CHAPTER 7

RECOMMENDATIONS

To assist in reducing bacteria loads in impaired waters, my thesis synthesizes bacteria TMDL control strategies and implementation efforts in Georgia and neighboring and explores how we could adapt some of the methods used in other southeastern states to improve Georgia's program. Recommendations for Georgia are summarized in Table 1 at the end of this chapter. The following discussion of case studies and recommendations can be used to facilitate future research, and complement existing efforts.

Bacteria Standard

Fecal coliform bacteria are the number one source of impairment to surface waters in the State of Georgia. The bacteria Technical Advisory Group (TAG) published recommendations in regard to bacteria TMDL development and implementation for the State of Georgia in June 2006. I reference their research in regard to the science of bacteria TMDLs and issues surrounding indicator bacteria and the correlative standard used. Switching from the current broad fecal coliform (FC) standard to the new federal recommendation to restrict the standard to E. coli may improve protection for Georgia's residents from gastrointestinal illnesses (Radcliffe et al. 2006; USEPA 1986, 2002). Issues exist, however, as to whether or not E. coli underestimates potential health hazards from other, more long-lived bacteria (Carroll, personal communication 2006). Some pathogenic bacteria, such as Enterococcus species, from fecal waste have lifetimes in natural waters much longer than E. coli (Carroll, personal communication

2006). In order to decrease public health risks, more investigation regarding a bacteria standard is needed. While more costly and time-consuming, one solution may be to use a combination of indicator bacteria for Georgia's standard.

Learning from the mistakes and successes of other states in the Southeast will assist Georgia through this transition. While the issues and controversies surrounding the indicator bacteria used and resulting standards was not a major focus of this research, I encountered state agencies that are dealing with similar bacteria standard problems. Both Virginia and North Carolina have switched to the E. coli standard from the more inclusive fecal coliform. Virginia, in particular, has conducted a great deal of research on the advantages and disadvantages associated with this new standard. Both Kevin Brannan from the Watershed Studies Center and Charlie Lunsford with the NPS Program at Virginia's Department of Conservation and Recreation (VA DCR) commented that the new E. coli standard (established per USEPA recommendations) has made the meeting of water quality standards almost impossible throughout the State because the numeric standard is difficult to meet[1] (personal communication 2006). Lunsford stated that the new standard is impractical and unrealistic; and they will be reviewing and revising it in the future (personal communication 2006). In particular, Virginia is struggling to meet designated uses due to high levels of E. coli from wildlife deposition and natural background conditions (Brannan, personal communication 2006). These contacts could be consulted by researchers and agency staff members in Georgia as they investigate the adoption of an E. coli standard. Therefore, it would be in the best interest of the State of Georgia to keep open lines of communication with VADCR and the TMDL and Watershed Studies

[1] The E. coli standard for Virginia is currently 126 cfu/100 mL (calendar month geometric mean) and an instantaneous standard of 235 cfu/100 mL (Brannan, personal communication 2006).

Center at VA Tech. Brannan, in particular, expressed interest in collaborative work with the University of Georgia (UGA) River Basin Center (personal communication 2006).

TMDL Implementation Strategies[2]

Monitoring Solutions for Implementation Measures

The Georgia Department of Natural Resource's Environmental Protection Division's (GAEPD) TMDL implementation program applies adaptive management to the implementation process in an effort to abide by principles and concepts of phased or staged implementation. The TMDL program is implemented on a five-year rotational river basin schedule. As the program returns to a river basin every five years, implementation plans for that basin are reviewed and altered if necessary to either improve upon implementation efforts or de-list an impaired segment. This is an appropriate approach for Georgia, especially since many of the implementation plans written during the consent decree were rushed and may require extensive revisions to be "ready" for the implementation phase and show measurable water quality improvements.

A key component to any sort of adaptive management or phased implementation approach is the collection of consistent data to measure whether water quality improvements are occurring after the initiation of control strategies and management measures. Water quality monitoring is essential to this process; however, limited resources have precluded water quality monitoring for TMDL implementation in Georgia. The issue of supplying dedicated funding sources for the implementation of environmental controls and actions is a serious one in Georgia

[2] TMDL implementation plans are named various things depending upon the state program. The most used alternative term is "watershed-based plans." It is also important to note that just because an "implementation plan" exists, the plan is not necessarily being implemented yet. The approach to writing implementation plans and actual implementation action differs a great deal between states.

and will be explored more in the following section on "Funding." In the face of inadequate funding, however, creative low-cost approaches for supplying monitoring data are necessary.

Efforts are currently underway amongst various groups in Georgia to improve volunteer monitoring programs[3]. While the Georgia Adopt-A-Stream is an excellent water quality monitoring and outreach program, it is not designed to provide the level of technical monitoring that is necessary for an adaptive management, proactive approach to TMDL development and implementation[4]. Either strengthening the technical component of the existing Adopt-A-Stream structure or creating another more technical monitoring effort (while leaving outreach and education efforts to the Adopt-A-Stream team) is one solution. An essential element to any monitoring solution is to align monitoring efforts with GAEPD's river basin schedule to supplement efforts already underway by state-led monitoring staff; therefore reducing duplication and increasing efficiency. In this way, volunteer monitors could increase the current labor force working to collect TMDL data. Technical monitoring efforts could also be supplemented by providing modest support funds for graduate students to conduct technical monitoring and further research into cost-effective methods. These recommendations for modifying monitoring efforts would meet overall goals of de-listing streams in a more expeditious manner, illustrate water quality improvements, and highlight situations that require implementation plan revisions.

