Total Maximum Daily Load

Evaluation

for

Three Stream Segments

in the

Savannah River Basin

for

Fecal Coliform

Submitted to:
The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

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EXECUTIVE SUMMARY

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of two categories with respect to designated uses: supporting or not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* (GA EPD, 2006 – 2007). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

Some of the 305(b) not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the 2008 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

The State of Georgia has identified three stream segments located in the Savannah River Basin as water quality limited due to fecal coliform bacteria. A stream is placed on the not support list if more than 10% of the samples exceed the fecal coliform criteria. Water quality samples collected within a 30-day period that have a fecal coliform geometric mean in excess of 200 counts per 100 milliliters during the period May through October, or in excess of 1,000 counts per 100 milliliters during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample maximum criteria (4,000 counts per 100 milliliters) for the months of November through April. The water use classification of the impacted streams is Fishing.

An important part of the TMDL analysis is the identification of potential source categories. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulated fecal coliform bacteria that wash off land surfaces as a result of storm events.

The process of developing fecal coliform bacteria TMDLs for the Savannah River Basin listed segments includes the determination of the following:

- The current critical fecal coliform load to the stream under existing conditions;
- The TMDL for similar conditions under which the current critical load was determined; and
- The percent reduction in the current critical fecal coliform load necessary to achieve the TMDL.

The calculation of the fecal coliform load at any point in a stream requires the fecal coliform concentration and stream flow. The availability of water quality and flow data varies considerably among the listed segments. The Loading Curve Approach was used to determine the current fecal coliform load and TMDL. The fecal coliform loads and required reductions for each of the listed segments are summarized in the table below.

Management practices that may be used to help reduce fecal coliform source loads include:

- Compliance with NPDES permit limits and requirements;
- Adoption of NRCS Conservation Practices; and
- Application of Best Management Practices (BMPs) appropriate to reduce nonpoint sources.

The amount of fecal coliform delivered to a stream is difficult to determine. However, by requiring and monitoring the implementation of these management practices, their effects will improve stream water quality, and represent a beneficial measure of TMDL implementation.

Fecal Coliform Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Broad River	7.87E+13	-	-	3.55E+13	3.94E+12	3.94E+13	50
Cowpen Branch	1.31E+11	-	-	6.27E+10	6.97E+09	6.97E+10	47
Turkey Branch	1.28E+11	-	-	1.12E+11	1.25E+10	1.25E+11	2

Notes: [1] The assigned fecal coliform load from each NPDES permitted facility for WLA was determined as the product of the fecal coliform permit limit and the facility average monthly discharge at the time of the critical load.

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are categorized with respect to designated uses as supporting or not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that addresses the assessment process, and are published in *Water Quality in Georgia* (GA EPD, 2006 – 2007). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

Some of the 305(b) not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the 2008 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality.

The list identifies the waterbodies that are not supporting their designated use classifications, due to exceedances of water quality standards for fecal coliform bacteria. Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. Table 1 presents the three streams of the Savannah River Basin included on the 2008 303(d) list for exceedances of the fecal coliform standard criteria.

Table 1. Water Bodies Listed on the 2008 303(d) List for Fecal Coliform Bacteria in the Savannah River Basin

Stream Segment	Location	Segment Length (miles)	Designated Use
Broad River	Deep Creek to South Fork Broad River	7	Fishing
Cowpen Branch	Headwaters to Runs Branch	7	Fishing
Turkey Branch	Headwaters to Runs Branch	13	Fishing

1.2 Watershed Description

The Savannah River Basin encompasses more than 10,570 square miles and the river forms the border between the states of South Carolina and Georgia. The Savannah River begins in the Blue Ridge Mountains of north Georgia and South Carolina where the Seneca and Tugaloo rivers meet and flow into Lake Hartwell. The Savannah River then flows southeast for more than 300 miles to the Atlantic Ocean. Upstream of Augusta, the river flows through Clark Hill Reservoir and Lake Stephens. The river flows through three geographically distinct ecoregions, beginning its meandering path in the Blue Ridge, flowing through the rich soils of

the Piedmont, and ending in the Coastal Plain, where it forms a braided network of tidal creeks that empty into the Atlantic Ocean.

The United States Geologic Survey (USGS) has divided the Savannah Basin into nine sub-basins, or Hydrologic Unit Codes (HUCs), of which seven are partially or completely located within Georgia. The HUCs located in Georgia are numbered 03060102 through 03060106, and 03060108 through 03060109. Figure 1 shows the locations of these sub-basins, and Figures 2 and 3 show the sub-basins with impaired stream segments.

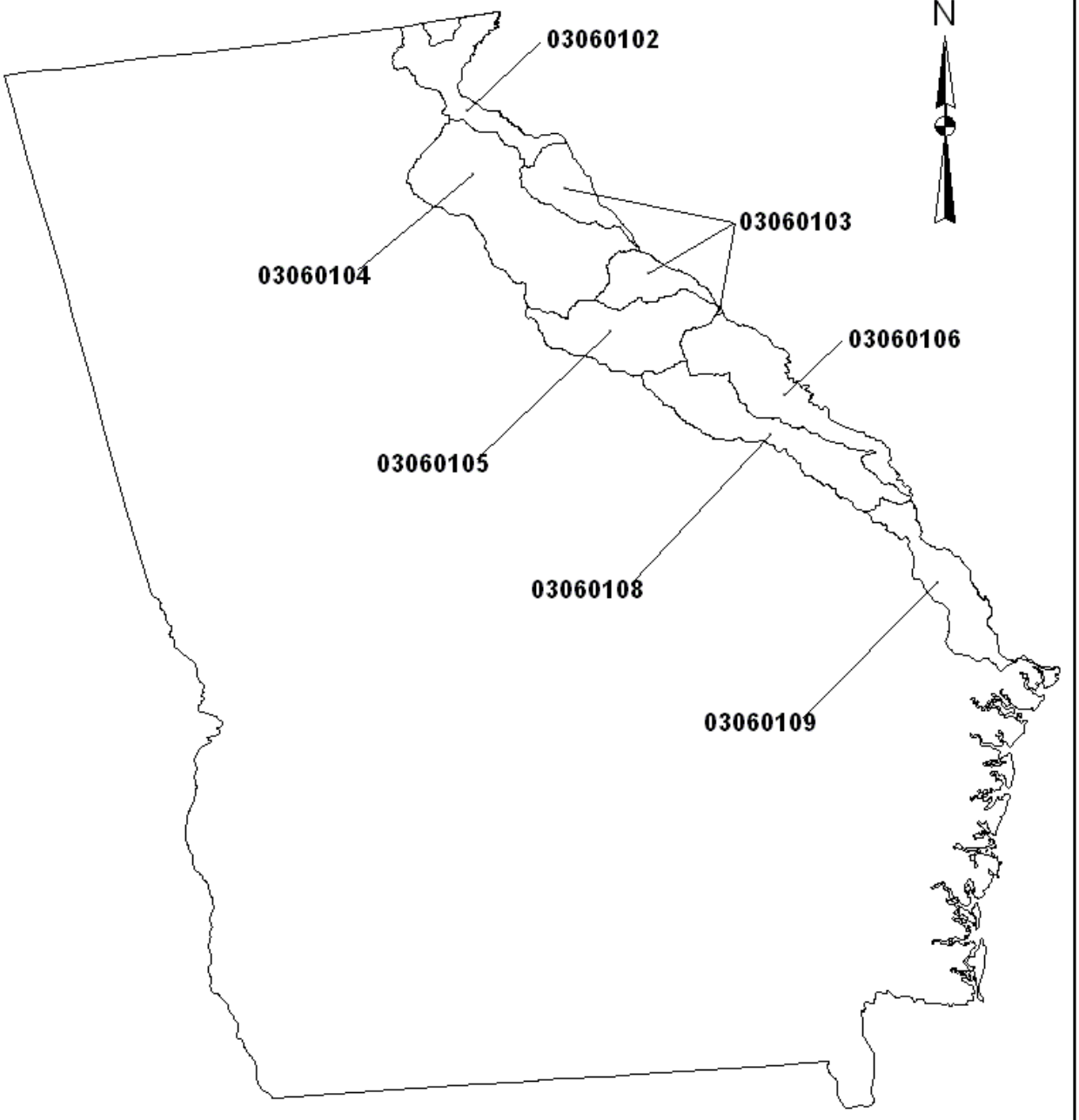
The land use characteristics of the Savannah River Basin watersheds were determined using data from the Georgia Land Use Trends (GLUT) for Year 2005. This raster land use product was developed by the University of Georgia – Natural Resources Spatial Analysis Laboratory (NARSAL) and follows land use trends for years 1974, 1985, 1991, 1998, 2001 and 2005. The raster data sets were developed from Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+). Some of the NARSAL land use types were reclassified, aggregated into similar land use types, and were used in the final watershed characterization. Table 2 lists the watershed land use distribution of the three stream segments.

1.3 Water Quality Standard

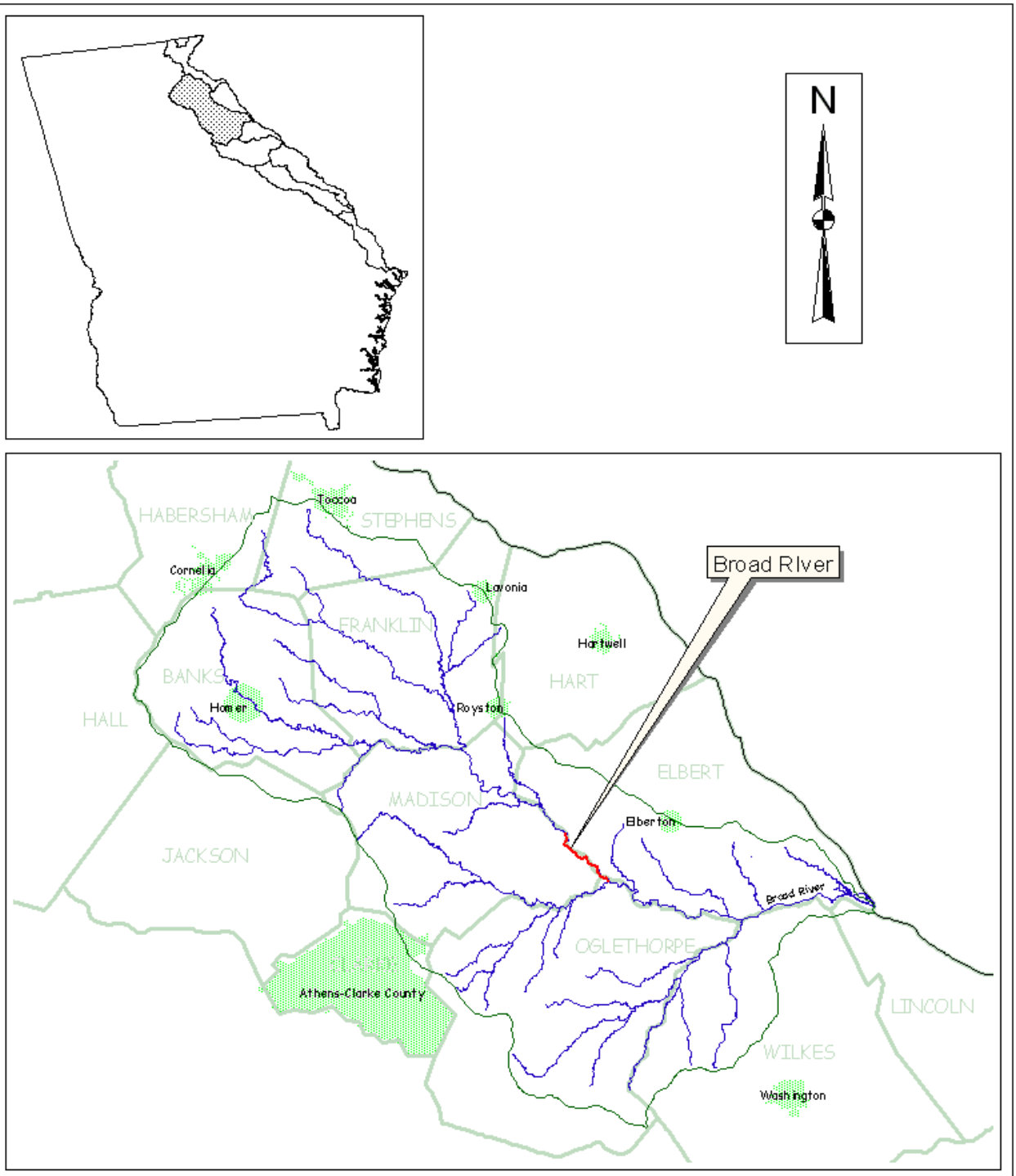
The water use classification for the listed stream segments in the Savannah River Basin is Fishing. The criterion violated is listed as fecal coliform. The potential causes listed include urban runoff, nonpoint sources, and municipal facilities. The use classification water quality standards for fecal coliform bacteria, as stated in the *State of Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (GA EPD, 2009), are:

(c) Fishing: Propagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality:

