WATERSHED MANAGEMENT PLAN FOR COOSAWATTEE RIVER – CARTERS LAKE WATERSHED

Ellijay, Georgia

prepared for
Georgia Soil and Water Conservation Commission

March 2019

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As Reviewed by:

Environmental Protection Division
Section 15 of the
Georgia Department of Natural Resources
State of Georgia
Contract between GAEPD and GSWCC

"The preparation of this report, was financed in part through a grant from the U.S. Environmental Protection Agency under the Provisions of Section 319(h) of the Federal Water Pollution Control Act, as amended."

March 2019

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ACKNOWLEDGMENTS

The Coosawattee River – Carters Lake Watershed Management Plan was developed by Nutter & Associates with the assistance and guidance of the Coosawattee River – Carters Lake Watershed Advisory Committee (WAC) and Stakeholder Group. The following individuals and organizations contributed their time, knowledge, and energy developing this final plan:

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Ben Hyer	GA Soil and Water Conservation Commission (GSWCC)
Glen Maxim	GA Forestry Commission (GFC)
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Jay Zipperman	Keep Gilmer Beautiful
Anakela Popp	Georgia Department of Natural Resources (DNR)

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Captain Eric Crowley	Lake and Stream Guide Service
Luke Garland	Garland Geological
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EXECUTIVE SUMMARY

The Coosawattee River – Carters Lake project area is comprised of four HUC 12 watersheds: Carters Lake (031501020404), Flat Creek (031501020402), Tails Creek (031501020403), and the Coosawattee (031501020401). The project area has been identified by the Georgia Soil and Water Conservation Commission (GSWCC) as a suitable project area for implementation of a Watershed Management Plan (WMP) because of the environmental conditions and impairments of the watersheds, the number of agricultural producers located within the watersheds, landowner needs, and the current listing status on the GA Georgia Environmental Protection Division (EPD) 305(b)/303(d) integrated report.

The project area encompasses approximately 46,037 acres and is located almost entirely in Gilmer County with smaller portions immediately surrounding Carters Lake reaching into Murray County. Within the project area, an approximately three-mile segment of the Coosawattee River, three-mile segment of Tails Creek, and a one-mile segment of the Flat Creek are listed on the 2016 GA EPD 305(d)/303(b) integrated report for not supporting the designated use of fishing due to elevated fecal coliform concentrations potentially caused by nonpoint source (NPS) pollution. In 2004, the EPD implemented a *Total Maximum Daily Load (TMDL) Evaluation for 58 Stream Segments in the Coosa River Basin for Fecal Coliform*. In 2006, the DNR published a Tier 2 TMDL Implementation Plan for the segment of the Coosawattee River that flows through Gilmer County and the cities of Ellijay and East Ellijay. The TMDL determined the need for a 43 percent reduction in fecal coliform loading for Tails Creek, a 57 percent reduction for Flat Creek, and a 74 percent reduction for the Coosawattee River to meet the Water Use Classifications and seasonal Water Quality Standards for fecal coliform.

The objective of the project was to develop and implement a nine-key element WMP using the U.S. Environmental Protection Agency (EPA) *Handbook for Developing Watershed Plans to Restore and Protect Our Waters.* The plan includes the long-term goal of meeting the recommended fecal coliform load reductions in the TMDL with the intent of delisting Flat and Tails Creeks and the Coosawattee River. This WMP was a collaborated effort of the Watershed Advisory Committee, stakeholder group, GSWCC, GA EPD, and Nutter & Associates (NAI). Funding for the WMP was financed through a grant from the US EPA to the GA EPD of the Department of Natural Resources (DNR) under Provisions of the Section 319(h) of the Federal Water Pollution Control Act.

To aid in the development of the WMP, a watershed characterization was conducted that assessed the current conditions of the watershed, established baseline conditions prior to management initiatives, identified pollutant sources, and prioritized areas for best management practices (BMPs) implementation. Fecal coliform bacteria have been identified as the primary pollutant within the project area. Stormwater runoff associated with urban and agricultural land use, failing or improper septic system maintenance, feces associated with wildlife and pets, livestock access to streams, illicit discharges, and stream buffer encroachment are likely sources of fecal coliform in the project area. Subwatershed UT02 (part of the Cooswattee River HUC 12 watershed) and the entire Flat Creek watershed have been identified as high priority areas for implementation of BMPs. Moderate priority watersheds include the Cooswattee HUC 12 watershed (excluding UT02) and all of the Tails Creek watershed.

In order to achieve 43 percent reduction in fecal coliform loading for Tails Creek, 57 percent reduction for Flat Creek, and 74 percent reduction for the Coosawattee River recommended by the TMDL, a series of BMPs should be implemented throughout the project area watershed. It is expected that with implementation of BMPs that control the input of fecal coliform bacteria and other pollution, such as sediment and nutrients, that the watershed will contribute a lower pollutant loading rate and allow for the achievement of the long-term goal of delisting Tails Creek, Flat Creek, and the Coosawattee River.

The WMP has been written to cover a 10-year time period and interim milestones and measures of success of the plan are broken down into three phases: short-term, mid-term, and long-term. To determine if load reductions are being achieved over time and substantial progress is being made towards the ultimate goal of delisting Tails Creek, Flat Creek, and Coosawattee River, a set of success criteria, milestones, and a long-term monitoring plan has been developed as a means to evaluate the success of the WMP.

1.0 INTRODUCTION

1.1 Location

The Coosawattee River – Carters Lake watershed area is in the Coosa River basin in northwestern Georgia approximately 75 miles north of Atlanta, Georgia within Gilmer, Dawson, Fannin, and Murray Counties (Figure 1). The project area includes the northern portions of the Coosa River watershed upstream of the Carters Lake Reservoir which is located almost entirely in Gilmer County with smaller portions in Murray County surrounding Carters Lake. The project area encompasses approximately 46,037 acres and is comprised of four smaller HUC12 watersheds: (031501020404), Tails Creek (031501020403), Coosawattee (031501020401), and Flat Creek (031501020402). Potential management activities to address fecal coliform pollution within the smaller Carters Lake HUC 12 watershed were not included in this Watershed Management Plan (WMP) as this watershed was not determined to be impaired for fecal coliform during 305(b)/303(d) evaluations. The Coosawattee River – Carters Lake Watershed Management Plan Area is located within the Coosawattee sub-basin (HUC 03150102) of the larger Coosa-Tallapoosa basin which eventually drains to the Gulf of Mexico (Figure 2).

1.2 Project Background

Within the Coosawattee River – Carters Lake WMP project area, three stream reaches are listed on the 2016 GA EPD 305(d)/303(b) integrated report for not supporting the designated use of fishing due to elevated fecal coliform concentrations potentially caused by nonpoint source (NPS) pollution (Figure 3). In accordance with the State of Georgia Water Use Classifications and Water Quality Standards (GA Code 391-3-6-03), for the designated use of fishing, fecal coliform concentrations shall not exceed a geometric mean of 200 CFU/100 mL for the months of May through October and shall not exceed a geometric mean of 1,000 CFU/100 mL for the months of November through April. This calculated geometric mean is based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. The standards further state that for the months of November through April, fecal coliform concentrations shall not exceed a maximum concentration of 4,000 CFU/100 mL for any single sample.

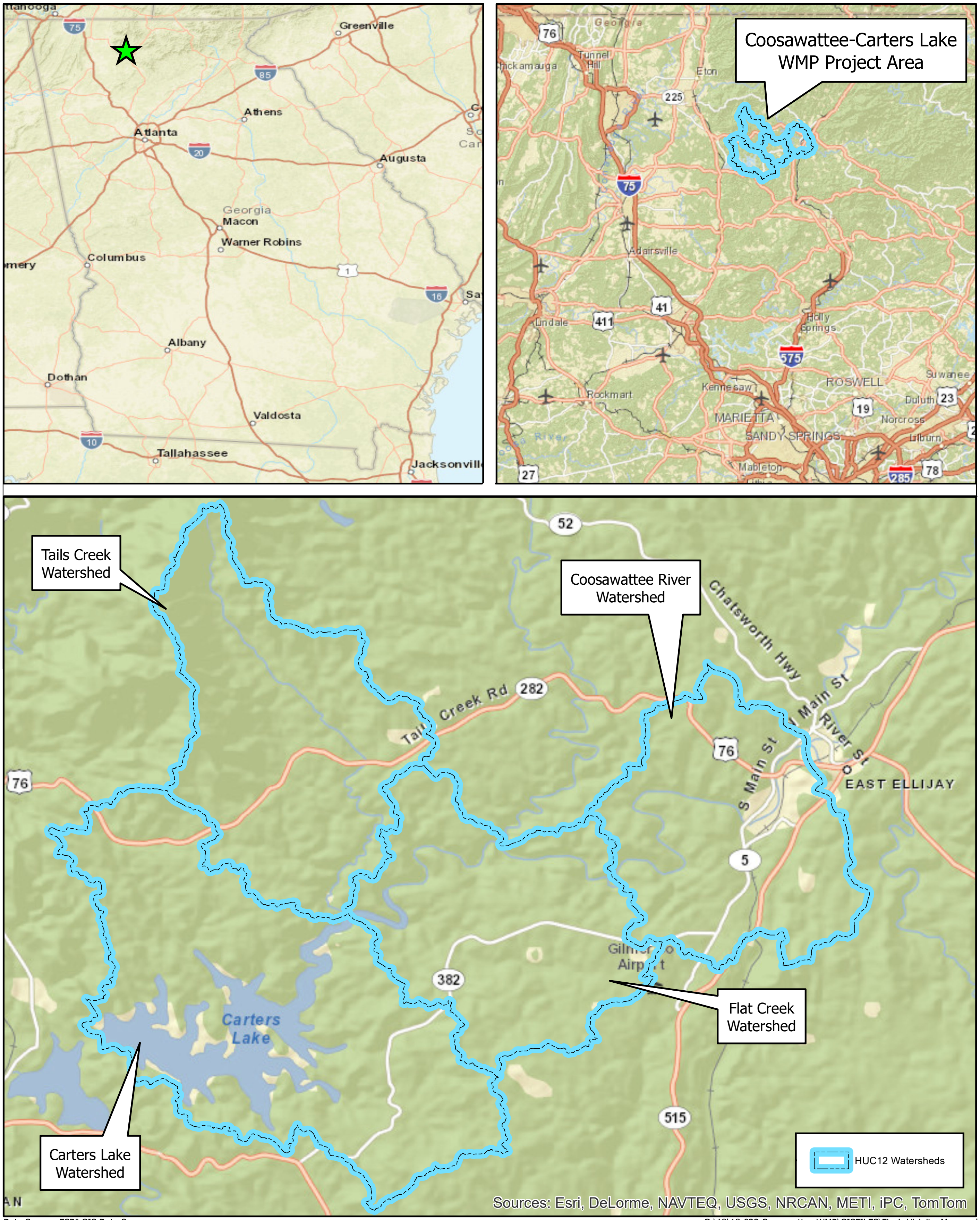
A *Total Maximum Daily Load (TMDL) Evaluation for 58 Stream Segments in the Coosa River Basin for Fecal Coliform* was completed in 2004 by the DNR and submitted to the EPA to assess in-stream water quality conditions in accordance with GA Code 391-3-6-03 Water Use Classifications and Water Quality Standards. In 2006, the DNR published a Tier 2 TMDL Implementation Plan for the segment of the Coosawattee River that flows through Gilmer County and the cities of Ellijay and East Ellijay. According to the TMDL, streams were classified as partially supporting their designated use if more than 10 percent of the samples exceeded the water quality standard for fecal coliform and not supporting if more than 25 percent of the samples collected exceeded that water quality standard. Tails Creek, Flat Creek, and the Coosawattee River were listed as not supporting because more than 25 percent of the samples exceeded the fecal coliform water quality standard (GA DNR, 2004). The TMDL determined the need for a 43 percent reduction in fecal coliform loading for Tails Creek, a 57 percent reduction for Flat Creek, and a 74 percent reduction for the

Coosawattee River to meet the Water Use Classifications and Water Quality Standards for fecal coliform (GA DNR, 2004).

The table below summarizes the three stream reaches located within the WMP project area that are listed for not meeting their designated use of fishing due to fecal coliform water quality exceedances (Figure 3).

Stream Name & Segment Length	**Watershed**	**Segment Length (mi)**	**TMDL Status**
Tails Creek – Hwy 282 to Carters Lake	Tails Creek	3	TMDL completed 2004 and; Implementation Plan completed in 2006
Flat Creek – SR 382 to Coosawattee River	Flat Creek	1	
Coosawattee River	Coosawattee River	3	

Four other stream segments located within the project area are also included on the integrated report for not supporting their designated use of fishing due to impacted fish community (BioF) potentially caused by sediment loadings from nonpoint sources and urban runoff. A five-mile segment of Fir Creek from the headwaters to the confluence with Tails Creek (Tails Creek watershed); a three-mile segment of Harris Creek upstream of Carter Lake (Carters Lake watershed); a four-mile segment Flat Creek from the headwaters to the upstream of State Route 382 (Flat Creek watershed); and one-mile segment of Flat Creek downstream of State Route 382 to the confluence with the Coosawattee River (Flat Creek watershed) are listed for impacted fish communities (Figure 3). A *Total Maximum Daily Load (TMDL) Evaluation for Fifty Stream Segments in the Coosa River Basin for Sediment* was completed in 2016 by the Georgia Department of Natural Resources (DNR) and submitted to the U.S. Environmental Protection Agency (EPA) to assess in-stream water quality conditions in accordance with GA Code 391-3-6-03 Water Use Classifications and Water Quality Standards for Fir, Harris, and Flat Creeks. In order to improve water quality for fish habitat, the TMDL determined a 40.8 percent and a 33.5 percent reduction in sediment loading for the upstream and downstream Flat Creek segments, respectively. Both the Fir and Harris Creek segments were assigned a required sediment load reduction of 0.0% by the TMDL. In addition, a six-mile segment of the Coosawattee River from approximately 250 feet downstream of the intersection of Newport Drive and Legion Road to the confluence of Mountaintown Creek, and six miles of Tails Creek from the headwaters to Hwy 282 are listed as supporting the designated use for fishing (Figure 3).



Data Source: ESRI GIS Data Server

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Figure 1. Coosawattee – Carters Lake Watershed Management Plan Project Area, Gilmer and Murray Counties, Georgia.

0 1 2 4 Miles

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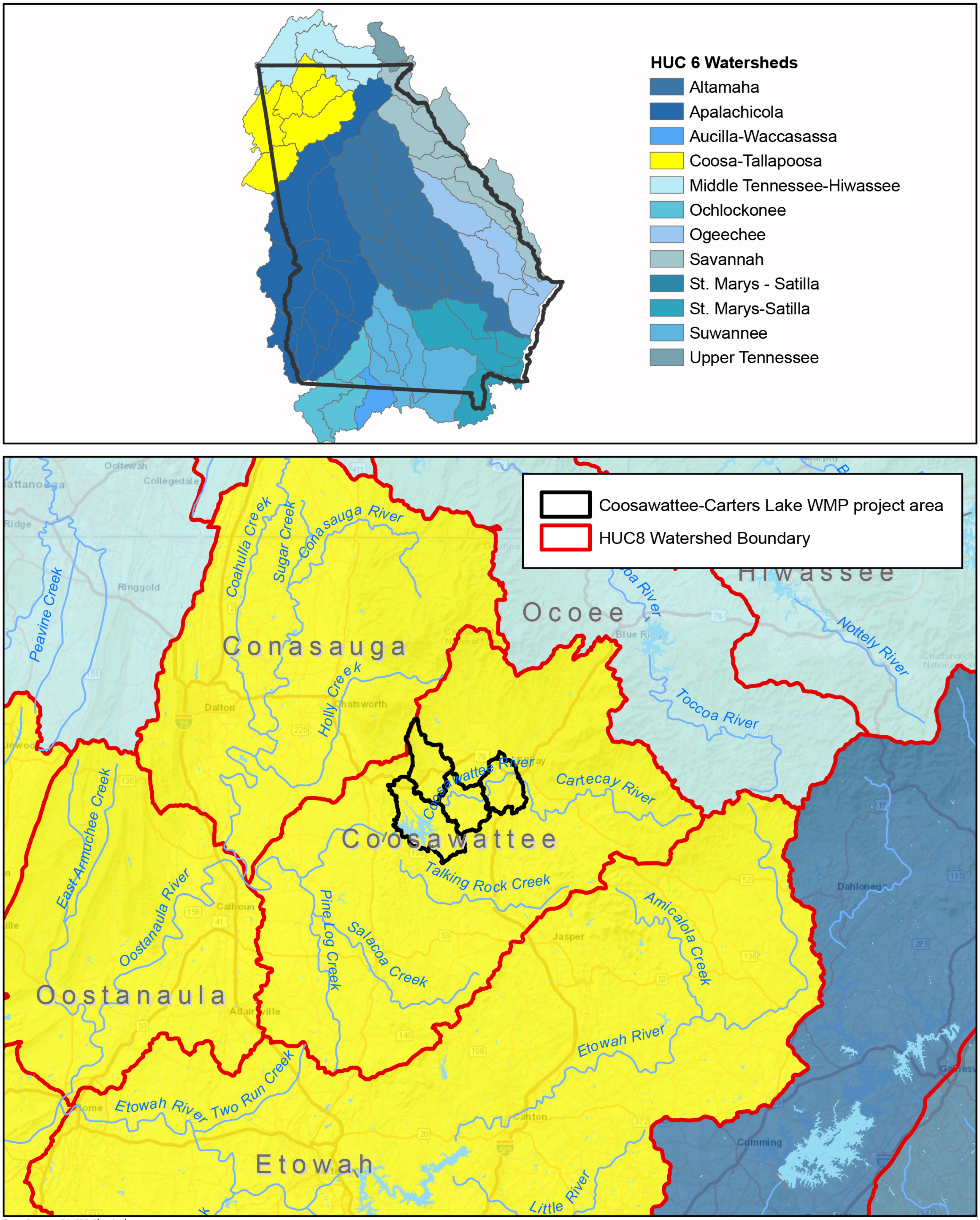

Data Source: GA GIS Clearinghouse

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Figure 2. Location of the Coosawattee – Carters Lake HUC12 Watershed Management Plan Project Area within the larger Coosa-Tallapoosa River Basin.

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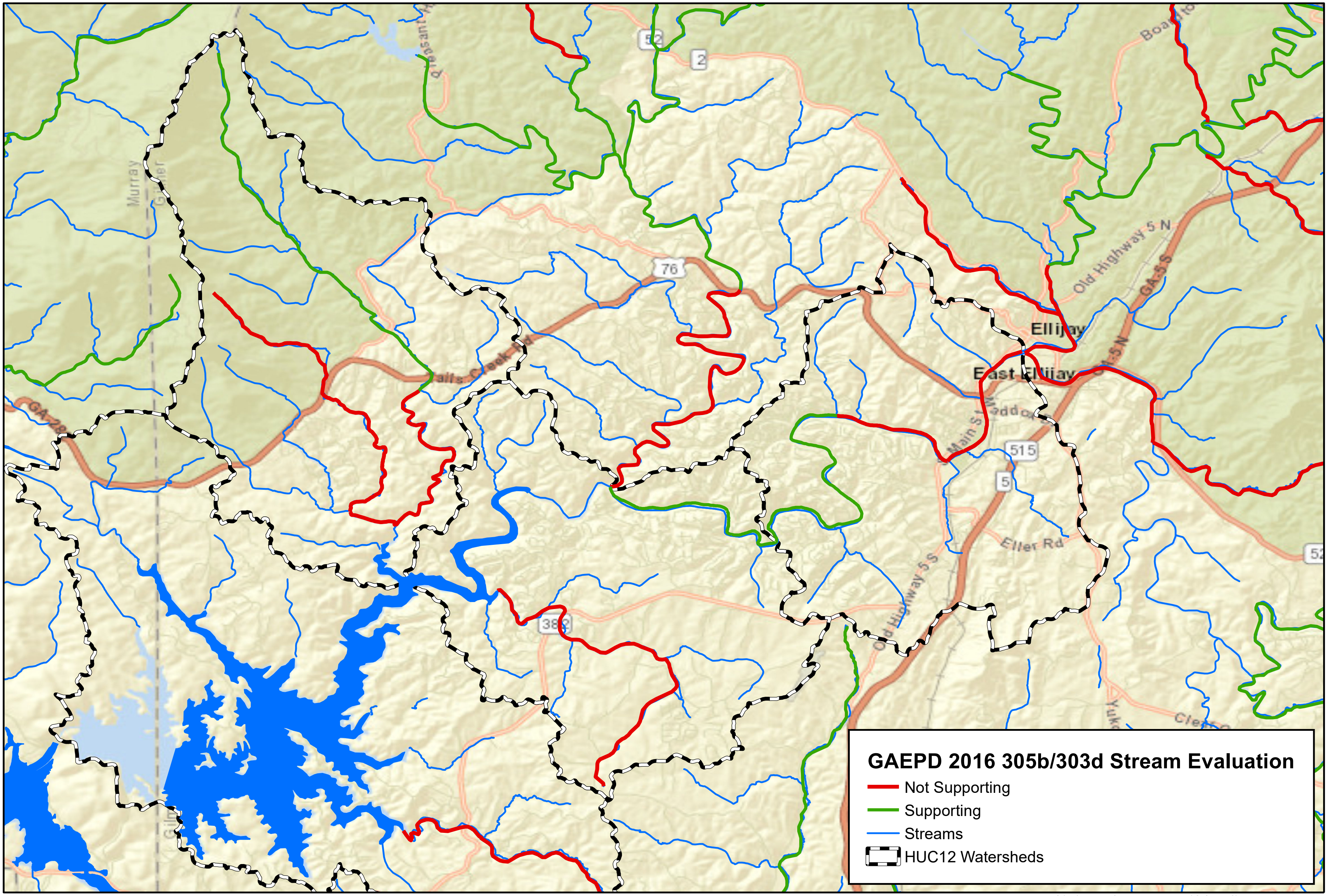

Data Source: USDA NAIP 2015

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Figure 3. Location of the 2016 GA EPD 305(b)/303(d) listed stream segments, Coosawattee – Carters Lake Watershed Management Plan Project Area.

0 1 2 4 Miles

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1.3 Project Objectives

The objective of the project is to develop and implement a nine-key element WMP. The nine key elements for watershed planning are:

1. Identification of causes and sources of pollution that need to be controlled;
2. Determine load reductions needed for each pollutant;
3. Develop NPS management measures that will be implemented to achieve reduction goals and critical areas where measures will be needed;
4. Identify technical and financial assistance needed to implement the plan;
5. Develop an information/education component that identifies education and/or outreach activities for plan implementation;
6. Schedule for implementing NPS management measures;
7. Develop interim milestones to track implementation of management measures;
8. Set of success criteria to determine if load reductions are being met; and,
9. Develop a long-term monitoring component to evaluate effectiveness of management measures or best management practices (BMPs) over time.

To aid in the development of the WMP, a watershed characterization was conducted that assessed the current conditions of the watershed, established baseline conditions prior to management initiatives, identified pollutant sources, and prioritized areas for implementation of BMPs. The primary pollutant addressed during the characterization was fecal coliform bacteria; secondary pollutants included nutrients and sediment.

The initial goal of the WMP is to achieve a reduction in fecal coliform in Tails Creek, Flat Creek, the Coosawattee River one year after implementation of management measures outlined in this WMP. Based on the TMDL, long-term goals of the WMP include a 43 percent reduction in fecal coliform in Tails Creek, a 57 percent reduction in Flat Creek, and a 74 percent reduction in the Coosawattee River following implementation of management measures identified in the WMP, as well as delisting of these streams from the 305(b)/303(d) integrated report.

1.4 Community Based Planning

Public involvement is a crucial aspect of the watershed planning process. It allows the stakeholders within the Coosawattee River – Carters Lake project area to provide insight and input in the decision-making processes that set goals, objectives, and actions for improving water quality in the project area. This WMP was a collaboration of the Coosawattee River – Carters Lake Watershed Advisory Committee (WAC), watershed stakeholder group, GSWCC, EPD, and NAI. Funding for the WMP was provided by the EPA to the EPD under Provisions of Section 319(h) of the Federal Water Pollution Control Act.

The Coosawattee River – Carters Lake WAC consisted of representatives from Gilmer County, Georgia Forestry Commission (GFC), GSWCC, University of Georgia Cooperative Extension Service, Natural Resource Conservation Service (NRCS), Coosawattee River Resort (CRR), DNR, and Keep Gilmer Beautiful. The WAC served as a steering committee for the WMP and was responsible for assisting with creating a vision for the WMP, the development and preparation of the WMP, project promotion, public education and outreach, and reviewing draft and final copies of the WMP.

The watershed stakeholder group, which included local business owners, landowners, residents, farmers, forestry and logging industry representatives, County and regional representatives, non-profit environmental organizations, and educators was formed to assist with the watershed planning process and plan development. Additionally, the stakeholders were responsible for helping identify issues or concern within the project area.

2.0 WATERSHED INVENTORY

2.1 Watershed Characterization

2.1.1 Watershed Reconnaissance and GIS Background Analysis

A "windshield survey" of the watershed was conducted on May 1, 2018. The purpose of the survey was to verify watershed land use data, identify problem areas or "hot spots" for fecal coliform pollution within the watershed, and determine suitable monitoring stations for baseline fecal coliform monitoring. A collection of background information and a GIS desktop analysis of the project area was also conducted (Appendix A). A summary of the report is included below:

- Background information collected and reviewed included historic land cover data, aerial delineation of problem areas, buffer inventories, historic water quality data, evaluation of the TMDL and TMDL Implementation Plan, identification of possible data gaps based on current land cover and 2011 land cover, determination of potential causes and sources of fecal coliform, and coordination with Gilmer County Extension Office to determine agricultural information such as number of livestock and poultry operations and row crop acreage;

- Other potential water quality stressors were identified and included the City of Ellijay Water Pollution Control Plant, the Pilgrims Pride Processing Plant, Priest Recycling Facility, and the Advanced Waste Disposal Transfer Station;

- Based on aerial photography four poultry facilities were identified as potential pollution sources in the Coosawattee HUC 12 watershed, six in the Flat Creek HUC 12 watershed, and two in the Tails Creek HUC 12 watershed;

- Two small scale cattle farms were identified in the Flat Creek HUC 12 watershed as potential sources of fecal coliform;

- The Cities of Ellijay and East Ellijay and the commercial corridor along Hwy 515 were identified as potential sources associated with stormwater runoff from urban land cover;

- Rural residential properties and the Cooswattee River Resort (Coosawattee and Flat Creek HUC 12 watersheds) were identified as potential sources of fecal coliform associated with on-site wastewater systems; and

- Nonpoint sources of fecal coliform identified during the reconnaissance included stormwater runoff from residential, urban, and agricultural land cover, on-site wastewater systems, poultry and small scale cattle operations, illicit discharges, and leaking municipal sewer systems.

A description of the watershed project area including the land use data, water quality impairments and standards, and an evaluation of the TMDL was included in the *Quality*

Assurance and Quality Control Targeted Monitoring Plan for Fecal Coliform in the Coosawattee – Carters Lake WMP Project Areas (Appendix B).

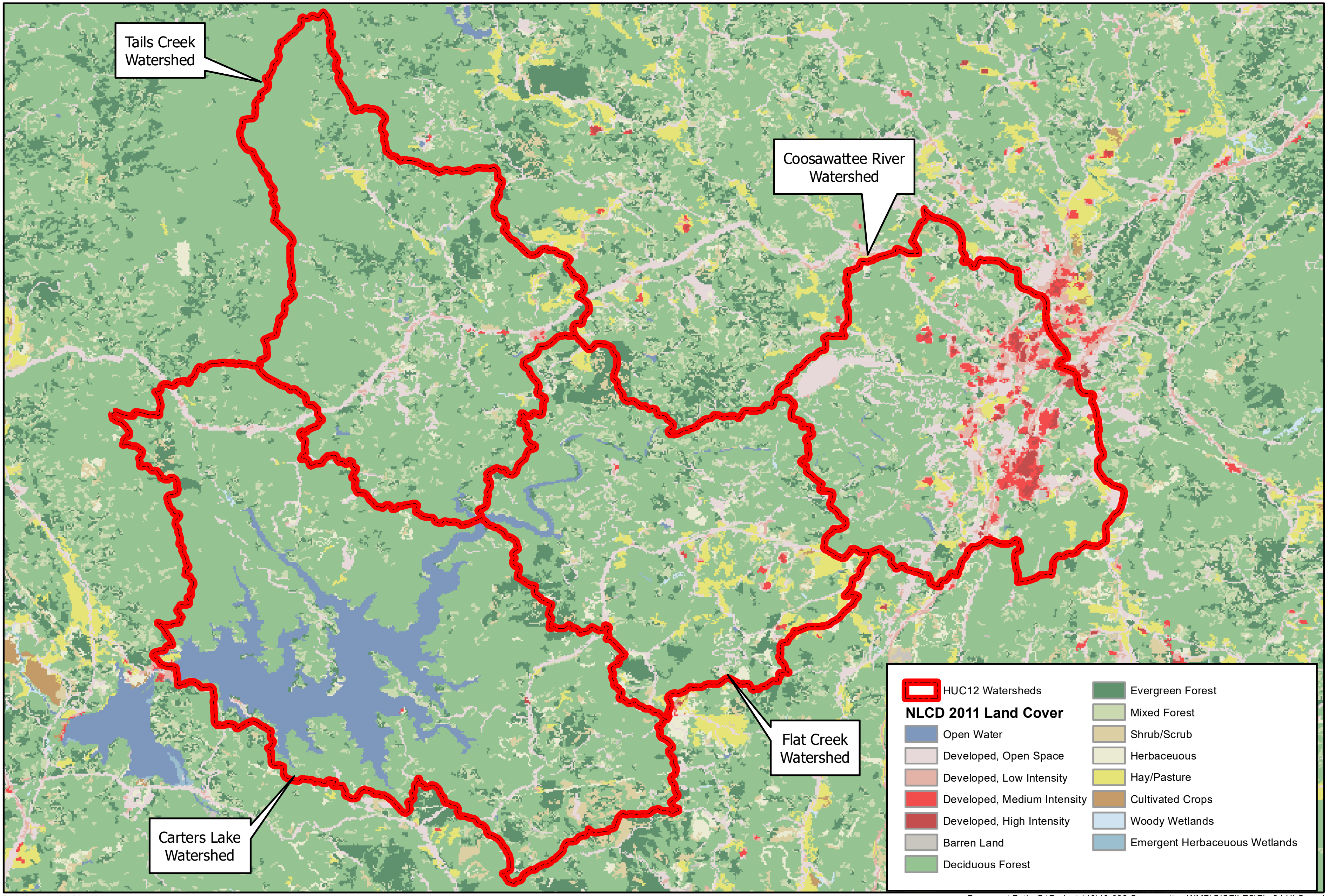
2.1.2 Land Cover

Land cover data for 1998 and 2011 by HUC12 watershed within the project boundary is provided in Table 1 and was used to evaluate changes in watershed land cover over time and to assess potential correlations with fecal coliform loading. Based on the visual assessment and field verification, the 2011 land cover data presented in Figure 4 is generally accurate and was used for development of the WMP. Since the TMDL was developed, very little land cover changes have occurred in the project area except for a 24 percent increase in forested land in the Flat Creek watershed, potentially associated with timberland land reforested (Table 1). Overall, the project area has experienced an increase in forest land cover (Table 1).

Table 1. 1998 and 2011 Land cover characteristics of the project area watersheds.[1]

	Tails Creek					Flat Creek					Coosawattee River				
	1998	2011	Percent Change	1998	2011	1998	2011	Percent Change	1998	2011	1998	2011	Percent Change	1995	2011
Land cover	Percent			Acres		Percent			Acres		Percent			Acres	
Open Water	0.5	0.4	-0.1	58	47	2.2	1.7	-0.5	218	170	0.6	0.3	-0.4	59	25
Low Intensity Urban & Residential	8.4	5.7	-2.7	922	624	20.5	8.0	-12.5	1,990	777	27.4	24.8	-2.6	2,498	2,261
High Intensity Urban & Commercial/Industrial	0.2	0.1	-0.2	24	6	0.4	0.2	-0.1	34	22	4.7	5.5	0.9	428	505
Clearcut/Sparse	3.5	1.4	-2.2	385	148	11.6	4.3	-7.2	1,123	418	6.5	2.7	-3.8	591	244
Quarries, Strip mines, Rock	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0
Forest	83.9	91.0	7.1	9,162	9,917	56.0	80.2	24.1	5,447	7,773	53.8	63.2	9.3	4,914	5,756
Row Crops & Pasture	3.4	1.3	-2.0	366	144	9.3	5.4	-3.9	902	520	7.0	3.4	-3.5	638	314
Forested Wetland	0.0	0.1	0.1	0	7	0.0	0.2	0.2	0	15	0.0	0.1	0.1	0	9

[1]Data source UGA Natural Resources Spatial Analysis Laboratory (1998 Landsat Landcover 18 Class) and 2011 National Land Cover Database



Data Source: NLCD, 2011

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Figure 4. 2011 National Landcover Database land use classification for the Coosawattee – Carters Lake Watershed Management Plan Project Area.

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2.1.3 Ecoregion

The Coosawattee – Carters Lake WMP project area is located within the Southern Metasedimentary Mountains (66g) Level IV Ecoregion of the larger Blue Ridge (66) Level III Ecoregion (Griffith et al., 2001). The Southern Metasedimentary Mountains formed on mostly late Pre-Cambrian and include slate, conglomerate, phyllite, metagraywacke, metasiltstone, metasandstone, and quartzite, with some schist and gneiss. The ecoregion has a vast diversity of plants, which include the Appalachian oak forests and northern hardwoods. Parts of the region have more open low hills interspersed with some isolated masses of rugged mountains (Griffith et al., 2001).