A successful volunteer monitoring model exists in Alabama that could be used as a template for Georgia. Alabama Water Watch (AWW), started by William Deutsch in 1992, provides water quality monitoring data for improvement efforts in Alabama, including TMDL development and implementation. Volunteers receive training in the more technical aspects of

[3] Such groups are included, but not limited to: Adopt-A-Stream, the UGA River Basin Center, Upper Oconee Watershed Network (UOWN), and the Georgia River Network (GRN)
[4] Georgia Adopt-A-Stream Program: http://www.riversalive.org/aas.htm

water quality monitoring. The program has been so successful, that it has been adopted in other states and countries[5]. AWW could be a useful model for Georgia monitoring efforts because of AWW's success in obtaining quality assurance approval for trainers and officers. The approval of monitoring efforts through the quality assurance process is integral for the use of data in the TMDL development and implementation process. According to federal and state regulations, entities other than the state must have approved Quality Assurance Project Plans (QAPP) if they want their data to be used in assessing TMDL streams, such as listing or de-listing impaired segments. USEPA offers a volunteer monitor's guide to QAPPs at http://www.epa.gov/volunteer/qappcovr.htm. The State of Georgia offers guidance for quality assurance data at http://www.gaepd.org/Documents/techguide_wpb.html (click on "Field Investigation Quality Assurance (Water Quality)"). Some argue that current unapproved monitoring efforts are supplying "trend data." While this data is useful to illustrate trends useful in making management decisions, such as whether or not certain BMP systems are reducing inputs, its use is limited and cannot be used in the listing and de-listing of streams. By organizing a large volunteer monitoring effort similar to AWW, the QAPP approval can essentially be distributed throughout the State so that groups are not supplying only trend data, but data that can be efficiently utilized in the TMDL process. When developing a technical monitoring volunteer effort in Georgia, I suggest using Alabama's Water Watch as a model for obtaining quality assurance approval to cover a network of monitors, and following GAEPD's river basin schedule to make the most out of adaptive management and phased implementation methodologies.

[5] Powerpoint presentation on the successes of Alabama Water Watch: http://www.usawaterquality.org/volunteer/Outreach/05KYALWW.ppt

Communication, Coordination & Ownership in Implementation Planning

One of the greatest challenges facing TMDL implementation is a lack of communication, coordination and ownership. While other states are struggling with these issues, there are some success stories.

Coordination

Alabama's Clean Water Partnership (CWP) referred to in Chapter 6 is an example of TMDL stakeholder coordination through a non-governmental initiative. The CWP also provides a neutral forum to discuss and mediate water quality issues because of its independence from vested public or private interests.

In many respects, the goals of the CWP align with those of the Georgia River Network (GRN), also a non-governmental organization (NGO). As the Georgia River Network continues to grow and expand their efforts to improve surface water quality in the State through outreach and citizen mobilization, they could possibly integrate some of the successful concepts and methods used by Alabama's CWP. Currently, GRN facilitates efforts and assists in communication between watershed groups (either already in existence or newly formed with help from GRN). With guidance from the CWP's experiences, GRN could consider including coordinators for each basin in GA to assist with TMDL implementation efforts. A GRN river basin coordinator could work in conjunction with outreach coordinators from GAEPD's TMDL implementation program. Currently, Georgia's TMDL implementation program provides a total of four (when all positions are filled) TMDL outreach coordinators to assist with implementation efforts throughout the State. These four outreach coordinators are then divided between the 16 Regional Development Centers (RDCs) who are contracted by GAEPD to develop TMDL

implementation plans. In order to see measurable improvements in water quality, we need to increase our state presence of guidance and technical assistance for TMDL implementation.

Ownership & Accountability

Ownership and accountability must be included as central elements of TMDL implementation plans. The concepts of ownership and accountability refer to assigning responsibility to appropriate entities and stakeholders for the development and/or implementation of actions to meet TMDL plan requirements. Mecklenburg County, which contains the metropolitan area of Charlotte, North Carolina, was able to include these elements. The Surface Water Improvement and Management (SWIM) initiative in Mecklenburg County coordinated the development of a bacteria TMDL implementation plan (or watershed plan) for Sugar, Little Sugar and McAlpine Creeks (Appendix A or http://www.rivercenter.uga.edu/research/bacteria_tmdl/documents/nc_sugar_tmdlip_nc.pdf). Overall, the implementation plan could be used as a template for urban TMDLs in Georgia. In particular, the elements of implementation ownership and accountability were strong and successful. Control strategies and management measures were organized and grouped according to which government entity or group would be responsible. Then each group was assigned ownership or responsibility and asked to write their own implementation action section to encourage communication and accountability. Rusty Rozelle, the program manager, commented that while this increased the length of the project and was frustrating at times; it was well worth it (personal communication 2006). I recommend that this implementation plan be reviewed by urban communities in Georgia with similar water quality management issues. Not only can the innovative aspects of BMP implementation be duplicated, but the template can be used to increase accountability and coordination – and water quality.

Communication

According to the bacteria TAG, a "disconnect" often exists between GAEPD and local stakeholders (Radcliffe et al. 2006). For example, the TAG stated that many local governments are frequently unaware of available assistance (Radcliffe et al. 2006). The Center for TMDL and Watershed Studies at VA Tech provides a central source for technical assistance to stakeholders and TMDL implementation project leaders. Through the Initiative for Watershed Excellence: Upper Altamaha Pilot Project, the University of Georgia (UGA) River Basin Center (RBC) can provide similar services through technical assistance and guidance. Therefore contacts made with researchers such as Kevin Brannan at the VA Tech Center could assist in the formation of similar guidance programs in Georgia through the UGA River Basin Center.

Virginia also provides the *Guidance Manual for Total Maximum Daily Load Implementation Plans* to assist communities with TMDL implementation plan development (Appendix B or http://www.deq.state.va.us/tmdl/implans/ipguide.pdf). One recurring theme I encountered during my research was the request and need for more specific guidance for plan development from regulatory agencies. The TMDL Implementation Plan guidance document produced by the State of Virginia's Department of Conservation and Recreation (VADCR) and Department of Environmental Quality (VADEQ) could provide an excellent template for a similar material aimed at stakeholders and communities in Georgia. I suggest, of Virginia's two agencies, that Georgia work with DCR because of their focus on NPS TMDLs, which is one of the greatest issues currently facing Georgia's TMDL program. It should be of particular importance to stay in contact with DCR because Charlie Lunsford (VADCR NPS 319 program manager) stated they will be revising their TMDL implementation plan guidance soon to include more information about urban TMDL implementation (personal communication 2006). Another

benefit of Virginia's guidance manual is that they have been using phased or staged implementation for TMDLs. This could assist Georgia in improving upon its own program. Virginia also uses many different sources of funding at the State and local levels and could provide useful information for future funding strategies in Georgia[6].