(iii) Bacteria: For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform not to exceed a geometric mean of 200 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams. For the months of November through April, fecal coliform not to exceed a geometric mean of 1,000 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 ml for any sample. The State does not encourage swimming in surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of fecal coliform. For waters designated as approved shellfish harvesting waters by the appropriate State agencies, the requirements will be consistent with those established by the State and Federal agencies responsible for the National Shellfish Sanitation Program. The requirements are found in the National Shellfish Sanitation Program Manual of Operation, Revised 1988, Interstate Shellfish Sanitation Conference, U. S. Department of Health and Human Services (PHS/FDA), and the Center for Food Safety and Applied Nutrition. Streams designated as generally supporting shellfish are listed in Paragraph 391-3-6-.03(14)



TMDL Evaluation - Fecal Coliform Savannah River Basin	Figure 1. USGS 8 Digit HUCs for Savannah River Basin



TMDL Evaluation - Fecal Coliform
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Figure 2. 303d Listed Streams in HUC 03060104

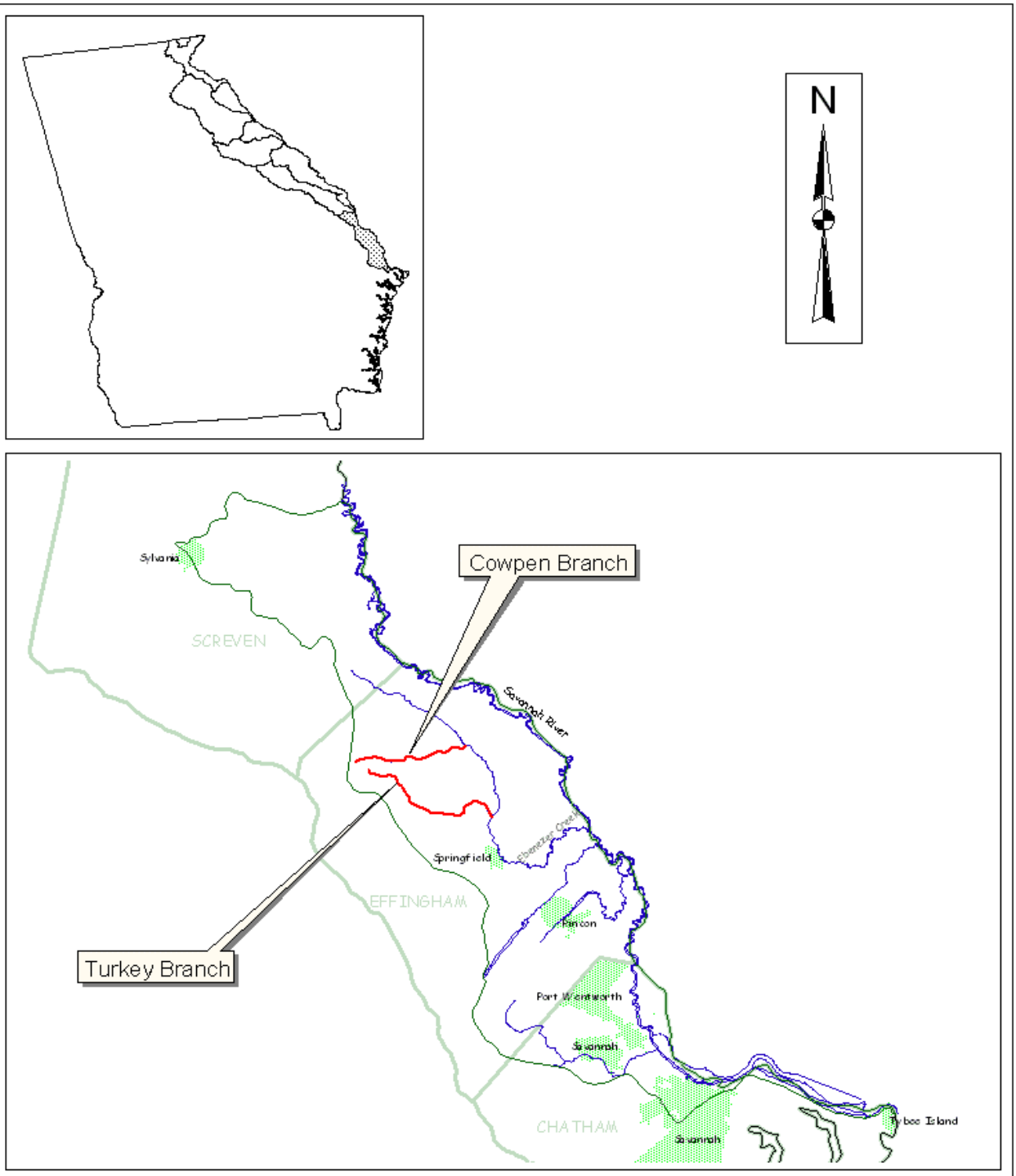

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Figure 3. 303d Listed Streams in HUC 03060109

Table 2. Savannah River Basin Land Coverage

Stream/Segment	Landuse Categories - Acres (Percent)													
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial, Industrial, Transportation	Bare Rock, Sand, Clay	Quarries, Strip Mines, Gravel Pits	Transitional	Forest	Row Crops	Pasture, Hay	Other Grasses (Urban, recreational; e.g. parks, lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Broad River	2,350	8,479	2,175	775	28	235	19,244	167,832	1,330	107,398	18,980	13,001	0	341,830
	(0.7)	(2.5)	(0.6)	(0.2)	(0.0)	(0.1)	(5.6)	(49.1)	(0.4)	(31.4)	(5.6)	(3.8)	(0.0)	(100.0)
Cowpen Branch	34	111	24	0	0	0	991	5,784	1,718	673	423	3,160	29	(12,946)
	(0.3)	(0.9)	(0.2)	(0.0)	(0.0)	(0.0)	(7.7)	(44.7)	(13.3)	(5.2)	(3.3)	(24.4)	(0.2)	(100.0)
Turkey Branch	151	190	24	2	0	0	1,623	9,209	3,136	1,398	929	6,393	103	23,157
	(0.7)	(0.8)	(0.1)	(0.0)	(0.0)	(0.0)	(7.0)	(39.8)	(13.5)	(6.0)	(4.0)	(27.6)	(0.4)	(100.0)

2.0 WATER QUALITY ASSESSMENT

Stream segments are placed on the 303(d) list as not supporting their water use classification based on water quality sampling data. A stream is placed on the not support list if more than 10% of the samples exceed the fecal coliform criteria. Water quality samples collected within a 30-day period that have a geometric mean in excess of 200 counts per 100 milliliters during the period May through October, or in excess of 1000 counts per 100 milliliters during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample maximum criterion (4000 counts per 100 milliliters) for the months of November through April.

Fecal coliform data used for TMDLs developed in this document were collected for calendar years 2002 and 2007 by the U.S. Geological Survey (USGS), and for the calendar year 2005 by GA EPD as part of the trend-monitoring program. These data are presented in Appendix A.

3.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of potential source categories. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulation of fecal coliform bacteria on land surfaces that wash off as a result of storm events.

3.1 Point Source Assessment

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. Basically, there are two categories of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated storm water discharges.

3.1.1 Wastewater Treatment Facilities

In general, industrial and municipal wastewater treatment facilities have NPDES permits with effluent limits. These permit limits are either based on federal and state effluent guidelines (technology-based limits) or on water quality standards (water quality-based limits).

The United States Environmental Protection Agency (USEPA) has developed technology-based guidelines, which establish a minimum standard of pollution control for municipal and industrial discharges without regard for the quality of the receiving waters. These are based on Best Practical Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT), and Best Available Technology Economically Achievable (BAT). The level of control required by each facility depends on the type of discharge and the pollutant.

The USEPA and the states have also developed numeric and narrative water quality standards. Typically, these standards are based on the results of aquatic toxicity tests and/or human health criteria and include a margin of safety. Water quality-based effluent limits are set to protect the receiving stream. These limits are based on water quality standards that have been established for a stream based on its intended use and the prescribed biological and chemical conditions that must be met to sustain that use.

Discharges from municipal and industrial wastewater treatment facilities can contribute fecal coliform to receiving waters. There are no NPDES permitted discharges with flows greater than 0.1 MGD identified in the Savannah River Basin that discharge treated municipal wastewater and that potentially impact streams on the 2008 303(d) list for fecal coliform bacteria.

Combined sewer systems convey a mixture of raw sewage and storm water in the same conveyance structure to the wastewater treatment plant. These are considered a component of municipal wastewater treatment facilities. When the combined sewage exceeds the capacity of the wastewater treatment plant, the excess is diverted to a combined sewage overflow (CSO) discharge point. There are no permitted CSO outfalls in the Savannah River Basin.

3.1.2 Regulated Storm Water Discharges

Some storm water runoff is covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe limits, storm water NPDES permits establish controls “to the maximum extent practicable” (MEP). Currently, regulated storm water discharges that may contain fecal coliform bacteria consist of those

associated with industrial activities including construction sites disturbing one acre or greater, and large, medium, and small municipal separate storm sewer systems (MS4s) that serve populations of 50,000 or more.

Storm water discharges associated with industrial activities are currently covered under a General Storm Water NPDES Permit. The industrial general permit requires that storm water discharging into an impaired stream segment or within one linear mile upstream of and within the same watershed as, any portion of an impaired stream segment identified as "not supporting" its designated use(s), must satisfy the requirements of Part III.C. if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to stormwater. Sampling must be conducted for the pollutant(s) from nonpoint sources identified in the TMDL as causing the impairment. This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), and record keeping.

Storm water discharges from MS4s are very diverse in pollutant loadings and frequency of discharge. At present, all cities and counties within the state of Georgia that had a population of greater than 100,000 at the time of the 1990 Census, are permitted for their storm water discharge under Phase I. This includes 60 permittees in Georgia.

Phase I MS4 permits require the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are eight Phase I MS4s in the Savannah River Basin (Table 3).

Table 3. Phase I Permitted MS4s in the Savannah River Basin

Name	Permit No.	Watershed
Augusta-Richmond County	GAS000200	Savannah
Bloomingdale	GAS000207	Savannah
Chatham County	GAS000206	Ogeechee, Savannah
Garden City	GAS000208	Ogeechee, Savannah
Pooler	GAS000209	Ogeechee, Savannah
Port Wentworth	GAS000210	Savannah
Savannah	GAS000205	Ogeechee, Savannah
Tybee	GAS000212	Ogeechee, Savannah

Source: Nonpoint Source Program, GA EPD, 2009

Small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities are permitted under the Phase II regulations in Georgia. There are three counties or communities located in the Savannah River Basin that are covered by the Phase II General Storm Water Permit (Table 4).

Table 4. Phase II Permitted MS4s in the Savannah River Basin

Name	Watershed
Augusta - Columbia County	Savannah
Grovetown	Savannah
Hephzibah	Savannah

Source: Nonpoint Source Program, GA EPD, 2009

There are no stream segments in the Savannah River Basin on the 303(d) list for fecal coliform bacteria that are located within a Phase I or Phase II MS4 city or county urbanized area.

3.1.3 Confined Animal Feeding Operations

Under the Clean Water Act, Concentrated Animal Feeding Units (CAFOs) are defined as point sources of pollution and are therefore subject to NPDES permit regulations. From 1999 through 2001, Georgia adopted rules for permitting swine and non-swine liquid manure animal feeding operations (AFOs). Georgia rules require medium size AFOs with more than 300 animal units (AU) but less than 1000 AU to apply for a non-discharge State land application system (LAS) waste disposal permit. Large operations with more than 1000 AU must apply for an NPDES permit (also non-discharge) as a CAFO. Table 5 presents the swine and non-swine liquid manure CAFOs located in the Savannah River Basin that are registered or have land application permits.

In 2002, the USEPA promulgated expanded NPDES permit regulations for CAFOs that added dry manure poultry operations larger than 125,000 broilers or 82,000 layers. Georgia is consistently among the top three states in the U.S. in terms of poultry operations. The majority of poultry farms are dry manure operations where the manure is stored for a time and then land applied. Freshly stored litter can be a nonpoint source for fecal coliform. However, land applied litter that was previously stored for an extended length of time typically exhibits very low fecal coliform levels. Current federal regulations require that large poultry farms operate under NPDES permits, but this may not apply in the future. Table 6 presents the dry manure poultry operations in the Savannah River Basin that have submitted an application for the General NPDES Permit GAG930000.

