CHAPTER 1

INTRODUCTION

Twenty years of federal regulation under the Clean Water Act (CWA) have led to significant improvements in water quality, particularly reducing inputs from point sources of pollution[1]. However, water pollution from non-point sources continues to plague the waters of the United States. As a result, non-point source inputs have become the number one source of pollution for our rivers, streams, and lakes (Wall 2003). According to the US Environmental Protection Agency (USEPA), non-point sources account for 65-75 percent of pollution in the nation's most polluted waters (qtd. in Garovoy 2003).

Under the 1972 amendments to the Clean Water Act in Section 303(d), the USEPA was charged with initiating the Total Maximum Daily Load (TMDL) Program to deal with water pollution by requiring states to set ambient water quality standards for all streams and rivers and develop plans for achieving those standards. States must identify sources of point and non-point pollution that impair their surface waters and then allocate among those sources the amount of pollution each contributes to the impairment. For each impaired portion of a stream or river, states develop a TMDL plan that determines the total amount of each pollutant the surface waters can receive on a daily basis without exceeding the state's water quality standard. This pollution load, or total maximum daily load, is allocated among point and non-point sources. The contribution of the TMDL program for decreasing non-point sources of pollution has not met expectations by state and federal entities (Houck 1999). Since Houck's statement in 1999, EPA

[1] The Federal Water Pollution Control Act Amendments of 1972; as amended in 1977, became commonly known as the Clean Water Act.

has published final rules implementing the TMDL program in an effort to see greater success in the program (Birkeland 2001). Controversy and implementation problems still exist as the TMDL program struggles to improve surface water quality.

In the state of Georgia, pollution from non-point sources continues to threaten our waters. According to the 2002 Assessment Data for Georgia, non-point sources are the most probable source of impairment for rivers and streams impairing over 4,000 miles within the State[2] (USEPA 2002). A central barrier to success is the lack of adequate funds (National Research Council 2001), especially for implementation. The low priority in federal and state allocation of support persists because there is likely a perceived lack of urgency and concern from the general public and constituency. Therefore increasing public support is necessary for short and long term success of the TMDL program in Georgia.

Too little funding is only part of the problem, and the situation will not change quickly. In the meantime, the State of Georgia can explore creative and innovative options and strategies for increasing support and improving water quality through the TMDL program. Highlighting different methods and success stories of TMDL implementation may also spur further public interest and support. The goal of this thesis is to assist the State of Georgia and its citizens in realizing improved water quality by (1) providing a non-technical description of how the TMDL process has been conducted in Georgia and neighboring states and (2) by offering recommendations for improving the process. Although many pollutants contribute to impairment, I concentrate on bacterial contamination in order to provide better focus. Many of my results and conclusions have application to other pollutants.

Our neighboring states, and other across the nation, are dealing with these same issues of meeting Federal clean water requirements with little funding and resources available. Rather

[2] For further information about water quality assessments in Georgia: http://www.gaepd.org/Documents/305b.html

than "reinvent the wheel," why don't we learn from each other's successes and failures? Sharing information will not only strengthen each state's program, but will also prepare us for eventual cross-state TMDL implementation plans. Due to the nature of surface waters, one state's actions will affect neighbors downstream and so on. If we can collaborate on these issues, we can conserve both time and resources while meeting mutual goals of water quality improvement. Therefore, I asked the question: what are other states in the Southeast doing about bacteria TMDL implementation?

Objectives

The objective of this thesis is to provide stakeholders in Georgia with a synthesis of bacteria TMDL control strategies and implementation programs that have proven successful in states of the Southeastern Piedmont: Alabama, North Carolina, South Carolina and Virginia. This study will augment the research and recommendations already being compiled and distributed by the bacteria TMDL Technical Advisory Group[3] (TAG) and other stakeholder groups in Georgia.