2.1.4 Water Resources and Hydrology

The WMP project area is located within the Coosawattee sub-basin (HUC 03150102) of the larger Coosa-Tallapoosa basin (Figure 2). Generalized areas of significant groundwater recharge in the State of Georgia are mapped in Georgia Geological Survey Hydrologic Atlas 18. The project area is not located within a significant groundwater recharge area (Figure 5). Groundwater pollution susceptibility for the State of Georgia is presented in the Georgia Geologic Survey Hydrologic Atlas 20. The entire project area is mapped as being of low groundwater pollution susceptibility (Trent, 1992).

2.1.5 Geology, Soils, and Topography

The WMP project area is located in the Cherokee Upland District of the Upland Georgia Section of the Southern Piedmont Province (Clark and Zisa, 1976). The Cherokee Upland District is characterized as hilly and rough with elevations ranging from 1,300 to 1,500 feet, which gradually decrease in the southern portion. In the higher elevations of the northern portion, the streams are in narrow valleys ranging from 300 to 600 feet below the surrounding hills and generally flow westward. In the lower southern portions, the streams generally flow to the southwest and exhibit wider valleys, 200 to 300 feet below the surrounding ridges.

Based on soil mapping published by the Soil Conservation Service (SCS) in Cherokee, Gilmer, and Pickens Counties, Georgia (issued September 1973), soil series mapped within the vicinity of the watershed include: alluvial land, Arkabutla, Ashe, Augusta, Buncombe, Cataska, Chewacla, Cartecay, Grover, Gwinnett, Hayesville, Hiwassee, Junaluska, Madison, Masada, Musella, Starr, Talladega, Tallapoosa, Toccoa, Tsali, Tusquitee, Wahadkee, and Wickham soil types (Figure 6).

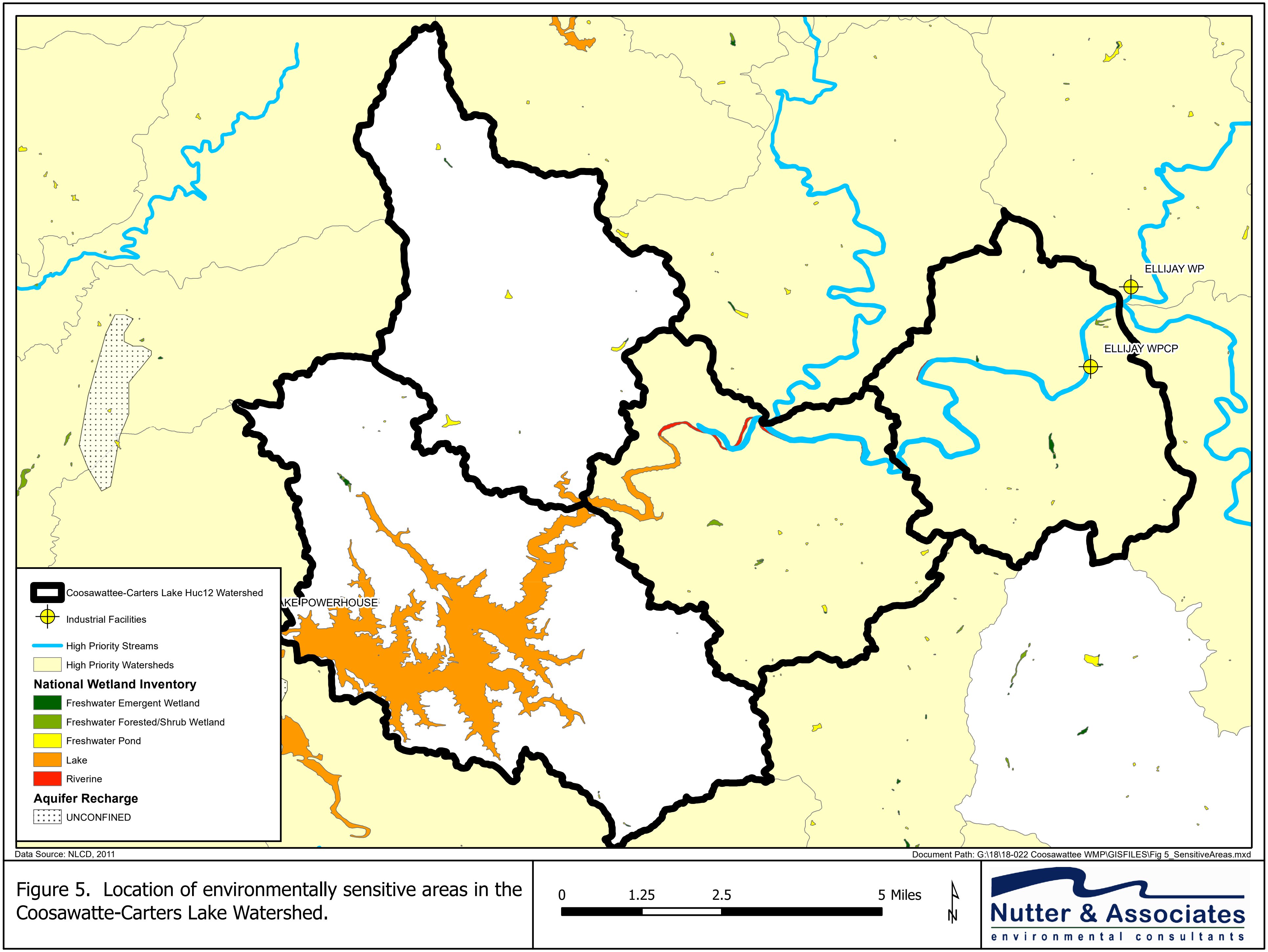
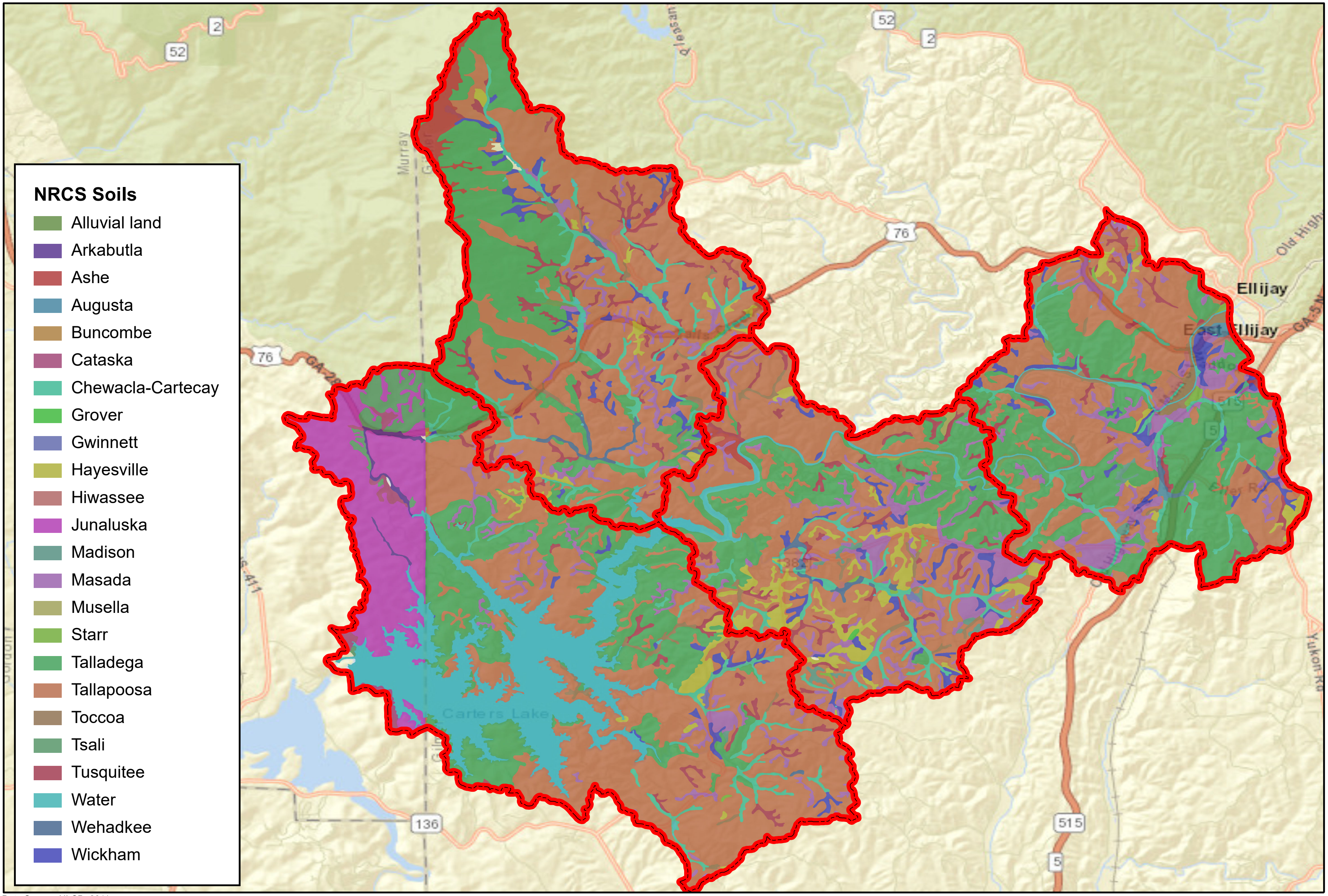


Figure 5. Location of environmentally sensitive areas in the Coosawatte-Carters Lake Watershed.



Data Source: NLCD, 2011

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Figure 6. The NRCS Soil Series for the Coosawatteee-Carters Lake Watershed.

0 1.25 2.5 5 Miles

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The watershed project area is dominated by Tallapoosa and Talladega soil types (Figure 6). These soil types are shallow to bedrock and well drained with a loamy texture. Depending on the topography and location, depth to soft bedrock (paralithic contact) ranges from 10 to 24 inches while depth to hard bedrock (lithic contact) ranges from 24 inches to greater than 60 inches. The surface layer is typically dark grayish brown to brown silt loam to loam texture. The clay rich horizon is thin (less than 10 inches) and typically yellowish red clay loam to silty clay loam and is underlain by multicolored saprolite (weathered rock) in shades of brown, yellow, and red before parting to soft bedrock with similar colors of the saprolite. Well drained soils are located along narrow ridges, steep to very steep uplands, and dissected sideslopes that formed in material weathered from granite, gneiss, schist, biotite, and hornblende (Jordan et. al., 1973). Poorly drained soils are located along the narrow to fairly broad flood plains, are subjected to frequent or occasional flooding, and formed in alluvial sediments washed from adjacent upland soils (Jordan et. al., 1973). Soils are considered to be one of the region's most basic and fragile natural resources.

2.1.6 Environmentally Sensitive Areas

Environmentally sensitive areas within and surrounding the Coosawattee River – Carters Lake WMP project area include but are not limited to: various wetland habitats, high priority streams and watersheds, groundwater recharge areas, endangered and protected species habitat, and recreational areas (Figure 5).

According to the GA DNR Rare Species & Natural Community Database, several rare element occurrences (plant and animal taxa and natural communities) are located within and surrounding the WMP project area. These include: (1) plant species such as Georgia aster (*Symphyotrichum georgianum*), yellow lady's slipper (*Cypripedium parviflorum*), hairy meadow parsnip (*Thaspium chapmanii*), Aaron's rod (*Thermopsis villosa*), Tennessee yellow-eyed grass (*Xyris tennesseensis*), broadleaf phlox (*Phlox amplifolia*), Eastern rough sedge (*Carex scabrata*), American ginseng (*Panax quinquefolius*), broadtooth hedgenettle (*Stachys latidens*), Pennsylvania rush (*Juncus gymnocarpus*), and (2) protected animal species, such as the Eastern spotted skunk (*Spilogale putorius*), mountain crayfish (*Cambarus conasaugaensis*), mountain shiner (*Lythrurus lirus*), Coosawattee crayfish (*Cambarus coosawattae*), blue shiner (*Cyprinella caerulea*), dwarf black-bellied salamander (*Desmognathus folkertsi*), Indiana bat (*Myotis sodalist*), blacktail chubs (*Macrhybopsis etnieri*), river redhorse (*Moxostoma carinatum*), seepage salamander (*Desmognathus aeneus*), pine snake (*Pituophis melanoleucus*), mountain forest frog (*Pseudacris brachyphona*), beautiful crayfish (*Cambarus speciosus*), fine-lined pocketbook (*Hamiota altilis*), goldline darter (*Percina aurolineata*), frosted elfin (*Callophrys irus*), tricolored bat (*Perimyotis subflavus*), bald eagle (*Haliaeetus leucocephalus*), and Northern long-eared myotix (*Myotis septentrionalis*).

2.1.7 Potential Water Quality Stressors

Nutter & Associates searched DNR, EPD and EPA (http://www.epa.gov/enviro/index.html) databases to identify water intakes, landfills, hazardous waste (CERCLIS) facilities, wastewater treatment plants, land application sites and other regulated facilities within the Coosawattee River – Carters Lake watershed. Results of the database search are summarized in the report included in Appendix A.

2.1.8 Historic Water Quality Data

According to historic fecal coliform water quality monitoring data acquired from the Georgia EPD Online Water Quality Database, fecal coliform monitoring was previously conducted at four locations throughout the project area: at the Carters Lake Dam, the Coosawattee River at Hwy 5 and at Newport Drive, and at Tails Creek at US Hwy 76 (Figures 7 and 8). In accordance with State of Georgia Water Use Classifications and Water Quality Standards (GA Code 391-3-6-03), fecal coliform concentrations shall not exceed a geometric mean of 200 CFU/100 mL for the months of May through October and 1,000 CFU/100 mL for the months of November through April. This calculated geometric mean is based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Further, for the months of November through April, fecal coliform concentrations shall not exceed a maximum concentration of 4,000 CFU/100 mL for any sample. Based on the *Total Maximum Daily Load (TMDL) Evaluation for 58 Stream Segments in the Coosa River Basin for Fecal Coliform* completed in 2004 by the GA DNR, stream segments (including the listed sections of the Coosawattee River, Tails Creek, and Flat Creek) were listed as not supporting their designated use if more than 25 percent of the subsamples exceeded the water quality standard. The results of historic monitoring including date, locations, and fecal coliform concentrations are included in Appendix A and discussed in Section 4.

2.1.9 Agricultural Producers

According to the Gilmer County Cooperative Extension Service, no commercial feedlots are located within Gilmer County. The Extension Service estimates there are approximately 25 small scale cattle operations, however, none of them would be classified as concentrated animal feeding operations (CAFOs). There are approximately 475 poultry houses within Gilmer County with a majority of these operations raising broilers. Of these 475 operations, approximately 100 of these farms operate as hatcheries and are considered poultry CAFOs[1]. Based on the watershed reconnaissance and GIS analysis, a majority of these poultry CAFOs are located within the Flat Creek and Tail Creek watersheds. Finally, according to the County Extension Office, a small percentage (less than five percent) of the county is currently in row crops. Table 3 below summarizes the agricultural commodities for Gilmer County according to the 2016 University of Georgia (UGA) Farmgate Survey.

[1] A CAFO is an AFO with more than 1000 animal units (an animal unit is defined as an animal equivalent of 1000 pounds live weight and equates to 1000 head of beef cattle, 700 dairy cows, 2500 swine weighing more than 55 lbs, 125 thousand broiler chickens, or 82 thousand laying hens or pullets) confined on site for more than 45 days during the year. Any size AFO that discharges manure or wastewater into a natural or man-made ditch, stream or other waterway is defined as a CAFO, regardless of size.

Table 2. 2016 UGA Farmgate Survey for agricultural commodities for Gilmer County.

Commodity	Quantity	
Fruits	705	acres
Forestry	45	acres
Poultry and Eggs	73,200	birds
Beef Cows	8,700	head
Dairy Cows	300	head
Pork	95	head
Horses	480	head
Other (sheep, goats)	850	head
Row Crops	11,012	acres
Hunting Leases	2,200	acres

2.1.10 On-Site Wastewater Management Systems

Based on information provided by the Georgia Department of Public Health, Environmental Health Section, in 2007 there were approximately 17,062 on-site wastewater systems operating in Gilmer County. From 2008 through 2017, approximately 1,261 new systems were permitted and installed increasing the total number of systems in the county to 18,323 (through 2017). Since 2002, the Gilmer County Health Department, Environmental Health Section issued 564 repair permits for systems within the County. Based on this data and rural residential land cover in the WMP project area, septic systems are a potential source of fecal coliform pollution. Specifically, failing and improperly functioning septic systems and lack of proper maintenance for existing systems have potentially led to an increase in septic system failures and inadequate treatment of residential wastewater.

2.2 Baseline Water Quality Assessment

2.2.1 Fecal Coliform Monitoring Events

To determine the current conditions of the project area, a baseline water quality assessment was conducted. In accordance with the *Quality Assurance (QA) and Quality Control (QC) Targeted Monitoring Plan* (Plan) for fecal coliform sampling (Appendix B), bacteriological density data for fecal coliform bacteria was collected as a geometric mean based on four samples collected within a 30-day period at intervals not less than 24 hours. For the baseline assessment, one geometric mean was conducted in three separate seasons (summer, fall, and winter), for a total of three discrete geometric means, in accordance with the schedule in Table 3. The results of the fecal coliform baseline sampling events are detailed in Appendix C and discussed in more detail in Section 3.1 and 4.2.

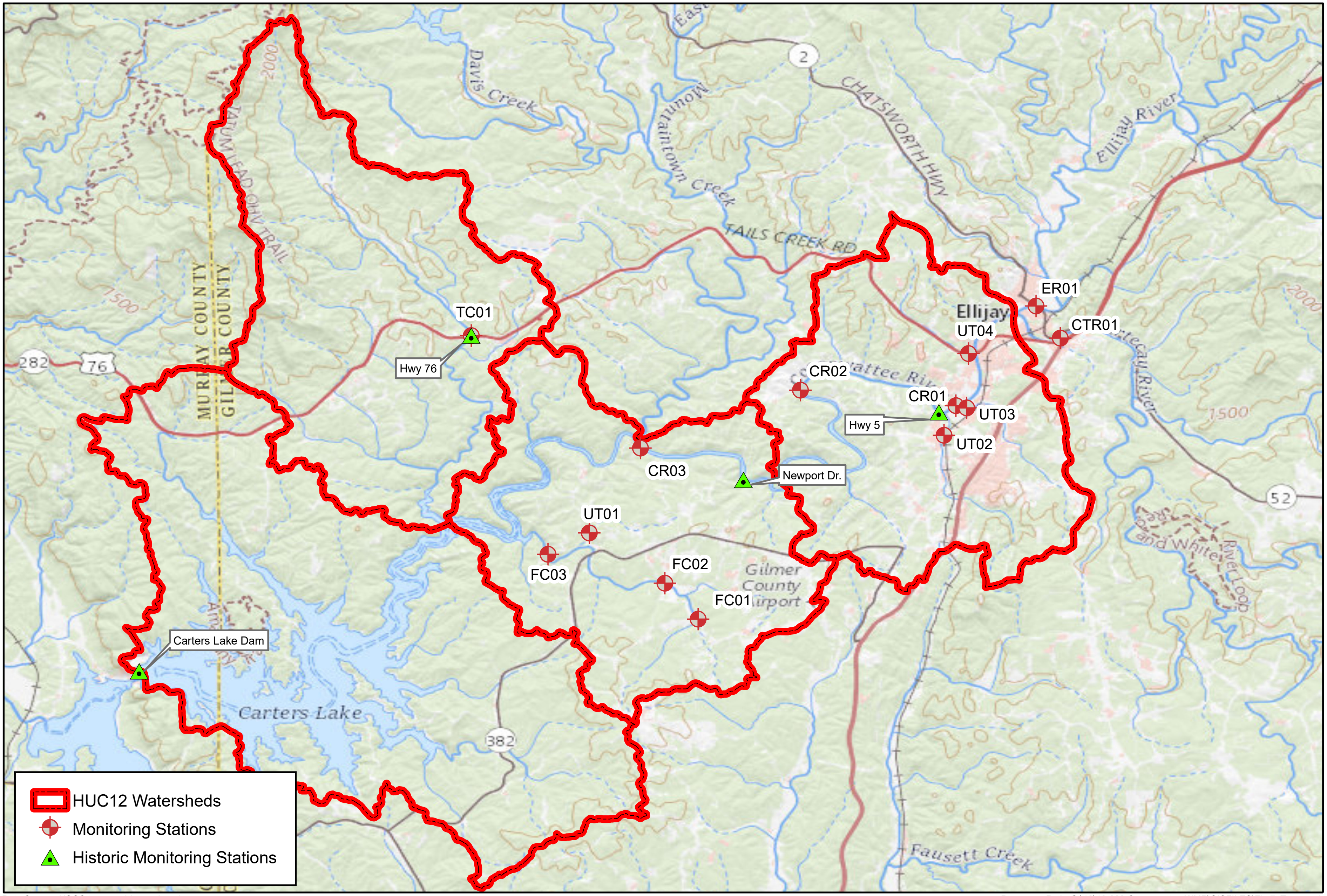
Table 3. Sampling schedule for the Coosawattee – Carters Lake WMP fecal coliform baseline analysis.

	2018		
	June	Sept	Dec
Fecal Coliform Baseline Assessment			
In-Situ Water Quality Analysis	✓	✓	✓
Fecal Coliform Geometric Mean (4 individual events for three geomeans)	✓	✓	✓

In-situ water quality measurements, including air and water temperature (^{o}C), dissolved oxygen (percent saturation and concentration in mg/L), pH (standard units), specific conductance (µS/cm), and turbidity (NTU) were collected in conjunction with each bacteriological grab sample event. For the February (winter) and May (spring) events, fecal coliform water quality monitoring was conducted for the WMP project area watershed at 13 monitoring locations (See Table 4 below and Figures 7 and 8 for location information).

Table 4. Location of the fecal coliform water quality monitoring stations for the Coosawattee River – Carters Lake Watershed Management Plan baseline line assessment.

Station Name	**Location (DD)**		**Station ID**
	Latitude	Longitude	
Cartecay River at 1st Ave	34.68588	-84.4742	CTR01
Coosawattee River at Veterans Memorial Park	34.67144	-84.4966	CR01
Coosawattee River at Ogden Drive	34.67473	-84.5299	CR02
Coosawattee River at Orchid Lane	34.66236	-84.5641	CR03
Ellijay River at Hwy 52/River Street	34.69277	-84.4794	ER01
Flat Creek at Sunlight Road	34.62570	-84.5518	FC01
Flat Creek at Knight Road	34.63340	-84.5589	FC02
Flat Creek at Nexus Drive	34.63959	-84.5839	FC03
Tails Creek at Tails Creek Road	34.68641	-84.6004	TC01
Unnamed tributary to Flat Creek at Eagle Mountain Drive	34.64417	-84.5751	UT01
Unnamed tributary to Coosawattee River at Progress Road	34.66511	-84.4991	UT02
Unnamed tributary to Coosawattee River at Veterans Memorial Park	34.67095	-84.4943	UT03
Unnamed tributary to Coosawattee River at Hwy 76	34.68256	-84.4939	UT04



Data Source: USGS topographic quadrangle

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Figure 7. Historic and baseline fecal coliform monitoring stations and topographic imagery, Coosawattee – Carters Lake Watershed Management Plan Project Area.

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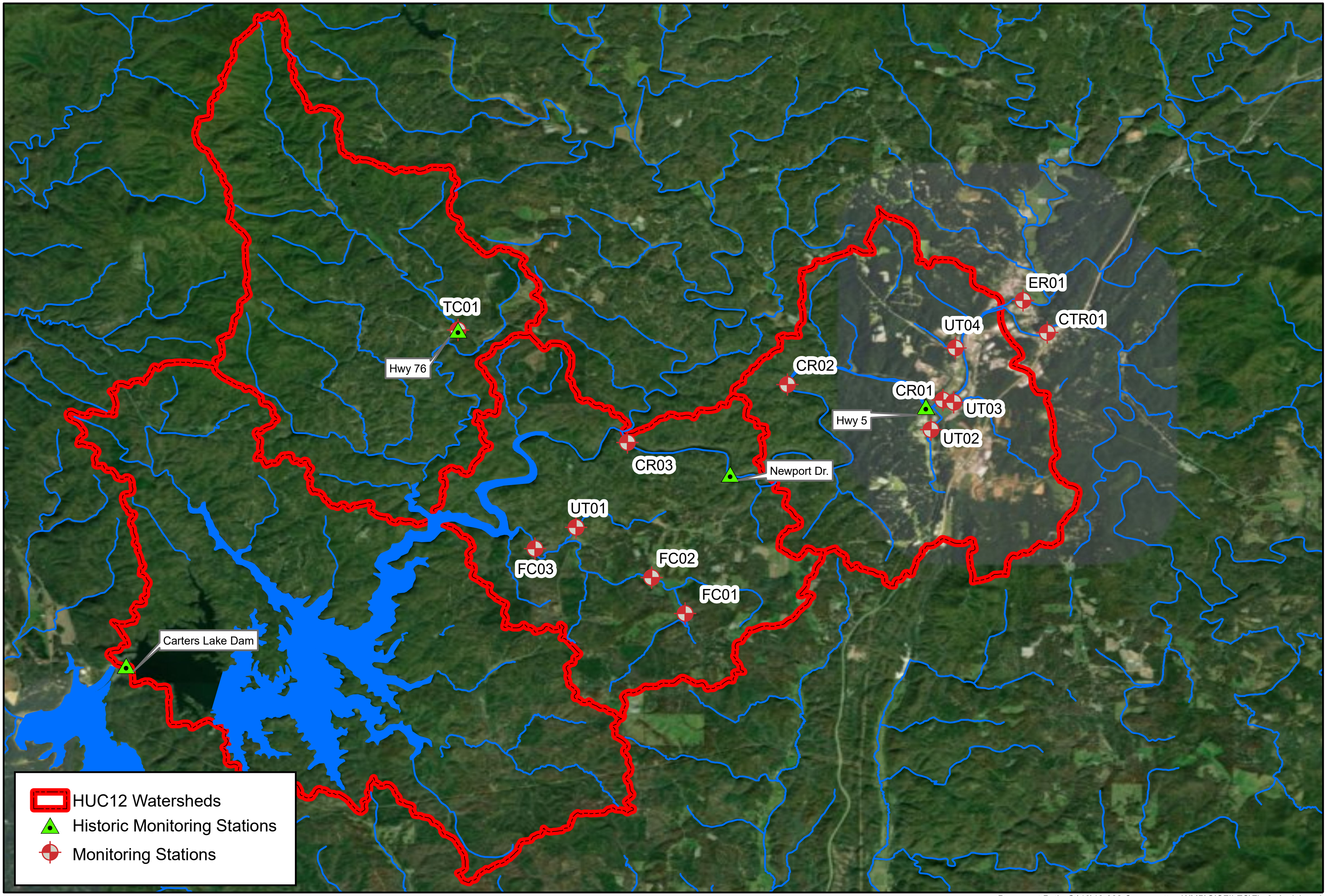

Figure 8. Historic and baseline fecal coliform monitoring stations and aerial imagery, Coosawattee – Carters Lake Watershed Management Plan Project Area.

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3.0 POLLUTANT SOURCE IDENTIFICATION

Based on the results of the watershed characterization, baseline assessment, public input, and the TMDL (GA DNR, 2004), fecal coliform has been identified as the primary pollutant within the Coosawattee River – Carters Lake WMP project area. Stormwater runoff associated with urban land use is the most likely source of fecal coliform in the Coosawattee River HUC 12 watershed while other potential sources include failing or improper septic system maintenance, illicit discharges, stream buffer encroachment, and feces associated with wildlife and pets. For the Flat Creek HUC 12 watershed, septic systems, illicit discharges, livestock access to streams, and buffer encroachment are the potential sources of fecal coliform identified during dry weather conditions, while stormwater runoff associated with both agricultural and residential land use are likely sources during wet weather conditions. For the Tails Creek HUC12 watershed, potential sources include stormwater runoff associated with agricultural land use, buffer encroachment, septic systems, and illicit discharges.

3.1 Evaluation and Location of BMP Priority Areas

For the baseline assessment, four discrete fecal coliform samples were collected each quarter (summer, fall, and winter) to calculate three geometric means (geomeans) at each station. The summer geomean baseline monitoring was calculated from four individual subsamples collected by Nutter & Associates, Inc. (NAI) personnel between June 5 and June 27, 2018; the fall event was collected between September 4 and September 25, 2018; and the winter event between November 27 and December 19, 2018. During the summer geomean determination, all stations met the State of Georgia Water Use Classifications and Water Quality Standard of 200 CFU/100 mL for the months of May through October excluding stations CTR01, CR01, UT02, CR02, FC01, FC02, and FC03 (Figure 9). For the fall geomean determination, stations ER01, TC01, UT02, CR03, FC01, FC02, and FC03 exceeded the warm weather water quality standard of 200 CFU/100mL (Figure 9). During the winter geomean determination, all stations met the State of Georgia Water Use Classifications and Water Quality Standard (Chapter 391-3-6-03) of 1,000 CFU/100 mL for the months of November through April. Apart from station FC03, all stations met the stricter warm weather (May through October) Water Quality Standard of 200 CFU/100 mL during the winter sampling (Figure 9).

The highest fecal coliform concentrations during the baseline monitoring were observed in subwatersheds UT02, FC01, FC02, and FC03 (Figure 9). Subwatershed UT02 is located within the Coosawattee HUC 12 watershed and has been identified as a high priority area for implementation of BMPs that address stormwater runoff associated with urban land use associated with the Cities of Ellijay and East Ellijay and impervious surfaces (Figure 10). The entire Flat Creek watershed (subwatersheds FC01, FC02, and FC03) has been identified as a high priority area for implementation of BMPs which address stormwater runoff from agricultural and rural residential land use, failing or improperly maintained septic systems, illicit discharges, livestock access to the stream, and buffer encroachment (Figure 10). Moderate priority watersheds include the Cooswattee HUC 12 watershed (excluding UT02) and all of the Tails Creek watershed (Figure 10). Areas located within the Coosawattee HUC 12 watershed have been identified for implementation of BMPs that address septic systems, illicit discharges, stream buffer encroachments, and feces associated with both dogs and wildlife. The entire Tails Creek watershed should be considered for implementation of BMPs that address buffer encroachment and stormwater runoff associated with agricultural and rural residential land use.

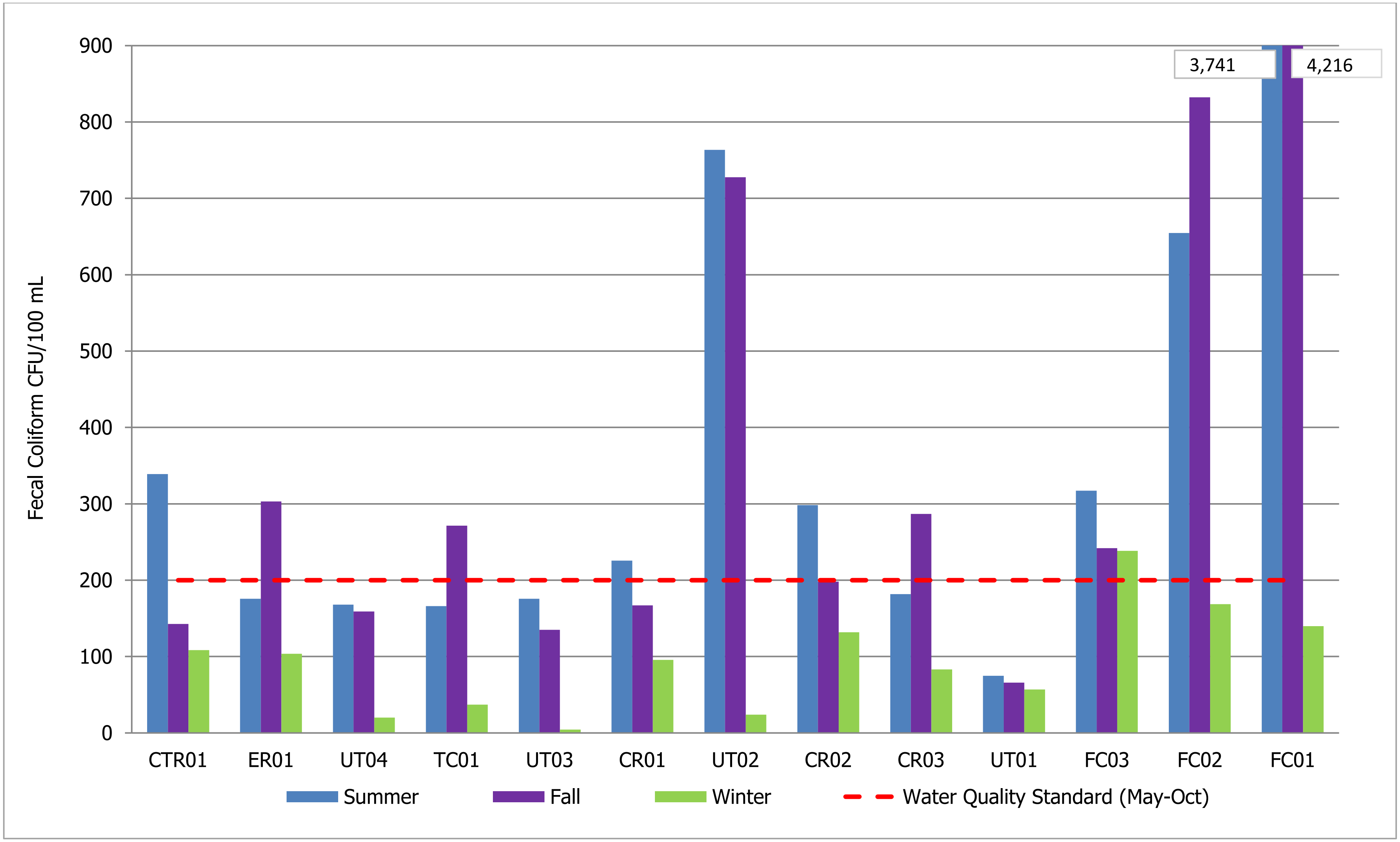

Figure 9. Calculated geometric mean concentrations for all stations during the summer, fall, and winter sampling events.