Table 5. Registered Liquid Manure CAFOs in the Savannah River Basin

Name	County	Animal Type	Total Number of Animals	Permit No.
Boling Farm	Banks	Swine	2800	GA0038172
Lee Arrendale State Prison Swine Unit	Banks	Swine	1600	GAU700000
Milky Way Dairy (Pineland Dairy # 2)	Burke	Dairy	360	GAU700000
Loudermilk Farm (Twin Line Dairy)	Elbert	Dairy	0	GAG930000
Smith's Egg Farm (Lavonia, GA)	Franklin	Layers	170000	GAG930000
Beasley Farms (Beasley Swine Farm)	Hart	Swine	4940	GAU700000
J. J. Wilson Swine Farm	Hart	Swine	-	Pending
Kinder Dairy	Hart	Dairy	320	GAU700000
Martin Dairy, LLP (Bowersville, GA)	Hart	Dairy	240	GAU700000
Yeargin Farms	Hart	Swine	-	Pending
Winfred Carey	Madison	Layers	24000	GAU700000
Winfred Carey 2	Madison	Layers	24000	GAU700000
Hillcrest Farms Inc.	McDuffie	Dairy	384	GAU700000
Whitaker Farms	McDuffie	Dairy	310	GAU700000
Cabaniss Dairy (Lakeview Farms)	Oglethorpe	Dairy	1950	GAG930000
Dean Pierce Farms (Pierce Farms)	Oglethorpe	Swine	3840	GA0038229
Gold Kist (Stephens) Gilt Center	Oglethorpe	Swine	2499	GAU700000
Mossland Farms Inc.	Oglethorpe	Swine	2450	GAU700000
Stocks Farms Inc.	Oglethorpe	Swine	1850	GAU700000
Taliaferro County Farm	Taliaferro	Swine	2450	GAU700000
A & J Dairy	Wilkes	Dairy	460	GAU700000
Smith Dairy Farms, Inc. (Comer, GA)	Wilkes	Dairy	1000	GAG930000

Source: GA Dept. of Agriculture, 2009

Table 6. Registered Dry Manure Poultry Operations in the Savannah River Basin

Name	County	Number of Animals (thousands)	Permit Number
Taylor's Egg Farm	Bacon	192	P
Banks County Pullet Farm	Banks	221	P
Hudson River Farm (K's Farms)	Banks	160	NAI
I. V. Henry	Banks	129	NAI
Max Carnes, Jr	Banks	350	NAI
T & P Farm	Banks	146	P
Turk Farm, Inc.	Banks	125	P
Wing Farm & Scales Creek Farm	Banks	169	P
Adams Poultry Farm	Elbert	132	NAI
Alan D. Mitchell	Franklin	230	NAI
Ambers Farm and Jessies Farm	Franklin	150	P
Blalock Farms	Franklin	150	P
Brian Barnes	Franklin	138	NAI
Classic Farm & R &A Farm	Franklin	283.7	P
Dawkins Farm	Franklin	200	NAI
Dennis Adams	Franklin	136	P
Edward Dowell Farm	Franklin	170	NAI
Hal Glaze Farms	Franklin	164	P
Hall Roane	Franklin	135	P
Hinson Family Partn.	Franklin	182	NAI
Hyde Farm	Franklin	172	NAI
Jack R. Keahey Farm	Franklin	132.5	NAI
Jeff and Christi Smith	Franklin	123.2	NAI
Jeffrey Osborn	Franklin	165	NAI
Kenneth Layton (Layton Farms)	Franklin	150	NAI
Kent Thomason	Franklin	150	NAI
Mag-One Farm	Franklin	126	P
Mark Macomson Farm	Franklin	150	NAI
Marvin Cole	Franklin	210	P
MB Farm	Franklin	152	NAI
Michael V. Thomason	Franklin	125.4	P
Nguyen Farm	Franklin	174	NAI
Patterson Farm	Franklin	86.9	P
R & R Farm	Franklin	150	P
Red Hill Chicken Farm	Franklin	185	NAI
Schaeffer Enterprises	Franklin	165	P
Steve Hallford	Franklin	155	NAI
Stone Bridge Farm	Franklin	126	NAI
T & A Bryant Farm, Inc.	Franklin	215	P
Tony Davison	Franklin	196	P

Table 6. Registered Dry Manure Poultry Operations in the Savannah River Basin

Name	County	Number of Animals (thousands)	Permit Number
Tracy Eaverson	Franklin	128	NAI
Wayne Ertzberger	Franklin	160	P
Abby's Farm	Hart	148	P
Brad Burton, LLC	Hart	166.2	P
Bryant Poultry, Inc.	Hart	126	P
Calvin Harms	Hart	150	NAI
Crystal Farms	Hart	144.8	P
Dale Brown (and Patti)	Hart	150	P
Emmanuel Poultry Farm	Hart	165	P
In The Woods Farm	Hart	200	NAI
Jerry Rice (J & J and S & G Farms)	Hart	158.6	NAI
Jones Farm	Hart	215	NAI
JSB Farm, Inc.	Hart	246	P
Mark Milford	Hart	120	NAI
McBay Farms	Hart	260	P
Moorhead Farms, Inc.	Hart	216	P
Oak Hills Poultry Farm, LLC	Hart	145	P
Rick McCurley	Hart	133	P
Rodney Maxwell	Hart	220	P
Stevie Duncan	Hart	160	P
T & J Farm	Hart	170	NAI
Thomas Saxon	Hart	172	P
Tim Milford Farm	Hart	120	NAI
Tim Mize	Hart	150	P
Tommy Stanton	Hart	144	P
Yeargin Farm, Inc.	Hart	128	P
Blue Water Farm, Inc.	Madison	150	NAI
Cory Smith Farm	Madison	-	NAI
Diamond S Farm	Madison	135	P
Dien V. Tran	Madison	158.6	NAI
Fred Hall Farm	Madison	155	P
Fred S. Martin (Martin Poultry)	Madison	150	P
George Chandler	Madison	150	P
Greg Mathis	Madison	135	NAI
Kim's Poultry Farm	Madison	-	NAI
Leon Rousey #586	Madison	176	NAI
Ray Dove	Madison	188	P
S & L	Madison	180	NAI
Southern Cross Farms	Madison	160.2	P
Tony Vu Farm	Madison	180	NAI
Winfred, Carey	Madison	58	NAI

Table 6. Registered Dry Manure Poultry Operations in the Savannah River Basin

Name	County	Number of Animals (thousands)	Permit Number
Allen Bridges (Bridges Dairy)	Oglethorpe	135	NAI
Chestnut Grove Farm 1 & 2	Oglethorpe	348	P
Edward Walker Farm	Oglethorpe	168	P
Evans Farms	Oglethorpe	150	P
Frankie & Alesha Ogle	Oglethorpe	125	NAI
Freddy Gilbert	Oglethorpe	150	NAI
Gretsch Farm	Oglethorpe	280	P
Jimmy Allen (Enterprises)	Oglethorpe	130	P
John N. Armour Farms	Oglethorpe	146.6	P
Keith & Jo Holloman	Oglethorpe	158	P
Larry Alexander (4A Farm)	Oglethorpe	180	P
Mallonee Farm 2	Oglethorpe	150	NAI
Mallonee Farms 1	Oglethorpe	150	NAI
Rock Bottom & Pay Dirt Farm	Oglethorpe	134	NAI
Rocky Ridge Farm	Oglethorpe	150	P
Russell Graham	Oglethorpe	138.7	NAI
Salem Oaks Farm	Oglethorpe	235	NAI
Tom Aikens	Oglethorpe	198	NAI
Wheless Farms, Inc	Oglethorpe	289.6	NAI
R.C. Robinson	Stephens	129	NAI
Willard Kesler (Diamond K Farm)	Stephens	144	P
Armour Bros. Inc. and Triple A Farms	Wilkes	448	P
Gunter Farm	Wilkes	142.5	P
Lazy L Poultry	Wilkes	204	NAI
Marty Smith	Wilkes	150	NAI

Source: GA Dept. of Agriculture, 2009
Notes: P = permit pending
NAI = needs additional information for application

3.2 Nonpoint Source Assessment

In general, nonpoint sources cannot be identified as entering a waterbody through a discrete conveyance at a single location. Typical nonpoint sources of fecal coliform bacteria include:

- Wildlife
- Agricultural Livestock
  - Animal grazing
  - Animal access to streams
  - Application of manure to pastureland and cropland
- Urban Development
  - Leaking sanitary sewer lines
  - Leaking septic systems
  - Land Application Systems
  - Landfills

In urban areas, a large portion of storm water runoff may be collected in storm sewer systems and discharged through distinct outlet structures. For large urban areas, these storm sewer discharge points may be regulated as described in Section 3.1.2.

3.2.1 Wildlife

The importance of wildlife as a source of fecal coliform bacteria in streams varies considerably, depending on the animal species present in the watersheds. Based on information provided by the Wildlife Resources Division (WRD) of GA DNR, the animals that spend a large portion of their time in or around aquatic habitats are the most important wildlife sources of fecal coliform. Waterfowl, most notably ducks and geese, are considered to potentially be the greatest contributors of fecal coliform. This is because they are typically found on the water surface, often in large numbers, and deposit their feces directly into the water. Other potentially important animals regularly found around aquatic environments include racoons, beavers, muskrats, and to a lesser extent, river otters and minks. Recently, rapidly expanding feral swine populations have become a significant presence in the floodplain areas of all the major rivers in Georgia. Population estimates of these animal species in Georgia are currently not available.

White-tailed deer populations are abundant throughout the Savannah River Basin. Fecal coliform bacteria contributions to water bodies from deer are generally considered to be less significant than that of waterfowl, racoons, and beavers. This is because a greater portion of their time is spent in terrestrial habitats. This also holds true for other terrestrial mammals such as squirrels and rabbits, and for terrestrial birds (GA WRD, 2002). However, feces deposited on the land surface can result in the introduction of fecal coliform to streams during runoff events. Between storm events, considerable decomposition of the fecal matter can occur, resulting in a decrease in the associated fecal coliform numbers.

3.2.2 Agricultural Livestock

Agricultural livestock are a potential source of fecal coliform to streams in the Savannah River Basin. The animals grazing on pastureland deposit their feces onto land surfaces, where it can then be transported during storm events to nearby streams. Animal access to pastureland varies monthly, resulting in varying fecal coliform loading rates throughout the year. Beef cattle spend all of their time in pastures, while dairy cattle and hogs are periodically confined. In addition, agricultural livestock will often have direct access to streams that pass through their pastures, and can thus impact water quality in a more direct manner (USDA, 2002).

Table 7 provides the estimated number of beef cattle, dairy cattle, goats, horse, swine, sheep, and chickens reported by county. These data were provided by the Natural Resources Conservation Service (NRCS).

Table 7. 2007 Estimated Agricultural Livestock Populations in the Savannah River Basin

County	Livestock							
	Beef Cattle	Dairy Cattle	Swine	Sheep	Horses	Goats	Chickens Layers	Chickens-Broilers Sold
Banks	11,500	-	850	150	1,750	4,400	510,000	78,336,000
Burke	11,700	3,300	35	40	650	1,300	-	-
Chatham	500	-	-	-	500	-	-	-
Clarke	1,200	300	200	160	1,000	300	1,440,000	-
Columbia	1,950	-	-	-	1,875	250	-	-
Effingham	3,900	-	1,750	-	1,100	1,100	-	-
Elbert	6,300	200	-	60	550	700	492,000	25,392,000
Franklin	15.000	-	50	100	1,000	700	1,200,000	124,500,000
Glascock	5,200	-	150	-	465	750	-	-
Greene	7,775	2,400	-	-	430	250	-	7,800,000
Habersham	13,200	-	3,633	-	1,200	4,500	800,000	92,160,000
Hart	20,300	1,050	14,300	25	380	700	3,113,000	70,963,200
Jackson	30,000	-	50	100	1,350	1,500	1,800,000	76,800,000
Jefferson	6,175	1,320	12	15	280	675	-	-
Jenkins	5,500	900	2,000	-	50	150	-	-
Lincoln	4,000	-	-	30	425	600	-	-
Madison	19,800	535	165	500	1,550	1,800	616,000	93,912,000
McDuffie	5,350	880	-	-	1,550	500	-	-
Oglethorpe	15,500	1,500	16,000	250	1,200	700	140,000	72,150,000
Rabun	2,200	-	-	-	-	200	-	2,457,600
Richmond	3,200	-	-	-	800	600	-	-
Screven	9,000	100	350	100	440	2,500	-	-
Stephens	13,090	-	20	100	340	620	200,000	20,582,400
Taliaferro	-	-	-	-	-	-	-	-
Warren	8,000	1,330	550	-	2,200	2,300	-	-
Wilkes	20,000	2,000	3,000	-	75	-	-	15,360,000

Source: NRCS, 2009

3.2.3 Urban Development

Fecal coliform from urban areas are attributable to multiple sources, including: domestic animals, leaks and overflows from sanitary sewer systems, illicit discharges, leaking septic systems, runoff from improper disposal of waste materials, and leachate from both operational and closed landfills.

Urban runoff can contain high concentrations of fecal coliform from domestic animals and urban wildlife. Fecal coliform bacteria enter streams by direct washoff from the land surface, or the runoff may be diverted to a storm water collection system and discharged through a discrete outlet structure. For large, medium, and small urban areas (populations greater than 50,000), the storm water outlets are regulated under MS4 permits (see Section 3.1.2). For smaller urban areas, the storm water discharge outlets currently remain unregulated.

In addition to urban animal sources of fecal coliform, there may be illicit connections to the storm sewer system. As part of the MS4 permitting program, municipalities are required to conduct dry-weather monitoring to identify and then eliminate these illicit discharges. Fecal coliform bacteria may also enter streams from leaky sewer pipes, or during storm events when inflow and infiltration can cause sewer overflows.

