

CHAPTER 5

BEST MANAGEMENT PRACTICES

This chapter is an overview of best management practices, particularly those employed in the abatement of surface water quality impairments from fecal coliform bacteria. Descriptions of potentially pathogenic bacteria from non-point sources are provided to clarify the setting for best management practice implementation. Furthermore, examples of bacteria-focused best management practices and bacteria TMDL implementation efforts are shown to illustrate current actions in the State of Georgia.

Background

A best management practice (BMP) is defined as: “. . . a practice or combination of practices that are determined (by state or designated area-wide planning agency) through problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable, (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals” (qtd. in Ice 2004). Water quality BMPs, specifically, are designed to control the delivery of pollutants from land use activities to water resources. Any two or more BMPs used together to control a pollutant from the same source constitute a BMP “system.” A BMP system can be tailored for a specific pollutant, source, geographical location, as well as an economic situation. According to Gale et al. (1996), BMP systems control non-point sources (NPS) more effectively than individual BMPs because they

can minimize the impact of the pollutant at several points: at the source, during transport from the source to the water body, and at the water body.

Essentially, best management practices can be divided into two categories: structural and non-structural. Structural BMPs are built structures or landscape features that are installed in a landscape to reduce or slow pollutant inputs into a water body. Examples of structural BMPs may be a constructed wetland to treat wastewater effluent or a stormwater retention pond in a residential subdivision. Non-structural BMPs may consist of policies to reduce pollutants before they enter waterways, land use planning and management, and outreach efforts. Non-structural and structural BMPs generally complement each other. Non-structural BMPs are often seen as preventative measures to be implemented before taking action through structural BMPs.

Throughout this report I often use “control strategies” and “best management practices” or “BMPs” interchangeably. My reason for using the term “control strategies” in place of BMPs is that I am attempting to broaden our view of BMPs to include more non-traditional and non-structural strategies like education and outreach.

Structural as well as non-structural BMPs are specific to an urban or agricultural setting. Examples specific to these environments are urban stormwater detention ponds and agricultural filter strips. In the following section, I elaborate on which best management practices can be used in the abatement of bacteria non-point source pollution for urban and rural settings as well as the nature of the pollutant sources themselves.

Bacteria Sources & Control Strategies

Fecal coliform bacteria in non-point source pollution¹ are from human and vertebrate animal sources such as urban runoff carrying pet waste, leaking septic systems and sewer lines, illicit discharges from non-point sources², wildlife, agricultural runoff and the accessibility of streams by cattle. Controlling pollution from non-point sources can be implemented through voluntary, incentive-based, or regulatory non-point source control programs aimed at reducing bacteria loads (Ice 2004).

Urban

The most common sources of urban bacteria pollution result from runoff or improper disposal of human and pet waste. Human waste can pollute water bodies by leaking from failing septic systems, faulty sewer lines, illicit discharges from residences into a stream, and Stormwater System Overflows (SSOs)³. Proper sewer line maintenance and repair is a constant water quality issue in urban environments.

In urban areas, stormwater resulting from various urban activities, such as construction and impervious pavement, that is collected in stormwater collection systems is considered a point source of water pollution under the Clean Water Act and is therefore regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater permitting program⁴. Industrial dischargers, construction activities of a certain size, and multiple separate storm sewer systems (MS4s) are all covered under this program. Stormwater is an issue in regard to bacteria

¹ Discharges from industrial and municipal sources such as sewer outlets are considered point sources and are regulated through the NPDES permitting program.

² Illicit discharges from non-point sources may include illegal piping of waste from a residence to a stream or stormwater system. These types of illicit discharges are referred to as “straight pipes.” These can be fairly common in older homes in particular. In Virginia, researchers assumed that 10 percent of old houses and 2 percent of middle-aged houses within 45 m of streams used straight pipes (Benham et al. 2005).

³ A SSO is a release of untreated wastewater before the flow reaches a treatment plan. SSOs pose a significant threat to public health and water quality. (USEPA 2006a)

⁴ NPDES: Section 402 of the Clean Water Act; for more information on the NPDES stormwater program: http://cfpub.epa.gov/npdes/home.cfm?program_id=6

impairment because of the high volumes of pollutants that can be washed into surface waters during storm events. Many structural BMPs are available for dealing with stormwater. Most of the BMPs function by slowing the speed of the stormwater and allowing pollutants to settle out. One example of this is a stormwater detention pond which is often seen in areas near shopping centers and subdivisions where a great deal of impervious pavement is present and storm flow rates are high. Stormwater BMPs that assist in slowing the flow of pollutants into surface waters and allow pollutants to settle out will also assist in the abatement of NPS runoff from bacteria sources. Although point sources of bacteria, including urban stormwater runoff, will not be explored in-depth, an increase or advancement in stormwater BMPs will assist in decreasing inputs of bacteria pollution.

