cumberland River Basin	Somerset College; Eastern Kentucky University
Tradewater-Lower Green River	Madisonville Community College; Brescia University; Wesleyan College
Upper Green River	Western Kentucky University
Kentucky Basin	KY Water Resources Institute – University of KY
Salt (and minor Ohio River tributaries	University of Louisville
Licking River	Morehead State
Four Rivers	Murray State University Paducah Community College
Big Sandy/Little Sandy	Prestonburg Community College

The scientific advisory panel is composed of water quality professionals (e.g., professors, state & local agency employees). They are charged with developing a "scientific study plan" (i.e., monitoring plan) that includes data quality objectives, monitoring protocols, training criteria, and QA/QC controls.

KY WW staff provides assistance to varying degrees with many of the ICC's and Local Basin Steering Committees' responsibilities. For example, its role has included assisting with identifying general monitoring protocols, coordinating bulk supply purchases, negotiating lab contracts, developing standardized data management protocols, developing uniform promotional and training materials, and providing template plans. In addition, the KY WW Manager actively participates in KY Watershed Watch's management through its membership on the ICC and a number of the basin steering committees.

Budgets

KY Watershed Watch currently operates in eight basins across Kentucky. Fiscally, each Steering Committee raises and manages its own operating funds. It therefore must either be an incorporated nonprofit or have a cooperating agreement with an 501(c)3 organization that has agreed to act on its behalf as its fiduciary agent.

Watershed Watch
Local Watershed Steering Committees
Fiscal Agents

Upper Cumberland River Basin	KY Waterways Alliance
Tradewater-Lower Green River	KY Waterways Alliance
Upper Green River	KY Waterways Alliance
Kentucky Basin	501c3 status
Salt (and minor Ohio River tributaries	KY Waterways Alliance
Licking River	501c3 pending
Four Rivers	Jackson Purchase Foundation
Big Sandy/Little Sandy	KY Waterways Alliance

Primary direct and/or in-kind funders for KY Watershed Watch have included:

- Cumberland Chapter of the Sierra Club.
- KWA.
- Kentucky DOW.
- KY Watershed Management Program.
- KY WW.

Each basin sets its own budget according to its work plan and must submit funding requests to support it, including financial requests, to KY WW. Many of the local basin committees seek funds from local/regional businesses and nonprofits. PRIDE, for example, has been a primary sponsor in five basins located within its service area. Appendix G contains an example of a proposed budget by the Upper Green River Watershed Watch Steering Committee.

Basin steering committees are also accountable to the ICC. Financial reports must be provided to the ICC and if a funding request is made using the name *Watershed Watch,* a copy must be provided to the ICC for review. Likewise, if a fiduciary agent's name is used in a funding request, a copy of the request must go to the respective agent.

Volunteer Monitoring Levels of Involvement

Watershed Watch volunteers may monitor streams, lakes, ponds, and/or rivers using multiple monitoring techniques. Types of waterbodies assessed and the monitoring techniques used vary by basin and are dependent on the monitoring objectives set out by the local watershed steering committee. These are influenced by the water quality conditions of the basin, the data needs of the KY DOW Watershed Management, and the types of local and regional water quality projects. Monitoring protocols can include the following, with a more complete description of each provided in Appendix H:

- Stream habitat assessment.
- Photo documentation of riparian conditions.
- Field chemistry.
- Organic/inorganic lab panels.
- Herbicide/pesticide samples.
- Microbiological sampling: Total Coliform and *E. coli.*
- Algae assays—Chlorophyll A.
- Level I, benthic macroinvertebrates.
- Level II, benthic macroinvertebrates.

Kentucky Watershed Watch Workshops & Web Site Accessible Manuals & Powerpoint Presentations

Activity	Workshop	On-line
Stream habitat assessment	Basic Training 1 hr lecture 1 hr field	Manual, Powerpoint
Photo documentation of riparian conditions	Basic Training 20 minutes	Manual, Powerpoint (as part of habitat assessment)
Field chemistry	Basic Training 45 Minutes	Manual, Powerpoint
Organic/inorganic lab panels	Additional Training 45 Minutes	Manual, Powerpoint
Herbicide/pesticide samples	Additional Training 45 minutes	Manual, Powerpoint
Coliform sampling	Additional Training 45 Minutes	Powerpoint (Part of Chemistry)
Algae assays—Chlorophyll A	12-hour advanced workshop; Lab day for identifications	None
Benthic Macro Level I	Basic Training 90 minutes	Manual, Powerpoint
Benthic Macro Level II	6 hour advanced workshop Time 4-6 hours	Manual, Powerpoint

Volunteer Training and Support Materials

Volunteer monitoring workshops are generally organized, advertised, and conducted at the basin level for volunteers. KY WW assists by posting on its Web site a sample workshop description, a workshop planning checklist, and upcoming training sessions. Moreover, it provides online basic training materials including manuals and presentations.

KY WW also provides train-the-trainer programs for individuals interested in teaching *Watershed Watch* courses. *Watershed Watch* trainers are generally professors from community colleges and universities and environmental professionals, who also participate on the local watershed basin steering committees. The KY WW manager also serves as a lead and/or co-trainer, upon the request of a basin steering committee.

QA/QC measures required under the basin sampling plan are covered in the workshop. These include proper sample collection and handling and data recording, tracking (i.e., chain of custody) and management. Workshop participants' knowledge and skill levels are not currently evaluated.

Volunteer Recruitment and Retention Strategies

Watershed Watch recruits volunteers at the state and basin levels. At the state level, KY WW provides promotional support through its Web site including programmatic descriptions and links to basin-specific web pages and volunteer registration forms.

At the basin level, the local watershed steering committees use a variety of written materials as well as their own Web sites to promote their programs. For example, the Kentucky River Basin created a 2003 colorful placemat that lists upcoming workshops and identifies their Web site address KY DOW, 2003). Most of the basins also have some type of "down at the river" activities/festivities that draw attention to their programs. The Tradewater/Lower Green Watershed Watch Basin, for example, conducts an annual "Green River-Clean Water" Day that typically includes pontoon boat rides, children's arts and crafts, and a cook-out (Dew, 2002).

Activities to retain participating volunteers vary by basin, with the KY WW staff assisting local watershed steering committees, as needed. All basins conduct some type of annual watershed protection meeting and/or conference. A primary purpose of these meetings is to provide feedback to the volunteers including interpretations of collected data, recognition of their contributions, and updates on relevant water quality issues. For example, the *Big Sandy River Basin Conference* held in April 2003 at Breaks Interstate Park included speakers and panel discussions on the link between clean water and tourism, updates on the CWA, and an awards banquet. Written materials like the Four Rivers Watershed Watch's colorful and information-filled newsletters also serve as a valuable vehicle for volunteer feedback.

Feedback on volunteer-collected data can be obtained at the state and basin-level via the KY WW and basin-specific Web pages. Some basins provide more interpretative feedback than others. For example, the Kentucky River Watershed Watch had the KY Water Resources Research Institute compile an in-depth report on 2002 volunteer monitoring (KWRRI, 2002). Likewise, "down-at-the-river" gatherings, like canoe trips and river-side picnics, also serve as enjoyable reminders of the significance of volunteers' contributions towards protecting the recreational and ecological resources flowing through their communities. In June 2003, for example, Licking River Watershed Watch organized a "Reclaim the River" event, with more than 500 canoes paddling the Licking and Ohio Rivers and ending with entertainment and food.

Data Tracking and Management

Within the statewide structure of KY Watershed Watch, each basin must develop a study plan that includes how data will be collected, tracked, and managed. General steps include the following:

- Local basin steering committee appoints a data manager, who is responsible for file structure of project data.
- Volunteers record data on chain of custody (COC) forms, make a copy of them, and then takes the samples along with the original COC to the lab.
- The manager of the contracted laboratory signs hard copies of the lab reports, COC records, field reports, and other documents submitted by the volunteers and then sends them to the data manager. The data manager should specify the preferable electronic format for the lab reports.
- Data is imported into ESRI Arcview 3.X for GIS application at http://kywater.org/watch/data/.
- Hard copies of all reports are archived at the KY WW Office.

Data Use

The use of *Watershed Watch* data varies by basin, but, in general, is used to:

- Educate volunteers and the community about the conditions of their basin's waterways.
- "Red-flag" problems like sewage line breaks, straight piping, and spills.
- Provide the KY DOW with ancillary water quality information. Although KY DOW does not currently use Watershed Watch data in the state water quality reports (i.e., 305b or 303d), it has been used in basin planning. In fact, Watershed Watch was initiated in concert with the KY WMF with the intent to more earnestly involve a more educated public in the state's basin planning process.
- Conduct "focus studies" as a part of planned or ongoing projects. For example, Upper Cumberland Watershed Watch volunteers have assessed fecal coliform levels in Buck Creek over a two year period as part of an effort to demonstrate the need for grant funds to support the installation of agricultural best management practices.

5.0 VOLUNTEER MONITORING CASE STUDY COMPARATIVE ANALYSIS

This section has two purposes. The first is to highlight commonalities and differences among Alabama Water Watch (AWW), Georgia Adopt-A-Stream (GA AAS), and KY Water Watch (KY WW) programs' key administrative and programmatic elements that are significant for program design and implementation in other states. The second is to point out how each program has addressed major challenges related to the implementation of these elements and any particular benefits and/or limitations their implementation may have conferred. As a part of this analysis, we include information gleaned from the literature review. We have also included select aspects of the implementation of the KY Watershed Watch program that are instructive to establishing a volunteer monitoring program.

5.1 Program Conception and its Significance

We found two significant themes reflected in the conception of the three volunteer monitoring programs. The first is that all three programs emerged out of a growing national awareness of the value of volunteer monitoring and at their outset each articulated a set of transparent goals and/or objectives. The second is that each relied on a top down approach to implementation.

Emergence of Programs and the Articulation of its Direction

KY WW was initiated in 1985, followed by AWW in 1992, and GA AAS in 1993 – all during a period when volunteer monitoring was nationally gaining momentum, both in terms of numbers and scope (US EPA, 1998). This increased momentum was in large part due to a growing recognition from the federal to local level that these programs could provide a valuable means of involving local citizenry in water quality issues, including collecting much needed data. Moreover, the Federal government, namely US EPA, was providing both fiscal and technical resources to make such programs possible. As with many other programs across the country, KY WW, AWW, and GA AAS capitalized on EPA and its Clean Water Act (CWA) grants to initiate statewide volunteer monitoring programs.

With guidance from EPA, the three programs set out to accomplish a similar set of goals including:

- Increase public awareness of water quality issues.
- Impart monitoring knowledge and skills.
- Collect water quality baseline data.
- Foster partnerships.
- Initiate efforts to address local water quality problems.

Divergences of goals and objectives among the three programs have related primarily to their unique aspects and the specificity of their stated outcomes. One of AWW's objectives, for example, is to "maintain a quality assurance program that implements EPA-approved protocols for keeping credible data." In contrast to GA AAS and KY WW, this has been an explicitly stated AWW objective since its outset.

In terms of the goal-setting process, all three programs allocated time early in their formations to examine the direction, management, and outcomes of other state volunteer monitoring programs before determining their own. The programs also sought input from other knowledgeable parties, as well. For example, GA AAS obtained input from its newly formed advisory board.

A primary benefit of setting goals and objectives that are transparent from a program's outset, as in these three programs, is that it provides a sense of direction for staff as well as volunteers. The consequences of not doing so, as felt by a number of fledgling volunteer monitoring programs, is a lack of clarity and focus that can affect, among other things, program design and volunteer perceptions (Godfrey, 1994). With program design based on having a clearly defined set of outcomes, a lack of program direction can result in an extended and more costly program development phase. A lack of direction can also color the perceptions of participating volunteers and their willingness to stay with the program. A mismatch between volunteers' expectations of a program and those set by its administration can result in feelings of frustration, mistrust, and eventual attrition (Ely, 1996).

A goal setting strategy recommended by volunteer monitoring professionals is to involve those who have a stake in volunteer monitoring (Godfrey, 1994). GA AAS followed this guidance by involving their statewide advisory board in the setting of goals. By doing so, they took into account the voices of Georgians across the state.

By not involving stakeholders, there is a risk of less stakeholder buy-in into the program and ultimately less community support.

Top-Down Approach

It is noteworthy that each of the programs was conceived at the state level—initially using a top-down approach—as opposed to starting at the local level and then "growing" into a statewide program. One benefit to this is that states can develop programs through the lens of their statewide short- and long-term needs. For example, GA AAS had received encouragement from EPA Region 4 to broaden their use of 319 funds to include educational and outreach opportunities; so accordingly, when GA AAS developed its volunteer monitoring program its initially emphasized this aspect. Another benefit of the top-down approach is that from program inception, there is less built-in regional bias; moreover, a program can strategically devise a structure that will provide the geographic coverage needed to support its volunteers.

Top-down approaches to building programs also have limitations, a primary one being that local and regional needs often go unnoticed, albeit unintentionally. Each of the three programs have dealt with this issue by using a combination of volunteer and community support systems as we will discuss in the following section.

5.2 Program Evolution and Expansion

We found that a primary challenge for all three programs as they have grown is how to meet the needs of an expanding base of volunteers on a relatively fixed budget while also meeting the demands of maintaining statewide program consistency and quality. Volunteer needs have included training, technical assistance, local project support, and monitoring supplies.

The programs have addressed this challenge in two key ways:

- Devising local, regional, and statewide training and technical support systems for volunteers.
- Creating and/or fostering supporting bodies/organizations that are comprised of statewide representation that can extend their streamlined staffs and serve as a voice for local communities.

Like many programs undergoing expansion, each of the three programs experienced "growing pains" before change was initiated. In some cases, the programs responded in similar ways; in others, they did not. Along with comparing the support systems and bodies created by the programs, we include in this section a discussion of their effectiveness, primarily as perceived by program staff.

Volunteer Training and Technical Support Systems

State College and University System

Both GA AAS and KY WW (as well as KY Watershed Watch) have used the state college and university system to assist with training and technical support. GA AAS began using this system very early in its formation, envisioning that participating colleges and universities would serve as regional training centers (RTCs). Each involved professors as trainers as well as technical advisors. In some cases, the professors managed data monitoring as well.

Both programs have articulated multiple merits to using academic institutions in a supporting role. To name several, volunteer monitoring programs gain academic expertise, well-equipped training spaces, and access to not only more of the institution's community members, but also to its students. In return, the colleges generally receive community service credit, and the professors can often incorporate the monitoring program into their curriculum.

The drawback to using colleges and universities as a primary training and technical support system for both GA AAS and KY WW became more evident as initial grant dollars to cover their involvement came to an end. In short, they found that it is not always feasible for professors to serve in supporting roles without an ongoing source of funding to cover their time. Without these resources from the state program, this burden is transferred to the professors and/or school administration. Other challenges of utilizing colleges/universities as primary support systems, as noted by GA AAS and KY WW, are faculty retirement and relocation. Professors often become involved because of personal interest and when they retire or leave replacements are not always readily available.

These challenges notwithstanding, GA AAS and KY Watershed Watch continue to use regional colleges and universities because of the many benefits they offer; however, their involvement has been scaled back. These schools that have stayed involved have either been able to secure grant funds to cover their time, use the volunteer monitoring work to fill an academic or service niche, and/or have professors who are conducting this work, in large part, on their own time.

Local Community/Watershed Organizations

With the decline of the role of the college and university RTCs, GA AAS managers identified another potential support system that could be fostered throughout their state. These were the community/watershed programs, the independently managed AAS programs established throughout the state under the auspices of the state AAS program. These local programs, if trained to provide support to local volunteers, could, by virtue of their numbers and geographic range, potentially serve more volunteers than the RTCs. In order to establish these programs as technical and training resources, the state program requested that their community/watershed program coordinators become certified trainers. A majority of coordinators have responded to this request, with currently more than half certified to conduct training workshops. The benefits have been twofold. First, additional certified trainers have provided more volunteer support by adding more training sites throughout the state. Second, additional trainers have reduced the workload of the state AAS staff members, resulting in more time for them to focus on other important tasks including database development, strengthening their quality assurance/quality control (QA/QC) protocols and improving training materials.

Neither AWW nor KY WW has a program structure analogous to GA AAS, thus neither has utilized this particular approach to expanding their volunteer support; however, each has asked their active volunteer monitors to step up to the plate to serve as trainers.

Citizen Volunteer Trainers

All three volunteer monitoring programs rely on active volunteer monitors to assist with training new volunteers, and each also requires these volunteers to meet specific requirements before becoming trainers. These requirements include successfully completing a train-the-trainer workshop and, for AWW and GA AAS, “interning” with a qualified trainer and participating in training recertifications. Of the three programs, AWW currently relies most heavily on volunteers for training support. Three years into its implementation, AWW began training its volunteers to serve in this role and now citizen monitors conduct over 90 percent of AWW’s workshops.

Each of the programs has found that the advantages of using volunteer monitors as trainers far outweigh any limitations. In particular, four benefits were noted. First, volunteer monitors are geographically distributed throughout the state, making them more accessible to a greater number of incoming volunteers (as opposed to the state program staff that are centralized to one area). Second, citizen volunteers generally know the local issues and waterways and incorporate these aspects into the training. Third, they can serve as liaisons between local communities and the state volunteer monitoring office. Fourth, because they are self-selected, they are generally enthusiastic about their role as trainers.

Drawbacks to the use of citizen monitors primarily stem from their lack of training experience and/or lack of technical knowledge to address sampling problems that may be presented to them. However, programs have addressed the latter issue by advising citizen trainers to pass these problems on to the state office as they arise. It should be noted that in each of our interviews with state program staff members, we specifically asked about any major challenges they had had with “renegade” trainers who disregarded program training protocols, and all three said this was not a problem.

Cooperative Extension Agents

In addition to using citizen trainers, AWW has recently tapped into another volunteer support system that has the potential to be highly useful. AWW is currently partnering with the state Cooperative Extension program located at Auburn as a part of a Community Based Water Monitoring Extension project. Through this partnership, AWW is training Extension agents across the state to serve in a variety of capacities including as trainers and resource contacts. Neither GA AAS nor KY WW currently has a statewide arrangement with Extension. However, both have used Extension agents for training and technical support at the local level.

There are three noteworthy benefits to using this support system. First, Extension has the capacity to reach volunteers who might not otherwise be exposed to this program, which can diversify a program’s volunteer base as well as bring it broader community

recognition. Second, overlapping programmatic goals between Extension and volunteer monitoring initiatives can make this partnership truly of mutual benefit. Third, Extension may have fiscal resources it can bring to bear, as has been the case for AWW.

