Total Maximum Daily Load

Evaluation

for

Eleven Stream Segments

in the

Suwannee River Basin

for

Bacteria

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

October 2022

TMDL Action ID: GAR4_22_09_03 **Approved by EPA:** 01/05/2023

Table of Contents

List of Tables

List of Figures

List of Appendices

EXECUTIVE SUMMARY

The State of Georgia Environmental Protection Division (GA EPD) assesses its waterbodies for compliance with water quality criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed waterbodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These waterbodies are found on Georgia's 2022 305(b) list as required by that section of the CWA that defines the assessment process and are published in *Water Quality in Georgia 2020-2021* (GA EPD, 2022). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

The subset of the waterbodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia 2020-2021* (GA EPD, 2022). Waterbodies on the 303(d) list are denoted as Category 5, and are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard(s).

The TMDL formulations in this document are based on impaired segments contained in the 2022 305(b)/303(d) List. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a waterbody 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.

Every waterbody in the State has one or more designated uses, and each designated use has water quality criteria established to protect it. Waterbodies in Georgia are assessed based on the 305(b)/303(d) Listing Assessment Methodology included in Appendix A of *Water Quality in Georgia 2020-2021*, as such GA EPD has placed two (2) stream segments in the Suwannee River Basin on the 303(d) list of impaired waters because it was assessed as "not supporting" its designated use of "Fishing" due to violation of the fecal coliform water quality criteria. The water quality criteria when the stream segments were listed was as follows:

> 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 counts 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 counts per 100 mL (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 counts per 100 mL in lakes and reservoirs and 500 counts 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 counts 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 counts per 100 mL for any sample. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

A waterbody is assessed as "not supporting" its use if more than ten percent of the geometric means are greater than their seasonal waterbody specific criteria or if more than ten percent of the samples exceed the single sample criteria.

In January 2022, the Georgia DNR Board adopted new bacteria criteria for "Fishing" and "Drinking Water" designated uses using the bacterial indicators *E. coli* and enterococci. These bacteria are better indicators for human health illnesses. The adopted criteria have the same estimated illness rate (8 per 1000 swimmers) as the previously established fecal coliform criteria. EPA approved the proposed standards August 31, 2022. Since this TMDL was written after EPA approved the new bacteria criteria, the TMDL will use both bacterial indicators. The current *E. coli* load cannot be determined, but the TMDL will use a 0.63 conversion factor to convert from fecal coliform standards to *E. coli* standards, based on the 30-day geometric mean water quality standard. The current water quality criteria approved August 31, 2022, are as follows:

> For the months of May through October, when primary water contact recreation activities are expected to occur, culturable *E. coli* not to exceed a geometric mean of 126 counts 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. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval. For the months of November through April, culturable *E. coli* not to exceed a geometric mean of 265 counts 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. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 861 counts per 100 mL in the same 30-day interval.

A waterbody is assessed as “not supporting” its use if more than ten percent of the geometric means are greater than their seasonal criteria or if more than ten percent of the samples exceeded the STV water quality criteria cited above. 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 following storm events.

The process of developing fecal coliform bacteria TMDLs for listed segments in the Suwannee River Basin involved the determination of the following:

- The current critical bacterial 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 bacterial load necessary to achieve the TMDL.

The calculation of the bacterial load at any point in a stream requires the bacterial 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 bacterial loads and required reductions for each of the listed segments are summarized in Table 1 below.

Point and nonpoint source management practices that should be used to help reduce bacteria source loads. The amount of fecal coliform bacteria delivered to a stream is difficult to determine. However, the use of these management practices should improve stream water quality, and future monitoring will provide a measurement of TMDL implementation.

Table 1: Bacterial Loads and Required Bacterial Load Reductions

AUID	Stream Segment	Description	Bacterial Indicator	Current Load (counts/ 30 days)	TMDL Components					Reduction Required
					WLA (counts/ 30 days)(1)	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
GAR031102030104	Cypress Creek	Hardy Mill Creek to the Withlacoochee River	Fecal coliform	2.62E+12	--	--	4.27E+11	4.75E+10	4.75E+11	81.9%
			E. coli	(2)	--	--	2.69E+11	2.99E+10	2.99E+11	Undetermined (3)
GAR031102030506	Little Creek	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Creek	Fecal coliform	2.87E+10	1.51E+09	--	1.99E+10	2.37E+09	2.37E+10	17.2%
			E. coli	(2)	9.54E+08	--	1.25E+10	1.49E+09	1.49E+10	Undetermined (3)
GAR031102030705	Piscola Creek	Headwaters to Tributary 0.3 miles upstream of Pope Road	Fecal coliform	1.28E+12	--	--	1.05E+11	1.17E+10	1.17E+11	90.9%
			E. coli	(2)	--	--	6.63E+10	7.37E+09	7.37E+10	Undetermined (3)
GAR031102030706	Piscola Creek	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	Fecal coliform	1.05E+13	--	--	4.71E+12	5.23E+11	5.23E+12	50.0%
			E. coli	(2)	--	--	2.97E+12	3.29E+11	3.29E+11	Undetermined (3)
GAR031102020508	Reedy Creek	Little Brushy Creek to the Willacoochee River	Fecal coliform	6.30E+11	--	--	1.16E+11	1.29E+10	1.29E+11	79.5%
			E. coli	(2)	--	--	7.31E+10	8.13E+09	8.13E+10	Undetermined (3)
GAR031102040404	Reedy Creek	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	Fecal coliform	5.27E+11	1.51E+09	--	1.95E+10	2.34E+09	2.34E+10	95.6%
			E. coli	(2)	9.54E+08	--	1.23E+10	1.47E+09	1.47E+10	Undetermined (3)
GAR031102010201	Tatum Creek	Tower Road to Jones Creek	Fecal coliform	7.88E+11	1.89E+09	--	4.12E+11	4.60E+10	4.60E+11	41.6%
			E. coli	(2)	1.19E+09	--	2.59E+11	2.90E+10	2.90E+11	Undetermined (3)
GAR031102030507	Tributary to Little Creek	Headwaters to Little Creek	Fecal coliform	1.21E+11	1.51E+09	--	7.22E+09	9.70E+08	9.70E+09	92.0%
			E. coli	(2)	9.54E+08	--	4.55E+9	6.11E+8	6.11E+9	Undetermined (3)
GAR031102030505	Tributary to Okapilco Creek	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	Fecal coliform	1.14E+10	--	--	3.88E+09	4.31E+08	4.31E+09	62.1%
			E. coli	(2)	--	--	2.44E+09	2.72E+08	2.72E+09	Undetermined (3)
GAR031102020608	Willacoochee River	Courthouse Branch to Turkey Branch	Fecal coliform	2.77E+12	--	--	5.83E+11	6.48E+10	6.48E+11	76.6%
			E. coli	(2)	--	--	3.91E+11	4.34E+10	4.34E+11	Undetermined (3)
GAR031102010108	Woodyard Creek	Tributary 400 feet downstream US 84 to Surveyors Creek	Fecal coliform	1.64E+12	3.79E+09	--	2.38E+11	2.69E+10	2.69E+11	83.6%
			E. coli	(2)	2.38E+09	--	1.50E+11	1.69E+10	1.69E+11	Undetermined (3)

Notes:

(1) The assigned bacterial load from the NPDES permitted facility for WLA was determined as the product of the permitted flow and bacteria permit limit.
(2) Sample was not analyzed for *E. coli*, therefore critical load calculation not possible.
(3) Percent reduction could not be determined due to absence of current load calculation.

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its waterbodies for compliance with water quality criteria established for their designated uses as required by the CWA. Assessed waterbodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These waterbodies are found on Georgia's 2022 305(b) list as required by that section of the CWA that defines the assessment process and are published in *Water Quality in Georgia 2020-2021* (GA EPD, 2022). This document is available on the GA EPD website.

The subset of the waterbodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia 2020-2021* (GA EPD, 2022). Waterbodies on the 303(d) list are denoted as Category 5, and 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 TMDL formulations in this document are based on impaired segments contained in the 2022 305(b)/303(d) list. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a waterbody 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 303(d) list identifies the stream segments that are not supporting its designated use classification due to exceedances of water quality standards for bacteria. Fecal coliform, *E. coli,* and enterococci bacteria are used as indicators of the potential presence of pathogens in a stream. Table 2 presents the stream segments in the Suwannee River Basin included on the 2022 303(d) list for exceedances of the fecal coliform standard criteria.

1.2 Watershed Description

The Suwannee River Basin is located in south-central Georgia and north-central Florida. The total basin occupies an area of approximately 10,000 square miles with approximately 5,560 square miles of the basin within Georgia. The United States Geologic Survey (USGS) has divided the Suwannee River Basin into six sub-basins, or Hydrologic Unit Codes (HUCs), four of which are located in Georgia. These are numbered as HUCs 03110201 through 03110204. Figure 1 shows the location of the Suwannee River Basin in Georgia and Figure 2 shows the sub-basins of the Suwannee River. Figures 3-9 show the location of the impaired stream segment within the Suwannee River Basin.

The Basin is in the Coastal Plain physiographic provinces that extend throughout the southeastern United States. The headwaters of the Suwannee River begin in the southeastern portion of Georgia in the Okefenokee Swamp and National Wildlife Refuge, located south of Waycross. Other major cities in the Suwannee River Basin include Valdosta, Adel, Tifton, Nashville, Fitzgerald, Quitman, Moultrie, Sylvester and Ashburn. The Suwannee River has several main tributaries, including the Alapaha, Withlacoochee, Willacoochee, and Little Rivers in Georgia and the Santa Fe River in Florida. The Suwannee River flows south through Florida and eventually drains into the Gulf of Mexico near the town of Suwannee.

Table 2: Stream Segments Listed on the 2022 303(d) List for Bacteria in the Suwannee River Basin

Stream Segment	Location	Reach AUID	Segment Length (miles)	Designated Use
Cypress Creek	Hardy Mill Creek to the Withlacoochee River	GAR031102030104	2	Fishing
Little Creek	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Creek	GAR031102030506	3	Fishing
Piscola Creek	Headwaters to Tributary 0.3 miles upstream of Pope Road	GAR031102030705	3	Fishing
Piscola Creek	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	GAR031102030706	5	Fishing
Reedy Creek	Little Brushy Creek to the Willacoochee River	GAR031102020508	2	Fishing
Reedy Creek	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	GAR031102040404	6	Fishing
Tatum Creek	Tower Road to Jones Creek	GAR031102010201	11	Fishing
Tributary to Little Creek	Headwaters to Little Creek	GAR031102030507	2	Fishing
Tributary to Okapilco Creek	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	GAR031102030505	3	Fishing
Willacoochee River	Courthouse Branch to Turkey Branch	GAR031102020608	5	Fishing
Woodyard Creek	Tributary 400 feet downstream US 84 to Surveyors Creek	GAR031102010108	5.6	Fishing

The land use characteristics of the Suwannee River Basin watersheds were determined using data from the Georgia Land Use Trends (GLUT) for Year 2015. This raster land use trend 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, 2005, 2008 and 2015. Some of the NARSAL land use types were reclassified, aggregated into similar land use types, and used in the final watershed characterization. Table 3 lists the watershed land use distribution for the drainage areas of the two stream segments.

1.3 State Water Planning

The Georgia Legislature enacted the Metropolitan North Georgia Water Planning District Act in 2001 to create the Metropolitan North Georgia Water Planning District (MNGWPD) to preserve and protect water resources in the 15-county metropolitan Atlanta area. The MNGWPD is charged with the development of comprehensive regional and watershed specific water resource management plans to be implemented

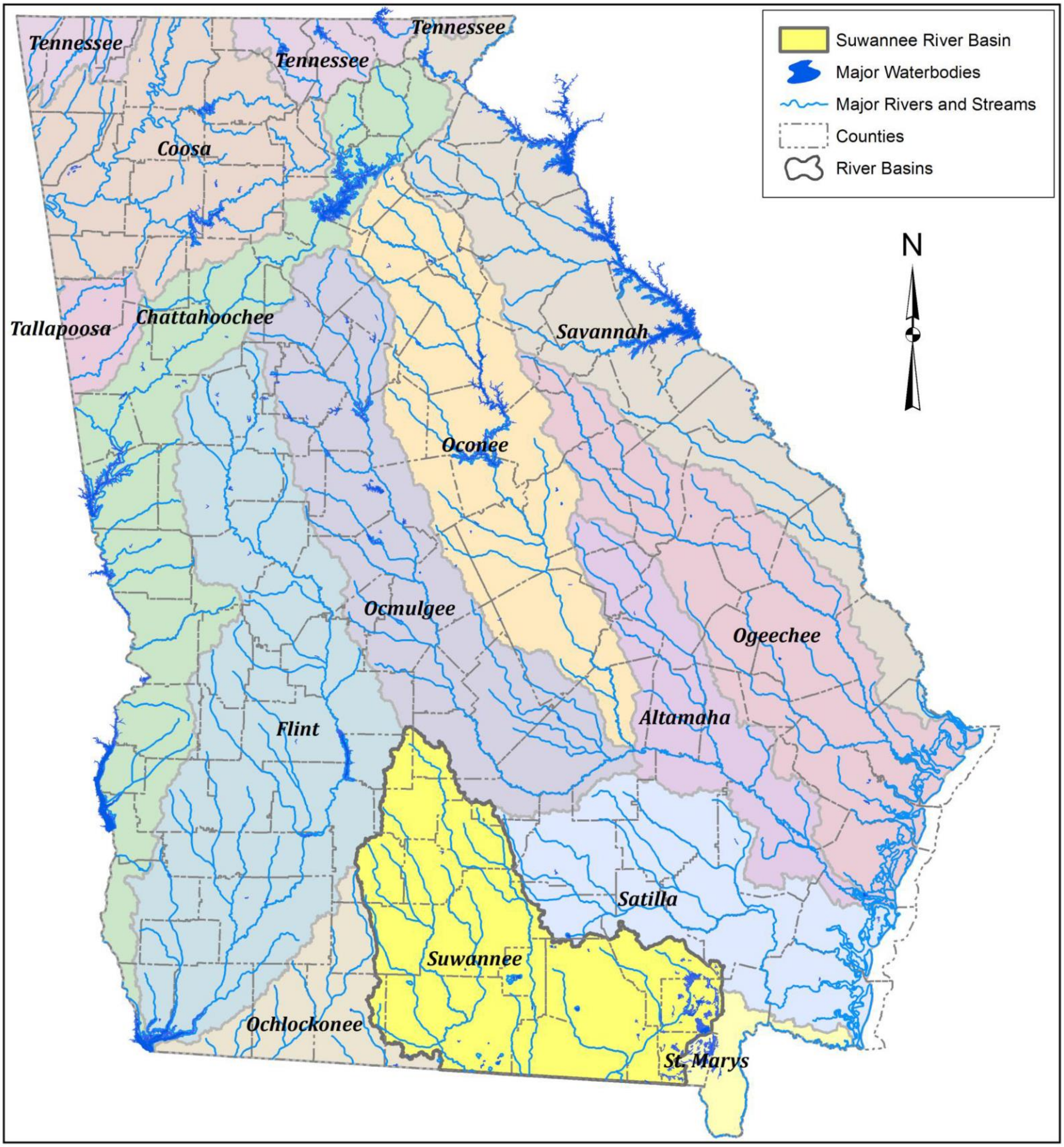

Figure 1: Location of the Suwannee River Basin in Georgia.