3.2.3.1 Leaking Septic Systems

A portion of the fecal coliform contributions in the Savannah River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 8 presents the number of septic systems in each county of the Savannah River Basin existing in 2002 and the number existing in 2007, based on the Georgia Department of Human Resources, Division of Public Health data. In addition, an estimate of the number of septic systems installed and repaired during the five- year period from 2002 through 2007 is given. These data show that a substantial increase in the number of septic systems has occurred in some counties. Often, this is a reflection of population increases outpacing the expansion of sewage collection systems during this period.

3.2.3.2 Land Application Systems

Many smaller communities use land application systems (LAS) for treatment of their sanitary wastewaters. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing fecal coliform bacteria to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying the wastewater, resulting in surface runoff from the field. If not properly bermed, this runoff, which probably contains fecal coliform bacteria, may discharge to nearby surface waters. There are 7 permitted LAS systems with flows of 0.1 MGD or greater located in the Savannah River Basin (Table 9).

Table 8. Number of Septic Systems in the Savannah River Basin

County	Existing Septic Systems (2002)	Existing Septic Systems (2007)	Number of Septic Systems Installed (2002 to 2007)	Number of Septic Systems Repaired (2002 to 2007)
Banks	3,596	4,779	1,183	196
Burke	10,352	11,289	937	168
Chatham	14,183	15,112	929	386
Clarke	10,219	11,416	1,197	238
Columbia	12,585	13,538	953	388
Effingham	14,047	17,208	3,161	467
Elbert	6,790	7,510	720	141
Franklin	8,200	9,565	1,365	321
Glascock	918	1,130	212	12
Greene	5,129	5,899	770	107
Habersham	10,200	12,650	2,450	538
Hart	3,590	5,200	1,610	371
Jackson	15,481	19,999	4,518	488
Jefferson	5,051	5,557	506	35
Jenkins	1,801	2,129	328	25
Lincoln	4,245	4,730	485	26
Madison	9,724	11,658	1,934	210
McDuffie	6,962	7,480	518	160
Oglethorpe	6,075	7,282	1,207	149
Rabun	10,076	11,533	1,457	239
Richmond	19,544	20,594	1,050	495
Screven	7,383	7,983	600	109
Stephens	7,727	8,726	999	353
Taliaferro	691	788	97	2
Warren	1,825	2,019	194	30
Wilkes	2,891	3,323	432	17

Source: The Georgia Dept. of Human Resources, Division of Public Health, 2009

Table 9. Permitted Land Application Systems in the Savannah River Basin

LAS Name	County	Permit No.	Type	Flow (MGD)
Coastal Water & Sewer Co	Effingham	GA02-234	Private	0.16
Effingham County South	Effingham	GA02-016	Municipal	1.0
Fieldale Corp	Stephens	GA01-369	Industrial	0.98
Grovetown Las	Columbia	GA02-222	Municipal	0.58
Hartwell Las	Hart	GA02-114	Municipal	1.75
Savannah Reuse Las	Chatham	GA02-198	Municipal	2.0
Springfield Las	Effingham	GA02-037	Municipal	0.35
Thomson Las	Mcduffie	GA02-252	Municipal	0.17

Source: Permitting Compliance and Enforcement Program, GA EPD, Atlanta, Georgia, 2009

3.2.3.3 Landfills

Leachate from landfills may contain fecal coliform bacteria that may at some point discharge into surface waters. Sanitary (or municipal) landfills are the most likely to serve as a source of fecal coliform bacteria. These types of landfills receive household wastes, animal manure, offal, hatchery and poultry processing plant wastes, dead animals, and other types of wastes. Older sanitary landfills were not lined and most have been closed. Those that remain active and have not been lined operate as construction/demolition landfills. Currently active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling. There are 114 known landfills in the Savannah River Basin (Table 10). Of these, 18 are active landfills, 5 are in the process of being closed and 90 are inactive or closed. As shown in Table 10, many of the older, inactive landfills were never permitted.

Table 10. Landfills in the Savannah River Basin

Name	County	Permit No.	Type	Status
Chambers R & B Landfill, Inc.	Banks	006-006D(SL)	Sanitary Landfill	Closed
R & B Wastes, Inc. - CR83, Homer	Banks	006-008P(RM)	Recover Materials	Inactive
Chambers R & B Landfill Site #2	Banks	006-009D(MSWL)	Municipal Solid Waste Landfill	Operating
Alto Prison	Banks	-	NA	Inactive
Banks Co. - Rucker Rd., Homer	Banks	-	NA	Inactive
Burke Co - Clarke RD (SL)	Burke	017-002D(SL)	Construction and Demolition Landfill	Operating
GA Power - Plant Vogtle #2	Burke	017-006D(LI)	Industrial Landfill	Operating
GA Power - Plant Vogtle #3	Burke	017-007D(LI)	Industrial Landfill	Operating
Hamp McGee	Burke	-	NA	Inactive
Sardis	Burke	-	NA	Inactive
Waynesboro	Burke	-	NA	Inactive
Savannah - Pate Ave.	Chatham	025-009D(L)	Dry Trash Landfill	Inactive
Garden City Landfill	Chatham	025-017D(L)	Dry Trash Landfill	Inactive
Savannah Sugar-US 17	Chatham	025-018D(LI)	Industrial Landfill	Operating
Clifton Equipment Rental Company, Inc.	Chatham	025-030D(L)	Industrial Landfill	Closed
Port Wentworth-Augstine Creek	Chatham	025-046D(L)	Dry Trash Landfill	Closed
Tybee Island-Polk Ave/Van Horne Dr	Chatham	025-048D(L)	Dry Trash Landfill	Closed
SEPCO-Grumman Rd	Chatham	025-061D(LI)	Industrial Landfill	Operating
GA DOT - Hutchinson Island	Chatham	025-067D(L)	Dry Trash Landfill	Inactive
Savannah Regional Industrial Landfill, Inc.	Chatham	025-072D(L)(I)	Industrial Landfill	Operating
Continental Can	Chatham	-	NA	Inactive
Port Wentworth	Chatham	-	NA	Inactive
Savannah - Cherokee Hills	Chatham	-	NA	Inactive
Savannah Beach	Chatham	-	NA	Inactive
Tremont Road	Chatham	-	NA	Inactive
Harlem Blythe Road Landfill	Columbia	036-003D(L)	Dry Trash Landfill	Inactive
Grovetown-Newmantown Rd	Columbia	036-006D(L)	Construction and Demolition Landfill	Closed
Harlem - Lamkin Rd	Columbia	036-007D(L)	Construction and Demolition Landfill	In-Closure
Columbia Co.-Baker Place Rd, PH 2	Columbia	036-010D(SL)	Municipal Solid Waste Landfill	Closed
Columbia Co.-Baker Place Rd, PH 1	Columbia	036-010D(SL)(1)	Sanitary Landfill	Closed
Reeves-Frontage/Buff Rds (L)	Columbia	036-012D(L)	Dry Trash Landfill	Closed
Columbia Co.-Sample & Son	Columbia	036-017D(C&D)	Construction and Demolition Landfill	Operating
Columbia Co. – I-20	Columbia	-	NA	Inactive
Cooper Cliatt - Hwy 232	Columbia	-	NA	Inactive
Elliots Cont. Ser. Inc.	Columbia	-	NA	Inactive
Gus Dunn - Washington Rd. & Kiokee Cr	Columbia	-	NA	Inactive
Harlem - Hinton Wilson Rd.	Columbia	-	NA	Inactive
Harry Mills - Fury's Ferry Rd.	Columbia	-	NA	Inactive
Sullivan - Hartsfield Rd.	Columbia	-	NA	Inactive
Effingham Co.-SR 119 W Springfield	Effingham	051-007D(L)	Dry Trash Landfill	Closed
SEPCO, Plant Mcintosh (LI)	Effingham	051-008D(LI)	Industrial Landfill	Operating
Ft Howard Paper (LI)	Effingham	051-009D(LI)	Industrial Landfill	Operating

Table 10. Landfills in the Savannah River Basin

Name	County	Permit No.	Type	Status
Rincon	Effingham	-	NA	Inactive
Springfield	Effingham	-	NA	Inactive
Westwood Heights	Effingham	-	NA	Inactive
Elberton-Old Middleton Rd PH 1	Elbert	052-002D(SL)	Sanitary Landfill	Closed
Elberton-Old Middleton Rd PH 2	Elbert	052-006D(SL)	Sanitary Landfill	Closed
Elbert Co.- Hull Chapel Rd PH 1	Elbert	052-008D(SL)	Sanitary Landfill	In-Closure
Bobby Brown St. Park	Elbert	-	NA	Inactive
Bowman	Elbert	-	NA	Inactive
Elberton – Elbert Co.	Elbert	-	NA	Inactive
Lavonia-Bear Creek Rd PH 1	Franklin	059-006D(SL)	Sanitary Landfill	Closed
Franklin Co. Harrison Bridge Rd PH	Franklin	059-008D(SL)	Unlined Sanitary Landfill	Closed
Lavonia-Bear Creek Rd PH 2	Franklin	059-009D(SL)	Sanitary Landfill	Closed
Franklin Co. Harrison Bridge MRF	Franklin	059-010P(RM)	Recover Materials	Inactive
Carnesville	Franklin	-	NA	Inactive
Poplar Springs	Franklin	-	NA	Inactive
Royston	Franklin	-	NA	Inactive
Habersham Co.- SR 13	Habersham	068-020D(SL)	Municipal Solid Waste Landfill	Operating
Hart Co.-SR 172 S PH 1&2	Hart	073-002D(SL)	Sanitary Landfill	Closed
Hart Co.-SR 172 S PH 3	Hart	073-005D(SL)	Sanitary Landfill	Closed
Commerce-Pigeon St	Jackson	078-007D(L)	Dry Trash Landfill	Closed
Wrens-Industrial St	Jefferson	081-009D(SL)	Sanitary Landfill	Closed
Lincoln Co.- Petersburg Road	Lincoln	090-002D(SL)	Sanitary Landfill	Inactive
Lincoln Co.- CR 121/Prater	Lincoln	090-004D(SL)	Sanitary Landfill	Closed
Lincolnton	Lincoln	-	NA	Inactive
Madison Co.	Madison	095-003D(SL)	Sanitary Landfill	Inactive
Madison Co.- Sanitary Landfill 2&3	Madison	095-006D(SL)	Sanitary Landfill	Closed
Madison Co.	Madison	095-008D(SL)	Sanitary Landfill	Inactive
McDuffie County Dallas Dr.	McDuffie	097-004D(SL)	Sanitary Landfill	Inactive
McDuffie County Dallas Dr. Landfill	McDuffie	097-006D(L)	Dry Trash Landfill	Inactive
McDuffie County -Mesena Rd PH 1	McDuffie	097-007D(SL)	Sanitary Landfill	Closed
James-SR 17 S	McDuffie	097-009D(L)	Construction and Demolition Landfill	In-Closure
Williams- Mesena Rd	McDuffie	097-010D(L)	Dry Trash Landfill	In-Closure
McDuffie Co. - Wrightsboro Rd/Moore Rd	McDuffie	097-012D(SL)	Sanitary Landfill	Inactive
National Homes (Pass - Brailsford)	McDuffie	-	NA	Inactive
Royal Trucking Co. (Pass - Brailsford)	McDuffie	-	NA	Inactive
Oglethorpe Co.-US 78	Oglethorpe	109-002D(SL)	Construction and Demolition Landfill	Closed
Oglethorpe Co.-US 78 PH 1	Oglethorpe	109-002D(SL)-(1)	Sanitary Landfill	Closed
Oglethorpe Co. - US 78 PH 2	Oglethorpe	109-003D(C&D)	Construction and Demolition Landfill	Operating
Hwy 441	Rabun	119-001D(SL)	Sanitary Landfill	Inactive
Rabun Co.-Eastman Mtn Rd #2	Rabun	119-005D(SL)	Sanitary Landfill	Closed
Rabun Co.-Boggs Mtn Rd	Rabun	119-006D(C&D)	Construction and Demolition Landfill	Operating
Rabun Co Dump	Rabun	-	NA	Inactive
Richmond Co. - RCC1 - Arkard Street	Richmond	121-001D(SL)	Sanitary Landfill	Inactive