Two components of the VA TMDL implementation plan guidance manual could assist Georgia stakeholders in the inclusion and implementation of appropriate actions and management measures detailed in TMDL implementation plans: "Chapter 6.0: Linking the TMDL to Implementation: Detail of TMDL Analysis (p.18)" and "Table 6.1: BMPs applicable to bacteria (p.27)" (see Appendix B or http://www.deq.state.va.us/tmdl/implans/ipguide.pdf). "Detail of TMDL Analysis" refers to chapter 6 of the Guidance Manual and covers how to determine the level of effort needed for assessing implementation action needs and what management measures are needed for success. The chapter is divided into sections on the level of analysis needed (and how to identify it) and what resultant steps are needed for implementation. The guidance provided is in-depth and easy to understand and broadly applicable. Important concepts are introduced, such as planning for future impairments. For instance, in various implementation plans written in Virginia, control strategies recommended to reduce bacteria loadings could also reduce other pollutants such as sediment and nutrients that could occur in future TMDLs. Guidance also refers to properly estimating future costs associated with technical and administrative assistance that should be taken into account. One of the most useful aspects of Virginia's implementation guidance chapter, is the table outlining BMPs that can be implemented to specifically reduce inputs of bacteria. In Table 6.1 (see Appendix B or http://www.deq.state.va.us/tmdl/implans/ipguide.pdf), best management practices

[6] See pages 64-67 of the VA TMDL implementation guidance manual for funding information at the state and federal levels: Appendix E or http://www.deq.state.va.us/tmdl/implans/ipguide.pdf

include information such as which impairment source (i.e. agriculture or urban) they are best suited for, their efficiency (if available) and average cost. After reviewing many BMP manuals, I have concluded that this table in particular provides a good "overview" of available practices for bacteria abatement in a user-friendly format.

The examples and resources referred to are just a sampling of the guidance available in the Virginia manual. The manual has a great deal to offer for the improvement of TMDL implementation in the State of Georgia, and is therefore included as a recommendation of this project. Using a 319 grant, or similar funding source, a group or consortium like the UGA River Basin Center could develop an implementation manual for the State of Georgia using Virginia's manual as a template.

Non-point Source 319 Program

Clean Water Act Section 319 NPS grants are a central funding source for TMDL implementation projects, at least for the non-point source pollution component. A common complaint is that the grant application process is onerous and lengthy; and the 40 percent match requirement poses difficulties. Despite these obstacles, there are many successful ongoing and planned 319 projects addressing various bacteria NPS sources in Georgia, such as failing septic systems and waste from agricultural livestock practices (Vincent, personal communication 2006). To strive towards water quality improvements and successful TMDL implementation in Georgia, the 319 program should also be reviewed and revised as necessary. Through my review of state programs, a trend emerged where state programs spent a sizable portion of their 319 funds in-house (or internally) to fund water quality positions and programs. While South Carolina strives to spend more 319 money externally (project grants awarded to a third party),

they are currently focusing on a balance between providing support at the State level and then assisting with projects at the community level (Barkley, personal communication 2006). Spending a larger percent in-house to fund administrative costs could assist in providing more stakeholder guidance and assistance from the State level. While this recommendation may not be the perfect solution, it could be considered in a reevaluation of the current program. The goal of allocating the majority of 319 funds externally is beneficial for on-the-ground water quality improvements and could be worked towards as alternative state-supported funding solutions come to fruition.

There also existed a close connection between the 319 program and TMDL implementation efforts at the State level. Many of South Carolina Department of Health and Environmental Control 319 and TMDL staff positions are funded through 319 monies. South Carolina's "watershed managers" not only coordinate TMDL implementation efforts in their respective watershed areas, but also encourage 319 grant proposals to fund implementation projects. Georgia's program is structured similarly and is continuing to work toward goals of aligning the TMDL Implementation Coordinators with 319 program staff.

Another opportunity for improvement exists in the addition of state support for the 319 match requirement. Several smaller communities express concern over applying for 319 monies because of their inability to provide the amount of funds required under the 40 percent match requirement. Leveraging state funds to assist these communities to reduce their percent match with either a low-interest loan or grant could alleviate this issue. As will be discussed in the next section on funding, monies could be made available by dedicating trust funds from permitting fees or a similar impact-fee program.

Funding

A central impediment facing water quality improvements and TMDL implementation is the availability of funding at the State level. Much of this is due to the trust fund system in Georgia where environmental fees are not dedicated[7]. The issue of funding dedication stems from the Georgia Constitution which states that no funds may be "dedicated," except by the Constitution itself (GWC 2005). Therefore the only solution, essentially, is to amend the Georgia Constitution (through placement on the ballot for public vote) to dedicate the funds specifically to the programs enforced by GAEPD (Edwards, personal communication 2006; ACCG 2006). Until this action occurs, current fees are not dedicated and are often redistributed to balance the budget by the General Assembly's appropriations committee (Edwards, personal communication 2006).

Georgia has collected fees since the early 1990s from individuals, companies and local governments under environmental programs for the purpose of supporting the administration and enforcement of program activities (GWC 2005). These fees generate enough revenue to fully fund their designated programs, but are instead being used in whole or part to balance the State's general fund (Edwards and Rooks 2005). Among southeastern states, Georgia is the only one not charging some type of NPDES permitting fee to assist in funding program costs. According to data collected by Todd Edwards in 2002, Georgia and Mississippi were the only two out of sixteen Southern states that were not implementing such fees[8]. Wendell Willard (49th) of the Georgia General Assembly co-sponsored HB 550 in the 2005 legislative session to provide for

[7] This is a legal term meaning that money collected for a stated purpose must be used *only* for that purpose. For example, the state's motor fuel tax is "dedicated" in the Constitution to "public roads and bridges" (GWC 2005).
[8] GAEPD does not charge fees for the issuance of industrial stormwater, industrial surface water discharge or municipal stormwater permits (Edwards 2002).

fees and change certain provisions of the Georgia Water Quality Control Act[9]. HB 550 provides not only for NPDES permitting fees, but creates a provision whereby government entities would receive fee reductions when fees they had previously paid to environmental trust funds were not appropriated back to the correct department. I recommend that this bill be introduced again and passed to assist in TMDL implementation funding efforts. Problems do still exist in terms of actual appropriation of these funds in light of the constitutional dedication situation. The feasibility of the permitting fee legislation and dedication of said funds should be addressed by the Georgia General Assembly.