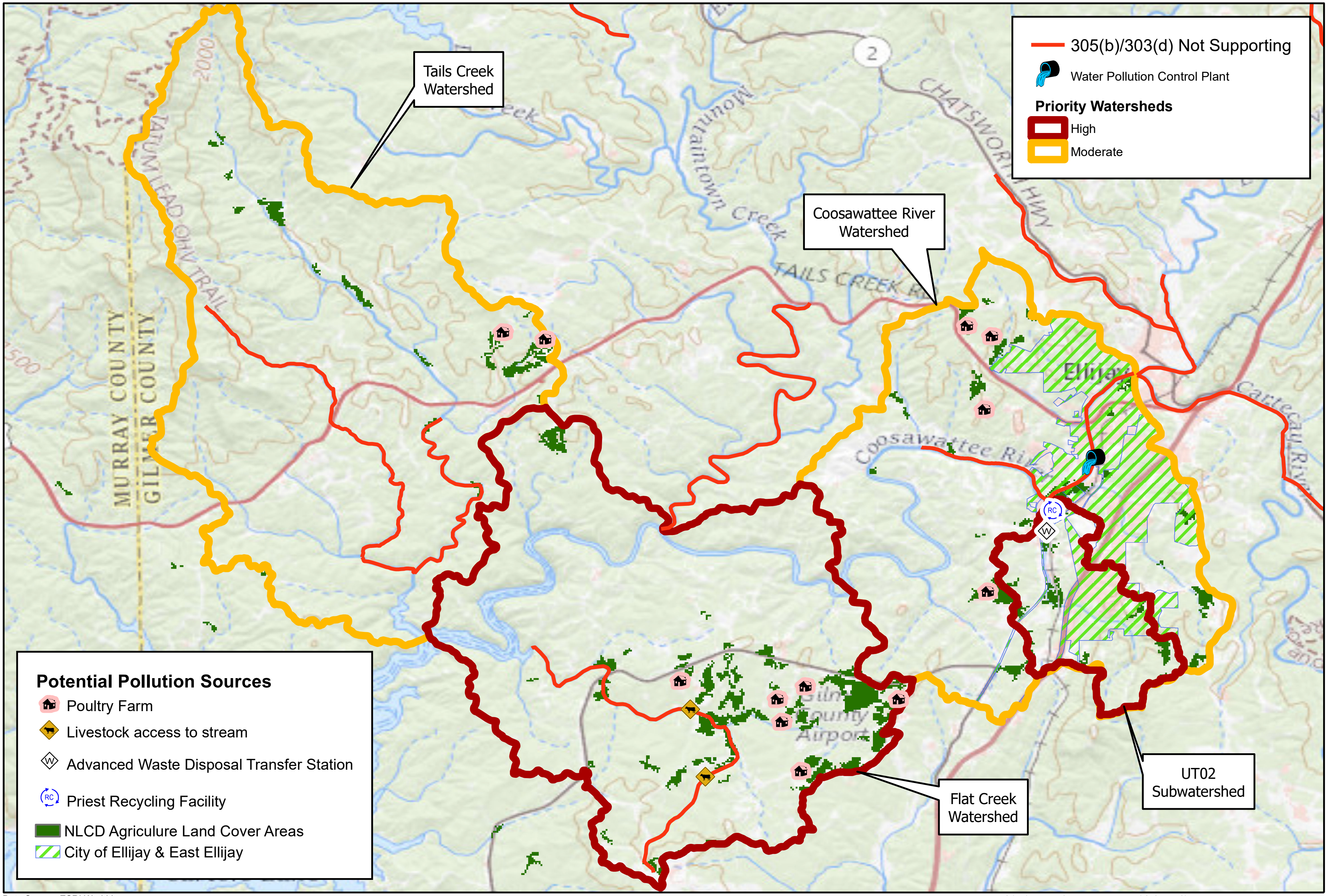

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Figure 10. Potential areas identified for implementation of management measures and each high priority sub-watershed.

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Acreages of agricultural, residential, and urban land for potential BMP installation within each HUC 12 watershed for the project area (Tails Creek, Flat Creek, and Coosawattee) were estimated based on observed conditions during the watershed reconnaissance, aerial photography, 2011 land use data, and the property's proximity to environmentally sensitive areas (Table 5). A GIS desktop analysis was performed using 2011 land use data and any agricultural properties that occurred within a 150-foot buffer of streams or wetlands in the project area were identified as areas as high priority for potential BMP installation. For urban areas, all properties within the project area that encompassed the Cities of Ellijay, East Ellijay, and the commercial corridor along Hwy 515 were identified as potential areas for BMP installation. Due to lack of data for the number and location of septic systems within the project area, all rural residential properties located outside of the sewer services areas of the Cities of Ellijay and East Ellijay were included for potential implementation of on-site wastewater best management practices. Percent impervious surface and urban land cover within the high priority sub-watershed UT02 was based on 2011 land use data (Table 6). Other potential areas for BMP implementation to address fecal coliform within the project area were identified based on the watershed reconnaissance, aerial photography investigation, and stakeholder input (Table 7; Figure 10).

Table 5. Areas for potential BMP installation within the Coosawattee River – Carters Lake WMP project area.

HUC 8 Watershed	Watershed Size	Land Use		Pollutant Source		
		Agricultural	**Urban[3]**	**Agricultural[4]**	**Urban[3]**	**Rural Residential[5]**
	Acres					
Project Area[1]	29,702	1,477	3,530	66	2,230	1,966
Flat Creek	9,693	758	664	39	20	719
Coosawattee[2]	9,113	372	2,514	--	2,154[6]	1,247
Tails Creek	10,896	347	352	27	--	56

[1]Project area does not include the Carters Lake HUC 12 watershed
[2]Includes high priority subwatershed UT02
[3]Includes residential land use
[4]Does not include poultry facilities located outside 150-foot riparian buffers
[5]Rural residential are properties serviced by on-site wastewater systems
[6]Includes the areas of the Cities of Ellijay and East Ellijay that are located within the Coosawattee HUC 12 watershed

Table 6. Impervious surface and urban areas identified for implementation of best management measures within sub-watershed UT02.

Watershed Size (acres)	Urban Land (acres)	% Impervious Surface	Impervious Surfaces (acres)
1,508	410	11	45

Table 7. Potential areas for BMP installation observed during the watershed reconnaissance and desktop analysis.

Land Use	Watershed	Description	Location	
			Lat / Long	
Poultry Farm	Tails Creek	5 Poultry Houses	34.697198	-84.585199
Poultry Farm	Tails Creek	2 Poultry Houses	34.698397	-84.592408
Livestock Access	Flat Creek	Livestock Access to Stream	34.622285	-84.557725
Livestock Access	Flat Creek	Livestock Access to Stream	34.633792	-84.560299
Poultry Farm	Flat Creek	4 Poultry Houses	34.638677	-84.562089
Poultry Farm	Flat Creek	4 Poultry Houses	34.635569	-84.545438
Poultry Farm	Flat Creek	6 Poultry Houses	34.631685	-84.544665
Poultry Farm	Flat Creek	4 Poultry Houses	34.637759	-84.540631
Poultry Farm	Flat Creek	4 Poultry Houses	34.635569	-84.524666
Poultry Farm	Flat Creek	6 Poultry Houses	34.623281	-84.541403
Poultry Farm	Flat Creek	2 Poultry Houses	34.624318	-84.534662
Poultry Farm	Coosawattee	4 Poultry Houses	34.699529	-84.512994
Poultry Farm	Coosawattee	6 Poultry Houses	34.697762	-84.508702
Poultry Farm	Coosawattee	13 Poultry Houses	34.685200	-84.509989
Industrial Facility	Coosawattee	Pilgrim's Pride Processing Facility	34.684941	-84.491666
Recycling Facility	Coosawattee / UT02	Priest Recycling Facility	34.667852	-84.498263
Waste Transfer Station	Coosawattee / UT02	Advanced Waste Disposal Transfer Station	34.664338	-84.499282
Commercial Development Corridor	Coosawattee / UT02	Rapid Development and Land Use Change	34.656912	-84.492892
Poultry Farm	Coosawattee	8 Poultry Houses	34.653998	-84.509424

3.2 Summary of Management Needs

For the entire project area watershed, BMPs that address stormwater runoff from both agricultural and urban land use (includes residential properties) and failing or improperly installed septic systems are considered a high priority. For the targeted areas, 66 acres of agricultural land and 2,230 acres of urban and residential land have been identified in the entire project area for potential installation of BMPs that address stormwater runoff (Table 5). To address fecal coliform in surface water associated with on-site wastewater systems, approximately 1,966 acres of rural residential land has been identified. For the entire project area, other potential management measures that address livestock access to streams, poultry facilities, wildlife and canine feces, buffer intrusion and reestablishment, potential leaking sewer lines in the Cities of Ellijay and East Ellijay, and illicit discharges should also be implemented to aid in the reduction of fecal coliform bacteria runoff to surface water. The following high priority subwatershed units located within the project area watershed have been identified for potential installation of BMPs:

Flat Creek – 39 acres of agricultural land, 20 acres of urban land, and 719 acres of rural residential land serviced by septic systems; and,

UT02 – 410 acres of urban land (45 acres of impervious surfaces).

The following moderate priority sub-watershed units located within the project area watershed have been identified for potential installation of BMPs:

Coosawattee – 2,154 acres of urban land (includes UT02) and 1,247 acres of rural residential land serviced by septic systems;

Tails Creek – 27 acres of agricultural land and 56 acres of rural residential land serviced by septic systems.

According to the UGA Cooperative Extension Service, no commercial feedlots or dairy farms are located within Gilmer County. However, several small-scale cattle operations (100-150 heads of cattle) are located within the county and were observed during the watershed reconnaissance (Table 7). An exact number of small-scale facilities could not be determined because the operations were located within individual properties where access and total heads of cattle was not provided. Therefore, the acreage of small-scale cattle facilities is included as part of the agricultural land class specified in Table 5. Several poultry operations are located in Gilmer County and a portion of these are considered concentrated animal feed operations (CAFOs). A list of the poultry operations were identified based on aerial photography and the watershed reconnaissance (Table 7). These areas are also included in the agricultural land if they occurred within the 150-foot buffer to streams and/or wetlands. Finally, and according to the county extension office, a small percentage of the watershed is in row crops (less than 5 percent), with a majority of the agricultural land use associated with poultry production (Table 5).

4.0 POLLUTANT LOAD REDUCTIONS

4.1 Fecal Coliform Load Reductions

4.1.1 TMDL and Baseline Results

As discussed in section 2.1.8, the Coosawattee River, Flat and Tails Creeks were listed as not supporting the designated use of fishing because more than 25 percent of fecal coliform subsamples or calculated geometric means collected in 2000 and 2001 exceeded the fecal coliform water quality standard of 200 CFU/100 mL (May to October) or 1,000 CFU/100 mL (November to April). The calculated geometric mean is based on at least four individual subsamples.

For the summer baseline monitoring event, two stations on the Coosawattee River (CR01 and CR02) and all stations on Flat Creek (FC01, FC02, and FC03) exceeded the water quality standard (Table 8; Figures 7 and 8). Stations TC01, CR03, and all Flat Creek stations exceeded the water quality standard of 200 CFU/100 mL during the fall baseline event (Table 8; Figure 7 and 8). No geometric means collected during the winter baseline water quality assessment exceeded the water quality standard for fecal coliform. During the winter sampling, all stations except FC03 met the stricter warm weather water quality standard of 200 CFU/100 mL (Table 8; Figures 7 and 8).

Table 8. Results of the summer, fall, and winter baseline fecal coliform water quality monitoring for all stations located on the Coosawattee River, Tails Creek, and Flat Creek and calculated geometric means for each station.

Round	Station	Fecal Coliform (CFU/100mL)				
		6/5/18	**6/13/18**	**6/20/18**	**6/27/18**	**Geomean**
Summer	TC01	40	80	170	1,400	166
	CR01	270	40	300	800	226
	CR02	230	300	500	230	298
	CR03	40	170	700	230	182
	FC03	500	230	110	800	317
	FC02	230	330	2,200	1,100	655
	FC01	2,400	>16,000	1,700	3,000	3,741
		9/4/18	**9/11/18**	**9/18/18**	**9/25/18**	**Geomean**
Fall	TC01	80	220	140	2,200	271
	CR01	40	300	130	500	167
	CR02	80	800	80	300	198
	CR03	130	800	130	500	287
	FC03	130	300	80	1,100	242
	FC02	2,400	500	800	500	832
	FC01	9,000	9,000	3,000	1,300	4,216
		11/27/18	**12/4/18**	**12/11/18**	**12/19/18**	**Geomean**
Winter	TC01	22	94	29	31	37
	CR01	42	147	300	46	96
	CR02	NM	100	230	100	132
	CR03	80	94	127	50	83
	FC03	46	192	1,009	363	238
	FC02	88	220	131	320	169
	FC01	102	229	200	82	140

NM = not measured due to leaking sample bottle

4.1.2 Comparison of Historic Sampling to Current Conditions

To compare the historic fecal coliform water quality data to the 2018 baseline assessment, a total geometric mean of all samples collected during the 2018 May to October (warm weather period) was calculated and compared to the warm weather period total historic geomean at all historic stations located on the Coosawattee River and Tails Creek (Table 9). No historic water quality data has been collected for Flat Creek and an equivalent site approach was used to list Flat Creek, which utilized fecal coliform data collected from similar streams as the listing criteria for sites with insufficient data (DNR, 2004). Tails Creek was one of the equivalent sites used to list the stream in 2004; therefore, historic data collected for Tails Creek was used to compare to the 2018 data for all stations on Flat Creek. The individual grab samples for the warm weather monitoring period and the calculations used to determine the total historic geomean and 2018 geomean for each station are included in Appendix D. The winter sample period (November to April) was excluded from this analysis because no stations exceeded the cold weather water quality standard of 1,000 CFU/100 mL during the baseline period.

Historic fecal coliform water quality data was collected by EPD for Tails Creek at Tails Creek Rd during 2001 (Figures 7 and 8). For the 2001 data, the total historic geomean was calculated based on 12 discrete samples (Table 9; Appendix D). In comparison to the historic water quality monitoring period in 2001, the total calculated geomean for the Tails Creek watershed was 17 percent higher during the 2018 baseline assessment (Table 9; Appendix D). Very little land cover changes have occurred for the Tails Creek watershed; however, according to historic rainfall data for the Ellijay area from the Southeastern Regional Climate Center, approximately 52.4 inches of precipitation was observed for the Ellijay area in 2001. In 2018, approximately 63.3 inches of precipitation was observed at the USGS Coosawattee River rain gage near Ellijay, GA (Station No. 02380500). Therefore, the higher total geomean for the 2018 baseline assessment could be attributed to the increase in precipitation for the area. Other potential causes of the higher geomean from 2001 to 2018 could be attributed to a decrease in stream buffers, an increase in on-site wastewater systems in the watershed, or an increase in malfunctioning on-site wastewater systems in the watershed since the 2001 historic monitoring period.

For the Coosawattee River, historic water quality data was collected by the EPD from 1996 to 2013 at Old Hwy 5, which is located immediately downstream of the baseline station CR01 (Figures 7 and 8). This historic water quality station is located in the same general vicinity as the 2018 baseline assessment station CR01 and therefore the two stations are comparable. For station CR01, the total historic geomean was calculated based on 111 discrete grab samples collected between 1996 and 2013 (Table 9; Appendix D). The total calculated geomean at this station was 55 percent lower for the 2018 baseline period compared to the historic data (Table 9; Appendix D). During 2011, historic fecal coliform water quality data was collected by the EPD on the Coosawattee River at Newport Drive, which is just upstream of station CR03 (Figures 7 and 8). Only one geomean was collected for this station in 2011 and thus, a comparison was not made to station CR03 due to the limited data available.

No historic water quality data has been collected for Flat Creek and an equivalent site approach was used to list Flat Creek, which utilized data collected from Tails Creek. A total geomean was calculated for all stations located within the Flat Creek watershed for the 2018 monitoring period and compared to the total historic geomean for Tails Creek (Figures 7 and 8). In comparison to the historic water quality monitoring data collected for Tails Creek, the total calculated geomean for the Flat Creek watershed was 413 percent higher during the 2018 baseline assessment (Table 9; Appendix D). Very little land cover changes have occurred for the Flat Creek watershed; therefore, the higher total geomean for the 2018 baseline assessment could be attributed to the increase in precipitation for the area. Other potential causes of the higher geomean from 2001 to 2018 could be attributed to a decrease in stream buffers, an increase in stormwater runoff associated with agricultural and urban land cover, on-site wastewater systems in the watershed, or an increase in malfunctioning on-site wastewater systems in the watershed since the 2001 historic monitoring period.

Table 9. Comparison of historic water and 2018 baseline fecal coliform geomeans calculated for stations TC01, CR01, and CR03 for the months of May to October.

Station	Historic Data Range	Historic Total Geomean	2018 Baseline Total Geomean	Percent Difference[1]
TC01	2001	182	212	17
CR01	1996 – 2013	431	194	-55
Flat Creek[2]	2001	182	933	413

[1]The individual grab samples at each station, calculations for the total historic and 2018 geomeans, and calculation of percent difference are summarized in Appendix D
[2]Includes all stations located on Flat Creek (FC01, FC02, and FC03)

The final goal of the WMP is to reduce fecal coliform pollution within the WMP project area such that Tails Creek, Flat Creek, and the Coosawattee River are in compliance with the fecal coliform water quality standard; thus, having these streams being removed from the Georgia 305(b)/303(d) list of impaired stream segments. In accordance to the 2004 TMDL, a 74 percent reduction in fecal coliform concentration in the Coosawattee River, 57 percent reduction in Flat Creek, and a 43 percent reduction in Tails Creek were required in order for these streams to meet the water quality standard. Based on the baseline assessment and the results presented in Table 9, these reduction targets can still be considered valid for Tails Creek as the total geomean was higher by only 17 percent when comparing 2001 and 2018. Since Flat Creek was listed using the equivalent site approach and compared to Tails Creek, the 57 percent reduction target may no longer be considered valid for watershed because the total geomean for 2018 was higher by 413 percent. More than a 57 percent reduction in fecal coliform may be needed for the Flat Creek watershed to achieve compliance with the water quality standard. Conversely, the total geomean was lower for station CR01 in 2018 compared to the historic water quality data at this location. Thus, the 74 percent reduction target in fecal coliform may not be necessary to achieve compliance with the water quality standard.

4.2 Goals

Goals for the Coosawattee River – Carters Lake WMP have been divided into three categories: short-term, mid-term, and long-term.

Short-term goals of the watershed management plan include:

1. Solicit participation of landowners, farmers, and the Cities of Ellijay and East Ellijay in implementation of the WMP;

2. Identify exact site locations for management measures;

3. Initiate and implement recommendations from the WMP within one year of receiving funding; and,

4. Find matching funds within one year of approval of the WMP.

Short-term goals should be achieved within three years following approval of the WMP.

Mid-term goals of the WMP include:

1. Reductions in historic fecal coliform levels in Tails Creek, Flat Creek, and Cooswattee HUC 12 watersheds after initial implementation of WMP recommendations; and

2. Sustained community involvement in water quality protection;

Mid-term goals should be achieved within three to six years following approval of the WMP.

Long-term goals of the WMP were set based on the existing TMDL developed by the EPD in 2004 and include:

1. Targeted reductions in historic fecal coliform concentrations in the Coosawattee River (74 percent), Flat Creek (57 percent), and Tails Creek (43 percent); and

2. Additional reductions in historic fecal coliform concentrations in the Coosawattee River, Flat Creek, and Tails Creek to meet seasonal water quality standards; and

3. Delisting of the Coosawattee River, Flat and Tails Creeks to meet the Clean Water Act (CWA) mandate to ensure these waters support the designated use of fishing.

Long-term goals should be achieved within six to ten years following implementation of approval of the WMP.

4.3 Expected Fecal Coliform Load Reductions and Proposed BMPs

The expected percent reductions for fecal coliform associated with each agricultural BMP listed in Table 10 are based on reductions provided in *Best Management Practices for Georgia Agriculture: Conservation Practices to Protect Surface Water Quality* (GSWCC, 2013). To determine the approximate percent reductions expected for urban and stormwater BMPs, the GA Stormwater Management Manual BMP Selection Guide (Table 4.1.3-1 in Volume 2) was utilized. The removal efficiency of fecal coliform bacteria of properly designed, installed, and maintained on-site waste water systems was estimated utilizing the EPA On-Site Wastewater Treatment Manual (EPA, 2002). In accordance with the EPA Manual, a conventional on-site wastewater system is capable of effectively reducing or nearly eliminating fecal coliform leaching to groundwater or occurring as runoff in surface water if properly designed, installed, and maintained (EPA, 2002). Management Practices listed in Table 10 were the only BMPs that have quantified removal efficiencies for fecal coliform; however, other BMPs were selected for implementation that have been determined to be effective for removal of other common pollutants associated with agricultural, urban, and residential nonpoint source pollution (i.e., sediment and nutrients) and are included in Tables 11 through 14.

Table 10. Fecal coliform removal efficiency of each suggested BMP and the average fecal coliform removal efficiency calculated for each land use.

Pollution Source	**BMP**	**Fecal Coliform Removal Efficiency**	**Average of Combined BMPs**
		Percent Removal	
Stormwater runoff from agricultural land cover, livestock and poultry operations	Anaerobic Digesters	99	83
	Field Borders	60	
	Filter Strips	60	
	Fencing and Access Control	99	
	Waste Storage Facilities	96	
On-Site Wastewater Systems for Rural Residential	Pumping tank every three to five years	99	99
	Repair/reinstall failing systems	99	
	Proper design, siting, installation, operation, and maintenance of newly installed systems	99	99
Stormwater runoff from urban land cover	Stormwater Bioretention Cells	90	80
	Stormwater Planter or Tree Boxes	80	
	Stormwater Ponds	70	

To calculate the expected percent reduction from implementation of BMPs within the project area watershed, an average fecal coliform removal efficiency of all of the combined BMPs was calculated for each pollution source. For example, for BMPs installed to reduce fecal coliform from stormwater runoff from agriculture land cover, the average fecal coliform removal efficiency listed in Table 10 was used to determine the overall expected percent reduction to the areas that drain to that BMP. A more comprehensive list of BMPs that can be used to reduce fecal coliform for agriculture, rural residential, and urban land are included in Tables 11 through 14. In addition to fecal coliform reductions, each BMP selected in Tables 11 through 14 will also help to reduce other common pollutants associated with nonpoint source pollution (i.e., sediment and nutrients), which were both identified as secondary pollutants within the project area watershed. Based on the percent reductions listed in Table 10, fecal coliform concentrations in the project area would be expected to be reduced following BMP implementation.

Table 11. Potential urban and residential NPS management measures to be implemented to achieve fecal coliform reductions.

Land Use	Pollutant Source	Best Management and Maintenance Practices (BMPs)
Urban and Residential Land Use	Stormwater Runoff	Public outreach and education campaign
		Establish or re-establish riparian buffers
		Avoid discharging or minimize discharging to sensitive areas (wetlands and streams)
		Continue enforcement of proper erosion, sediment, and pollution control for land disturbing activities through Local Issuing Authority (LIA)
		Continue protection of sensitive areas through regulations at local level that require developers to use additional erosion and sediment control measures in problem and high-risk areas
		Add additional erosion and sediment control inspectors
		Continue to make improvements and additional protections to local erosion and sediment control regulations
		Enhancement and development of community greenspaces and parks
		Bioswales
		Encourage land conservation and urban tree canopy
		Use or permeable pavement in urban areas
		Stormwater planter or tree boxes
	Illicit Discharges	Stream walks to detect and address
		Develop local ordinances to prohibit
		Develop plan or to detect and address
		Public outreach and education with mailings, flyers, social media, signage, and kiosks
		Develop a community hotline
	Leaking Sanitary Sewer System	City of Ellijay/East Ellijay establishes a leak detection system.

Table 12. Potential agricultural NPS management measures to be implemented to achieve fecal coliform, sediment, and nutrient load reductions.

<table>
<tr><th rowspan="2">Land Use</th><th rowspan="2">Pollutant Source</th><th colspan="2">Best Management Practices (BMPs)</th></tr>
<tr><th>Structural Practices</th><th>Non-Structural Practices</th></tr>
<tr><td rowspan="2">Agricultural Land Use</td><td>Row Crops</td><td>Field Borders
Filter Strips
Contour Buffer Strips
Grassed Waterways
Riparian Buffer or Buffer Strips
Terraces
Contour Farming
Diversions</td><td>Conservation Tillage
Reduced Tillage Systems
Cover Crops
Education Materials
Field Days
Erosion and Sediment Control Plans</td></tr>
<tr><td>Small Scale Cattle and Poultry Operations</td><td>Anaerobic Digesters
Fencing and Access Control
Waste Storage Facilities
Heavy Use Areas
Alternative Watering Facilities
Stream Crossings
Water Well
Runoff Management
Vegetative Barriers and Buffers
Poultry Stackhouse
Composter and Incinerator Mortality Facilities</td><td>Access Control
Nutrient Management Plans
GSWCC Farm Assessment
Prescribed Grazing
Residue Management
Rotational Grazing
Animal Trails and Walkways</td></tr>
</table>

Table 13. Potential on-site wastewater system management measures to be implemented to achieve fecal coliform reductions.

Pollutant Source	Best Management and Maintenance Practices (BMPs)
On-site Wastewater Systems	Enforcement of existing regulations
	Public outreach and education campaign about importance of proper maintenance and usage
	Establish a cost share program to assist homeowners with septic system maintenance, repairs, or replacement
	Eliminate garbage disposals
	Utilize graywater approach
	Public outreach and education campaign about importance of proper maintenance and usage in Coosawattee River Resort newsletter
Illicit discharges of on-site waste water systems	Maintain plumbing system
	Stream walks to identify and eliminate illicit discharges
	Public outreach and education campaign

Table 14. Other potential best management practices to be implemented to achieve fecal coliform reductions in the project area.

Pollutant Source	Best Management and Maintenance Practices (BMPs)
Buffer Intrusion	Enforcement of existing regulations
	Establish more stringent regulations to protect existing buffers
	Stream restoration
	Public outreach and education program about the importance of stream buffers
	Buffer enhancement or reestablishment program
Wildlife and Pets	Signage about the importance of cleaning up after dogs
	Dog waste disposal facilities/bags
	Public outreach and education campaign about not feeding wildlife
Litter	Stream cleanups
	Public outreach and education campaign

5.0 NON-POINT SOURCE (NPS) MANAGEMENT MEASURES & PROPOSED BMPs

5.1 Critical Areas

In order to achieve the percent fecal coliform reductions detailed in Section 4.3 above, a series of BMPs that address fecal coliform associated with urban/residential land use, agriculture, on-site wastewater systems, and other sources such as buffer intrusion, wildlife, pets, and litter should be implemented throughout the WMP project area (Tables 11 through 14). Priority should be given to areas adjacent to streams and wetlands and other environmentally sensitive areas. A collaborative effort should be made between stakeholders within the WMP project area and project coordinators to carefully select BMPs and management measures which will achieve the long-term goal of delisting the impaired segments of the Coosawattee River, Tails Creek, and Flat Creek.

5.2 Urban Management Measures

Potential BMPs and low impact development management measures that address stormwater runoff associated with urban land and impervious surfaces, illicit discharges, and leaking sanitary sewer systems are also summarized in Table 11. Management measures in Table 11 were selected to address fecal coliform, sediment, and nutrient loading within the WMP project area watershed. To address stormwater runoff associated with new development, Gilmer County operates as the Local Issuing Authority (LIA) and is responsible for ensuring all new development and land disturbing activities incorporate proper BMPs to protect State Waters. The LIA conducts regular site inspections and continually makes improvements to the existing program and county regulations. The Gilmer County LIA has also imposed additional requirements above the minimum required by the State for developments in problem or high risks areas (i.e., adjacent to floodplains or other sensitive areas). Currently, the LIA has one full-time inspector and plans to add an additional inspector to address future development within Gilmer County.

5.3 Agricultural Management Measures

Table 12 summarizes the possible agricultural NPS management measures to be implemented in order to achieve fecal coliform reductions discussed in Section 4.0 above. Proposed BMPs listed in Table 12 are targeted at the protection or establishment of riparian buffers, stormwater management strategies, and controlling agricultural runoff associated with small-scale livestock and poultry operations. According to the Gilmer County Agricultural Extension Agency, less than four percent of Gilmer County is currently in row crops; therefore, management measures that address livestock and poultry operations should be given priority over row crop BMPs. Management measures should also be selected to address additional pollutants such as sediment and nutrients.

5.4 On-Site Wastewater Systems

The EPA On-site Wastewater Systems Manual (2002) and Georgia Department of Public Health (DPH) Wastewater Management Division provides guidance for the proper design, installation, maintenance, and usage for on-site wastewater systems. Table 13 summarizes the possible management measures that could be implemented in order to ensure proper treatment of rural residential wastewater. Proposed management measures should be prioritized in areas located within and adjacent to sensitive areas such as streams, wetlands, and floodplains. Public outreach and education programs should focus on educating homeowners on proper maintenance such as cleaning out the tank every three to five years, minimizing wastewater volumes by utilizing water conservation (reducing shower times or utilizing low flow toilets and faucets), and eliminating garbage disposals and the use of septic tank additives. The DPH also has a *Homeowner's Guide to On-Site Sewage Management Systems* that could be utilized to educate homeowners about how a septic system works, operation and maintenance, and signs of a malfunctioning system. A cost-share program could also be established to assist homeowners with the financial burden of cleaning out a septic tank or repairing/replacing a malfunctioning system. Potential funding sources for a cost-share program include the Community Development Block Grant (CDBG) and USDA Rural Development Program.

5.5 Other Potential Management Measures

Based on stakeholder input and conditions observed during the watershed reconnaissance and baseline monitoring, other potential sources of fecal coliform in the WMP project area include buffer intrusion, wildlife such as deer and geese, dog parks and pet feces, and litter. A series of proposed BMPs, including buffer and stream restorations or enhancement, more stringent stream buffer regulations, and public outreach and education campaigns about the importance of and function of stream buffers, have been proposed to address stream buffer intrusion and reestablishment (Table 14). Other programs, including educating the public about the importance of not feeding wildlife such as geese and deer, dog park waste disposal bags and signage about the importance of cleaning up after your pet, stream cleanups, and a litter reduction campaign are also potential BMPs that could be implemented to address and reduce fecal coliform pollution. The Coosawattee River Resort (CRR) comprises a large portion of the WMP project area and the CRR Board of Directors has recently created an Environmental Committee to help educate the residents and citizens of the resort about the importance of protecting surface water resources within the resort. The CRR currently operates a dog park, which provides waste disposal bags and signage about the importance of cleaning up after pets. The CRR also currently operates a litter reduction program that utilizes closed circuit TVs and strict penalties to ensure compliance with litter reduction and a public outreach and education campaign about the importance of proper septic system maintenance, function, and repairs.

6.0 FINANCIAL AND TECHNICAL ASSISSTANCE

6.1 Associated Costs

Costs associated with each proposed task to be implemented to make the WMP a success were estimated (Table 15). For each identified task, the personnel, planning, time for implementation, operation, maintenance, and equipment costs are included in the total costs. Additionally, the party responsible for implementation of each task and the proposed funding source have been identified. Several authorities, organizations, and individual producers, which are identified below, will be relied upon for successful implementation of the WMP:

- US FWS
- Watershed stakeholders
- Cities of Ellijay and E. Ellijay
- Gilmer County Commissioners
- Gilmer Co. Environmental Health
- Individual Producers and Landowners
- Georgia Poultry Federation
- Georgia Forestry Commission
- Gilmer County Extension
- UGA Sustainable Agriculture
- Keep Gilmer Beautiful
- Gilmer County Highschool
- Warnell School of Forestry and Natural Resources

In addition to the organizations identified above, several volunteers and or organizations have expressed interest in serving as long-term stakeholders to be relied upon for the implementation of the WMP. These volunteers include:

1. Mr. James Halloway, City of Ellijay Local Issuing Authority
2. Luke Garland, Garland Geological
3. Jennette Gayer, Environment Georgia
4. Gary McVey, Ellijay-Gilmer Water and Sewer Authority
5. Rick Tanner, Coosawattee River Resort Board of Directors
6. Anakela Popp, Georgia Department of Natural Resources (DNR)
7. Doug Towery and David May, Natural Resource Conservation Service (NRCS)
8. Debbie Rupp, watershed stakeholder
9. CRR Environmental Committee
10. Limestone Valley Soil and Water Conservation District

Table 15. Approximate Costs for Implementation of WMP.