Table 10. Landfills in the Savannah River Basin

Name	County	Permit No.	Type	Status
Richmond Co.- RCC1 - Arkard Street PH2	Richmond	121-009D(SL)	Sanitary Landfill	Inactive
US ARMY-FT Gordon 17th St	Richmond	121-010D(SL)	Sanitary Landfill	Closed
Richmond Co. - RCC1 - Arkard Street	Richmond	121-011D(SL)	Sanitary Landfill	Closed
Augusta-Goodrich St	Richmond	121-012D(L)	Dry Trash Landfill	Closed
US ARMY- FT Gordon Gibson Rd PH 1-3	Richmond	121-014D(SL)	Construction and Demolition Landfill	Operating
Richmond Co. - Dean Bridge Rd PH 2A	Richmond	121-015D(SL)	Sanitary Landfill	Closed
Richmond Co. - Dean Bridge Rd PH 2C	Richmond	121-016D(SL)	Municipal Solid Waste Landfill	Operating
Richmond Co. - Dean Bridge Rd PH 2B	Richmond	121-016D(SL)-(2B	Sanitary Landfill	Closed
Federal Paper Board - Sludge Lagoon	Richmond	CON001	Industrial Landfill	Operating
Blackstone - Harrison - Wheeler Rd.	Richmond	-	NA	Inactive
Old Augusta Site	Richmond	-	NA	Inactive
Richmond Co. - Hwy 56 Loop	Richmond	-	NA	Inactive
Richmond Co. Corr. Inst Landfill	Richmond	-	NA	Inactive
Stephens Co. - SR 145 Ph. 2 + 3	Stephens	127-002D(SL)	Sanitary Landfill	Inactive
Stephens Co.-SR 145 PH 2&3	Stephens	127-003D(SL)	Construction and Demolition Landfill	Operating
Buena Vista Rd. Dump	Stephens	-	NA	Inactive
Martin	Stephens	-	NA	Inactive
Stephens Co. (Co. Farm Rd.)	Stephens	-	NA	Inactive
Toccoa	Stephens	-	NA	Inactive
Taliaferro Co.-US 278 Crawfordville	Taliaferro	131-001D(SL)	Sanitary Landfill	Closed
Taliaferro Co.-CR 10 PH 1	Taliaferro	131-002D(SL)	Sanitary Landfill	Closed
Taliaferro Co.-CR 10 PH 2	Taliaferro	131-003D(SL)	Sanitary Landfill	In-Closure
Thiele Kaolin-CR 101	Warren	081-007D(LI)	Industrial Landfill	Operating
Camak	Warren	-	NA	Inactive
Norwood	Warren	-	NA	Inactive
Wilkes CO-CR 40	Wilkes	157-003D(SL)	Sanitary Landfill	Closed
Wilkes County - CR 40	Wilkes	157-003D(SL)	Sanitary Landfill	Inactive
Wilkes Co. - CR40 PH2	Wilkes	157-004D(MSWL)	Municipal Solid Waste Landfill	Inactive
Washington	Wilkes	-	NA	Inactive

Source: Land Protection Branch, GA DNR, 2009

4.0 ANALYTICAL APPROACH

The process of developing fecal coliform TMDLs for the Savannah River Basin listed segments includes the determination of the following:

- The current critical fecal coliform load to the stream under existing conditions;
- The TMDL for similar conditions under which the current load was determined; and
- The percent reduction in the current critical fecal coliform load necessary to achieve the TMDL.

The calculation of the fecal coliform load at any point in a stream requires the fecal coliform concentration and stream flow. The Loading Curve Approach was used to determine the current fecal coliform load and the TMDL. For the listed segments, fecal coliform sampling data were sufficient to calculate at least one 30-day geometric mean to compare with the regulatory criteria (see Appendix A).

4.1 Loading Curve Approach

For those segments in which sufficient water quality data were collected to calculate at least one 30-day geometric mean that was above the regulatory standard, the loading curve approach was used. This method involves comparing the current critical load to summer and winter seasonal TMDL curves.

The USGS monitored some of the listed segments and collected stream flow information concurrently with water quality samples. Stream depths were measured and used to determine stream flows, based on rating curves developed by the USGS for each sampling location.

In cases where no stream flow measurements were available, flow on the day the fecal coliform samples were collected was estimated using data from a nearby USGS gaged stream. The nearby stream had relatively similar watershed characteristics, including landuse, slope, and drainage area. The stream flows were estimated by multiplying the gaged flow by the ratio of the listed stream drainage area to the gaged stream drainage area. Table 11 lists those segments for which no flow data were available and indicates the gaged station that was used to estimate the flow.

Table 11. Stream Segments with Estimated Flows and Corresponding USGS Flow Gages

Stream Segment	Location	USGS Station Name	Station No.
Cowpen Branch	Headwaters to Runs Branch	Ebenezer Creek At Springfield, Ga	0 2198690
Turkey Branch	Headwaters to Runs Branch	Ebenezer Creek At Springfield, Ga	0 2198690

The current critical loads were determined using fecal coliform data collected within a 30-day period to calculate the geometric means, and multiplying these values by the arithmetic means of the flows measured at the time the water quality samples were collected. Georgia's instream fecal coliform standards are based on a geometric mean of samples collected over a 30-day period, with samples collected at least 24 hours apart. To reflect this in the load calculation, the

fecal coliform loads are expressed as 30-day accumulated loads with units of counts per 30 days. This is described by the equation below:

$$L_{critical} = C_{geomean} \times Q_{mean}$$

Where:

$L_{critical}$ = current critical fecal coliform load
$C_{geomean}$ = fecal coliform concentration as a 30-day geometric mean
Q_{mean} = stream flow as an arithmetic mean

The current estimated critical load is dependent on the fecal coliform concentrations and stream flows measured during the sampling events. The number of events sampled is usually 16 per year. Thus, these loads do not represent the full range of flow conditions or loading rates that can occur. Therefore, it must be kept in mind that the current critical loads used only represent the worst-case scenario that occurred among the time periods sampled.

The maximum fecal coliform load at which the instream fecal coliform criteria will be met can be determined using a variation of the equation above. By setting C equal to the seasonal, instream fecal coliform standard, the load will equal the TMDL. However, the TMDL is dependent on stream flow. Figures in Appendix A graphically illustrate that the TMDL is a continuum for the range of flows (Q) that can occur in the stream over time. There are two TMDL curves shown in these figures. One represents the summer TMDL for the period May through October when the 30-day geometric mean standard is 200 counts/100 mL. The second curve represents the winter TMDL for the period November through April when the 30-day geometric mean standard is 1,000 counts/100 mL. The equations for these two TMDL curves are:

$$TMDL_{summer} = 200 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

$$TMDL_{winter} = 1{,}000 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

The graphs show the relationship between the current critical load ($L_{critical}$) and the TMDL. The TMDL for a given stream segment is the load for the mean flow corresponding to the current critical load. This is the point where the current load exceeds the TMDL curve by the greatest amount. This critical TMDL can be represented by the following equation:

$$TMDL_{critical} = C_{standard} \times Q_{mean}$$

Where:

$TMDL_{critical}$ = critical fecal coliform TMDL load
$C_{standard}$ = seasonal fecal coliform standard (as a 30-day geometric mean)
summer - 200 counts/100 mL
winter - 1,000 counts/ 100 mL
Q_{mean} = stream flow as an arithmetic mean (same as used for $L_{critical}$)

A 30-day geometric mean load that plots above the respective seasonal TMDL curve represents an exceedance of the instream fecal coliform standard. The difference between the current critical load and the TMDL curve represents the load reduction required for the stream segment to meet the appropriate instream fecal coliform standard. There is also a single sample maximum criterion (4,000 counts per 100 milliliters) for the months of November through April.

If a single sample exceeds the maximum criterion, and the seasonal geometric mean criteria is also exceeded, then the TMDL is based on the criteria exceedance requiring the largest load reduction. The load reduction can be expressed as follows:

$$\text{Load Reduction} = \frac{L_{critical} - TMDL_{critical}}{L_{critical}} \times 100$$

5.0 TOTAL MAXIMUM DAILY LOADS

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard, which in this case, are the seasonal fecal coliform standards. A TMDL is the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For fecal coliform bacteria, the TMDLs are expressed as counts per 30 days as a geometric mean.

A TMDL is expressed as follows:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The TMDL calculates the WLAs and LAs with margins of safety to meet the stream's water quality standards. The allocations are based on estimates that use the best available data and provide the basis to establish or modify existing controls so that water quality standards can be achieved. In developing a TMDL, it is important to consider whether adequate data are available to identify the sources, fate, and transport of the pollutant to be controlled.

TMDLs may be developed using a phased approach. Under a phased approach, the TMDL includes: 1) WLAs that confirm existing limits and controls or lead to new limits, and 2) LAs that confirm existing controls or include implementing new controls (USEPA, 1991). A phased TMDL requires additional data be collected to determine if load reductions required by the TMDL are leading to the attainment of water quality standards.

The TMDL Implementation Plan establishes a schedule or timetable for the installation and evaluation of point and nonpoint source control measures, data collection, assessment of water quality standard attainment, and if needed, additional modeling. Future monitoring of the listed segment water quality will then be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

The fecal coliform loads calculated for each listed stream segment include the sum of the total loads from all point and nonpoint sources for the segment. The load contributions to the listed segment from unlisted upstream segments are represented in the background loads, unless the unlisted segment contains point sources that had permit violations for fecal coliform. In these cases, the upstream point sources are included in the wasteload allocations for the listed segment. In situations where two or more adjacent segments are listed, the fecal coliform loads to each segment are individually evaluated on a localized watershed basis. Point source loads originating in upstream segments are included in the background loads of the downstream segment. The following sections describe the various fecal coliform TMDL components.

5.1 Waste Load Allocations

The waste load allocation is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems with NPDES effluent limits. There are no active

NPDES permitted facilities that have flows greater than 0.1 MGD with fecal coliform permit limits in the Savannah River Basin watershed that discharge into listed segments or have permit violations upstream of a listed segment.

State and Federal Rules define storm water discharges covered by NPDES permits as point sources. However, storm water discharges are from diffuse sources and there are multiple storm water outfalls. Storm water sources (point and nonpoint) are different than traditional NPDES permitted sources in four respects: 1) they do not produce a continuous (pollutant loading) discharge; 2) their pollutant loading depends on the intensity, duration, and frequency of rainfall events, over which the permittee has no control; 3) the activities contributing to the pollutant loading may include the various allowable activities of others, and control of these activities is not solely within the discretion of the permittee; and 4) they do not have wastewater treatment plants that control specific pollutants to meet numerical limits.

The intent of storm water NPDES permits is not to treat the water after collection, but to reduce the exposure of storm water to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to control pollutant discharges from each storm water outfall. Therefore, storm water NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment.

The waste load allocations from storm water discharges associated with MS4s (WLAsw) are estimated based on the percentage of urban area in each watershed covered by the MS4 storm water permit. As discussed in Section 3, no MS4s were located in the watersheds of the 303(d) listed stream segments in the Savannah Basin.

Wet and dry manure CAFOs are located within the Savannah River Basin (see Section 3.1.3). These facilities are either included under or have applied for an LAS General Permit or an NPDES General Permit. A small number have an individual NPDES permit. Presently no CAFOs discharge wastewater, and therefore, they were not provided a WLA.

5.2 Load Allocations

The load allocation is the portion of the receiving water's loading capacity that is attributed to existing or future nonpoint sources or to natural background sources. Nonpoint sources are identified in 40 CFR 130.6 as follows:

- Residual waste;
- Land disposal;
- Agricultural and silvicultural;
- Mines;
- Construction;
- Saltwater intrusion; and
- Urban storm water (non-permitted).

The LA is calculated as the remaining portion of the TMDL load available, after allocating the WLA and the MOS, using the following equation:

$$\Sigma LA = TMDL - (\Sigma WLA + \Sigma WLAsw + \Sigma MOS)$$

As described above, there are two types of load allocations: loads to the stream independent of precipitation, including sources such as failing septic systems, leachate from landfills, animals in the stream, leaking sewer system collection lines, and background loads; and loads associated with fecal coliform accumulation on land surfaces that is washed off during storm events, including runoff from saturated LAS fields. At this time, it is not possible to partition the various sources of load allocations. Table 12 presents the total load allocation expressed as counts per 30 days for the 303(d) listed streams located in the Savannah River Basin for the current critical condition. In the future, after additional data has been collected, it may be possible to partition the load allocation by source.

5.3 Seasonal Variation

The Georgia fecal coliform criteria are seasonal. One set of criteria applies to the summer season, while a different set applies to the winter season. To account for seasonal variations, the critical loads for each listed segment were determined from sampling data obtained during both summer and winter seasons, when possible. The TMDL and percent reduction given in Table 12 for each listed segment was based on the season in which the critical load occurred. The TMDLs for each season, for any given flow, are presented as equations in Section 5.5.

Analyses of the available fecal coliform data and corresponding flows were performed to determine if the fecal coliform violations occurred during wet weather (high flow) or dry weather (low flow) conditions. The flow data from each sampling site were normalized by dividing the measured flow by the product of the average annual runoff (cfs/sq mile), published in Open-File Report 82-577 (Carter, 1982), and the appropriate drainage area. Plots of the normalized flows (Q/Q_o) versus fecal coliform are shown in Appendix B. The plots do not show a consistent relationship between fecal coliform concentrations and flow. The summer and winter plots show that the fecal coliform violations occur during both high (wet weather) and low (dry weather) flow conditions.

5.4 Margin of Safety

The MOS is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative modeling assumptions to develop allocations; or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL, an explicit MOS of 10 percent of the TMDL was used. The MOS values are presented in Table 12.

5.5 Total Fecal Coliform Load

The fecal coliform TMDL for the listed stream segment is dependent on the time of year, the stream flow, and the applicable state water quality standard.