Program and Volunteer Supporting Bodies

Advisory Board

GA AAS exemplifies another innovative approach for providing internal programmatic and volunteer support through its formation of an advisory board. Created at its outset, the advisory board initially assisted the staff in developing a vision for how the program should function and has since continued to provide input on its direction, growth, technical issues, and training. The AAS board's strengths appear to stem, in large part, from its members who geographically represent the state and who come from varying backgrounds and work sectors. As a result, the board provides connections back to the local communities and brings a diverse body of knowledge and set of skills to GA AAS. For example, a highly valuable skill that one of the board members recently contributed to the program was assistance in overhauling the database, no small undertaking. In regards to community connections, the board, over the course of this last year, has assisted GA AAS staff in making inroads into the southwestern region of Georgia. As these examples illustrate, an advisory board can make very real and valuable contributions to a volunteer monitoring program. The tradeoff to these benefits is primarily the staff time it takes to coordinate board meetings (four times a year) and an annual retreat, and keeping the members informed of ongoing programmatic activities.

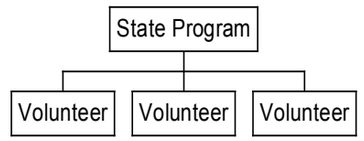
Citizen-based Supporting Organization

Another creative approach to meeting programmatic and volunteer needs is exemplified by the establishment of the AWW Association (AWWA), a grassroots "sister" nonprofit to AWW. In contrast to the GA AAS advisory board that provides input on program direction, AWWA focuses on providing resources to support AWW implementation. For example, it raises funds for replacement reagents and printing costs for reports that highlight monitoring groups' efforts. It also provides a reservoir of volunteers to assist with organizing and conducting volunteer monitor gatherings. In addition, AWWA advocates on behalf of volunteer monitors, representing citizen concerns at meetings with the state environmental protection agency.

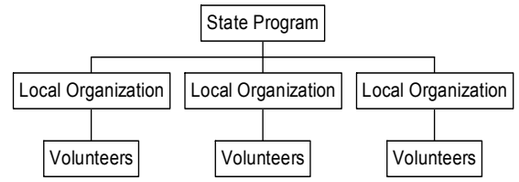
Undeniably, AWWA is a tremendous asset to AWW. However, it should be kept in mind that it was citizen initiated; and for another state volunteer monitoring program to have an analogous supporting entity, a group of highly motivated citizens would have to spearhead it and then provide ongoing management. Thus, though the benefits of such a group are clear, costs in citizen time and attention must also be acknowledged.

5.3 Program Delivery Structure

A statewide program can be structured in multiple ways to ultimately support its citizens in its monitoring efforts. Below are two possible program administrative models. Model 1 is more vertical in its orientation with a single entity serving local volunteers while Model 2 is more horizontal, involving multiple local organizations in its administration. The challenge for programs is selecting a structure that can provide statewide program control and accountability while also meeting the multiple needs of local communities.



Model 1



Model 2

Analysis of AWW, GA AAS, and KY WW reveal that each is, to a certain extent, a hybrid of these two models. Since their inceptions, all three programs have provided support directly to volunteers, as shown in Model 1. In this model, a "volunteer" is defined as an individual or a group without an administrative structure in place to manage the state monitoring program at a local level. For example, a "group" could be comprised of a husband-wife team, a class, or a neighborhood association. Likewise all three programs, albeit to a lesser extent, have used Model 2 where local organizations (i.e., those with some semblance of an administrative structure) have been at the helm, implementing the state monitoring program at the community level.

Although all three state programs used a hybridization of these two models as they have evolved, each in its current operation appears to have a structure that is more

aligned with one model over another. Following, we evaluate each program's current primary operating model and discuss the benefits and limitations of each model type.

Current Program Model Alignments

In comparing GA AAS and AWW, the former appears to currently be operating more under Model 2 (horizontal) while the latter is still predominantly operating under Model 1 (vertical). GA AAS has helped to establish a core of "local organizations" (i.e., watershed/community programs) that are essentially fiscally and administratively autonomous from the state program. In contrast, AWW generally works directly with volunteer groups (i.e., those groups without an autonomous administrative structure).

KY WW offers another interesting model variant. Like GA AAS, KY WW's model increasingly reflects Model 2 (horizontal), supporting a network of organizations across the state that are administratively and, to a large degree, fiscally autonomous from the state program. However, there is a major distinction between it and GA AAS that is not so much about the model type as it is about statewide program conformity and consistency. As a "technical service provider" for volunteer monitoring groups and organizations across the state, KY WW works with each to tailor a program to meet its monitoring objectives. Although the Kentucky program draws on a core set of baseline monitoring activities to retain some statewide monitoring consistency, there is generally less overall standardization of program delivery, including uniformity among monitoring protocols used by KY WW-affiliated monitoring programs.

Benefits and Limitations of Model Types

Model 1: Top-Down Delivery System

There are likely multiple reasons why a volunteer monitoring program would prefer the use of one model over another. From our discussions with volunteer monitoring staff and a review of the literature that cites common barriers to program implementation, we infer two primary benefits to the use of Model 1(vertical). These are:

- *Better control of QA/QC procedures and protocols.* For example, data collected by AWW volunteers are sent or submitted directly to the AWW office where staff members follow stringent data entry protocol.
- *Clearer lines of authority.* For example, operating primarily now under Model 2, KY WW's volunteers have indicated confusion about the state program's relationship to the independently managed volunteer monitoring programs, according to the KY WW's manager.

Three potential limitations to using Model 1 include:

- A centralized staff that is constrained in size by budget may require a more extensive volunteer support system throughout the state. (AWW has addressed this through a combination of volunteer monitoring systems as discussed in Section 5.2 and by its staffing opportunities as described in Section 5.4.)
- Fewer built-in lines of communication with local communities, thus requiring greater effort on the part of the state program to foster local program-related partnerships and to stay informed of local needs.
- Potentially less local ownership and buy-in to the state volunteer monitoring program due to a lack of investment of local resources.

Model 2: Community-Based Delivery System

After examining the GA AAS program, we identified potential ways both the state and local organizations could benefit from using Model 2 (horizontal). From the state's perspective, using local organizations:

- Provides built-in support to its volunteers by both its structure and its organizational membership network.
- Can more effectively recruit volunteers (including having a built-in volunteer base through its current membership) and solicit community support by having a better understanding of the local social, political, and cultural climate.
- Provide an invaluable line of communication from local communities to the state office and vice versa.
- Serve as volunteer training centers.

In addition, the fiscal responsibility placed on the local organizations may engender more local ownership while also diversifying funding sources.

Model 2 may also confer benefits to local organizations, including:

- Flexibility to adapt and/or expand monitoring program goals to meet community needs and address local problems and issues.
- Opportunities to integrate the monitoring program into local initiatives (e.g., a municipal stormwater division incorporating volunteer monitoring into its Phase II Stormwater program).
- A standardized structure and operational materials so communities do not have to "reinvent the wheel" to initiate and conduct a local volunteer monitoring program on their own (e.g., GA AAS offers standardized workshops, training, and promotional materials; a Web site [http://riversalive.org/aas.htm] that promotes and encompasses the statewide program).
- Increased name recognition by virtue of the program being conducted statewide.

The effectiveness of Model 2 appears, in large part, to be contingent on open lines of communication and support between the state and local organizations. At the state level, the staff must be willing to:

- Provide leadership to local programs.
- Clearly articulate roles and responsibilities.
- Maintain open lines of communication among the local organization's statewide network.
- Provide a timely response to local organizations' needs.

At the local level, institutions and organizations implementing the volunteer monitoring program must have the ability and be willing to:

- Advocate and follow state program protocols.
- Be sensitive and respond to volunteer and community needs.
- Maintain communication with the state office.

In short, it appears that the state and local communities must mutually support one another to effectively implement Model 2.

5.4 Program Governance and Housing

From our analysis of the three state volunteer monitoring programs, it appears that the operating entity and its location can significantly impact how a program is perceived and managed. Although all three are governed under the auspices of their state's environmental protection departments, there is a primary distinction: AWW is operated out of a university in contrast to GA AAS and KY WW, which are directly managed out of state environmental protection division offices.

Discussions with program staff members suggest that operating a volunteer monitoring program out of a university and more specifically a land grant educational institution offers multiple benefits. These include:

- The perception of a greater degree of impartiality (i.e., a step removed from state politics). In the case of AWW, it may also be perceived as being more credible because it is conducted out of a highly respected fisheries department.
- A greater opportunity for "creative staffing" by drawing on a pool of part-time student workers and sharing employees among departments and programs.

Benefits of an enlarged and diversified staff, including those who are only with the program for a limited time are: 1) the infusion of ideas and enthusiasm each new employee brings to the program and 2) the ability to align students' field of study with their work. Also there is an obvious benefit of eliminating payout of benefits to part-time employees. On the other hand, drawbacks to this type of staffing arrangement include: 1) increased training demands with greater staff turnover and 2) a lack of continuity among staff.

- Fewer restrictions on being able to seek a more diverse base of funding support.
- By virtue of the program being located at a "land grant university," it has been able to establish a valuable partnership with the CE Service.

Several of these benefits are dramatically revealed in a comparison of the three state programs' administrative support. Through greater funding opportunities and more flexibility in staffing, AWW may typically have six to eight part- and full-time employees, whereas GA AAS has since its inception generally retained two full-time employees and KY WW, one full time and one half-time employee.

5.5 Funding

Each of the three programs exemplifies a problem endemic to all volunteer monitoring programs: constant risk of losing funds. Factors such as competing state program needs, economic climate, and perceived conflict of interest between the volunteer monitoring program and its state environmental management department must all be taken into account. Based on the case studies as well as the literature, a major step can be taken toward addressing this problem through the diversification of funding sources.

All three programs derive their primary base funding from CWA grants, with GA AAS and AWW from 319 funds and KY WW from 205j and 106 grants. Over and above this funding, AWW has the most diversified fiscal portfolio, which includes private sector and nonprofit grants; support from the Extension; direct and in-kind support from the AWWA; and a modest influx of funds from the sales of an educational game developed by AWW.

As discussed in Section 5.4, the ability of AWW to create this diversified portfolio is largely the result of where the program is housed. In short, being located within the university allows the program to more readily submit and manage multiple private and public grants and provides an opportunity for academic departments and affiliated programs to “buy in” to the monitoring program. In the case of AWW, Auburn and the Cooperative Extension located at the school now provide two-thirds and one-third of the manager’s salary, respectively.

KY WW falls next in line in terms of funding diversity, although much less so than AWW. Drawing roughly 60% of its funds from federal grant sources (i.e., Water Pollution Prevention Planning and Water Pollution Control Abatement programs) and the remainder from State Executive Budget funds, it is in a higher risk category for funding loss, particularly with the precarious nature of many current state budgets. In contrast, GA AAS receives its sole support from 319 funds. Although it would be assumed to be at highest risk of funding loss, the dedication of the state to its volunteer monitoring program also must be taken into account. At the behest of EPA Region 4, the GA EPD expanded the use its 319 funds into public education and outreach through the initiation of GA AAS. This directive may somewhat increase the security of the funding of this program.

Beyond the diversification of its funding sources, other strategies AWW uses to retain its funding, according to its manager, are to: 1) maintain accountability in the use of its funds; 2) strive to be recognized on local, state, and national for program contributions; and 3) provide grant matches to the state over those required.

5.6 Quality Assurance and Quality Control

A primary message related to QA/QC that resonated throughout the literature as well as in the three case studies was that QA/QC is essential if volunteer monitoring data is to be viewed as credible (Mayio, 2001; Godfrey, 1993; EPA, 1996). All three programs have incorporated QA/QC measures; however, there are differences in their emphases, which in large part have been influenced by how the programs have intended to use their data.

Both AWW and GA AAS developed and submitted Quality Assurance Project Plans (QAPP) to EPA Region 4 within two years of program inception. Although this was, in part, to fulfill an EPA mandate that EPA-funded volunteer monitoring programs should do so, it was also a means for both programs to gain credibility. In the case of AWW, a primary goal was (and still is) to collect water quality trend data that would be recognized as credible by ADEM and other agencies. In contrast, GA AAS initially emphasized the educational aspects of monitoring. QA/QC procedures, among other benefits, demonstrated “good science” to students.

The distinction between AWW and GA AAS in their emphasis on QA/QC is also reflected in the amount of resources each has invested in this aspect of its program. The AWW manager stated that upwards of 30 to 40 percent of total resources have been invested in ensuring that quality data is produced. For example, staff members were initially hired to specifically oversee and implement QA/QC procedures, and in-house laboratory evaluations were put into place to conduct ongoing verification of sampling kit accuracy and precision, among other things. In contrast, the initial investment by GA AAS in its QAPP implementation was much more limited.

As GA AAS has evolved, it has placed increasing emphasis on QA/QC. This has in part been due to more participation from adults who have had an interest in broadening how collected data is used. Although its resource investment in the implementation of its QAPP is still comparatively less than AWW’s (in part, because of its restricted funding opportunities), many aspects of the AWW and the GA AAS QA/QC protocols are actually quite similar, as reflected in Table 5.1.

Table 5.1
Comparative Analysis of Select Aspects of the US EPA-Approved AWW and GA AAS Quality Control/Quality Assurance Project Plans

QA/QC Requirements	GA AAS	AWW
Volunteer Training		
• ***Chemical***		
○ Requires volunteer QA/QC certification	Yes	Yes
○ Workshop competency exam	Written plus skill observation	Skill observation only
○ Requires QA/QC volunteers to maintain "active" status	Yes (monthly)	Yes (bimonthly)
○ Recertification of QA/QC volunteers	Yes (annual)	Yes (biannual with active status)
• ***Biological (Benthic)***		
○ Requires volunteer QA/QC certification	Yes	No*
○ Workshop competency exam	Yes	N/A
○ Requires QA/QC volunteers to maintain "active" status	Yes (quarterly)	N/A
○ Recertification of QA/QC volunteers	Yes (annual)	N/A
• ***Bacteriological***		
○ Requires volunteer QA/QC certification	N/A	Yes
○ Workshop competency exam	N/A	No
Sampling Protocols		
In-house laboratory evaluations of chemical kits' accuracy and precision	No	Yes
Data Tracking and Management		
Data entry error detection system	Yes	Yes (Double-checks all entries; additional checks in place with new on-line data entry)

* AAW does not QA/QC certify benthic monitoring due to the variability in volunteer monitor results. It does promote this type of monitoring as an educational experience and as another gross-level indicator of stream health.

Of the many benefits of this increased focus by GA AAS on QA/QC, we note two primary ones. First, GA AAS has broadened its data uses. Although GA AAS has no immediate goals of having its state use its data for water quality reporting as AWW does, data collected by GA volunteers is now being considered for use by the state for basin planning. Collected data is also increasingly being used by volunteers as "red flags" of potential water quality problems. Second, GA AAS's emphasis on QA/QC has fostered an agreement between it and AWW that data collected by each of their QA/QC-certified volunteers in shared basins be accepted by each program. This is an important step forward for addressing one of the major barriers cited for volunteer monitoring, which is a lack of standardization among states (Godfrey, 1994). In addition, this agreement has the obvious benefit of increasing the amount of volunteer monitoring data available in shared basins.

In contrast to AWW and GA AAS, KY WW has never submitted a QAPP to US EPA. However, KY WW does incorporate quality control measures in its monitoring activities. Moreover, the extent that it has assisted KY Watershed Watch in integrating QA/QC measures into this program is worth noting. Each basin participating in Watershed Watch must convene a scientific advisory panel to develop a study plan with the primary purpose being to set out QA/QC procedures for the collection of credible data. The reason for this emphasis on quality control stems from why this program was initially created—to support the genuine involvement of the public in developing basin-wide plans. Specifically, volunteers would collect data that would then be used in the KY Watershed Management Framework basin planning process.

5.7 Levels of Volunteer Involvement

Each of the three state programs offers its volunteers a range of ways to become involved in monitoring and improve the conditions of their waterways. These include opportunities for conducting chemical, biological, and physical assessments on waterbodies. In addition, each program encourages volunteers to use this information to address problems and educate others. There are, however, some distinctions among the programs in regard to the emphases placed on certain activities that are highlighted in Table 5.2. This rather subjective table is based on staff interviews, an evaluation of program Web sites, and training materials. For example, we evaluated to what extent a program appears to be encouraging its volunteers to conduct an

assessment or activity and how much time is dedicated in workshops to training volunteers on its methodology. In some cases, we distinguish between the programs on a relative basis.

Table 5.2
Comparative Summation of Volunteer Activities
Offered by AWW, GA AAS, and KY WW

	AWW	GA AAS	KY WW
Watershed Assessment	Secondary	Primary	Secondary
"Visual Stream Assessment," "Streamwalk," or "Watershed Habitat Assessment"	Secondary	Primary	Primary
Chemical Testing	Primary	Primary	Primary
Macroinvertebrate Assessment	Primary	Primary	Primary
Bacteriological Assessment	Primary	Secondary	Secondary
Outreach	Secondary	Primary	Secondary

One inference we make from this comparison is that there is no one "right" combination of activities; rather, it is a matter of selecting a set of activities that achieves the goals of the program. For example, GA AAS has, since its inception, placed a particular emphasis on encouraging its volunteers to become involved in outreach activities, explicitly requesting that they conduct, at a minimum, one outreach activity (e.g., speak to a civic group about local stream conditions) and one trash clean-up per year. With this appeal, it also then offers its volunteers outreach opportunities, including participation in "Rivers Alive," the statewide river cleanup, and becoming involved in riparian protection and improvement projects through the Citizen Riparian Network.

Another inference we make is that a newly established program can expect changes in monitoring activities as it evolves and as new sampling technologies enter the market. For example, with the development of a simple and accurate bacteriological test, AWW now offers this monitoring option to its volunteers. The option is, in large part, being offered because the test meets QA/QC requirements and thus aligns with AWW's goal of collecting credible data.

5.8 Volunteer Training

Each of the programs offers training sessions, varying in both topic and length. Table 5.3 provides a comparison of the commonly conducted AWW, GA AAS, and KY Watershed Watch workshops. KY WW is not included in this comparison because it does not currently provide a standard "menu" of training sessions, per se. However, it has supported the development of training sessions offered by KY Watershed Watch and thus we include those instead.

Table 5.3
Comparative Analysis of Training Session Topics and Lengths
Offered by GA AAS, AAW and KY Watershed Watch

	GA AAS	AWW	KY Watershed Watch
Basic Training			
Watershed Assessment/Visual Survey	2.5 hrs.	Brief overview in chemistry training	2 hrs (plus 20 min on photo documentation)
Chemistry	2.5 hrs	6 hrs	Field kit - .75 hr Org/Inorganic grab samples - .75 hr Herbicide/pesticide grab samples .75 hr
Macroinvertebrate	5 hours	4 hours	1.5 hr; 6 hr (advanced)
Bacteriological	No	3 hrs	0.75 hr
Recertification (QA/QC requirement)			
Chemistry	Attend part of basic training and pass test (annually)	1 hour (biannually)	None required
Benthic	Attend part of basic training and pass test (annually)	None required	None required
Train-the-Trainer			
Chemistry	Yes	Yes	Yes
QA Officer	No	Yes	No

All three programs require that workshops be conducted by trained instructors who have successfully completed a train-the-trainer course. Both AWW and GA AAS require the trainer to intern with an experienced trainer and be evaluated. In addition, GA AAS requires that the trainer conduct, at minimum, two additional workshops per year.