Each state structures their NPDES fee program differently. Alabama charges NPDES application fees that assist with supporting program staff, but do not directly impact the TMDL program (Hughes, personal communication 2006). North Carolina uses a portion of their permit fees to fund staff positions in water planning and TMDL development (Edwards 2002) [10]. South Carolina charges flat, annual permit fees which support staff positions and program costs for the NPDES state program since 1993 (Edwards 2002; Montebello, personal communication 2006) [11]. According to Michael Montebello at SC DHEC, permit fees are now just seen as a cost of business and are considered an asset to the program (personal communication 2006). Virginia charges permitting fees that last for five years, and fund NPDES permitting administrative costs (Edwards 2002) [12]. Research into funding from NPDES permitting fees and trust funds was not a primary piece of this project, but is an important aspect to the future success of TMDL implementation in the State of Georgia. While current information was gained from some of the states studied, it is no way exhaustive and could be an element of future research.

[9] Locate HB 550 at http://www.legis.state.ga.us/legis/2005_06/sum/hb550.htm
[10] North Carolina NPDES permit fees: http://h2o.enr.state.nc.us/su/Fee_schedule.html
[11] South Carolina program fees: see Regulation 61-30, Environmental Protection Fees
[12] Virginia's Department of Conservation and Recreation's website has more information about permit fee schedules: http://www.dcr.virginia.gov

North Carolina and Virginia have successfully implemented trust funds to pay for environmental regulatory and enforcement measures. The State of North Carolina supplements funding for water quality improvement projects through the Clean Water Management Trust Fund[13] (CWMTF) as established in 1996 by Article 18, Chapter 113Aof the North Carolina General Statutes[14]. The CWMTF issues grants to local governments, state agencies and conservation non-profits for projects specifically addressing water pollution problems, such as TMDL implementation. Alternatively, the State of Virginia utilizes Water Quality Improvement Funds (WQIF), established under the Water Quality Improvement Act (WQIA), to supplement funding for water quality efforts[15].

What is important to note is that all of our neighboring states are leveraging fees and trust funds to improve water quality. Through our work in the Upper Altamaha watershed of Georgia at the UGA River Basin Center, we are encountering city and county leaders and officials who are concerned with implementing TMDLs not only for water quality reasons, but economic ones. These leaders and communities are asking for help from the State. A revision of limitations on expenditures and encouragement of new revenues, through fees for example, should be undertaken in Georgia.

Best Management Practices

Through my review of programs and practices implemented in Georgia, Alabama, North Carolina, South Carolina and Virginia; I found that the real difference lies not in which best management practices are being used, but in *how* they are being implemented.

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[13] http://www.cwmtf.net/

[14] http://www.cals.ncsu.edu/wq/SwineFarmZoningNotebook/PDFNorthCarolina/PDFNCPollutionStatutesandCode/CleanWaterManagementTrustFund.PDF#search=%22Clean%20Water%20Management%20Trust%20Fund%22

[15] http://www.dcr.virginia.gov/sw/wqia.htm

Outreach & Education

Under federal and state regulations, outreach and education efforts are required aspects of water quality implementation projects, whether through the NPDES permitting process or TMDL implementation planning. While this should allow for great successes in stakeholder and citizen educational opportunities, the requirement is often glossed over, and quickly checked off of the laundry list of "things to do," resulting in ineffective outreach and unusable tools. Therefore the brochures and pamphlets are found in the trash can of the citizen or the storage closet of the project leader; and often never reach the audience that needs the information or assistance the most. While any effort is better than none at all, implementation efforts will never be successful without a strong, targeted outreach component.

A specific component of strong outreach campaigns involves targeting your audience and then "framing" the issue around the factors that are important to them. One project leader (and county extension agent) in South Carolina found that the "usual" forms of outreach, such as public meetings and media campaigns, did not work with his audience, owners of failing septic systems (Warner 2005). This was partially due to homeowners being generally wary of regulatory agency personnel (Warner 2005). Therefore, the project leader discovered that the best method for communicating with these homeowners was to solicit the help of certified septic contractors to inform individuals that contacted them about the 319-funded installation and repair project being led by Warner's team (Warner 2005). By identifying where and how his audience could best be reached, the project leader could effectively reach the population that needed him most (or at least reach some of them). Sometimes this targeting aspect takes significant creativity, such as that involved in the "faith-based" septic outreach project in South Carolina led by Harold Seabrook (see chapter 6 for more information). These successful outreach projects

will hopefully inspire and guide more creative strategies in the State of Georgia. To assist in this process, USEPA has produced a helpful guidance document for watershed outreach campaigns: http://www.epa.gov/owow/watershed/outreach/documents/getnstep.pdf. Improving outreach campaigns to better serve the audiences intended will assist in the implementation of bacteria TMDLs.

Due to the voluntary nature of most NPS control measures, outreach must also contain social mechanisms to encourage implementation actions. One tactic involves creating situations where people essentially feel peer pressure or ownership, which encourages them to self-enforce water quality-friendly control measures and often convince others to do the same. One example of this is creating dog parks to centralize dog owners and then implement BMPs and outreach tools to encourage cleaning up pet waste for bacteria NPS abatement. Another method is one used in Alabama in which watershed boundary signs are installed to familiarize and connect residents with the watershed they impact. "Stream naming" can also be a useful tool to provide a sense of ownership to a community of its surface waters. Children in particular can take great pride in "naming" the stream that runs through their school's property or neighborhood.

Increasing the attention, time and weight given to the impact of education and outreach in TMDL implementation is a central element to demonstrating measurable water quality improvements.

Urban TMDLs

Future research and data on urban control strategies and bacteria TMDL implementation will soon be coming out of 319 projects in North Carolina and Virginia Tech's Center for TMDLs and Watershed Studies. While many of the TMDL implementation projects reviewed focused on best management practices for non-point sources from agriculture, there were two

projects in North Carolina that focused on abating bacteria NPS pollution from urban environments. The North Carolina SWIM TMDL Watershed Plan for Sugar, Little Sugar and McAlpine Creek located in and near the urban center of Charlotte provides a strong example for urban watershed communities in the State of Georgia. The implementation project offers comprehensive guidance as it included aspects of accountability, urban BMPs and adaptive management (with monitoring). The Crowders Creek project, similarly, hopes to provide sound guidance and research on best management practices for bacteria TMDLs in the urban environment surrounding the metropolitan area of Charlotte, North Carolina. Further information and descriptions of these BMPs can be found in Chapter 6 of this thesis, the Appendices and the project website at http://www.rivercenter.uga.edu/research/bacteria_tmdl.htm. The results of Crowders Creek implementation project will be relevant to urban communities of Georgia installing structural BMPs in a densely populated landscape. The technical FC BMP database in particular will be a useful tool for urban stakeholders and growing communities throughout the State of Georgia.