Pet Waste

Many pollutants can be found in stormwater runoff from urban areas. One such pollutant is pathogenic bacteria from pet waste. Pets and urban wildlife can be a significant source of bacteria impairment. This is exacerbated by the high densities of pets in urban areas. According to the American Pet Products Association, four in ten U.S. households include at least one dog and Americans owned 68 million dogs in 2000 (Watson 2002). Combine this number with surveys showing that 40 percent of people don't clean up their pet's waste (Swann 1999), and it is apparent that a high volume of feces potentially enters our surface waters. Non-human waste is a significant source of contamination. According to studies by Alderiso et al. (1996) and Trail et al. (1993), 95 percent of FC found in urban stormwater was of non-human origin. For wildlife sources of bacteria contamination such as from waterfowl populations, few measures can be taken to reduce inputs. Inputs from pet waste, however, can be abated through various control strategies. To identify human vs. non-human waste, molecular-based bacterial source tracking

(BST) can be used. This form of identification can be prohibitively expensive, especially for smaller communities. Various methods exist to identify NPS pollutant sources with less expensive methods, such as targeted sampling⁵.

Therefore, if high numbers of pet households exist in a watershed, it is reasonable to implement inexpensive, holistic control strategies to reduce inputs. The Center for Watershed Protection's Stormwater Center provides information for "animal waste collection" (or "scooping the poop strategies"). According to the Stormwater Center's review of current research on animal waste collection, the strongest need is for more education of pet owners about the importance of pet waste as a water quality pollutant (CWP n.d.). Educational tools can vary depending on the target population and the funding available. The most common tools are brochures, public service announcements, and signage in public parks, which are often the biggest "receptacle" for pet waste. Pet waste ordinances are becoming more and more common in urban communities. These ordinances usually focus on pet waste removal from public areas, but can also apply to private front lawns. Subdivisions and planned developments are enforcing these types of controls, generally for aesthetic reasons associated with lawn beautification. Also becoming more popular is the installation of designated dog parks where pets are allowed off-leash in a confined area. Various management options can be implemented in these parks to collect pet waste, as well as proper siting of the park in relation to surface water drainage areas. These control strategies for parks and educational campaigns will be examined further in the recommendations chapter.

⁵ For more information about various bacteria sampling methods, consult the bacteria TAG white paper and/or research conducted by Dr. Peter Hartel in UGA Crop and Soil Sciences: Hartel et al. 2006. "Targeted sampling and bacterial source tracking (BST) of Potato Creek between Griffin and Thomaston, Georgia, during baseflow and stormflow conditions. 319 Report to McIntosh Trail Regional Development Center, Griffin, GA. (being turned into a manuscript for the *Journal of Water and Health*); and McDonald, et al. 2006. "Identifying sources of fecal contamination inexpensively with targeted sampling and bacterial source tracking" *Journal of Environmental Quality*. 35:889-897.

On-site Wastewater Disposal Systems

Another ubiquitous source of bacteria contamination originates from systems designed for human waste disposal. While sewer systems are more common in urban residential areas, septic systems can be found in both urban and rural areas of Georgia due to the nature of sprawling development. According to the Metropolitan North Georgia Water Planning District, the number of septic systems in their 16-county area is estimated to be more than half a million with over 12,000 being added each year (2006). The bacteria Technical Advisory Group (TAG) estimates there are more than 1.5 million systems in the State, which probably represents more than 40 percent of the homes in Georgia (Radcliffe et al. 2006). The use of septic versus sewer is also considered a tool for limiting growth, and is employed by many counties fearing the encroachment of the metro Atlanta area. Septic systems are quite effective and beneficial to the environment if properly installed and maintained⁶.