The total maximum daily seasonal fecal coliform loads for Georgia are given below:

$TMDL_{summer}$ = 200 counts (as a 30-day geometric mean)/100 mL x Q

$TMDL_{winter}$ = 1,000 counts (as a 30-day geometric mean)/100 mL x Q

$TMDL_{winter}$ = 4,000 counts (instantaneous) /100 mL x Q

For purposes of determining the necessary load reductions required to meet the instream water quality criteria, the current critical TMDL was determined. This load is the product of the applicable seasonal fecal coliform standard and the mean flow used to calculate the current critical load. It represents the sum of the allocated loads from point (WLA and WLA_{SW}) and nonpoint (LA) sources located within the immediate drainage area of the listed segment, and a margin of safety (MOS). The current critical loads and corresponding TMDLs, WLAs (WLA and WLA_{sw}), LAs, MOSs, and percent load reductions for the Savannah River Basin listed stream segments are presented in Table 12. For these calculations, there were no NPDES permitted discharges or MS4 contributions and, therefore, no fecal coliform loads for WLA or WLA_{SW}.

The relationships of the current critical loads to the TMDLs are shown graphically in Appendix A. The vertical distance between the two values represents the load reductions necessary to achieve the TMDLs. As a consequence of the localized nature of the load evaluations, the calculated fecal coliform load reductions pertain to point and nonpoint sources occurring within the immediate drainage area of the listed segment. These current critical values represent a worst-case scenario for the limited set of data. Thus, the load reductions required are conservative estimates, and should be sufficient to prevent exceedances of the instream fecal coliform standard for a wide range of conditions.

Evaluation of the relationship between instream water quality and the potential sources of pollutant loading is an important component of TMDL development, and is the basis for later implementation of corrective measures and BMPs. For the current TMDLs, the association between fecal coliform loads and the potential sources occurring within the subwatersheds of each segment was examined on a qualitative basis.

Table 12. Fecal Coliform Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Broad River	7.87E+13	-	-	3.55E+13	3.94E+12	3.94E+13	50
Cowpen Branch	1.31E+11	-	-	6.27E+10	6.97E+09	6.97E+10	47
Turkey Branch	1.28E+11	-	-	1.12E+11	1.25E+10	1.25E+11	2

Notes: [1] The assigned fecal coliform load from each NPDES permitted facility for WLA was determined as the product of the fecal coliform permit limit and the facility average monthly discharge at the time of the critical load.

6.0 RECOMMENDATIONS

The TMDL process consists of an evaluation of the subwatersheds for each 303(d) listed stream segment to identify, as best as possible, the sources of the fecal coliform loads causing the stream to exceed instream standards. The TMDL analysis was performed using the best available data to specify WLAs and LAs that will meet fecal coliform water quality criteria so as to support the use classification specified for each listed segment.

This TMDL represents part of a long-term process to reduce fecal coliform loading to meet water quality standards in the Savannah River Basin. Implementation strategies will be reviewed and the TMDLs will be refined as necessary in the next phase (next five-year cycle). The phased approach will support progress toward water quality standards attainment in the future. In accordance with USEPA TMDL guidance, these TMDLs may be revised based on the results of future monitoring and source characterization data efforts. The following recommendations emphasize further source identification and involve the collection of data to support the current allocations and subsequent source reductions.

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. The GA EPD has adopted a basin approach to water quality management that divides Georgia's major river basins into five groups. This approach provides for additional sampling work to be focused on one of the five basin groups each year and offers a five-year planning and assessment cycle. The Savannah, and Ogeechee River Basins will again receive focused monitoring in 2012.

The TMDL Implementation Plan will outline an appropriate water quality monitoring program for the listed streams in the Savannah River Basin. The monitoring program will be developed to help identify the various fecal coliform sources. The monitoring program may be used to verify the 303(d) stream segment listings. This will be especially valuable for those segments where no data, old data, or spill data resulted in the listing.

6.2 Fecal Coliform Management Practices

Based on the findings of the source assessment, NPDES point source fecal coliform loads from wastewater treatment facilities usually do not contribute significantly to the impairment of the listed stream segments. This is because these facilities are required to treat to levels corresponding to instream water quality criteria. Sources of fecal coliform in urban areas include wastes that are attributable to domestic animals, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, leaking septic systems, runoff from improper disposal of waste materials, and leachate from both operational and closed landfills. In agricultural areas, potential sources of fecal coliform may include CAFOs, animals grazing in pastures, dry manure storage facilities and lagoons, chicken litter storage areas, and direct access of livestock to streams. Wildlife, especially waterfowl can be a significant source of fecal coliform bacteria.

Management practices are recommended to reduce fecal coliform source loads to the listed 303(d) stream segments, with the result of achieving the instream fecal coliform standard criteria. These recommended management practices include:

- Compliance with NPDES permit limits and requirements;
- Adoption of NRCS Conservation Practices; and
- Application of Best Management Practices (BMPs) appropriate to agricultural or urban land uses, where applicable.

6.2.1 Point Source Approaches

Point sources are defined as discharges of treated wastewater or storm water into rivers and streams at discrete locations. The NPDES permit program provides a basis for municipal, industrial and storm water permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations.

In accordance with GA EPD rules and regulations, all discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times. In the future, all municipal and industrial wastewater treatment facilities with the potential for the occurrence of fecal coliform in their discharge will be given end-of-pipe limits equivalent to the water quality standard of 200 counts/100 mL. An exception is constructed wetland systems, which have a natural level of fecal coliform input from animals attracted to the artificial wetlands. In addition, the permits will include routine monitoring and reporting requirements.

6.2.2 Nonpoint Source Approaches

The GA EPD is responsible for administering and enforcing laws to protect the waters of the State. The GA EPD is the lead agency for implementing the State's Nonpoint Source Management Program. Regulatory responsibilities that have a bearing on nonpoint source pollution include establishing water quality standards and use classifications, assessing and reporting water quality conditions, and regulating land use activities that may affect water quality. Georgia is working with local governments, agricultural and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission, to foster the implementation of BMPs to address nonpoint source pollution. In addition, public education efforts are being targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality. The following sections describe, in more detail, recommendations to reduce nonpoint source loads of fecal coliform bacteria in Georgia's surface waters.

6.2.2.1 Agricultural Sources

The GA EPD should coordinate with other agencies that are responsible for agricultural activities in the state to address issues concerning fecal coliform loading from agricultural lands. It is recommended that information (e.g., livestock populations by subwatershed, animal access to streams, manure storage and application practices, etc.) be periodically reviewed so that watershed evaluations can be updated to reflect current conditions. It is also recommended that BMPs be utilized to reduce the amount of fecal coliform bacteria transported to surface waters from agricultural sources to the maximum extent practicable.

The following three organizations have primary responsibility for working with farmers to promote soil and water conservation, and to protect water quality:

- University of Georgia (UGA) - Cooperative Extension Service;
- Georgia Soil and Water Conservation Commission (GSWCC); and
- Natural Resources Conservation Service (NRCS).

UGA has faculty, County Cooperative Extension Agents, and technical specialists who provide services in several key areas relating to agricultural impacts on water quality.

The GA EPD designated the GSWCC as the lead agency for agricultural Nonpoint Source Management in the State. The GSWCC develops nonpoint source management programs and conducts educational activities to promote conservation and protection of land and water devoted to agricultural uses.

The NRCS works with federal, state, and local governments to provide financial and technical assistance to farmers. The NRCS develops standards and specifications for BMPs that are to be used to improve, protect, and/or maintain our state's natural resources. In addition, every five years, the NRCS conducts the National Resources Inventory (NRI). The NRI is a statistically based sample of land use and natural resource conditions and trends that covers non-federal land in the United States.

The NRCS is also providing technical assistance to the GSWCC and the GA EPD with the Georgia River Basin Planning Program. Planning activities associated with this program will describe conditions of the agricultural natural resource base once every five years. It is recommended that the GSWCC and the NRCS continue to encourage BMP implementation, education efforts, and river basin surveys with regard to river basin planning.

6.2.2.2 Urban Sources

Both point and nonpoint sources of fecal coliform bacteria can be significant in the Savannah River Basin urban areas. Urban sources of fecal coliform can best be addressed using a strategy that involves public participation and intergovernmental coordination to reduce the discharge of pollutants to the maximum extent practicable. Management practices, control techniques, public education, and other appropriate methods and provisions may be employed. In addition to water quality monitoring programs, discussed in Section 6.1, the following activities and programs conducted by cities, counties, and state agencies are recommended:

- Uphold requirements that all new and replacement sanitary sewage systems be designed to minimize discharges into storm sewer systems;

- Further develop and streamline mechanisms for reporting and correcting illicit connections, breaks, surcharges, and general sanitary sewer system problems;

- Sustained compliance with storm water NPDES permit requirements; and

- Continue efforts to increase public awareness and education towards the impact of human activities in urban settings on water quality, ranging from the consequences of industrial and municipal discharges to the activities of individuals in residential neighborhoods.

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. An allocation to a point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, GA EPD will determine whether a new or existing discharger has a reasonable potential of discharging fecal coliform levels equal to or greater than the total allocated load. The results of this reasonable potential analysis will determine the specific type of requirements in an individual facility's NPDES permit. As part of its analysis, the GA EPD will use its USEPA approved 2003 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

Georgia is working with local governments, agricultural and forestry agencies, such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission, to foster the implementation of best management practices to address nonpoint sources. In addition, public education efforts will be targeted to individual stakeholders to provide information regarding the use of best management practices to protect water quality.

6.4 Public Participation

A thirty-day public notice is being provided for this TMDL. During this time, the availability of the TMDL will be public noticed, a copy of the TMDL will be provided on request, and the public is invited to provide comments on the TMDL.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

7.1 Initial TMDL Implementation Plan

This plan identifies applicable State-wide programs and activities that may be employed to manage point and nonpoint sources of bacteria loads for three segments in the Savannah River Basin. Local watershed planning and management initiatives will be fostered, supported or developed through a variety of mechanisms. Implementation may be addressed by GA EPD initiated Watershed Improvement Projects, assessments for Section 319 (h) grant projects, the local development of watershed assessment and protection plans, and GA EPD "Targeted Outreach" to foster and support local watershed management initiatives. These procedures would supplant or replace this initial implementation plan.

7.2 Impaired Segments

This initial plan is applicable to the following waterbodies that were added to Georgia's 305(b) list of impaired waters in *Water Quality in Georgia* (GA EPD, 2006 – 2007) available on the EPD website:

Water Bodies Listed on the 2008 303(d) List for Fecal Coliform Bacteria in the Savannah River Basin

Stream Segment	Location	Segment Length (miles)	Designated Use
Broad River	Deep Creek to South Fork Broad River	7	Fishing
Cowpen Branch	Headwaters to Runs Branch	7	Fishing
Turkey Branch	Headwaters to Runs Branch	13	Fishing

Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. The current water quality standard states that four or more water samples collected within a 30-day period that have a geometric mean for fecal coliform either in excess of 200 Colony Forming Units (CFU) per 100 milliliters from May through October, or in excess of 1000 (CFU) per 100 milliliters from November through April are in violation of the bacteria water quality standard. In addition, a single sample in excess of 4000 (CFU) per 100 milliliters from November through April can also provide a basis for adding a stream segment to the 303(d) listing.

7.3 Potential Sources

An important part of the TMDL analysis is the identification of potential source categories. A source assessment characterizes the known and suspected bacteria sources in the watershed.

Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. NPDES permittees discharging treated wastewater are the

primary point sources of bacteria. Nonpoint sources of bacteria are diffuse sources that cannot be identified as entering the water body at a single location. These sources generally involve land use activities that contribute bacteria to streams during a rainfall runoff event.

NPDES point source fecal coliform loads from wastewater treatment facilities usually do not contribute to impairments. This is because these facilities are required to treat to levels corresponding to instream water quality criteria. However, point sources can and do fail, which may contribute to bacteria loads through leaks and overflows from sanitary sewer systems, CAFOs, or leachate from operational landfills.

Nonpoint sources of fecal coliform in urban areas include wastes that are attributable to domestic animals, illicit discharges of sanitary waste, leaking septic systems, runoff from improper disposal of waste materials, and leachate from closed landfills. In non-urban areas, potential sources of fecal coliform may include animals grazing in pastures, dry manure storage facilities and lagoons, chicken litter storage areas, and direct access of livestock to streams. Wildlife, especially waterfowl can be a significant source of fecal coliform bacteria.

7.4 Management Practices and Activities

GA EPD is responsible for administering and enforcing laws to protect the waters of the State and is the lead agency for implementing the State's Nonpoint Source Management Program. Georgia is working with local governments, agricultural and forestry agencies such as the Georgia Department of Agriculture, the Natural Resource Conservation Service (NRCS), the Georgia Soil and Water Conservation Commission (GSWCC), and the Georgia Forestry Commission (GFC) to foster implementation of BMPs that address nonpoint source pollution. The following management practices are recommended to reduce fecal coliform loads to stream segments:

- Sustained compliance with NPDES permit limits and requirements where applicable;
- Adoption of NRCS Conservation Practices for primarily agricultural lands;
- Application of BMPs appropriate to specific non-urban and urban land uses;
- Further development and streamlining of local jurisdictional mechanisms for identifying, reporting, and correcting illicit connections, breaks, and other sanitary sewer system problems;
- Adoption of local ordinances that address local water quality such as septic tanks, stormwater, and others; and
- Ongoing public education efforts on the sources of fecal coliform and common sense approaches to lessen the impact of this contaminant on surface waters.