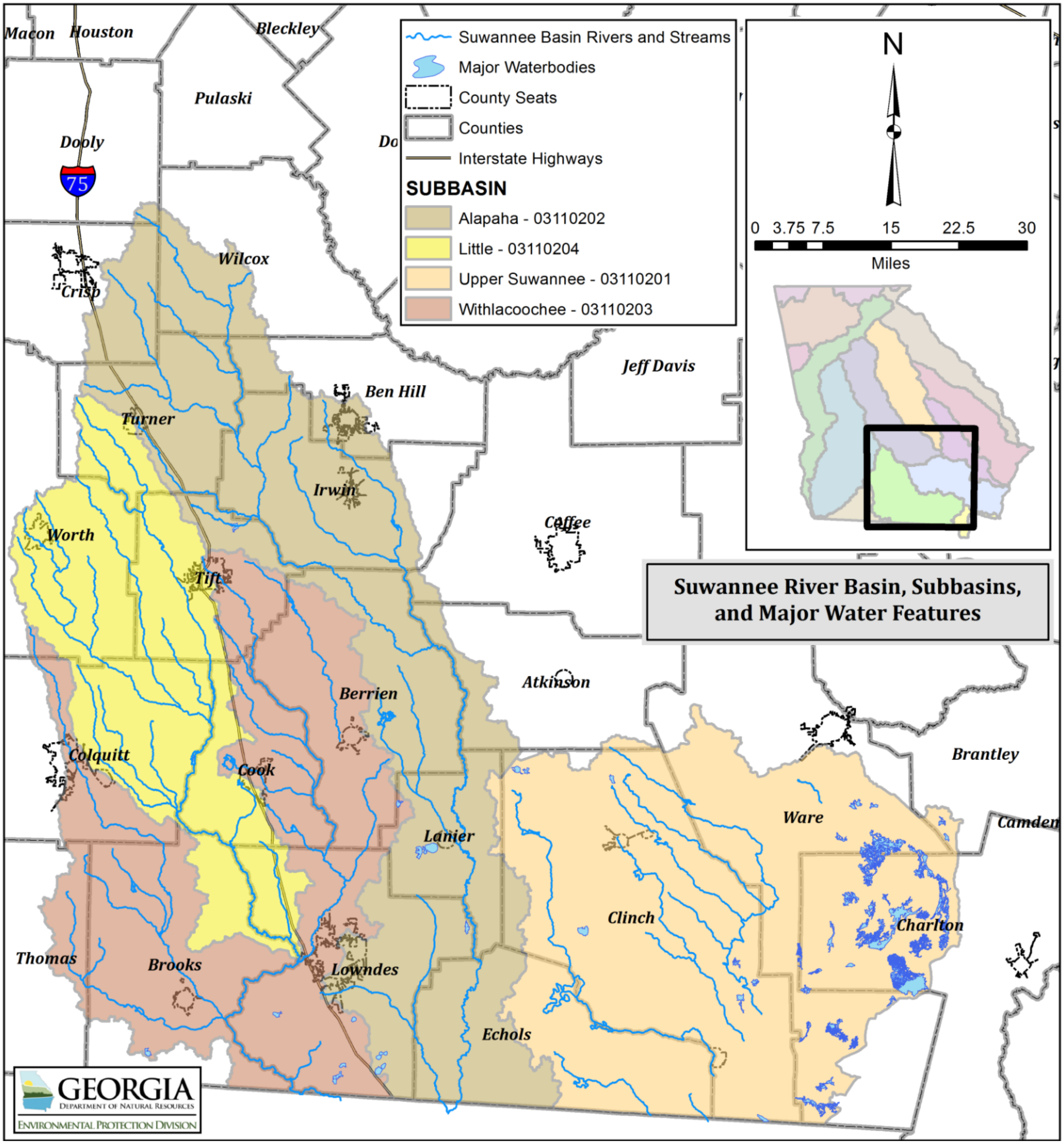

Figure 2: Major Political Boundaries, Water Features, and U.S.G.S. 8-digit HUC

Figure 3: Impaired Stream Segment of Cypress Creek

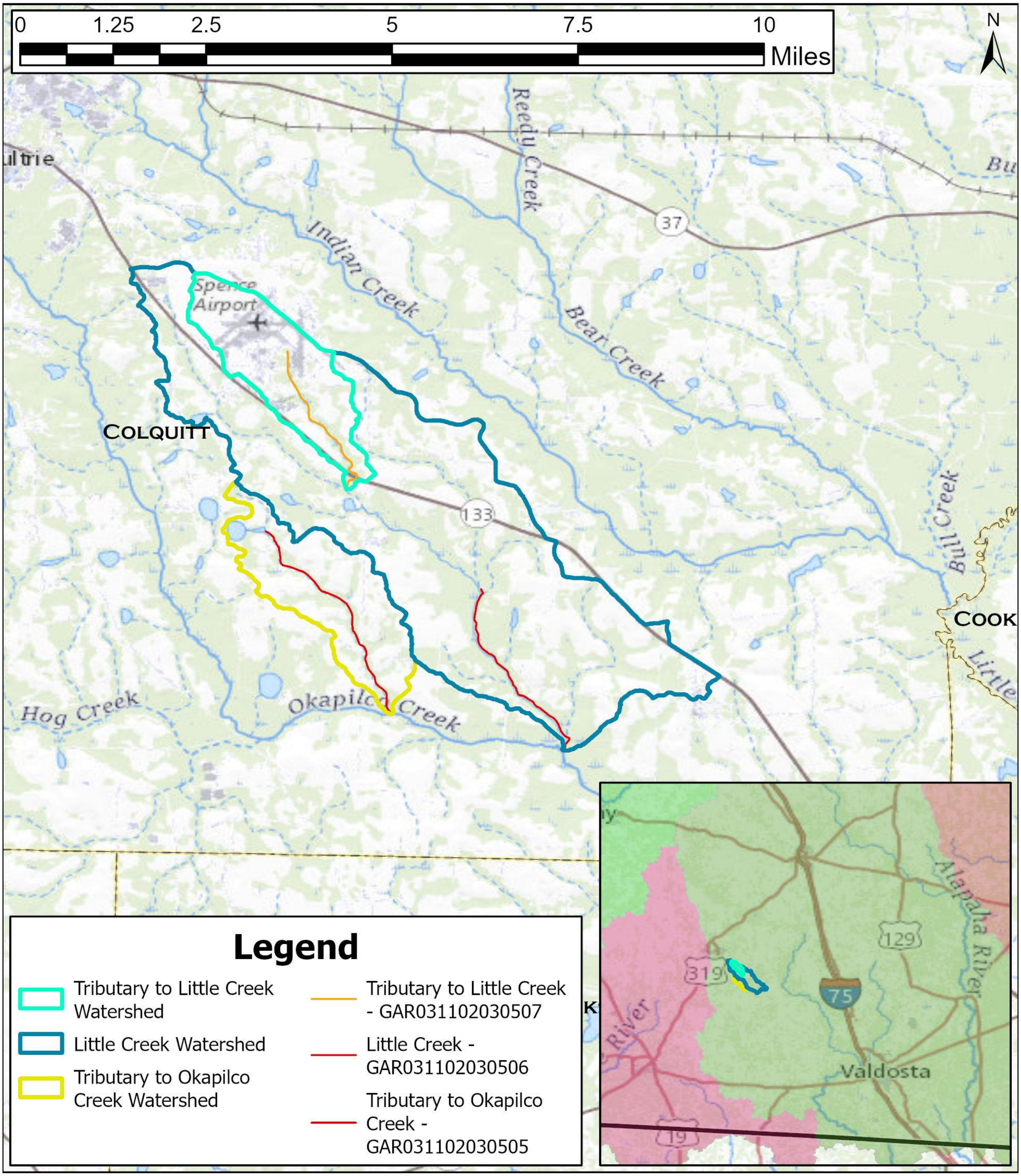

Figure 4: Impaired Stream Segments of Little Creek, tributary to Little Creek, and Tributary to Okapilco Creek

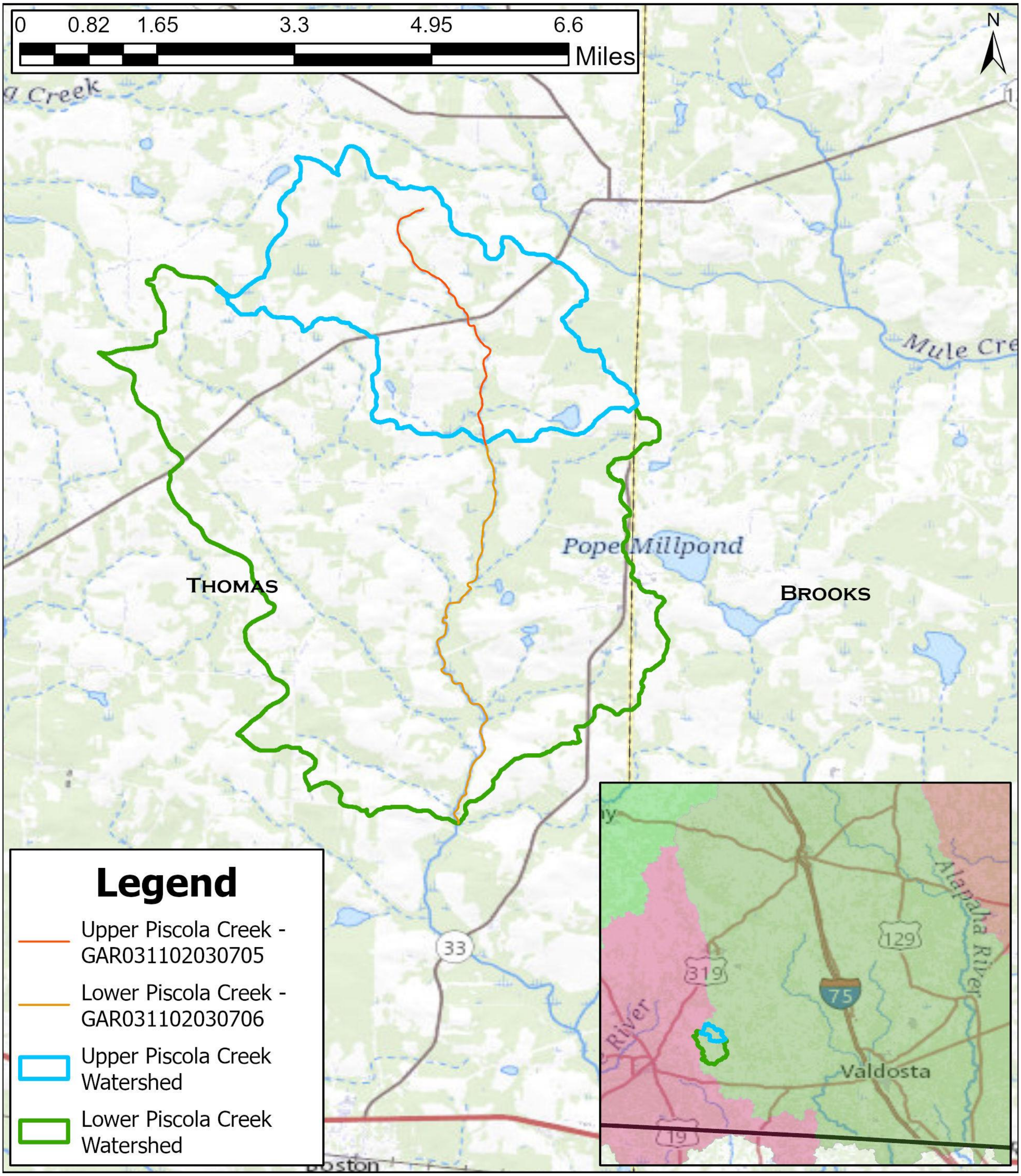

Figure 5: Impaired Stream Segments of Upper and Lower Piscola Creek

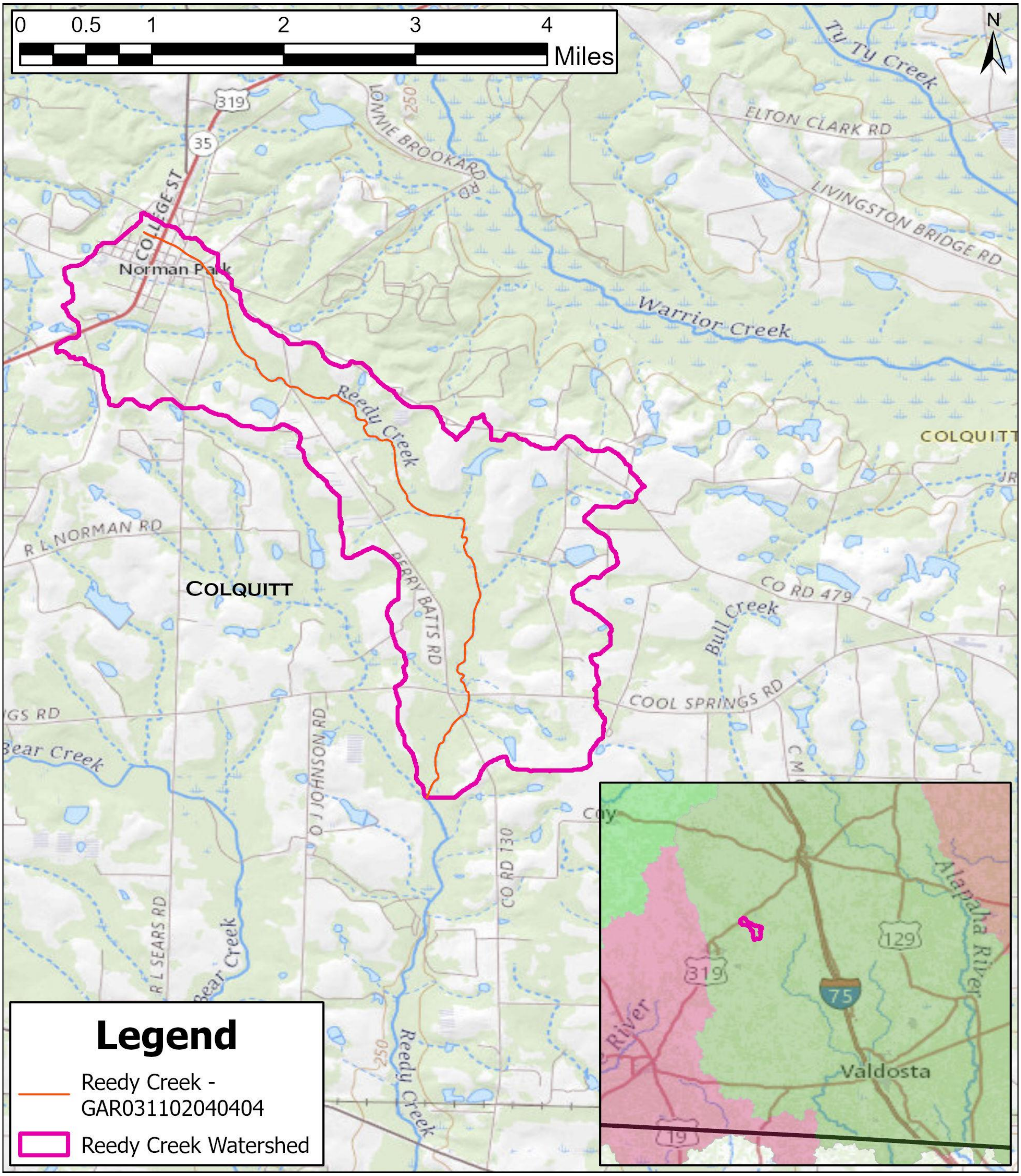

Figure 6: Impaired Stream Segment of Reedy Creek (GAR031102040404)

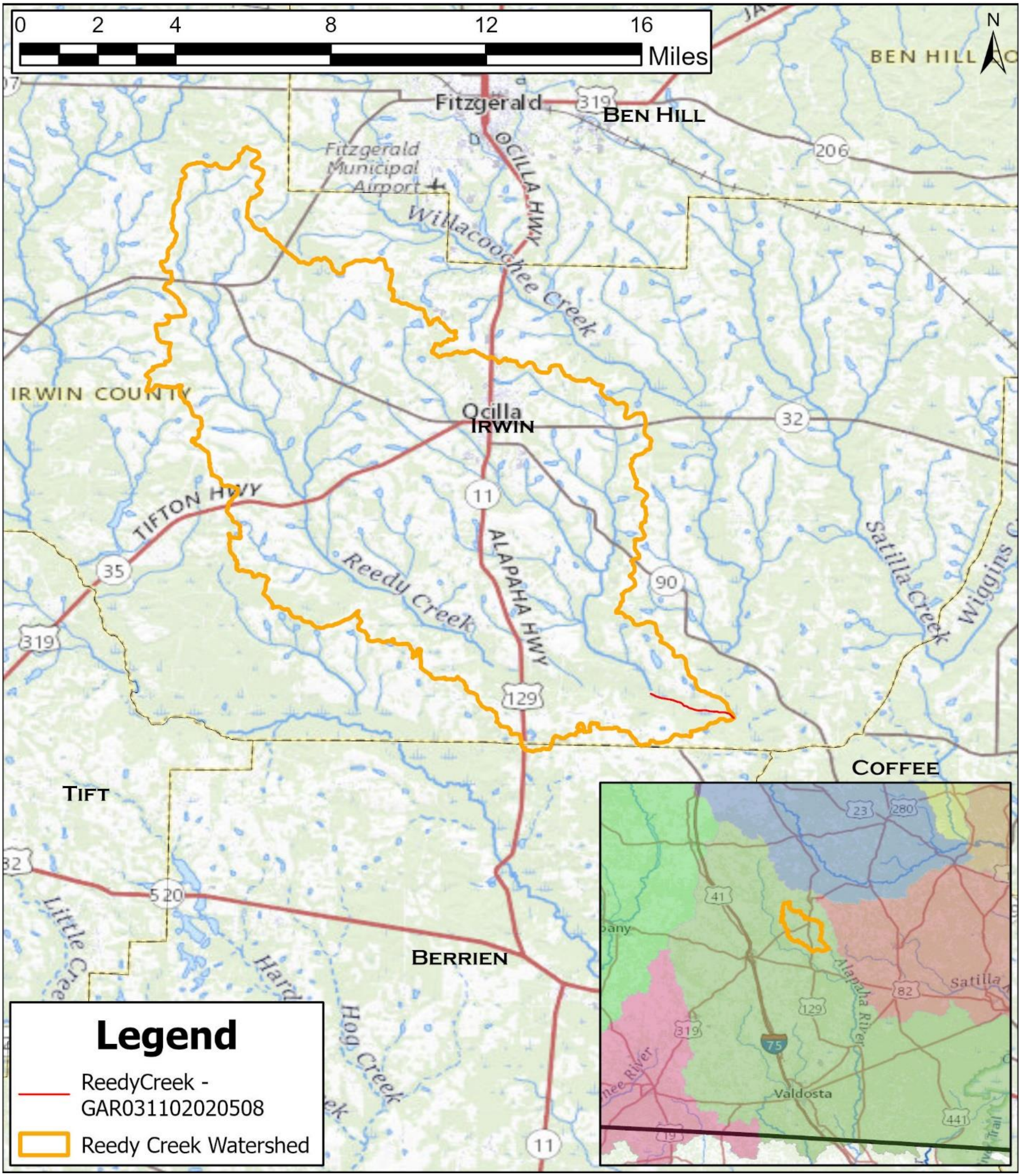

Figure 7: Impaired Stream Segment of Reedy Creek (GAR031102020508)