Conventional septic systems consist of a tank to separate solids which are broken down by bacteria and the wastewater which is directed into an absorption field known as a drainfield or leachfield. The “filtered” wastewater is leached into the soil and does not pose risks to public health if sited properly depending upon drainfield size, soil type and other factors⁷. To properly maintain systems and avoid failures, the remaining solid waste in the tank must be pumped out every three to five years. If maintenance measures are performed, a drainfield can last up to twenty to thirty years. The greatest threat to surface water bacteria impairment originates from system failure when septage comes to the soil surface and results in overland flow. If sited improperly, groundwater contamination can occur in drinking water wells or seep into the water

⁶ More general information can be found through the National Environmental Services Center and the National Small Flows Clearinghouse.

⁷ For a more technical and in-depth overview of septic systems processes, consult the bacteria TAG paper at <http://www.georgiaconservancy.org/WaterQuality/TMDL.pdf>

table. Due to lack of knowledge about septic system performance and maintenance needs, many homeowners do not know there is a problem until failure occurs. At this point, costs to fix or replace the failing system can be high and present quite a burden for homeowners, and the surrounding community. In the state of Georgia, it costs approximately \$300-350 for a “pump-out” of a standard 1,000 gallon tank (Banks, personal communication 2006). Repairs to failing systems, which are generally focused on the drainfield, are charged by the foot. In a 3 bedroom home, this is estimated to cost about \$3300. However, Banks remarked that some repairs can cost upwards of \$20,000 depending upon the extent of failure and damage to the septic system (personal communication 2006).

In Georgia, as in many other states, the County Boards of Health and the State’s Department of Human Resources (DHR) regulate septic systems up to 10,000 gallon tank capacity. DHR rules establish a permitting and inspection system for installations and repairs; and certification requirements for contractors, inspectors, soil classifiers and pumpers⁸ (Metropolitan North Georgia Water Planning District 2006). DHR has also written a manual that details design criteria, site suitability parameters, as well as the installation and operational requirements for on-site sewage management systems⁹ (Metropolitan North Georgia Water Planning District 2006). It is the responsibility of the County Boards of Health to enforce these minimum requirements outlined by DHR¹⁰.

According to the Metropolitan North Georgia Water Planning District, a problem arose in the regulations when the duties of the county Boards of Health in regard to septic systems maintenance were amended by O.C.G.A. § 31-3-5 in 2000 (2006). The amendment removed the

⁸ Chapter 290-5-26 of the Rules of the GA Department of Human Resources, “On-Site Sewage Management Systems,” establishes statewide regulations.

⁹ Obtain a copy of the GADHR On-site sewage manual at <http://health.state.ga.us/programs/envservices/onsitemanual.asp>

¹⁰ On-site sewage rules for GA can be found at: <http://health.state.ga.us/programs/envservices/onsiterules.asp>

ability of the Boards of Health to require maintenance on non-mechanical septic systems, which do not require electricity or pumps to function; and are what most people think of when picturing a traditional septic system (Metropolitan North Georgia Water Planning District 2006). This amendment explicitly prohibits local health departments from enacting or enforcing a regular maintenance schedule to prevent malfunctions and failures. Property owners are still responsible for properly operating and maintaining the septic systems to increase life expectancy and prevent failures¹¹. There is no explicit requirement however, for the regular pump-out of systems, nor is there any sort of enforcement mechanism. The Georgia Department of Natural Resources Environmental Protection Division (GAEPD) regulates larger systems (more than 10,000 gallons of wastewater per day) and therefore has no enforcement authority over the smaller residential systems which make up the majority of systems in the State. Georgia also does not require homeowners when selling their homes to disclose whether or not they have a septic system to would be buyers. Because of these limitations on the authority of local governments, communities are attempting to prevent failures in other ways. The Metropolitan North Georgia Water Planning District, GADHR, and county Boards of Health are implementing efforts to educate homeowners on proper maintenance through education pamphlets, DVDs, and distribution of other advisory materials (Metropolitan North Georgia Water Planning District 2006).

Solutions for these various bacteria impairments will be explored in the recommendations chapter of this thesis.

Agriculture

Water pollution from agricultural sources creates an interesting regulatory problem especially in Southeastern states like Georgia that are home to many animal-based farming

¹¹ GA DHR Rules 290-5-26-.18

operations. Traditionally, agriculture is exempted from water quality regulations¹², even though it is believed to be the source of seventy percent of the degraded miles of river surveyed in the U.S. (Wall 2003). Livestock waste, specifically, is a major source of non-point source water pollution¹³. A 1989 summary of state non-point source water quality assessment conducted under the Clean Water Act's section 319 revealed that over one-third of all water impairments attributed to agricultural pollution were caused by animal waste (USEPA 2002). Bacteria from animal waste can reach surface waters through manure that is applied to fields, manure deposited on fields where animals are grazing, or deposition in streams where animals have access (Radcliffe et al. 2006).