Course times may vary according to whether courses are combined or not. For example, AWW often combines its chemistry and bacteriological training for a daylong session. Similarly, KY Watershed Watch commonly combines all its introductory training sessions into a one-day workshop. AAS sometimes shortens its watershed assessment training and combines it with chemistry. In addition, all three programs appear fairly flexible in accommodating training requests from their volunteer groups in regards to combining training sessions and modifying times, as long as QA/QC requirements are met.

As we did with volunteer activities, we infer that there is no one “right” formula for devising training modules, including topics and times. Rather, the end goal for all training sessions should be to impart to volunteers the knowledge and skills needed to carry out the program’s prescribed set of monitoring activities. Staff members from each of the three programs acknowledged the limited amount of time most citizens can dedicate to a volunteer program and discussed their efforts to make their training sessions as efficient as possible.

5.9 Monitoring Protocols

All three state programs use similar monitoring protocols, including those used for chemistry, physical, and benthic assessments as shown in Table 5.4. If a volunteer moved from one of these states to another and joined its volunteer monitoring program, undoubtedly the volunteer’s learning curve for conducting a new set of protocols would be shortened. For example, all three use mostly LaMotte colorimetric chemistry kits. Kentucky Watershed Watch stands apart in its chemistry protocols, primarily “grabbing” samples for laboratory analysis.

That being said, nuances in monitoring protocols become much more significant when it comes down to comparing data among states. There are differences in accuracy and precision among some brands of kits that test for the same parameters, but use slightly different procedures. Even these slight differences can turn into a liability as programs look to broadening the usefulness of their data by using it for regional and/or basin-wide purposes, particularly in interstate basins, such as Tennessee has with its neighboring states. As the literature indicates, a standardization of monitoring protocols among states would make their data more comparable and thus more useful. Moreover, it would likely endow the data with more credibility. Appendices D, E, F, and G highlight the commonalities as well as the differences among the specific methods used by GA AAS, AWW, KY WW, and KY Watershed Watch.

5.10 Volunteer Recruitment and Retention Strategies

One of the most important and sometimes daunting tasks facing all volunteer monitoring programs is attracting and retaining volunteers. With limited funding available, programs must attempt to reach the greatest number of potential volunteers with the least amount of fiscal output. Additionally, the programs are challenged to retain those volunteers who are already involved. Volunteer attrition translates into a loss of revenue from funds invested in training, gaps in data that obscure long-term trends in water quality, and the weakening of a network of interested and involved citizens who provide both social and technical support for one another.

Recruiting New Volunteers

All three programs have relied heavily on both word-of-mouth and the Internet as effective and cost-efficient ways to attract new volunteers. Following are Web site features that we believe are particularly useful to newcomers, along with explanations for why we find them useful. It should be noted that not all of the program Web sites contain all of these features. However, we do not identify differences in the programs’ Web sites because of the frequency with which they are updated.

Table 5.4
Comparative Overview of GA AAS, AWW, KY WW, and KY Watershed Watch Monitoring Protocols

	GA AAS	AWW	KY WW	KY Watershed Watch
Watershed Assessment	More extensive: multiple tools used, including land-use survey and estimation of impervious surface	Limited: upland land uses	Limited: upland land uses	Limited: upland land uses
Visual Stream Assessment	- Based on US EPA Stream Monitoring Manual (US EPA, 1997) - Optional: Wentworth pebble count and flow	Based on US EPA Stream Monitoring Manual (US EPA, 1997)	Based on US EPA Rapid Bioassessment Protocol (Barbour, 1999) Optional: flow	Based on US EPA Rapid Bioassessment Protocol (Barbour, 1999) - Encourages video and photo documentation
Chemistry*	LaMotte, primarily colorimetric	LaMotte, primarily colorimetric	LaMotte and Hach, primarily colorimetric	Grab samples, organics, inorganics, herb/pesticides analyzed in certified lab
Benthic**	Field ID to order level	Field ID to order level	Field ID to order level	Lab ID to family level
Bacteriological	Not typically done: grab and analyze at certified lab	ColiScan Easygel®	Not typically done: grab and analyze at certified lab	Grab and analyze at certified lab
Algae	Not generally done	Not generally done	Not generally done	Chlorophyll A if in sampling plan

* Common parameters tested among all three programs are currently limited to dissolved oxygen, pH, and temperature.

** AAW, GA AAS, KY WW/KY Watershed Watch (Level 1) use similar protocols, sorting and counting by pollution sensitivity groupings. KY Watershed Watch uses a protocol based on *Rapid Bioassessment Protocol* (Barbour, 1999)

- *"Snapshot" of the types of available activities:* By providing the range of activities, programs can appeal to a broader, more diverse citizenry.
- *Links to more detailed descriptions of each of these activities along with photographs:* May increase comfort level of those interested by giving them a greater level of understanding.
- *Descriptions of training workshops:* Gives newcomers a better sense of what to expect.
- Work*shop schedules:* Allows for advanced planning.
- *Description of program staff credentials:* Increases confidence in staff competency.
- *Downloadable training manuals:* Allows trainees to preview information prior to workshop and gains insight in what will be covered.
- *Contact information:* This is particularly useful if Web site viewers are given multiple ways to contact the program.
- *Newsletters:* Provides inspirational volunteer stories that may encourage newcomers and give them a better sense of the statewide scope of the program and the available support.

Fortunately, many of the outreach activities that serve to educate and involve current members can also double for attracting new members. Following are some examples of each.

- *Development and distribution of watershed educational materials:* Circulation of educational materials can have a two-fold impact on garnering new membership. First, education can pique the public's interest in water-related issues and second, it can promote volunteer monitoring as a way of becoming actively engaged in these issues. AWW, for example, in conjunction with local monitoring groups and supporting nonprofits, has published a series waterbody-specific reports that provide monitoring results in combination with profiles of volunteer groups and their successes.
- *Volunteer/Community seminars/workshops:* Each of the three programs maintains a presence at the local level by hosting and/or cosponsoring watershed education workshops and/or seminars, most often in conjunction with local partners. These events provide opportunities for increased media coverage and recruitment.

- *Organization of watershed/awareness community events:* Getting citizens down to a stream or river for a day of work and/or festivities can be a prime way of piquing citizen interest in volunteer monitoring. GA AAS's "Rivers Alive" event epitomizes such an event. With the support of a statewide group of partners, literally thousands of Georgians are mobilized each year across the state to help clean up their waterways. Along with the other sponsoring organizations and coordinators, GA AAS receives statewide press and additional name recognition through the distribution of event-sponsored T-shirts.
- *Involvement of volunteers in spearheading outreach activities:* Each of the three programs recommends its volunteers reach out to fellow community members to educate them on watershed issues and/or involve them in some type of environmental improvement activity. GA AAS is most explicit in this regard, requesting that its volunteers organize one waterway clean-up per year along with conducting one other outreach activity. As with other outreach events, those organized by current members can be particularly effective in recruiting new volunteers.

In recruiting new volunteers, the case studies as well as the literature point to the importance of targeting a diversity of citizen monitors. For example, while Kohlepp (Michigan DEQ, 2001) emphasized the importance of involving professionals, Heimann (1997) described the many benefits laypersons can bring to a volunteer monitoring program. Staff members from each of the studied state programs likewise emphasized the importance of recruiting a combination of volunteers with science and non-science backgrounds. For example, those with science backgrounds may be more equipped to become citizen trainers and those that have a greater knowledge of their local community and its natural resources may be better able to prioritize problem areas and identify sampling sites. It was also noted that a broader diversity of volunteers will allow the program to increase its network over a broader social and cultural landscape.

Another consideration in new membership recruitment is looking to involve previously formed groups. Kohlepp (Michigan DEQ, 2001) pointed out that existing water-related groups generally have access to a greater number of potential volunteers and ongoing activities that can be linked to volunteer monitoring. AWW provides evidence for this approach by an initial expansion of its volunteer base through involvement of established lake home owner/boat owner (HOBO) associations.

Maintaining Current Volunteers

Retaining members of a volunteer organization is never easy, given competing family and community obligations (e.g., relocation; changes in job; expanding families). The most significant retention strategy that a volunteer monitoring organization can influence is "frequent and meaningful" volunteer feedback (Ely, 1996). The case studies of the three state programs provide examples of many different and creative forms by which this may be done. Types of information conveyed to the three programs' volunteers include:

- Interpretation of data.
- Current events relative to the volunteers' monitoring experience.
- Updates on technical issues.
- Success stories related to the use of volunteer data and/or volunteer-led watershed improvement projects.
- Kudos on volunteer work well done.

In short, the studied programs provide feedback to volunteers on multiple programmatic fronts.

The Web site, as would be anticipated, has been a primary means for providing feedback to volunteers. Types of Web site information that we believe are significant for retaining current volunteers include:

- Trend data collected by volunteers along with interpretative text.
- Newsletters that provide technical information and success stories.
- Banners that promote upcoming events.
- Articles on relevant and timely local, state, and national events.
- Information on procuring replacement reagents.
- Basin technical reports.
- Community and statewide meeting minutes.
- Links to listserves that allow for communication among members and staff.
- Links to related Web sites, including those of other volunteer monitoring programs, those promoting relevant upcoming events, those providing additional technical information, and those related to fundraising.

Feedback on data results was noted by all three programs as being particularly important to volunteers. AWW currently provides the most immediate feedback with a revamped database that now allows volunteers to enter data online and view real-time graphic displays of this data. KY WW and GA AAS currently do not have this technology available; however, they both provide data feedback to their volunteers upon request. In addition, KY WW provides select online monitoring reports.

An additional method of feedback is to bring volunteers together from around the state for an annual conference, meeting, and/or social gathering to review the past year's accomplishments, learn more about volunteer monitoring, and present awards to volunteers and groups. For example, partnering with the Environmental Education Association and others, GA AAS helps to coordinate a statewide conference that offers sessions and field outings on water monitoring topics and other environmentally related topics. AWW coordinates two statewide conferences, one focusing on technical issue updates and the other (i.e., an annual catfish fry by the river) on fellowship, program business updates, and volunteer kudos. While KY WW does not have a statewide annual conference per se, it does help to coordinate basin-wide conferences as a part of its support of KY Watershed Watch. These conferences provide attendees an opportunity to receive interpretative feedback on data they have collected, programmatic and technical updates, and accolades for their contributions. In addition, most of the basin Watershed Watch groups have "down-at-the-river" social gatherings as reminders of what their monitoring efforts are helping to protect.

5.11 Data Management

All three state programs have customized databases to house monitoring data and information on participating monitoring groups. Each has acknowledged the key administrative role that a multi-functional database serves and shared the challenges, particularly related to time and cost, in its development and upgrades.

Of the three programs, AWW has devoted more resources to the development and customization of its database. Using Microsoft Access software, its current database has been customized to provide a wide range of functions including the capability for volunteers to enter and access data online as well as graph multi-year data in real-time. By far the greatest challenge for AWW staff in regard to its database development was identifying a contractor who had the skills to develop a database that would meet the needs of the program. It was somewhat of a trial and error process and a tremendous amount of resources was used. According to AWW staff, the person who developed their program's current database had the right set of skills along with a personal interest in AWW, both of which contributed to him delivering an effective database that meets the needs of the program. AWW's "investment" has been partially defrayed by using its database to manage data for international water monitoring projects coordinated by the AWW manager through the International Center for Aquaculture and Aquatic Environments, an interdisciplinary and international outreach department of the College of Agriculture at Auburn.

In contrast to AWW, both the GA AAS and KY WW databases are more limited. While GA AAS also uses Microsoft Access, it has not yet customized its database to provide some advanced interactive features like allowing volunteers to enter data or providing graphic feedback although it has long-range plans to do so. KY WW stores data on a secure SQL server; currently its volunteers can enter data on line, but they cannot yet receive graphic real-time feedback.

GA AAS and KY WW have shared a common challenge. Being housed at their respective state offices, they have access to technical assistance provided to state governmental departments. However, both have been frustrated with these services, including that they do not always provide the required technical skills or the staffing to meet schedule demands. GA AAS has been able to partially circumvent this challenge by relying on the talent available on its advisory board, with one of its members volunteering to make significant technical upgrades to its database.

5.12 Key Program Outcomes

Clearly, the ultimate intended outcome of water quality volunteer monitoring programs is to protect and improve local waterways. However, to achieve this, programs, including GA AAS, AWW, and KY WW, produce a range of significant interim outcomes. At a macroscopic level, there are two outcomes in particular that the programs hold in common. First, there is the formation of strong and enduring partnerships at the state as well as at the local level and secondly, there is the generation of water quality data, with an increasing emphasis on quality control. Both of these interim outcomes have been used by the programs as a basis for:

- community education and outreach programs,
- waterbody remediation/restoration projects, and/or
- influencing waterbody policies and regulations.

That being said, on further examination of the outcomes of the three programs, there are some notable distinctions on the emphases each has placed on these two interim outcomes.

Georgia Adopt-A-Stream

GA AAS has consistently focused on the building and maintenance of local partnerships that have taken on the GA AAS mission as well as its identity. Moreover, it has made a dedicated effort to form these local groups into a cohesive statewide network by promoting communication among program coordinators through annual gatherings organized for this purpose and by encouraging the coordinators to become regional GA AAS trainers. A primary adhesive outreach event among the local partnerships has been the “Rivers Alive” statewide waterways cleanup that is, in large part, coordinated by GA AAS. On a statewide level, GA AAS has garnered a geographically and occupationally diverse set of partners through its formation of a statewide advisory board. Through these partnerships differing perspectives are brought to the program along with a range of knowledge and skills.

In regard to data collection, GA AAS has from its outset placed a particular emphasis on this activity’s inherent educational value, as has been reflected in its proportionally high number of secondary education teacher and student involvement. It has increasingly focused on the collection of quality-controlled data, with it now being more commonly used to “red-flag” local problems as well as to identify water quality trends. However, the state uses little or no volunteer data in waterbody reporting (i.e., 303d list and 305b report) and indicates and indicates no short-term aspirations that it will be used for such purposes.

Alabama Water Watch

The hallmark of AWW has been, unquestionably, its commitment to collecting long-term, quality-controlled trend data. Integral to making this happen has been a manager with a vision; facilities that have supported this vision (including an on-site water analysis laboratory); EPA Region 4-approved QA/QC plans; and a mix of staff with varying backgrounds and skills. A related key byproduct to AWW’s emphasis on data acquisition has been the development of an advanced data management system. As a result of the program’s emphasis on quality control and its acquisition of long-term data by its volunteers, the state environmental regulatory agency (i.e., ADEM) is now using AWW’s data, at least in a corroborative fashion, in its federal waterbody reports and state basin plans.

The development of partnerships by AWW has also played a key role in the acquisition and use of its data. Its partnership with the AWW Association has provided additional fiscal support for volunteer data collection as well as a “voice” (i.e., through its Citizens Advisory Council) for its monitors in their efforts to have the state use their collected data in a meaningful way. Through its partnerships with the lake HOBO organizations, not only has water quality data been collected on a number of reservoirs throughout Alabama, but for several reservoirs, information-packed glossy reservoir reports have been created that can be used as effective public education tools.

Kentucky Water Watch

KY WW, like GA AAS, began with an emphasis on education, partnering with hundreds of teachers and their classes to involve them in educational water quality activities, including the collection of chemical and benthic data. The lack of a program QAPP is indicative of the emphasis KY WW placed on education versus influencing water quality policy through the collection of data for state water quality reports.

As it has evolved into more of a technical consultative service for emerging volunteer monitoring groups, KYWW has fostered key partnerships across the state that have resulted in volunteer monitoring programs with a greater emphasis on the collection of credible data. KY Watershed Watch, one of the largest volunteer monitoring organizations in the state, involves citizens in collecting grab water samples that are then analyzed at certified laboratories. Moreover, scientific advisory groups that develop basin-specific sampling plans oversee these sampling efforts. With this elevated level of data accuracy and precision, Watershed Watch has been able to broaden its data use to encompass “red-flagging” water quality problems and to justify funding for remediation projects. In addition, the state has acknowledged the value of this data by beginning to incorporate it into basin plans. It is also worth noting that under the guidance of KY WW, KY Watershed Watch began in conjunction with the state’s Wa tershed Management Framework as a way to more effectively engage the public in the state’s basin planning process.

6.0 SURVEY RESULTS

Following are survey results including a summary and analysis of each finding, followed by our interpretation. Section 6.1 provides the results of the survey we conducted with past and current volunteers participating in Alabama Water Watch (AWW), Georgia Adopt-A-Stream (GA AAS), and Kentucky (KY) Watershed Watch. The survey was designed to function as a measurement of volunteer perception as opposed to the more objective information gathered from program staff members and provided in Section 4.0, Program Case Studies.

Section 6.2 provides the results of our survey of Tennessee stakeholders, those with a stake in water quality and more specifically with the potential of participating in a Tennessee statewide volunteer monitoring program. As described in Section 2.0, Research Design, this survey is not statistically representative. Rather, it is intended to indicate Tennessee stakeholder perceptions.

6.1 Southeastern Volunteer Monitoring Programs

Demographics

Summary

As shown in Figures 6.1, 6.2, 6.3, and 6.4, A typical volunteer monitor participating in AWW, GA AAS, or KY Watershed Watch falls into the age category of 35-64, has been involved in the program for more than two years, and has a college degree or higher. No predominant occupational background was found.

Figure 6.1 Age of AWW, GA AAS and KY Watershed Watch Volunteers

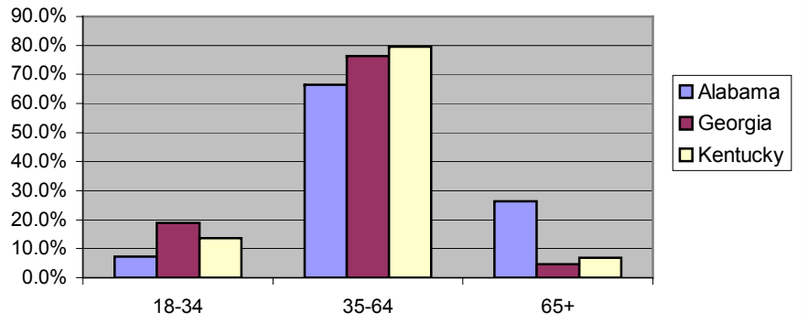
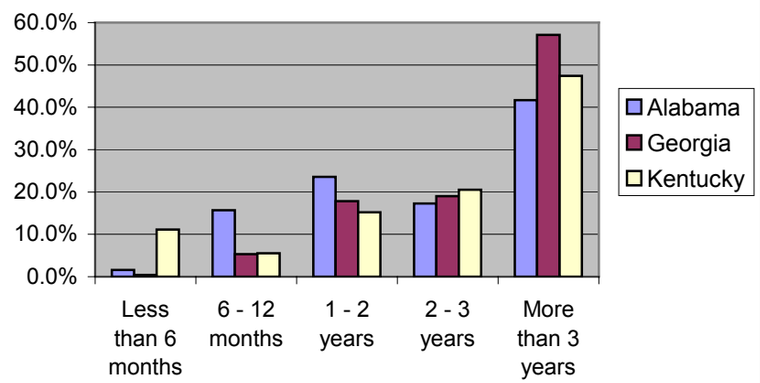


Figure 6.2 Length of Involvement of AWW, GA AAS and KY Watershed Watch Volunteers



Detailed Findings

Alabama Water Watch:

- AWW volunteers tended to be older as a group than those in GA AAS or KY Watershed Watch, with substantially more falling into the 65+ age cohort (26.3 percent versus 6.9 for KY Watershed Watch and 4.7percent for GA AAS).
- AWW also had a higher percentage of newer volunteers, with a greater number having been involved for two or fewer years than the other programs.
- AWW volunteers are highly educated as a group, with the vast majority, 90.6 percent, having had some college or a college degree or higher.
- The majority of AWW volunteers identify their occupational background as business/industry or education. A high number also identify themselves as scientists or environmentalists, with a small number of students involved.