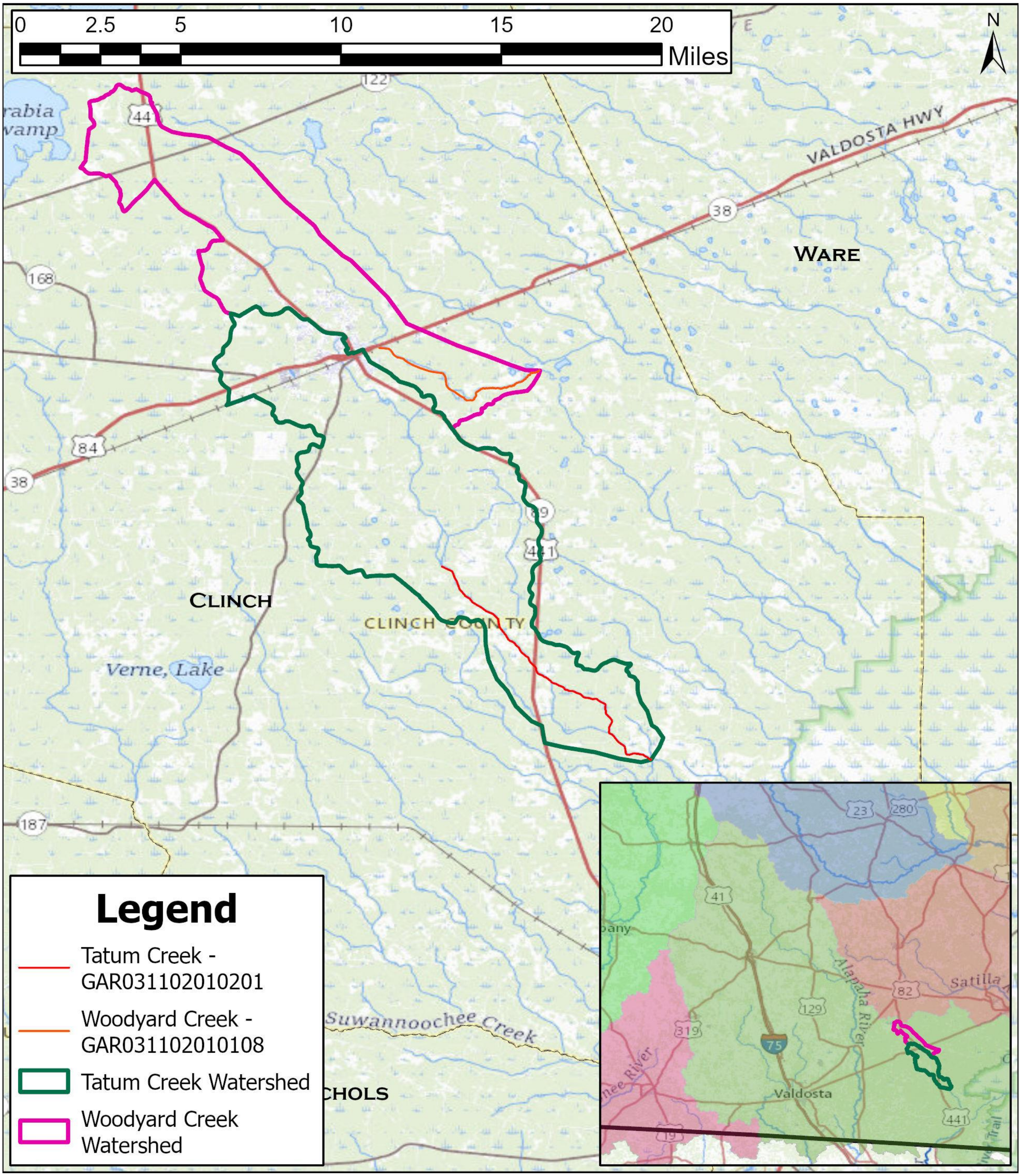

Figure 8: Impaired Stream Segments of Tatum Creek and Woodyard Creek

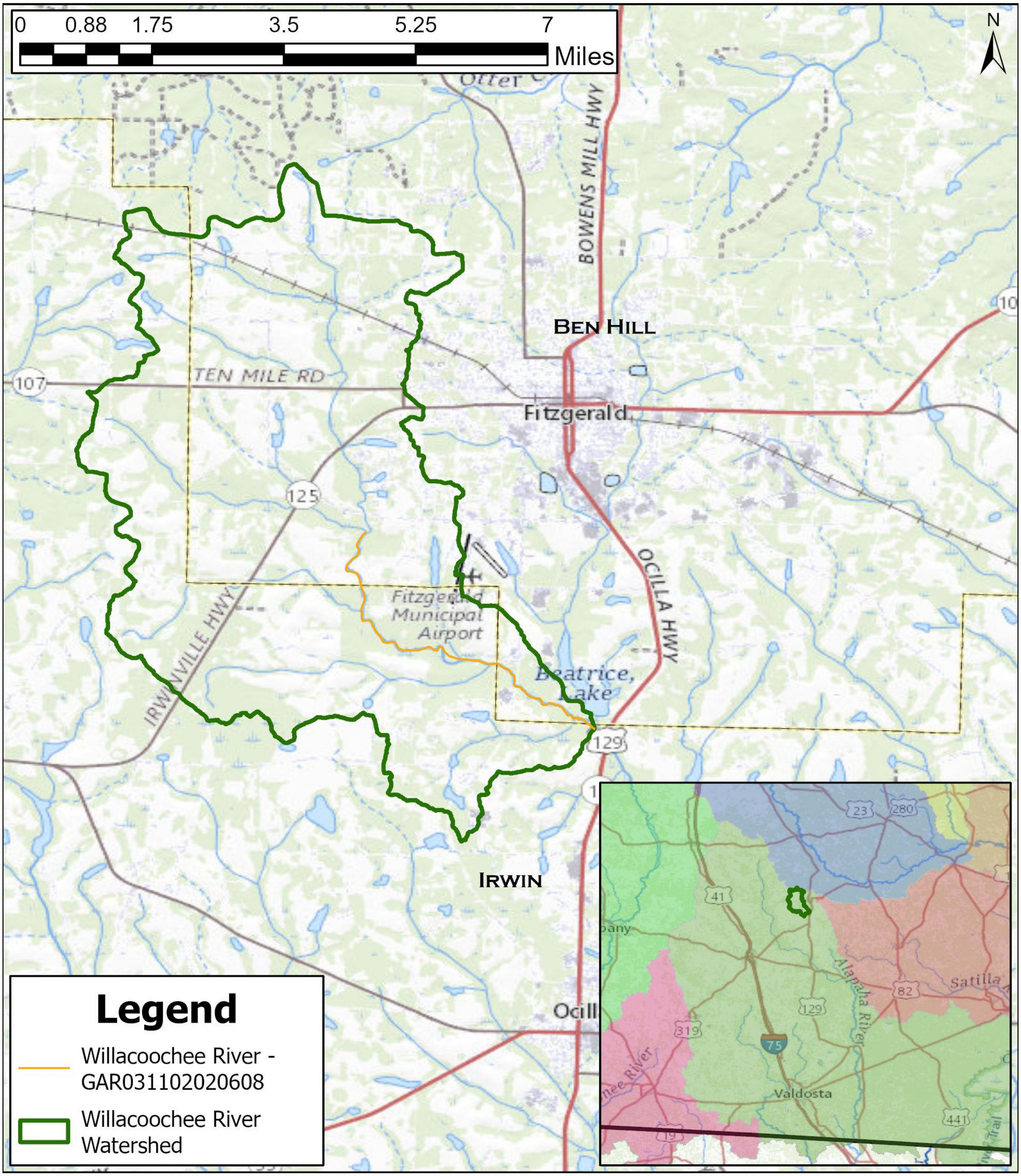

Figure 9: Impaired Stream Segment of Willacoochee River

by local governments in the metropolitan Atlanta area. The MNGWPD issued its first water resource management plan documents in 2003.

In 2004, the Georgia Legislature enacted the Comprehensive State-wide Water Management Planning Act to ensure management of water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens on a state-wide level. GA EPD later developed the 2008 Comprehensive State- wide Water Management Plan, which established Georgia's ten Regional Water Planning Councils (RWPCs) and laid the groundwork for the RWPCs to develop their own Regional Water Plans. The boundaries of these ten RWPCs, in addition to the MNGWPD, are shown in Figure 10. The eleven listed waterbodies are located within the boundaries of the Suwannee-Satilla Regional Water Planning Council.

In 2011, each RWPC developed and adopted Regional Water Plans, which identify ranges of actions or management practices to help meet the State's water quality challenges. Implementation of these plans is critical in meeting Georgia's water resource challenges. The Suwannee-Satilla RWPC updated its Water Plan in June 2017, which was adopted by GA EPD in July 2017. Their Water Plan is available here.

1.4 Water Quality Standard

Every waterbody in the State has one or more designated uses, and each designated use has water quality criteria established to protect it. Waterbodies in Georgia are assessed based on the 305(b)/303(d) Listing Assessment Methodology, as such GA EPD placed eleven (11) stream segments in the Suwannee River Basin on the 2022 303(d) list of impaired waters because it was assessed as "not supporting" its designated use of "Fishing" due to violations of the fecal coliform criteria. The potential causes listed include urban runoff and nonpoint sources. The fishing bacteria water quality standards as approved by US EPA Region 4 on January 20, 2021, and applicable at the time of listing was as follows:

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

(i) Bacteria:

1. 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 counts 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 counts per 100 mL (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 counts per 100 mL in lakes and reservoirs and 500 counts 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 counts 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 counts per 100 mL for any sample. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

2. For waters designated as shellfish growing areas by the Georgia DNR Coastal Resources Division, 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 National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2007 Revision (or most recent version), Interstate Shellfish Sanitation Conference, U.S. Food and Drug Administration.

In January 2022, the Georgia DNR Board adopted new bacteria criteria for "Fishing" and "Drinking Water" designated uses using the bacterial indicators *E. coli* and enterococci. These bacteria are better indicators for human health illnesses. The adopted criteria have the same estimated illness rate

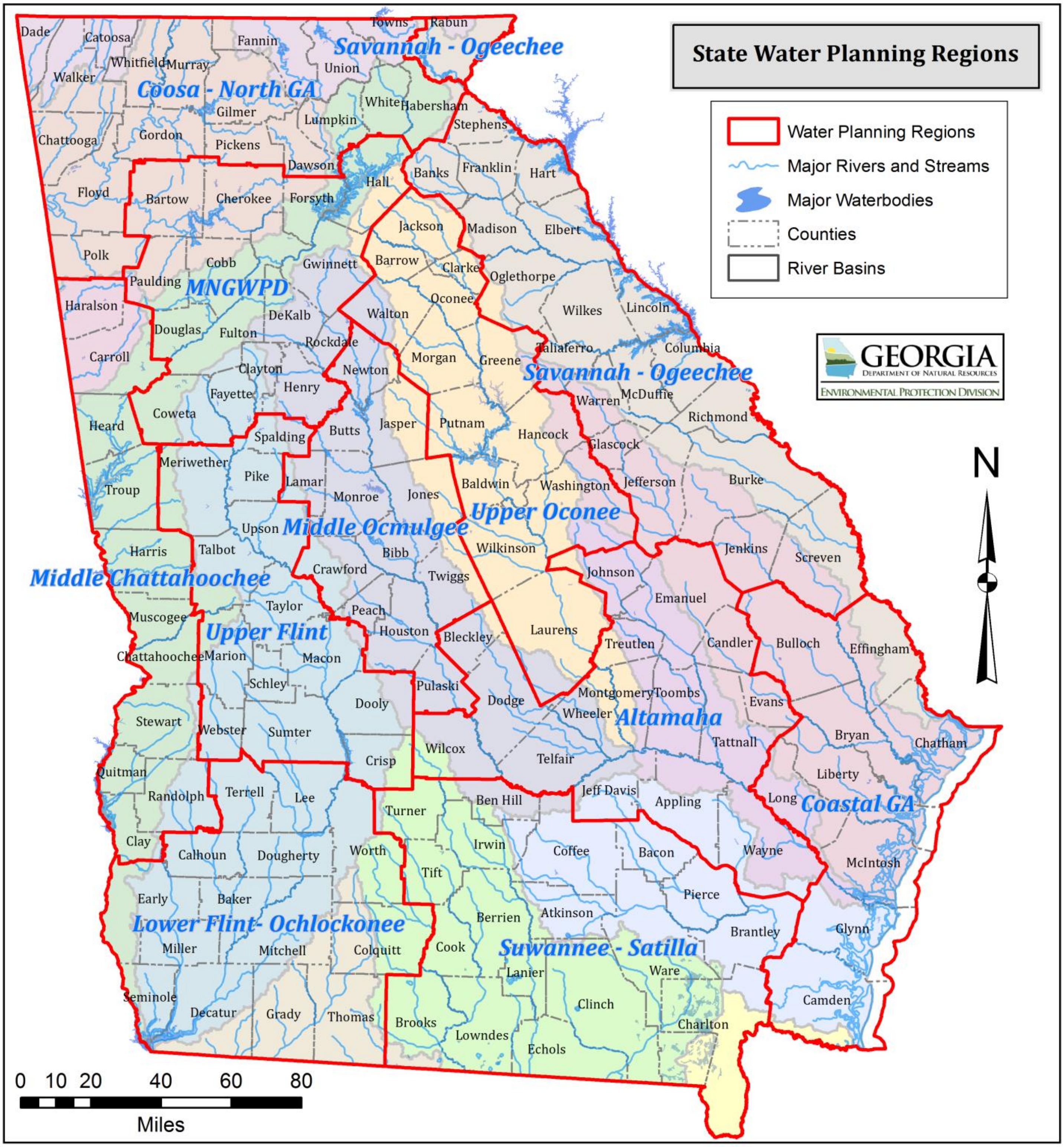

Figure 10: Boundaries of the Regional Water Planning Councils and the Metropolitan North Georgia Water Planning District

(8 per 1000 swimmers) as the previously established criteria. EPA approved the proposed standards August 31, 2022. Since this TMDL was written after EPA approved the new bacteria criteria, the TMDL will use both bacterial indicators. 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, 2022), are:

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

(i) Bacteria:

1. Estuarine waters: For the months of May through October, when primary water contact recreation activities are expected to occur, culturable enterococci not to exceed a geometric mean of 35 counts 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. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 130 counts per 100 mL the same 30-day interval.

   For the months of November through April, culturable enterococci not to exceed a geometric mean of 74 counts 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. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 273 counts per 100 mL in the same 30-day interval.

2. All other fishing waters: For the months of May through October, when primary water contact recreation activities are expected to occur, culturable E. coli not to exceed a geometric mean of 126 counts 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. There shall be no greater than a ten percent excursion frequency of an E. coli statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval.

   For the months of November through April, culturable E. coli not to exceed a geometric mean of 265 counts 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. There shall be no greater than a ten percent excursion frequency of an E. coli statistical threshold value (STV) of 861 counts per 100 mL in the same 30-day interval.

3. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

4. For waters designated as shellfish growing areas by the Georgia DNR Coastal Resources Division, 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 National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2007 Revision (or most recent version), Interstate Shellfish Sanitation Conference, U.S. Food and Drug Administration

Table 3: Suwannee River Basin Land Coverage

Stream/Segment	Land Use Categories - Acres (Percent)													
	Beaches, Dunes, Mud	Open Water	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Transitional, Clearcut, Sparse	Forest	Row Crops	Pasture, Hay	Other Grasses (Developed Open Space, Utility Swaths, Golf Courses)	Forested Wetlands	Non-Forested Wetlands (Salt/Brackish)	Non-Forested Wetlands (Freshwater)	Total
Cypress Creek	74.9	592.2	484.4	133.9	14.9	855.3	7985.8	12656.3	4330.7	1154.9	3788.5	26.9	58.9	32157.6
GAR031102030104	0.2%	1.8%	1.5%	0.4%	0.0%	2.7%	24.8%	39.4%	13.5%	3.6%	11.8%	0.1%	0.2%	100%
Little Creek	5.8	28.2	282.4	164.3	222.0	100.5	2025.6	3850.3	1414.9	525.5	978.3	1.8	5.3	9605.0
GAR031102030506	0.1%	0.3%	2.9%	1.7%	2.3%	1.0%	21.1%	40.1%	14.7%	5.5%	10.2%	0.0%	0.1%	100%
Piscola Creek	7.3	26.7	47.8	10.0	1.6	28.5	974.3	2334.5	592.7	173.7	634.7	0.4	35.4	4867.6
GAR031102030705	0.2%	0.5%	1.0%	0.2%	0.0%	0.6%	20.0%	48.0%	12.2%	3.6%	13.0%	0.0%	0.7%	100%
Piscola Creek	17.6	86.5	222.0	27.6	4.4	136.3	3713.1	9048.6	1830.5	720.6	2343.4	2.2	95.6	18248.4
GAR031102030706	0.1%	0.5%	1.2%	0.2%	0.0%	0.7%	20.3%	49.6%	10.0%	3.9%	12.8%	0.0%	0.5%	100%
Reedy Creek	68.5	618.7	1265.2	305.3	145.7	794.2	11176.9	28401.8	5469.4	3054.6	9387.3	16.9	102.5	60807.0
GAR031102020508	0.1%	1.0%	2.1%	0.5%	0.2%	1.3%	18.4%	46.7%	9.0%	5.0%	15.4%	0.0%	0.2%	100%
Reedy Creek	3.1	11.8	99.9	46.5	18.5	109.0	943.6	1299.9	631.6	169.2	369.8	1.6	4.2	3708.7
GAR031102040404	0.1%	0.3%	2.7%	1.3%	0.5%	2.9%	25.4%	35.1%	17.0%	4.6%	10.0%	0.0%	0.1%	100%
Tatum Creek	3.3	8.2	1059.0	222.8	183.7	803.3	15691.7	451.5	1357.9	1692.6	14857.8	0.0	43.8	36375.8
GAR031102010201	0.0%	0.0%	2.9%	0.6%	0.5%	2.2%	43.1%	1.2%	3.7%	4.7%	40.8%	0.0%	0.1%	100%
Tributary to Little Creek	1.1	0.7	97.6	86.7	195.3	5.1	69.6	484.6	270.9	219.7	102.1	0.0	1.8	1535.2
GAR031102030507	0.1%	0.0%	6.4%	5.6%	12.7%	0.3%	4.5%	31.6%	17.6%	14.3%	6.6%	0.0%	0.1%	100%
Tributary to Okapilco Creek	2.2	10.7	24.9	2.4	0.0	10.2	208.8	983.0	228.4	74.9	193.7	0.7	3.8	1743.8
GAR031102030505	0.1%	0.6%	1.4%	0.1%	0.0%	0.6%	12.0%	56.4%	13.1%	4.3%	11.1%	0.0%	0.2%	100%

Stream/Segment	Land Use Categories - Acres (Percent)													
	Beaches, Dunes, Mud	Open Water	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Transitional, Clearcut, Sparse	Forest	Row Crops	Pasture, Hay	Other Grasses (Developed Open Space, Utility Swaths, Golf Courses)	Forested Wetlands	Non-Forested Wetlands (Salt/Brackish)	Non-Forested Wetlands (Freshwater)	Total
Willacoochee River	22.2	208.6	353.4	82.1	34.0	227.3	3871.9	7490.3	1926.8	937.8	2238.6	6.9	45.8	17445.8
GAR031102020608	0.1%	1.2%	2.0%	0.5%	0.2%	1.3%	22.2%	42.9%	11.0%	5.4%	12.8%	0.0%	0.3%	100%
Woodyard Creek	1.3	6.7	669.2	107.6	44.7	364.5	7934.6	191.9	731.9	902.3	7592.1	0.2	27.1	18574.2
GAR031102010108	0.0%	0.0%	3.6%	0.6%	0.2%	2.0%	42.7%	1.0%	3.9%	4.9%	40.9%	0.0%	0.1%	100%

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. Currently, a stream is placed on this list if more than ten percent of the calculated geometric means exceed their water quality criteria or if more than ten percent of the samples exceed the single sample 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 (mL) during the period May through October, or in excess of 1000 counts per 100 mL during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample criterion (4000 counts per 100 mL) not to be exceeded at any given time.

Fecal coliform data used for development of the TMDL in this document were collected during calendar years 2016 through 2020 by GA EPD as part of the trend monitoring program. A summary of sampling station locations and sampling dates is given in Table 4. The raw data are presented in Appendix A.

Table 4: Sampling Stations and Dates – Suwannee River Basin

Stream Segment	Location	GA EPD Monitoring Station No.	GPS Coordinates	Monitoring Station Description	Sample Date Range
Cypress Creek GAR031102030104	Hardy Mill Creek to the Withlacoochee River	RV_09_17774	31.339004, -83.314021	Cypress Creek at Vickers Church Rd near Enigma, GA	03/1/2021-7/13/2021
Little Creek GAR031102030506	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Ck	RV_09_5073	31.067985, -83.657325	Little Creek at Perry Road near Berlin, GA	03/9/2015-12/09/2015
Piscola Creek GAR031102030705	Headwaters to Tributary 0.3 miles upstream of Pope Rd	RV_09_16764	30.939235, -83.768289	Piscola Creek at Hwy 122 near Pavo, Ga.	03/2/2017-12/20/2018
Piscola Creek GAR031102030706	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	RV_09_16765	30.881135, -83.771941	Piscola Creek at Coffee Rd near Barwick, Ga.	03/2/2017-12/20/2018
Reedy Creek GAR031102020508	Little Brushy Creek to the Willacoochee River	RV_09_17661	31.48904, -83.17775	Reedy Creek at Bethlehem Church Rd near Ocilla, Ga	03/3/2020-12/16/2020
Reedy Creek GAR031102040404	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	RV_09_5070	31.268065, -83.680011	Reedy Creek at East Broad Street near Norman Park, GA	03/2/2016-12/20/2016
Tatum Creek GAR031102010201	Tower Road to Jones Creek	RV_09_3183	30.896389, -82.665833	Tatum Creek at U.S. Highway 441 near Homerville, GA	02/17/2020-12/1/2020
Tributary to Little Creek GAR031102030507	Headwaters to Little Creek	RV_09_16323	31.127075, -83.70089	Tributary to Little Creek at Edmonson Road near Moultrie, GA	03/2/2016-12/20/2016
Tributary to Okapilco Creek GAR031102030505	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	RV_09_5072	31.075812, -83.687737	Unnamed Tributary to Okapilco Creek at Old Berlin Rd near Moultrie, GA	03/9/2015-12/9/2015
Willacoochee River GAR031102020608	Courthouse Branch to Turkey Branch	RV_09_3167	31.660538, -83.262252	Willacoochee River at Perry House Rd. near Fitzgerald, GA	02/13/2013-11/18/2013
Woodyard Creek GAR031102010108	Tributary 400 feet downstream US 84 to Surveyors Creek	RV_09_17673	31.03621, -82.7288	Woodyard Cr at Bypass Rd near Homerville, GA	02/17/2020-12/1/2020

3.0 SOURCE ASSESSMENT

An important part of the TMDL development process is the identification of potential sources of pollutants causing the waterbody to be listed on the 303(d) list. A source assessment identifies the known and suspected sources and discharges of bacteria in the watershed. Sources are broadly classified as either point or nonpoint sources. The CWA defines a point source i as any "discernable, confined, and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture." Nonpoint sources are diffuse, and generally, but not always, involve accumulation of bacteria on land surfaces that wash off due to storm events.

3.1 Point Source Assessment

Title IV of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) permit program. Basically, there are two categories of NPDES permits: 1) wastewater treatment facilities, and 2) regulated stormwater discharges.

3.1.1 Wastewater Treatment Facilities

In general, NPDES point source discharge permits are issued to Publicly Owned Treatment Works (POTWs) and Non-Publicly Owned Treatment Works (Non-POTWs) authorizing the discharge of treated wastewater to surface waters. POTWs are commonly associated with city and county owned wastewater treatment facilities; whereas Non-POTWs are associated with industrial, private, and federal facilities. The permits include permit conditions, requirements, and numeric effluent limits developed using federal and state effluent guidelines (secondary treatment standards for POTWs and technology-based limits (TBELs) for Non-POTWs) or on water quality standards (water quality-based effluent limits, WQBELs).

The United States Environmental Protection Agency (USEPA) has developed technology-based standards and guidelines, which establish a minimum standard of pollution control for POTW and Non-POTW discharges without regard for the quality of the receiving waters. For POTWs, EPA has established Secondary Treatment Standards. For Non-POTW, the TBELs are based on Best Practical Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT), and Best Available Technology Economically Achievable (BAT)), and New Source Performance Standards. The level of control required by each facility is dependent on the source of wastewater generated and the pollutants found in the discharge.