Agricultural Sources of Bacteria

In terms of bacteria pollution, livestock grazing poses a risk to water quality. Various studies have been conducted to show the connections between livestock, bacteria, and best management practice effectiveness. Belsky et al. (1999) showed that livestock degrade riparian zones under all circumstances. In general, riparian BMPs such as grass filter strips and buffer areas are believed to reduce inputs of FC as well as other pollutants such as sediment. Some studies (Coyne et al. 1998; Desmarais et al. 2002), however, have indicated problems with the potential for regeneration or regrowth of pathogenic bacteria in sediments. This research is particularly important to this project because it reminds us of the need for BMP systems instead of individual BMP installation. For instance, filter strips will assist in reducing immediate inputs in the stream, while other measures such as alternative watering systems and rotational grazing

¹² While most NPDES regulations exclude agricultural stormwater runoff from permit requirements, some large facilities may be regulated under this program (such as CAFOs, see note below) (USEPA, http://cfpub.epa.gov/npdes/home.cfm?program_id=41)

¹³ By "livestock waste" I am not referring to CAFOs (confined animal feeding operations) which are regulated by the CWA as point sources. Grazing livestock, which deposit feces in the pastures and water bodies (if given access), are considered to be non-point sources of bacteria impairment.

will reduce the inputs of FC coming from the pastureland above the filter strips and therefore reducing the stress to the riparian BMPs.

The deposition of feces from cattle into streams is an important source of FC inputs to surface waters (Mostaghimi et al. 2002). Thomas (2002) found a dramatic improvement in water quality as a result of fencing cattle out of streams and riparian areas. Before fencing, FC units average over 51,000 cfu/100 ml which then decreased to 258 cfu/100 ml after fencing. Cattle also use riparian zones for shade in the hot summer months. Byers et al. (2005) found that cattle went to riparian areas in response to environmental stressors. When they provided cattle with water troughs, time spent in riparian areas by cattle reduced 40 to 96 percent, depending on the time of the year. By implementing best management practices such as fencing cattle out of streams and providing alternative shade and water sources, agricultural producers can greatly decrease the negative affect of cattle grazing in and around streams.

The practice of manure application, especially poultry litter, on fields and pasture land is potentially harmful to water quality. The issue with spreading manure is related to bacteria die-off rates. By providing storage facilities to store poultry litter, the bacteria are allowed time to die-off without getting washed into surface waters during a storm event. Hartel et al. (2000) found that in Georgia, poultry litter that is placed in “stack houses” for more than a few days had low levels of FC. Another useful best management practice is to compost poultry litter before applying it to fields. The high temperatures reached during composting will kill FC bacteria (Carroll, personal communication 2006). Combining these BMP options with a nutrient management plan can assist in overall reductions in FC inputs.

In the *National Management Measures to Control Nonpoint Pollution from Agriculture*, USEPA recommends the following management measures¹⁴ to alleviate the negative effects of grazing on water quality (2003):

- maintenance of riparian and upland area vegetation
- manage for deposition of fecal material away from water bodies and to enhance nutrient cycling by better manure distribution and increased rate of decomposition
- exclusion of livestock and/or controlling livestock access to and use of sensitive areas, such as streambanks, wetlands, estuaries, ponds, lake shores, soils prone to erosion, and riparian zones through the use of:
 - herding
 - installation of alternative drinking water sources
 - installation of hardened access points to prevent stream bank erosion for water consumption where alternatives are not feasible
 - placement of salt and additional shade, including artificial shelters, at locations and distances adequate to protect sensitive areas
 - stream crossings with hardened substrates
 - exclusionary practices, such as fencing, hedgerows, moats, and others

Difficult and complex issues, however, often pose barriers to implementation by farmers.