Objective 1			
High Priority	Reduce fecal coliform, sediment, and nutrient associated with agricultural and rural residential land use in the Flat Creek watershed (septic systems, illicit discharges, poultry operations, small scale cattle operations, and buffer intrusions) and urban land use in the UT02 subwatershed (stormwater runoff, sanitary sewer leaks, illicit discharges, and buffer intrusion).		
Moderate Priority	Reduce fecal coliform, sediment, and nutrients associated with rural residential land use in the Coosawattee watershed (septic systems, illicit discharges, buffer intrusion, wildlife, and canines) and rural residential and agricultural land use in Tails Creek watershed (stormwater runoff from pastureland, buffer intrusion, septic systems).		
Tasks	**Responsible Party**	**Cost**	**Funding**
Identify agricultural producers within the watershed	USDA Farm Service Agency, Extension Service, GSWCC	$0	319(h) Grant, Community Development Block Grant (CDBG), USDA Rural Development Program, Rural Housing Service (RHS) Direct Loan Program, RHS Home Repair Loan & Grant Program, RHS Rural Utilities Service
Identify other landowners/areas for BMP implementation	Stakeholders, GSWCC	$0	
Contact producers/landowners for participation in cost-share program	GSWCC, Stakeholders	$2,500	
Identify landowners with septic system for implementation of BMPs	Coosawattee River Resort (CRR), Local Health Department, GA Department of Public Health (DPH)	$0	
Identify urban areas for implementation of stormwater BMPs	Cities of Ellijay and East Ellijay	$0	
Identify areas for buffer/stream restoration and/or enhancement	Stakeholders, GSWCC, CRR	$0	
Establish relationship with local regulators (City and County)	Stakeholders, GSWCC	$0	
Implementation of Agricultural and Urban BMPs	GSWCC, NRCS, Gilmer County, Cities of Ellijay and East Ellijay, Stakeholders	--	
Structural and Non-structural (See Tables 11 through 14)		$131,500	
Stream walks and inventory of illicit discharges; stream cleanups	Watershed Volunteers	$0[1]	
Implementation of septic system maintenance and repairs program[2]	GSWCC, Health Department, GA DPH; Keep Gilmer Beautiful	$130,000	
Continue routine inspections for new development	Ellijay – Gilmer Local Issuing Authority	$0[1]	
Dog waste disposal facilities/bags at parks and other facilities	City and County, CRR	$3,000	
	Subtotal	**$267,000**	

Table 15. Approximate Costs for Implementation of WMP. (continued)

Objective 2			
Information and Education Component			
Tasks	**Responsible Party**	**Cost**	**Funding**
Advertising, news articles, public notices, and public meetings	Stakeholders, Limestone Valley SWCD, GSWCC, City and County	$1,500	319(h) Grant, US EPA Environmental Education (EE) Grant, US EPA Surface Water Grant and Loan Programs, US FWS Grants, NRCS EQIP, Georgia Environmental Finance Authority (GEFA), Clean Water State Revolving Fund, Southeastern Regional Water Quality Assistance Network, Catalog for Federal Funding
Educational brochures, quarterly fact sheets, direct mailings, fliers		$600	
Watershed signage		$3,000	
Website development and maintenance		$5,500	
Farm Assessment	GSWCC, NRCS	$0[1]	
Nutrient Management Plans		$5,000	
Promotional materials for conservation agricultural programs and practices	GSWCC, NRCS, City and County, Extension Office	$600	
Meetings and trainings for producers	GSWCC, Limestone Valley SWCD, County, Local AAS	$800	
Promotional materials about the importance of proper septic system maintenance and usage and cost share program	CRR, County Health Department, GA DPH, Stakeholders	$2,500	
Outreach and education campaign about the importance of not feeding wildlife	CRR, Stakeholders	$1,000	
Promotional material about the importance of cleaning up after your dog	CRR, City and County Parks and Recreation, Stakeholders	$1,000	
Educational material about the importance of stream buffers and vegetation	GSWCC, Stakeholders, CRR	$1,000	
Educational material about a litter reduction campaign		$1,000	
	Subtotal	**$23,500**	

Table 15. Approximate Costs for Implementation of WMP. (continued)

Objective 3			
Long-term monitoring to measure success of project			
Tasks	**Responsible Party**	**Cost**	**Funding**
Conduct AAS monitoring (*in-situ* water quality analysis)	Local AAS, GSWCC, County, Volunteers, Stakeholders	\$9,000[3]	319(h) Grant, US EPA Environmental Education (EE) Grant, US EPA Surface Water Grant and Loan Programs, US FWS Grants, GEFA, Clean Water State Revolving Fund, Southeastern Regional Water Quality Assistance Network, Catalog for Federal Funding
Secure funding for future long-term monitoring	GSWCC, Stakeholders	\$0[3]	
Contract consultant to conduct long-term monitoring (annually)	GSWCC, Stakeholders	\$22,000	
Post BMP monitoring	NRCS, County, GSWCC, volunteers	\$5,000	
	Subtotal	**\$36,000**	
	Project Total	**\$326,500**	

[1]No cost is associated with task due to the use of in-kind hours
[2]Cost assumes \$250 to \$500 per tank clean out/pumping and \$3,000 to \$7,000 per new system replacement
[3]Cost includes equipment (turbidity meter and water quality meter)

7.0 INFORMATION AND EDUCATION

An integral part of a WMP is to gather public support, promote the WMP, and educate the citizens of the WMP project area watershed about the importance of protecting surface water quality. Many of the recommended management measures require volunteer hours and public participation and increasing the public's understanding of the WMP which is important to the success and implementation of the plan. Providing adequate education, outreach, and awareness of how land management practices influence NPS loading of sediment, nutrients, and bacteria to surface water resources may then motivate changes in behavior.

Specifically, the education and outreach components should be designed to teach producers, rural residential property owners, and other stakeholders about the pollution issues facing the WMP project area watershed. The goal of the education and outreach component is to bring attention to what impact each individual's land use and management decisions will have on water quality in the project area watershed, how they can address those impacts, and what opportunities and innovative solutions exist. The table below summarizes outreach and education activities recommended for the Coosawattee River – Carter Lake WMP watershed.

Tasks	Actions
Gather public support and participation, Promote WMP, Public Education	Work with local media through advertising, publishing news articles and public notices, and continue to conduct public meetings
	Educational brochures, quarterly fact sheets, direct mailings, fliers
	Develop watershed signage to promote activities in the watershed
	Develop a website
	Work with local Adopt-a-stream program
Educate Producers	GSWCC Farm Assessment
	Nutrient Management Plans
	Promotional materials for reduced tillage systems, cover crops, crop rotations, small scale cattle operations, and poultry operation BMPs
	Conduct meetings and trainings
Educate Homeowners	Educational brochures, quarterly fact sheets, direct mailings, fliers about the importance of septic system maintenance and usage, stream buffers, not feeding wildlife, and cleaning up after dogs

Advertising through published articles or notices and educational brochures such as quarterly fact sheets, direct mailings, or fliers (public educational materials) should contain information on the project, challenges, proposed solutions, and project updates. The public education materials can also contain information about water quality, the effects of NPS pollution on water quality, and the importance of BMPs and proper septic systems maintenance and function for the protection of water quality.

Watershed signage can include watershed boundary signs, information about illegal dumping, proper disposal of pet waste, yard signs, or recognition of watershed improvements. Yard signs can promote individual property owners and recognize conservation practices that have been implemented. Recognition can be given to landowners or others through signs that display "Stream-Friendly Farm", "River-Friendly Farm", or "Residential Wastewater Improvement Project funded by the Coosawattee River WMP".

A project website can also be developed and maintained by a webpage designer, which promotes the project, provides regular updates, and recognizes agricultural producers and volunteers. As discussed in the public meetings, the Stakeholder Group can also establish a relationship with the local adopt-a-stream (AAS) group currently under the management of the Coosawattee Watershed Alliance. The goals of the AAS program are to increase public awareness of NPS pollution, provide citizens with tools and training to evaluate, monitor, and protect their local waterways, to encourage partnerships between local stakeholders, citizens, and local governments, and to collect water quality data. The AAS group in conduction with the WMP stakeholders could conduct an outreach event, conduct AAS monitoring, and attend AAS workshops. The level of AAS participation and involvement can be determined by the Stakeholder Group and volunteer interest. More information concerning the AAS program and contact information for the program coordinator can be found at www.GeorgiaAdoptAStream.org.

To educate producers and homeowners, promotional materials can be distributed or meetings and trainings can be conducted about sustainable agricultural practices, agricultural BMP implementation and maintenance, land owner recognition, and the progress of the WMP. Other education and outreach activities that specifically target producers include the GSWCC Farm Assessment. The Farm Assessment is a voluntary program, which is a multi-phased nutrient planning initiative available to farmers. Updates can be made to existing nutrient management plans or new plans can be established. Other incentives of the Farm Assessment include record keeping protocols, identification of areas within each farm for improvements for the protection of natural resources, and the assistance in identifying potential funding sources to complete improvements based on the assessment.

8.0 IMPLEMENTATION SCHEDULE

Table 16 presents the proposed approach for implementing the WMP. The implementation schedule is meant to serve as a reference tool to recognize tasks that are scheduled immediately following plan approval in the upcoming year. The proposed schedule is also dependent on funding, producer, homeowner, and County participation, and public support. The schedule should be adaptable and updated on a regular basis due to shifting priorities, new opportunities, and expected delays. The long-term stakeholder group should conduct an annual review of the WMP and make revisions on an as needed basis. The provisions and schedules for evaluating the effectiveness of the installed BMPs and assessing water quality following implementation of the BMPs are discussed in Section 9.2 (Long-term Monitoring).

Table 16. Proposed Implementation Schedule for the WMP.

Activity	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Initiate first project meeting	May 2019									
Secure additional funding to implement the WMP	May to December 2019	First Six Months								
Identify producers, urban and rural residential properties, and other areas for BMP implementation	May to December 2019	First Six Months								
Contact producers, property owners and others for participation in cost-share program	May to December 2019	First Six Months								
Implementation of septic system cost share program		Annually								
Implementation of agricultural BMPs		Annually								
Implementation of urban and residential BMPs		Annually								
Implementation of other BMPs (stream buffers, wildlife, canine, and stream cleanups)		Annually								
Post BMP inspections		Quarterly	Quarterly	Annually	Annually	Annually	Annually	Annually	Annually	Annually
Education, Outreach, and Public Information Components	May 2019	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Conduct Adopt-a-stream (AAS) monitoring with existing Coosa River Basin Initiative		Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Conduct annual stream cleanups	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
Secure funding for long-term monitoring	First Six Months	First Six Months								
Conduct Post-Construction BMP Monitoring		Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	
Conduct Long-term monitoring for delisting										Quarterly
Review WMP and make changes as needed		Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually

May 2019
May to December 2019
First Six Months
Quarterly
Annually

9.0 INTERIM MILESTONES, SUCCESS CRITERIA, AND LONG-TERM MONITORING

9.1 Milestones and Success Criteria

The WMP was written to cover a 10-year time period. Interim milestones and measures of success of the plan are broken down into three phases: short-term, mid-term, and long-term. A summary of each interim milestone and success criteria for each phase of the WMP is included within Table 17. The party responsible for each

Table 17. Interim milestones for the short-term, mid-term, and long-term phases of the WMP.

Phase	Time after Implementation	Milestones	Measure of Success
Short-term	3 months to 1 year	Secure additional funding for implementation of the WMP, Participation and partnerships with landowners, producers, volunteers, & County and City Departments	90% involvement of stakeholders
			Public attendance and participation in public meetings
			Distribution of flyers or installation of signage or kiosk
			Establish relationship with existing AAS program
			Development of cooperative partnerships
			40-man hours per volunteer per year
			In-kind donation of City and County equipment, man hours, and resources
			Initiate public education and outreach campaign about WMP and cost share program for septic systems, agricultural, urban and residential, wildlife and canine, and buffer enhancement BMPs and litter reduction campaign/stream cleanups
	Within 1 year to 2 years	Initiation and implementation of management measures from WMP	90% of recommendations implemented according to schedule
			Implementation of septic systems maintenance on approximately 60 onsite waste water systems or rural residential properties
			Implementation of septic system repairs or replacement on approximately 20 systems or rural residential properties
			Implementation of agricultural management measures on approximately 66 acres
			Implementation of urban/residential management measures on approximately 2,230 acres
			Implementation of other BMPs for buffer intrusion, wildlife and canine sources, and stream cleanups
			In-kind donation of City/County equipment, man hours, and resources
			Conduct stream walks and determine need to illicit discharge elimination system
			Continue public outreach and education campaign
	2 years to 3 years	Post BMP Success Monitoring	Examine for vegetation establishment and success
			Examine for effectiveness for stormwater control, proper maintenance, or need for reinstallation
			Establish tracking system for installation and maintenance of BMPs
			Establish recording keeping system with local County health departments to track septic maintenance and repairs
Mid term	3 years	Reduction in fecal coliform concentration	Contract and hire consulting firm to conduct fecal coliform monitoring
	3 to 6 years	Sustained landowner, producers, volunteers, and County involvement	Quarterly AAS monitoring events
			Continued support and donations from City/County and volunteers
			Continued public and stakeholder participation

Table 17. Interim milestones for the short-term, mid-term, and long-term phases of the WMP. (continued)

Phase	Time after Implementation	Milestones	Measure of Success
Long-term	6 to 10 years	Sustained community involvement in water quality protection	Quarterly AAS monitoring events, continued public and stakeholder participation
	1 or 2 years to 10 years	Establish long-term monitoring program	Contract and hire consulting firm to conduct fecal coliform monitoring
			Conduct quarterly AAS events
			Reduction in fecal coliform, sediment, and nutrients
	6 to 10 years	Targeted 74% reduction in fecal coliform for Coosawattee River, 57% reduction for Flat Creek, and 43% reduction for Tails Creek	Measured by long-term monitoring
	10 years plus	Further reduction in fecal coliform for Coosawattee River, Flat Creek, and Tails Creek to meet seasonal water quality standards	Measured by long-term monitoring and delisting of Flat and Tails Creeks and Coosawattee River

9.2 Long-term Monitoring

Water quality monitoring is an integral part of assessing the progress and success of the WMP. Long-term monitoring shall be conducted to determine the success of the implemented BMPs and to provide a basis for delisting of the Coosawattee River, Tails Creek, and Flat Creek. In order to meet the seasonal water quality standards, the Coosawattee River, Flat Creek, and Tails Creek require a 74, 57, and 43 percent reduction in fecal coliform loading, respectively. The sections below describe recommendations and needs for future monitoring for documenting the water quality improvements that occur due to the implementation of the WMP. Results of the long-term monitoring will also be an effective measure of determining the success of the WMP or the need for future revisions.

9.2.1 BMP Success Monitoring

Post Construction BMP Inspections

It is anticipated that implementation of BMPs will assist in reducing fecal coliform, sediment, and nutrient loads within the WMP project area watershed. Post-construction inspections should occur immediately following installation of the structural BMPs and should include the examination of effectiveness for stormwater and pollution control, proper installation, design, and maintenance of each BMP, and/or the need for additional stabilization measures. An Operations and Maintenance Manual or Standard Operating Procedure will be produced for each BMP installed. Following the post-construction inspections, success monitoring should be conducted quarterly for the first two years and on an annual basis thereafter. Success monitoring of installed BMPs should include examination for proper maintenance, vegetation establishment and success, presence of erosion rills or gullies, or the need for reinstallation or additional measures. A tracking program should be established to monitor the success of the septic system maintenance and repair cost share program.

For non-structural BMPs, watershed "windshield surveys" should be conducted to determine the effectiveness of the signage or other litter control and illegal dumping management measures. Additional stream walks should be conducted to survey the success of elimination programs for illicit discharges. Records should be kept to track the success of outreach campaigns for septic system maintenance and repairs, not feeding wildlife, and cleaning up after pets. The parties responsible for conducting post-BMP monitoring, associated costs, and potential funding sources are listed in Table 14.

Post-construction BMP Fecal Coliform Monitoring

Analyses should include laboratory determination of fecal coliform concentration and should be conducted quarterly following the implementation of management measures. Monitoring should be conducted in accordance with the *Quality Assurance (QA) and Quality Control (QC) Targeted Monitoring Plan* (Plan) for fecal coliform sampling (Nutter & Associates, January 2018), EPD Watershed Protection Branch *Quality Assurance Manual* (2005), and *Title 40* of the *Code of Federal Regulations*, *Part 136*. At a minimum, monitoring should be conducted in areas where BMPs are implemented to determine if each installed BMP is effective at reducing fecal coliform.

In accordance with GA Water Quality Standards, a minimum of four individual samples per station will be collected per 30-day period to calculate a geometric mean in accordance with the proposed schedule in Table 17. Fecal coliform samples should be collected on a regular schedule on the same day of the week over a four-week period (i.e., every Monday for four weeks) regardless of weather. If desired, *in-situ* water quality measurements, including air and water temperature (^{o}C), dissolved oxygen (percent saturation and mg/L), pH (standard units), specific conductance (µS/cm), and turbidity (NTUs) can be conducted in conjunction with each fecal coliform grab sample event. Data collected following BMP implementation will be compared to data collected prior to implementation of BMPs and during the baseline monitoring to determine if a reduction in fecal coliform has occurred.

Table 18. Sampling schedule for the WMP fecal coliform post construction BMP analysis.

	Sample Events				
	Mar	May	July	Sept	Dec
Fecal Coliform Long-term Monitoring					
In-Situ Water Quality Analysis	✓	✓	✓	✓	✓
Fecal Coliform Geometric Mean (4 individual events for four geomeans on an annual basis)	✓	✓	✓	✓	✓

9.2.2 Long-term Monitoring Plan for Delisting

To determine if fecal coliform load reductions are being achieved over time and substantial progress is being made towards the ultimate goal of delisting the streams within the WMP project area, a fecal coliform long-term monitoring plan has been developed as a means to evaluate the success of the WMP. Long-term success monitoring data shall be collected and submitted in accordance with the quality assurance/quality control requirements described in EPD's *Guidance on Submitting Water Quality Data for use by the Georgia Environmental Protection Division in 305(b)/303(d) Listing Assessments* (October 2002) and the EPD's *Water Protection Branch Quality Assurance Manual* (June 1999, revised January 2005). Samples should be collected at the same sites used to previously list each stream segment (with the exception of Flat Creek), which are summarized in the table below. The monitoring station locations are based on the locations sampled during the baseline assessment.

Monitoring Station	**Location** Decimal Degrees	
Tails Creek at Hwy 76 (Tails Creek Rd)	34.68641	-84.60041
Coosawattee River at Old Hwy 5	34.67027	-84.50017
Flat Creek at Nexus Dr	34.63959	-84.58393
Flat Creek at Sunlight Rd	34.62570	-84.55179
Flat Creek at Knight Road	34.63340	-84.55890

The Coosawattee River, Flat Creek, and Tails Creek could be delisted if the calculated fecal coliform geometric means collected during the long-term monitoring are below the water quality standard. The table below lists the minimum sample requirements for fecal coliform monitoring in order to delist the three stream segments and the GA water quality standard.

Pollutant	**Summary of Water Quality Standards**	**Required Number of Samples**
Fecal Coliform	Geomean 1,000 MPN/100mL (Nov to April) or Geomean 200 MPN/100mL (May to Oct)	16 samples per site (4 samples collected within 30-day period during each of 4 calendar quarters to calculate 4 geometric means[1])

[1]30-day sampling period must not overlap the months of April to May or October to November

Adopt-a-Stream Monitoring

If enough volunteer interest is shown, a relationship can be established with the existing Adopt-a-Stream (AAS) program currently in progress with the Coosawattee Watershed Alliance. An AAS monitoring program would be an effective tool in monitoring the implementation of the WMP, establishing local partnerships, and increasing community involvement and education about NPS pollution. The AAS program goals include increasing public awareness of NPS pollution and water quality issues, collecting water quality data for the watershed, gathering observations about the watershed, encouraging partnerships between citizens, volunteers, and local government entities, and providing citizens with the tools and training to evaluate and protect water resources. Training workshops can be scheduled to train local officials and volunteers on the proper procedures for collecting chemical and bacteriological water quality data. This data can be used to determine the effectiveness of installed BMPs and if reduction in fecal coliform has occurred by comparing data collected by AAS to historic and baseline water quality data. It can also be used as an effective public outreach and education tool by increasing the awareness of NPS pollution in the project area.

10.0 FUTURE REVISIONS AND PLAN SUCCESS

Periodic reviews should be conducted by the Stakeholder Group of the implementation schedule, accomplishments, and monitoring results to determine whether or not the goals of the WMP are being met. The WMP is a "living" document, meaning that the goals and objectives contained within can be modified, strengthened, and/or removed based upon water quality monitoring results and the needs of the stakeholders in the watershed. For long-term success of the plan, it is recommended that the WMP be reviewed and evaluated on an annual basis to determine if milestones and associated success criteria are being accomplished. Revisions to the WMP should be made following the annual review process conducted by the long-term stakeholder group and the GSWCC. It is expected that with implementation of BMPs that control the input of excessive concentrations of fecal coliform bacteria and other pollutants, such as sediment and nutrients, that the watershed will contribute a lower pollutant load and allow for the achievement of the long-term goal of delisting the Cooswattee River, Flat Creek, and Tails Creek.

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The preparation of this document was financed in part through a grant from the U. S. Environmental Protection Agency under the Provisions of Section 319(h) of the Federal Water Pollution Control Act, as amended
March 2019 - Georgia Department of Natural Resources Environmental Protection Division.

APPENDIX A. WATERSHED RECONNAISSANCE AND WINDSHIELD SURVEY

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August 13, 2018

Jessica Mimbs
Rural Water Manager
Georgia Soil & Water Conservation Commission
4310 Lexington Road
Athens, Georgia 30605

Subject: Coosawattee River – Carters Lake Watershed Management Plan Watershed Reconnaissance. Project No. 18-022.

Dear Mrs. Mimbs,

The purpose of this report is to provide a summary of the Coosawattee River – Carters Lake watershed reconnaissance. A "windshield survey" and watershed reconnaissance were completed on May 1, 2018. Photo documentation and findings of the reconnaissance are included below. Based on the results of the reconnaissance, we have developed a Targeted Monitoring Plan for fecal coliform sampling. The first round of baseline sampling was conducted in June 2018 and results will be summarized in the July 2018 quarterly status report.

If you have any questions or need any other information, please do not hesitate to contact me.

Sincerely,
NUTTER & ASSOCIATES, INC.

Erin M. Harris

Erin M Harris, CPESC, CPSS
Project Scientist

cc: Veronica Craw, GA EPD Watershed Protection Branch Grants Unit

Enclosures

Coosawattee River – Carters Lake Watershed Management Plan Watershed Reconnaissance and Windshield Survey Report

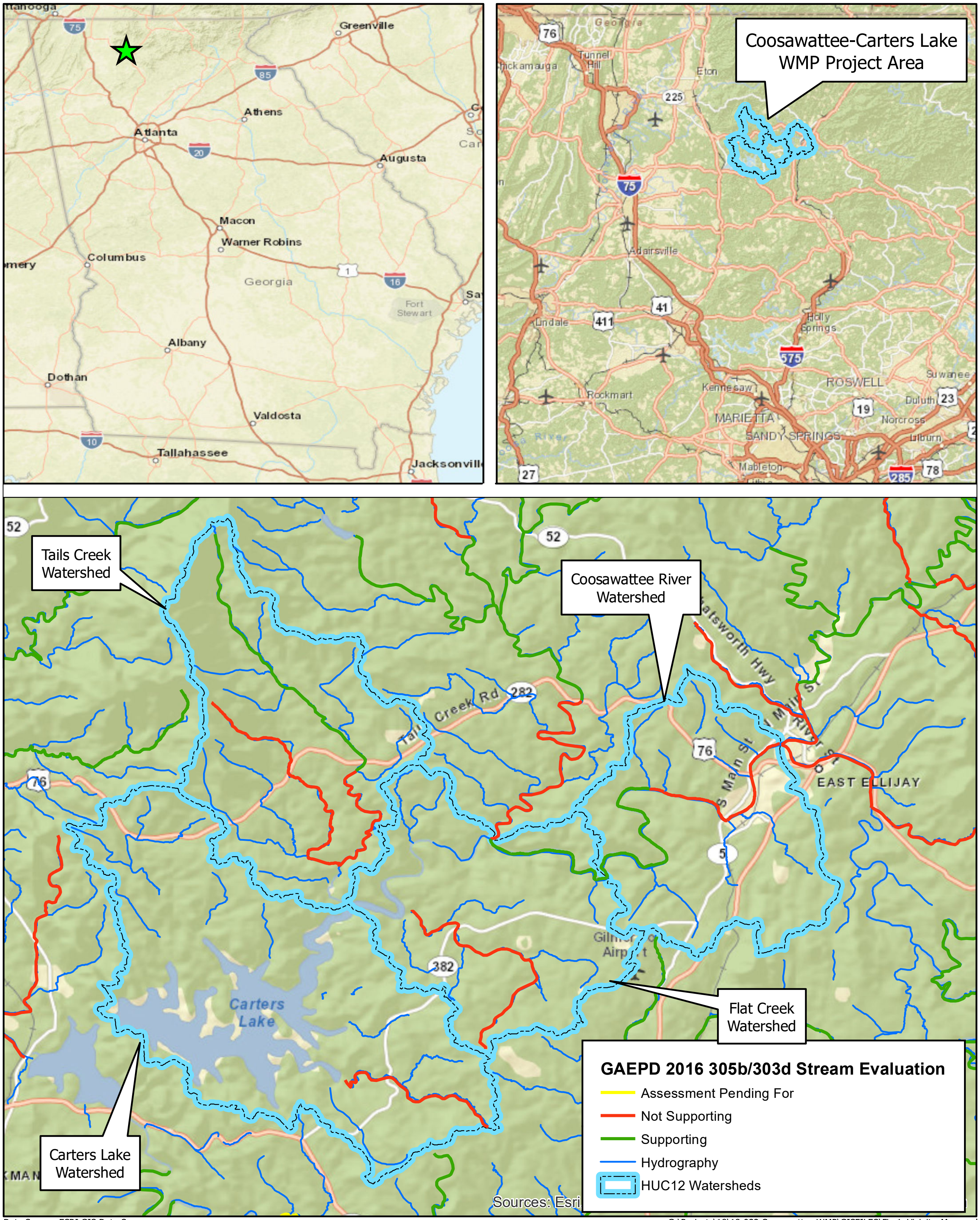
A windshield survey of the watershed was conducted on May 1, 2018. The purpose of the survey was to verify watershed land use data, identify problem areas or "hot spots" for fecal coliform pollution within the watershed, and determine suitable monitoring stations for the baseline fecal coliform monitoring. Figure 1 presents the location of the Coosawattee – Carters Lake Watershed Management Plan (WMP) project area and surrounding vicinity and Figure 2 depicts the 2011 land use coverage. A description of the watershed project area including the land use data, water quality impairments and standards, and an evaluation of the Total Maximum Daily Load (TMDL) was included in the submitted and approved *Quality Assurance and Quality Control Targeted Monitoring Plan for Fecal Coliform in the Coosawattee – Carters Lake WMP Project Areas* (Nutter & Associates, May 2018).

As part of the visual assessment, land use data (Figure 2) was verified in the watershed. Additionally, a visual inspection was conducted at approximately 20 potential monitoring locations within the WMP project area and any potential sources of fecal coliform pollution were spatially located using a GPS. The locations of the 20 monitoring stations that were evaluated are presented in Figure 3 and summarized in Table 1. Photo documentation of the visual assessment is included in the Plates section below. In conclusion, the land use data presented in Figure 2 was verified to be accurate.

Table 1. Location of potential water quality monitoring stations that were evaluated during the watershed reconnaissance of the project area on May 1, 2018.

Station Name	Location (DD)		Suitable Station[1]	Plate Number
	Latitude	Longitude		
Cartecay River at 1st Ave	34.68588	-84.4742	Yes	1, 2
Coosawattee River at Veterans Memorial Park	34.67144	-84.4966	Yes	3, 4
Coosawattee River at Ogden Drive	34.67473	-84.5299	Yes	5, 6
Coosawattee River at Orchid Lane	34.66236	-84.5641	Yes	7, 8
Unnamed Tributary to the Coosawattee at Legion Road	34.68011	-84.5162	No	9, 10
Unnamed Tributary to the Coosawattee at Newport Dr and Darian Way	34.67968	-84.5209	No	11, 12
Mountain Town Creek[2]	34.66483	-84.5646	No	--
Ellijay River at Hwy 52/River Street	34.69280	-84.4794	Yes	13, 14
Flat Creek at Cajun Drive	34.61030	-84.5683	No	15, 16
Flat Creek at Sunlight Road	34.62570	-84.5518	Yes	17, 18
Flat Creek at Knight Road	34.63340	-84.5589	Yes	19, 20
Flat Creek at Nexus Drive	34.63959	-84.5839	Yes	21, 22
Flat Creek at Hwy 382	34.63992	-84.5741	No	--
Unnamed Tributary to Flat Creek at Sunlight Road	34.62508	-84.5513	No	--
Unnamed tributary to Flat Creek at Eagle Mountain Drive	34.64417	-84.5751	Yes	23, 24
Tails Creek at Tails Creek Road	34.68641	-84.6004	Yes	25, 26
Fir Creek at Lower Tails Creek Road	34.67458	-84.6117	No	27, 28
Unnamed tributary to Coosawattee River at Progress Road	34.66511	-84.4991	Yes	29, 30
Unnamed tributary to Coosawattee River at Veterans Memorial Park	34.67095	-84.4943	Yes	31, 32
Unnamed tributary to Coosawattee River at Hwy 76	34.68256	-84.4939	Yes	33 - 35

[1]Potential monitoring locations were evaluated based on surrounding land use data, potential pollution sources, and site accessibility
[2]No public access



Data Source: ESRI GIS Data Server

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Figure 1. Coosawattee – Carters Lake Watershed Management Plan Project Area assessment segment vicinity, Gilmer and Murray Counties, Georgia.

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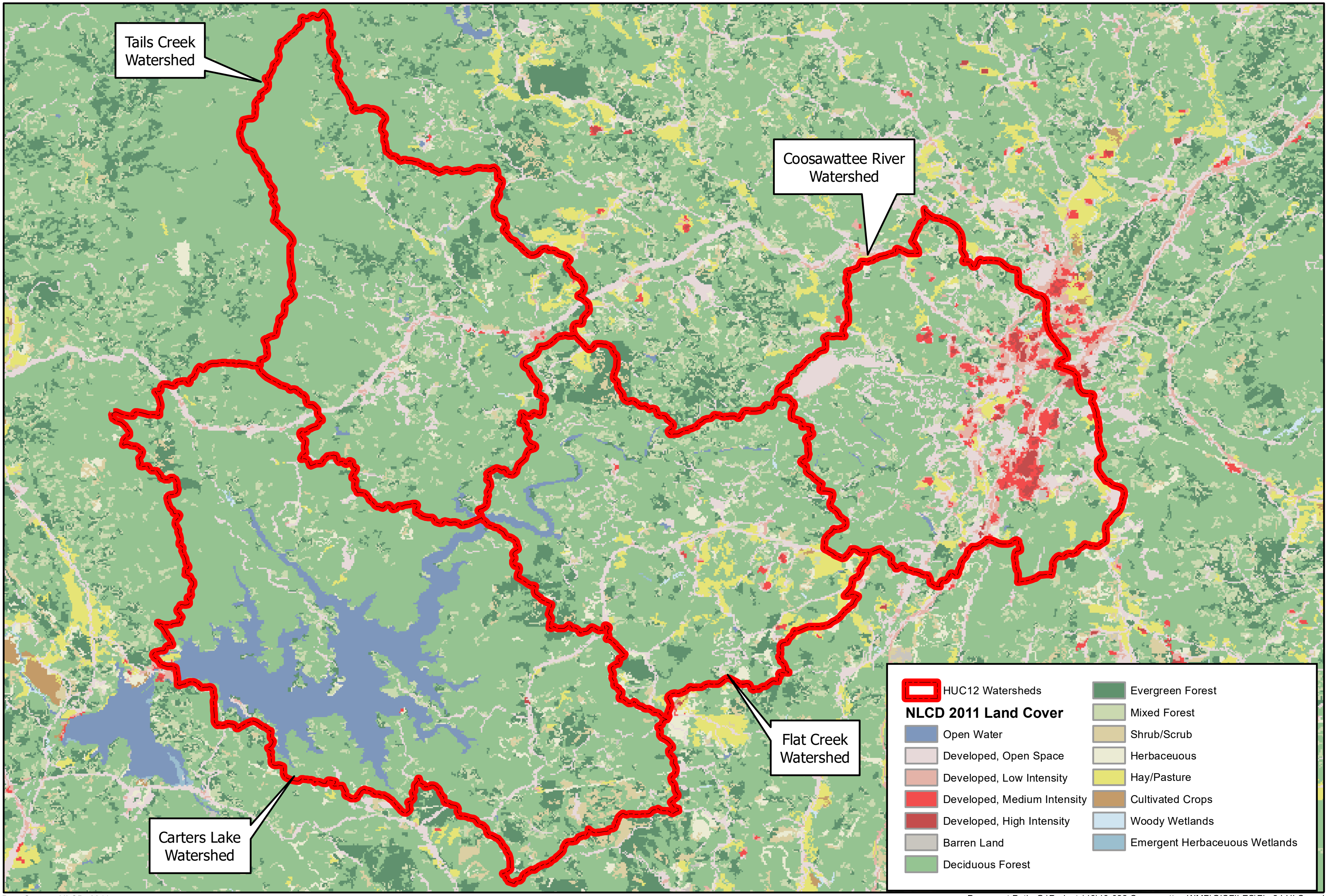

Data Source: NLCD, 2011

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Figure 2. 2011 National Landcover Database land use classification for the Coosawattee – Carters Lake Watershed Management Plan Project Area.