Georgia Adopt-A-Stream:

- GA AAS has the youngest volunteers, with a higher number falling into the 18-34 year age cohort, and the smallest percentage falling into the 65+ cohort.
- GA AAS volunteers have the longest terms of involvement, with the majority having participated in the program for over three years. They had the smallest number of newer volunteers, with very few falling into the groups with less than one year of involvement. About 37 percent have been involved for 1-3 years.
- GA AAS volunteers are the most highly educated of the three groups, with nearly 82 percent having a college or graduate degree. However, a slightly higher percentage have an education level of less than high school.
- Over 70 percent of GA AAS volunteers identify their occupational background as business/industry or education. GA AAS has a smaller percentage of volunteers who identify their occupational background as affiliated with local or state government than the other two programs. They also have a smaller number who identify themselves as students.

Figure 6.3 Education Level of AWW, GA AAS and KY Watershed Watch Volunteers (% distribution)

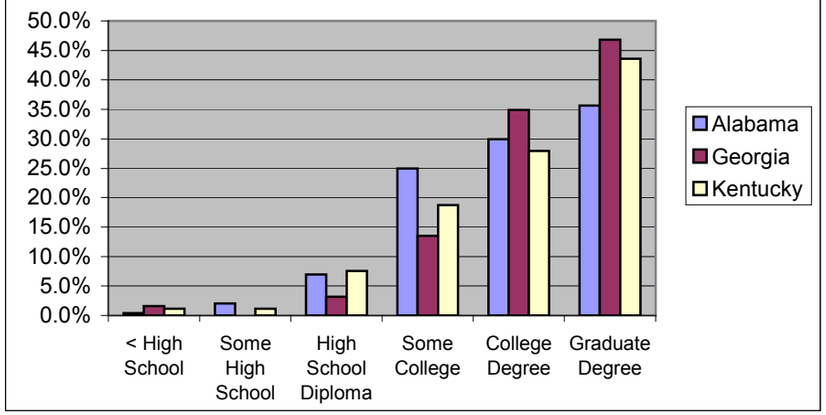
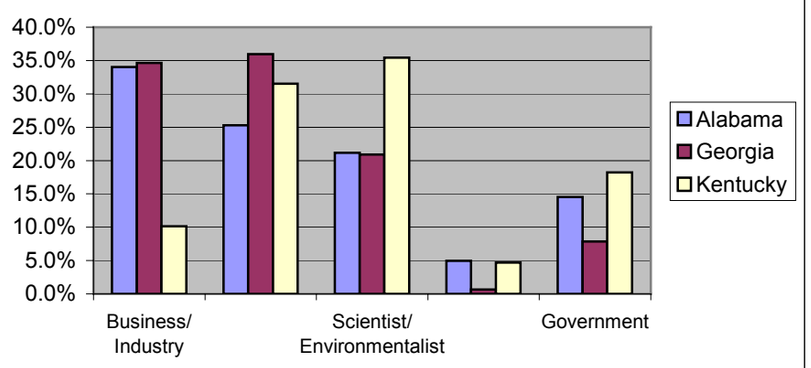


Figure 6.4 Occupational Background of AWW, GA AAS and KY Watershed Watch Volunteers (% distribution)



Kentucky Watershed Watch:

- KY Watershed Watch volunteers tend to be older than GA AAS volunteers, but younger than AWW volunteers.
- KY Watershed Watch has a substantially larger number of volunteers who have been involved in the program for less than six months (11.1 percent versus 1.6 percent for AWW and 0.4 percent for GA AAS; however, the majority have been involved for two or more years (67.9 percent).
- The vast majority (90.2 percent) of KY Watershed Watch volunteers have had some college or have a college or graduate degree.
- KY Watershed Watch volunteers primarily identify their occupational background as scientist/environmentalist (35.4 percent) or education (31.5 percent). The number identified as scientist/environmentalist is substantially higher than for AWW (21.2 percent) or GA AAS(20.9 percent); moreover, KY Watershed Watch volunteers were less likely to identify their occupational background as business or industry (10.2 percent for KY Watershed Watch versus 34 percent for AWW and 34.6 percent for GA AAS). A slightly higher percentage of Kentucky volunteers identified their occupational background as state or local government.

Interpretation

Overall, the demographic makeup of the volunteers is broadly similar across the three programs. Differences in education levels and occupational backgrounds may be explained to some degree by the intent and administration of the program. For example, the relatively high proportion of GA AAS volunteers who identify themselves as having an educational background may relate in some part to that program's focus on education. In contrast, the relatively high number of scientists and environmentalists involved in KY Watershed Watch may, in part, be explained by KY Watershed Watch's association with the state's Watershed Management Framework, which involves a substantial number of environmental professionals.

Perceived Volunteer Monitoring Benefits and Limitations

Summary

As shown in Figures 6.5 and 6.6, perceived benefits were rated much higher than perceived limitations, indicating that for most volunteers, the benefits of their programs greatly outweigh any perceived limitations.

Detailed Findings

Alabama Water Watch:

- AWW tended to rate the perceived benefits higher than did volunteers from the other two programs. The highest rankings were increased awareness of water quality issues (8.4) and increased scientific knowledge of water quality issues (8.1).
- AWW volunteers tended to rank perceived limitations lower than GA AAS volunteers and somewhat equally with KY Watershed Watch volunteers. Lack of sufficient funding was rated as being the greatest limitation to AWW, with a mean score of 6.5, significantly higher than KY Watershed Watch's average rating of 5.8.

Georgia Adopt-A-Stream:

- GA AAS volunteers rated volunteer monitoring programs' ability to increase scientific knowledge of water quality issues significantly lower at 7.4, than AAS and KY Watershed Watch volunteers, who rated this benefit at 8.1. However, overall ratings of perceived benefits were high, with increased awareness of water quality issues being perceived as the greatest potential benefit with an overall rating of 8.1.
- GA AAS volunteers tended to rate potential limitations to volunteer monitoring programs higher than volunteers in the other two programs. They ranked insufficient QA/QC protocol (4.7 versus 3.7 for AWW and KY) and collected data not being viewed as credible (5.7 versus 4.3 for AWW and 4.8 for KY) significantly higher. Overall, GA AAS volunteers viewed insufficient funding as the greatest limitation to volunteer monitoring programs.

Figure 6.5 AWW, GA AAS and KY Watershed Watch Perceived Benefits (Mean) of Volunteer Monitoring

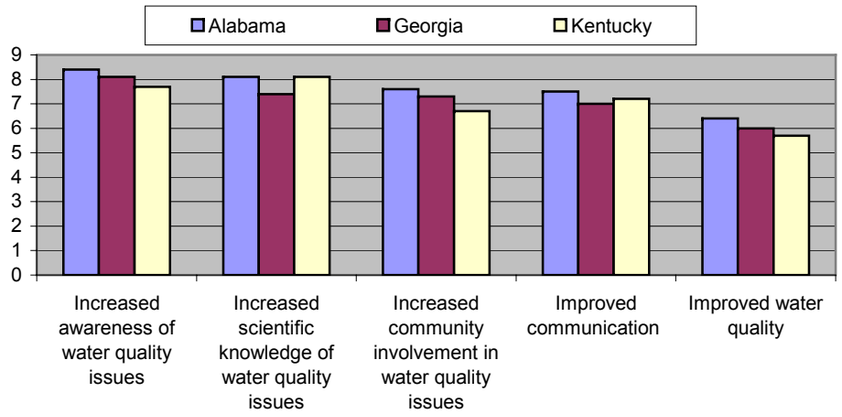
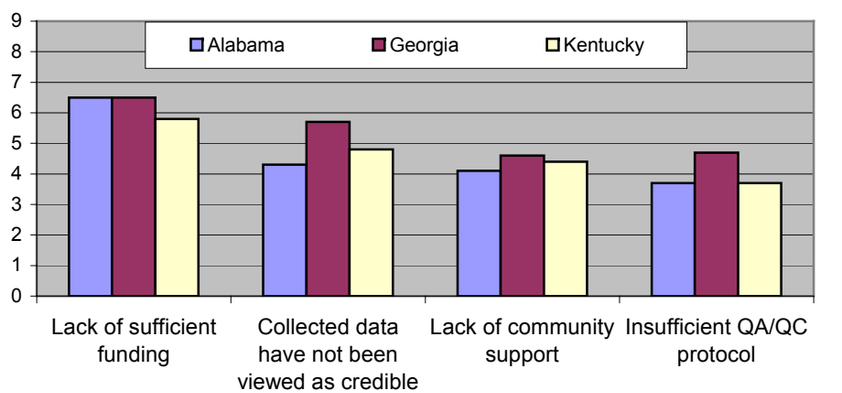


Figure 6.6 AWW, GA AAS and KY Watershed Watch Perceived Limitations (Mean) of Volunteer Monitoring



Kentucky Watershed Watch:

- KY Watershed Watch volunteers rated increased scientific knowledge of water quality issues (8.1) as a volunteer monitoring program's greatest benefit. They rated increasing awareness of water quality issues and improving water quality significantly lower than did AWW volunteers (7.7 versus 8.4 and 5.7 versus 6.4). Overall, however, they gave high ratings to all potential benefits.
- KY Watershed Watch volunteers rated lack of sufficient funding most highly in terms of potential program limitations. However, they gave this limitation a lower overall score (5.8) compared to AWW and GA AAS volunteers (6.5).

Interpretation

Survey results show that participants in citizen volunteer water monitoring programs believe that the potential benefits of these programs outweigh any potential limitations. Such a belief may account in part for the fairly rapid growth in these programs, as cited in the literature review. It is axiomatic that people will tend to be more willing to be involved in a program when they feel that it is beneficial. Perhaps most telling is the fact that participants in all three groups rated improved water quality least of all identified benefits. This may indicate that participants believe that the true potential benefits of volunteer monitoring programs lies in the ability of such programs to raise awareness of and interest in water quality issues, and that possibly the benefit of improving water quality is viewed as a long-term goal that cannot realistically be immediately achieved. The relatively low ranking of identified limitations may indicate that, though these limitations may be problematic, they are not insurmountable. Perhaps most revealing here is that volunteers gave lack of sufficient funding the highest ratings. This limitation is the one least linked to the state program's structure and implementation approach, indicating that the limitation does not lie directly so much with program design as it does with a lack of ongoing external support.

Perceived Greatest Benefits and Limitations to Volunteer Monitoring Programs

Summary

As shown in Figures 6.7 and 6.8, volunteers indicated that, by far, the greatest benefits of their state's volunteer monitoring programs are related to their ability to educate citizens on and involve them in water quality issues. In contrast, they identified a lack of sufficient funding and community support as their greatest limitations.

Detailed Findings

Alabama Water Watch:

- AWW volunteers named an increased awareness of water quality issues, at 47.1 percent, as the greatest benefit achieved by their program. They named increased community involvement, at 26.2 percent, second most often. Least often, they chose increased scientific knowledge of water quality issues.
- 39.9 percent of AWW volunteers cited insufficient funding as its program's greatest limitation. They identified a lack of community support (34.9 percent) as its second greatest limitation. Least often, they cited problems with data credibility and QA/QC protocols as limiting factors.

Georgia Adopt-A-Stream:

- 43.7 percent of GA AAS volunteers believe an increased awareness of water quality issues is the primary benefit of their program. Second most often, volunteers named increased community involvement in water issues as its primary benefit.
- As with the other volunteer monitoring programs, GA AAS viewed lack of sufficient funding as the greatest limitation to their program, although the gap between insufficient funding (34.5 percent) and lack of community support (31.9 percent) was narrower than in the other programs. Compared to AWW volunteers, more from GA AAS felt that data credibility and insufficient QA/QC protocols were a greater limitation to their program.

Figure 6.7 AWW, GA AAS, and KY Watershed Watch Volunteers' Greatest Perceived Benefit of their Program

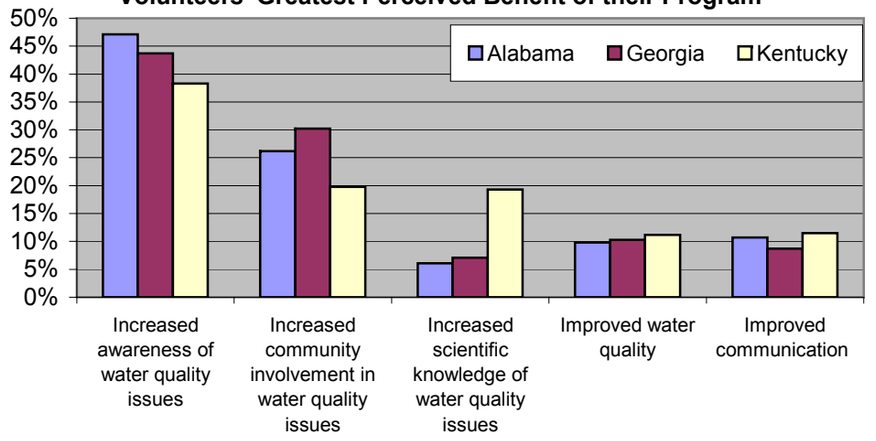
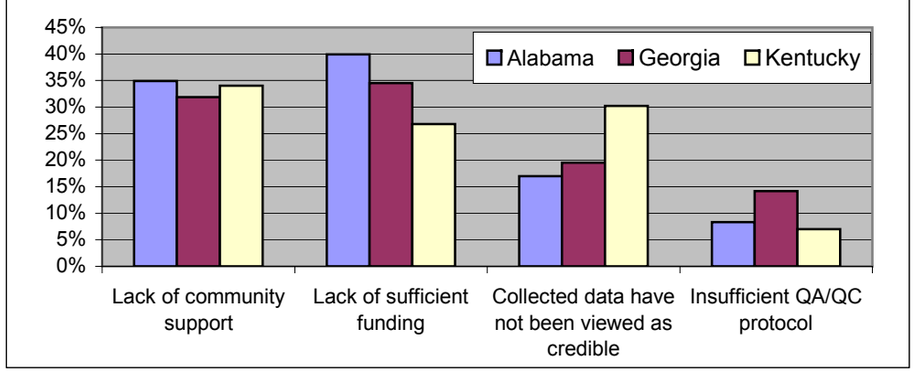


Figure 6.8 AWW, GA AAS, and KY Watershed Watch Volunteers' Greatest Perceived Limitation to their Program



Kentucky Watershed Watch:

- KY Watershed Watch volunteers also tend to think that the greatest benefit provided by their program is that of an increased awareness of water quality issues, with 38.3 percent naming this benefit most often. KY Watershed Watch volunteers, unlike AWW or GA AAS volunteers, were about evenly split on the benefits of increased community involvement in water quality issues (19.8%) and increased scientific knowledge of water quality issues (19.3%).
- In terms of the greatest limitations to their program, KY Watershed Watch volunteers differed fairly substantially in their views from those participating in AWW and GA AAS. The greatest limitation identified by KY volunteers, at 34 percent, was lack of community support. A slightly smaller percentage, 30.2 percent, cited data credibility. Insufficient funding, ranked first by GA AAS and AWW volunteers, was chosen by only 26.8 percent of KY Watershed Watch volunteers as its program's greatest limitation. As in AWW and GA AAS, KY Watershed Watch volunteers identified insufficient QA/QC protocols least often as its program's greatest limitation.

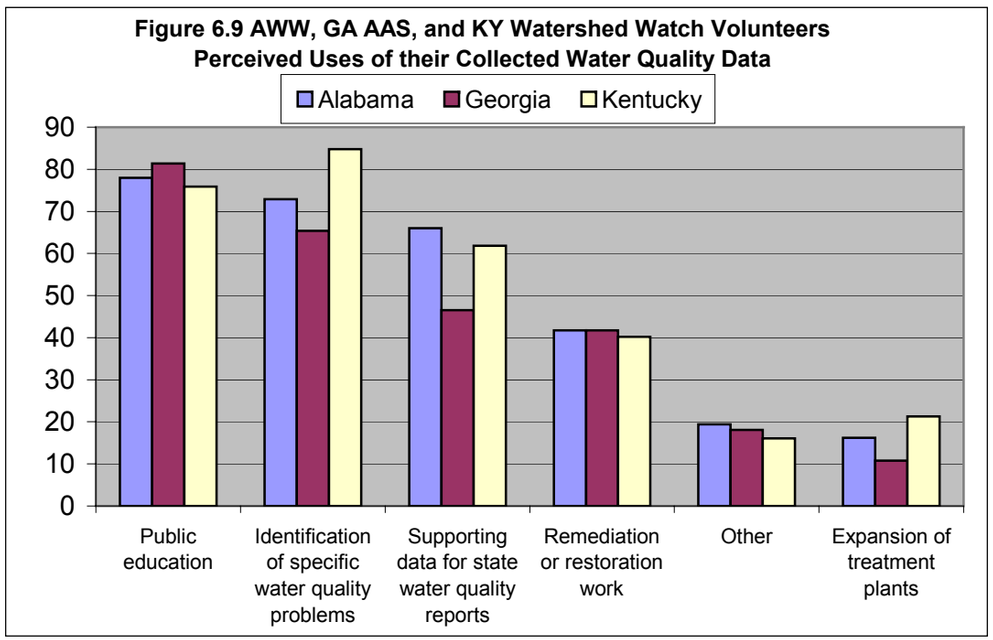
Interpretation

Volunteer monitors from the three programs tended to be more in agreement on the greatest benefit provided by their programs than on the limitations the programs face. Clearly, they believe the greatest benefits achieved by volunteer water monitoring programs are increased awareness of and involvement in water quality issues. In terms of limitations, they tended to be more divided, with no one limitation standing out as the greatest for all programs. It is notable, given that the greatest benefits cited concerned increasing awareness and involvement, that lack of community support was cited by so many as the greatest limitation. This indicates that much of the success of volunteer monitoring programs is linked to their ability to connect with the communities they serve.

Summary

Although the primary perceived uses of volunteer monitoring data are to educate the public and identify specific water quality problems as shown in Figure 6.9, it does appear that citizen volunteers feel their data are being used for other purposes as well.

Figure 6.9 AWW, GA AAS, and KY Watershed Watch Volunteers Perceived Uses of their Collected Water Quality Data



Perceived Uses of Volunteer Water Quality Monitoring Data

Detailed Findings

Alabama Water Watch:

- Generally, most AWW volunteers (78 percent) believe their data is used for public education. More than half of all volunteers also feel that their data is used for identifying specific water quality problems and as supporting data for state water quality reports.
- Smaller percentages feel that their data is used for remediation or restoration work and for expansion of treatment plants.