The USEPA and the States have also developed numeric and narrative water quality criteria to protect a stream's designated uses. Typically, these standards are based on the results of aquatic toxicity tests and/or human health criteria and include a margin of safety. Wastewater NPDES permits also include WQBELs to protect these narrative and numeric water quality criteria and their designated uses. WQBELs ensuring water quality standards are met in the receiving water and downstream uses are protected.

For purposes of this TMDL, permitted wastewater treatment facilities are considered point sources, and include POTWs and Non-POTWs. Pollutants discharged from wastewater treatment plants can contribute bacteria to receiving waters. There are four (4) NPDES permitted discharges identified in the watershed of the listed segments in the Suwannee River Basin that could potentially impact streams on the 2022 303(d) list for fecal coliform bacteria. Typically, the contributing watershed for a 303(d) listed segment is defined as the area upstream of the segment, and each of the four (4) NPDES permitted discharges are upstream of sampling stations used to classify the listed stream segment, so they are considered a contributor to the bacteria listing.

Table 5 provides the monthly average discharge flow and fecal coliform concentrations for these facilities that currently have bacteria permit limits. These data were obtained from calendar years 2015 through 2020 Discharge Monitoring Reports (DMR). The current permitted flow and fecal coliform concentrations are also included in this table. There are no known existing Non-POTW discharges without bacteria permit limits that discharge into or upstream of the listed segments. It is possible these facilities could contribute bacteria to receiving water because the type of treatment processes they employ.

Another potential point source contribution may be a combined sewer system (CSS) that conveys a mixture of raw sewage and stormwater in the same conveyance structure to the wastewater treatment plant and may also have direct discharges (as authorized under a NPDES permit) to waters of the state. These are generally a component of POTWs. 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 Suwannee River Basin.

3.1.2 Regulated Stormwater Discharges

Discharges of stormwater authorized under a NPDES permit are considered a point source. Unlike other wastewater NPDES permits that establish end-of-pipe effluent limits, storm water NPDES permits establish best management practices (BMPs) and controls that are intended to reduce the quantity of pollutants that storm water picks up and carries into storm sewer systems during rainfall events “to the maximum extent practicable.” Currently, regulated stormwater discharges that may contain bacteria, consist of those associated with industrial activities and large, medium, and small municipal separate storm sewer systems (MS4s) that serve populations of 10,000 or more.

3.1.2.1 Industrial General Stormwater NPDES Permit

Storm water discharges associated with industrial activities are currently covered under the 2022 NPDES General Permit for Stormwater Discharges Associated with Industrial Activity (GAR050000) also called the Industrial General Permit (IGP). This permit requires visual monitoring of storm water discharges, site inspections, implementation of BMPs, preparation of a Storm Water Pollution Prevention Plan (SWPPP), and annual reporting. The IGP requires that stormwater 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 Appendix C of the 2022 IGP, if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to stormwater as a result of industrial activity at the site. If a facility is covered under Appendix C of the IGP, then benchmark monitoring for the pollutant(s) of concern is required. Delineations of both supporting and not supporting waterbodies are provided on the GA EPD website, and are available in ESRI ArcGIS shapefile format or in KMZ format for use in Google Earth. Interested parties may evaluate their proximity to not supporting waterbodies by utilizing these geospatial files.

Table 5: NPDES Facilities Discharging Fecal Coliform in the Suwannee River Basin

Facility Name	NPDES Permit No.	Receiving Stream	303(d) Listed Segment(s)	Actual Discharge (2015–2021)		NPDES Permit Limits		Number of Spills[c]
				Avg. Monthly Flow (MGD)[a]	Avg. Monthly fecal coliform (#/100mL)[b]	Avg. Monthly Flow (MGD)	Avg. Monthly fecal coliform (#/100mL)	
Homerville WPCP	GA0031828	Unnamed tributary to Woodyard Creek	Woodyard Creek (GAR031102010108)	0.34 (0.04-0.959)	10.43 (0.0-77.0)	0.5	200	0
Homerville Industrial Park WPCP	GA0037460	Unnamed tributary to Tatum Creek	Tatum Creek (GAR031102010201)	0.0	0.0	0.25	200	0
Moultrie Spence Field WPCP	GA0025879	Little Indian Creek	Tributary to Little Creek (GAR031102030507) Little Creek (GAR031102030506)	N/A[d]	N/A[d]	0.2	200	0
Norman Park WPCP	GA0033600	Reedy Creek	Reedy Creek (GAR031102040404)	0.258 (0.047-0.816)	790 (2-55,000)	0.2	200	3

Source: GA EPD – Discharge Monitoring Report (DMR) data from ICIS-NPDES

Notes: [a] - Values shown are the average of the monthly average flows reported in DMRs, followed by the monthly average ranges.
[b] - Values shown are the annual average of the monthly geometric means and the monthly average ranges.
[c] - From GAPDES self-reported spill monitoring system.
[d] - LAS underdrain monitoring not required by permit.

3.1.2.2 MS4 NPDES Permits

The collection, conveyance, and discharge of diffuse storm water to local waterbodies by a public entity are regulated in Georgia by the NPDES MS4 permits. These MS4 permits have been issued under two phases. Phase I MS4 permits cover medium and large cities, and counties with populations over 100,000. Each individual Phase I MS4 permit requires 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. A program to monitor and control pollutants in storm water discharges from industrial facilities, construction sites, and highly visible pollutant sources that exist within the MS4 area must be implemented under the permit. Additionally, monitoring of not supporting streams, public education and involvement, post-construction storm water controls, low impact development, and annual reporting requirements must all be addressed by the permittee on an ongoing basis. As of 2022, fifty-seven (57) counties and municipalities are covered by Phase I MS4 permits in Georgia.

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 10,000 people and an overall population density of at least 1,000 people per square mile. As of 2022, seventy-three (73) municipalities, thirty-five (35) counties, five (5) Department of Defense facilities, and the Georgia Department of Transportation (GDOT) are permitted under the Phase II storm water regulations in Georgia. All municipal Phase II permitees are authorized to discharge under Storm Water General Permit GAG610000. Department of Defense facilities are authorized to discharge under Storm Water General Permit GAG480000. GDOT owned or operated facilities are authorized to discharge under Storm Water General Permit GAR041000. Under these general permits, each permittee must design and implement a SWMP that incorporates BMPs that focus on public education and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction storm water management, and pollution prevention in municipal operations. Urbanized areas include land uses identified as lawns, parks, and greenspace, as well as residential, commercial, industrial, and transportation facilities. Table 6 provides the Phase II counties or communities covered by MS4s Permits in the Suwannee River Basin. There are no permitted MS4s that discharge into the stream segments not supporting its designated use for bacteria.

Table 6. Permitted MS4s in the Suwannee River Basin

Permit No.	MS4 Permittees	MS4 Phase
GAG610000	Lowndes County	Phase 2 >10,000
GAG610000	Valdosta (Lowndes County)	Phase 2 >10,000
GAG610000	Hahira (Lowndes County)	Phase 2 <10,000
GAG610000	Remerton (Lowndes County)	Phase 2 <10,000
GAR041000	Georgia Department of Transportation	Phase 2

Source: Nonpoint Source Program, GA DNR, 2022

3.1.3 Concentrated Animal Feeding Operations

Animal feeding operations (AFOs) are agricultural operations where animals are kept and raised in confined situations. AFOs that meet the regulatory definition of a concentrated animal feeding operation (CAFO) are regulated under the NPDES permitting program. The NPDES program regulates the discharge of pollutants from point sources to waters of the state. From 1999 through 2001, Georgia adopted rules for permitting swine and non-swine liquid manure animal feeding operations (AFOs). Georgia rules required medium size AFOs with more than 300 animal units (AU), but less than 1,000 AU, to apply for a non-discharge state land application system (LAS) waste disposal permit. Large operations with more than 1000 AU were required to apply for an NPDES permit (also non-discharge) as a CAFO. The USEPA CAFO regulations were successfully appealed in 2005. They were revised to comply with the court's decision that NPDES permits only be required for actual discharges. Georgia's rules were amended on August 7, 2012, to reflect the USEPA revisions. The revised state rules authorize LAS permitting of medium and large size liquid manure AFOs unless they elect to obtain an NPDES permit. There are two (2) known liquid manure CAFOs located in the watershed of the listed segment in the Suwannee River Basin that have NPDES or 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. In accordance with the Georgia rule amendment discussed above, the general permit covering these facilities has been terminated and they are no longer covered under any permit. Georgia is consistently among the top three states in the U.S. in terms of poultry operations. Most 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 of bacteria. However, land-applied litter previously stored for an extended length of time typically exhibits very low bacteria levels. Table 7 presents the current swine and non-swine (primarily dairies) CAFOs located in the Suwannee River Basin and indicates those that may impact the listed streams.

Table 7. Permitted CAFOs in the Suwannee River Basin

Name	Permit No.	County	Animal Type	Total No. of Animals Units	Impaired Stream Watershed
Danforth Hog Farms	GAG940029	Berrien	Swine	>1000 AU	Cypress Creek (GAR031102030104)
Grassy Flats Dairy, LLC	GAG920019	Brooks	Dairy	300 to 1000 AU	n/a
Green Hill Dairy LLC	GAG920020	Brooks	Dairy	300 to 1000 AU	n/a
Jumping Gully Dairy LLC	GAG920021	Brooks	Dairy	300 to 1000 AU	n/a
Brooksco Dairy LLC	GAG930061	Brooks	Dairy	>1000 AU	n/a
Westbrook Dairy	GAG930064	Brooks	Dairy	>1000 AU	n/a
Wynn Swine Farm	GAG920036	Colquitt	Swine	300 to 1000 AU	n/a
Messer Dairy Inc.	GAG920024	Thomas	Dairy	300 to 1000 AU	Piscola Creek (GAR031102030706)
Coastal Plain Experiment Station-Dairy Research Center	GAG920051	Tift	Dairy	300 to 1000 AU	n/a

Source: Georgia Pollutant Discharge Elimination System, GA EPD, 2022

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 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 stormwater 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 significance of wildlife as a source of bacteria in streams varies considerably depending on the animal species present in the watershed. Based on information provided by the Wildlife Resources Division (WRD) of GA DNR, the greatest wildlife sources of bacteria are the animals that spend a large portion of their time in or around aquatic habitats. Of these, waterfowl, especially ducks and geese, are considered to be the most significant source, because when present, they are typically found in large numbers on the water surface. Other 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 substantial presence in the floodplain areas of the major rivers in Georgia.

White-tailed deer populations are also abundant throughout the Suwannee River Basin. Bacteria contributions to waterbodies 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, 2007). However, feces deposited on the land surface can result in the introduction of bacteria to streams during runoff events. Between storm events, considerable decomposition of the fecal matter might occur, resulting in a decrease in the associated bacteria numbers.

3.2.2 Agricultural Livestock

Agricultural livestock are a potential source of bacteria to streams in the Suwannee 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 bacteria loading rates throughout the year. Beef cattle spend all 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).

Commercial chickens are raised indoors, and their litter is periodically disposed of. The litter can be aged or composted. This results in a decomposition of the litter into a soil amendment that can be used as a fertilizer. The stockpiled manure should be kept in a sheltered area. Proper composting should generate temperatures of 140ºF to 160ºF, which destroys bacteria. Aging the manure and litter reduces populations of microbes by providing unfavorable growing conditions causing the bacteria to gradually die off due to changes in moisture content and temperature. Table 8 provides the estimated number of beef cattle, dairy cattle, goats, horses, swine, sheep, and chickens reported by county.

Table 8. Estimated Agricultural Livestock Populations in Counties Containing the 303(d) Listed Segment Watershed in the Suwannee River Basin

County	Livestock								
	Beef Cattle	Dairy Cattle	Swine	Sheep	Horses	Goats	Chickens		
							Broilers	Layers	Pullets
Atkinson	8,892	-	-	-	456	3,000	19,043,895	119,870	161,438
Ben Hill	5,800	-	-	45	-	900	2,746,527	-	-
Berrien	9,962	500	5,116	-	345	120	8,446,484	238,813	106,560
Brantley	1,008	-	-	-	55	125	-	1,137,109	199,800
Brooks	7,083	11,000	500	135	240	1,250	1,794,987	55,569	-
Charlton	737	-	75	-	100	-	-	81,766	189,810
Clinch	315	-	-	30	55	140	-	29,372	-
Coffee	25,053	-	12,471	50	1,232	2,001	37,247,072	112,593	483,649
Colquitt	13,772	-	5,022	50	450	650	54,915,247	220,952	196,470
Cook	6,539	-	-	50	300	500	7,568,643	54,246	-
Crisp	1,744	1,600	-	-	344	1,201	2,377,790	-	-
Dooly	3,056	-	-	-	30	210	5,880,657	33,077	-
Echols	1,255	-	-	-	-	-	-	-	-
Irwin	9,045	-	136	-	110	800	2,388,949	24,940	-
Lanier	1,200	-	80	50	75	330	-	-	-
Lowndes	9,721	-	351	475	945	2,502	-	13,231	-
Thomas	17,089	600	-	-	3,800	-	1,602,823	11,908	110,556
Tift	8,173	-	100	25	200	1,500	-	-	-
Turner	8,674	-	-	65	-	250	2,765,514	-	-
Ware	3,466	800	200	-	-	700	1,559,149	85,073	155,844
Wilcox	6,299	800	-	20	120	1,101	24,577,341	49,615	-
Worth	21,098	-	-	75	340	2,502	3,907,334	27,784	-

Source: Center for Agribusiness and Economic Development, UGA 2022

3.2.3 Urban Development

Bacteria 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 bacteria from domestic animals and urban wildlife. Bacteria enter streams by direct wash off from the land surface, or the runoff may be diverted to a stormwater collection system and discharged through a discrete outlet structure. For large, medium, and small urban areas (populations greater than 10,000), the stormwater outlets are regulated under MS4 permits (see Section 3.1.2). For smaller urban areas, the stormwater discharge outlets currently remain unregulated.

In addition to urban animal sources of bacteria, 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, but this may not occur in unpermitted storm sewer systems. 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 bacteria contributions in the Suwannee River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 9 below presents the number of septic systems existing at the end of 2015 and the number existing at the end of 2020in counties in the Suwannee River Basin. These data are based on data provided by the Georgia Department of Public Health and information obtained from the U.S. Census. In addition, an estimate of the number of septic systems installed and repaired during the period from 2015 through 2020 is given. These data show an increase in the number of septic systems in all counties. Often, this reflects population increases outpacing the expansion of sewage collection systems.

Table 9: Estimated Number of Septic Systems in Counties within the Suwannee River Basin

County	Existing Septic Systems (2015)	Existing Septic Systems (2020)	Number of Septic Systems Installed (2015 to 2020)	Number of Septic Systems Repaired (2015 to 2020)
Atkinson	2841	2990	149	23
Ben Hill	5122	5207	85	110
Berrien	5529	5758	229	49
Brantley	9064	9409	345	214
Brooks	5960	6153	193	147
Charlton	3874	4015	141	45
Clinch	1792	1890	98	38
Coffee	13439	14075	636	227
Colquitt	13224	13566	342	339
Cook	4361	4510	149	51
Crisp	5626	5771	145	123
Dooly	2616	2671	55	35
Echols	1458	1525	67	32
Irwin	3063	3168	105	81
Lanier	3438	3578	140	36
Lowndes	18073	18640	567	417

County	Existing Septic Systems (2015)	Existing Septic Systems (2020)	Number of Septic Systems Installed (2015 to 2020)	Number of Septic Systems Repaired (2015 to 2020)
Thomas	12379	12697	318	269
Tift	9052	9315	263	200
Turner	2148	2212	64	61
Ware	9843	10111	268	117
Wilcox	2463	2526	63	7
Worth	7773	7957	184	304

Source: The Georgia Dept. of Public Health, Environmental Health Section, 2022

3.2.3.2 Land Application Systems

Some communities and industries use land treatment systems for wastewater disposal. These facilities are required through land application system (LAS) permits to dispose of their treated wastewater by land application, and to operate as non-discharging systems that do not contribute wastewater effluent runoff to surface waters. However, sometimes the soil's percolation rate is exceeded when applying the wastewater, or encountering excess precipitation, resulting in runoff. This runoff could contribute bacteria to nearby surface waters. Runoff of storm water might also carry surface residual containing bacteria. Listed in Table 10 below are the LASs found in the Suwannee River Basin and the LASs that could potentially impact the stream segments in this TMDL are identified.

Table 10: Permitted Land Application Systems in the Suwannee River Basin

LAS Name	Permit No.	County	Type	Flow (MGD)	Impaired Stream Watershed
Brookside Choice Properties (Fellowship Home at Brookside WPCP)	GAJ030963	Atkinson	Municipal	0.015	n/a
Willacoochee, City of (Willacoochee WPCP)	GAJ020164	Brooks	Municipal	0.355	n/a
Quitman, City of (Quitman WPCP)	GAJ020022	Colquitt	Municipal	1.3	n/a
Sanderson Farms, Inc.	GAJ010333	Irwin	Industrial	1.7	n/a
Ocilla, City of (Ocilla WPCP)	GAJ020180	Lowndes	Municipal	0.85	Reedy Creek (GAR031102020508)
Lowndes County (South Regional WPCP)	GAJ020294	Lowndes	Municipal	2.5	n/a
Packaging Corporation of America	GAJ010451	Lowndes	Industrial	[a]	n/a
Stoker Utilities, LLC (Hamilton Point/Heather Woods Subdivision WPCP)	GAJ020030	Tift	Municipal	0.03	n/a
Omega, City of (Omega WPCP)	GAJ020219	Turner	Municipal	0.131	n/a
Sycamore, City of (Sycamore WPCP)	GAJ020067	Worth	Municipal	0.082	n/a
Sylvester, City of (Sylvester WPCP)	GAJ020132	Atkinson	Municipal	0.64	n/a

Source: Georgia Pollutant Discharge Elimination System, GA EPD, Atlanta, Georgia, 2022 a – Facility operated under extended permit GA01-451 until requesting termination on July 14, 2021. New permit (GAJ010451) withdrawn/not issued based on termination request.

3.2.3.3 Landfills

Leachate from landfills may contain bacteria that could at some point reach surface waters. Sanitary (or municipal) landfills are the most likely to serve as a source of 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. Table 11 provides the landfills located in the Suwannee River Basin.