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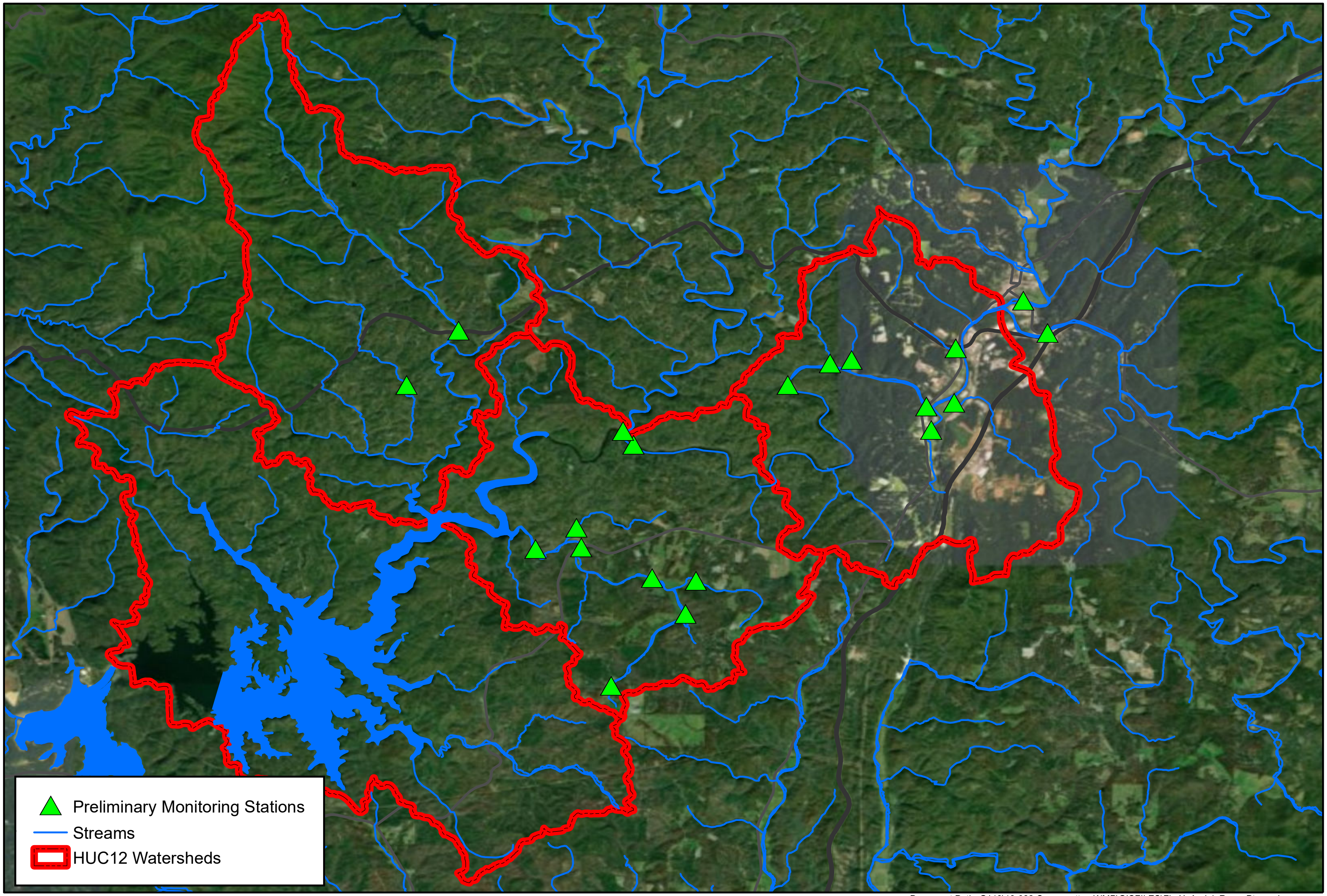

Data Source: USDA NAIP 2015

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Figure 3. Preliminary baseline fecal coliform monitoring stations, Coosawattee – Carters Lake Watershed Management Plan Project Area.

0 1 2 4 Miles

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Collection of Background Information and GIS Desktop Analysis

A collection of background information and GIS desktop analysis for the Coosawattee – Carters Lake WMP project areas (project area) has been completed. Background information collected includes:

1. Historic land use and land cover;
2. Aerial delineation of problem areas;
3. Buffer inventories;
4. Historic water quality data;
5. Evaluation of TMDL;
6. Identification of possible data gaps based on current land usage; and,
7. Determination of potential causes and sources of pollutants.

Further, as part of the development of the WMP and background data analysis, we will coordinate with the agencies in Gilmer and Murry Counties to determine agricultural extension information (number of livestock, agricultural tillage practices, etc.).

Other Potential Water Quality Stressors

As part of the GIS analysis, Nutter & Associates (NAI) searched Georgia Department of Natural Resources, GA EPD and U.S. Environmental Protection Agency (US EPA) databases to identify landfills, RCRA sites, hazardous waste (CERCLIS) facilities, wastewater treatment plants, land application sites and other regulated facilities that could be potential water quality stressors within the project area watershed. Land use data (Figure 2) was used to identify any industrial areas located within the watershed. A summary of the potential stressors is included below:

- One wastewater pollution control plant (WPCP), the City of Ellijay WPCP, with a National Pollutant Discharge Elimination System (NPDES) permit exists in the northernmost portion of the Coosawattee watershed (Figure 4). The WPCP discharges to the Coosawattee River and is located at 64 Merk Davis Street (NPDES GA0021369). The facility discharges within the three-mile segment of the Coosawattee River, which is listed on the 305(b)/303(d) integrated report. No fecal coliform violations have been reported for the facility.

- The Pilgrims Pride Processing Plant is located at 125 Industrial Boulevard in the northern portion of the Coosawattee watershed (Figures 4). The facility is permitted to discharge industrial stormwater (ICIS-NPDES GAIS00849). No violations have been reported for the facility.

- No solid waste disposal facilities were identified in the project area.

- No Land Application Sites (LAS) are in use or known to be located within the project area.

The EPD Hazardous Site Inventory website, www.gaepd.org/Documents/hazsiteinv.html, was used to search for hazardous waste sites located within the Coosawattee River watershed. Further, the EPA Envirofacts website, www.epa.gov/emefdata/em4ef.home, was used to search Aerometric Information Retrieval System/AIRS Facility Subsystem (AIRS/AFS), Toxic Release Inventory System (TRI), Toxic Substances Control Act (TSCA), Section Seven Tracking System (SSTS), Permit Compliance System (PCS), Integrated Compliance Information System (ICIS), National Emission Inventory (NEI), Hazardous Site Inventory (HSI), and Geographic Information Management System (GEIMS) databases to identify small quantity generators and potential polluters in the service area. Approximately 38 sites were identified in the project area; however, none of the identified facilities likely attribute to fecal coliform pollution within the project area watershed. All facilities identified as potential sources of fecal coliform pollution have been identified in the table above.

Historic Water Quality Data

According to historic fecal coliform water quality monitoring data acquired from the Georgia EPD Online Water Quality Database, fecal coliform monitoring has been conducted at four locations throughout the project area. Water quality monitoring was conducted at the Carters Lake Dam, the Coosawattee River at Hwy 5 and at Newport Drive, and at Tails Creek at US Hwy 76 (Figure 4). In accordance with State of Georgia Water Use Classifications and Water Quality Standards (GA Code 391-3-6-03), fecal coliform concentrations shall not exceed a geometric mean of 200 MPN/100 mL for the months of May through October and 1,000 MPN/100 mL for the months of November through April. This calculated geometric mean is based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Further, for the months of November through April, fecal coliform concentrations shall not exceed a maximum concentration of 4,000 MPN/100 mL for any sample.

The results of the historic monitoring including date, locations, and fecal coliform concentrations are included in Appendix A. At the Carters Lake Dam, GA EPD conducted fecal coliform sampling from 1984 through 2005 (Figure 4). Eleven discrete samples were collected, and concentrations were below detection limits (20 MPN/100 mL) for all events completed at the dam (Appendix A). The GA EPD conducted water quality monitoring at the Coosawattee River at Hwy 5 from February 1995 through December 2013 (Figure 4; Appendix A). Results of the calculated geometric means at this location are presented in Table 2. In total, 217 discrete fecal coliform samples were collected at this location, which allowed for the calculation of 47 unique fecal coliform geometric mean calculations (Table 2; Appendix A). At this station, the calculated fecal coliform geometric mean concentration has exceeded the water quality standard 18 times (Table 2) over the 18 year monitoring period. All water quality exceedances at this station occurred during the summer months (i.e., May to October).

Additional fecal coliform monitoring was conducted along the Coosawattee River at Newport Drive by the GA EPD in 2011 (Figure 4; Appendix A). For that sampling period, 17 individual samples were collected for fecal coliform analysis (Appendix A). Due to sampling frequency the calculation of the fecal coliform geometric mean could only be calculated for one round of sampling from July 21 through August 9, 2011 (Table 2). No water quality exceedances for fecal coliform were calculated for the 2011 sampling; however, individual samples exceeded the GA water quality standard (Appendix A).

Finally, GA EPD conducted fecal coliform monitoring on Tails Creek at US Hwy 76 (Figure 4). In total, 16 discrete fecal coliform samples were collected, which allowed for the calculation of four unique fecal coliform geometric mean calculations (Table 2). Samples collected from August 29 through September 19, 2001 exceeded the water quality standard of 200 MPN/100 mL, while the March, May, and October geometric mean concentrations were below the standard (Table 2). Additionally, the Sept. 19 concentration exceeded the single event maximum concentration of 1,000 MPN/100mL (Appendix A).

Table 2. Calculated geometric mean concentrations from historic fecal coliform water quality monitoring data acquired from the Georgia EPD Online Water Quality Database.

Stream	EPD Station ID	Location	Sampling Date Range	Fecal Coliform Geometric Mean[1] MPN/100 mL	Water Quality Exceedance[2]
Coosawattee River	RV_14_4520	At Hwy 5	Feb to March 2001	520	No
			May to June 2001	773	Yes
			Aug to Sept 2001	668	Yes
			Oct 2001	271	Yes
			Jan to Feb 2002	401	No
			April 2002	344	No
			July to Aug 2002	951	Yes
			Nov to Dec 2002	172	No
			Jan to Feb 2003	119	No
			May to June 2003	942	Yes
			July to Aug 2003	705	Yes
			Nov to Dec 2003	204	No
			Feb 2004	258	No
			March 2004	52	No
			July to Aug 2004	429	Yes
			Sept to Oct 2004	240	Yes
			April 2005	51	No
			May to June 2005	332	Yes
			Feb to March 2006	53	No
			Aug to Sept 2006	95	No
			Nov to Dec 2006	118	No
			Feb 2009	41	No
			Mar to April 2007	28	No
			June to July 2007	249	Yes
			Aug to Sept 2007	199	No
			Jan to Feb 2008	61	No
			Mar to April 2008	60	No
			July to Aug 2008	105	No
			Sept to Oct 2008	86	No
			Feb to Mar 2009	110	No
			May to June 2009	396	Yes
			Aug to Sept 2009	260	Yes
			Nov to Dec 2009	168	No
			Feb to Mar 2010	38	No
			June to July 2010	609	Yes
			Aug to Sept 2010	360	Yes
			Nov to Dec 2010	74	No

[1]Geometric mean = calculated based on four samples collected over a 30-day period at intervals not less than 24 hours
[2]Water quality standard is a geometric mean of 200 MPN/100 mL from May to October and 1,000 MPN/100 mL from November to April

Table 2. Calculated geometric mean concentrations from historic fecal coliform water quality monitoring data acquired from the Georgia EPD Online Water Quality Database (continued).

Stream	EPD Station ID	Location	Sampling Date Range	Fecal Coliform Geometric Mean[1] MPN/100 mL	Water Quality Exceedance[2]
Coosawattee River	RV_14_4520	At Hwy 5	Feb to Mar 2011	152	No
			June to July 2011	1,583	Yes
			Aug to Sept 2011	910	Yes
			Nov to Dec 2011	599	No
			Feb to Mar 2012	124	No
			June to July 2012	605	Yes
			Aug to Sept 2012	185	No
			Nov to Dec 2012	48	No
			Feb to Mar 2013	34	No
			July to Aug 2013	496	Yes
			Oct 2013	130	No
			Nov 2013	109	No
Coosawattee River	RV_14_4522	At Newport Drive	July to Aug 2011	61	No
Tails Creek	RV_14_4877	At US Hwy 76	Feb to Mar 2001	82	No
			May to June 2001	82	No
			Aug to Sept 2001	348	Yes
			Oct 2001	118	No

[1]Geometric mean = calculated based on four samples collected over a 30-day period at intervals not less than 24 hours

[2]Water quality standard is a geometric mean of 200 MPN/100 mL from May to October and 1,000 MPN/100 mL from November to April

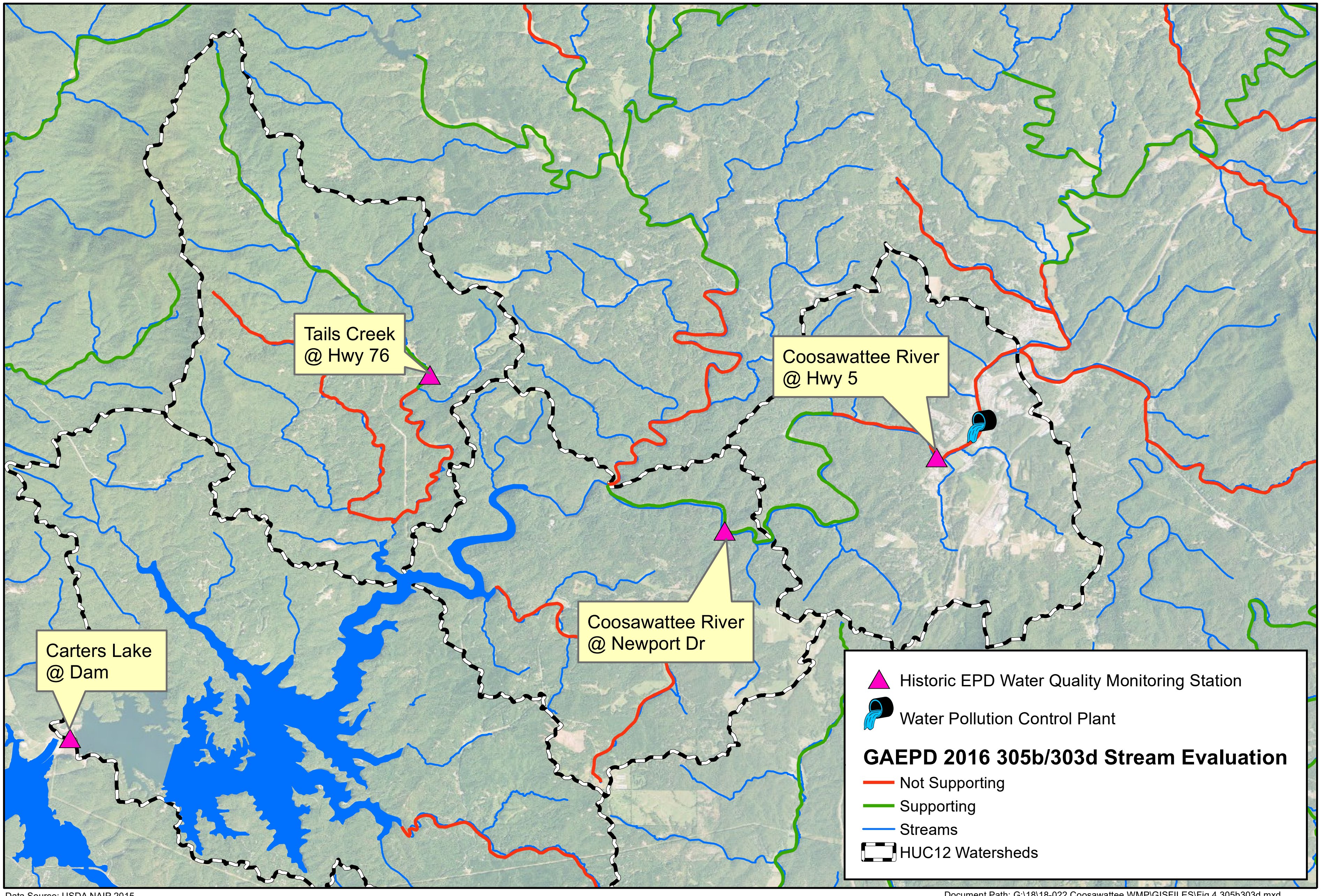

Figure 4. Location of the GA EPD historic fecal coliform water quality monitoring stations located within the project area.

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Results of the Watershed Reconnaissance

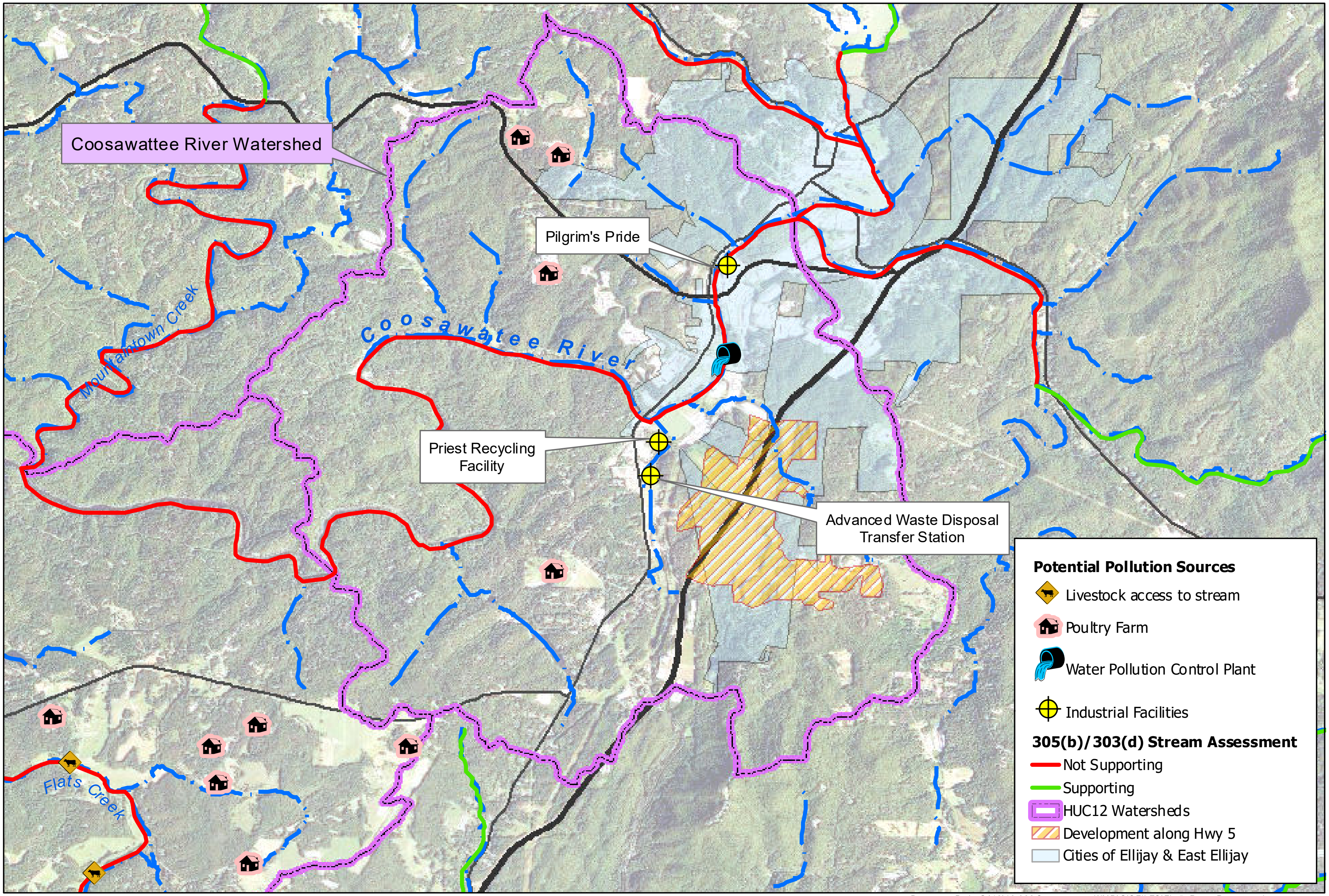
Potential sources of fecal coliform pollution within the Coosawattee River project area are summarized in Table 3 and the location of each are presented on Figure 5.

Table 3. Location of potential sources of fecal coliform pollution that were identified during the watershed reconnaissance of the project area on May 1, 2018.

Location (DD)		**Watershed**	**Land Use**	**Details**
34.684941	-84.491666	Coosawattee	Industrial	Pilgrim's Pride
34.667852	-84.498263		Industrial	Priest Recycling Facility
34.664338	-84.499282		Industrial	Advanced Waste Disposal Transfer Station
34.653998	-84.509424		Agricultural	Poultry Farm
34.685200	-84.509989			
34.697762	-84.508702			
34.699529	-84.512994			
34.696380	-84.482156		Urban	Cities of Ellijay and East Ellijay
34.656912	-84.492892		Commercial	Development along Hwy 5
34.655601	-84.542185	Coosawattee and Flat Creek	Residential	Coosawattee River Resort
34.623281	-84.541403	Flat Creek	Agricultural	Poultry Farm
34.635569	-84.524666			
34.637759	-84.540631			
34.631685	-84.544665			
34.635569	-84.545438			
34.638677	-84.562089			
34.633792	-84.560299			Livestock access to stream
34.622285	-84.557725			
34.697198	-84.585199	Tails Creek	Agricultural	Poultry Farm
34.698397	-84.592408			

In addition to the sources identified in the Table above, other potential nonpoint sources of fecal coliform pollution observed within the project area includes:

1. Stormwater runoff from urban and residential areas;
2. Failing septic systems;
3. Illicit discharges;
4. Runoff from pastureland and other agricultural operations;
5. Removal of riparian or stream buffer vegetation (See Plates section for examples observed during the reconnaissance);
6. Leaking sewer pipes; and,
7. Livestock access to streams.



Data Source: USDA NAIP 2015

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Figure 5. Location of potential sources of fecal coliform pollution that were identified during the watershed reconnaissance of the Coosawatte River Watershed.

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Development of the Watershed Management Plan

To aid in the development of the WMP, information collected during this watershed characterization will be utilized along with data from the fecal coliform baseline monitoring conducted in June, September, and December 2018. This information, along with input from the advisory committee and public input from the watershed stakeholders group will be used to further identify sources of fecal coliform pollution, establish baseline conditions prior to the development of the WMP, and to prioritize areas for implementation of Best Management Practices.

PLATES

Plate 1. View upstream at the Cartecay River at 1st Avenue

Plate 2. View downstream at the Cartecay River at 1st Avenue

Plate 3. View upstream at the Coosawattee River at Veterans Memorial Park

Plate 4. View downstream at the Coosawattee River at Veterans Memorial Park

Plate 5. View upstream at the Coosawattee River at Ogden Drive

Plate 6. View downstream at the Coosawattee River at Ogden Drive

Plate 7. View upstream at the Coosawattee River at Orchid Lane

Plate 8. View downstream at the Coosawattee River at Orchid Lane

Plate 9. View upstream at an unnamed tributary to the Coosawattee River at Legion Road

Plate 10. View downstream at an unnamed tributary to the Coosawattee River at Legion Road

Plate 11. View upstream at an unnamed tributary to the Coosawattee River at Newport Drive and Darien Way

Plate 12. View downstream at an unnamed tributary to the Coosawattee River at Newport Drive and Darien Way

Plate 13. View upstream at the Ellijay River at Hwy 52 (River Street)

Plate 14. View downstream at the Ellijay River at Hwy 52 (River Street)

Plate 15. View upstream at Flat Creek at Cajun Drive

Plate 16. View downstream at Flat Creek at Cajun Drive Road

Plate 17. View upstream at Flat Creek at Sunlight Road

Plate 18. View downstream at Flat Creek at Sunlight Road

Plate 19. View upstream at Flat Creek at Knight Road

Plate 20. View downstream at Flat Creek at Knight Road

Plate 21. View upstream at Flat Creek at Nexus Road

Plate 22. View downstream at Flat Creek at Nexus Road

Plate 23. View upstream at unnamed tributary to Flat Creek at Eagle Mountain Drive

Plate 24. View downstream at an unnamed tributary to Flat Creek at Eagle Mountain Drive

Plate 25. View upstream at Tails Creek at Tails Creek Road (Hwy 76)

Plate 26. View downstream at Tails Creek at Tails Creek Road (Hwy 76)

Plate 27. View upstream at Fir Creek at Lower Tails Creek Road

Plate 28. View downstream at Fir Creek at Lower Tails Creek Road

Plate 29. View upstream at an unnamed tributary to the Coosawattee River at Progress Road

Plate 30. View downstream at an unnamed tributary to the Coosawattee River at Progress Road

Plate 31. View upstream at an unnamed tributary to the Coosawattee River at Veterans Memorial Park soccer fields

Plate 32. View downstream at an unnamed tributary to the Coosawattee River at Veterans Memorial Park soccer fields

Plate 33. View of unnamed tributary to the Coosawattee River Hwy 76

Plate 34. View upstream of an unnamed tributary to the Coosawattee River at Hwy 76

Plate 35. View downstream of an unnamed tributary to the Coosawattee River at Hwy 76

Appendix A .

Historic Water Quality Data

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Carters Lake	LK_14_4527	At Carters Lake Dam	34.61652	-84.666664	6/6/84	20
					6/6/85	20
					6/11/86	20
					6/24/87	20
					5/26/88	20
					6/12/89	20
					7/9/90	20
					6/4/91	20
					5/4/93	20
					5/27/93	20
					10/18/05	20
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	2/6/95	125
					1/18/96	230
					3/5/96	110
					4/2/96	170
					5/7/96	6350
					6/4/96	330
					6/25/96	3300
					8/6/96	2200
					9/3/96	330
					10/8/96	7000
					11/5/96	790
					12/3/96	2300
					2/27/01	310
					3/5/01	210
					3/14/01	230
					3/20/01	4900
					5/15/01	1700
					5/22/01	490
					5/29/01	3300
					6/12/01	130
					8/28/01	130
					9/5/01	2400
					9/10/01	1300
					9/18/01	490
					10/2/01	170
					10/4/01	110
					10/9/01	170
					10/15/01	1700
					1/7/02	1700
					1/14/02	330
					1/28/02	330
					2/4/02	140
					4/1/02	1300
					4/8/02	130
					4/15/02	170

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	4/29/02	490
					7/8/02	110
					7/15/02	490
					7/22/02	3300
					8/5/02	4600
					11/4/02	170
					11/12/02	940
					11/18/02	170
					12/2/02	20
					1/7/03	80
					1/14/03	70
					1/28/03	110
					2/6/03	330
					5/28/03	130
					6/3/03	700
					6/10/03	9200
					6/17/03	2300
					7/22/03	1100
					7/29/03	490
					8/5/03	1700
					8/12/03	270
					11/18/03	330
					12/2/03	170
					12/9/03	220
					12/15/03	140
					2/3/04	790
					2/12/04	110
					2/16/04	300
					2/23/04	170
					3/10/04	230
					3/18/04	20
					3/22/04	80
					4/8/04	20
					7/8/04	1600
					7/13/04	800
					7/20/04	500
					8/4/04	53
					9/14/04	1400
					9/20/04	800
					9/27/04	110
					10/4/04	27
					4/5/05	40
					4/12/05	140
					4/18/05	60
					4/28/05	20

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	5/10/05	130
					5/24/05	80
					5/31/05	130
					6/9/05	9000
					8/15/05	170
					2/22/06	40
					2/27/06	20
					3/6/06	20
					3/14/06	500
					5/8/06	800
					5/15/06	300
					5/22/06	5000
					6/5/06	80
					6/26/06	9000
					8/21/06	170
					8/28/06	140
					9/11/06	170
					9/18/06	20
					11/6/06	40
					11/15/06	3000
					11/27/06	20
					12/4/06	80
					2/7/07	40
					2/14/07	40
					2/21/07	90
					2/22/07	20
					3/15/07	20
					3/21/07	40
					3/28/07	20
					4/12/07	40
					6/21/07	700
					6/26/07	80
					7/12/07	300
					7/19/07	230
					8/14/07	40
					8/20/07	230
					8/28/07	130
					9/12/07	1300
					1/23/08	20
					1/31/08	70
					2/6/08	90
					2/20/08	110
					3/4/08	800
					3/10/08	20
					3/25/08	20

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	4/2/08	40
					7/15/08	1400
					7/22/08	110
					8/6/08	20
					8/12/08	40
					9/16/08	20
					9/24/08	80
					10/8/08	1700
					10/15/08	20
					2/18/09	3000
					3/4/09	40
					3/10/09	20
					3/19/09	60
					5/6/09	24000
					5/13/09	300
					5/20/09	170
					6/3/09	20
					8/5/09	170
					8/20/09	300
					8/27/09	300
					9/2/09	300
					11/23/09	220
					12/8/09	40
					12/10/09	300
					12/15/09	300
					2/18/10	20
					3/4/10	20
					3/9/10	30
					3/16/10	180
					6/24/10	500
					7/8/10	40
					7/15/10	230
					7/22/10	30000
					8/11/10	170
					8/19/10	3000
					8/25/10	500
					9/2/10	140
					9/8/10	170
					11/8/10	20
					11/17/10	170
					11/30/10	220
					12/7/10	40
					2/9/11	20
					2/17/11	300
					2/28/11	300

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	3/2/11	300
					6/23/11	13000
					7/7/11	3000
					7/14/11	230
					7/21/11	700
					8/10/11	300
					8/18/11	130
					9/1/11	8000
					9/7/11	2200
					11/9/11	20
					11/17/11	900
					11/29/11	1100
					12/6/11	6500
					2/8/12	20
					2/16/12	300
					2/27/12	80
					3/6/12	500
					6/21/12	300
					7/5/12	70
					7/12/12	8000
					7/19/12	800
					8/8/12	110
					8/16/12	230
					8/30/12	220
					9/5/12	210
					11/13/12	20
					11/27/12	40
					12/4/12	30
					12/12/12	230
					2/14/13	40
					2/28/13	40
					3/7/13	20
					3/14/13	40
					7/17/13	110
					7/23/13	800
					7/30/13	300
					8/13/13	2300
					9/19/13	300
					9/25/13	22000
					10/22/13	700
					10/24/13	60
					10/28/13	170
					10/30/13	40
					11/13/13	20
					11/19/13	180

Stream	EPD Station ID	Location	Latitude	Longitude	Date	Fecal Coliform MPN/100 mL
Coosawattee River	RV_14_4520	At GA Hwy 5	34.6717	-84.50016	12/3/13	230
					12/11/13	170
Coosawattee River	RV_14_4522	At Newport Drive	34.65554	-84.54224	2/9/11	80
					02/21/11	230
					02/28/11	300
					03/14/11	85
					03/16/11	800
					04/26/11	1300
					05/05/11	20
					05/19/11	20
					05/24/11	230
					07/28/11	80
					08/02/11	40
					08/09/11	110
					08/22/11	40
					10/24/11	20
					11/14/11	500
					11/17/11	750
					11/21/11	20
Tails Creek	RV_14_4877	at US Hwy 76	34.68618	-84.60025	2/27/01	20
					3/5/01	50
					3/14/01	20
					3/20/01	2,300
					5/15/01	130
					5/22/01	490
					5/30/01	80
					6/12/01	90
					8/29/01	40
					9/6/01	570
					9/10/01	460
					9/19/01	1,400
					10/2/01	81
					10/3/01	110
					10/9/01	170
					10/15/01	130

APPENDIX B. TARGETED MONITORING PLAN

QUALITY ASSURANCE AND QUALITY CONTROL
TARGETED MONITORING PLAN
FOR FECAL COLIFORM MONITORING IN THE COOSAWATTEE – CARTERS LAKE WATERSHED MANAGEMENT PLAN PROJECT AREA

Prepared for:

Georgia Soil and Water
Conservation Commission &
Georgia Environmental Protection Division

Prepared by:

Nutter & Associates, Inc.
Athens, Georgia
NutterInc.com

May 2018

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1.0 INTRODUCTION

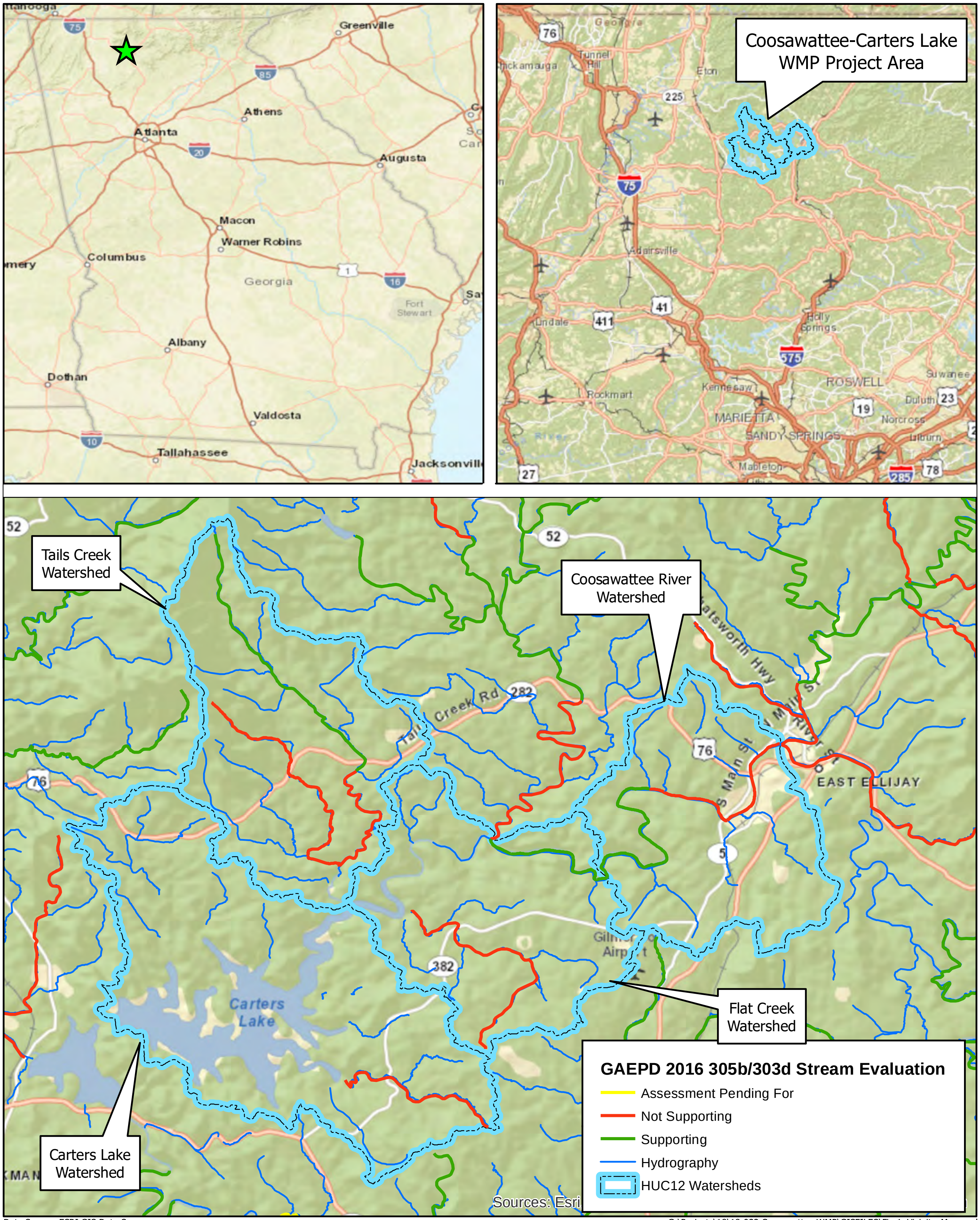
1.1 Watershed Description

The Coosawattee River – Carters Lake Watershed area is in the Coosa River basin in northwestern Georgia approximately 75 miles north of Atlanta, Georgia within Gilmer, Dawson, Fannin, and Murray Counties (Figure 1). The project area includes the northern portions of the Coosa River watershed upstream of the Carters Lake Reservoir and is located almost entirely in Gilmer County with smaller portions reaching into Murray County. The project area encompasses approximately 46,037 acres and is comprised of four smaller HUC12 watersheds: Carters Lake, Tails Creek, Coosawattee River, and Flat Creek. In 2011, existing land cover in the watershed was predominately forested. Specifically, forested land made up approximately 78% of the Coosawattee – Carters Lake Watershed Management Plan (WMP) project area while agricultural accounted for approximately 2% of the land use in the watershed. The remainder of the WMP project area is comprised of wetlands and open water (7%) and urban land and residential (11%) land uses. Land cover data for the Coosawattee – Carters Lake Watershed Management Plan Area is presented in Figure 2.