Public education efforts target individual stakeholders to provide information regarding the use of BMPs to protect water quality. GA EPD will continue efforts to increase awareness and educate the public about the impact of human activities on water quality.

7.5 Monitoring

GA EPD encourages local governments and municipalities to develop water quality-monitoring programs. These programs can help pinpoint various fecal coliform sources, as well as verify the 303(d) stream segment listings. This will be particularly valuable for those segments where listing was based on limited data. In addition, regularly scheduled sampling will determine if there has been some improvement in the water quality of the listed stream segments. GA EPD is available to assist in completing a monitoring plan, preparing a Sampling Quality Assurance Plan (SQAP), and provide necessary training as needed.

7.6 Future Action

This Initial TMDL Implementation Plan includes a general approach to pollutant source identification as well as management practices to address pollutants. In the future, GA EPD will continue to determine and assess the appropriate point and non-point source management measures needed to achieve the TMDLs and also to protect and restore water quality in impaired waterbodies.

For point sources, any wasteload allocations for wastewater treatment plant facilities will be implemented in the form of water-quality based effluent limitations in NPDES permits. Any wasteload allocations for regulated storm water will be implemented in the form of best management practices in the NPDES permits. Contributions of bacteria from regulated communities may also be managed using permit requirements such as watershed assessments, watershed protection plans, and long term monitoring. These measures will be directed through current point source management programs.

GA EPD will work to develop Watershed Improvement Projects (WIPs) to address non-point source pollution. This is a process whereby GA EPD and/or Regional Commissions or other agencies or local governments, under a contract with GA EPD, will develop a Watershed Improvement Plan intended to address water quality at the small watershed level (HUC 12). These plans will be developed as resources, needs, and willing partners become available. The development of these plans may be funded via several grant sources including but not limited to Clean Water Act Section 319(h), Section 604(b), and/or Section 106 grant funds. These plans are intended for implementation upon completion.

Any Watershed Improvement Plan that specifically address waterbodies contained within this TMDL will supersede the Initial TMDL Implementation Plan once GA EPD accepts the plan. Future Watershed Improvement Plans intended to address this TMDL and other water quality concerns, written by GA EPD and for which GA EPD and/or the GA EPD Contractor are responsible, will contain at a minimum the US EPA's 9-Key Elements of Watershed Planning:

1) An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load allocations or achieve water quality standards. Sources should be identified at the subcategory level (with estimates of the extent to which they are present in the watershed (e.g., X numbers of cattle feedlots needing upgrading, Y acres of row crops needing improved bacteria control, or Z linear miles of eroded streambank needing remediation);

2) An estimate of the load reductions expected for the management measures;

3) A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

4) An estimate of the sources of funding needed, and/or authorities that will be relied upon, to implement the plan;

5) An information/education component that will be used to enhance public understanding of and participation in implementing the plan;

6) A schedule for implementing the management measures that is reasonably expeditious;

7) A description of interim, measurable milestones (e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

8) A set of criteria that can be used to determined whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

9) A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8).

The public will be provided an opportunity to participate in the development of Watershed Improvement Plans that address impaired waters and to comment on them before they are finalized.

GA EPD will continue to offer technical and financial assistance (when and where available) to complete Watershed Improvement Plans that address the impaired waterbodies listed in this and other TMDL documents. Assistance may include but will not be limited to:

- Assessments of pollutant sources within watersheds;
- Determinations of appropriate management practices to address impairments;
- Identification of potential stakeholders and other partners;
- Developing a plan for outreach to the general public and other groups;
- Assessing the resources needed to implement the plan upon completion; and
- Other needs determined by the lead organization responsible for plan development.

GA EPD will also make this same assistance available, if needed, to proactively address water quality concerns. This assistance may be in the way of financial, technical, or other aid and may be requested and provided outside of the TMDL process or schedule.

7.7 References

Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03, Water Use Classifications and Water Quality Standards, Revised November 2005.

GA EPD, 2009. Total Maximum Daily Load Evaluation for Four Stream Segments in the Savannah River Basin for Fecal Coliform, Draft July 2009.

REFERENCES

Carter, R.F., 1982. *Storage Requirements for Georgia Streams*, USGS, Water Resources Investigations, Open File Report 82-557.

Federal Register, 1990. *Federal Register, Part II: Environmental Protection Agency*, Vol. 55, No. 222, November 16, 1990.

GA EPD, 2006 – 2007. *Water Quality in Georgia,* 2006 – 2007, Georgia Department of Natural Resources, Environmental Protection Division.

GA EPD, 2001. *Savannah River Basin Management Plan 2001,* State of Georgia, Department of Natural Resources, Environmental Protection Division, Water Protection Branch.

GA EPD, 2000. *Combined Databases Of Landfills In Georgia; Historic And Current Through 1999,* State of Georgia, Department of Natural Resources, Environmental Protection Division, Land Protection Branch.

GA EPD, 2009. Personal Communications with Ms. Tamara Fischer, State of Georgia, Department of Natural Resources, Environmental Protection Division, Land Protection Branch. February-June 2009.

GA EPD, 2007. *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised February 2009,* State of Georgia, Department of Natural Resources, Environmental Protection Division, Water Protection Branch.

GA WRD, 2007. Personal Communications with Mr. Charlie Killmaster, Region IV Office, Wildlife Resources Division, Georgia Department of Natural Resources, Thomson, GA, February-May 2007.

USDA, 2009. Personal Communications with Mr. Jimmy Bramblett, Water Resources Specialist, U.S. Department of Agriculture, NRCS, 355 East Hancock Ave., Athens, GA, January 2009.

USEPA, 1991. *Guidance for Water Quality Based Decisions: The TMDL Process*, EPA 440/4-91-001, U.S. Environmental Protection Agency, Assessment and Watershed Protection Division, Washington, D.C.

Appendix A

30-day Geometric Mean Fecal Coliform Monitoring Data

2002 Though 2007 Monitoring Water Quality Stations

Stream Segment	Location	Monitoring Station No.	Monitoring Station Description
Broad River	Deep Creek to South Fork Broad River	02191300 (a)	Broad River at State Road 72 near Carlton, Ga
Cowpen Branch	Headwaters to Runs Branch	01014251 (b)	Cowpen Branch at Springfield Road near Clyo, Ga
Turkey Branch	Headwaters to Runs Branch	01014321 (b)	Turkey Branch at Sister Ferry Road near Springfield, Ga

(a) Samples collected by USGS
(b) Samples collected by GAEPD

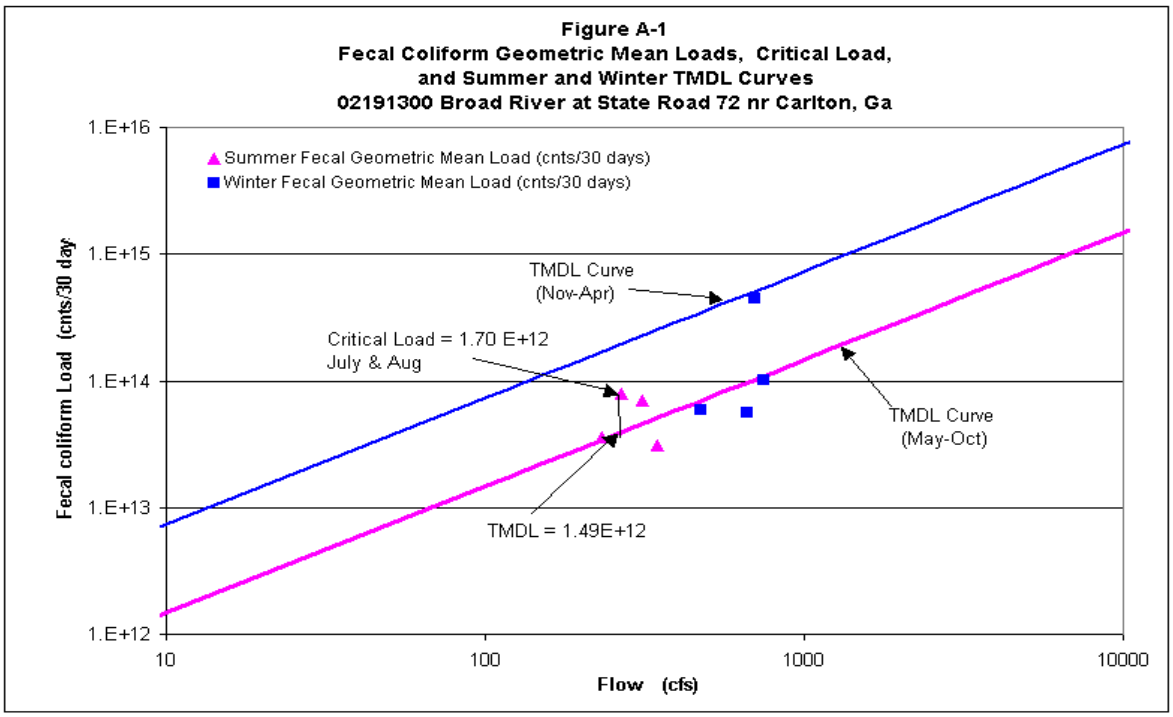


Table A-1. Data for Figure A-1

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
9-Jan-02	430	264.0				
16-Jan-02	80	220.0				
24-Jan-02	1300	1130.0				
7-Feb-02	13000	1180.0	873.2	698.5	4.48E+14	5.13E+14
3-Apr-02	2400	108.0				
9-Apr-02	130	622.0				
15-Apr-02	50	656.0				
18-Apr-02	50	520.0	167.1	476.5	5.84E+13	3.50E+14
27-Aug-02	230	63.0				
4-Sep-02	330	103.0				
12-Sep-02	20	39.0				
18-Sep-02	1300	720.0	210.8	231.3	3.58E+13	3.39E+13
3-Oct-02	170	421.0				
21-Oct-02	170	220.0				
23-Oct-02	130	215.0				
31-Oct-02	2400	387.0	308.2	310.8	7.03E+13	4.56E+13
24-Jan-07	800	942.0				
31-Jan-07	110	619.0				
7-Feb-07	20	662.0				
14-Feb-07	700	754.0	187.3	744.3	1.02E+14	5.46E+14
21-Mar-07	230	726.0				
28-Mar-07	20	671.0				
4-Apr-07	130	627.0				
17-Apr-07	300	617.0	115.7	660.3	5.61E+13	4.85E+14
17-May-07	70	401.0				
24-May-07	80	335.0				
7-Jun-07	130	263.0				
14-Jun-07	300	381.0	121.6	345.0	3.08E+13	5.06E+13
19-Jul-07	1700	335.0				
1-Aug-07	1700	398.0				
7-Aug-07	110	213.0				
15-Aug-07	**80**	**128.0**	**399.3**	**268.5**	**7.87E+13**	**3.94E+13**

Figure A-2
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
01014251 Cowpen Branch at Springfield Road near Clyo, Ga

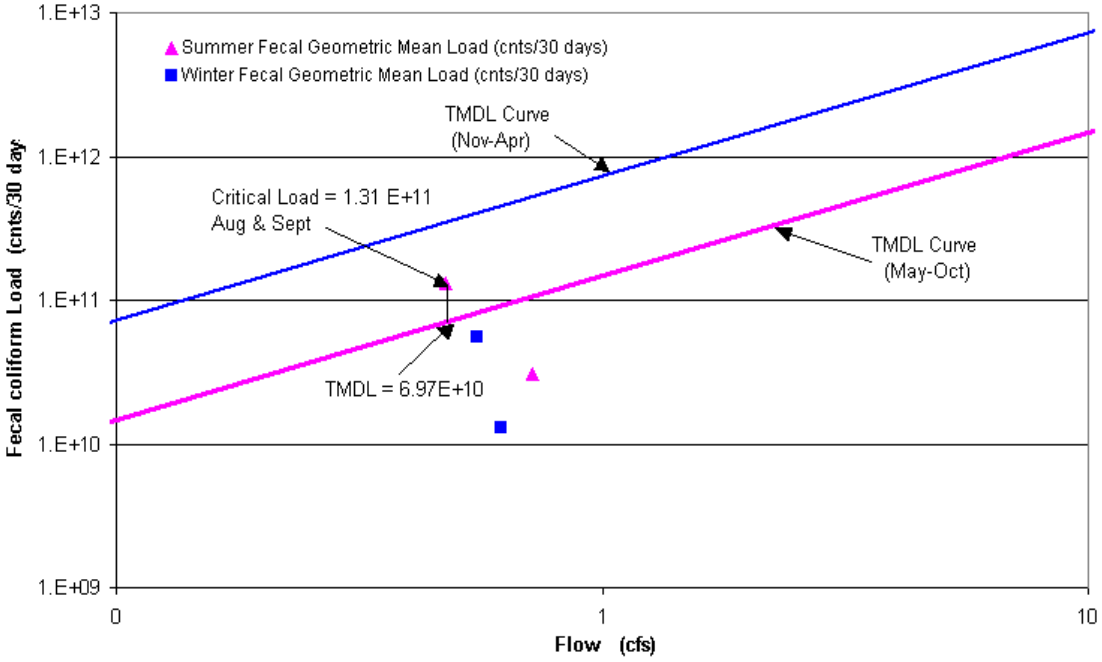


Table A-2. Data for Figure A-2

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
16-Feb-05	80	0.58				
23-Feb-05	20	0.51				
2-Mar-05	20	0.82				
9-Mar-05	20	0.57	28	0.62	1.28E+10	4.54E+11
23-May-05	20	0.50				
31-May-05	230	0.39				
6-Jun-05	130	1.14				
13-Jun-05	20	0.84	59	0.72	3.10E+10	1.05E+11
15-Aug-05	125	0.57				
22-Aug-05	16000	0.41				
29-Aug-05	500	0.58				
12-Sep-05	**20**	**0.35**	**376**	**0.47**	**1.31E+11**	**6.97E+10**
15-Nov-05	300	0.36				
21-Nov-05	3000	0.72				
30-Nov-05	20	0.50				
14-Dec-05	20	0.62	138	0.55	5.58E+10	4.05E+11