Funding for Agricultural BMPs

A central impediment is the availability of funds to implement management plans, and difficulties associated with obtaining funds such as lengthy applications and onerous contractual

¹⁴ This list of management measures is not exhaustive and only includes measures that can specifically abate bacteria impairment to water quality. More grazing management information can be found in Ch. 4 of USEPA's *National Management Measures to Control Nonpoint Pollution from Agriculture*, EPA-841-B-03-004. <http://www.epa.gov/nps/agmm/index.html>

agreements. Through federal agencies such as the United State Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) each state receives access to federal funds to assist in the implementation of best management practices¹⁵. The differences between states lies in the programs and support they each provide to agricultural producers as they apply for these federal monies, such as supplemental state-funded cost-share programs. The federal cost-share application process can often be onerous, time consuming, and confusing to agricultural producers and other interested parties. The Environmental Quality Incentives Program (EQIP) is commonly used to fund BMPs to protect or improve water quality from bacteria impairments¹⁶. The EQIP program is closely tied to the 1985 and 2002 Farm Bill. The application includes an EQIP plan of operations and a schedule for implementation of conservation practices, such as various structural BMPs. For example, if a plan of operations includes an animal waste storage facility, the participant must provide for the development and implementation of a comprehensive nutrient management plan (NRCS 2004). EQIP is a popular option among farmers, and therefore more competitive, because it requires only a one year contractual commitment. Natural Resources Conservation Service (NRCS) agents in each locality work with participants and these agreements can be up to ten years in duration.

Other FSA and NRCS sponsored programs include the Continuous Conservation Reserve Program¹⁷ (CRP) and the Conservation Security Program¹⁸ (CSP). Cost-share programs do require a great deal of will and compromise on the part of the farmer. Federal cost-share

¹⁵ The NRCS is a federal agency charged with assisting residents in the conservation of natural resources on private lands. NRCS focuses on providing private landowners with assistance and support to conserve their soil, water and other natural resources. NRCS staff also provide expertise and technical guidance to local, state and federal agencies and policymakers. <http://www.nrcs.usda.gov>

¹⁶ For more information: <http://www.nrcs.usda.gov/programs/eqip>. This online tool has been provided for farmers and ranchers to see if they qualify for the special cost-share payment rates under EQIP for limited resource farmers and ranchers; <http://www.lrfctool.sc.egov.usda.gov/>.

¹⁷ <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep>

¹⁸ <http://www.nrcs.usda.gov/programs/csp/>

programs have attempted to make it less of a burden by “renting” the land being excluded by fencing or other similar best management practices. Some programs also provide funds for maintenance. With an increase in focused assistance from NRCS and county extension agents, familiarity and use of these funding mechanisms could increase.

Funding for Non-Point Source Water Quality BMPs

To assist in the implementation of BMPs in the State of Georgia and to complement existing federal cost-share programs, Georgia provides some financial incentives. These are administered by the GAEPD and are generally implemented with the assistance of CWA Section 319 water quality grants, similar to other state programs. In Georgia, the State Soil and Water Conservation Commission (SWCC) sponsors an Agricultural Conservation Incentive Program. This program funds practices such as exclusionary fencing, alternative watering systems, and critical area plantings¹⁹. The GA SWCC has implemented it as a water conservation program for irrigators (who irrigate with center pivot systems) (Risse, personal communication 2006). The GA SWCC’s Ag Lands Program²⁰ provides a cost-share match for BMPs implemented for 319-funded TMDL projects in the State, such as exclusionary fencing for livestock. According to Mark Risse, these 319 projects add flexibility in a few watersheds but are not used widely enough to offer a large impact across the State (personal communication 2006).

While these incentive programs assist in water quality improvements, the CWA 319NPS grant program in Georgia provides the major support for NPS water quality improvement efforts in the State²¹. 319 funds are allocated to each state to address NPS abatement strategies. Section 319 funds pay up to 60% of eligible project costs, with the applicant providing a 40% non-

¹⁹ O.C.G.A. § 2-6-52 (g)

²⁰ http://gaswcc.georgia.gov/00/channel_title/0,2094,28110777_30158446,00.html

²¹ For more information regarding the regulatory background of CWA Section 319, see Chapter 3 of this report.

federal match²². The allocation of these funds varies a great deal from state-to-state. In Georgia, the 319 program is administered by GAEPD. Michelle Vincent is the Unit Manager for the Grants Unit within the Watershed Protection Branch's Nonpoint Source Program and provided information regarding the program in the state of Georgia. The state of Georgia gives 90 percent of its 319 funds to external (outside of GAEPD) projects/contracts. Because of the high number of external contracts, the 319 application and implementation process is slower and the resulting annual draw-down rate is lower. The annual draw-down rate is used as a measure of success by the federal budget office (Barkley, personal communication 2006). If the draw-down rate is "slow," the federal budget office assumes that there is less "action" on the part of the State (Barkley, personal communication 2006). This can be deceiving, however, especially when many long-term projects are being implemented that may have greater overall water quality improvement affects. A three-year project, for instance, may not spend most of its allotted budget until the third year of implementation due to practical planning constraints (Barkley and Vincent, personal communication 2006).