The Coosawattee – Carters Lake Watershed Management Plan Area is located within the Coosawattee sub-basin (HUC 03150102) of the larger Coosa-Tallapoosa basin (Figure 3). A majority of the watershed area is located within the Southern Metasedimentary Mountains (66g) Level IV Ecoregion of the larger Blue Ridge (66) Level III Ecoregion (Griffith et al., 2001). The Southern Metasedimentary Mountains formed on mostly late Pre-Cambrian and include slate, conglomerate, phyllite, metagraywacke, metasiltstone, metasandstone, and quartzite, with some schist and gneiss. The ecoregion is most floristically diverse ecoregions, and includes Appalachian oak forests, northern hardwoods and parts of the region have more open low hills, there are some isolated masses of rugged mountains (Griffith et al., 2001).

1.2 Water Quality Standards

Within the Coosawattee – Carters Lake WMP project area, three stream reaches are listed on the 2016 GA EPD 305(d)/303(b) integrated report for not supporting the designated use for fishing due to elevated fecal coliform concentrations potentially caused by nonpoint source (NPS) pollution. In accordance with the State of Georgia Water Use Classifications and Water Quality Standards (GA Code 391-3-6-03), for the designated use for fishing, fecal coliform concentrations shall not exceed a geometric mean of 200 CFU/100 mL for the months of May through October and 1,000 CFU/100 mL for the months of November through April. This calculated geometric mean is based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Further, for the months of November through April, fecal coliform concentrations shall not exceed a maximum concentration of 4,000 CFU/100 mL for any sample.



Data Source: ESRI GIS Data Server

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Figure 1. Coosawattee – Carters Lake Watershed Management Plan Project Area assessment segment vicinity, Gilmer and Murray Counties, Georgia.

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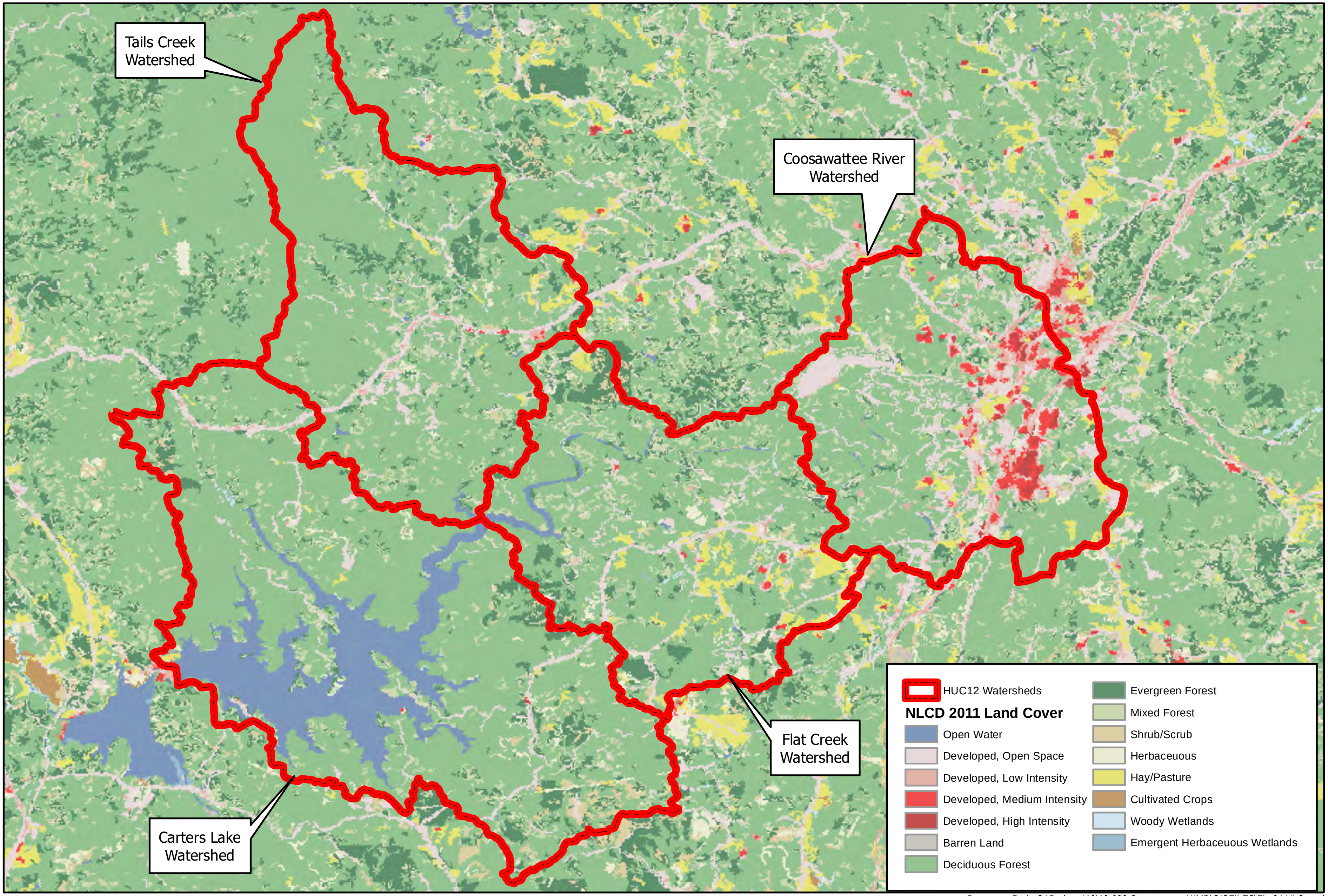

Data Source: NLCD, 2011

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Figure 2. 2011 National Landcover Database land use classification for the Coosawattee – Carters Lake Watershed Management Plan Project Area.

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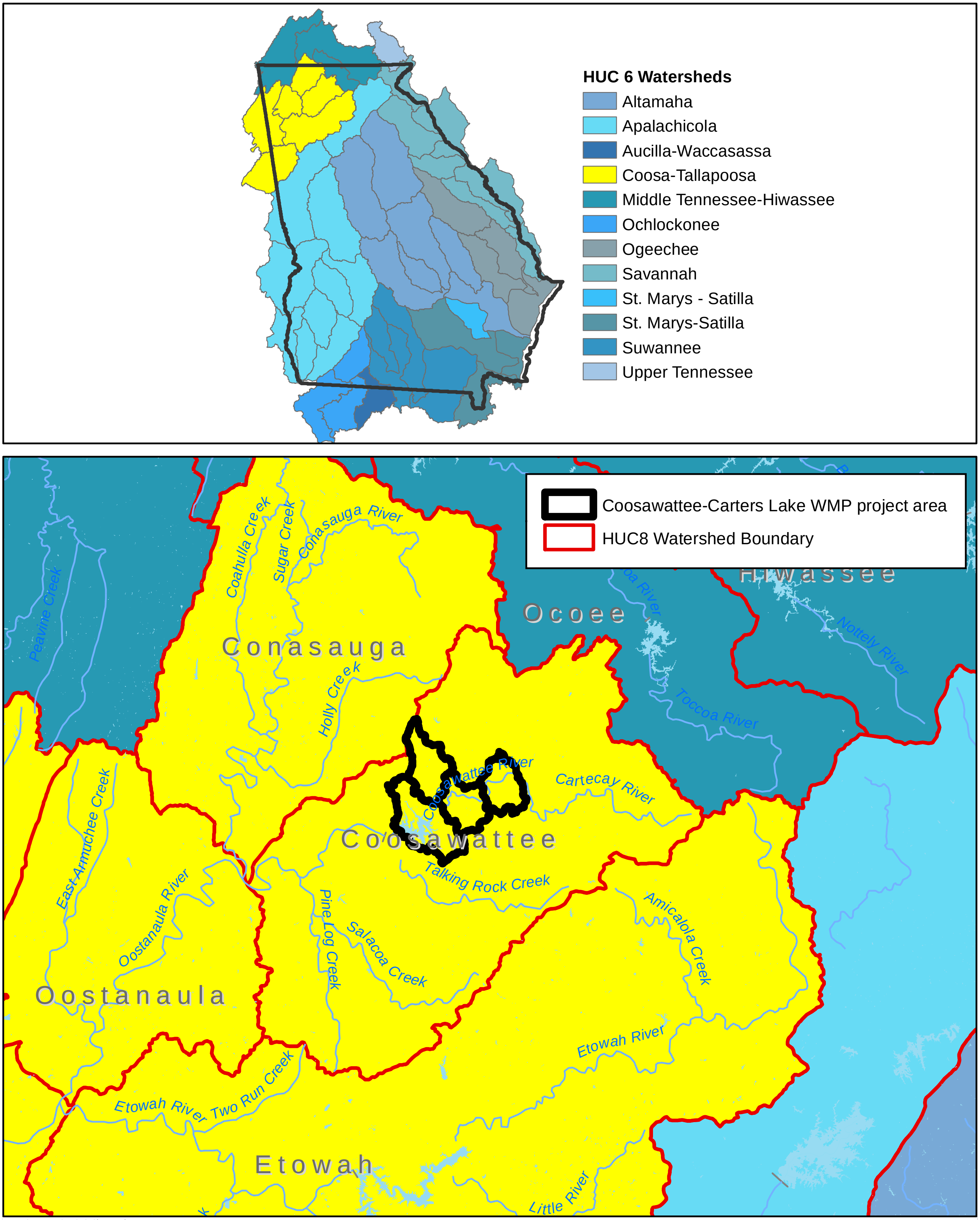

Data Source: GA GIS Clearinghouse

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Figure 3. Location of the Coosawattee – Carters Lake HUC12 Watershed Management Plan Project Area within the larger Coosa-Tallapoosa River Basin.

0 4 8 16 Miles

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1.3 Water Quality Impairments

The table below summarizes the three stream reaches located within the WMP project area that are listed for not meeting their designated use for fishing due to fecal coliform water quality exceedances. The location of the listed streams is presented on Figure 4.

Stream Name & Segment Length	Watershed	TMDL Status
Tails Creek – Hwy 82 to Carters Lake		Fecal Coliform 2006
Three-mile segment	Tails Creek	
Flat Creek – SR 382 to Coosawattee River		
One-mile segment	Flat Creek	
Coosawattee River		
Three-mile segment	Coosawattee River	

Two other stream segments located within the project area are also included on the integrated report for not supporting their designated use for fishing due to impacted fish community potentially caused by NPS pollution. An approximate five-mile segment of Fir Creek from the headwaters to the confluence with Tails Creek (Tails Creek watershed) and a three-mile segment of Harris Creek upstream of Carter Lake (Carters Lake Watershed) are listed for impacted fish communities (Figure 4). Conversely, a six-mile segment of the Coosawattee River from approximately 250 feet downstream of the intersection of Newport Drive and Legion Road to the confluence of Mountaintown Creek is listed as supporting the designated use for fishing (Figure 4).

A Total Maximum Daily Load (TMDL) Evaluation for 58 Stream Segments in the Coosa River Basin for Fecal Coliform was completed in 2004 by the Georgia Department of Natural Resources (DNR) and submitted to the U.S. Environmental Protection Agency (US EPA) to assess in-stream water quality conditions in accordance with GA Code 391-3-6-03 Water Use Classifications and Water Quality Standards. In 2006, the DNR published a Tier 2 TMDL Implementation Plan for the segment of the Coosawattee River that flows through Gilmer and the cities of Ellijay and East Ellijay. According to the TMDL, streams were classified as partially supporting their designated use if more than 10% of the samples exceeded the water quality standard for fecal coliform and not supporting if more than 25% of the samples collected exceeded that water quality standard. Tails Creek, Flat Creek, and the Coosawattee River were listed as not supporting because more than 25% of the samples exceeded the fecal coliform water quality standard (GA DNR, 2004). The TMDL also determined the need for a 43% reduction in fecal coliform loading for Tails Creek, a 57% reduction for Flat Creek, and a 74% reduction for the Coosawattee River to meet the Water Use Classifications and Water Quality Standards for fecal coliform (GA DNR, 2004).

The TMDL identifies one Water Pollution Control Plant (WPCP) that discharges to the Coosawattee River, which is the City of Ellijay WPCP. According to the TMDL and US EPA Envirofacts search, no violations for fecal coliform have been reported for the facility; however, violations were reported for ammonia and total phosphorus in 2015, ammonia in 2016, and dissolved oxygen in 2017 and 2018. No other WPCP facilities are located in the project area. Recommended management practices in the TMDL to reduce fecal coliform loading included compliance with NPDES permit limits and requirements, adoption of USDA NRCS conservation practices, and application of best management practices (BMPs) for agricultural and urban

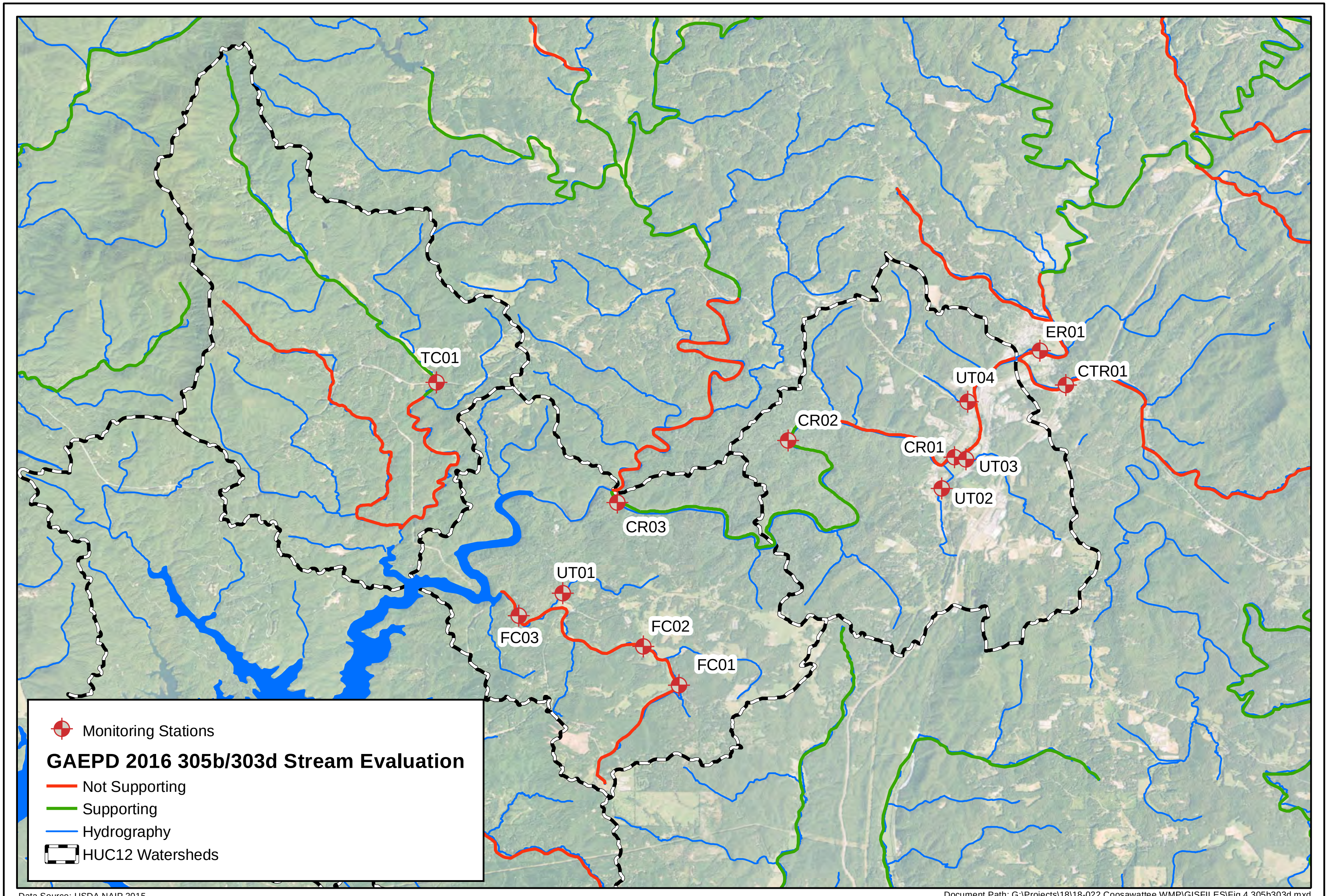

Figure 4. Location of the 2016 GA EPD 305(b)/303(d) listed stream segments, Coosawattee – Carters Lake Watershed Management Plan Project Area.

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land uses. The TMDL identified both point source and NPS approaches for addressing and reducing fecal coliform loading in the Coosa River watershed. The point source approach required all discharges from point source facilities comply with their NPDES permit at all times with fecal coliform limits of 200 CFU/100 mL or less. Specific NPS approaches include working with local governments, USDA NRCS, GA Forestry Commission, and GSWCC to implement BMPs to address NPS pollution. Further, the TMDL recommended a public outreach and education effort to help identify and implement BMPs within the watershed that address NPS pollution.

The 2006 TMDL Implementation Plan identified malfunctioning septic systems, agricultural runoff, wild animal waste, poultry operations, urban stormwater runoff, storm sewer system discharges, and sewerage system leaks and spills as potential sources of fecal coliform pollution within the Coosawattee River watershed (GA DNR, 2006). The Implementation Plan recommended a series of management practices to reduce fecal coliform loading in the watershed and included:

- Enforcement of GA Water Quality Control Act and rules and regulations for on-site wastewater systems;
- Septic system repair assistance program;
- Agricultural BMP installation assistance program;
- Implementation of an Environmental Quality Incentives Program (EQIP) and Conservation Reserves Program;
- Major river corridor protection regulations by Gilmer County;
- Enforcement or establishment of rules and regulations for water quality and NPDES discharges for new concentrated animal feed operations (CAFOs); and,
- Implementation of city and county sanitary sewer maintenance program and stormwater management program for Ellijay and East Ellijay.

1.4 Reason for Monitoring

The objective of the project is to develop and a nine-key element WMP for the Coosawattee – Carters Lake WMP project area that addresses fecal coliform pollution. The nine key elements for watershed planning include:

1. Identification of causes and sources of pollution that need to be controlled;
2. Determine load reductions needed for each pollutant;
3. Develop NPS management measures that will be implemented to achieve reduction goals and critical areas where measures will be needed;
4. Develop information/education component that identifies education and/or outreach activities for plan implementation;

5. Identify technical and financial assistance needed to implement the plan;
6. Schedule for implementing NPS management measures;
7. Develop interim milestones to track implementation of management measures;
8. Develop criteria to measure progress towards meeting to goals of the WMP; and,
9. Develop a monitoring component to evaluate effectiveness of management measures or best management practices (BMPs) over time.

To aid in the development of the WMP, a watershed characterization will be conducted that will include a visual assessment of the watershed, verification of current land use and conditions within the watershed, and identification of "hot spots" or potential sources of fecal coliform pollution. Further, fecal coliform water quality monitoring will be conducted within the watershed to further identify sources of fecal coliform pollution, establish baseline conditions prior to the development of the WMP, and to prioritize areas for implementation of BMPs.

2.0 POLLUTANTS TO BE MONITORED

All monitoring shall be conducted in accordance with the most recent versions of GA EPD Standard Operating Procedures and GA Adopt-A-Stream (AAS) manuals. In accordance with Georgia Water Quality Standards, bacteriological density data for fecal coliform bacteria will be collected as a geometric mean based on at least four samples collected within a 30-day period at intervals not less than 24 hours apart. For the baseline assessment, a minimum of three geometric means will be conducted in accordance with the proposed schedule in Table 1. The three geometric mean samples will be conducted at least one month apart with targeted collections in June, September, and December 2018. Fecal coliform samples will be collected on a regular schedule on the same day of the week over a four week period (i.e., every Monday for four weeks) regardless of weather. *In-situ* water quality measurements, including air and water temperature (°C), dissolved oxygen (percent saturation and mg/L), pH (standard units), specific conductivity (µS/cm), and salinity (PSU) will be conducted in conjunction with each bacteriological grab sample event.

Table 1. Sampling schedule for the Coosawattee-Carters Lake Management Plan project area fecal coliform baseline analysis.

	2018		
	June	Sept	Dec
Fecal Coliform Baseline Assessment			
In-Situ Water Quality Analysis	✓	✓	✓
Fecal Coliform Geometric Mean (4 individual events for three geomeans)	✓	✓	✓

3.0 MONITORING LOCATIONS

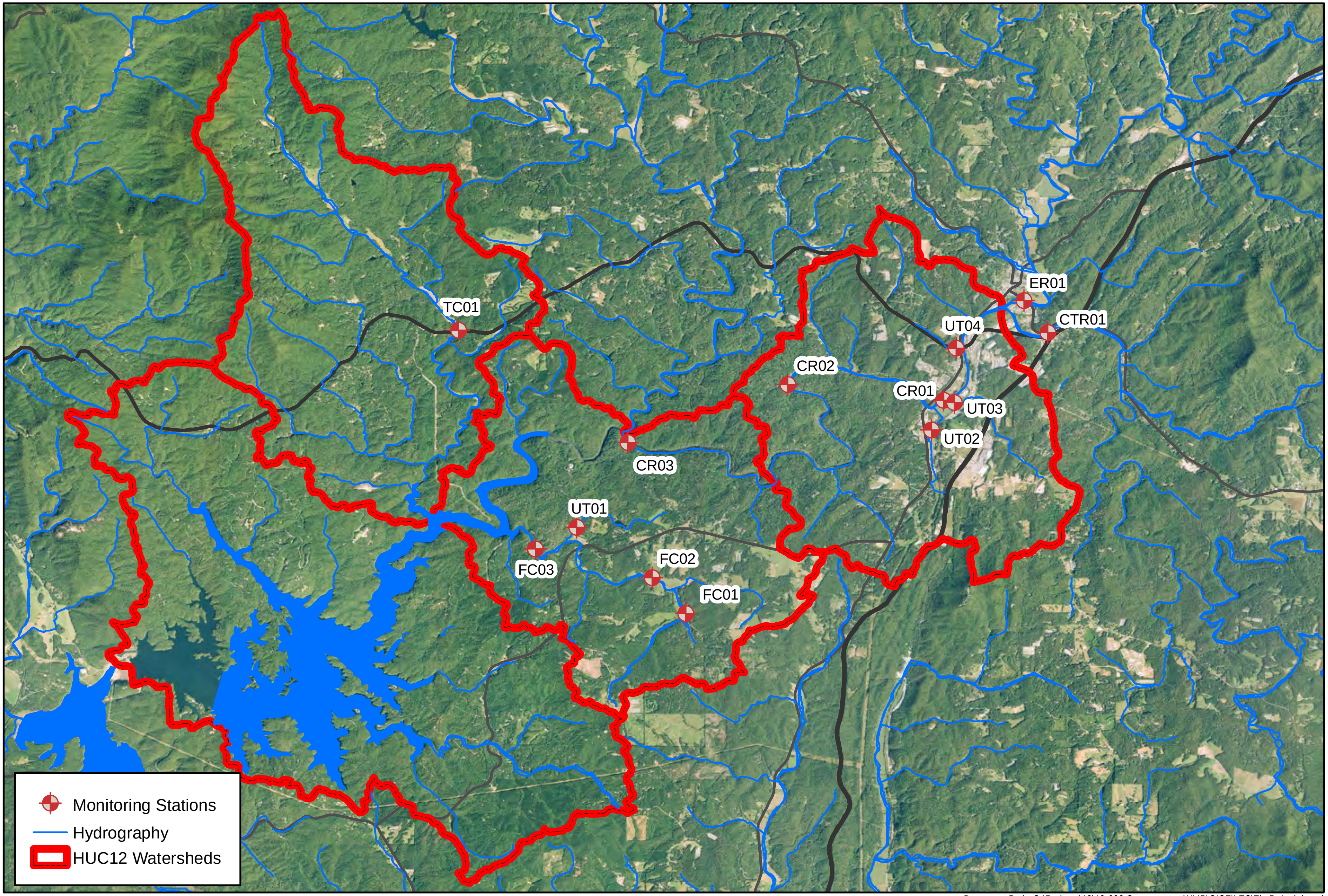
3.1 Monitoring Stations

Following a GIS-based desktop analysis and field watershed reconnaissance, 13 fecal coliform monitoring stations will be established within the Coosawattee - Carters Lake watershed project area for the initial fecal coliform characterization WMP component. Suitability of monitoring stations for fecal coliform analysis was based on surrounding land use, potential pollution sources, and site accessibility. The proposed water quality monitoring stations are identified in Figures 5 and 6 Water quality parameters to be collected at these monitoring stations include *in-situ* parameters and grab samples for fecal coliform analysis, as detailed in proceeding sections of this sampling plan. GPS coordinates and a brief description of each station are provided below.

Station Name	Location (DD)		Station ID
	Latitude	Longitude	
Cartecay River at 1st Ave	34.68588	-84.4742	CTR01
Coosawattee River at Veterans Memorial Park	34.67144	-84.4966	CR01
Coosawattee River at Ogden Drive	34.67473	-84.5299	CR02
Coosawattee River at Orchid Lane	34.66236	-84.5641	CR03
Ellijay River at Hwy 52/River Street	34.69277	-84.4794	ER01
Flat Creek at Sunlight Road	34.6257	-84.5518	FC01
Flat Creek at Knight Road	34.6334	-84.5589	FC02
Flat Creek at Nexus Drive	34.63959	-84.5839	FC03
Tails Creek at Tails Creek Road	34.68641	-84.6004	TC01
Unnamed tributary to Flat Creek at Eagle Mountain Drive	34.64417	-84.5751	UT01
Unnamed tributary to Coosawattee River at Progress Road	34.66511	-84.4991	UT02
Unnamed tributary to Coosawattee River at Veterans Memorial Park	34.67095	-84.4943	UT03
Unnamed tributary to Coosawattee River at Hwy 76	34.68256	-84.4939	UT04

Cartecay River at 1st Ave (CTR01)

Station CTR01 is located on the Cartecay River at 1st Avenue (Figures 5 and 6). Land use surrounding the station includes low to medium intensity urban and commercial areas. Grab samples at this station should be collected downstream of the 1st Avenue bridge. This station is located just upstream of the WMP project area, the City of Ellijay Water Pollution Control Plant (WPCP), and the three-mile segment of the Coosawattee River that is listed on the 2016 GA EPD 305(b)/303(d) integrated report for fecal coliform.



Data Source: USDA NAIP 2015

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Figure 5. Baseline fecal coliform monitoring stations (topographic), Coosawattee – Carters Lake Watershed Management Plan Project Area.

0 1 2 4 Miles

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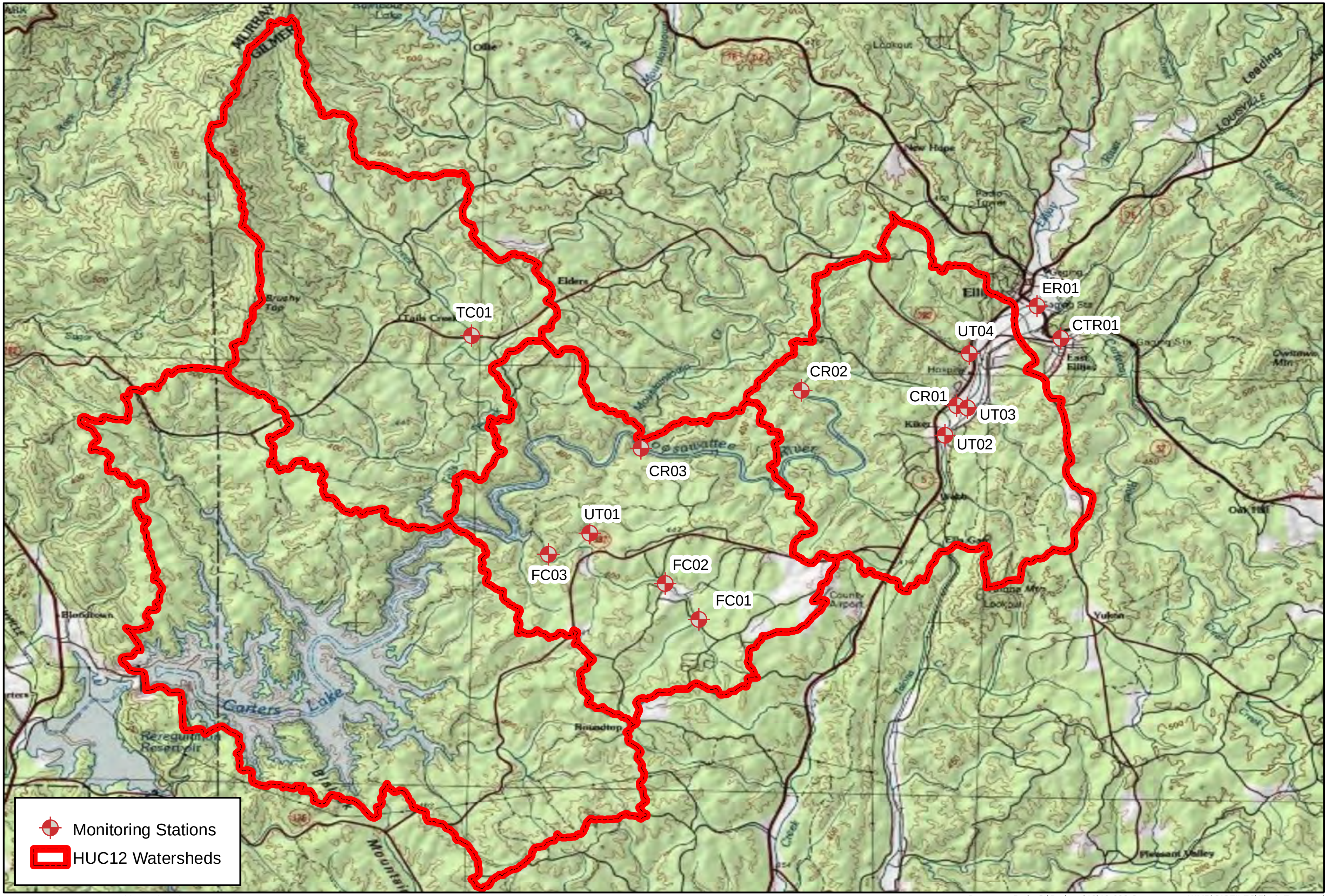

Data Source: USGS topographic quadrangle

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Figure 6. Baseline fecal coliform monitoring stations and 2015 aerial imagery, Coosawattee – Carters Lake Watershed Management Plan Project Area.

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Coosawattee River at Ogden Drive Swinging Bridge (CR02)

Station CR02 is also located within the Coosawattee River Resort at the Riverside Pool and Park along Ogden Drive (Figures 5 and 6). This station should be sampled upstream from a swinging bridge that crosses the Coosawattee River. Land use immediately surrounding this station is dominated by forested and residential land cover. This station is located at the upstream extent of the six-mile portion of the Coosawattee River that is listed as supporting the designated use for fishing.

Coosawattee River at Orchid Lane (CR03)

This station is located within the Coosawattee River Resort just west of the intersection of Lyric Land and Orchid Court (Figures 5 and 6). Land use surrounding this station is dominated by forested and residential land cover. This station is located at the downstream extent of the six-mile portion of the Coosawattee River that is listed as supporting the designated use for fishing. Further, this station was selected because it is located just downstream of the monitoring station that was sampled in 2011 by the GA EPD as part of the historic water quality monitoring. The fecal coliform data collected at this site can be used in establishing baseline conditions and identifying changes that have occurred to the watershed since the historic monitoring was conducted.

Ellijay River at Hwy 52/River Street (ER01)

Station ER01 is located on the Ellijay River along River Street (Figures 5 and 6). Grab samples at this station should be collected downstream of the River Street bridge. This station is located just upstream of the WMP project area, the City of Ellijay Water Pollution Control Plant (WPCP), and the three-mile segment of the Coosawattee River that is listed on the 2016 GA EPD 305(b)/303(d) integrated report for fecal coliform. This station was selected because it was sampled in 2004 by the GA EPD as part of the watershed's TMDL development. The fecal coliform data collected at this site can be used in establishing baseline conditions and identifying changes that have occurred to the watershed since the TMDL was developed.

Flat Creek at Sunlight Road (FC01)

This station is located downstream of the Sunlight Road bridge crossing (Figures 5 and 6) and within a one-mile segment of the stream that is listed on the 2016 GA EPD 305(b)/303(d) integrated report for fecal coliform. A mixture or forested and agricultural land use surround this monitoring station.