Georgia Adopt-A-Stream:

- GA AAS volunteers are most likely, at 81.4 percent, to believe their data is used for public education. Well over half also believe their data is used to identify specific water quality problems.
- When compared to AWW (66 percent) or KY Watershed Watch (61.8 percent), a substantially smaller number of GA AAS volunteers (46.5 percent) believe their data is used to corroborate data in state water quality reports.
- GA AAS volunteers are on par with those in AWW in believing their data is used for remediation or restoration work, though fewer GA AAS volunteers feel their data is used for expansion of treatment plants.

Kentucky Watershed Watch:

- Most (84.8 percent) KY Watershed Watch volunteers believe their data is used for identifying specific water quality problems. More than half also believe their data is used to educate the public and as supporting data for state water quality reports.
- A slightly higher number of KY volunteers feel their data is used for expansion of treatment plants.

Interpretation

It is not surprising that such a large number of volunteers feel their data is used for purposes of public education, given that increased knowledge of and involvement in water quality issues were generally perceived as the greatest benefits of volunteer water quality monitoring programs. It is notable, however, that such a large proportion of volunteers believe that their data is used for identification of specific water quality problems. The response from KY Watershed Watch volunteers may, in part, be explained by the fact that this program was developed in conjunction with the state's Watershed Management Framework which, among other purposes, was designed to prioritize watershed problems. However, this finding would seem to be contrary to the fact that volunteers from all three programs gave lower ratings to improved water quality in terms of the benefits of volunteer monitoring. The lower proportion of volunteers who think their data is used remediation and restoration work may indicate that they believe their data is used to identify problems but not always to resolve or mitigate them.

Level of Satisfaction with Water Quality Monitoring Program

Summary

As shown in Figure 6.10, volunteer monitors appear to be markedly satisfied with the support provided to them by their state programs.

Detailed Findings

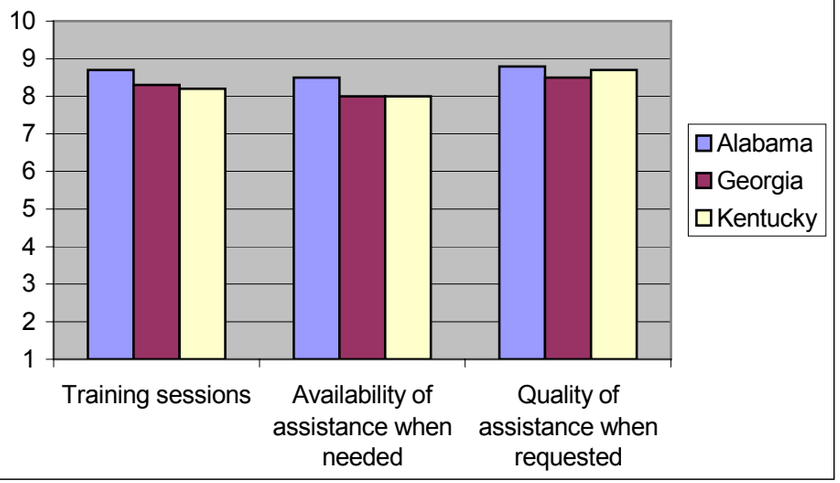
Alabama Water Watch:

- Overall, AWW volunteers reported the greatest levels of satisfaction with their program training sessions (8.7), availability of assistance when needed (8.5) and the quality of the assistance given (8.8).

Georgia Adopt-A-Stream:

- GA AAS volunteers were also quite satisfied their program's level of support, though their satisfaction with training sessions (8.2) and availability of assistance (8.0) were significantly lower than those of AWW volunteers. Their rating of availability of assistance when needed was also slightly lower, at 8.0, than those given by AWW and KY Watershed Watch volunteers.

Figure 6.10 AWW, GA AAS, and KY Watershed Watch Volunteers' Levels of Satisfaction with Program Support



Kentucky Watershed Watch:

- KY Watershed Watch volunteers also reported high levels of satisfaction with their program, with the quality of assistance scoring highest (8.7). Like GA AAS, KY volunteers also rated availability of assistance significantly lower, at 8.0, than AWW volunteers.

Interpretation

The results from this portion of the survey indicate that volunteers in all three programs are quite satisfied with the level and quality of support they have received from their programs. Given the variation in program delivery systems among the three programs, this may indicate that how a program is structured is less important than the combination of strategies used to provide technical and training support to the volunteers.

Additional Comments Provided by Survey Respondents

We also gave survey participants an opportunity to make additional comments about volunteer monitoring programs. Many of these comments, recorded by survey administrators, added additional support to the findings generated by specific survey questions, but some also highlighted issues and areas that may have been overlooked in the survey. The following section offers a general overview of these comments.

Limitations

In terms of limitations, volunteer comments tended to support the finding that a lack of community support is perceived as the greatest barrier to a successful program. In particular, a number addressed their program's lack of publicity or public relations, which may indicate that volunteers feel the lack of community support is due in part to a lack of information exchanged between the program and the community. Volunteer comments also reflected a frustration over a lack of support from government entities, particularly in regards to agencies' perceptions of the credibility of the collected data and their willingness to use it.

Interestingly, two limitations not specifically identified in the survey were addressed in volunteer comments across all three programs, namely:

- Lack of volunteer time.
- Difficulty of access to waterbodies which need monitoring.

These limitations may also tie into the ongoing challenge of community support including, obtaining sufficient numbers of volunteers to provide adequate monitoring coverage and obtaining permission to monitor on private property.

Other concerns identified by survey respondents related to the following general issues:

- Lack of adequate training or access to training.
- Inadequate laboratory or technical support.
- Lack of regulatory "teeth."
- Lack of funding.
- Prohibitive cost of testing equipment.
- Lack of feedback to volunteers.
- Lack of adequate data analysis.

These issues were generally noted by volunteers across all three programs.

Benefits

Comments provided by survey participants, for the most part, reflected their views that the two most important benefits of volunteer monitoring are increased public awareness of and involvement in water quality issues. A number of comments specifically addressed the educational opportunities volunteer monitoring programs provide to students.

Overall, volunteer comments indicate a belief that many of the benefits of volunteer monitoring programs cannot be expected to be seen immediately. Rather, their effects will become more evident in the future as quality-controlled data reveal long-term trends and as volunteers, particularly students, continue to stay involved in addressing many of the water quality problems that lack a quick-fix solution.

6.2 Perceptions of Tennessee Stakeholders

The following section provides the results of our survey of Tennessee stakeholders. We compare these findings to the results from surveys administered to AWW, GA AAS, and KY Watershed Watch volunteers, which we later pooled and averaged. The purpose of this comparison is to gauge similarities and differences between responses from past and current volunteers of statewide monitoring programs and individuals who could potentially participate in a Tennessee volunteer monitoring program, if implemented. We may refer to this collective pool of survey respondents across all three statewide monitoring programs simply as “statewide volunteer monitoring program (SVMP) respondents.”

Demographics

Summary

As shown in Figures 6.11, 6.12, and 6.13, Tennessee stakeholders who responded to our survey tended, on average, to differ in terms of demographics from SVMP respondents (i.e., AWW, GA AAS, and KY Watershed Watch survey respondents).

Detailed Findings

Tennessee respondents were on average younger than SVMP respondents. A higher percentage of Tennessee stakeholders surveyed fell into the 18-34 year age cohort (31 percent), while fewer were 65 or older (4.5 percent).

Tennessee respondents tended to identify their occupational background as scientist or environmentalist, with this category being selected by 45.9 percent of respondents. This is in contrast to SVMP respondents, who, on average, tended to identify their occupational background as either education (30.9 percent) or business/industry (26.3 percent). For Tennessee respondents, business/industry was the second most identified occupation (at 17.8 percent) while education was selected third most often (17.3 percent). A smaller percentage of both the Tennessee respondents and SVMP respondents identified their occupation as being affiliated with government service or as a student, though Tennessee was slightly higher in both categories.

Figure 6.11 TN Survey Respondents' Age in Contrast to Statewide Monitoring Program Volunteers

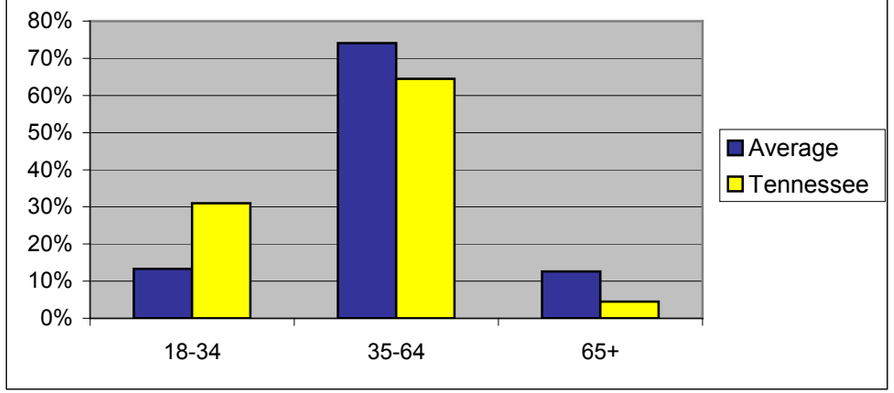


Figure 6.12 TN Survey Respondents' Occupations in Contrast to Statewide Monitoring Program Volunteers

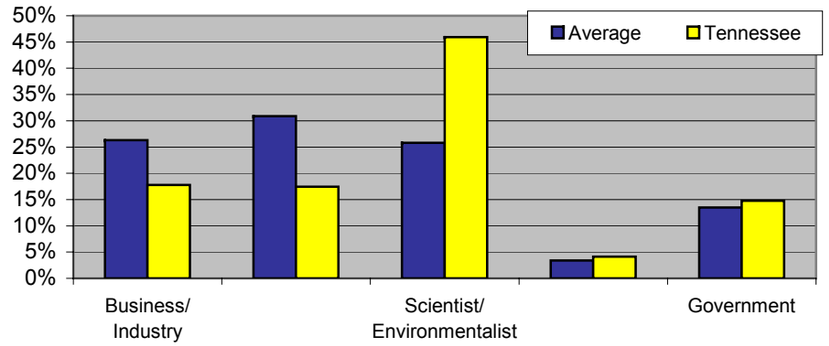
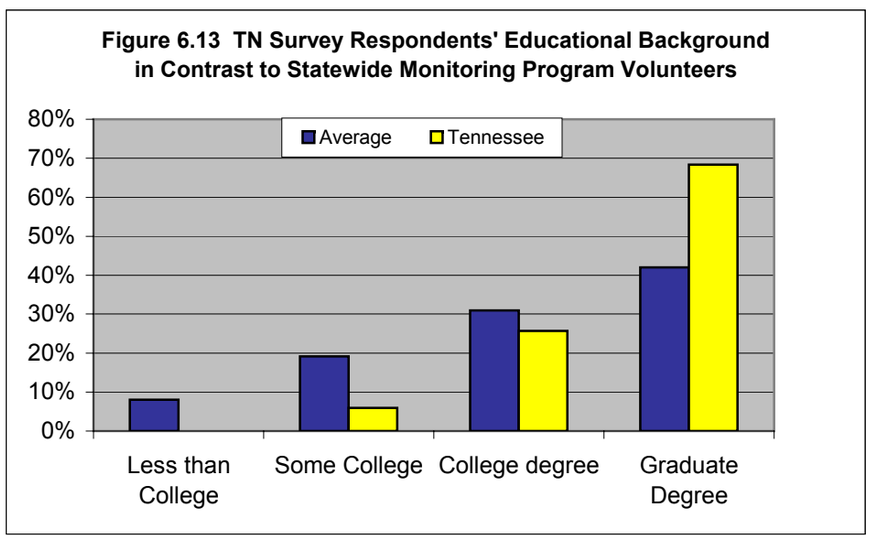


Figure 6.13 TN Survey Respondents' Educational Background in Contrast to Statewide Monitoring Program Volunteers



Education levels among Tennesseans also differed from SVMP respondents. Tennessee respondents overwhelmingly identified their highest education level as a graduate degree, with none reporting less than some college. This is in contrast to SVMP respondents, a small percentage of whom reported having less than some college. However, the general trend of respondents having a college degree or higher did carry through for both groups of respondents.

Interpretation

Some of the differences found in the demographic breakdowns of the Tennessee survey participants versus those from the collective pool of survey respondents from AWW, GA AAS, and KY Watershed Watch programs are likely attributable to survey methods. Tennessee survey participants were in large part drawn from a conference targeted for water resource-related professionals. This may explain why a greater percentage of Tennesseans in contrast to SVMP respondents had occupational backgrounds related to science/environment and had more advanced degrees. Also, the older average age of SVMP respondents may in part be due to the fact that retirees generally a greater amount of free time to volunteer in contrast to those still in the work force.

Perceived Benefits and Limitations

Summary

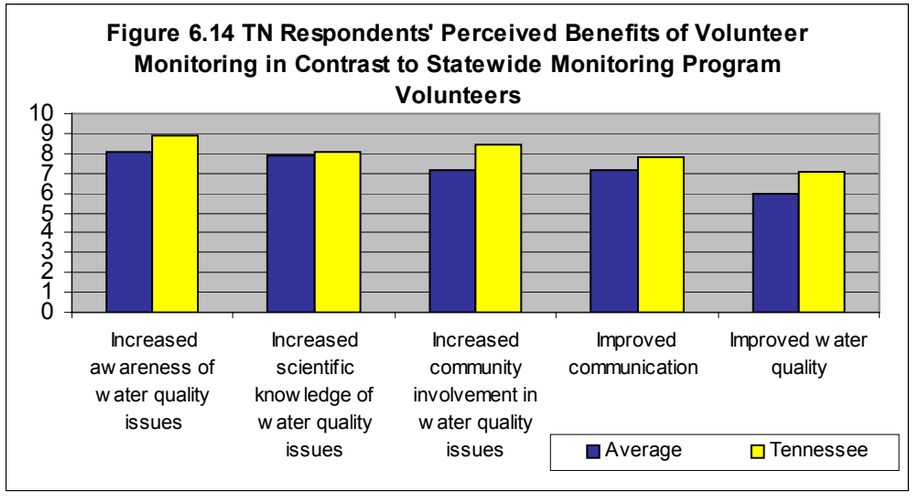
As shown in Figures 6.14 and 6.15, Tennessee survey respondents tended to give both perceived benefits and perceived limitations higher ratings than did SVMP respondents.

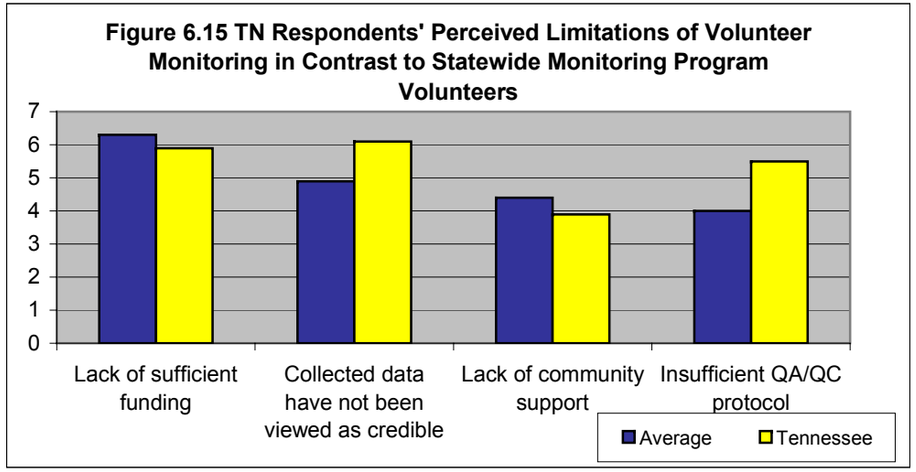
Detailed Findings

Tennessee stakeholders tended to give slightly higher ratings to perceived benefits of volunteer monitoring programs than those participating in AWW, GA AAS, and KY Watershed Watch. Particularly high ratings from Tennessee respondents include increased community involvement in water quality issues (8.4 versus an average rating by SVMP respondents of 7.2) and improved water quality (7.1 versus a rating of 6 by SVMP respondents). The perceived benefit which the two groups tended to rate most closely was the potential for volunteer water monitoring programs to increase

scientific knowledge of water quality issues (8.1 by Tennessee respondents and 7.9 by SVMP respondents.

In terms of perceived limitations to volunteer monitoring programs, Tennesseans appeared to have the greatest concerns about data credibility and program funding. The problem of collected data not being viewed as credible was rated most highly, with an average of 6.1. This was followed by a lack of funding, with an average rating of 5.9. Most of the Tennessee respondents seemed to feel that a lack of community support would be the least problematic of the four limitations identified.





Interpretation

The Tennessee survey results, when compared with the collective responses from the three statewide programs, seem to indicate that the Tennessee respondents are slightly more idealistic regarding the benefits of volunteer monitoring than the SVMP respondents, yet are grounded in the reality of the some of the issues related to monitoring. Tennesseans may have rated perceived benefits higher because many have not yet been in the “volunteer monitoring trenches” and thus have not been involved in the challenges of translating the monitoring experience into these benefits.

The response from Tennesseans in regards to potential limitations to volunteer monitoring programs indicate that they are aware of and share concerns with volunteer monitoring critics that sufficient QA/QC protocols will not be established to collect credible data. Tennessee respondents’ somewhat lower rating given to a lack of community support as a potential program barrier when compared to SVMP respondents indicates that they may be slightly underrating the importance of establishing community support for a successful program. This, again, may be partially due to their lack of experience with such programs.

Greatest Perceived Benefits and Limitations

Summary

Generally, surveyed Tennesseans rated perceived benefits approximately the same as SVMP respondents (see Figure 6.16). In terms of the greatest perceived limitation, however, the results were quite different (see Figure 6.17).

Detailed Findings

Tennessee survey respondents tended to choose either an increased awareness of water quality issues (38.4 percent) or increased community involvement in water quality issues (31.8 percent) as the greatest perceived benefit. This is in keeping with the results from the SVMP respondents, though they were more likely to indicate awareness (at 43 percent) than involvement (averaging 25.4 percent). The remaining three identified benefits were indicated as being the greatest benefit by approximately the same number of persons from both groups, though slightly fewer Tennessee respondents (9.3 percent versus 10.4 percent) believe that improved water quality will be the greatest benefit.

In terms of limitations, Tennesseeans were far less likely than the SVMP respondents to name lack of community support as the greatest potential limitation to volunteer monitoring programs. Only 21.3 percent of Tennessee respondents named this option, whereas it was chosen by 33.6 percent of the SVMP respondents. The low relative percentage of Tennessee respondents who choose this option may be partially accounted for by the relatively higher percentages who choose lack of credibility of data or an insufficient QA/QC protocol as the greatest potential limitations (28.7 percent versus 22.2 percent of the SVMP respondents and 16 percent versus 9.8 percent of the SVMP respondents, respectively). Lack of sufficient funding was identified by approximately the same percentage of respondents from both groups (34 percent of Tennesseeans and 33.7 percent of SVMP respondents).