Table 11: Permitted Landfills in the Suwannee River Basin

Facility Name	Permit Number	County	Interest Type	Operating Status
Fitzgerald - Kiochee Church Rd Ph 1 (Sl)	009-004D(SL)	Ben Hill	SW- Municipal Solid Waste Landfill	Closed/PCC
Fitzgerald, Kiochee Church Rd, Ph.2	009-005D(SL)	Ben Hill	SW- Municipal Solid Waste Landfill	Operating
City Of Fitzgerald Inert Landfill	PBR-009-04IL	Ben Hill	SW- Inert Landfill	Closed
Fitzgerald Ben Hill Co. Reg. Sol. Waste Auth. Inert Lf	PBR-009-06IL	Ben Hill	SW- Inert Landfill	Operating
Ross Of Georgia Borrow Pit	PBR-009-08IL	Ben Hill	SW- Inert Landfill	Operating
Berrien Co - Brogdon Rd (L)	010-007D(L)	Berrien	SW- Construction & Demolition Landfill	Archived
Berrien Co - Cr 48/Cr 28 Ph 1 (L)	010-008D(L)	Berrien	SW- Construction & Demolition Landfill	Closed/PCC
Berrien Co - Sr 76 W Nashville (Sl)	010-004D(SL)	Berrien	SW- Municipal Solid Waste Landfill	Archived
Concrete Enterprises,Inc. Inert Landfill	PBR-010-03IL	Berrien	SW- Inert Landfill	Closed
Robert Griner	PBR-010-06IL	Berrien	SW- Inert Landfill	Closed
Virgil Barber Contractor, Inc. Inert Landfill	PBR-010-04IL	Berrien	SW- Inert Landfill	Closed
City Of Nashville	PBR-010-08IL	Berrien	SW- Inert Landfill	Closed/PCC
City Of Nashville Inert Landfill	PBR-010-12IL	Berrien	SW- Inert Landfill	Closed/PCC
Berrien County Inert Landfill	PBR-010-07IL	Berrien	SW- Inert Landfill	Operating
Berrien County Public Works Il	PBR-010-014IL	Berrien	SW- Inert Landfill	Operating
Clinch Co - Smith Road Phase 1 Mswl	032-004D(SL)	Clinch	SW- Municipal Solid Waste Landfill	Closed/PCC
Clinch Co Board Of Commissioners Inert Landfill	PBR-032-09IL	Clinch	SW- Inert Landfill	Closed
Brockway Standard,Inc.	PBR-032-04IL	Clinch	SW- Inert Landfill	Operating
Clinch County Board Of Commissioners Dupont Highway Inert Lf	PBR-032-03IL	Clinch	SW- Inert Landfill	Operating

Facility Name	Permit Number	County	Interest Type	Operating Status
Johnny Smith Us Highway 441 Inert Lf	PBR-032-01IL	Clinch	SW- Inert Landfill	Operating
Manor Timber Company,Inc. Sr38 Inert Lf	PBR-032-02IL	Clinch	SW- Inert Landfill	Operating
Nass Hendley Private Inert Landfill	PBR-032-08IL	Clinch	SW- Inert Landfill	Operating
Cook Co-Taylor Rd Adel (L)	037-008D(L)	Cook	SW- Construction & Demolition Landfill	Closed/PCC
Cook Co. - C.R. 216 Construction/Demolition Landfill	037-011D(C&D)	Cook	SW- Construction & Demolition Landfill	Operating
Cook Co - Taylor Rd Rd Adel Ph 1 (Sl)	037-006D(SL)	Cook	SW- Municipal Solid Waste Landfill	Closed/PCC
Cook County Landfill	037-010D(MSWL)	Cook	SW- Municipal Solid Waste Landfill	Operating
Weyerhauser - CR 250 (LI)		Cook	SW- Private Industrial Landfill	
City Of Adel	PBR-037-03IL	Cook	SW- Inert Landfill	Closed
City Of Adel	PBR-037-02IL	Cook	SW- Inert Landfill	Closed
Frankie Ledbetter Inert Landfill	PBR-037-07IL	Cook	SW- Inert Landfill	Closed
Acree Investments, Ltd	PBR-037-08IL	Cook	SW- Inert Landfill	Operating
Gary Mcmillan Daughtrey Sawmill Road Inert Lf	PBR-037-01IL	Cook	SW- Inert Landfill	Operating
Williams Investment Company	PBR-037-06IL	Cook	SW- Inert Landfill	Operating
Cordele - Us 41 S Ph 2 (Sl)	040-004D(SL)	Crisp	SW- Municipal Solid Waste Landfill	Closed/PCC
Crisp County Landfill	040-008D(MSWL)	Crisp	SW- Municipal Solid Waste Landfill	Operating
Crisp County Board Of Commissioners	PBR-040-02IL	Crisp	SW- Inert Landfill	Closed
Folsom Construction Co.-Us41/Sr300 Inert Lf	PBR-040-01IL	Crisp	SW- Inert Landfill	Closed
Jerry Backhoe Service, Inc.	PBR-040-04IL	Crisp	SW- Inert Landfill	Closed
Tri-County Waste, Inc. Inert Landfill	PBR-040-05IL	Crisp	SW- Inert Landfill	Closed/PCC
Crisp County Landfill	PBR-040-06IL	Crisp	SW- Inert Landfill	Operating
Sam Buchanan Inert Landfill	PBR-040-03IL	Crisp	SW- Inert Landfill	Operating
Dooly Co - Cr 101 (Sl)	046-006D(SL)	Dooly	SW- Construction & Demolition Landfill	Closed/PCC
Dooly Co - Us 41 (Sl)	046-001D(SL)	Dooly	SW- Municipal Solid Waste Landfill	Archived
Echols Co - Carter St (L)	050-003D(L)	Echols	SW- Construction & Demolition Landfill	Archived
Echols Co - Cr 135 (L)	050-002D(L)	Echols	SW- Construction & Demolition Landfill	Archived
Echols County Inert Landfill	PBR-050-01IL	Echols	SW- Inert Landfill	Closed
Lanier Co - Studstill Rd Ph 1 (Sl)	086-004D(SL)	Lanier	SW- Municipal Solid Waste Landfill	Closed/PCC
City Of Lakeland Inert Landfill	PBR-086-02IL	Lanier	SW- Inert Landfill	Closed

Facility Name	Permit Number	County	Interest Type	Operating Status
Willie Frank Mathis-Studstill/Howell Road Inert Lf	PBR-086-01IL	Lanier	SW- Inert Landfill	Operating
Hahira - Friendship Church Rd (Sl)	092-003D(SL)	Lowndes	SW- Municipal Solid Waste Landfill	Archived
Valdosta - SR 94 (SL)	092-001D(SL)	Lowndes	SW- Municipal Solid Waste Landfill	Archived
Lowndes Co - Sr 31 Clyattvlle Ph 3 A1 (Sl)	092-015D(SL)	Lowndes	SW- Municipal Solid Waste Landfill	Closed/PCC
Onyx Pecan Row Landfill, Llc	092-019D(MSWL)	Lowndes	SW- Municipal Solid Waste Landfill	Closed/PCC
Advanced Disposal Dba Evergreen Landfill, Inc.	092-022D(MSWL)	Lowndes	SW- Municipal Solid Waste Landfill	Operating
Valdosta - Wetherington Lane (Sl)	092-014D(SL)	Lowndes	SW- Municipal Solid Waste Landfill	Permit Revoked
Packaging Corp Of America		Lowndes	SW- Private Industrial Landfill	
Strickland Cotton Mills (LI)		Lowndes	SW- Private Industrial Landfill	
347 Ces/Cev Environmental Flight	PBR-092-19IL	Lowndes	SW- Inert Landfill	Closed
Lowndes Co. Board Of Commissioners/Bobby Green	PBR-092-22IL	Lowndes	SW- Inert Landfill	Closed
Lowndes Co-Larry A Benson Inert Landfill	PBR-092-28IL	Lowndes	SW- Inert Landfill	Closed
Lowndes Co-Scruggs Sr 7 (Inert)	PBR-092-02IL	Lowndes	SW- Inert Landfill	Closed
Lowndes County Mcmillan Road Inert Lf	PBR-092-06IL	Lowndes	SW- Inert Landfill	Closed
The Langdale Company Inert Landfill	PBR-092-15IL	Lowndes	SW- Inert Landfill	Closed
Lowndes Co Board Of Commissioners Clyattville Inert Landfill	PBR-092-14IL-A	Lowndes	SW- Inert Landfill	Closed/PCC
Reames And Son Construction Company, Inc. Inert Lf	PBR-092-13IL	Lowndes	SW- Inert Landfill	Closed/PCC
Valdosta, Val Tech Rd Inert Landfill	PBR-092-03IL	Lowndes	SW- Inert Landfill	Closed/PCC
Chaney, Howell Rd Inert Landfill	PBR-092-04IL	Lowndes	SW- Inert Landfill	Operating
Charles E. Miller	PBR-092-21IL	Lowndes	SW- Inert Landfill	Operating
David Day Inert Landfill	PBR-092-18IL	Lowndes	SW- Inert Landfill	Operating
Foxborough Inert Landfill (Former Polishing Pond Wastewater Treat	PBR-092-24IL	Lowndes	SW- Inert Landfill	Operating
Frank Bird-Old Clyattville Road Inert Lf	PBR-092-07IL	Lowndes	SW- Inert Landfill	Operating
Fredrick W. Atkinson, Iii Inert Landfill	PBR-092-14IL	Lowndes	SW- Inert Landfill	Operating
Gandy Construction Company Inert Landfill	PBR-092-20IL	Lowndes	SW- Inert Landfill	Operating
Katherine L. Cowart Inert Landfill	PBR-092-16IL	Lowndes	SW- Inert Landfill	Operating
Reames & Sons Construction Co., Inc	PBR-092-23IL	Lowndes	SW- Inert Landfill	Operating
Reames And Son Construction Co.,Inc. Inert Lf	PBR-092-05IL	Lowndes	SW- Inert Landfill	Operating
Rountree Construction Company	PBR-092-09IL	Lowndes	SW- Inert Landfill	Operating

Facility Name	Permit Number	County	Interest Type	Operating Status
Wayne Fann Inert Landfill	PBR-092-17IL	Lowndes	SW- Inert Landfill	Operating
Tifton - Maple St (L)	137-014D(L)	Tift	SW- Construction & Demolition Landfill	Archived
Tifton - US 82 E/E 2nd St (L)	137-008D(L)	Tift	SW- Construction & Demolition Landfill	Archived
Tifton - Omega/Eldorado Rd Ph 1 (Sl)	137-007D(SL)	Tift	SW- Municipal Solid Waste Landfill	Closed/PCC
Tifton/Tift County Landfill	137-007D(SL)(3)	Tift	SW- Municipal Solid Waste Landfill	Operating
American Legion Post 21 Highway 82 Inert Lf	PBR-137-05IL	Tift	SW- Inert Landfill	Closed
Fulwood-Wright Virginia Drive Inert Lf	PBR-137-03IL	Tift	SW- Inert Landfill	Closed
Lonnie Pittman Highway 82 East Inert Lf	PBR-137-02IL	Tift	SW- Inert Landfill	Operating
Walker's Auto Sales Inert Landfill	PBR-137-10IL	Tift	SW- Inert Landfill	Operating
Turner Co - Sr 112 Ashburn Ph 1 & 2 (Sl)	142-001D(SL)	Turner	SW- Municipal Solid Waste Landfill	Archived
Turner Co - Sr 112 Ashburn Ph 3 (Sl)	142-004D(SL)	Turner	SW- Municipal Solid Waste Landfill	Closed/PCC
City Of Sycamore	PBR-142-01IL	Turner	SW- Inert Landfill	Closed/PCC
City Of Ashburn Inert Landfill	PBR-142-04IL	Turner	SW- Inert Landfill	In-Closure
Cornerstone Mfg. Co., Inc.	PBR-142-05IL	Turner	SW- Inert Landfill	Operating
Ponder Inert Landfill	PBR-142-06IL	Turner	SW- Inert Landfill	Operating
Wilcox County Sanitary Landfill Dba. Public Works	156-001D(SL)	Wilcox	SW- Municipal Solid Waste Landfill	Closed/PCC
City Of Abbeville	PBR-156-07IL	Wilcox	SW- Inert Landfill	Closed
City Of Abbeville-Us280 Inert Lf	PBR-156-01IL	Wilcox	SW- Inert Landfill	Closed
Stone Construction Company Inert Landfill	PBR-156-04IL	Wilcox	SW- Inert Landfill	Operating
Wilcox Co-County Farm Rd Inert Landfill	PBR-156-02IL	Wilcox	SW- Inert Landfill	Operating
Wilcox County Board Of Education Inert Landfill	PBR-156-03IL	Wilcox	SW- Inert Landfill	Operating

Source: Land Protection Branch, GA EPD, 2022

4.0 ANALYTICAL APPROACH

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

- The current critical bacteria 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 bacteria load necessary to achieve the TMDL.

The calculation of the bacteria load at any point in a stream requires the bacteria concentration and stream flow. The Loading Curve Approach was used to determine the current bacteria 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 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 available field measurements and water quality data used to develop the TMDL for this document were calculated using data from a nearby USGS gage. The nearby stream gage had relatively similar watershed characteristics, including land use, slope, and drainage area. The stream flows were estimated by multiplying the measured stream flow by the ratio of the listed stream drainage area to the gaged stream drainage area. One stream gage, located on the Suwannee River, was used to estimate the flow. Table 12 below provides the USGS stream gage used to estimate the flow for the listed stream segments. For each listed segment, the drainage areas and USGS gage used to estimate the steam flow are given in Table A-1 in Appendix A.

Table 12: USGS Flow Gage Used to Estimate Stream Flow in the 303(d) Listed Segments in the Suwannee River Basin

Waterbody Name	Location	USGS Station No.	USGS Station Name	Flow Gage Drainage Area (sq miles)
Suwannee River	(30.680556, -82.560556)	02314500	Suwannee River at US Hwy 441 at Fargo, GA	1,130

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 bacteria 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 bacteria 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 bacteria load
$C_{geomean}$ = bacteria 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 during the sampling period.

The maximum bacteria load at which the instream bacteria criteria will be met can be determined using a variation of the equation above. By setting C equal to the seasonal, instream bacteria 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:

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

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

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

A 30-day geometric mean load that plots above the respective seasonal TMDL curve represents an exceedance of the instream bacteria 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 bacteria standard. There is also a single sample maximum criterion of 4,000 counts per 100 mL for fecal coliform. 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.

For future *E. coli* TMDLs, one curve will represent the summer TMDL for the period May through October when the 30-day geometric mean standard is 126 counts/100 mL. The second curve will represent the winter TMDL for the period November through April when the 30-day geometric mean standard is 265 counts/100 mL. The equations for these two TMDL curves are:

$$TMDL_{summer} = 126 \text{ counts/100 mL (as a 30-day geometric mean)} \times Q$$

$$TMDL_{winter} = 265 \text{ counts/100 mL (as a 30-day geometric mean)} \times Q$$

The TMDL for a given stream segment is the load for the mean flow corresponding to the current critical fecal coliform load. This is the point where the current fecal coliform load exceeds the fecal coliform 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 bacteria TMDL load
$C_{standard}$ = seasonal bacteria standard (as a 30-day geometric mean)
summer – 126 counts/100 mL as *E. coli*
winter – 265 counts/ 100 mL as *E. coli*
Q_{mean} = stream flow as an arithmetic mean

There is also a statistical threshold value (STV) maximum criterion for the months of May through October (410 counts per 100 mL for *E. coli*) and November through April (861 counts per 100 mL for *E. coli*). If a single sample exceeds the STV 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.

For a TMDL, the percent load reduction can be expressed as follows:

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

The current critical loads and the TMDLs are expressed as equations that show the loads as a function of the total flow at any given time. The general equations for the critical load and the TMDL are:

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

Where:

$L_{critical}$ = current critical bacteria load
$C_{geomean}$ = bacteria concentration as a 30-day geometric mean
Q_{total} = stream flow

$$TMDL = C_{criterion} \times Q_{total}$$

Where:

TMDL = total maximum daily load
$C_{criterion}$ = criterion
Q_{total} = estimated instantaneous flow

5.0 TOTAL MAXIMUM DAILY LOAD

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. In this case, it is the seasonal bacterial standard. A TMDL is the sum of the individual wasteload 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 waterbody. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For bacteria, the TMDLs are expressed as counts per 30 days as a geometric mean.

A TMDL is expressed as follows:

$$\text{TMDL} = \Sigma\text{WLAs} + \Sigma\text{LAs} + \text{MOS}$$

The TMDL calculates the WLAs and LAs with a margin 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, and to understand the fate and transport of the pollutant(s) 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.

Watershed-based plans may be developed to address and assess both point and nonpoint sources. These plans establish a schedule or timetable for the installation and evaluation of source control measures, data collection, and assessment of water quality standard attainment. Future monitoring of the listed segments water quality may be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

The existing fecal coliform loads calculated for each listed stream segment are based on sampling data and measured or estimated flows and represent the sum of the total loads from all point and nonpoint sources for the 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. The following sections describe the various bacteria TMDL components.

5.1 Wasteload Allocations

5.1.1 Wastewater Treatment Facilities

The wasteload allocation (WLA) 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 POTW and Non-POTW wastewater treatment systems with NPDES end-of-pipe effluent limits established to meet the applicable water quality standard. In addition, the permits include routine monitoring and reporting requirements.

For facilities that currently have a bacteria effluent limit, the permit information, receiving stream, impaired stream and WLAs are provided in Table 13. This information is provided for facilities that discharge into or within 25 miles upstream of a listed segment. In most cases, the WLAs are calculated based on permitted or design flow and permitted bacteria concentration. However, for those facilities whose wastewater is reused, the bacteria limit to discharge into surface waters may be overly restrictive and for these facilities the WLA is calculated using the permitted flow and permitted bacteria concentration. This was expressed as an accumulated load over a 30-day period and presented in units of counts per 30 days. If there is a new facility or a facility expands its capacity and the permitted flow increases, the wasteload allocation for the facility will be the permitted flow times the appropriate water quality criteria, either 200 counts/100 mL for fecal coliform or 126 counts/100 mL for E. coli as a 30-day geometric mean.

Table 13: WLAs for the Facilities that Currently have Bacteria Limits in the Suwannee River Basin

Facility Name	NPDES Permit No.	Receiving Stream	Listed Stream Segment	Bacterial Indictor	WLA (counts/ 30 days)	30 Day Geometric Mean Concentration (counts/100mL)
Homerville WPCP	GA0031828	Unnamed tributary to Woodyard Creek	Woodyard Creek (GAR031102010108)	Fecal coliform	3.79E+09	200
				E. coli	2.38E+09	126
Homerville, Industrial Park WPCP	GA0037460	Unnamed tributary to Tatum Creek	Tatum Creek (GAR031102010201)	Fecal coliform	1.89E+09	200
				E. coli	1.19E+09	126
Moultrie, Spence Field WPCP	GA0025879	Little Indian Creek	Tributary to Little Creek (GAR031102030507) & Little Creek (GAR031102030506)	Fecal coliform	1.51E+09	200
				E. coli	9.54E+08	126
Norman Park WPCP	GA0033600	Reedy Creek	Reedy Creek (GAR031102040404)	Fecal coliform	1.51E+09	200
				E. coli	9.54E+08	126

[a] – WLA calculated using concentration of 63 counts/100mL (Half of instream *E.coli* criterion) to ensure segment has adequate load allocation for nonpoint sources

Non-POTW facilities that discharge sanitary wastewater directly or sanitary waste streams commingled with other waste streams will be given a bacteria effluent limit in their permit.

Potential WLAs for existing Non-POTW discharges without bacteria permit limits would be the facility design flow multiplied by the appropriate bacteria criterion, either 200 counts/100 mL for fecal coliform or 126 counts/100 mL for *E. coli* as a 30-day geometric mean. For these facilities, it is not known if their discharge contains any bacteria at levels that would exceed the instream water quality criteria because the type of treatment processes employed. Therefore, existing Non-POTW facilities may be required to submit bacteria data with their NPDES permit renewal application. Non-POTW discharges must collect, analyze, and submit appropriate bacteria data from at least 4 samples collected 24 hours apart within a 30-day period. GA EPD will evaluate these data and determine if a permit limit for bacteria is needed. There are currently no known existing Non-POTW discharges without bacteria permit limits in the contributing watersheds.

5.1.2 Regulated Stormwater Discharges

State and Federal Rules define stormwater discharges covered by NPDES permits as point sources. However, stormwater discharges are from diffuse sources and there are multiple stormwater outfalls. Stormwater 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 stormwater NPDES permits is not to treat the water after collection, but to reduce the exposure of stormwater to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to control pollutant discharges from each stormwater outfall. Therefore, stormwater NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment.