In the case studies included in this report, 319 projects are highlighted as some of the more successful BMP implementation projects. These projects often include funding from federal agricultural cost-share programs, assistance for individual farmers to apply for cost-share monies, and/or State-sponsored environmental trust fund monies.

Role of BMPs in TMDL Implementation

TMDL implementation plans include a section on implementation strategies and actions – what best management practices will be implemented to achieve the TMDL. Clearly defined

²² The 40% non-federal match can be in the form of cash or in-kind services (<http://www.scdhec.net/eqc/water/pubs/319match.pdf>).

implementation actions and best management practices are essential to reducing surface water quality impairments and showing measurable success. Oftentimes, the BMP implementation information contained in the plan lacks site specificity, creativity, and practicality. BMP planning and implementation is very complex and the distinctions should be made among the non-use of available BMPs that could be effective if used, those BMPs that are not effective, and new BMPs that need to be developed and implemented.

Based on reviews of existing TMDL implementation plans and scoping interviews with TMDL implementation professionals²³, current BMP usage in Georgia can be categorized as follows:

- Agriculture: exclusionary fencing, etc.
- Septic and sewer inspection and maintenance programs
- Education and outreach programs
- Local city and county ordinances

This listing is very broad and general, and addresses most of the issues associated with bacteria TMDL implementation.

Examples from Georgia

Before reviewing control strategies and TMDL implementation projects in other states of the Southeast, examples from Georgia can illustrate some of the current efforts. The 16 RDCs of Georgia are essentially on the “front-lines” of TMDL implementation in the diverse urban and rural communities of the State. Therefore, two Regional Development Center (RDC) staff members from different regions of the State were interviewed about their experiences and

²³ Such as Bill Bumback, a former University of Georgia River Basin Center environmental planner and coordinator for the Georgia TAG on TMDL implementation.

successes. A professor and public service associate with the University of Georgia (UGA) Cooperative Extension Service was also interviewed for an understanding of current agricultural BMP implementation projects in the State focused on bacteria impairment sources.

The metropolitan area of Atlanta, Georgia (Metro Atlanta) has many unique water quality issues as its surrounding counties have cushioned increasing growth and development pressures. The exponential growth of the urban and suburban population creates a dilemma with the available surface water for consumption and correlative water quality. Dealing with the seemingly conflicting needs of Metro Atlanta is Matt Harper with the Atlanta Regional Commission (ARC). The ARC is the Regional Development Center (RDC)²⁴ for ten counties in the metro area of Atlanta. Harper made the distinction that the counties of the Atlanta area have better stormwater controls because of their MS4²⁵ requirements and sewer inspection and maintenance programs (personal communication 2006). For example, Cobb County is particularly proactive as they implement quarterly sewer line stream walks where they look for problems that may lead to discharges of waste into the nearby water body. A major problem in Atlanta, is the presence of a high number of septic systems in the Metro Area. Septic-to-sewer transition programs have become popular in some of the more affluent counties, like Gwinnett, but are generally too costly for many of the communities. The ARC has focused on public education and outreach as the “most efficient” way to improve water quality in the metro area (Harper, personal communication 2006). Education efforts have included everything from septic

²⁴ Regional Development Centers (RDCs) are sub-state districts created by the state government of Georgia. GAEPD contracts out most TMDL implementation with the RDCs. (see Chapter 3 of this Thesis for further explanation).

²⁵ Multiple Separate Storm Sewer systems are regulated under the NPDES permitting system, which establishes guidelines for municipalities (populations of more than 100,000) to minimize pollutants in stormwater runoff. Treating storm sewers and runoff like point sources, local governments must enact a comprehensive soil erosion and sedimentation control program, periodically screen and monitor water samples from local stream and storm sewer systems, and test for a number of parameters. (Clean Water Campaign, *Local Programs in Your Community*, http://www.cleanwatercampaign.com/community_programs/local_programs.html)

tank maintenance to proper pet waste disposal²⁶. Before implementation can be initiated, however, the ARC must first gain stakeholder support and buy-in into the TMDL process. This can be obtained using two tactics: virtual (internet-based web forums) public meetings and internet mapping sites (Harper, personal communication 2006). Internet mapping sites are online applications where a general citizen can “map their impaired stream.” GOOGLE EARTH in particular has a great software tool, which is relatively inexpensive for an organization or public entity and available for free download by the public (Harper, personal communication 2006). Increasing the use of such simple and inexpensive tools should increase the success of implementation efforts in urban environments.