On-site Wastewater Treatment Control Strategies & Alternatives

In general, most soils in Georgia are suitable for septic systems (Radcliffe et al. 2006). As development pressures for residential housing increase; however, soils with shallow water tables are more commonly being used (Radcliffe et al. 2006). Combine this issue with the increasing density of septic systems in housing developments, and the risk of system failure and potential problems increases. At the very least, high housing density and limited space offer fewer options to homeowners for "switching" drainfields or other methods to increase and maintain the life of their systems. Hydraulic failure, or surfacing (water accumulating on the soil surface), is probably low; however, weak sampling suggest the need for further research and data

tracking and management (Radcliffe et al. 2006). Hydraulic failure in particular involves the greatest potential risk for surface water contamination. While septic systems may not be a major source of bacteria water quality impairment, the potential remains, and it is best to act proactively if the potential could increase with the combining factors of growing populations, densities, and lack of accountability.

On-site disposal of wastewater will be an issue as the population of Georgia continues to grow. With proper planning and implementation of best management practices; however, Georgia can avoid an accompanying decline in water quality from impaired on-site waste disposal. In general, the following areas need improvement for on-site wastewater management:

- Creative use of education and outreach methods;
- Regulatory controls and enforcement mechanisms, such as ordinances, for septic systems maintenance, management and inspections;
- Use of alternative systems to septic when faced with bad conditions, such as unsuitable soil types.

Improving efforts or implementation actions in any one of these areas will improve septic system performance; however, it is a combination of these factors that will see the most success. For instance, if homeowners are knowledgeable about septic systems, they will hopefully expect a higher quality of work out of septic contractors, home builders and developers. Focusing on tactics that are both proactive and reactive will assist in alleviating problems from past management and allowing for improvements in new installations and development.

Targeting specific audiences for septic outreach efforts and decreasing the use of generalized brochures and unsupervised self-assessments will improve current efforts in septic homeowner education. Through my review of state programs and implementation efforts in

regard to reducing bacteria impairment, I found that many states are using, or have used, the Home-A-Syst self-assessments to increase awareness of septic system issues among homeowners. While the "A-Syst" program has proven success as a national model in many respects, self-assessments may not be the "best" method for Georgia to use in the attainment of water quality improvements[16]. More importantly, self-assessment should not be the only method used. For instance, the self-assessment structure (that already exists in Georgia) could be combined with methods encouraging targeted outreach and individual attention. The REINS program in North Carolina or the Clean Water Partnership in Alabama described in Chapter 6 could be useful models to follow in creating a trained volunteer network to assist with self-assessments and water quality outreach and consultation. The most beneficial aspects of the A-Syst program are confidentiality and regulatory distance. To highlight these benefits and treat the issue as separate from "government control" could have success particularly with rural homeowners in Georgia. Trained volunteers from each community or region could assist homeowners with self-assessments of their onsite wastewater management systems. Without this kind of one-on-one support and motivation, self-assessments are often useless. According to Tina Pagán, of UGA Cooperative Extension Service, self-assessments are only used by residents if they already have a problem (such as septic system surface failure) or have someone to lead them through it (such as a NRCS agent) (personal communication 2006). These types of self-assessments are rarely proactive. From her experiences working with outreach materials such as the A-Syst program, Pagán emphasized that partnering with NRCS agents in order to have face-

16 More info about the national Home-A-Syst/Farm-A-Syst: http://www.uwex.edu/farmasyst. The national program is used by states as a model and tailored to the specific state's needs, like Georgia's A-Syst program (see the Georgia Agricultural Pollution Prevention Program at http://www.agp2.org/ for further information).

to-face interaction and focusing on what issues are most important to the resident are useful tactics to combine with self-assessments (personal communication, 2006).

Various changes on the state and local levels in regard to regulations and rules could improve problems with the repair and maintenance of septic systems. Much research has and is being done into policy changes and other solutions for communities in Georgia. Therefore, I refer to these sources for policy recommendations for the State. For instance, the bacteria TAG recommends that state legislation (O.C.G.A. § 31-3-5(b)(6)) be changed to provide local health departments that currently hold permitting authority for non-mechanical residential sewage management systems with enforcement authority to perform inspections and require repairs and maintenance on these systems as necessary to prevent significant pollution contributions from these sources (Radcliffe at al. 2006). While this legislation makes it difficult to enforce septic system maintenance, it does not preclude a municipality or other entity separate from the local health department from enacting regulatory controls or measures to require maintenance. This type of actions is already being taken in Georgia communities, such as in Douglas County where the Water and Sewer Authority can disconnect water to houses if septic tanks aren't pumped every five years because of the proximity of septic systems to a drinking water source[17]. The Metropolitan North Georgia Water Planning District (Planning District), however, found that 75 percent of metro county health departments were not supportive of mandatory pump-out or inspection programs due to implementation problems such as lack of resources, enforcement, and capacity to dispose of septage (Metropolitan North Georgia Water Planning District 2006). Therefore the Planning District recommends, instead, a strong focus on homeowner education (Metropolitan North Georgia Water Planning District 2006). These are important issues that

[17] Protecting a municipal drinking water source is within the rights of a city or county under police powers. More information about Douglas County's program can be found at http://www.dca.state.ga.us/toolkit/ToolDetail.asp?GetTool=48

need to be addressed. A graduate student at the UGA River Basin Center, Amanda Worthington, is exploring ways to fund septic system repairs through the State Revolving Fund[18]. I encourage the State of Georgia to follow the recommendations of groups like the bacteria TAG, the Planning District and researchers like Amanda Worthington as it explores solutions for failing septic systems in the State.