Figure 6.16 TN Respondents' Greatest Perceived Benefit of Volunteer Monitoring in Contrast to Statewide Monitoring Program Volunteers

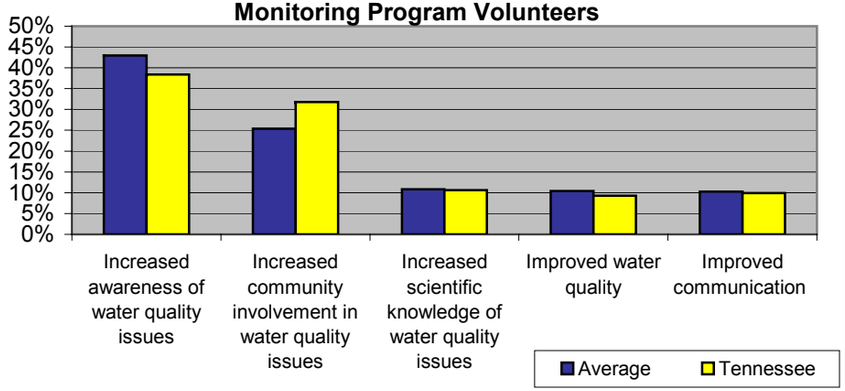
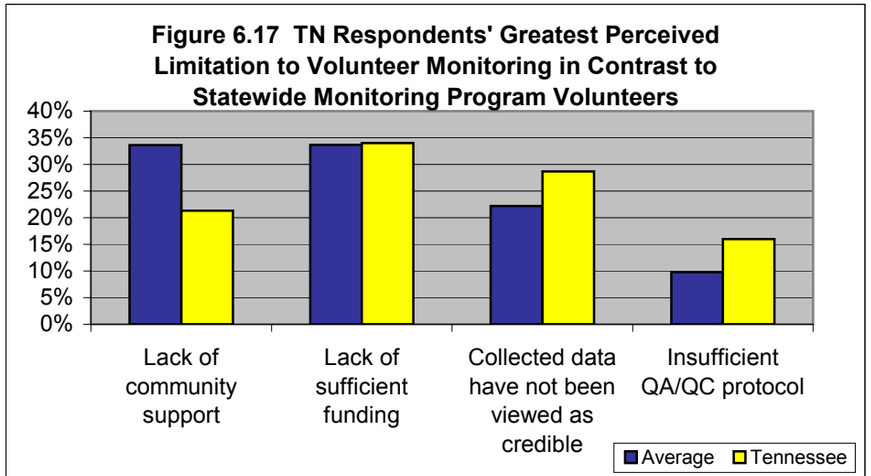


Figure 6.17 TN Respondents' Greatest Perceived Limitation to Volunteer Monitoring in Contrast to Statewide Monitoring Program Volunteers



Interpretation

The relative proportions of Tennessee respondents were fairly close to those of the SVMP respondents when selecting the greatest benefits of volunteer monitoring programs. However, the somewhat higher proportion of Tennesseans who selected increased community involvement as the greatest potential benefit indicates that Tennesseeans, to some extent, feel that volunteer monitoring programs have the capability of promoting of community action.

In contrast, the lower percentage of Tennessee respondents naming a lack of community support as a limitation to volunteer monitoring programs may indicate that Tennesseeans underestimate the impacts that a lack of community support may have on a statewide volunteer monitoring program. It also appears that Tennessee respondents are concerned about the ability of statewide volunteer monitoring programs to collect credible data and develop sufficient QA/QC plans. This perspective may have a positive outcome for a TN volunteer monitoring program if it results in additional efforts on ensuring sound QA/QC protocols are developed.

Tennessee Survey Respondents' Involvement In Water Quality Improvement Programs (WQIPs)

As shown in Figure 6.18, the majority of Tennesseeans (61 percent) who responded to the volunteer monitoring survey are currently involved in a water quality improvement program. Of this 61 percent, 81 percent are involved in WQIPs that also involve water monitoring (see Figure 6.19). Though the method of conducting the Tennessee survey emphasized those who are currently involved with water quality in some way, these citizens would be the most likely to become involved in a statewide volunteer monitoring program, given the opportunity. This indicates Tennessee already has a network of people who may be prepared to invest time and resources into developing and implementing a statewide volunteer monitoring program.

Figure 6.18 TN Respondents Currently Involved in a Water Quality Improvement Program (WQIP)

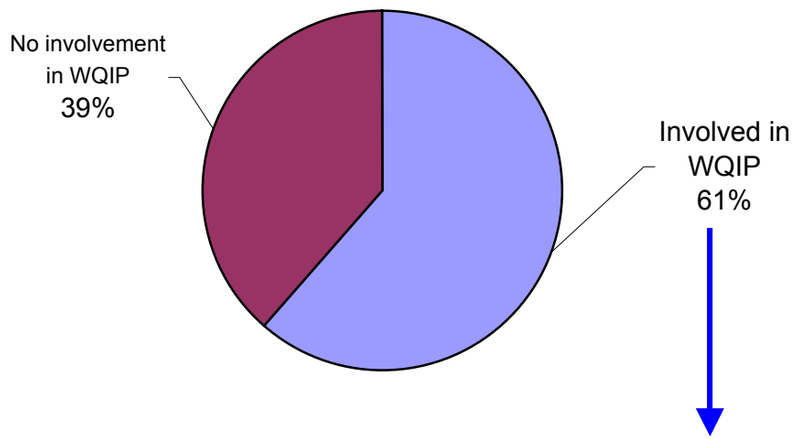
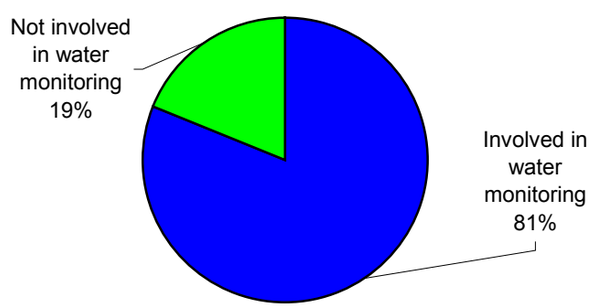
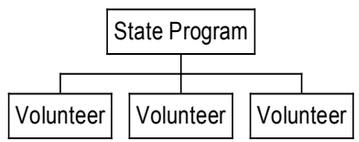


Figure 6.19 TN Respondents Who Are Currently Involved in WQIPs and in Water Monitoring



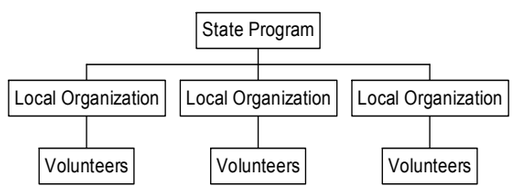
Program Model Preferences

In the Tennessee survey, two volunteer monitoring program implementation models were explained and participants were asked to choose which of the two, if either, they preferred. Model 1 consists of a structure where the state program provides support directly to the volunteers.



Model 1

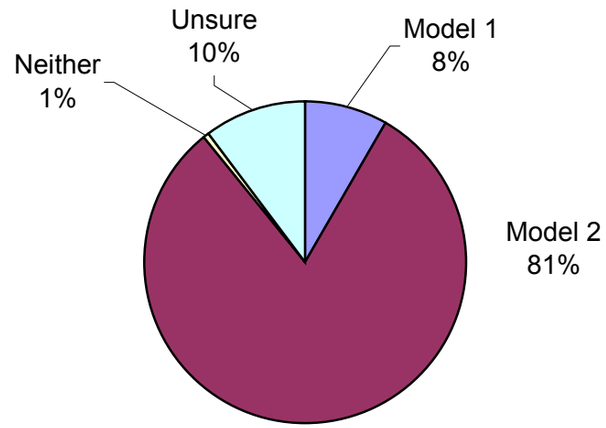
Model 2 consists of a structure where the state provides support to local programs, which in turn provide support to volunteers.



Model 2

As shown in Figure 6.20, survey respondents overwhelmingly preferred Model 2 (81 percent versus 8 percent for Model 1, while eleven percent chose neither or unsure. These results indicate that Tennessee stakeholders prefer a model where there is some level of support and/or involvement at the local level.

Figure 6.20 TN Survey Respondents' Statewide Volunteer Monitoring Program Model Preferences



7.0 RECOMMENDATIONS

Our goal has been to provide relevant and practical recommendations to Tennessee policy makers and other stakeholders regarding the establishment of a statewide volunteer monitoring program. Our aim is that these recommendations be used as a basis for an earnest dialogue among Tennessee stakeholders about the viability of initiating, structuring, and implementing such a program. These recommendations stem from the findings of this study – a review of literature on volunteer monitoring; the case studies of the Alabama, Georgia, and Kentucky statewide volunteer monitoring programs; and the results from surveying past and current volunteer monitors of these three state-wide programs as well as Tennesseans who have a stake in water quality.

Our overarching recommendation is that Tennessee should become part of the national trend of initiating a statewide volunteer monitoring program. Program benefits to states, communities, and volunteers have resulted in growing acceptance of their validity. From a state perspective, volunteer monitoring data is increasingly being used to bridge water quality information gaps, allowing state environmental management departments to maximize their already stretched funding. Volunteer monitoring efforts have also been shown to expand baseline data, thus allowing state personnel to concentrate their efforts in areas of greatest need and make the most efficient use of limited staff and resources. In short, the use of volunteer monitoring data by a state can potentially enhance it's ability to effectively and efficiently meet Clean Water Act and other federal requirements.

At the local level, volunteer monitoring is becoming increasingly useful as municipalities begin to enforce US EPA Storm Water Phase II regulations. As noted in the literature review, one recommendation made by US EPA for meeting the public participation and involvement component of the Phase II requirements is to implement a volunteer monitoring program, a recommendation which indicates both US EPA's support of volunteer monitoring activities as well as their belief that this is a viable way for local areas to meet regulatory requirements. In addition, volunteer monitors are increasingly working in partnership with local officials and public works departments to identify ("red-flag") water quality problems. Not only does this stretch local budgets, it also reinforces the notion that we can all play a part in the solution to water pollution.

The case studies of Alabama Water Watch (AWW), Georgia Adopt-A-Stream (GA AAS), and Kentucky Water Watch (KY WW) further validate valuable outcomes produced through these programs' implementation. Formation of strong and enduring local and statewide partnerships and the generation of water quality data are two of the predominant outcomes, both serving as the basis for community education and outreach programs, waterbody remediation & restoration projects, and/or changes in waterbody policies and regulations. Volunteer monitors emphatically concur that there are multiple benefits to the implementation of their programs, including their capacity to increase the scientific literacy of citizens, open up lines of communication between government agencies and citizen-based organizations, and, particularly, to raise citizens' awareness of and involvement in water quality issues. Tennesseans concur; in fact, they especially feel volunteer monitoring has the potential of translating knowledge into community action.

Finally, our research has shown that volunteers also believe they reap personal benefits from participating in volunteer monitoring programs, as well. Volunteers feel they have an opportunity to become more educated on water quality issues as well as become involved in addressing them. The literature also suggests that through citizens' involvement in volunteer monitoring programs that it not only affects their personal behaviors that impact water quality, but also those around them (i.e., "the ripple effect"). The combined impact of these benefits provides volunteers with both an increased sense of connectedness to their local waterways and a greater desire to participate in their protection.

The implementation of a volunteer monitoring program in Tennessee will not be without its impediments, as the literature and case studies have shown. Volunteer monitors of the three statewide monitoring programs we examined identified three primary barriers: 1) the challenges of attaining stable and sufficient funding, 2) collecting data that is and is perceived as credible, and 3) maintaining community support. Funding is a hurdle that almost every program will continue to face as it attempts to maintain the resources it needs to fully support its volunteers and the mission of its program. We also do not expect this challenge to diminish anytime soon. With the economy continuing to falter and more federal funds being diverted to security and other high-profile national issues, programs must even be more

fiscally accountable and provide ongoing substantiation of their worth. Additionally, many communities are currently facing what many perceive as “unfunded mandates” of the Clean Water Act (e.g., Phase II stormwater regulations) that are stretching local water-related funding sources even further. It will be incumbent upon a state monitoring program to show how it can be implemented locally to help fulfill these and other regulatory requirements.

The perception of AWW, GA AAS, and KY Watershed Watch volunteers that their collected data is not viewed as credible by professionals and government agencies dovetails with concerns of Tennessee stakeholders. Actually, Tennesseans have a dimmer view of the potential for volunteer monitoring data to be widely accepted. The need and challenge of implementing standardized sampling protocols backed by a sound quality control plan resonate throughout their concerns, and there are unquestionably many ancillary administrative and programmatic challenges that must be addressed to overcome this credibility issue. Program designers will need to:

- At the outset, determine how volunteer monitoring data will be used and incorporate this plan into programmatic goals and implementation strategies.
- Include the appropriate stakeholders (e.g., data users) in validating intended data uses and the methods used for collecting and managing it.
- Incorporate into a public relations plan strategies that specifically address the stigmas associated with volunteer monitoring data.

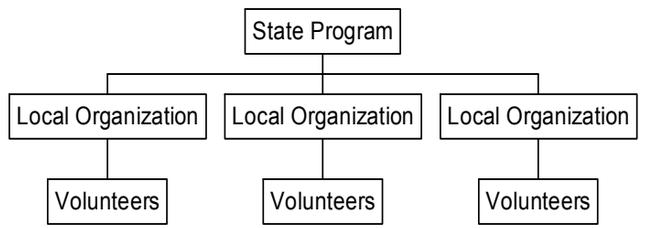
The importance of community support in implementing a volunteer monitoring program should not be underestimated, according to volunteers who have been and are currently participating in programs. Stakeholders from across aspectrum of affiliations second this belief (Godfrey, 1994). Furthermore, comments by AWW, GA AAS, and KY Waterwatch volunteers suggest that perhaps without community support a destructive “domino effect” can ensue, resulting in a lack of financial support, misconceptions about programs, and a deficit of volunteer involvement.

Those participating in volunteer monitoring have resoundingly stated that the benefits of implementing a statewide monitoring program outweigh its barriers. However, formidable barriers, some of which we have just discussed, are very real and must be overcome if a program is to ultimately succeed in its mission. Based on the results of this study, we recommend strategies for devising such a program under the framework of three driving questions. First, how should a Tennessee volunteer monitoring program be structured administratively? Second, what programmatic elements should be incorporated into such a program? Finally, what can be done to increase the probability of long-term viability of the program?

7.1 How should a Tennessee volunteer monitoring program be structured?

Recommendation S-1

The program should be administered by local organizations but should also be able to serve volunteers directly when no local oversight organization is in place.



Key Supporting Findings

This recommendation is first and foremost based on the desires of Tennessee survey respondents who overwhelmingly (81%) preferred a program structure that would allow local organizations to administer a statewide water monitoring program in contrast to a program that would solely provide direct support to its volunteers. Their comments reveal some of the reasons for their strong stance on the use of this model. These include how it can better serve the interests and needs of local communities, engender more ownership, and provide more immediate support for its volunteers. This locally driven approach likewise resonates with EPA’s place-

based philosophy of program implementation. Additional support for the use of this model is found in the case study comparative analysis (Section 5). The Georgia program, which most closely aligns with this recommended structure, demonstrates not only its feasibility but also its benefits.

Considerations

The effectiveness of implementing a community-based state volunteer monitoring program appears, in large part, to hinge on the state and local programs mutually supporting one another. The state program, among other things, must communicate to local decision-makers specifically how it will support communities in their efforts to establish and maintain a community-based volunteer monitoring program (e.g., marketing, training, support materials, building of local and regional supporting partnerships). In particular, it is important for the state to identify how it will assist local communities in two primary challenges: acquiring sufficient funding and garnering needed community support. In return, local programs will need to communicate their needs to the state as well as be willing to follow state monitoring protocols. The latter will be particularly important for the state to ensure its QA/QC standards are being met.

Recommendation S-2

House the state volunteer monitoring program at a land grant college or university and partner with the Cooperative State Research, Education and Extension Service (CSREES).

Key Supporting Findings

A comparison of the three studied statewide programs indicates that the location of AWW, within a university setting, makes significant contributions to its reputation, stability, and resource accessibility. This finding is based on the views articulated by program managers in their interviews, which include:

- A volunteer monitoring organization will be viewed with greater impartiality if not associated with a regulatory agency.
- A university-based program has access to a greater range of fund-raising mechanisms than one that is housed within a regulatory agency.
- A university has more options for creative staffing. This can include using student interns and graduates in fields of study that align with program needs as well as greater flexibility in sharing employee time among departments and programs.
- A university often has greater access to state-of-the-art resources, including computer systems and laboratories.

Additionally, nationwide, the Cooperative Extension Service is currently providing a range of services and resources in support of volunteer monitoring activities. This includes direct funding resources as well as valuable in-kind support that includes technical and training assistance. AWW provides a case in point in this regard. The state extension service located at Auburn currently supports a third of the AWW program manager's position in addition to providing an increasing cadre of AWW-trained Extension agents who can support volunteers in their monitoring efforts.

Considerations

There are some citizens, as pointed out by the GA AAS manager who view his state's program as being more credible because it is conducted out of a state regulatory agency. This perception along with those who, in contrast, are wary of a program having ties too close with the state may be addressed by defining to the public the program's relationship to the state environmental agency. The intent of this disclosure is to diminish misperceptions that on the one hand the state monitoring program has no working relationship with the state environmental protection agency and on the other that the relationship is so close that it introduces programmatic bias.

Recommendation S-3

Involve a diversity of citizen monitors and organizations with varying affiliations and a mix of science-associated professionals and laypersons.

Key Supporting Findings

Information gathered from the literature review and case studies indicates that a diversity of citizen monitors will ultimately strengthen an overall program. In fact, the knowledge and skills the volunteers' varying backgrounds bring may be used to help fulfill varying needs of the program. Moreover, this diversity can also allow a program to expand its network over a broader social and cultural landscape. It was also evidenced in the case studies that by tapping into pre-formed organizations, a program can capitalize on these organizations' existing administrative structures, community connections, and volunteer networks to build and expand its volunteer base. The demographic profile of the survey respondents from the three statewide volunteer monitoring programs provides an example of the occupational diversity as well as age range of volunteers that may become involved in these types of programs. It should be pointed out, however, that the survey targeted only those 18 years of age or older and thus does not reflect K-12 school-age involvement.

Considerations

AWW, GA AAS, and KY Watershed Watch survey respondents indicated through a noteworthy number of similar comments that an additional benefit of monitoring programs is the hands-on education they provide to students. Although this does unquestionably diversify the volunteer base as well as expand the population educated on water quality issues, there are several caveats of involving this group, as pointed out by the three program managers. First, they noted that it is an ongoing challenge to keep teachers and their classes consistently involved from year to year. Second, because of the school schedule, data collection is seldom consistently conducted throughout the year. Third, teachers' expectations of the amount of resources and support they will receive is often much higher, sometimes unrealistically so, than other volunteer groups. These challenges may at least partially be overcome by taking the following steps: First, acknowledge these potential barriers; second, in context of programmatic goals, weigh the merits of school involvement versus the challenges; and third, if it is determined that schools will be involved, identify in the programmatic development stage how these potential problems can be proactively addressed. For example, program expectations should be laid out to the teachers prior to their involvement.