Figure A-3
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
01014321 Turkey Branch at Sister Ferry Road near Springfield, Ga

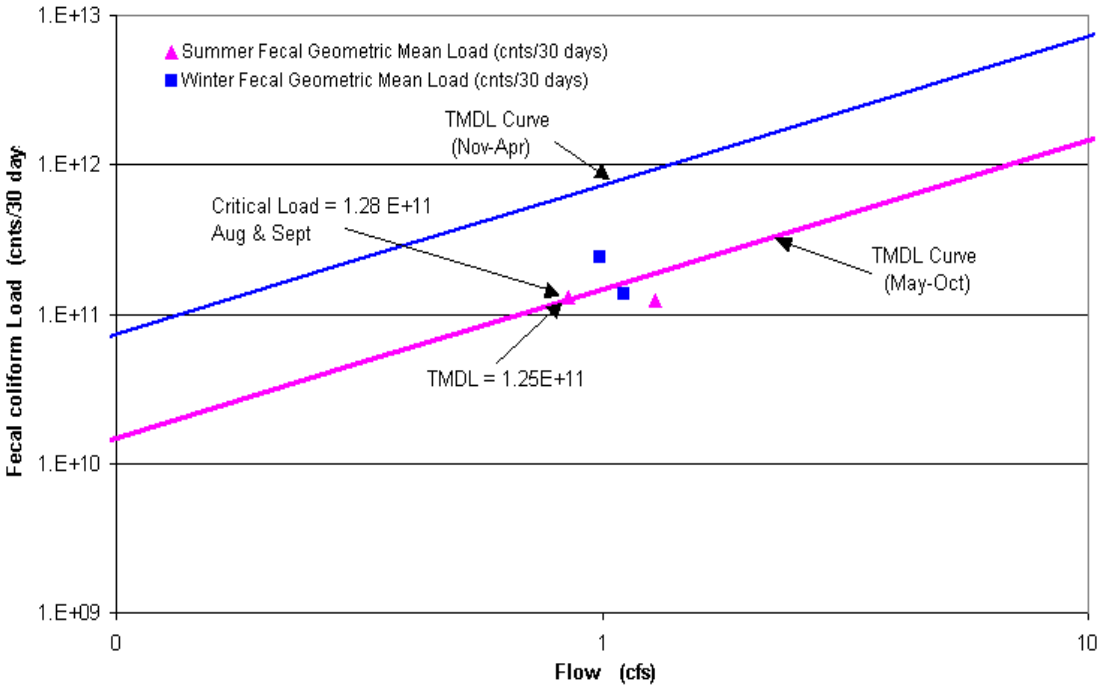
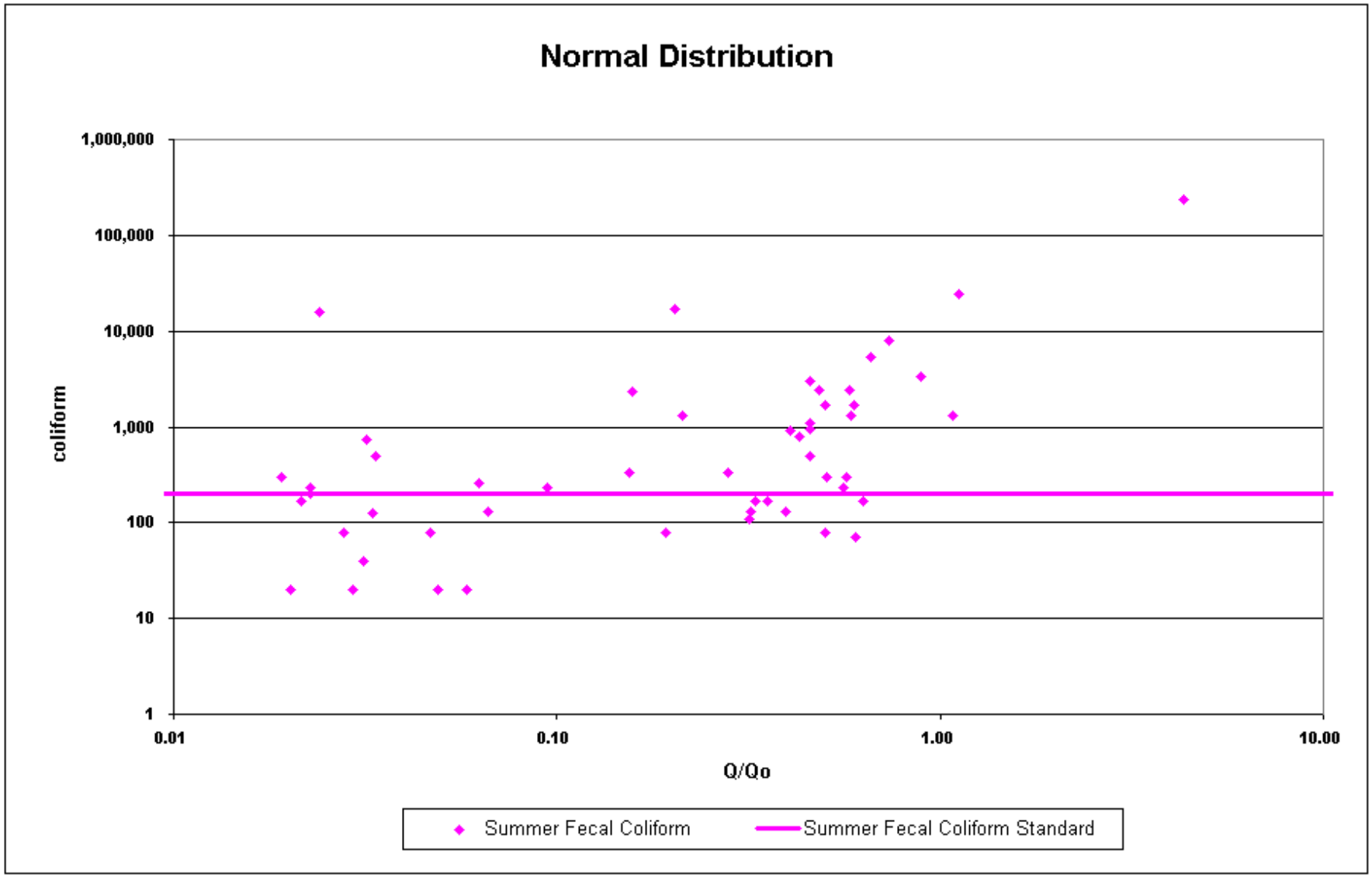


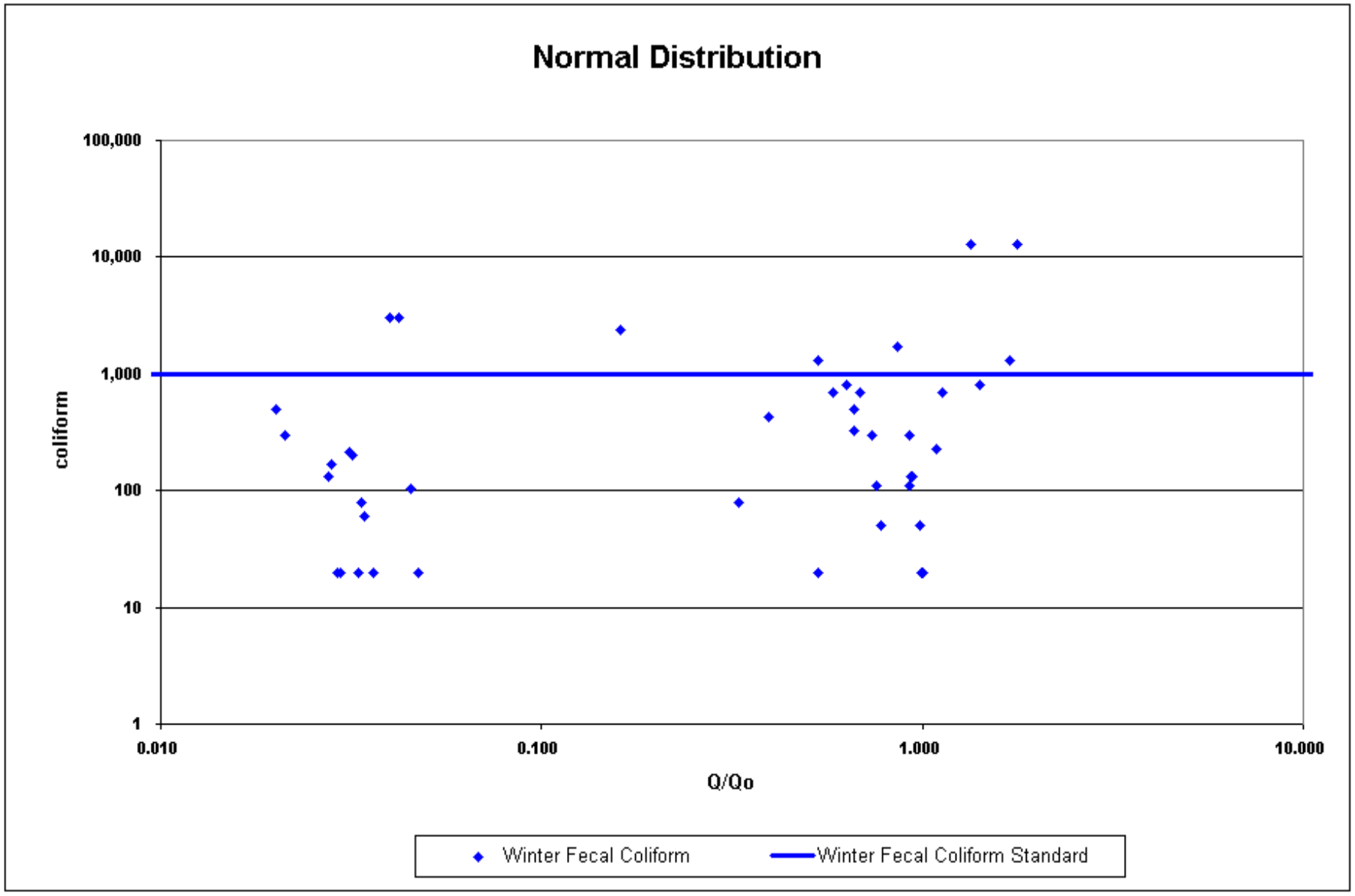
Table A-3. Data for Figure A-3

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
16-Feb-05	200	1.04				
23-Feb-05	170	0.91				
2-Mar-05	105	1.47				
9-Mar-05	215	1.02	166	1.11	1.35E+11	8.13E+11
23-May-05	80	0.90				
31-May-05	170	0.70				
6-Jun-05	260	2.04				
13-Jun-05	80	1.51	130	1.29	1.23E+11	1.89E+11
15-Aug-05	40	1.01				
22-Aug-05	200	0.74				
29-Aug-05	735	1.03				
12-Sep-05	**300**	**0.62**	**205**	**0.85**	**1.28E+11**	**1.25E+11**
15-Nov-05	500	0.65				
21-Nov-05	3000	1.30				
30-Nov-05	130	0.89				
14-Dec-05	60	1.12	329	0.99	2.39E+11	7.26E+11

Appendix B

Normalized Flows Versus Fecal Coliform Plots


Normal Distribution
1,000,000
100,000
10,000
1,000
100
10
1
coliform
0.01
0.10
1.00
10.00
Q/Qo
Summer Fecal Coliform
Summer Fecal Coliform Standard


Normal Distribution
100,000
10,000
1,000
100
10
1
coliform
0.010
0.100
1.000
10.000
Q/Qo
Winter Fecal Coliform
Winter Fecal Coliform Standard