Flat Creek at Knight Road (FC02)

Station FC02 is located along Knight Road and within a one-mile segment of the stream that is listed on the 2016 GA EPD 305(b)/303(d) integrated report for fecal coliform. Land use immediately surrounding this station is mostly agricultural areas. Grab samples at this station should be sampled upstream of the Knight Road bridge (Figures 5 and 6).

Flat Creek at Nexus Drive (FC03)

FC03 is located upstream of Nexus Road (Figures 5 and 6) and within a one-mile segment of the stream that is listed on the 2016 GA EPD 305(b)/303(d) integrated report for fecal coliform. Samples at this location should be collected upstream of the road crossing.

Tails Creek at Tails Creek Road (TC01)

Station TC01 is located within the Tails Creek watershed and is located just downstream of Tails Creek Road/US Hwy 76 (Figures 5 and 6). This station was selected because it was sampled in 2002 by the GA EPD as part of the watershed's TMDL development. The fecal coliform data collected at this site can be used in establishing baseline conditions and identifying changes that have occurred to the watershed since the TMDL was developed.

Unnamed Tributary (UT01) to Flat Creek at Eagle Mountain Drive

Station UT01 is located on an unnamed tributary to Flat Creek at Eagle Mountain Drive (Figures 5 and 6). Grab samples should be collected upstream of the Eagle Mountain Drive road crossing at this station. Land use surrounding this station is mostly forested with smaller portions of agricultural and residential lands.

Unnamed Tributary (UT02) to Coosawattee River at Progress Road

UT02 is located on an unnamed tributary to the Coosawattee River just downstream of Progress Road (Figures 5 and 6). This station was selected because it drains commercial and industrial areas in Ellijay and is located just downstream of areas identified in the watershed reconnaissance as a potential source of fecal coliform pollution.

Unnamed Tributary (UT03) to Coosawattee River at Gilmer Soccer Fields

This station is located at the Gilmer Soccer Fields within the Three Rivers Athletic Club along an unnamed tributary to the Coosawattee River (Figures 5 and 6). Samples at this station should be collected within the portion of the unnamed tributary located just north-northeast of the soccer fields within the park. This station was selected because it drains commercial and industrial areas in Ellijay and is located just downstream of areas identified in the watershed reconnaissance as a potential source of fecal coliform pollution.

Unnamed Tributary (UT04) to Coosawattee River at US Hwy 76

Station UT04 is located on an unnamed tributary that runs just south of US Hwy 76 (Figures 5 and 6). Samples at this location should be sampled just upstream of the intersection of Hwy 76 and South Main Street. This station drains a mixed-use area of forested, residential, and agricultural land uses.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Sample Collection Techniques

All samples will be collected according to requirements of the GA EPD Standard Operating Procedures (SOPs), including:

- Watershed Protection Branch *Quality Assurance Manual* (2005);
- *Surface Water Sampling* (SOP#EPD-WPMP-2)(March 2013); and,
- Water Quality *Assurance Manual* (June 1999, revised Jan 2005).

Additionally, the GA AAS *Bacterial Monitoring* Manual establishes monitoring protocols for the collection and analysis of *Escherichia coli* (*E. coli*) and as such, will be utilized as a guidance document for the fecal coliform baseline analysis. *Title 40* of the *Code of Federal Regulations, Part 136* will be adhered to during all sample collection events. Each sample event will be conducted in accordance with the sample schedule (Table 1). A list of equipment needed to conduct the sampling is included in Appendix A.

4.2 Water Quality Instrument Calibration

<u>*Water Quality Multiprobe*</u>

The *in-situ* water quality multiprobe unit can be any brand that conforms to GA EPD/US EPA methodologies and specifications. The parameters to measure are: air and water temperature (ºC), specific conductance (umhos/cm), salinity (PSU), dissolved oxygen (mg/L), dissolved oxygen (% saturation), turbidity (NTUs), and pH. The multiprobe is to be pre-and post-calibrated for any sampling event where *in-situ* water quality sampling is required. During multiple-day sampling events, the multiprobe is to be pre-calibrated daily prior to sampling. Pre-calibrate all probes using the following standard calibration solutions and units (Refer to probe's manual for specific operating instructions). Record the calibration standard used, mulitprobe readings prior to and following calibration, and the temperature reading on the Data Sonde Calibration Sheet (Appendix A).

- <u>Conductivity</u>: Calibrate utilizing the 400 µmhos/cm;
- <u>Dissolved Oxygen</u>: Calibrate at 100% saturation; and,
- <u>pH</u>: Perform a two-point calibration utilizing the pH 4 and pH 7 standard solutions. Perform a post calibration check with the pH 10 standard.

A post-sample event calibration check of the multiprobe should be conducted once you have returned to the lab. This is conducted by taking measurements of the same standards used during multiprobe calibration. Post-sample event calibration checks should be recorded on the Data Sonde Calibration Sheet (Appendix A). If the post-sample calibration verification is outside of the specified QA/QC thresholds, then the data should be flagged and not used in the analysis. These calibrations will be your starting and ending value for each sampling day. This is to prevent data from being collected using an erroneous calibration and to detect any drifting readings or multiprobe malfunction. Manufacturer maintenance and cleaning procedures should be performed according to the equipment manual.

Turbidimeter

The turbidimeter is to be pre- and post-calibrated for any sampling event where *in-situ* water quality sampling is required. During multiple-day sampling events, the turbidimeter is to be pre-calibrated daily prior to sampling. Pre-calibrate to expected turbidity unless a multi-point calibration can be conducted (Refer to Turbidimeter manual for specific instructions). Record the turbidimeter readings prior to and following calibration at each standard on the Turbidimeter Calibration & Turbidimeter Secondary Standards Standardization Sheet (Appendix A). The turbidimeter should then undergo a post-calibration check upon returning to the lab. If the post-sample calibration verification is outside of the specified QA/QC thresholds, then the data should be flagged and not used in the analysis. These calibrations will be your starting and ending value for each sampling day. Manufacturer maintenance and cleaning procedures should be performed according to the equipment manual.

4.3 Fecal Coliform Baseline Assessment

Fecal coliform sampling events will be collected as grab samples. *In-situ* water quality measurements, including water and air temperature, dissolved oxygen (percent saturation and mg/L), pH, salinity, specific conductivity, and turbidity will be conducted in conjunction with each grab sample event. GA EPD requires that fecal coliform density data be collected as a geometric mean based on at least four samples collected within a 30-day period at intervals not less than 24 hours apart. Samples will be collected on a regular schedule on the same day of the week over a four week period (i.e., every Monday for four weeks) regardless of the weather.

Grab samples should be collected before anyone in the group has disturbed the stream in the intended sample reach. The samples should be taken at mid-channel, being careful not to disturb the stream sediments. The grab sample should be collected in an area with cross-sectional homogeneity where the water is well mixed. After conducting the grab sample, place the water quality multiprobe unit into the stream and wait for all parameters to stabilize before taking readings. While the water quality multiprobe unit is stabilizing, the *in-situ* turbidity can be measured. Filled sample containers will be placed in an ice chest with ice to maintain samples at a temperature of 4° C or less until they are received by the analytical laboratory.

A chain of custody noting sample identification, date, time, number of containers, sample matrix, sample parameters, laboratory, sampling personnel and project manager will be completed and will accompany the samples to the laboratory. The chain of custody will be signed by the field sampler and the date and time noted, then the chain of custody will be sealed in a Zip-loc bag and taped inside of the lid of the ice chest. Samples will be transmitted to the analytical laboratory and will be analyzed within the holding times specified for the analytical methods listed in Table 2.

Table 2. Water quality parameters, test methods, and reporting limits, Coosawattee-Carters Lake Management Plan project area fecal coliform baseline analysis.

Parameter	Units	Method	Method Detection Limit	Reporting Limit	Water Quality Standard
Temperature, Air	°C	--	--	--	N/A
Temperature, H_2O	°C	--	--	--	32.2°C (equivalent to 90°F)
pH	S.U.	--	--	--	Within the range 6.0 - 8.5
Dissolved Oxygen	mg/L	--	--	--	A daily average of 5.0 mg/L; no less than 4.0 mg/l at all times
Specific Conductivity	µS/cm	--	--	--	None
Turbidity	NTU	--	--	--	Refer to 391-3-6-.03(5)(d)
Fecal Coliform[1]	MPN/100 mL	SM 9221 E	2	2	May-Oct: 200 MPN/100mL Nov-Apr:1,000 MPN/100ml

[1] Holding time of 24 hours following sample collection

The following procedure was taken from EPD guidance and SOPs and EPA method #1669 and should be utilized during all fecal coliform sampling:

1. Calibrate the water quality sonde (multiprobe) before sampling.

2. Wear gloves (clean, non-talc, polyethylene, latex, vinyl, or PVC) during bottle labeling and sampling.

3. Prior to sampling, keep bottles dry (out of cooler with ice), so that the sharpie will work on the labels.

4. When sampling (w/ no preservative bottle), turn the bottle upside down and then submerge into the water. Then turn the bottle right side up to fill it up. This prevents getting films that are on the surface in the sample.

5. Always sample in an upstream direction to prevent sediments kicked up by feet from flowing into the bottle. If sediments have been kicked up, walk upstream to sample or wait until sediment has cleared.

6. Samples will be collected at mid-channel one meter below the water surface, or at locations where total water depth is less than 2 meters, samples will be collected at mid-depth.

7. Using your sonde (multiprobe), collect *in-situ* measurements (pH, DO, air and water temperature, specific conductivity, turbidity, and salinity) and record on the field sheet (Appendix B). It is also good to document flow conditions, water color and clarity observations, weather, and any anomalies observed, including the presence of

anything that may affect water quality. This information can also be recorded on the field sheet (Appendix A).

8. When possible take upstream and downstream photos of each sample station and store these in a dedicated computer folder with the date and name of the water quality sampling event (i.e., Station BC01).

9. Perform a multiprobe post-calibration at the end of the day and record all findings.

In-Situ Water Quality Measurements

1. While wearing gloves, place the probe module within the stream making sure all probes are completely immersed. Where possible, measurements will be obtained from the same location where grab sampling was conducted at approximately mid-channel and mid-depth.

2. Care will be taken to avoid contact with the probes and the sediment along the bottom of the stream.

3. Allow time for probe to equilibrate within the stream.

4. Watch the readings on the display until they are stable. Record results on *In-Situ* Water Chemistry field sheet for each station (Appendix B).

5. Rinse the probe with deionized water after usage and store it per manufacturer's directions between each station.

6. Perform a post-calibration at the end of the day and record all findings.

7. Refer to manufacturer's direction for long-term storage.

Turbidity Sample Collection and Analysis (Method 180.1)

1. Meter should be calibrated in advance of sampling according to manufacturer's operating instructions.

2. Periodically check the turbidity meter using the standards provided.

3. While wearing gloves, collect a grab sample of at least 25mL of water in a clean turbidity cuvette. To ensure cleanliness, the turbidity cuvette will be washed with stream water a minimum of three times prior to sample collection.

4. The sampler should face upstream and collect the sample without disturbing the sediment on the bottom of the stream.

5. Samples will be collected at mid-channel one meter below the water surface, or at

locations where total water depth is less than 2 meters, samples will be collected at mid-depth.

6. Cap the cuvette and wipe the tube dry with a Kimwipe or cleaning cloth provided by manufacturer.

7. If the sample is not immediately analyzed following collection, sample containers will be placed in an ice chest with ice to maintain samples at a temperature of 4°C. Samples should be analyzed within 48 hours of collection. If possible, allow samples to come to room temperature prior to analysis. Gently mix the sample to thoroughly disperse the solids if the sample has been refrigerated.

8. Open the lid on the turbidity meter and align the indexing arrow on the cuvette with the indexing arrow on the meter. Insert the turbidity cuvette into the chamber.

9. Close the lid and push the READ button. The turbidity in NTU units will be displayed within 5 seconds. Record results on the Watershed Assessment Water Quality Field Sheet.

10. Perform a post-calibration check at the end of the day and record all results.

4.4 Laboratory Analysis

Laboratory analysis will be conducted by a State of Georgia Certified Lab Analyst, and the lab will ensure all quality assurance/quality control (QA/QC) measures required by specific methods referenced in 40 CFR Part 136 are implemented. Adequate records on analytical procedures and the QA/QC measures shall be maintained to document their proper implementation and performance. Those records shall remain on file and be available for review for a minimum of three years.

4.5 Staff Training

Nutter & Associates has prepared over 22 Watershed Assessments, Protection Plans, and Management Plans from 2006 to the present and has worked extensively in the Coosa-Tallapoosa River basin. Additionally, our staff has conducted multiple water quality studies in which we developed study plans and conducted water quality sampling within the northwest Georgia region. The staff who will be conducting the Coosawattee-Carters Lake WMP sampling have a wealth of experience conducting water quality and fecal coliform sampling, including state-sponsored training and/or certifications in Georgia, South Carolina, and Florida. Further, members of our sampling team have also participated in the GA EPD Macroinvertebrate Biological Assessment Workshop, which provided training on required water quality and biological sampling standard operating procedures.

5.0 REFERENCES

Georgia Department of Natural Resources (GA DNR). 2004. Total Maximum Daily Load (TMDL) Evaluation for Fifty-Eight Stream Segments in the Coosa River Basin for Fecal Coliform. Submitted by: Georgia Department of Natural Resources, Environmental Protection Department. January 2004.

Georgia Department of Natural Resources (GA DNR). 2005. Water Quality Assurance Manual. Georgia Department of Natural Resources, Environmental Protection Division, Watershed Protection Branch. January 2005.

Georgia Department of Natural Resources (GA DNR). 2006. Tier 2 Total Maximum Daily Load (TMDL) Implementation Plan for the Coosawattee River (HUC 0315010204). Georgia Department of Natural Resources, Environmental Protection Department. 2006.

Griffith, G.E., J.M. Omernik, J.A. Comstock, S. Lawrence, G. Martin, A. Goddard, V.J. Hulcher, and T. Foster. 2001. Ecoregions of Alabama and Georgia (map scale 1:1,700,000), U.S. Geological Survey, Reston VA.

APPENDIX A

Equipment and Material Load-outs

Equipment and Material Load-outs (to be completed prior to sampling event)

General Materials – to be included in all field sampling events

Equipment	Required Items/Amount	Load-out
Field maps (Topo and Aerial)		
Field book		
Field data sheet(s)		
Waders and rain gear		
Camera		
GPS		
Pencils		
Clipboard		
Flagging		
Bug spray		
Sun screen		
Hand sanitizer		

Fecal Coliform Sampling Assessment

Equipment	Required Items/Amount	Load-out
Water quality multi-probe meter		
Calibration Standards		
pH buffer solutions (4, 7, & 10 S.U.)		
Conductivity solution		
Sock for dissolved oxygen calibration		
De-ionized water		
Turbidimeter with calibration solutions		
Water quality meter maintenance kit		
Sample bottles or whirl-pak bags		
Cooler and ice		
Chain of custody forms (COC)		
Extra batteries (AA)		
Gloves		

APPENDIX B

Field Data Sheets

In-Situ Water Quality Meter Calibration Sheet

Calibrators:____
Study:______________________________Sampling
Location:____________________________
Meter Model:_________________________
Meter/Sonde Serial Number:__________________

	Date	Time (24hr)	Initials
Pre-Sampling Calibration			
Post-Sampling Check			

	Date	Logging Interval (min)	Download Remarks
Launched			
Download			

Miscellaneous

	Battery Level (V) (%)	
Pre Sampling Calibrate		
Post-Sampling Check		

ORP Redox

	Standard: MV		Temp C^o
	Initial	Calibrated	
Pre-Sample Calibrate			
Post-Sample Check			

Dissolved Oxygen (mg/L)

	Temp ^{o}C	Initial % Saturation	Calibrated % Saturation	Barometric Pressure (mmHg)	Altitude (ft)	D.O. Table Value	Initial Conc. (mg/L)	Calibrated Conc. (mg/L)
Pre Sampling Calibration								
Post-Sampling Calibration								
						Within $\mp$0.5? Y/N		

Specific Conductance (μmhos/cm)

Conductivity Standard:	μS/cm			
Pre Sampling Calibration	Initial Meter Reading	Calibrated Meter Reading	Initial Meter Reading	Calibrated Meter Reading
Post Sampling Calibration				
	Within $\mp$ 10%? Y/N		Within $\mp$ 10%? Y/N	

pH (SU)

	Buffer #1 7.0 Buffer Temp:_____		Buffer #2 4.0 Buffer Temp:_____		Confirmation Butter 10.0
	Initial Reading	Calibrated Reading	Initial Reading	Calibrated Reading	Meter Reading
Pre-sample Calibration					
Post Sample Check					Within $\mp$ 0.2%? Y/N
	Within $\mp$ 0.2%? Y/N		Within $\mp$ 0.2%? Y/N		

TURBIDIMETER CALIBRATION & TURBIDIMETER SECONDARY STANDARDS STANDARDIZATION SHEET

Project: ______________________________
Calibration Date: ___________________
Calibrated By: _____________________
Standardized Date:____________________
Standardized By:____________________

Portable Turbidimeter Instrument
Model #:
Start Time: ____________
End Time: _____________

Turbidimeter Calibration				
Primary Standards	**Initial Reading**	**Cal. Std. Value**	**Final Reading**	**Δ**
<0.1 NTU		0		
20 NTU		20		
100 NTU		100		
800 NTU		800		

Turbidimeter Standardization				
Secondary Standards	**Initial Reading**	**Determined Value**	**Final Reading**	**Δ**
Range:				
Range:				
Range:				

Notes: ____

Initial When Completed ______

Watershed Assessment Biological *In situ* and Grab Sample Water Chemistry Field Sheet (Front)

STREAM NAME:	**LOCATION DESCRIPTION:**	
WA SITE ID:	**DATE:**	**GPS ERROR (+/-) ft:**
LATITUDE (DD):	**LONGITUDE (DD):**	
START TIME:	**END TIME:**	**TIME ZONE: EST or EDT**
INVESTIGATORS:		
FIELD MEASURER/COLLECTOR:	**FIELD RECORDER:**	
SAMPLE TYPE: Targeted	**ACTIVITY TYPE:** Field Measurement/Observation Field Replicate Msr/Obs	
COMPOSITE TYPE: Horizontal Single Horizontal Multi None (Grab)	**PROJECT:** Watershed Assessment	
PROJECT/REASON FOR SURVEY:		
COMMENTS:		

In-situ **Field Chemistry Data**

Water Temperature:	**º C**	**Model of Sonde:**	
Air Temperature:	**º C**	**Serial # of Unit:**	
Specific Conductance:	**(μmhos/cm)**	**Salinity:**	**PPB**
Dissolved Oxygen (mg/L):		**Dissolved Oxygen:**	**%**
pH:		**Battery Volts:**	
Turbidity:	**NTU**	**Turbidity Instrument #:**	

STREAM CHARACTERIZATION (Circle All that Apply)

WATER APPEARANCE:	Blackwater	Clearwater	Unsure	Unsure/Black	Unsure/Clear				
WATER CLARITY:	Clear	Slightly Turbid	Turbid	Stained	Opaque	Other___________			
TIDAL CYCLE:	1/4 ebb	1/2 ebb	3/4 ebb	Low Tide	1/4 flood	1/2 flood	3/4 flood	High Tide	N/A
WATER COLOR:	Clear	Foamy (natural or pollution)	Green (algal coloration evident)	Other________					
	Tannic (Tea-colored)	Muddy (cloudy brown)	Milky (cloudy white or gray)	Other________					
DOMINANT SUBSTRATE(S):	Bedrock	Boulders	Cement	Clay	Cobble	Boulders/RipRap			
	Concrete	Fines	Gravel	Hardpan	Sand	Silt	Other_______		

VISUAL CONDITIONS (Circle Items from List)

WATER LEVEL/FLOW:	Normal	Above Normal	Normal, but no Velocity
	Low	Flood	Drought Impact
WEATHER PAST 24 HOURS (circle and fill in all that apply):	_______% Cloud Cover	Clear (0% cloud cover)/Sunny	Rain (Steady Rain)
	Showers (intermittent)	Storm (heavy rain)	Snow
	Unsure (past)		
WEATHER NOW (circle and fill in all that apply):	______% Cloud Cover	Clear (0% cloud cover) /Sunny	Rain (Steady Rain)
	Showers (intermittent)	Storm (heavy rain)	Snow

Grab Water Quality Chemistry Samples Collected

Parameters (Circle All that Apply)

Total Suspended Solids	Metal Blank	Chlorophyll *a*
Alkalinity	TKN	Ortho-Phosphorus
Total Hardness	Ammonia	Total Phosphorus
Metals	Nitrate-Nitrite	Fecal
E. Coli	Biological Oxygen Demand	Chemical Oxygen Demand
Total Organic Carbon	Others:_________________________	Others:________________________

APPENDIX C. FECAL COLIFORM MONITORING REPORT

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TECHNICAL MEMORANDUM NO. 18-022.01

PREPARED FOR: Ben Hyer and Jessica Mimbs
Georgia Soil and Water Conservation Commission

PREPARED BY: Erin M. Harris, CPESC, CPSS

DATE: January 8, 2018

SUBJECT: Coosawattee River – Carter Lake Watershed Management Plan Fecal Coliform Baseline Monitoring Report

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LIST OF FIGURES

1.0 INTRODUCTION

The objective of the project is to develop and a nine-key element WMP for the Coosawattee River – Carters Lake Watershed Management Plan (WMP) project area that addresses fecal coliform pollution. To aid in the development of the WMP, a watershed characterization was conducted that included a visual assessment of the watershed, verification of current land use and conditions within the watershed, and identification of "hot spots" or potential sources of fecal coliform pollution (Nutter & Associates, August 2018). Further, fecal coliform water quality monitoring was conducted within the watershed to further identify sources of fecal coliform pollution, establish baseline conditions prior to the development of the WMP, and to prioritize areas for implementation of best management practices (BMPs).

The Coosawattee River – Carters Lake Watershed lies within the Coosa River basin in northwestern Georgia approximately 75 miles north of Atlanta, Georgia within Gilmer, Dawson, Fannin, and Murray Counties (Figure 1). The project area includes the northern portions of the Coosawattee River watershed upstream of the Carters Lake Reservoir and is located almost entirely in Gilmer County with smaller portions reaching into Murray County. The project area encompasses approximately 46,037 acres and is comprised of four smaller HUC12 watersheds: Carters Lake, Tails Creek, Coosawattee River, and Flat Creek (Figure 1).

2.0 METHODS

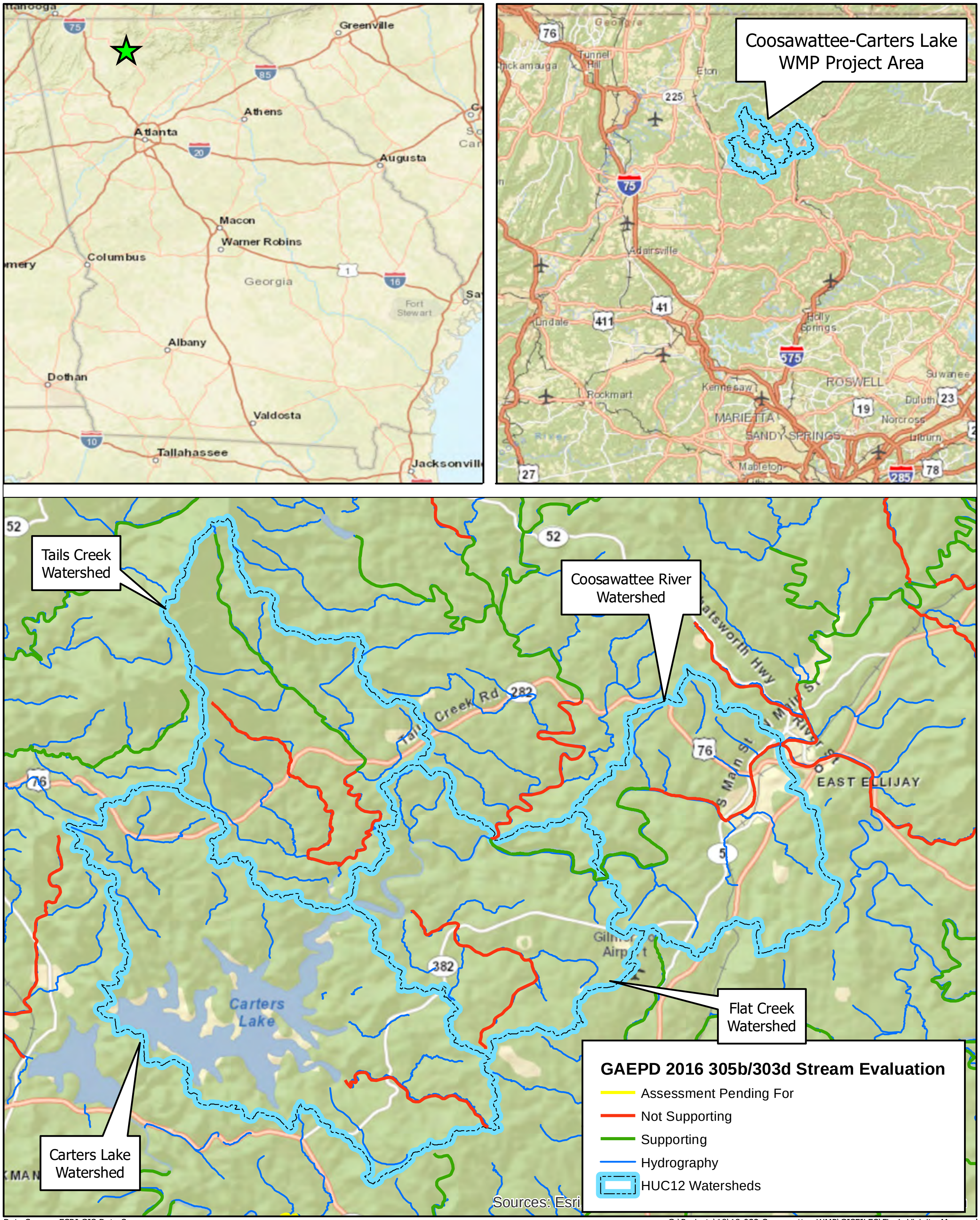
In accordance with the Quality Assurance (QA) and Quality Control (QC) Targeted Monitoring Plan (Plan) for fecal coliform sampling (Nutter & Associates, May 2018), bacteriological density data for fecal coliform bacteria was collected as a geometric mean (geomean) based on four samples collected once every seven days over a 28-day period within the Coosawattee River – Carters Lake WMP project area (Figure 1). For the baseline assessment, four discrete fecal coliform samples were collected each quarter (summer, fall, and winter) to calculate three geomeans at each station in accordance with the schedule in Table 1. *In-situ* water quality measurements, including air and water temperature (°C), dissolved oxygen (percent saturation and mg/L), pH (standard units), specific conductance (µS/cm), and turbidity (NTU) were measured in conjunction with each fecal coliform grab sample event. During each geomean (summer, fall, and winter), fecal coliform water quality monitoring was conducted for the Coosawattee River – Carters Lake Watershed Management Plan project area at 13 monitoring locations (Table 2; Figures 2 and 3).

Table 1. Sampling schedule for the Coosawattee River – Carters Lake WMP fecal coliform baseline analysis.

	2018		
	June	Sept	Dec
Fecal Coliform Baseline Assessment			
In-Situ Water Quality Analysis	✓	✓	✓
Fecal Coliform Geometric Mean (4 individual events for three geomeans at 13 stations)	✓	✓	✓

Table 2. Location of the fecal coliform water quality monitoring stations for the Coosawattee River – Carters Lake Watershed Management Plan baseline line assessment.

Station Name	Location (DD)		Station ID
	Latitude	Longitude	
Cartecay River at 1st Ave	34.68588	-84.47423	CTR01
Coosawattee River at Veterans Memorial Park	34.67144	-84.49656	CR01
Coosawattee River at Ogden Drive	34.67473	-84.52987	CR02
Coosawattee River at Orchid Lane	34.66236	-84.56414	CR03
Ellijay River at Hwy 52/River Street	34.69277	-84.47940	ER01
Flat Creek at Sunlight Road	34.62570	-84.55179	FC01
Flat Creek at Knight Road	34.63340	-84.55893	FC02
Flat Creek at Nexus Drive	34.63959	-84.58393	FC03
Tails Creek at Tails Creek Road	34.68641	-84.60041	TC01
Unnamed tributary to Flat Creek at Eagle Mountain Drive	34.64417	-84.57513	UT01
Unnamed tributary to Coosawattee River at Progress Road	34.66511	-84.49912	UT02
Unnamed tributary to Coosawattee River at Veterans Memorial Park	34.67095	-84.49425	UT03
Unnamed tributary to Coosawattee River at Hwy 76	34.68256	-84.49386	UT04



Data Source: ESRI GIS Data Server

G:\Projects\18\18-022 Coosawattee WMP\GISFILES\Fig 1_Vicinity_Map.mxd

Figure 1. Coosawattee – Carters Lake Watershed Management Plan Project Area assessment segment vicinity, Gilmer and Murray Counties, Georgia.

0 1 2 4 Miles

N

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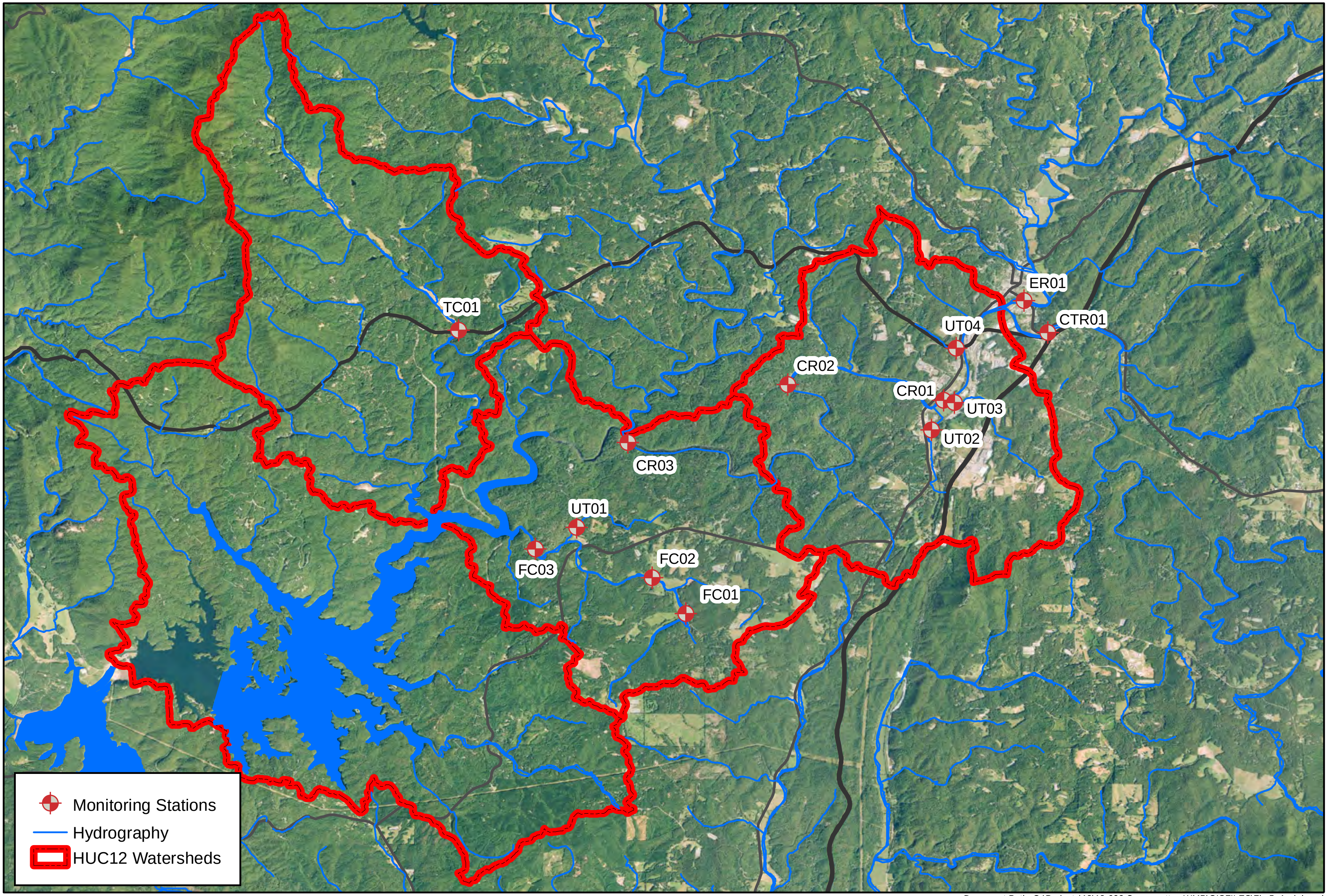

Data Source: USDA NAIP 2015

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Figure 2. Baseline fecal coliform monitoring stations (topographic), Coosawattee – Carters Lake Watershed Management Plan Project Area.