The wasteload allocations from stormwater discharges (WLAsw) associated with MS4s are estimated based on the percentage of urban area in each watershed covered by the MS4 stormwater permit. At this time, the portion of each watershed that goes directly to a permitted storm sewer or is non-permitted sheet flow or diffuse runoff has not been clearly defined. Thus, it is assumed that approximately 70 percent of stormwater runoff from the regulated urban area is collected by the MS4s. This can be represented by the following equation:

$$WLA_{SW} = Q_{WLAsw} \times C_{standard}$$

where: WLA_{SW} = Wasteload Allocation for permitted storm water runoff from all MS4 urban areas

Q_{WLAsw} = Runoff from all MS4 urban areas conveyed through permitted storm water structures

$Q_{WLAsw} = \Sigma Q_{urban} \times 0.7$

ΣQ_{urban} = Sum of all storm water runoff from MS4 urban

$C_{standard}$ = seasonal fecal coliform standard (as a 30-day geometric mean)
summer – 200 counts/100 mL as fecal coliform
winter – 1000 counts/ 100 mL as fecal coliform
summer – 126 counts/100 mL as *E. coli*
winter – 265 counts/ 100 mL as *E. coli*

For stormwater permits, compliance with the terms and conditions of the permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP), and demonstrates consistency with the assumptions and requirements of the TMDL. GA EPD acknowledges that progress with the assumptions and requirements of the TMDL by stormwater permittees may take one or more permit iterations. Achieving the TMDL reductions may constitute compliance with a SWMP or a SWPPP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved so long as reasonable progress is made toward attainment of water quality standards using an iterative BMP process.

5.1.3 Concentrated Animal Feeding Operations

Wet manure facilities are either included under a State-issued LAS General Permit or an NPDES General Permit. A small number of wet manure operations have an individual NPDES permit. Dry manure facilities are not required to obtain permits. None of the wet manure or dry manure facilities have discharges. Presently, there are no wet or dry manure CAFOs located in the watersheds of the listed segments in the Suwannee River Basin, 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 stormwater (non-permitted).

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

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

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 bacteria accumulation on land surfaces that is washed off during storm events, including runoff from saturated LAS fields. Currently, it is not possible to partition the various sources of load allocations. 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 bacteria 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 for each listed segment is 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.

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.

5.5 Total Bacteria Load

The bacteria TMDL for the listed stream segment is dependent on the time of year, the stream flow, and the applicable state water quality standard. In January 2022, the Georgia DNR Board adopted new bacteria criteria for “Fishing” and “Drinking Water” designated uses using the bacterial indicators *E. coli* and enterococci. These bacteria are better indicators for human health illnesses. The adopted criteria have the same estimated illness rate (8 per 1000 swimmers) as the previously established fecal coliform criteria. Since this TMDL is based on fecal coliform data, but the current bacteria criteria is *E. coli*, this TMDL will use both fecal coliform and *E. coli* as the bacterial indicators.

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

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

$TMDL_{winter}$ = 1000 counts/100 mL (as a 30-day geometric mean) x Q

TMDL = 4000 counts/100 mL (instantaneous) x Q

The total maximum daily seasonal *E. coli* loads for Georgia are given below:

$TMDL_{summer}$ = 126 counts/100 mL (as a 30-day geometric mean) x Q

$TMDL_{winter}$ = 265 counts/100 mL (as a 30-day geometric mean) x Q

TMDL = 410 counts/100 mL (instantaneous) x Q

For purposes of determining 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 bacteria standard and the mean flow used to calculate the current fecal coliform 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). For these calculations, the bacteria contributed by a permitted facility to the WLA was the product of the bacteria permitted limit and the monthly permitted discharge. The current critical loads and corresponding TMDLs, WLAs (WLA and WLA_{sw}), LAs, MOSs, and percent load reductions for the Suwannee River Basin listed stream segment is presented in Table 14.

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. Because of the localized nature of the load evaluations, the calculated bacterial load reductions pertain to point and nonpoint sources occurring within the immediate drainage area of the listed segment. The 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 bacteria 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 bacterial loads and the potential sources occurring within the sub-watershed of each segment was examined on a qualitative basis.

Table 14: Bacteria Loads and Required Load Reductions

AUID	Stream Segment	Description	Bacterial Indicator	Current Load (counts/ 30 days)	TMDL Components					Reduction Required
					WLA (counts/ 30 days)(1)	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
GAR031102030104	Cypress Creek	Hardy Mill Creek to the Withlacoochee River	Fecal coliform	2.62E+12	--	--	4.27E+11	4.75E+10	4.75E+11	81.9%
			E. coli	(2)	--	--	2.69E+11	2.99E+10	2.99E+11	Undetermined (3)
GAR031102030506	Little Creek	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Creek	Fecal coliform	2.87E+10	1.51E+09	--	1.99E+10	2.37E+09	2.37E+10	17.2%
			E. coli	(2)	9.54E+08	--	1.25E+10	1.49E+09	1.49E+10	Undetermined (3)
GAR031102030705	Piscola Creek	Headwaters to Tributary 0.3 miles upstream of Pope Road	Fecal coliform	1.28E+12	--	--	1.05E+11	1.17E+10	1.17E+11	90.9%
			E. coli	(2)	--	--	6.63E+10	7.37E+09	7.37E+10	Undetermined (3)
GAR031102030706	Piscola Creek	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	Fecal coliform	1.05E+13	--	--	4.71E+12	5.23E+11	5.23E+12	50.0%
			E. coli	(2)	--	--	2.97E+12	3.29E+11	3.29E+11	Undetermined (3)
GAR031102020508	Reedy Creek	Little Brushy Creek to the Willacoochee River	Fecal coliform	6.30E+11	--	--	1.16E+11	1.29E+10	1.29E+11	79.5%
			E. coli	(2)	--	--	7.31E+10	8.13E+09	8.13E+10	Undetermined (3)
GAR031102040404	Reedy Creek	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	Fecal coliform	5.27E+11	1.51E+09	--	1.95E+10	2.34E+09	2.34E+10	95.6%
			E. coli	(2)	9.54E+08	--	1.23E+10	1.47E+09	1.47E+10	Undetermined (3)
GAR031102010201	Tatum Creek	Tower Road to Jones Creek	Fecal coliform	7.88E+11	1.89E+09	--	4.12E+11	4.60E+10	4.60E+11	41.6%
			E. coli	(2)	1.19E+09	--	2.59E+11	2.90E+10	2.90E+11	Undetermined (3)
GAR031102030507	Tributary to Little Creek	Headwaters to Little Creek	Fecal coliform	1.21E+11	1.51E+09	--	7.22E+09	9.70E+08	9.70E+09	92.0%
			E. coli	(2)	9.54E+08	--	4.55E+9	6.11E+8	6.11E+9	Undetermined (3)
GAR031102030505	Tributary to Okapilco Creek	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	Fecal coliform	1.14E+10	--	--	3.88E+09	4.31E+08	4.31E+09	62.1%
			E. coli	(2)	--	--	2.44E+09	2.72E+08	2.72E+09	Undetermined (3)
GAR031102020608	Willacoochee River	Courthouse Branch to Turkey Branch	Fecal coliform	2.77E+12	--	--	5.83E+11	6.48E+10	6.48E+11	76.6%
			E. coli	(2)	--	--	3.91E+11	4.34E+10	4.34E+11	Undetermined (3)
GAR031102010108	Woodyard Creek	Tributary 400 feet downstream US 84 to Surveyors Creek	Fecal coliform	1.64E+12	3.79E+09	--	2.38E+11	2.69E+10	2.69E+11	83.6%
			E. coli	(2)	2.38E+09	--	1.50E+11	1.69E+10	1.69E+11	Undetermined (3)

Notes:
1. (1) The assigned bacterial load from the NPDES permitted facility for WLA was determined as the product of the permitted flow and bacteria permit limit.
2. (2) Sample was not analyzed for *E. coli*, therefore critical load calculation not possible.
3. (3) Percent reduction could not be determined due to absence of current load calculation.

6.0 RECOMMENDATIONS

The TMDL process consists of an evaluation of the sub-watersheds for each 303(d) listed stream segment to identify, as best as possible, the sources of the bacteria 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 bacteria water quality criteria to support the use classification specified for the listed segment.

This TMDL represents part of a long-term process to reduce bacteria loading to meet water quality standards in the Suwannee River Basin. Implementation strategies will be reviewed and the TMDL 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, the TMDL 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 several locations across the State each year. Sampling is conducted statewide by GA EPD personnel in Atlanta, Augusta, Brunswick, Cartersville, and Tifton. Additional monitoring sites are added as necessary.

In the case where a watershed-based plan has been developed for a listed stream segment, an appropriate water quality monitoring program will be outlined. The monitoring program will be developed to help identify the various bacteria sources. The monitoring program may be used to verify the 303(d) stream segment listings. This will be especially valuable for those segments where limited data resulted in the listing.

6.2 Bacteria Management Practices

Based on the findings of the source assessment, NPDES point source bacteria loads from wastewater treatment facilities usually do not significantly contribute to the impairment of the listed stream segments. This is because most facilities are required to treat to levels corresponding to instream water quality criteria. Sources of bacteria 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 bacteria 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 and mammals living close to or in water environments, can be a significant source of bacteria.

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

- Compliance with NPDES (wastewater, construction, industrial stormwater, and/or MS4) permit limits and requirements;

- Ensure storm water management plans are in place and being implemented by the local governments located in the watershed;
- Implementation of the Georgia's *Statewide Nonpoint Source Management Plan* (GA EPD, 2019);
- Implementation of recommended Water Quality management practices in the Suwannee-Satilla Water Planning Region;
- Implementation of *Georgia's Best Management Practices for Forestry* (GFC, 2009);
- Implementation of *Best Management Practices for Georgia Agriculture* (GSWCC, 2013) and Adoption of National Resource Conservation Service (NRCS) Conservation Practices for agriculture;
- Adoption and implementation of the *Georgia Stormwater Management Manual* (ARC, 2016) and the *Coastal Stormwater Supplement to the Georgia Stormwater Management Manual* (CWP, 2009) to facilitate water quality treatment of stormwater runoff, including bacteria removal, through structural stormwater BMP installation.

6.2.1 Point Source Approaches

The NPDES permit program provides a basis for municipal, industrial, and stormwater permits, monitoring and compliance with permit limitations, and appropriate enforcement actions for violations. In accordance with GA EPD rules and regulations, all discharges from point source facilities are required to follow the conditions of their NPDES permit at all times. Wastewater treatment plants with the potential for bacteria in their discharge are given end-of-pipe limits to meet the applicable water quality standard. In addition, the permits include routine monitoring and reporting requirements.

Achieving the TMDL reductions may constitute compliance with a SWMP or SWPPP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved so long as reasonable progress is made toward attainment of water quality standards using an iterative BMP process.

6.2.2 Nonpoint Source Approaches

GA EPD is the lead agency for implementing the State's Nonpoint Source Management Program, as described in Georgia's *Statewide Nonpoint Source Management Plan* (GA EPD, 2019). GA EPD will continue to work with local governments, agricultural, and forestry agencies such as the Natural Resources Conservation Service (NRCS), the Georgia Soil and Water Conservation Commission (GSWCC), and the Georgia Forestry Commission (GFC) to foster the implementation of BMPs that address nonpoint source pollution. The following sections describe programs in place and recommendations which should result in reducing nonpoint source loads of bacteria in Georgia's surface waters.

6.2.2.1 Agricultural Sources

GA EPD should coordinate with other agencies that are responsible for agricultural activities in the state to address issues concerning bacteria loading from agricultural lands. It is recommended that information such as livestock populations by sub-watershed, animal access to streams, manure storage and application practices 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 number of 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. 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 bacteria can be significant in the Suwannee River Basin urban areas. Urban sources of bacteria can best be addressed using a strategy that involves stormwater management, 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. The following activities and programs conducted by cities, counties, and state agencies are recommended:

- Implement stormwater BMPs that incorporate water quality treatment and/or pollutant removal

- Uphold requirements that all new and replacement sanitary sewerage 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;

- 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

GA EPD is responsible for administering and enforcing laws to protect the waters of the State. Reasonable assurance ensures that a TMDL's wasteload and load allocations are properly distributed to meet the applicable water quality standards. Without such distribution, a TMDL's ability to serve as an effective guidepost for water quality improvement is significantly diminished. Federal regulations implementing the CWA require that effluent limits in permits be consistent with "the assumptions and requirements of any available [WLA]" in an approved TMDL [40 CFR 122.44(d)(1)(vii)(B)]. NPDES point source permits will be given effluent limits in the permit consistent with the individual WLAs specified in the TMDL.

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 NRCS, GSWCC, and GFC, to foster the implementation of BMPs to address nonpoint sources. In addition, public education efforts will be targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality.

6.4 Public Participation

A thirty-day public notice was provided for this TMDL. During that time, the TMDL was available on the GA EPD website, a copy of the TMDL was provided on request, and the public was invited to provide comments on the TMDL.

7.0 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 the segment in the Suwannee River Basin. Local watershed planning and management initiatives will be fostered, supported, or developed through a variety of mechanisms. Implementation may be addressed by Watershed-Based Plans or other assessments funded by Section 319(h) grants, the local development of watershed protection plans, or "Targeted Outreach" initiated by GA EPD. These initiatives will supplement or possibly replace this initial implementation plan. Implementation actions should also be guided by the recommended management practices and actions contained within each applicable Regional Water Plan developed as part of *Georgia's Comprehensive State-wide Water Management Plan* implementation (Georgia Water Council, 2008).

7.1 Impaired Segments

This initial plan is applicable to the following waterbody that was added to Georgia's 2022 Integrated 305(b)/303(d) List of not supporting waters in *Water Quality in Georgia 2020-2021* (GA EPD, 2022) available on the GA EPD website. The following table summarizes the descriptive information provided in the 303(d) list.

Table 15: Stream Segments Listed on the 2022 303(d) List for Bacteria in the Suwannee River Basin

Stream Segment	Location	Reach AUID	Segment Length (miles)	Designated Use
Cypress Creek	Hardy Mill Creek to the Withlacoochee River	GAR031102030104	2	Fishing
Little Creek	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Creek	GAR031102030506	3	Fishing
Piscola Creek	Headwaters to Tributary 0.3 miles upstream of Pope Road	GAR031102030705	3	Fishing
Piscola Creek	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	GAR031102030706	5	Fishing
Reedy Creek	Little Brushy Creek to the Willacoochee River	GAR031102020508	2	Fishing
Reedy Creek	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	GAR031102040404	6	Fishing
Tatum Creek	Tower Road to Jones Creek	GAR031102010201	11	Fishing
Tributary to Little Creek	Headwaters to Little Creek	GAR031102030507	2	Fishing
Tributary to Okapilco Creek	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	GAR031102030505	3	Fishing
Willacoochee River	Courthouse Branch to Turkey Branch	GAR031102020608	5	Fishing
Woodyard Creek	Tributary 400 feet downstream US 84 to Surveyors Creek	GAR031102010108	5.6	Fishing

The water use classification for the listed stream segments in the Altamaha River Basin is "Fishing." The criterion violated is listed as fecal coliform. The potential causes listed include urban runoff and nonpoint sources. The "Fishing" bacteria water quality standards as approved by US EPA Region 4 on January 20, 2021, and applicable at the time of listing was as follows:

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

(i) Bacteria:

1. 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 counts 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 counts per 100 mL (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 counts per 100 mL in lakes and reservoirs and 500 counts 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 counts 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 counts per 100 mL for any sample. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

2. For waters designated as shellfish growing areas by the Georgia DNR Coastal Resources Division, 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 National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2007 Revision (or most recent version), Interstate Shellfish Sanitation Conference, U.S. Food and Drug Administration.

In January 2022, the Georgia DNR Board adopted new bacteria criteria for "Fishing" and "Drinking Water" designated uses using the bacterial indicators *E. coli* and enterococci. These bacteria are better indicators for human health illnesses. The adopted criteria have the same estimated illness rate (8 per 1000 swimmers) as the previously established criteria. EPA approved the proposed standards August 31, 2022. Since this TMDL was written after EPA approved the new bacteria criteria, the TMDL will use both bacterial indicators. 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, 2022), are:

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

(i) Bacteria:

1. Estuarine waters: For the months of May through October, when primary water contact recreation activities are expected to occur, culturable enterococci not to exceed a geometric mean of 35 counts 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. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 130 counts per 100 mL the same 30-day interval.

   For the months of November through April, culturable enterococci not to exceed a geometric mean of 74 counts 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. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 273 counts per 100 mL in the same 30-day interval.

2. All other fishing waters: For the months of May through October, when primary water contact recreation activities are expected to occur, culturable E. coli not to exceed a geometric mean of 126 counts 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. There shall be no greater than a ten percent excursion frequency of an E. coli statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval.

   For the months of November through April, culturable E. coli not to exceed a geometric mean of 265 counts 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. There shall be no greater than a ten percent excursion frequency of an E. coli statistical threshold value (STV) of 861 counts per 100 mL in the same 30-day interval.

3. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

4. For waters designated as shellfish growing areas by the Georgia DNR Coastal Resources Division, 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 National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2007 Revision (or most recent version), Interstate Shellfish Sanitation Conference, U.S. Food and Drug Administration.

7.2 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. Point sources of bacteria include NPDES permittees discharging treated wastewater and storm water. Nonpoint sources of bacteria are diffuse sources that cannot be identified as entering the waterbody at a single location. These sources generally involve land use activities that contribute bacteria to streams during a rainfall runoff event.

NPDES point source bacteria 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 bacteria 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 bacteria 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 and mammals living close to or in water environments, can be a significant source of bacteria.

7.3 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, NRCS, GSWCC, and GFC to foster implementation of BMPs that address nonpoint source pollution. The following management practices are recommended to reduce bacteria loads to stream segments:

- Sustain compliance with NPDES treated wastewater permit requirements;
- Sustain compliance with NPDES MS4 permit requirements, where applicable;
- Compliance with future NPDES Industrial General Permit requirements, including where applicable, achieving benchmark levels for monitored constituents;
- Ensure storm water management plans are in place and being implemented by the local governments, and by the industrial facilities located in the watershed;
- Implementation of Georgia's *Statewide Nonpoint Source Management Plan* (GA EPD, 2019);
- Adoption and implementation of the *Georgia Stormwater Management Manual* (ARC, 2016) to facilitate water quality treatment of stormwater runoff, including bacteria removal, through structural stormwater BMP installation;
- Further develop and streamline mechanisms for reporting and correcting illicit discharges, breaks, surcharges, and general sanitary sewer system problems;
- Uphold requirements that all new and replacement sanitary sewage systems be designed to minimize discharges into storm sewer systems;
- Adoption of local ordinances (i.e., septic tanks, storm water, etc.) that address local water quality;
- Continue efforts to increase public awareness and education regarding the impact of human activities on water quality, ranging from industrial and municipal discharges to individual's activities in residential neighborhoods;
- Continue working with Federal, State, and local agencies and owners of sites where cleanup measures are necessary, and in developing control measures to prevent future releases of constituents of concern;
- Implementation of recommended Water Quality management practices in the *Suwannee-Satilla Regional Water Plan* (GA EPD, 2017);
- Adoption of NRCS Conservation Practices for primarily agricultural lands;
- Application of BMPs appropriate to both urban and rural land uses, where applicable; and
- Ongoing public education efforts on the sources of bacteria and common-sense approaches to lessen the impact of this contaminant on surface waters.

7.4 Monitoring

GA EPD encourages local governments and municipalities to develop and continue water quality monitoring programs. These programs can help pinpoint various bacteria 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 would like to particularly commend and encourage downgradient sampling on the LAS system and supports expanding monitoring to quarterly or monthly sampling schedules. GA EPD is available to assist in providing technical guidance regarding the preparation of monitoring plans and Sampling Quality Assurance Plans (SQAP).

7.5 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 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 stormwater will be implemented in the form of BMPs 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 support watershed restoration, improvement and protection projects that address nonpoint 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 Management Plan intended to address water quality at the small watershed level (HUC 10 or smaller). These plans will be developed as resources and willing partners become available. The development of these plans may be funded via several grant sources, including, but not limited to: CWA Section 319(h), Section 604(b), and/or Section 106 grant funds. These plans are intended for implementation upon completion.