The use of alternative technologies and systems to replace conventional septic systems can be implemented, particularly under conditions where traditional methods may have failed. For this thesis I have focused on the alternatives being used in other southeastern states, particularly the sub-surface constructed wetlands project in South Carolina described in Chapter 6. Based on my research, sub-surface constructed wetlands, like those used in South Carolina, could be a viable option in a situation where conventional septic system drainfields are failing due to poor soil conditions[19]. Comments by several septic experts in Georgia referred to the high maintenance required with a constructed wetland. These comments were made mostly in regard to the vegetative maintenance that was referred to in the interview with South Carolina homeowner and NRCS agent, Gordon Bowdler in Chapter 6. Mr. Bowdler referred to the difficulty involved in maintaining the plant, elephant ears, but otherwise stated that overall maintenance was minimal and much less costly than his former conventional septic system (personal communication 2006). Larry West, a UGA professor in Crop and Soil Sciences, pointed out that when residents are out of town for an extended amount of time there may not be enough wastewater created to keep the sub-surface constructed wetland vegetation alive, and therefore may cause problems on return (personal communication 2006). These comments point again to the need for site-specificity. All systems require maintenance. The maintenance

[18] consult http://www.rivercenter.uga.edu/research/bacteria_tmdl.htm for a link to Worthington's thesis.
[19] For instance, this alternative may be successful in the coastal plain region of Georgia.

required for this alternative system may be more labor-intensive for the homeowner, but may also be less costly over the long term since the alternative drainfield will lengthen the life of the septic tank and overall systems. This alternative BMP may not be for everybody or every situation, and these maintenance requirements should be kept in mind when choosing which systems to install.

The installation of individual on-site wastewater treatment technologies (under 10,000 gallons) is regulated by the Georgia Department of Human Resources Division of Public Health, as discussed in the *Urban* section of the previous chapter. According to the *Manual for On-site Sewage Management Systems*,[20] published by the Department of Human Resources,[21] and the "Approved Products"[22] list, sub-surface constructed wetlands would qualify as an "Experimental On-site Sewage Management System." In this case, experimental systems must apply for temporary approval from the Technical Review Committee for the installation of a limited number of systems to be evaluated over a prescribed period of time (Section G of the On-site Manual; GA DHR 2006). There is a provision allowing for the delegation of approval to the County for subsequent permit approvals once three installations of an experimental system have been permitted (Section G of the On-site Manual; GA DHR 2006). Upon completion of the experimental system installation, the permit holder must prepare final reports on the results and lessons-learned, which, upon review by the Technical Review Committee, can result in statewide approval as an alternative on-site sewage management system. In general, the process is fairly onerous, especially for an individual homeowner. It seems as though most of the applicants for

[20] The *Manual for On-site Sewage Management Systems* is accessible online at http://health.state.ga.us/programs/envservices/onsitemanual.asp

[21] A staff member in the land use department of DHR suggested contacting Todd Jones (experimental units and aerobic treatment) or Scott Uhlich (director of the program) for more information regarding installation of alternative systems in the State of Georgia.

[22] The approved products list is accessible online at http://health.state.ga.us/programs/envservices/product.asp

this process are manufacturers, research entities or organizations. Therefore, the best method for introducing individual sub-surface constructed wetlands as an alternative on-site system may be through a research university or other entity that could more easily access funding such as a 319 grant for implementation (like the project in South Carolina). While it is beneficial to require such stipulations to protect public health, introduction of alternative technologies should be researched, approved, and implemented in a more expeditious manner. Like many new methods and ideas, this lag-time is resulting from a general lack of will and effort at various levels. Especially in the face of failing conventional septic systems, residents should be able to implement innovative technologies and methods if the current system is not meeting their needs.

Pet Waste Programs

Various educational and regulatory methods exist for the abatement of water quality impairment from pet waste. Many ordinances and municipal programs are in place across the State of Georgia. However, these programs or ordinances are often un-enforced and not provided adequate support or respect from the local residents and citizenry. Similar to the issue of septic system maintenance, people are often unaware of the negative affect of pet waste on water quality. More importantly, they are often unaware of the cumulative affect. Maybe one small dog will not make a big difference, but it is the high number and density of all dogs and other pets that will degrade surface water quality throughout the watershed.

Education and the establishment of social mechanisms will be the most successful initial control strategies to implement in the fight against pet waste inputs. I refer to social mechanisms in this instance because it will take more than traditional methods to change people's behaviors. For instance, in the Swann (1999) survey in the Chesapeake Bay, 44 percent of dog walkers who did not clean up after their pets indicated they would still refuse to do so, even if confronted by

complaints from neighbors, threatened with fines or provided with more sanitary and convenient options for retrieving and disposing of dog waste. Another disconcerting fact about this survey in particular, is that it was conducted in the Chesapeake Bay area. Residents in the Chesapeake Bay area have been inundated by environmental outreach and education campaigns for years, and are potentially more aware of their individual and cumulative environmental impacts. Therefore, I suspect that Georgians would be even more recalcitrant to ordinances for controlling pet waste. Speaking from my own personal experience as a Georgia native, I was shocked to learn about the impact of pet waste on water quality. The only times I have seen people clean up their dog's waste are in the confines of a dog park when they are feeling "peer pressure" to clean up the waste. In this case, people are frequently unconcerned or unaware of any water quality impact, and are instead more concerned about stepping in a pile of dog waste. The outcome is still the same, however, whether people are cleaning up waste for aesthetic, public health, or water quality reasons.

Because of the opportunity for peer pressure and other social mechanisms to be initiated, I encourage the use and installation of dog parks in public parks where appropriate. Particular consideration should be made to site the park in a location beneficial to water quality such as low grade or slope, significant distance from surface waters, and the use or installation of vegetated buffers. Not only should pet waste receptacles be placed in the park, but also along paths and trails in areas outside of the dog park, particularly along the path leading to the park. The easiest, and potentially cheapest, receptacles to install are simple metal trash cans with a plastic bag retrieval system. Oftentimes, dog park users will bring their own reused plastic grocery bags to refill the systems, therefore reducing the maintenance obligations of park managers. Because of the number of dog owners visiting the area, signs and information boards can be utilized to not

only remind people to clean up after their pet, but to also educate them on the impact of pet waste on water quality and public health. If the community has also initiated pet waste ordinances, these information kiosks at the dog parks can further educate the public on the pet waste laws and how they could be held accountable. The dog park pilot projects in Virginia, described in Chapter 6, could be used as models for implementation in Georgia. The Upper Roanoke River Roundtable, in particular, is a good model because of the small budget, proving that installation of these best management practices with little funding is possible. The Four Mile Run dog park BMP pilot provides a great deal of detailed, replicable information on its project at its website and should be encouraged as a source of information to groups in Georgia[23].