Alternatively, Dr. Mark Risse, an Extension Engineer at UGA’s Agricultural Pollution Prevention Program is working with agricultural producers in Georgia to meet water quality goals. The Georgia Agricultural Pollution Prevention Program is a partnership between the State Pollution Prevention Assistance Division (P2AD) and UGA’s Cooperative Extension Service which provides education and technical assistance to the agricultural community²⁷. Risse is specifically focusing on bacteria NPS impairment by targeting one of the most “elusive” and growing sources: horse farms. Since horses are not considered to provide food or fiber, they are essentially unregulated, as opposed to cattle and other livestock (Risse, personal communication 2006). Horse farms are also therefore ineligible for federal cost-share programs such as those provided by NRCS for installation of best management practices. To complicate matters, according to Risse, many horse farmers in Georgia are essentially “hobby” farmers who are entering the industry as a “second” career and often have either limited or no previous

²⁶ Pet waste disposal is quite problematic, particularly in high-density residential areas. Matt Harper referred to having seen people disposing of pet waste by dumping it into storm drains (June 7, 2006).

²⁷ http://www.agp2.org/env_assess/

experience with farming of any kind. Therefore, Risse and his team saw a need for an outreach and education program focused on horse farmers and developed the Equine-A-Syst program.

Equine-A-Syst, modeled after the nationally recognized Farm-A-Syst²⁸ program, is a self-assessment and education program targeting horse farmers in Georgia (Risse, personal communication 2006). A pilot of the program is currently being implemented by Risse's team in Barrow and Oglethorpe counties with the Oconee Resource Conservation and Development Council²⁹ (RC&D). Taking advice from the State of Kentucky, Risse's team is looking at ways to gain eligibility for cost-share monies for horse farmers since horse farming is a top ten commodity in the State. The "Master Equine" program consists of coursework on horse farming with subtle environmental messages throughout. Participants must complete Equine-A-Syst and then work through the application process for NRCS cost-share monies. Thus far, participation response has been overwhelming (Risse, personal communication 2006).

Success in the use of education and outreach-based programs to encourage best management practices has occurred at the South Georgia Regional Development Center (RDC) with an environmental planner, Emily Perry Davenport. Much of Davenport's achievement stems from her close relationship with the South GA region as she grew up there and has a better understanding of the community's needs. This connection to the community and correlative success of environmental education and outreach is often forgotten, and is one of the simplest ways to meet our water quality goals.

²⁸ The National Farm-A-Syst program was developed at the University of Wisconsin and is cooperatively supported by the USDA Cooperative State Research, Education and Extension Service (CSREES), USDA Natural Resources Conservation Service (NRCS), and U.S. Environmental Protection Agency (EPA). Farm-A-Syst and Home-A-Syst are self-assessments to locate areas for improvement in water quality impacts from homes and farms. The program is used in many states and can be tailored to each states' needs.

²⁹ RC&Ds are a partnership between the USDA and rural communities. Through this entity, the USDA can provide technical and financial assistance for collaborative work.

Davenport related different projects and initiatives occurring within communities in the South GA RDC region. For all of their communities, the RDC has implemented a stormwater awareness program which includes (Davenport, personal communication 2006)

- curb markers;
- media involvement (cable shows);
- workshops with landscapers, developers and home builders associations;
- building partnerships within the community;
- strengthening working relationships with RC&Ds; and
- encouraging 319 project proposals for NPS abatement strategies.

In terms of agricultural-based projects, the South GA RDC works closely with NRCS agents (who have an acquaintance with local landowners) and the UGA Cooperative Extension Service. Davenport's successes involved situations where communities had taken the lead on outreach programs like stormwater management and septic pilot projects with the county health department (personal communication 2006).

Conclusion

Understanding the non-point sources of bacteria and which best management practices can be employed to abate these inputs will assist in the analysis and review of methods and practices other state have to offer. It is also particularly important to highlight innovative bacteria control strategies already being implemented in the State of Georgia. Analysis and recommendations can therefore include information on how programs and practices in other states can complement, update or change existing structures in Georgia.