Any Watershed Management Plan that specifically addresses a waterbody contained within this TMDL will supersede this Initial TMDL Implementation Plan for that waterbody once GA EPD accepts and/or approves the plan. Watershed Management Plans intended to address this TMDL and other water quality concerns, prepared for 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 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 determine 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 Management 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 Management 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 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.

REFERENCES

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

CWP, 2009. Coastal Stormwater Supplement to the Georgia Stormwater Management Manual, First Edition, Center for Watershed Protection. April 2009.

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

GA Dept. of Public Health, 2022. Most Current Summary Data Septic Inspections 2016-08-06, Department of Public Health, Environmental Health Section. August 2022.

GA EPD, 2022. Personal Communications with State of Georgia, Department of Natural Resources, Environmental Protection Division, Land Protection Branch. August 2022.

GA EPD, 2022. Solid Waste Facility Information, State of Georgia, Department of Natural Resources, Environmental Protection Division, Land Protection Branch.

GA EPD, 2017 Suwannee-*Satilla Regional Water Plan,* Adopted by GA EPD November 2011, Revised June 2017.

GA EPD, 2022. *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6*, State of Georgia, Department of Natural Resources, Environmental Protection Division, Water Protection Branch, amended February 2022.

GA EPD, 2022. *Water Quality in Georgia 2020-2021*, Georgia Department of Natural Resources, Environmental Protection Division, Watershed Protection Branch.

GA EPD, 2022. Georgia Pollutant Discharge Elimination System, Department of Natural Resources, Environmental Protection Division, Watershed Protection Branch, Wastewater Regulatory Program.

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

Georgia Water Council, 2008. *Georgia Comprehensive State-wide Water Management Plan*, Atlanta, Georgia, January 2008.

MNGWPD, 2017. *Metropolitan North Georgia Water Planning District Water Resource Management Plan,* June 2017

UGA, 2022. Animal Inventory, Center for Agribusiness and Economic Development, College of Agriculture and Environmental Sciences, University of Georgia, 304A Lumpkin House, Athens, Georgia 30605.

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

Table A-1: Drainage Areas and USGS Flow Gage Used to Estimate Stream Flow in 303(d) Listed Streams

Stream Segment	Location	Drainage Area (sq miles)	USGS Station ID	USGS Description	USGS Drainage Area (sq miles)
Cypress Creek GAR031102030104	Hardy Mill Creek to the Withlacoochee River	50.2	02314500	Suwannee River at US Hwy 441 at Fargo, GA	1,130
Little Creek GAR031102030506	Unnamed tributary 1.7 miles upstream Perry Road to Okapilco Ck	15.0			
Piscola Creek GAR031102030705	Headwaters to Tributary 0.3 miles upstream of Pope Rd	7.6			
Piscola Creek GAR031102030706	Tributary 0.3 miles upstream of Pope Road to Whitlock Branch	28.5			
Reedy Creek GAR031102020508	Little Brushy Creek to the Willacoochee River	95.0			
Reedy Creek GAR031102040404	Headwaters to unnamed tributary 0.7 miles downstream DH Alderman Rd	5.8			
Tatum Creek GAR031102010201	Tower Road to Jones Creek	55.5			
Tributary to Little Creek GAR031102030507	Headwaters to Little Creek	2.4			
Tributary to Okapilco Creek GAR031102030505	Pond 0.25 miles upstream Wilder Road to Okapilco Creek	2.7			
Willacoochee River GAR031102020608	Courthouse Branch to Turkey Branch	27.2			
Woodyard Creek GAR031102010108	Tributary 400 feet downstream US 84 to Surveyors Creek	32.4			

Table A-2: RV_09_ 17774: Cypress Creek at Vickers Church Rd near Enigma, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/01/2021	110	140.303	129	115	8.66E+11	1.34E+12
03/15/2021	65	115.121				
03/22/2021	300	88.589				
06/15/2021	500	4.196	**1106**	41	2.62E+12	4.75E+11
06/22/2021	8000	4.187				
06/28/2021	220	13.401				
07/13/2021	1700	140.303				

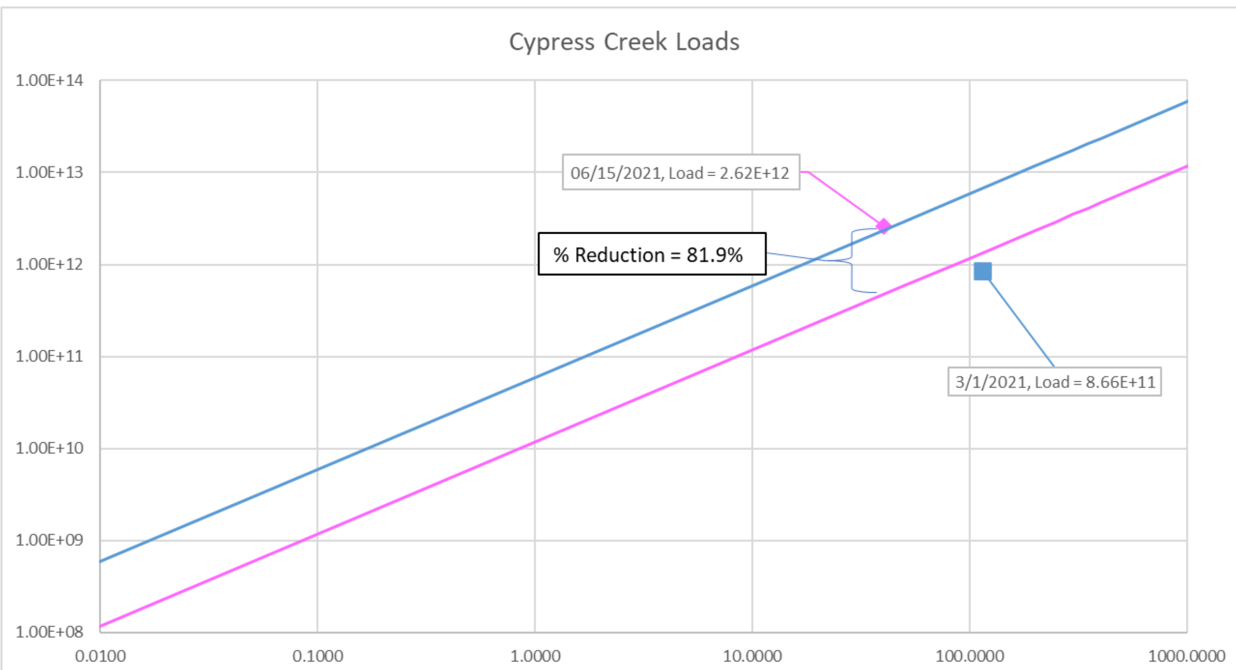

Figure A-1: Cypress Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-3: RV_09_5073 - Little Creek at Perry Road near Berlin, GA
Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/09/2015	170	32.113	69	25	1.03E+11	2.96E+11
03/11/2015	170	30.255				
03/26/2015	40	20.038				
03/30/2015	20	18.843				
06/03/2015	800	1.080	**241**	2	2.87E+10	2.37E+10
06/09/2015	220	1.181				
06/30/2015	80	3.822				
09/10/2015	110	22.824				
12/03/2015	1400	1.924	165	2	1.64E+10	1.99E+10
12/07/2015	40	1.632				
12/09/2015	80	1.539				

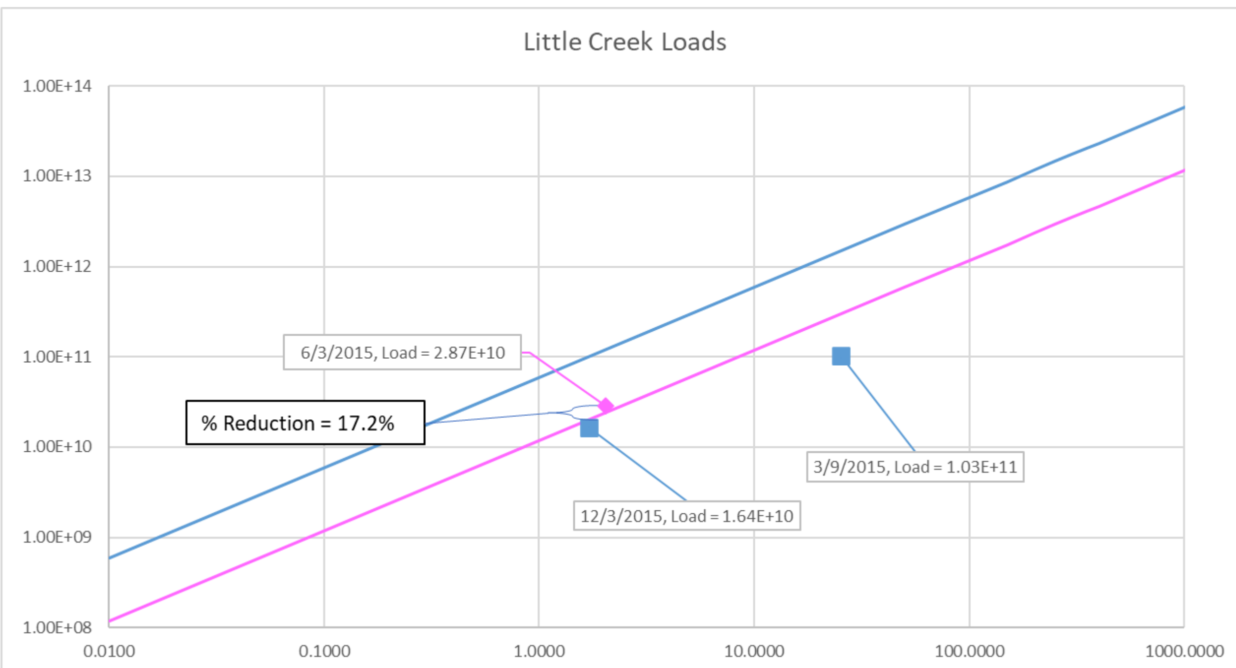

Figure A-2: Little Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

**Table A-4: RV_09_16764 - Piscola Creek at Hwy 122 near Pavo, GA
Water Quality Monitoring Data**

Date	Observed Fecal coliform (Count/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)
03/02/2017	2300	13.235	967	7	3.96E+11	8.19E+10
03/15/2017	500	6.126				
03/20/2017	950	4.588				
03/22/2017	800	4.033				
06/20/2017	16000	10.613	**2191**	10	1.28E+12	1.17E+11
06/26/2017	300	9.403				
12/13/2017	1800	7.714	1530	7	6.24E+11	8.16E+10
12/19/2017	1300	6.227				
03/07/2018	800	6.000	1246	5	3.50E+11	5.62E+10
03/14/2018	1100	4.588				
03/19/2018	2200	3.807				
06/18/2018	500	15.554	**727**	16	6.68E+11	1.84E+11
06/21/2018	70	12.529				
07/05/2018	1000	14.697				
09/10/2018	8000	19.965			9.35E+12	4.68E+12
12/03/2018	3000	22.335	1009	157	9.28E+12	1.84E+12
12/10/2018	500	178.227				
12/17/2018	2300	219.317				
12/20/2018	300	208.729				

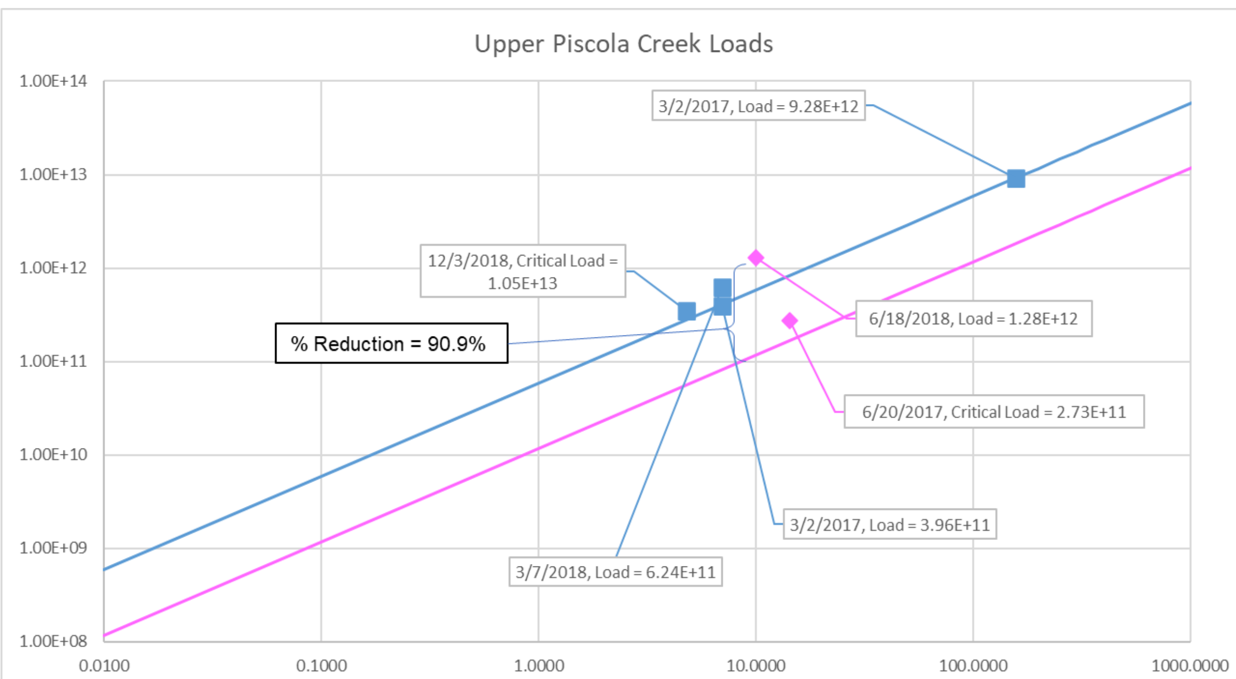

Figure A-3: Upper Piscola Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-5: RV_09_16765 - Piscola Creek at Coffee Rd near Barwick, GA
Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/02/2017	230	13.235	199	7	8.13E+10	8.19E+10
03/15/2017	650	6.126				
03/20/2017	130	4.588				
03/22/2017	80	4.033				
03/07/2018	300	6.000	193	5	5.43E+10	5.62E+10
03/14/2018	80	4.588				
03/19/2018	300	3.807				
06/18/2018	80	15.554	**323**	14	2.69E+11	1.67E+11
06/21/2018	140	12.529				
07/05/2018	3000	14.697				
12/03/2018	**8000**	22.335	553	157	1.05E+13	5.23E+12
12/10/2018	300	178.227				
12/17/2018	230	219.317				
12/20/2018	170	208.729				

Figure A-4: Lower Piscola Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-6: RV_09_17661 - Reedy Creek at Bethlehem Church Rd near Ocilla, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/03/2020	40	3.725	151	4	3.69E+10	4.90E+10
03/10/2020	80	4.673				
03/25/2020	230	4.980				
03/30/2020	700	3.356				
06/11/2020	1300	19.215	**710**	18	7.62E+11	2.15E+11
06/15/2020	1300	22.238				
06/18/2020	300	19.112				
06/23/2020	500	12.758				
09/14/2020	1300	3.607	**976**	11	6.30E+11	1.29E+11
09/21/2020	650	14.296				
09/24/2020	1100	15.167				
12/03/2020	80	1.553	634	1	5.07E+10	1.60E+10
12/07/2020	2300	1.440				
12/14/2020	800	1.240				
12/16/2020	1100	1.230				

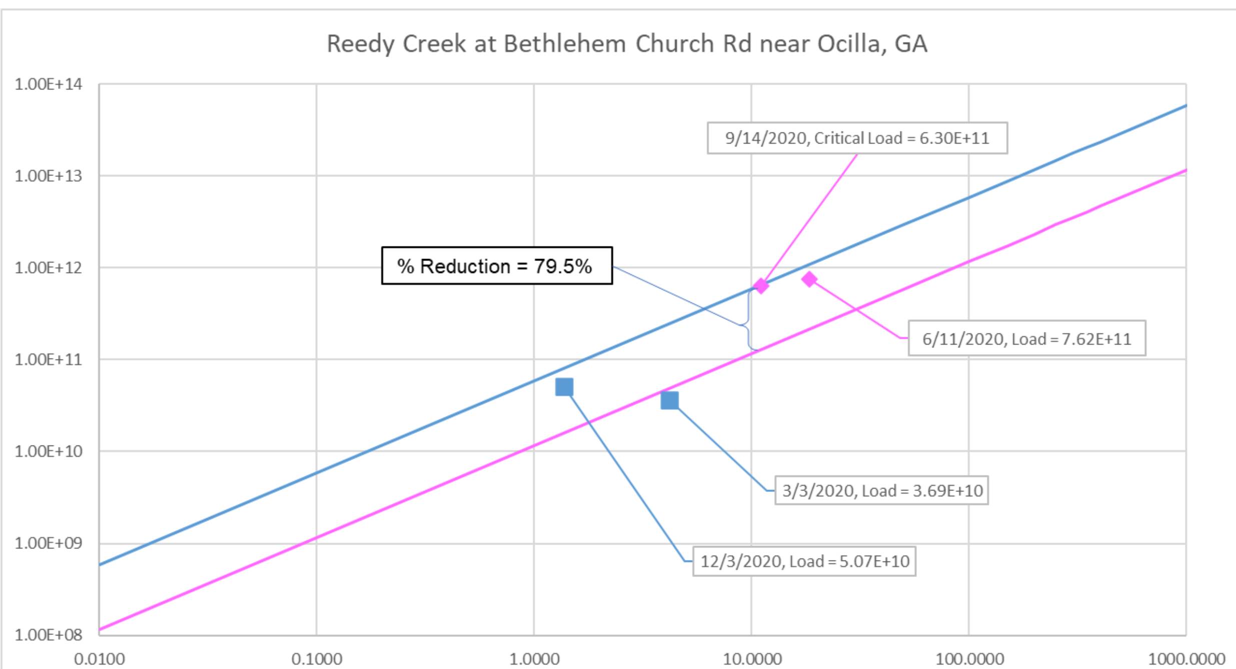

Figure A-5: Reedy Creek at Bethlehem Church Rd near Ocilla, GA Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-7: RV_09_5070 - Reedy Creek at East Broad Street near Norman Park, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/02/2016	800	2.536	411	2	4.28E+10	2.08E+10
03/22/2016	700	1.537				
03/24/2016	300	1.358				
03/30/2016	170	1.681				
06/02/2016	1100	0.268	1992	0.24	2.80E+10	2.81E+09
06/13/2016	1300	0.281				
06/16/2016	5000	0.205				
06/20/2016	2200	0.205				
09/06/2016	3000	0.943	2807	0.53	8.76E+10	6.24E+09
09/08/2016	3000	0.702				
09/12/2016	2300	0.340				
09/19/2016	3000	0.146				
12/01/2016	3000	0.050	3274	0.10	1.91E+10	1.17E+09
12/06/2016	**90000**	0.100			5.27E+11	2.34E+10
12/12/2016	130	0.149				