Another tool available to ease the implementation of a pet waste campaign is the availability of materials from communities who are already implementing successful campaigns. The Erase the Waste Campaign in Los Angeles County, California has developed a storm water toolbox with materials available for use by other communities, programs and organizations free of charge. While some of the materials may have to be adapted slightly to fit the needs of Georgia residents, many communities and states throughout the Southeast are already using them as a cost-effective solution for producing outreach materials and pet waste campaigns. Their materials can be accessed and downloaded, along with instructions and advice, at http://www.waterboards.ca.gov/erasethewaste/index.html?counter=1075#toolbox. The metro Atlanta – based Clean Water Campaign provides information on pet waste and other water pollutants at its website:

[23] http://novaregion.org/fourmilerun.htm

http://www.cleanwatercampaign.com/what_can_i_do/pet_waste_home.html[24]. They have also published a pet waste brochure for use in the metro Atlanta area: http://www.cleanwatercampaign.com/resources/petwastefactsheet.pdf.

Best management practices for the reduction of pet waste non-point source pollution are fairly simple and inexpensive to implement. The main issue lies in creating a social mechanism for further enforcement and behavior changes amongst pet owners. By using the models in Virginia as a guide, and the multitude of other resources available across the country, Georgia could begin to see an improvement in bacteria impairment from pet waste sources.

Agriculture

In terms of best management practices to reduce bacteria inputs from agricultural sources, there are three areas in which to focus improvements: innovative BMP systems, technical guidance and assistance from NRCS and county extension agents, and funding cost-share options for producers. The most important of these areas is guidance offered to agricultural producers from NRCS and county extension agents. These agents are often the best resources for efforts at the state level because of their knowledge of and relationship with the community and agricultural producers. In each state, 319 project leaders and regulatory agency staff commented that these agents were necessary partners for any sort of implementation project involving rural or agricultural communities. Federal support for NRCS technical staff has decreased significantly (Risse, personal communication 2006). Overall, the current Bush administration increased total funding to NRCS, but required that most of the money go to cost-share programs (Risse, personal communication 2006). According to Mark Risse, Georgia is

[24] The Clean Water Campaign is a cooperative, multi-agency public education initiative spearheaded by local governments in metro Atlanta, supported by the Metropolitan North Georgia Water Planning District and managed by the Atlanta Regional Commission. Its mission is to build awareness about water quality problems and solutions in the Atlanta region.

doing the best they can, but it is difficult to give out more money with cost-shares when the same or less personnel are available to provide administrative support (personal communication 2006). Increasing support at the state level for county extension agents could help with this burden on NRCS agents and essentially improve the allocation and implementation of cost-share funds and producer-oriented support. Options could include workshops, training, and technical support. Watershed tours and BMP demonstration projects are also successful tools for garnering support for installation participation and education.

The UGA Cooperative Extension Service is investigating ways to improve the current program. The Georgia Agricultural Pollution Prevention Program[25] provides education and technical assistance to the agricultural community through a partnership between the State Pollution Prevention Assistance Division (P2AD) and the UGA Cooperative Extension Service. Cooperative Extension and the UGA River Basin Center's Initiative for Watershed Excellence: Upper Altamaha Pilot Project are working together to pilot the State's first "watershed agent." A watershed agent can focus on water quality issues that extension agents generally do not have the time or mandate to address[26].

Dr. Mark Risse at the UGA Cooperative Extension Service is also organizing and implementing efforts to alleviate the negative impacts of livestock on water quality. In particular, the Equine-A-Syst pilot project shows great potential for success in Georgia. Combining this horse farmer education program with a volunteer mobilization effort like the REINS program in North Carolina could show measurable improvements in water quality on horse farms throughout the State. One of the most important aspects of the program is the use of

[25] Focus areas include animal waste management, land application, environmental assessment, sustainable agriculture, crop production, and green industry outreach. For more information, contact Dr. Mark Risse or visit http://www.agp2.org.

[26] Extension agents are essentially required to help farmers with productivity issues to keep them in business – not necessarily issues pertaining to water quality improvements (Risse, personal communication 2006).

horse producers as volunteer trainers. This strengthens the relationship between horse producers and extension agents and encourages communication and accountability. Programs such as these can also provide solidarity amongst horse producers, who often do not have the same outlets for meeting other producers (like the Cattlemen's Association) (Risse, personal communication 2006).

Continuing to combine management strategies into BMP systems will not only improve water quality, but also the efficiency of the individual best management practices. Based on current literature (Mostaghimi et al. 2002; Thomas 2002; Byers et al. 2005) and reviews of state programs and projects (particularly Clemson University County Extension Agent, Morris Warner in South Carolina), the exclusion and management of grazing livestock away from surface waters will have the greatest impact on the improvement of bacteria impaired streams. These best management practices can include exclusionary fencing, alternative shade sources, and alternative water sources. Kevin Brannan at VA Tech mentioned that oftentimes exclusionary fencing is abandoned after it's damaged in a flood because cost-share monies only cover the original installation and repairs can be quite costly (personal communication 2006). In Byers et al. (2005), however, cattle spent less time in riparian areas when alternative sources of shade and water were provided. Therefore, if exclusionary fencing is inappropriate or too costly, providing additional shade and water sources for cattle will still decrease direct deposition of feces into surface waters. Focusing on creative methods for implementing the necessary BMP systems could serve as the most efficient tactic for bacteria TMDL implementation when agricultural land uses and livestock exist.

Federal and State-funded cost-share programs are essential for agricultural BMP installation in the private sector. USDA-NRCS cost-share programs contain certain weaknesses.

According to Mark Risse with UGA Cooperative Extension Service, these federal programs will only fund on-farm BMPs so there are few opportunities for community-based initiatives and solutions for agricultural programs and producers (personal communication 2006). Virginia has implemented several state-funded cost-share programs to assist with the installation of agricultural best management practices. These funds are combined with federal cost-share programs and implemented through a partnership between VADCR and Soil and Water Conservation Coordinators and their Districts. Virginia has also explored creative options such as a BMP tax credit program and low interest loans. I did not thoroughly investigate whether these financial incentive programs would be feasible in the State of Georgia. However, it does seem like these options could complement existing efforts such as the Georgia Soil and Water Conservation Commission's Agricultural Conservation Incentive Program and the Ag Lands Program. These current efforts alone are not sufficient, and the development and implementation of a State cost-share program for Georgia is necessary to see increased successes (Risse, personal communication 2006). Various recommendations for improving agriculture cost-share programs and efforts in the State were discussed at the Georgia Water Resources Conference in 2001. Some of these relevant conference proceedings are provided on the thesis website at http://www.rivercenter.uga.edu/research/bacteria_tmdl.htm.