Recommendation S-4

Create a statewide advisory board that can provide programmatic direction and guidance.

Key Supporting Findings

GA AAS appears to have been well served by the establishment of an advisory board comprised of occupationally diverse stakeholders who geographically represent the state. The board has brought a source of knowledge, skills, community connections, and other resources to the program and in the process helped to address some of the following potential barriers to effective program implementation. First, it provided focus and guidance in the development of the program, a common frustration among fledgling programs. Second, it has served as a conduit between local communities and the state, helping to address the ongoing challenge of acquiring sufficient community support. Third, it has made available a reservoir of "nonvolunteer" support, another primary need noted by programs.

Considerations

In order to reap the benefits of a working board, staff time must be dedicated to its support. This includes allocating time to planning and conducting board meetings (GA AAS board meets four times per year and attends one weekend retreat); maintaining open lines of communication with members; and recruiting and maintaining board members who have a composition combination of knowledge, skills, and geographic representation to serve the needs of the program.

7.2 What programmatic elements should be incorporated into a Tennessee volunteer monitoring program?

Recommendation P-1

Clearly define at the outset of a program its mission and goals.

Key Supporting Findings

Program design is ultimately based on the desired outcomes of a program; therefore, it is critical to have these outcomes clearly defined at the program's outset. According to volunteer monitoring professionals, this is a key barrier to many programs. They blame program failure on a lack of specific desired outcomes at program inception or a mismatch between the program administrator's goals and the goals of stakeholders who will be supporting and/or involved in implementing the program. Each of the studied state programs allocated time at its outset to clarify its objectives. As a part of this process, each examined the intent and implementation strategies of other state volunteer monitoring programs. GA AAS also involved its advisory board in identifying its missions and goals, thereby taking into account local perspectives as well as increasing state-wide buy-in.

Considerations

Volunteer monitors from all three studied state programs ranked a lack of community support as one of the top impediments to their programs. Tennessee could potentially circumvent this challenge, at least in part, by involving stakeholders from across the state in defining their volunteer monitoring program's goals and subsequently identifying strategies for accomplishing them.

Recommendation P-2

Consider using multiple strategies for meeting volunteer training and technical needs as the program expands.

Key Supporting Findings

Early in their establishment, all three state programs met volunteer training and technical demands with limited staffing. However, as their programs grew, they devised and established alternative support systems to meet increasing demands of providing more technical assistance and conducting more training workshops. Case studies of the three state programs have revealed merits to the use of the following agents:

- *Citizen Volunteer Trainers*: All three programs use citizen monitors as trainers. Benefits have included an increased number of geographically accessible workshops to incoming volunteers; trainers with an increased knowledge of local issues and waterways; and more individuals who can serve as community liaisons to the state volunteer monitoring office.

- *Community/Watershed Program Coordinators:* GA AAS has encouraged local AAS program coordinators to become certified AAS trainers. This has provided a wider distribution of trainers and allowed for local AAS organizations to more efficiently train its own volunteers.

- *State College & University System Professors:* Both GA AAS and KY Water Watch have tapped into the statewide community college system for ongoing training and technical support by using professors who teach in the biological and ecological fields. Benefits have included a broad geographic range of training locations; the use of individuals skilled in teaching and science; and access to teaching facilities (e.g., classrooms, labs).

- *Cooperative Extension Agents:* AWW and, to a lesser extent, GA AAS and KY Water Watch have partnered with Cooperative Extension Services to use their extension agents as trainers and technical resources. Their overlapping programmatic goals have resulted in a mutually beneficial relationship; moreover, their wide dispersion across the state has also expanded the program's geographic scope to volunteers.

Considerations

Use of these four resources has not been without challenge. Local trainers, for example, are not always as adept in training as others nor do they possess the technical knowledge to address sampling problems that may occur. Some programs have overcome these challenges by requiring trainer recertification; others have taken advantage of state staff offering technical update seminars and guidance. The case studies also illustrate that using professors through the state community college system can present some demands, as well. A primary one is related to financial compensation. For professors to become involved in a volunteer monitoring program as part of their academic responsibilities, they must be compensated and/or the work must fill an academic or service niche within the college. It then becomes incumbent upon the state program or the professors to raise the necessary resources to maintain their involvement. In addition, faculty retirement and relocation are ongoing challenges. It is important to recognize these limitations; however, it may be worth evaluating on a case-by-case basis whether the involvement of select community colleges can be arranged so that it is not an undue burden either upon the state program or the participating professors.

Recommendation P-3

Use AWW's multi-functional database as a model for information management.

Key Supporting Findings

The AWW case study points to the benefits of creating a multi-functional database that allows for: 1) data entry by volunteers, including real time, multi-year data graphing; 2) compliance with programmatic QA/QC requirements; and 3) volunteer and public access to the data by multiple variables. According to AWW staff, the ease of on-line data entry for their volunteers has resulted in an increasing number using this mode of data transmission. Beyond benefiting the volunteers, it has also improved data handling efficiency within the program. Moreover, because the database has been devised to meet QA/QC requirements, AWW can also continue to deliver scientifically-credible water quality information through this system. Finally, the staff also believes that the real-time graphing feature may serve as such positive reinforcement to volunteers that it may potentially reduce volunteer attrition, although this feature is still so new this belief has yet to be validated.

Considerations

Fiscal support is an ongoing challenge for most monitoring programs across the country as discussed in the literature review, as well as for the three studied programs according to survey respondents. As such, whenever there appears to be a mutually beneficial way to share resources, it should be considered. AWW has invested significant resources into developing a very effective electronic system to manage its data. At minimum, the Tennessee Volunteer Monitoring Program should look to this program for technical guidance in the development of its database, but it may be more practical and economical to explore the possibility of the Tennessee Program contracting with AWW to manage its data.

Recommendation P-4

Develop a recruitment/outreach initiative to garner community support, increase volunteer involvement, and local buy-in.

Key Supporting Findings

Outreach activities organized by each of the three state programs at the state and local levels serve as a vital means to promoting volunteer monitoring as well as increasing stakeholder buy-in. Categorically, these activities include:

- Development and distribution of watershed educational materials.
- Development and ongoing updates of a program Web site.
- Volunteer/community seminars/workshops.
- Volunteer/community social events (such as "down at the river").
- Organization of watershed protection/improvement events.
- Involvement of volunteers in spearheading outreach activities.

The key to effectively implementing many of the activities organized by the three programs appears to be related to involving community and statewide partners.

Considerations

Even with the extensive outreach that all three statewide programs have conducted, their volunteers still identified a lack of community support as a primary impediment to their programs. Moreover, comments from survey respondents indicated that some believe communities are still not familiar enough with their program and that more media coverage is needed. By comparison, Tennessee stakeholders were less concerned that community support would be a challenge for their program, which may indicate that Tennesseans have an unrealistic view of the challenges related to garnering community support. Together, these perspectives emphasize the need for Tennessee to be aware of the value of initiating a multi-prong outreach plan that includes a strong media component.

7.3 What can be done to increase the probability of long-term viability of a Tennessee volunteer monitoring program?

Recommendation V-1

Seek a mix of governmental, private sector, and nongovernmental organization (NGO) funds to support the program.

Key Supporting Findings

Recognizing that their programs' existence ultimately depend on state and federal grants, each of the program managers emphasized the importance of securing a diversity of funds beyond this primary source, if possible. This approach is also supported in the literature. AWW provides a case in point of how a program has been able to successfully achieve this. Alabama has sought out and solidified multiple partnerships that have yielded fiscal support over and above its primary funding from ADEM's nonpoint source program. These have included key partnerships with the Cooperative Extension, Auburn Department of Agriculture, and the citizen-based AWW Association.

Considerations

Funding appears to be a major challenge to most volunteer monitoring programs across the United States and AWW, GA AAS, and KY WW are no exception to this, according to their volunteers. Tennessee stakeholders likewise foresee funding as a potential challenge for their state as well. According to the managers, a primary way the three studied state programs have addressed this challenge, in particular how they have retained funding for more than a decade now, is to be fiscally responsible and judicious in how their grantors' funds are used, including ensuring that their grantors' goals are being met. The AWW manager further emphasized the importance of being recognized on local, state, and national levels for program contributions, which reflects well on donors. He also pointed out the importance of providing 319 grant matches back to the state that are more than what is required so that the state can use these funds for other federally-funded programs that also require match. In addition, he discussed how AWW staff members have learned that modest grants often are not cost effective due to administration costs.

Other lessons may also be learned through the case studies. In particular, when identifying where a state monitoring program will be housed, Tennessee should consider the challenge GA AAS and KY WW have encountered with not being able to raise funds outside federal and state grant sources because of close affiliation with state regulatory agencies. In addition, Tennessee should also keep in mind the key role that partnerships have played in AWW's fund-raising strategies should also be kept in mind.

Finally, Tennessee stakeholders may also want to explore the possibility of establishing a supporting nonprofit organization similar to the AWW Association. It should be noted, however, that the formation of this nonprofit organization would involve a major commitment from volunteers and/or other supporters who would be responsible for spearheading and managing the organization.

Recommendation V-2

Seek and implement a US EPA Region 4-approved Quality Assurance Project Plan (QAPP) that supports long-term monitoring objectives.

Key Supporting Findings

US EPA recommends obtaining an approved QAPP if a program is proactively seeking to broaden its potential uses of volunteer monitoring data. Conversely, without such a plan, as volunteer monitoring professionals have pointed out, a program would continue to be impeded from collecting scientifically-credible water quality data. AWW provides a prime example of a program that from its outset identified the collection of high quality data as a primary goal. Within two years of program inception, it obtained a US EPA Region 4-approved QAPP. With this initial emphasis on quality control, AWW confronted head-on the controversial issue of volunteers being able to collect "quality assured" data. Positive returns to the program have included:

- Long-term acquisition of reliable data that is now being used to educate the public on water quality issues, including basin water quality trends.
- Increased data credibility with their state's environmental protection agency (ADEM) and subsequent use of this data by this agency in watershed planning and in corroborating agency-collected data used in regulatory water quality reporting (303d listing and 305b report).
- Increased trust in data by other agencies and local governments that partner on stream remediation projects.
- Greater clout to the AWW Association that uses this data to advocate volunteer monitors' issues of concern.

Considerations

The notion of volunteers being able to collect credible data is an issue still widely debated within the literature. Moreover, data credibility also appears to be an ongoing concern among some Tennessee stakeholders who identified it as a potential barrier to a Tennessee volunteer monitoring program, particularly if QA/QC protocols are not established. This being the case, it gives even more basis, if the Tennessee aspires to collect scientifically-credible volunteer monitoring data, to develop, as AWW did, a robust QAPP at its outset. Moreover, it will need to consider the cost of implementing such a plan. According to the AWW manager, this program invests approximately one-quarter to one-third of its budget in ensuring that QA/QC protocols are followed, substantiating the adage "nothing good comes without a price."

Recommendation V-3

Devise volunteer recruitment strategies to maintain long-term commitment of volunteers. Consider strategies that will provide multiple forms of volunteer feedback and minimize volunteer time commitment and expenditures.

Key Supporting Findings

Both the literature as well as staff of the three statewide programs have recognized the challenge of obtaining a long-term commitment from volunteers as well as the importance of addressing this issue. Noted programmatic impacts of high attrition rates included costs (e.g., training), the ability to obtain long-term water quality trends; and effects on stability and volunteer morale. Strategies successfully implemented by the studied state programs as well as by others across the United States particularly address volunteers' concerns regarding a lack of feedback including an interpretation of data, the limited amount of time they have to devote to volunteer monitoring; and the costs associated with purchasing monitoring supplies. Successful strategies utilized by AWW, GA AAS, and KY Water Watch are provided in the case studies (Section 4), with a summation provided in the program comparative analysis (Section 5).

Considerations

Survey results from AWW, GA AAS, and KY Watershed Watch respondents indicate they do not believe that the most important outcome of volunteer monitoring, at least in the short term, is improved water quality; rather it is raising awareness and involving communities in water quality issues. It is likely that volunteers just being introduced to water quality monitoring would be much more idealistic and expect more immediate water quality improvement. This is just one example of how false expectations may be set up; articulating short and long-term goals at the outset of a program will help to avoid volunteer disillusionment and subsequent attrition.

8.0 Appendices

Appendix A

Southeastern State Monitoring Program
Analytic Framework

ADMINISTRATIVE ELEMENTS

State-Level Program Affiliation

Is the program affiliated with a university, agency, and/or other organization (e.g., 501c3)?
Yes____ No____

If so, describe these affiliation(s):

_____

_____

Staffing

Total number of employees
Full-time: Volunteer_____
Paid_____
Part-time: Volunteer_____
Paid_____

Who are staff members employed by?

_____

_____

Employee titles and responsibilities (If needed, please attach additional sheet)

Title	Number	Responsibilities

Have there been any major changes in staffing since program inception? ___No ____Yes.

If yes, describe:

_____

_____

Organizational Structure

Does the program have an advisory board? Yes____ No____

If so, what is its composition?

_____

_____

Describe and/or attach the current organizational structure:

_____

_____

_____

_____

_____

How long has the administration been in place in its current configuration?_____

Describe any major changes in organizational structure since program inception:

_____

_____

_____

_____

Budget

Percentage of past year's annual budget that came from:

State grants	_____
Federal grants	_____
Foundation grants	_____
Individual donations	_____
Membership dues	_____
Corporations	_____
Events	_____
Other	_____

Percentage of past year's annual budget directed towards each of the following divisions:

Staffing	_____
Programs	_____
Materials	_____
Monitoring Supplies	_____
Media/Advertising	_____
Training	_____
Other (Please specify)	_____

Since program inception, have there been any major changes in the budget?
Yes____ No____ If yes, please explain:

_____

_____

_____

_____

_____

_____

Annual Report

Does your program produce an annual report? Yes____ No____
If yes, how can this report be obtained?

_____

Volunteer Recruitment/Management

How are individuals recruited for your program?

Word of mouth	_____
Advertising	_____
Public meetings	_____
Other (please specify)	_____
	_____

What methods do you use to retain volunteers?

About how many volunteers are currently participating in your specific program?

_____

Are there any certain predominant types of volunteers involved in your monitoring program (i.e. school groups, nonprofit organizations, Boy/Girl Scouts, etc.)?

What is the estimated proportion of scientists versus nonscientists participating as volunteers?

Scientists _____ %
Nonscientists _____ %

How many volunteer hours are logged in an average year?_____

What is average term of involvement for your volunteers?_____

What is the volunteer attrition rate for your organization?_____

What are the estimated proportions of short-term (less than a year) versus long-term (1-5 years) volunteers currently participating in your program?

Short Term _____%
Long Term _____%

Have volunteer numbers dropped, increased, or remained steady over the past five years? How do you account for these changes?

Under what circumstances would a volunteer be requested to leave the program?

Is there a limit to the number of volunteers that can be accepted into the program?
Yes____ No____

PROGRAMMATIC ELEMENTS

Mission/Goals/Objectives

What are the current mission, goals and/or objectives of the program?

Strategic Plan (State to Local Implementation Structure)

Describe the state's program strategy for implementing its monitoring program at the local level. For example, does it primarily serve as a resource (e.g., training and materials, data management) for monitoring programs conducted by counties or municipalities and/or does it work directly with volunteer and volunteer organizations across the state? (Attach or reference any document [e.g., strategic plan] in which this information is obtained.)

Monitoring Levels/Certifications

In general, what types/categories of watershed/water monitoring options are provided for your volunteers (e.g., 1. watershed/land use; 2. visual "streamwalk;" 3. physical/chemical water monitoring; 4. benthic/bioassessment monitoring; 5. bacteriological monitoring)? Are these activities organized into levels or tiers? If so, how?

Other "Watershed Improvement" Activities

Does your volunteer monitoring program provide support (system; fiscal) for other activities to improve watershed health (e.g., statewide stream cleanup providing gloves and bags; stenciling/decals supplies for storm drains)? If yes, please describe:

Targeted Monitoring Sites

What types of waterbodies do your volunteers monitor?

Streams ❒[JD1] Lakes ❒ Ponds ❒

Rivers ❒ Estuaries ❒ Other: _____

Are any other aspects of a watershed monitored (e.g., land use changes)? If yes, please describe.

Monitoring Parameters

What specific monitoring activities does your state program offer its volunteers (please list specific parameters evaluated)?

Type of Waterbody (if applicable to a specific type)	**Activity**	**Method**

Monitoring Schedule

Do volunteers typically monitor one waterbody over an extended period of time, or are waterbodies monitored on a project-to-project basis?

How often are volunteers required to monitor to remain active in the program?

Monitoring Equipment/Supplies

What, if any, monitoring equipment/supplies are provided to the volunteer?

Who purchases the monitoring equipment/supplies?

Training Protocol

Who conducts training sessions?

Is training offered as a single course or as an ongoing series designed to train volunteer monitors at different levels?

How often and when are training sessions typically offered?

How long are training sessions (one-day, weekend, etc)?

Are participants trained in QA/QC initiatives? Yes____ No____

Are training sessions designed to teach all methods of monitoring activities in one session, or are separate sessions taught for such activities as chemical and benthic monitoring?

Are "train the trainer" sessions offered? Yes____ No____

Is testing required at training sessions? Yes____ No____

Is ongoing assistance offered? Yes____ No____

If yes, in what form is it offered?

Help line _____
Web-based _____
Other (please specify) _____

Safety Protocol

Does the organization carry liability insurance? Yes____ No____

Please describe the specific strategies your program has in place to protect your volunteers (e.g., safety training, safety gear)

Quality Control Protocol

Do you have a QA/QC protocol? _____ Yes _____ No

If yes, is it available in an electronic or written format for the public, and how may it be obtained?

Has your QA/QC program been approved by your US EPA Region 4?
_____ Yes _____ No _____ N/A If so, when was it approved? _____

Data Management

List the data management steps from collection to input into a central state data base, if one is currently being used (e.g., 1. Volunteer records data. 2. Monitoring partner verifies data entry. 3. Volunteer sends field sheets once per quarter via US mail. 4. Data manager enters data into a state database. 5. Second party verifies accuracy.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Data Distribution/Use

Do volunteers receive feedback? Yes____ No____ How and in what form are data shared back to volunteers and the public?

Please complete the following table.

Data Uses		Data Users						
		Our Program	Non-gov't groups	Local gov't	State gov't	Fed gov't	University	Other
Education								
Advocacy								
Research								
Community Organizing								
Screen for problems								
Establish baseline conditions								
Nonpoint source assessment								
BMP evaluation								
Land use decisions								
Watershed planning								
Plan restoration projects								
Enforcement								

Data Uses		Data Users						
		Our Program	Non-gov't groups	Local gov't	State gov't	Fed gov't	University	Other
Legislation								
Shellfish bed closures								
Swimming advisories								
State 305(b) report								
Other (Please specify)								

Please identify the top three data users and uses identified in the table above, providing as many specifics as possible.