TMDLs in Georgia

Through Section 303(d) of the Clean Water Act, states are required to assign each water body in the state a designated use and set water quality standards for each of these uses[4]. Total maximum daily loads (TMDLs) of pollutants are established for waters not meeting water

[3] Organized by the Georgia Conservancy and the University of Georgia, the bacteria TAG meetings included a total of 60 university, state and federal scientists, local officials and members of non-profit groups.
[4] Section 303(d) of the Clean Water Act establishes the federal TMDL program.

quality standards. If a water body does not support or only partially supports its designated use[5] by violating water quality standards set for each use, it is considered "impaired" and a TMDL must be allocated for each impairment or pollutant (Risse et al. 2004). A TMDL, therefore, is a calculation of the maximum amount of a particular pollutant that a water body can assimilate while meeting water quality standards. Once the TMDL is set, the local government, or other third party entity, must produce and follow an implementation plan so that TMDLs are not exceeded. States are responsible for determining who will be charged with implementing the plans and how implementation plans will be developed. This charge is often assigned to and divided between quasi-governmental agencies, local communities and the state environmental agency. The Department of Natural Resources Environmental Protection Division (GAEPD) is responsible for facilitating the TMDL implementation planning process in Georgia. States must dictate what is required in a TMDL implementation plan to meet load reductions and other state-specific requirements[6]. In the State of Georgia, a TMDL implementation plan dictates implementation actions and strategies to meet load reduction requirements and identifies current and potential impairment sources. Active stakeholder and public involvement must also be included. As a requirement of Section 303(d), streams should be ultimately "de-listed" by meeting the water quality standard for its designated use. The process of TMDL implementation is particularly complex and burdensome for state and local governments, particularly do to high costs and little available guidance or financial support. In particular, there is no clear guidance from USEPA on TMDL implementation plan development and specifics on what should be

[5] Georgia's designated use categories: drinking, recreation, fishing, wild and scenic, or coastal fishing (set by GAEPD)

[6] Chapter 3 will provide more information about what is required in Georgia after citizen suits mandated USEPA enforcement of the TMDL program in the State (similar to many other states).

included in the plan. These challenges, as well as more background on TMDL implementation in Georgia, will be discussed further in Chapter 3 of this thesis.

In 2002, the University of Georgia and the Georgia Conservancy convened a Technical Advisory Group (TAG) to generally assist the State with plans for meeting TMDL requirements. One area in which the TAG chose to focus is that of bacteria TMDL implementation (Radcliffe et al. 2006).

Bacteria TMDLs

Of the over 800 water bodies in Georgia that require TMDLs, Fecal coliform (FC) bacteria from the intestinal tracts of vertebrate animals are the most prevalent impairment or pollutant (Radcliffe et al. 2006)[7]. A total of 385 FC implementation plans have been completedin the State (Radcliffe et al. 2006)[8]. Overall, 48 segments have been delisted from the 2002 303(d) list (Booth, personal communication 2006).

FC bacteria are found in both urban and rural settings (Radcliffe et al. 2006; Mallin et al. 2000) and pathogenic forms pose a great risk to the health of our population (USEPA 2004) and to the expense of water treatment for our communities (Mallin et al. 2000). However, FC can be effectively managed by the implementation of control strategies such as structural and non-structural best management practices (BMPs). By focusing on TMDL implementation strategies, I hope to provide a useful product to the Georgia communities faced with the difficulties of bacteria TMDL control.

[7] FC is used as an indicator of the presence of pathogenic bacteria in a water body. I will use the term "bacteria" very generally which may include pathogenic bacteria, FC, or E. coli, which is now the recommended USEPA standard (see Chapter 4 for more information).
[8] Implementation plan completion does not mean actions are actually being implemented, just that the plan has been written.

Overview of Thesis

In Chapter 2, I discuss the methods used for collecting data from other States about the programs and strategies used in the implementation of bacteria TMDLs. I present a review of the Clean Water Act provisions that affect TMDL implementation efforts, and a review of Georgia's TMDL program, in chapter 3. Chapter 4 further explains the science, controversies, and challenges surrounding the standard for bacteria TMDL establishment and implementation.

Chapter 5 provides background information on best management practices, sources of bacteria impairment to surface waters, and current implementation efforts in Georgia. Chapter 6 consists of a review and analysis of best management practices and management measures that are being used in other states in the Southeastern Piedmont: Virginia, North Carolina, South Carolina, and Alabama. Emphasis is placed on programs and strategies that have a higher probability to succeed in Georgia's current social, political, and economic climate.

Chapter 7 recommends changes to the current TMDL implementation program in Georgia and management measures that can be implemented by communities and TMDL stakeholders to abate non-point source pollution from bacteria sources.

The final product of this project consists of the thesis text, and an informative website. The goal of the website echoes that of the thesis, but is presented in a more "user-friendly" format aimed at assisting bacteria TMDL stakeholders in improving surface water quality in the State. It is an extension of the current University of Georgia River Basin Center site and will provide stakeholders with my findings: bacteria control strategies from other Southeastern states that can be implemented throughout Georgia.