Final Thoughts

Through a review of general state programs and practices, South Carolina and Alabama both contain program aspects that could be implemented fairly easily in Georgia. Alabama utilizes innovative methods to organize volunteer labor to meet TMDL implementation goals. South Carolina utilizes federal 319 funds creatively to support state program costs and fund

community-based projects. North Carolina and Virginia have implemented programs that could serve as present and future goals of Georgia's TMDL implementation program. Mecklenburg County's urban TMDL implementation plan could and should be used as a template for appropriating ownership and showing measurable water quality improvement in an urban watershed. Virginia's guidance manual for TMDL implementation can serve as a template for a similar guidance material for TMDL stakeholders and responsible parties in the State of Georgia. Both North Carolina and Virginia have implemented state-sponsored funding programs for BMP installation and water quality improvement projects. Virginia can be tapped as a resource when developing a new bacteria indicator standard for E. coli. All of these states should be reviewed and consulted on the implementation and structure for trust funds, particularly in regard to NPDES permitting fees to support water quality improvement efforts. Further information about state contacts and resources is available at the project website: http://www.rivercenter.uga.edu/research/bacteria_tmdl.htm.

Learning what our neighboring states are doing to address bacteria TMDLs is essential to the growth and progression of successful implementation strategies in the State of Georgia. What are they doing differently? What can we learn from them? What could they learn from us? These are questions we should be asking, and continue to ask, as we deal with bacteria TMDLs and surface water quality issues. While some of our watersheds are located within our state borders, many are not. Making connections and contacts now in neighboring states will assist us when we must develop and implement TMDLs on waters that cross state borders, such as the Savannah River. We will be prepared and will have information about programs and strategies are already being implemented in our neighboring states.

Table 1: Recommendations for Georgia

TOPIC	RECOMMENDATION	CASE STUDY TOOL
TMDL Implementation Planning	Create a TMDL Implementation Guidance Manual for GA with the assistance of groups like the UGA River Basin Center & 319 funds	Virginia's TMDL implementation plan guidance manual
	Create Urban bacteria TMDL implementation plans that assign responsibility & accountability for implementation actions to show measurable water quality improvements	North Carolina's Mecklenburg County SWIM program and TMDL IP for Sugar, Little Sugar, and McAlpine Creeks
	Provide more technical support & guidance to assist stakeholder coordination efforts by using river basin coordinators to complement GAEPD's TMDL Implementation Program & the Georgia River Network water quality outreach efforts; also use lessons from the VA Tech Center for TMDL & Watershed Studies	Alabama's Clean Water Partnership; VA Tech Center for TMDL & Watershed Studies
	Increase use of qualitative reporting to show water quality improvements and supplement quantitative data reporting to USEPA	South Carolina Coneross & Beaverdam Creek TMDL Implementation project
	Create statewide technical (approved QAPP) volunteer monitoring network to provide usable data for TMDL development & implementation, aligned with GAEPD's River Basin Schedule. Can complement & focus existing efforts by Adopt-A-Stream and other volunteer groups	Alabama Water Watch
Bacteria Standard	Follow federal guidance and consider switch to use of E. coli as indicator bacteria; or consider using a combination of indicator bacteria depending on site conditions and other factors	Bacteria TAG white paper
	Use guidance and advice from other states to guide bacteria standard change	Virginia DCR, VA Tech Center for TMDL & Watershed Studies & North Carolina DEQ

TOPIC	RECOMMENDATION	CASE STUDY TOOL
NPS 319 Program	Program reevaluation to determine the appropriate allocation of funds to meet water quality improvement goals	South Carolina DHEC NPS 319 Program
	Increased coordination between the TMDL Implementation Program and the NPS 319 grant program	South Carolina DHEC Watersheds & Planning Department
	State-supported 319 match assistance to reduce the 40% requirement for communities unable to meet it	
Funding	Constitutional dedication of environmental trust funds	Fact sheets & documents
	Approve legislation (HB 550) providing for the establishment of NPDES permitting fees to fund water quality improvements	North Carolina & Virginia state programs
Outreach & Education	Increase the attention, time & weight given to the impact of education & outreach in TMDL implementation to assist in the demonstration of measurable water quality improvements	South Carolina: "faith-based" outreach project, Coneross & Beaverdam Creek outreach project
	Encourage ownership of water resource for citizens & stakeholders through methods such as stream naming & watershed boundary signs	Alabama outreach tools (Troy State University report)
On-site Wastewater Control Strategies & Alternatives	Increase awareness of septic systems and maintenance needs using creative outreach methods	South Carolina: "faith-based" outreach project, Coneross & Beaverdam Creek outreach project
	Use alternative systems to replace failing conventional septic systems	South Carolina: sub-surface constructed wetland project
	Encourage municipal adoption of creative regulatory enforcement controls	Metro Planning District Issues Working Paper; bacteria TAG white paper
	Explore & implement creative options for financing septic systems repairs	Amanda Worthington's thesis

TOPIC	RECOMMENDATION	CASE STUDY TOOL
Pet Waste Programs	Install dog parks to create social mechanisms for further enforcement & encourage behavior changes among pet owners	Virginia models: Four Mile Run Project, Upper Roanoke River Roundtable pet awareness project
	Increase awareness among pet owners through creative outreach methods	Other outreach resources
Agriculture	Encourage the installation of water quality BMPs such as exclusionary fencing, alternative shade & water sources, poultry composting & stack houses through cooperative 319 projects; combined with creative outreach tools & qualitative reporting of agricultural efficiency & water quality improvements	South Carolina: Coneross & Beaverdam Creek TMDL Implementation Project
	Facilitate more technical support & guidance for horse farmers	North Carolina REINS program; the Georgia Equine-A-Syst pilot
	Initiate a State-funded cost-share program for Georgia	Financial incentive programs in North Carolina & Virginia
	Use the extension agent template to provide support to agricultural producers in water quality improvement practices	The UGA River Basin Center's IWE pilot "watershed agent"