Appendix B
Survey Instrument

Introduction: part a
Hello! My name is [YOUR NAME] and I am calling from the University of Tennessee. May I speak to _____?

Introduction: part b
About a week ago we sent you a letter telling you about interviews we are doing with volunteers in the _____. Your answers will be confidential and your name will not be identified with any answers you give.

Do you have time to do the interview right now?
1 YES
2 NO

Question: call back
When would be a good time to call back?
HIT CTRL/END AND SCHEDULE A TIME TO CALL BACK.

Introduction: question lead in
Supporters of volunteer monitoring programs believe that these types of programs benefit communities in a number of ways. Based on your involvement in the [NAME OF PROGRAM] I would like to ask you a few questions about how you believe this volunteer monitoring program has benefited your community. For each question, I would like for you to use a scale of 1 to 10 to tell me how much you either agree or disagree with the statement. Using this scale, 1 means that you absolutely disagree with the statement and 10 means that you totally agree with a statement. Any questions?

Question 1
Volunteer monitoring programs have increased awareness of water quality issues.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 2
Volunteer monitoring programs have increased scientific knowledge of water quality issues.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 3
Volunteer monitoring programs have increased community involvement in water quality issues.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 4
Volunteer monitoring programs have improved water quality.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 5
Volunteer monitoring programs have improved communication between government and non-government agencies on issues pertaining to water quality.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 6
Please identify which of these benefits has been MOST important to your community. [READ CHOICES]
1 Increase awareness of water quality issues
2 Increase scientific knowledge of water quality issues

3 Increase community involvement in water quality issues
4 Improve water quality
5 Improve communication between government and non-government agencies
9 REFUSED

Question: other benefits
Are there any other benefits that you feel are more important than the ones I've just described?
1 YES
2 NO

Question: other benefits
What are those benefits?

Question: intro limitations
Critics of volunteer monitoring programs feel that these types of programs also have a number of limitations. Based on your involvement in your state's monitoring program, please tell me how much you agree or disagree with the following statement. Again, 1 means that you absolutely disagree and 10 means that you totally agree.

Question 7
There has been a lack of sufficient funding.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 8
The quality assurance and quality control protocol has been insufficient.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 9
Collected data has not been viewed as credible by professionals and government agencies.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 10
There has been a lack of community support for the program.

1	2	3	4	5	6	7	8	9	10
Absolutely disagree									Totally agree

Question 11
Please identify which of these has been the greatest limitation to your program: [READ RESPONSES]
1 Lack of sufficient funding
2 Insufficient quality assurance and quality control protocols
3 Collected data not viewed as credible by professionals and goverment agencies
4 Lack of community support for the program
9 REFUSED

Question: other limitations
Are there any other limitations that you feel are more important than the ones I've just described?
1 YES
2 NO

Question: other limitations
What are those limitations?

Question intro3
Please identify your level of satisfaction with the following aspects of the [NAME OF PROGRAM] with 1 being completely unsatisfied and 10 being completely satisfied.

Question 12
Training sessions.
1 2 3 4 5 6 7 8 9 10
Completely Completely
unsatisfied satsified

Question 13
Availability of assistance when needed.
1 2 3 4 5 6 7 8 9 10
Completely Completely
unsatisfied satsified

Question 14
Quality of assistance when requested.
1 2 3 4 5 6 7 8 9 10
Completely Completely
unsatisfied satsified

Question 15
I am going to read you a list of ways in which water quality monitoring data has been used by government agencies, industries, and citizens. Please identify all the ways in which you think the data YOU have collected through the [NAME OF PROGRAM] has been used or shared. READ RESPONSES AND CHECK ALL THAT APPLY

1 Identification or red flagging of specific water quality problems
2 Remediation/Restoration work
3 Public Education
4 Expansion of treatment plants
5 Supporting data for state water quality reports, such as 305b or 303d reports
6 Other
7 Not Known
NO MORE CHOICES

Question 17
Please describe any program-related activities, BESIDES sampling, that you have been involved in, such as conferences, workshops, trash cleanup or storm drain stenciling.

Question 18
Now I would like to ask you a few questions for demographic purposes only.
All of your answers are completely confidential. Please identify which age category you belong to: [READ RESPONSES]
1 18-34
2 35-64
3 65 or older
9 = REFUSED

Question 20
What is the highest level of education that you have completed?
1 Less than High School
2 Some High School
3 High School diploma or GED
4 Some college (community, associate, or 4-year)
5 College degree
6 More than a college degree - Graduate studies or degree
9 REFUSED

Question: major
What was your major?

Question 21
Which of the following best decribes your occupational background?
READ RESPONSES AND CHECK ALL THAT APPLY
1 Business
2 NPDES Permit-holding Industry
3 Non NPDES Permit-holding Industry
4 Environmentalist
5 Scientist
6 K-12 Educator
7 University Educator

8 State Government
9 Local Government
10 Student
11 Other
12 NONE OF THE ABOVE
13 NO MORE CHOICES

Question 22
In terms of involvement in the volunteer monitoring program, do you classify yourself as: [READ CHOICES]
1 ACTIVE (have participated in one or more activities over the last year)
2 INACTIVE (have not participated in one or more activities over the last year)
9 REFUSED [DO NOT READ]

Question: Kentucky program
Are you associated with the Kentucky Water Watch or the Kentucky Watershed Watch Program?

1 KENTUCKY WATER
2 WATERSHED WATCH
3 BOTH
8 DON'T KNOW
9 REFUSED

Question 23
How long have you been associated with this program?
1 LESS THAN 6 MONTHS
2 6 MONTHS - 12 MONTHS
3 1 - 2 YEARS
4 2 - 3 YEARS
5 OVER 3 YEARS
8 NOT SURE
9 REFUSED

Question 24
We may be conducting a mail survey to obtain further opinions on this program. Would you be willing to participate in this survey?
1 Yes
2 No

Question address
The address that we currently show for you is:

Is this correct?
1 YES
2 NO

Question: zip code
What is your zip code?

Question: new address
What is your address?
ENTER THE NEW STREET ADDRESS. BE SURE TO INCLUDE APT NUMBER.

Question: new city
ENTER THE NEW CITY.

Question: new state
ENTER THE STATE

Question: new zip
ENTER THE NEW ZIP CODE

Closing: thanks
These are all of my questions. Thank you for taking your time to answer our questions. Have a good day.

Appendix C
Pre-Survey Volunteer Monitor Letter

The University of Tennessee
Water Resources Research Center
311 Conference Center Building
600 Henley Street , Knoxville, TN 37996
(865) 974-9124

To Whom it May Concern:

Volunteer monitoring has been heralded as a way for citizens and communities to translate knowledge into action. Its upsurge across the nation and particularly in the Southeast over the past decade has indicated its growing federal, state, and local support. In an effort to learn from this trend, the **Tennessee Water Resources Research Center has embarked on a comparative analysis of state-supported volunteer monitoring programs in the Southeast.** This analysis will include evaluating administrative and programmatic structure of these programs as well as perceptions of key stakeholders from each selected state about the general benefits and drawbacks of their monitoring efforts.

A primary goal of our research is to provide useful information and insights to two groups: first, to those currently involved volunteer monitoring; and second, to those considering establishing such a program. In regard to the latter, we will include in our analysis an evaluation of perceptions from key stakeholders in the state of Tennessee on volunteer monitoring. It is our hope that this data along with information gleaned from the analysis of established volunteer monitoring programs may be used by Tennessee decision-makers and stakeholders in determining the viability of a statewide monitoring program.

We invite you to assist us with what we believe is valuable research on a very important issue. We recognize that the [name of program] is a leading volunteer monitoring program in the Southeast and have selected it as one of the monitoring programs we will evaluate. In the coming months, we will be asking you to participate in a brief phone interview. As a part of the interview, we will ask you to address your knowledge and/or perceptions, if any, of the following: (1) general benefits of the [name of program]; (2) its programmatic limitations; (3) issues related to its long-term sustainability; and (4) how the volunteer monitoring data has been/is used and who uses it.

Thank you for your consideration and we hope you will participate in this survey. We recognize that your time is valuable and therefore will ensure that the length of your interview will be kept to less than 20 minutes. Please do not hesitate to contact us if you have any questions regarding the project.

Sincerely,

Ruth Anne Hanahan
Project Manager

Caitlin Cottrill
Graduate Research Assistant

Appendix D
Georgia Adopt-A-Stream Monitoring Protocols

Assessment Type	Parameters & Methods		Recommended Frequency
Watershed Survey	1. Survey land use adjacent to the adopted body of water and/or throughout the watershed. 2. Estimate percent impervious surface cover of the watershed. 3. Evaluate general waterbody and watershed characteristics. • Identify structural hydrologic modifications. • Identify other hydrologic changes (e.g., straightening, dredging). • Measure vegetative buffer width. • Describe physical appearance of waterbody (e.g., litter amount, special problems, general extent of erosion). • Inventory pipe and drainage ditches.		Yearly
Visual Stream Assessment	1. Evaluate in-stream characteristics. • Measure flow (channel width and water velocity). • Evaluate substrate embeddedness. • Measure organic content. • Describe water appearance and odor. • Measure bank erosion (use of bank erosion pins). • Describe substrate composition (pebble count). 2. Conduct biological surveys. • Describe wildlife & fish. • Estimate extent of aquatic plants. • Estimate extent of and describe algae. • Estimate extent of shade cover.		Quarterly
Biological	Conduct benthic macroinvertebrate assessment.	Method is based, in part, on Izaak Walton League protocol.	Quarterly

Assessment Type	Parameters & Methods		Recommended Frequency
Chemical	1. Basic stream tests	LaMotte Field Kits	Monthly
	• Temperature	Code 1066	
	• pH	Code 5858	
	• Dissolved oxygen	Code 5860	
	• Settleable solids	Imhoff Cone -45 min.	
	2. Advanced Stream Tests	LaMotte Field Kits	
	• Alkalinity	Code 4533	
	• Phosphates	Code 3121	
	• Nitrate-Nitrogen	Code 3354	
	• Salinity	Knudsen titration Code 7459 Refractometer	
	• Secchi Disk	Code 1062	
	• Conductivity	Corning CD-30 meter	

Appendix E
Alabama Water Watch Monitoring Protocols

Assessment Type	Parameters & Methods		Recommended Frequency
Chemical	*Customized AWW Chemistry All-in-One LaMotte Kit*		Monthly
	Temperature	Thermometer	
	pH	Color comparator	
	Dissolved Oxygen	Micro Winkler Titration	
	Alkalinity	Colorimetric, drop test	
	Hardness	Colorimetric, drop test	
	Turbidity	Turbidity column, standard turbidity reagent	
Biological (bacteria)	General Coliform, *E. coli*	ColiScan Easygel (Micrology Labs)	Project-based
Biological (benthics)	Benthic macroinvertebrates	Based on pollution sensitivity groups	Quarterly to semiannually
Visual Stream Assessment	1. Measure In-stream characteristics • Water appearance and odor • Substrate type • Flow • Streamside bank cover 2. Describe biological characteristics • Extent and description of algae • Observed wildlife and fish • Extent of aquatic plants • Extent of shade cover • Extent of riparian cover 3. Human impacts • Types of streamside land uses and primary land uses in watershed • Types of in-stream barriers • Approximate amount of trash		Initial assessment and thereafter project-based

Appendix F
Kentucky Water Watch Monitoring Protocols

Assessment Type	Parameters and Methods		Recommended Frequency
Visual Stream Assessment	Evaluate riparian zone, in stream features, bank stability. • Describe riparian and aquatic vegetation. • Measure vegetative zone width. • Describe sediment substrate components, odors, oils and deposits. • Describe riffle quality, embeddedness, and sediment deposition. • Measure flow (velocity, channel cross-section) • Describe natural features, human impacts, constructed features, discharge pipes or other items of interest.	• US EPA Rapid Bioassessment Protocol • Still and/or Video photo documentation	Project-specific – generally at outset and regular intervals to monitor impacts
Chemical	Dissolved oxygen	LaMotte Dissolved Oxygen Testing Kit Cat#7414	Project-specific For trend data; generally once a year
	Total iron (done on a limited basis)	LaMotte Iron Octet Comparator Testing Kit Cat#4447	
	Nitrate/nitrite/nitrogen	LaMotte Nitrate-Nitrite Testing Kit Cat#3354	
	pH	LaMotte Wide Range pH Testing Kit Cat#2119	
	Orthophosphate	Hach Orthophosphate-Model #PO-19 Catalog #2248-00	

Assessment Type	Parameters and Methods		Recommended Frequency
Physical	Conductivity	LaMotte meter	Project-specific
	Total settleable solids		
	Flow rate	Visual estimate (e.g., normal, low)	
Biological	Benthic macroinvertebrate community structure – Level I	"Kick seine" or dip net technique – field identification	Project-specific
	Fecal coliform bacteria	Recommend to send to a certified lab if done	Project-specific

Appendix G
Upper Green River Watershed Watch — Proposed Budget

Expense item	Quantity	Total Amount	Requested from PRIDE	Provided by other Sources
Training materials	200	$1,000		$1,000 Water Watch
Volunteer field testing kits	60 @ $105	6,300	$6,300	
Herbicide testing samples[1]	60 @ $50	3,000	3,000	
Fecal coliform testing samples[2]	120 @ $25 (2 per site)	3,000	3,000	
Fall low flow lab samples and containers	60 @ $ 335	20,000		$20,000 DOW Watershed Program *(Federal)*
Follow-up laboratory testing	Variable	4,000	4,000	
Volunteer time				(In Kind)
Staff support	20 days	2,700		$2,700 Water Watch
Steering committee leadership time[4]	120 @ $25	3,000		Volunteer In-Kind
Scientific advisors' time[4]	75 @ $25	1,875		Volunteer In-Kind
Volunteer trainers' time[4]	75 @ $25	1,875		Volunteer In-Kind
Volunteer sample runners' time[4]	120 @ $12.50	1,500		Volunteer In-Kind
Supervising samplers' [4]	720 @ $4.00	2,880		Volunteer In-Kind
Sample team members'[4]	1,400 @ $4.00	5,600		Volunteer In-Kind
GIS software/training		2,000	2,000	
Computer platform for Arcview Software		5,000		Match from Local Sponsor
GPS Units for Geo-Location	4 @ $150	600	600	
Communications and Travel Expenses for Steering Committee, Trainers and Sample Runners	Mileage, Telephone meals and lodging	1,000	1,000	
Expenses related to training workshop facilities	4 @ $125	500		$500 In kind from Local Hosts
Steering committee operational budget, including purchase of logo imprinted materials		$1,500		$1,500 Virginia Environmental Endowment Grant # 99-102
Expenses related to year end conference [3]	1	1000		$1,000 KY DOW plus In-Kind from hosting institution
Photographic film for surveys	135	$675		$675 Water Watch
Project budget total	**$69,005**			
Total from other sources	**$49,105**			
Total requested from PRIDE	**$19,900**			

Budget Considerations:

1. Field kits will include dissolved oxygen testing kits, pH testing kits, water clarity measuring devices, biological collection nets, waste containers and collection pans.
2. The herbicide and fecal coliform lab analysis will be done by professional labs. These labs have offered to conduct the work at discounted rates charging only for sample containers and lab materials.
3. "Followup testing" fund will be for additional laboratory analysis should initial screening indicate a problem. Steering committee and scientific advisory committee members will review data, then develop an analysis profile for the particular situation. We anticipate funding 10-15 such cases.
4. Conference and workshop expenses relate to facility rental, security, and custodial services.
5. Volunteer time will be documented by: 1. meeting rosters and 2. field reports from monitoring activity.
6. Virginia Environmental Endowment is a private foundation grant to Kentucky Waterways Alliance for Watershed Watch activities. The grant specified $3,000 for startup activities in the Green River Basin. The $3,000 has been equally divided between the Upper and Lower Green River basins.

Source: http://water.nr.state.ky.us/watch/green/pride_2000.htm

Appendix H
Kentucky Watershed Watch Monitoring Protocols

Assessment Type	Parameters and Methods		Recommended Time of Year*
Visual Stream Assessment	**Method:** US EPA Rapid Bioassessment Protocol Evaulate riparian zone, in stream features, bank stability: • Riparian and aquatic vegetation, vegetative zone width • Sediment substrate components odors, oils and deposits • Riffle quality, embeddedness, sediment deposition • Flow, velocity depth combinations		April-June
	Method: Still and video taping Natural features, human impacts, constructed features, discharge pipes or other items of interest.		April-October
Chemical (field)	Dissolved Oxygen	Modified Winkler (LaMotte dissolved oxygen testing kit Cat#7414)	April-October
	pH	Colorimetric (LaMotte wide range pH testing Kkt Cat#2119)	
	Temperature	Thermometer	
	Conductivity	Specific conductance (TDS Test)	

Assessment Type	Parameters and Methods		Recommended Time of Year*
Lab-tested organic/Inorganic	**Method:** Grab samples analyzed in certified laboratory. Alkalinity mg/l — Conductivity µmho TSSolids mg/l — TDSolids mg/l Hardness mg/l — Nitrate mg/l Nitrite mg/L Ammonia-Nitrogen mg/L Total Kjeldhal Nitrogen mg/L Phosphorus ortho mg/L Phosphorus total mg/L Organic Carbon mg/L Fluoride mg/l — Chloride mg/l Bromide mg/l — Sulfate mg/L Calcium mg/L — Magnesium mg/L Sodium mg/L — Potassium mg/L Aluminum mg/L — Arsenic mg/L Barium mg/L — Cadmium mg/L Chromium mg/L — Copper mg/L Iron mg/L — Lead mg/L Manganese mg/L — Mercury mg/L Zinc mg/L		September/October (low-flow)
Chemical (lab-tested herbicide/pesticides)	**Method:** Grab samples analyzed in certified laboratory. • 2,4-D (amine) Pastures/Lawn chemicals • Chlorpyrifos (Dursban, replacing Diazinon) • Metolachlor (used on Soybeans) • Pendimethalin found in urban streams or areas of concentrated tobacco cultivation • Triazine (used as pre-emergent for corn)		May
Biological (benthics)	Benthic macroinvertebrate – Level 1	Kick seine or dip net technique; field identification to group level.	April - June
	Benthic macroinvertebrate – Level II	Kick seine or dip net technique; lab identification to family level.	June - October

Assessment Type	Parameters and Methods		Recommended Time of Year*
Biological (bacteria)	Total coliform (*E.coli*) (colonies/100 ml)	US EPA standard methods with no more than 6 hour holding time from sample collection to lab delivery; analyzed in certified lab.	July
Algae	Chlorophyll A	Field and lab algal assessment; Chlorophyll A. US EPA Method 445.0, 1992 is the preferred method or may use Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 1992.	September

* Time of year is based on general recommendations of scientific advisory panels that develop basin-specific scientific study plans and oversee QA/QC protocols for Kentucky Watershed Watch projects.

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