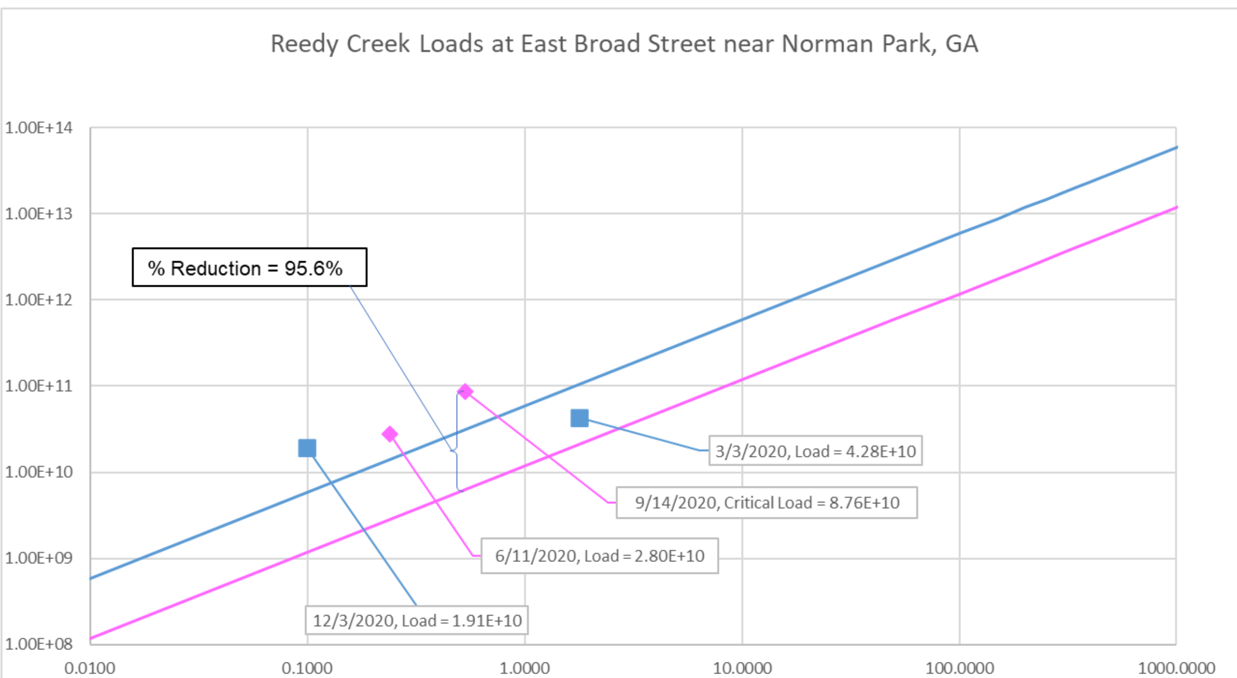

Figure A-6: Reedy Creek at East Broad Street near Norman Park, GA Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-8: RV_09_3183 - Tatum Creek at U.S. Highway 441 near Homerville, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
02/17/2020	800	22.162	96	29.94	1.67E+11	3.51E+11
02/20/2020	130	28.402				
02/24/2020	40	32.039				
03/02/2020	20	37.149				
05/05/2020	20	69.777	52	32.27	9.82E+10	3.78E+11
05/20/2020	40	19.950				
05/26/2020	70	18.427				
06/01/2020	130	20.933				
08/17/2020	300	38.574	343	39.24	7.88E+11	4.60E+11
08/19/2020	2300	45.896				
08/31/2020	40	36.952				
09/02/2020	500	35.527				
11/19/2020	20	20.540	32	18.17	3.38E+10	2.13E+11
11/23/2020	20	17.985				
12/01/2020	80	15.970				

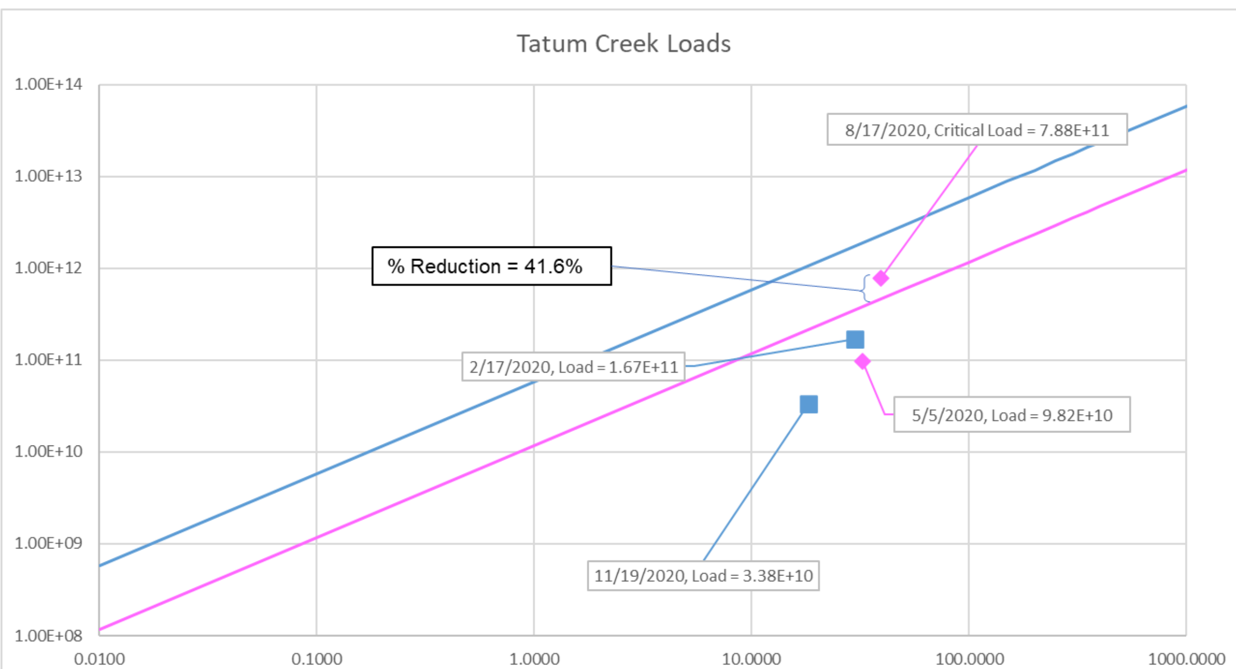

Figure A-7: Tatum Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-9: RV_09_ 16323 - Tributary to Little Creek at Edmonson Road near Moultrie, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/02/2016	140	1.051	63	0.74	2.72E+09	8.63E+09
03/22/2016	70	0.637				
03/24/2016	40	0.563				
03/30/2016	40	0.697				
06/02/2016	800	0.111	926	0.10	5.39E+09	1.16E+09
06/13/2016	2300	0.117				
06/16/2016	500	0.085				
06/20/2016	800	0.085				
09/06/2016	8000	0.391	1428	0.22	1.85E+10	2.59E+09
09/08/2016	800	0.291				
09/12/2016	1300	0.141				
09/19/2016	500	0.061				
12/01/2016	30000	0.021	3360	0.05	8.95E+09	5.32E+08
12/06/2016	**50000**	0.041			1.21E+11	9.70E+09
12/12/2016	170	0.062				
12/20/2016	500	0.058				

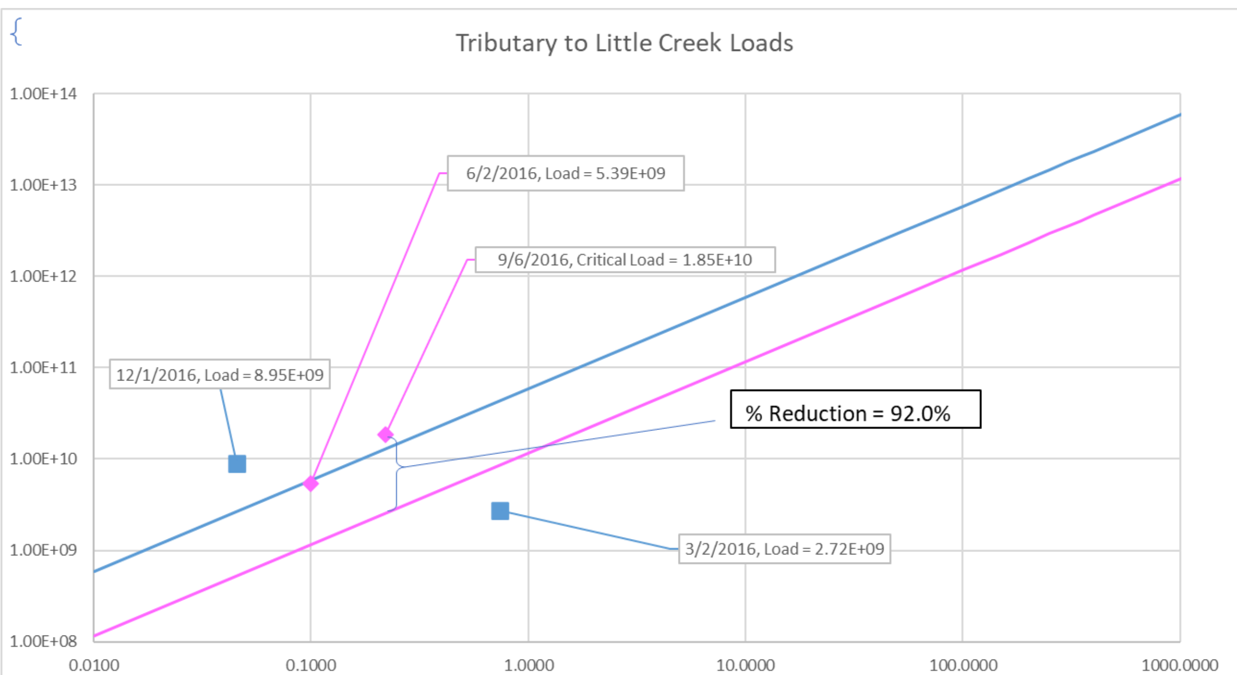

Figure A-8: Tributary to Little Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-10: RV_09_5072 - Unnamed Tributary to Okapilco Creek at Old Berlin Rd near Moultrie, GA Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
03/09/2015	110	5.825	84	4.59	2.25E+10	5.38E+10
03/11/2015	160	5.488				
03/26/2015	70	3.635				
03/30/2015	40	3.418				
06/03/2015	800	0.196	528	0.37	1.14E+10	4.31E+09
06/09/2015	230	0.214				
06/30/2015	800	0.693				
12/03/2015	500	0.349	846	0.31	1.53E+10	3.61E+09
12/07/2015	1100	0.296				
12/09/2015	1100	0.279				

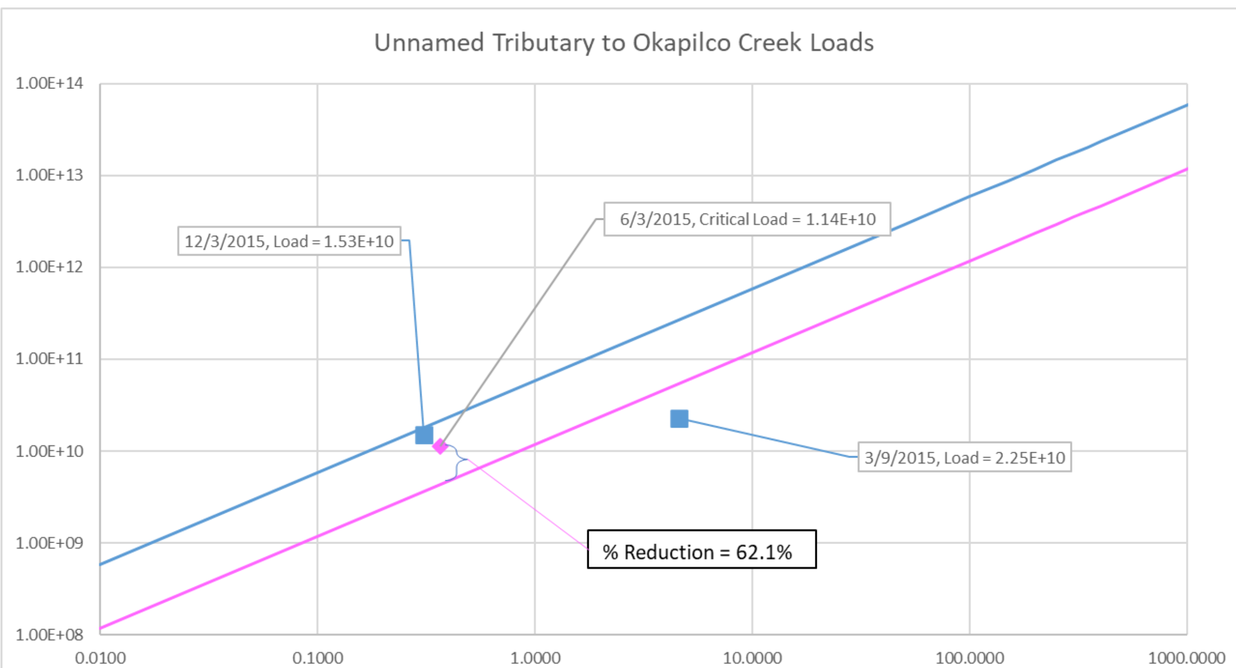

Figure A-9: Unnamed Tributary to Okapilco Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-11: RV_09_3167 - Willacoochee River at Perry House Rd. near Fitzgerald, GA

Date	Observed Fecal coliform (Count/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)
02/13/2013	**5000**	1.825	159	9.51	5.34E+11	4.28E+11
02/19/2013	40	1.495			8.86E+10	1.11E+11
02/21/2013	40	1.442				
02/28/2013	80	33.273				
05/06/2013	800	40.506	79	27.73	1.28E+11	3.25E+11
05/16/2013	60	30.138				
05/20/2013	20	24.111				
05/28/2013	40	16.154				
08/01/2013	1300	58.830	853	55.33	2.77E+12	6.48E+11
08/20/2013	1700	47.980				
08/21/2013	3000	53.284				
08/29/2013	80	61.241				
11/05/2013	700	4.219	501	3.67	1.08E+11	4.30E+10
11/07/2013	130	4.026				
11/12/2013	230	3.400				
11/18/2013	3000	3.038				

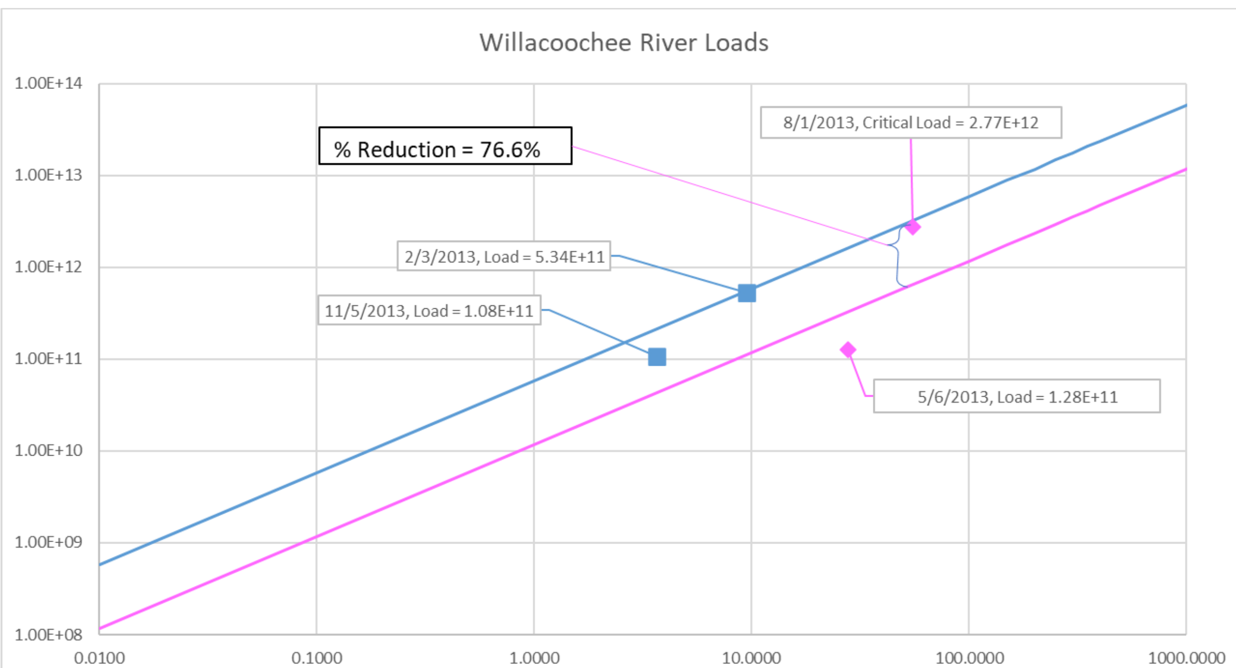

Figure A-10: Willacoochee River Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves

Table A-12: RV_09_17673 - Woodyard Cr at Bypass Rd near Homerville, GA
Water Quality Monitoring Data

Date	Observed Fecal coliform (Count/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)
02/17/2020	1700	12.950	312	17.49	3.20E+11	2.05E+11
02/20/2020	230	16.596				
02/24/2020	110	18.721				
03/02/2020	220	21.707				
05/05/2020	20	40.773	107	18.86	1.19E+11	2.21E+11
05/20/2020	170	11.658				
05/26/2020	130	10.767				
06/01/2020	300	12.232				
08/17/2020	400	22.540	1219	22.93	1.64E+12	2.69E+11
08/19/2020	6500	26.818				
08/31/2020	1700	21.592				
09/02/2020	500	20.760				
11/09/2020	1100	15.878	1739	11.93	1.22E+12	1.40E+11
11/19/2020	800	12.002				
11/23/2020	8000	10.509			4.92E+12	2.46E+12
12/01/2020	1300	9.332				

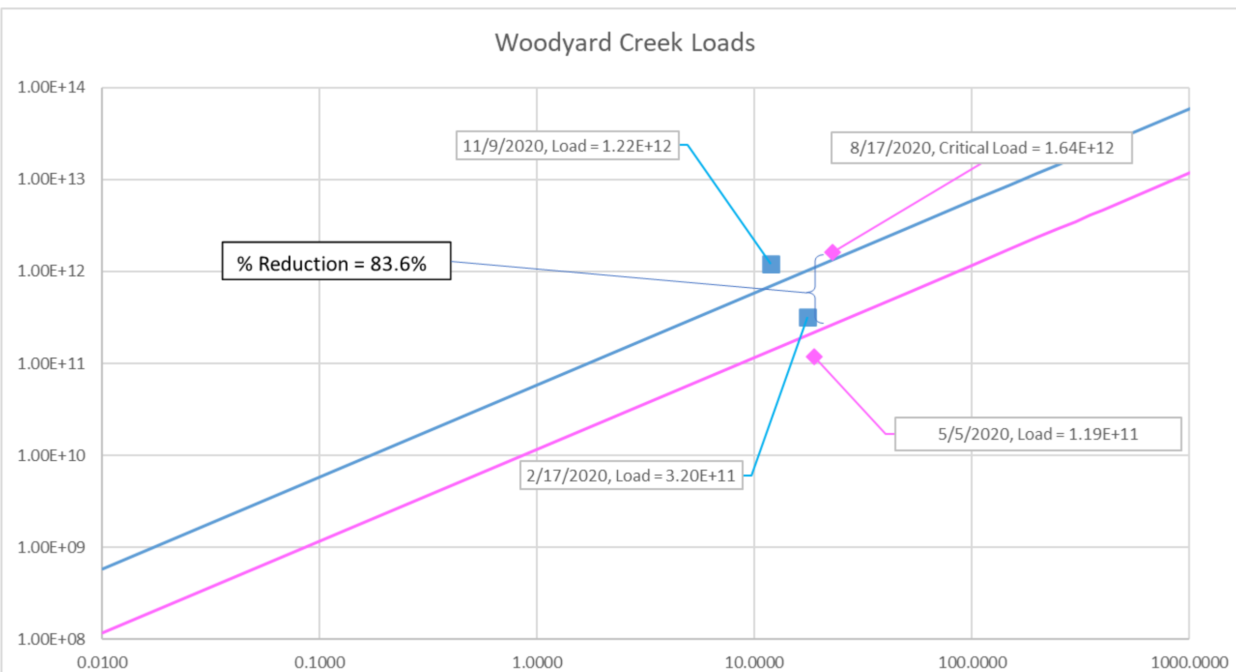

Figure A-11: Woodyard Creek Fecal Coliform Geometric Mean Loads and Summer and Winter TMDL Curves