0 1 2 4 Miles

N

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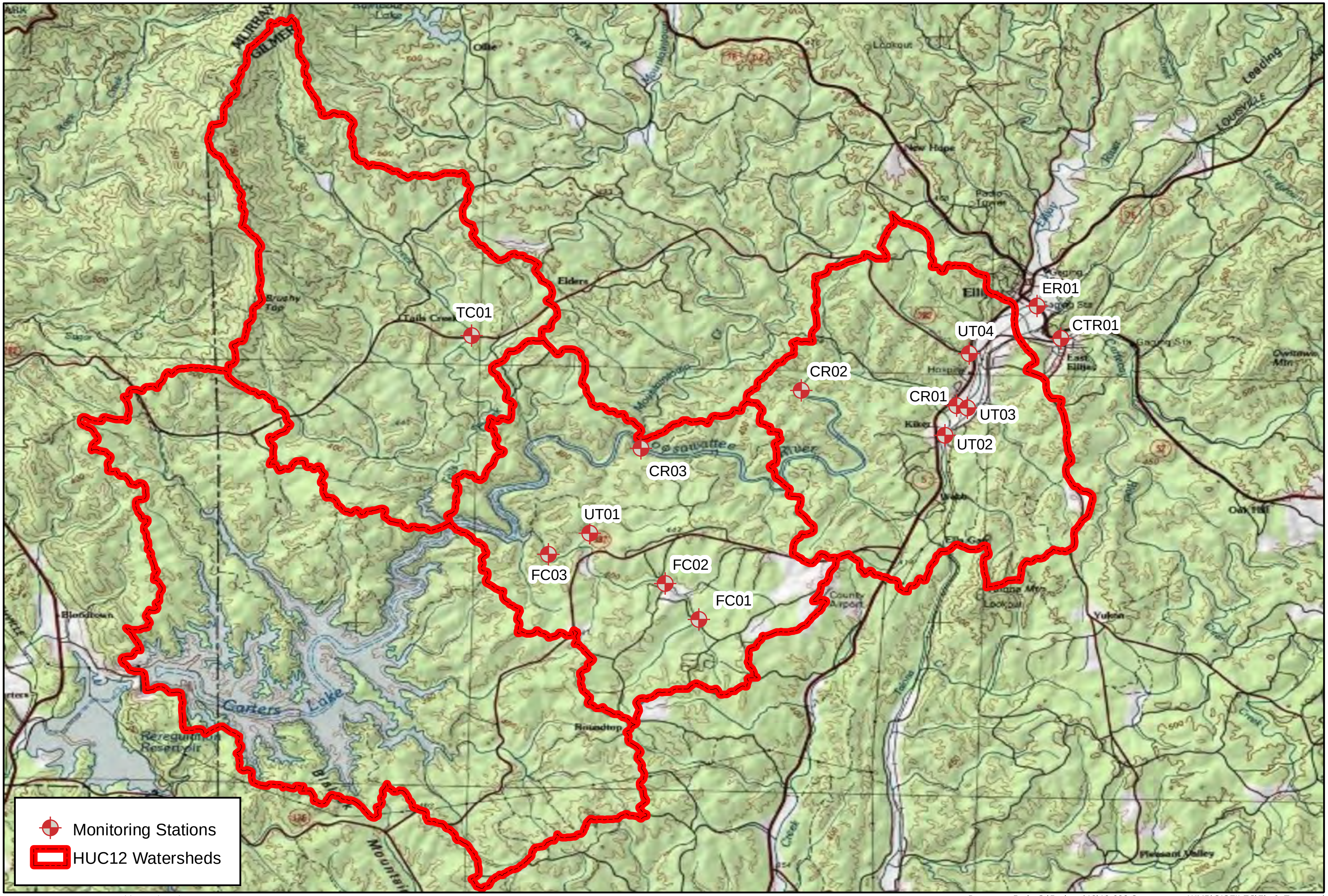

Data Source: USGS topographic quadrangle

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Figure 3. Baseline fecal coliform monitoring stations and 2015 aerial imagery, Coosawattee – Carters Lake Watershed Management Plan Project Area.

0 1 2 4 Miles

N

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3.0 WATER QUALITY STANDARDS

In accordance with the State of Georgia Water Use Classifications and Water Quality Standards (GA Code 391-3-6-03), for the designated use for fishing, water temperature shall not exceed 32.2℃, the range for pH is 6.0 to 8.5, and dissolved oxygen (DO) shall not be less than 4.0 mg/L (Table 3). Fecal coliform concentrations shall not exceed a geometric mean of 200 CFU/100 mL for the months of May through October (warm weather) and 1,000 CFU/100 mL for the months of November through April (cold weather). This calculated geometric mean is based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours (Table 3). Further, for the months of November through April, fecal coliform concentrations shall not exceed a maximum concentration of 4,000 CFU/100 mL for any sample. On a biannual basis, the State of Georgia assesses its waters for compliance with the water quality standards. Water bodies are classified as "not supporting" for exceeding the standards summarized in Table 3. In addition to the requirements in Table 3, the Georgia Environmental Protection Division (EPD) has historically listed any streams in the Coosa River basin if more than 25 percent of the individual subsamples exceeded the fecal coliform water quality standard (GA DNR, 2004).

Table 3. Georgia Water Use Classification and water quality standards.

Parameter	**Units**	**Water Quality Standard**
Water Temperature	°C	32.2℃ (equivalent to 90℉)
pH	S.U.	Within the range 6.0 - 8.5
Dissolved Oxygen	mg/L & % saturation	A daily average of 5.0 mg/L; no less than 4.0 mg/l at all times
Specific Conductance	µS/cm	--
Turbidity	NTU	Refer to 391-3-6-.03(5)(d)
Fecal Coliform	CFU/ 100 ml	May-Oct: 200 CFU/100mL
		Nov-Apr: 1,000 CFU/100ml

4.0 MONITORING RESULTS

4.1 FECAL COLIFORM

The summer geomean baseline monitoring was calculated from four individual subsamples collected by Nutter & Associates, Inc. (NAI) personnel between June 5 and June 27, 2018; the fall event was collected between September 4 and September 25, 2018; and the winter event between November 27 and December 19, 2018 (Table 4; Figure 4).

Table 4. Results of the individual fecal coliform sampling events and calculated geometric mean determinations collected for the baseline assessment period of the Coosawattee River – Carters Lake WMP during the summer, fall, and winter 2018 sampling events.

Round	Station	Fecal Coliform (CFU/100mL)				
		6/5/18	**6/13/18**	**6/20/18**	**6/27/18**	**Geomean**
Summer	CTR01	300	80	500	1,100	339
	ER01	90	40	330	800	176
	UT04	40	500	80	500	168
	TC01	40	80	170	1,400	166
	UT03	<20	270	800	220	176
	CR01	270	40	300	800	226
	UT02	1,700	500	800	500	764
	CR02	230	300	500	230	298
	CR03	40	170	700	230	182
	UT01	80	80	70	70	75
	FC03	500	230	110	800	317
	FC02	230	330	2,200	1,100	655
	FC01	2,400	>16,000	1,700	3,000	3,741
Fall		**9/4/18**	**9/11/18**	**9/18/18**	**9/25/18**	**Geomean**
	CTR01	20	300	230	300	143
	ER01	40	2,400	80	1,100	303
	UT04	<20	800	80	500	159
	TC01	80	220	140	2,200	271
	UT03	40	80	80	1,300	135
	CR01	40	300	130	500	167
	UT02	300	1,100	500	1,700	728
	CR02	80	800	80	300	198
	CR03	130	800	130	500	287
	UT01	90	130	40	40	66
	FC03	130	300	80	1,100	242
	FC02	2,400	500	800	500	832
	FC01	9,000	9,000	3,000	1,300	4,216
Winter		**11/27/18**	**12/4/18**	**12/11/18**	**12/19/18**	**Geomean**
	CTR01	86	102	171	92	108
	ER01	26	500	200	46	104
	UT04	12	26	54	10	20
	TC01	22	94	29	31	37
	UT03	<2.0	8	14	2	5
	CR01	42	147	300	46	96
	UT02	16	90	40	6	24
	CR02	NM	100	230	100	132
	CR03	80	94	127	50	83
	UT01	56	72	135	19	57
	FC03	46	192	1,009	363	238
	FC02	88	220	131	320	169
	FC01	102	229	200	82	140

NM = not measured due to leaking sample bottle

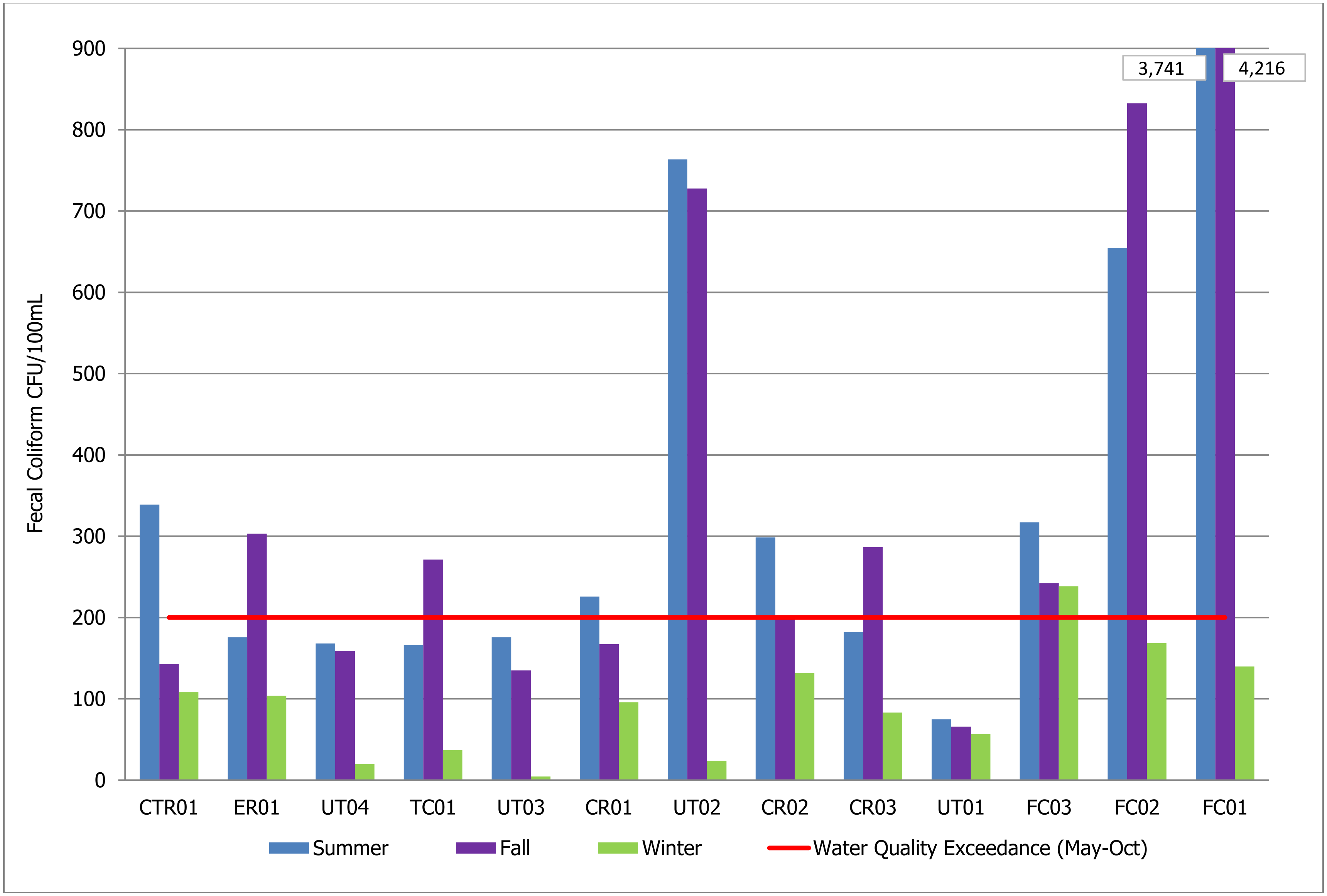

Figure 4. Calculated geometric mean concentrations for all stations during the summer, fall, and winter sampling events.

During the summer geomean determination, all stations met the State of Georgia Water Use Classifications and Water Quality Standard of 200 CFU/100 mL for the months of May through October excluding stations CTR01, CR01, UT02, CR02, FC01, FC02, and FC03 (Table 3; Figure 4). For the fall geomean determination, stations ER01, TC01, UT02, CR03, FC01, FC02, and FC03 exceeded the warm weather water quality standard of 200 CFU/100mL. During the winter geomean determination, all stations met the State of Georgia Water Use Classifications and Water Quality Standard (Chapter 391-3-6-03) of 1,000 CFU/100 mL for the months of November through April. Apart from station FC03, all stations met the stricter warm weather (May through October) Water Quality Standard of 200 CFU/100 mL during the winter sampling. Based on all sample events, the highest concentrations during the baseline assessment were observed at stations FC01, FC02, and UT02 (Figure 4). Other stations with exceedances during the baseline assessment were CR02 and FC03 during the summer round of sampling and TC01, CR03, and FC03 during the fall sampling (Figure 4). Station CTR01 exceeded the warm weather standard during the summer round of sampling while station ER01 also exceeded the water quality standard during the fall assessment. These stations are both located upstream of the project area and could have potentially contributed to the higher fecal coliform concentrations at stations located downstream (e.g., CR01 and CR02 during the summer sampling).

4.2 IN-SITU WATER QUALITY

All physiochemical parameters including water temperature, pH, dissolved oxygen (DO), and turbidity were within ranges specified in GA Code 391-3-6-03 Water Use Classifications and water quality standards with few exceptions (Table 5). The measured pH at stations CTR01, ER01, UT04, TC01, and CR01 during the baseline assessment was below the specified range, however, the regulations recognize that certain natural waters of the State may have pH readings that are not within the 6.0 to 8.5 range (Table 5). Low pH readings are characteristic of many streams in Georgia and these circumstances do not constitute violations of the Water Quality Standard. Excluding station TC01, the highest turbidity concentrations for all stations occurred during the summer baseline assessment on June 27, 2018 due to an increase in stormwater runoff from precipitation prior to that event. Overall, during all sampling events the highest turbidity values were observed in the Flat Creek watershed at stations FC01, FC02, and FC03, which also had the highest fecal coliform concentrations (Table 5; Figure 4). The State of Georgia does not publish water quality standards for specific conductivity, but the highest specific conductivity readings were observed at station UT02 on August 4, 2018 (100 µS/cm), which also had the highest average specific conductivity compared to other stations (84 µS/cm) (Table 5).

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment.

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec. Cond.	Dissolved Oxygen		pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
CTR01	Summer	6/5/18	19.5	28.0	26	9.2	104.3	7.6	13
		6/13/18	19.9	23.8	27	9.1	103.5	7.4	10
		6/20/18	21.5	25.7	27	9.3	109.2	6.5	9.0
		6/27/18	21.2	27.2	27	8.6	100.5	6.6	17
	Fall	9/4/18	21.9	26.3	28	9.3	NM	7.7	5.3
		9/11/18	21.3	26.6	31	8.7	102.1	5.4	5.7
		9/18/18	21.8	27.5	29	8.6	102.3	5.6	6.2
		9/25/18	21.0	24.8	34	8.7	100.9	8.0	5.0
	Winter	11/27/18	7.1	9.5	28	11.4	98.9	7.0	3.4
		12/4/18	9.8	15.2	34	10.9	99.5	7.3	4.9
		12/11/18	7.8	13.4	29	11.4	99.2	5.5	10.2
		12/18/18	7.7	4.5	27	12.3	106.8	6.3	3.8
		AVERAGE	**16.7**	**21.0**	**29**	**9.8**	**102.5**	**6.1**	**7.8**
ER01	Summer	6/5/18	19.4	28.1	28	8.8	99.8	7.2	11
		6/13/18	20.5	25.2	31	8.7	100.4	7.3	5.7
		6/20/18	22.2	29.5	31	8.6	102.7	6.3	8.4
		6/27/18	21.7	27.4	32	8.2	97.4	6.8	23
	Fall	9/4/18	22.2	27.0	36	8.6	102.3	7.3	4.5
		9/11/18	21.4	26.1	37	8.1	95.4	5.5	22
		9/18/18	21.9	28.0	36	8.2	97.5	5.7	5.4
		9/25/18	22.1	26.6	35	8.2	97.0	8.1	6.9
	Winter	11/27/18	7.6	9.5	32	11.1	97.2	6.9	4.7
		12/4/18	9.3	14.8	31	10.6	95.8	6.7	7.5
		12/11/18	7.7	11.1	28	11.4	98.4	5.7	6.8
		12/18/18	8.0	10.8	30	12.0	105.3	6.4	4.3
		AVERAGE	**17.0**	**22.0**	**32**	**9.4**	**99.1**	**6.2**	**9**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen	Dissolved Oxygen	pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
UT04	Summer	6/5/18	19.0	29.5	46	8.8	98.0	7.0	7.2
		6/13/18	18.6	25.3	48	9.2	101.8	7.2	8.8
		6/20/18	19.0	29.8	46	9.1	102.2	6.4	7.7
		6/27/18	19.2	26.8	45	9.1	102.0	6.8	10
	Fall	9/4/18	20.8	27.8	49	8.8	101.2	7.3	5.6
		9/11/18	20.2	24.8	50	8.6	95.3	5.8	8.8
		9/18/18	20.1	28.5	50	8.5	97.5	5.8	4.7
		9/25/18	20.3	26.7	50	8.9	101.4	8.1	7.6
	Winter	11/27/18	8.3	7.8	49	11.2	99.5	6.9	3.4
		12/4/18	9.3	13.5	52	10.9	98.4	6.5	4.5
		12/11/18	8.1	9.1	52	11.5	100.3	5.8	7.1
		12/18/18	8.6	10.5	50	12.0	107.2	6.5	3.8
		AVERAGE	**16.0**	**21.7**	**49**	**9.7**	**100.4**	**6.3**	**6.6**
TC01	Summer	6/5/18	18.5	27.6	19	9.0	100.7	7.2	9.0
		6/13/18	18.5	24.9	20	9.2	102.5	7.1	6.7
		6/20/18	19.8	28.7	20	9.0	103.6	6.4	6.0
		6/27/18	19.9	27.6	35	9.0	102.9	7.0	9.0
	Fall	9/4/18	20.8	27.1	21	9.0	103.9	7.4	7.2
		9/11/18	20.4	24.1	22	8.5	98.7	5.8	7.3
		9/18/18	20.8	27.2	23	8.5	98.9	5.8	5.0
		9/25/18	21.0	27.3	24	8.5	98.4	8.3	15
	Winter	11/27/18	7.3	9.8	20	11.3	98.1	7.0	4.9
		12/4/18	9.4	NM	19	10.7	97.0	6.6	5.7
		12/11/18	8.3	9.0	17	11.3	99.9	6.6	4.7
		12/18/18	7.8	14.0	19	12.2	107.1	6.4	3.6
		AVERAGE	**16.0**	**22.5**	**22**	**9.7**	**101.0**	**6.4**	**7.0**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen	Dissolved Oxygen	pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
UT03	Summer	6/5/18	20.1	27.5	62	8.2	94.5	6.6	4.5
		6/13/18	19.4	25.3	65	8.5	96.5	6.9	3.6
		6/20/18	21.2	27.5	61	8.2	96.9	6.3	5.2
		6/27/18	20.9	28.7	58	8.3	96.4	6.8	7.8
	Fall	9/4/18	21.3	27.7	69	8.6	100.6	7.0	3.9
		9/11/18	21.1	23.4	69	8.1	94.3	6.0	3.7
		9/18/18	23.3	27.0	70	7.8	95.0	6.2	3.4
		9/25/18	21.2	27.9	65	8.1	93.9	7.8	4.2
	Winter	11/27/18	7.4	11.0	70	11.1	96.1	6.7	1.6
		12/4/18	8.8	12.6	67	10.4	92.9	6.3	2.8
		12/11/18	8.4	14.5	60	10.9	96.0	6.6	4.0
		12/18/18	8.0	17.1	63	11.7	102.5	6.5	2.4
		AVERAGE	**16.8**	**22.5**	**65**	**9.2**	**96.3**	**6.5**	**3.9**
CR01	Summer	6/5/18	21.0	31.5	36	9.0	104.2	6.5	15
		6/13/18	21.0	28.9	38	8.8	102.4	7.0	12
		6/20/18	23.6	32.4	41	8.8	107.8	6.5	8.2
		6/27/18	24.0	25.0	37	8.5	107.4	6.9	22
	Fall	9/4/18	24.3	30.8	62	8.4	103.3	7.4	5.6
		9/11/18	23.3	27.8	50	8.1	99.1	6.0	13
		9/18/18	24.1	30.3	64	8.7	108.1	5.9	7.7
		9/25/18	22.9	26.9	81	8.4	100.9	7.9	6.2
	Winter	11/27/18	7.1	12.5	55	11.3	97.4	6.7	3.4
		12/4/18	8.4	10.3	43	11.4	100.9	6.3	6.0
		12/11/18	9.1	14.1	36	11.2	100.9	6.5	10.0
		12/18/18	7.9	14.2	46	12.1	105.4	6.6	3.7
		AVERAGE	**18.0**	**23.7**	**49**	**9.6**	**103.1**	**6.4**	**9**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen	Dissolved Oxygen	pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
UT02	Summer	6/5/18	20.9	29.0	81	8.2	95.9	6.4	5.4
		6/13/18	20.6	28.3	89	8.4	97.2	6.9	5.4
		6/20/18	22.5	32.0	80	8.0	97.1	6.4	8.3
		6/27/18	21.9	31.4	73	8.1	96.4	6.7	12
	Fall	9/4/18	22.8	29.2	100	8.1	97.4	7.1	8.5
		9/11/18	22.4	27.7	95	7.8	93.0	6.0	8.2
		9/18/18	22.9	30.5	95	7.7	93.2	6.0	7.2
		9/25/18	21.6	27.4	91	7.7	90.5	7.7	14
	Winter	11/27/18	8.0	11.3	92	10.8	100.0	6.7	2.6
		12/4/18	8.7	10.0	78	10.6	95.0	6.2	3.7
		12/11/18	7.9	14.1	62	11.2	97.2	6.2	4.8
		12/18/18	8.0	15.0	79	11.8	103.8	6.5	4.2
		AVERAGE	**17.3**	**23.8**	**84**	**9.0**	**96.4**	**6.4**	**7.0**
CR02	Summer	6/5/18	21.0	28.7	56	8.0	90.1	6.9	16
		6/13/18	21.2	27.2	42	8.5	99.3	7.0	8.0
		6/20/18	23.0	31.1	NM	8.6	105.0	6.6	11
		6/27/18	22.6	29.1	41	8.4	101.0	6.9	23
	Fall	9/4/18	23.6	29.1	60	8.7	106.5	7.5	4.8
		9/11/18	22.7	29.1	49	8.2	98.3	6.3	48
		9/18/18	22.8	28.9	54	8.5	102.7	6.2	5.8
		9/25/18	23.4	29.4	60	8.2	98.9	7.8	7.5
	Winter	11/27/18	7.6	11.4	48	11.2	98.0	7.1	3.5
		12/4/18	8.6	11.5	42	11.1	98.5	6.2	7.2
		12/11/18	7.7	15.9	34	11.4	98.6	6.4	10.8
		12/18/18	8.3	16.8	40	12.0	105.7	6.7	6.9
		AVERAGE	**17.7**	**24.0**	**48**	**9.4**	**100.2**	**6.8**	**13**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen		pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
CR03	Summer	6/5/18	21.3	26.2	34	9.1	106.9	7.1	12
		6/13/18	22.2	26.8	39	9.2	109.5	7.0	9.7
		6/20/18	23.8	28.3	43	9.2	113.1	6.1	14
		6/27/18	23.5	27.0	39	8.9	108.7	7.0	17
	Fall	9/4/18	24.2	28.7	60	9.2	112.7	8.0	5.1
		9/11/18	23.3	28.4	49	8.5	103.4	6.2	15
		9/18/18	23.4	28.6	52	8.6	104.8	6.2	6.2
		9/25/18	24.0	30.9	47	8.7	106.1	7.8	6.3
	Winter	11/27/18	8.2	14.6	43	11.3	100.0	7.1	3.4
		12/4/18	9.1	12.7	40	11.1	99.5	6.3	7.0
		12/11/18	7.8	12.0	33	11.6	100.5	6.4	10.4
		12/18/18	8.5	16.0	38	12.3	108.3	7.0	4.9
		AVERAGE	**18.3**	**23.4**	**43**	**9.8**	**106.1**	**6.5**	**9**
UT01	Summer	6/5/18	21.5	26.4	30	8.2	97.3	7.0	7.5
		6/13/18	21.6	26.0	32	8.4	99.7	6.9	7.0
		6/20/18	22.9	28.6	30	8.1	99.0	6.2	9.2
		6/27/18	22.9	26.6	29	8.1	98.5	6.8	7.3
	Fall	9/4/18	22.9	28.6	32	8.4	100.9	7.6	4.1
		9/11/18	22.8	28.3	33	8.0	96.4	6.3	6.0
		9/18/18	22.5	28.3	33	8.0	95.9	6.2	4.1
		9/25/18	22.9	30.6	33	8.0	96.0	7.6	5.2
	Winter	11/27/18	8.6	13.9	32	10.8	97.1	6.9	3.8
		12/4/18	9.9	12.5	32	10.6	97.2	6.2	4.2
		12/11/18	9.1	15.8	31	11.0	98.8	6.4	8.1
		12/18/18	10.0	18.5	30	11.6	107.2	6.9	5.4
		AVERAGE	**18.1**	**23.7**	**31**	**9.1**	**98.7**	**6.5**	**6.0**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen	Dissolved Oxygen	pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
FC03	Summer	6/5/18	20.4	27.0	34	8.8	101.0	7.1	12
		6/13/18	20.7	27.5	35	9.0	104.4	7.0	12
		6/20/18	22.0	29.1	32	8.8	104.4	6.2	9.5
		6/27/18	21.5	27.1	NM	8.0	104.1	6.9	22
	Fall	9/4/18	21.7	27.5	35	8.9	104.4	7.5	6.2
		9/11/18	21.4	26.7	38	8.5	99.9	6.4	8.3
		9/18/18	21.3	28.5	37	8.5	100.3	6.3	4.5
		9/25/18	21.3	29.1	38	8.8	102.4	7.6	11
	Winter	11/27/18	7.6	12.9	36	11.6	100.7	7.1	4.1
		12/4/18	9.1	11.8	38	11.1	100.4	6.3	5.6
		12/11/18	8.0	14.9	38	11.8	101.9	6.4	12.0
		12/18/18	8.1	16.2	36	12.4	109.0	6.8	4.2
		AVERAGE	**16.9**	**23.2**	**36**	**9.7**	**102.7**	**6.6**	**9**
FC02	Summer	6/5/18	22.1	26.5	34	9.0	107.6	6.6	14
		6/13/18	21.7	28.0	34	9.4	111.0	6.9	6.8
		6/20/18	23.4	31.6	NM	9.3	114.8	6.2	25
		6/27/18	25.2	29.7	34	9.0	114.6	7.0	67
	Fall	9/4/18	21.9	26.3	35	9.3	110.3	6.9	3.9
		9/11/18	21.9	26.2	38	8.7	103.3	6.3	7.7
		9/18/18	22.1	28.3	36	8.7	104.4	6.2	4.4
		9/25/18	24.6	31.5	36	8.4	105.4	7.5	31
	Winter	11/27/18	8.6	13.9	37	11.5	101.0	7.0	4.6
		12/4/18	9.8	13.3	38	11.0	101.3	6.5	7.1
		12/11/18	9.9	17.8	38	10.9	99.6	6.4	12.8
		12/18/18	10.6	20.0	35	10.6	99.1	6.5	5.9
		AVERAGE	**18.5**	**24.4**	**36**	**9.7**	**106.0**	**6.5**	**16**

NM = not measured

Table 5. Results of the physiochemical water quality monitoring for the fecal coliform baseline assessment (continued).

Station	Sampling Event Season	Date	Temperature Water	Temperature Air	Spec Cond	Dissolved Oxygen		pH	Turbidity
			°C		µS/cm	mg/L	%	S.U.	NTU
FC01	Summer	6/5/18	20.7	25.2	30	8.2	95.2	7.0	12
		6/13/18	20.9	27.6	34	8.1	94.4	7.0	27
		6/20/18	22.0	32.0	30	8.0	95.2	6.2	20
		6/27/18	22.3	27.1	32	8.2	99.0	7.0	50
	Fall	9/4/18	21.4	26.7	38	7.9	92.1	7.2	13
		9/11/18	21.3	25.9	39	7.7	90.7	6.3	20
		9/18/18	21.5	28.6	36	7.4	87.8	6.2	8.8
		9/25/18	24.4	32.7	35	7.7	95.7	7.4	8.6
	Winter	11/27/18	8.6	13.2	30	10.9	98.1	7.0	5.3
		12/4/18	NM	14.4	NM	NM	NM	NM	12
		12/11/18	8.9	20.0	31	11.0	98.4	6.4	12.5
		12/18/18	9.7	19.8	29	11.7	107.2	6.7	6.7
		AVERAGE	**18.3**	**24.4**	**33**	**8.8**	**95.8**	**6.6**	**16**

NM = not measured

Based upon review of the Georgia Environmental Protection Division (GA EPD) On-line Water Quality Database, water quality sampling was conducted at 31 streams located within the Coosa River Basin, Ecoregion 66(g), and Gilmer County, Georgia. The average water temperature, specific conductivity, dissolved oxygen, and pH from 1972 to 2014 was calculated for the 31 stations (Table 6). During the baseline assessment, the average *in-situ* water quality parameters at all stations were similar to the historic average with the exception of specific conductivity. At stations CR01, CR02, CR03, UT03, and UT04, the average specific conductivity concentration was higher compared to the regional average (Tables 5 and 6). All other *in-situ* parameters were similar to the regional average during the baseline assessment.

Table 6. Average *in-situ* water quality data for streams located within the Coosa River Basin, Ecoregion 66(g), and Gilmer County as reported on the GA EPD Online Water Quality Database.

Sample Period	No. of Stations	Water Temperature	Spec Cond	Dissolved Oxygen		pH
		°C	µS/cm	mg/L	%	S.U.
1972 - 2014	31	14.2	31	9.9	97.5	6.7

4.3 WEATHER AND CLIMATE DATA

The U.S. Geologic Survey (USGS) maintains a monitoring station located on the Coosawattee River at U.S. Hwy 76 (Station No. 02380500) that measures gage height, discharge, and precipitation. Data was acquired from this station and used to calculate the precipitation three and seven days prior to each sampling event (Table 7). Further, during the sampling period from June to December 2018, the Ellijay area experienced an excess of rainfall of over nine inches compared to the historic average (Table 8).

Table 7. Observed precipitation at the USGS Coosawattee River rain gage near Ellijay, GA (station No. 02380500) three and seven days prior to each sampling event for the baseline fecal coliform assessment.

Date	Observed Precipitation[1]	
	7 days	3 days
	inches	
6/5/2018	1.75	0.00
6/13/2018	1.82	1.41
6/20/2018	0.53	0.53
6/27/2018	2.75	2.11
9/4/2018	0.00	0.00
9/11/2018	1.57	1.57
9/18/2018	0.13	0.13
9/25/2018	0.67	0.67
11/27/2018	0.61	0.52
12/4/2018	2.00	1.64
12/11/2018	3.50	3.48
12/18/2018	0.45	0.10

[1] Rainfall during November and December were obtained from the UGA Weather Network Hillcrest Orchards gage near Ellijay, GA due to malfunction with USGS gage

Table 8. Observed precipitation during the baseline monitoring period (June – December 2018) compared to the historic monthly average for the months of June to December at the UGA Weather Network Hill Crest Orchards station near Ellijay, Gilmer County, GA station.

Month	2018 Observed Precipitation	1949 – 2016 Monthly Average	Departure from Average
	inches		
June	5.14	4.28	0.86
July	5.51	5.24	0.27
Aug	5.08	4.39	0.69
Sept	3.22	4.01	-0.79
Oct	6.14	3.61	2.53
Nov	7.80	4.39	3.41
Dec	7.66	5.28	2.38
TOTAL	**40.55**	**31.20**	**9.35**

5.0 DISCUSSION

The fecal coliform geomean exceeded the water quality standard during the summer events at stations CTR01, CR01, UT02, CR02, and FC01, FC02, and FC03 (Table 4; Figure 4). For the summer sampling event, the June 27, 2018 sampling event had the most subsamples above 200 CFU/100mL, which coincides with increased discharge resulting from precipitation prior to that event (Table 7; Figure 5). All stations, excluding station UT01, had subsamples greater than 200 CFU/100mL during this sampling event (Table 4). The highest subsample concentration was observed at station FC01 on June 13, 2018 (16,000 CFU/100mL) (Table 4) and is also correlated with increased stormwater flows from rainfall (Table 7; Figure 5). Overall, the highest concentrations during the summer sampling occurred at stations UT02, FC01, FC02, and FC03 (Table 4).

For the fall round of sampling, stations ER01, TC01, UT02, CR03, FC01, FC02, and FC03 had fecal coliform geomeans that exceeded the water quality standard (Table 4; Figure 4). Seven stations exceeded the 200 CFU/100mL threshold for fecal coliform concentration on September 25, 2018 compared to three stations on September 4, five stations on September 11, and one stations on September 18 (Table 4). The September 25 event was conducted during increased stormwater flow due to recent precipitation (Table 7; Figure 6). The highest subsamples were observed at station FC01 during the September 4 and 11, 2018 events (9,000 CFU/100mL, respectively) (Table 4). Fecal coliform concentrations were elevated at this station regardless of precipitation or stream flow conditions (Table 7; Figure 6). For the Tails Creek watershed, the highest fecal coliform concentrations at station TC01 were observed during the September 25, 2018 sampling event (Table 4; Figure 4), which are correlated with increased stormwater flow and precipitation (Table 7; Figure 6). Overall, the highest fecal coliform concentrations for the fall sampling occurred at stations UT02, FC01, and FC02 (Figure 4) and were elevated during both dry and wet weather conditions (Table 7; Figure 6).

For the winter assessment all subsamples were below 1,000 CFU/100mL excluding station FC03 (Table 4). Additionally, and with the exception of station FC03, all stations had geomeans below the more stringent warm weather threshold of 200 CFU/100mL (Table 4). A rainfall surplus of approximately 2.38 inches was observed during December for the winter sampling period; however, fecal coliform concentrations were generally lower during the winter sampling period compared to the summer and fall sampling potentially due to lower air and water temperatures. The highest concentration during the winter period was observed at station FC03 on December 11, 2018 (1,009 CFU/100mL). However, approximately 3.50 inches of precipitation was observed during the previous seven days (Table 7) resulting in increased discharge (Figure 7).

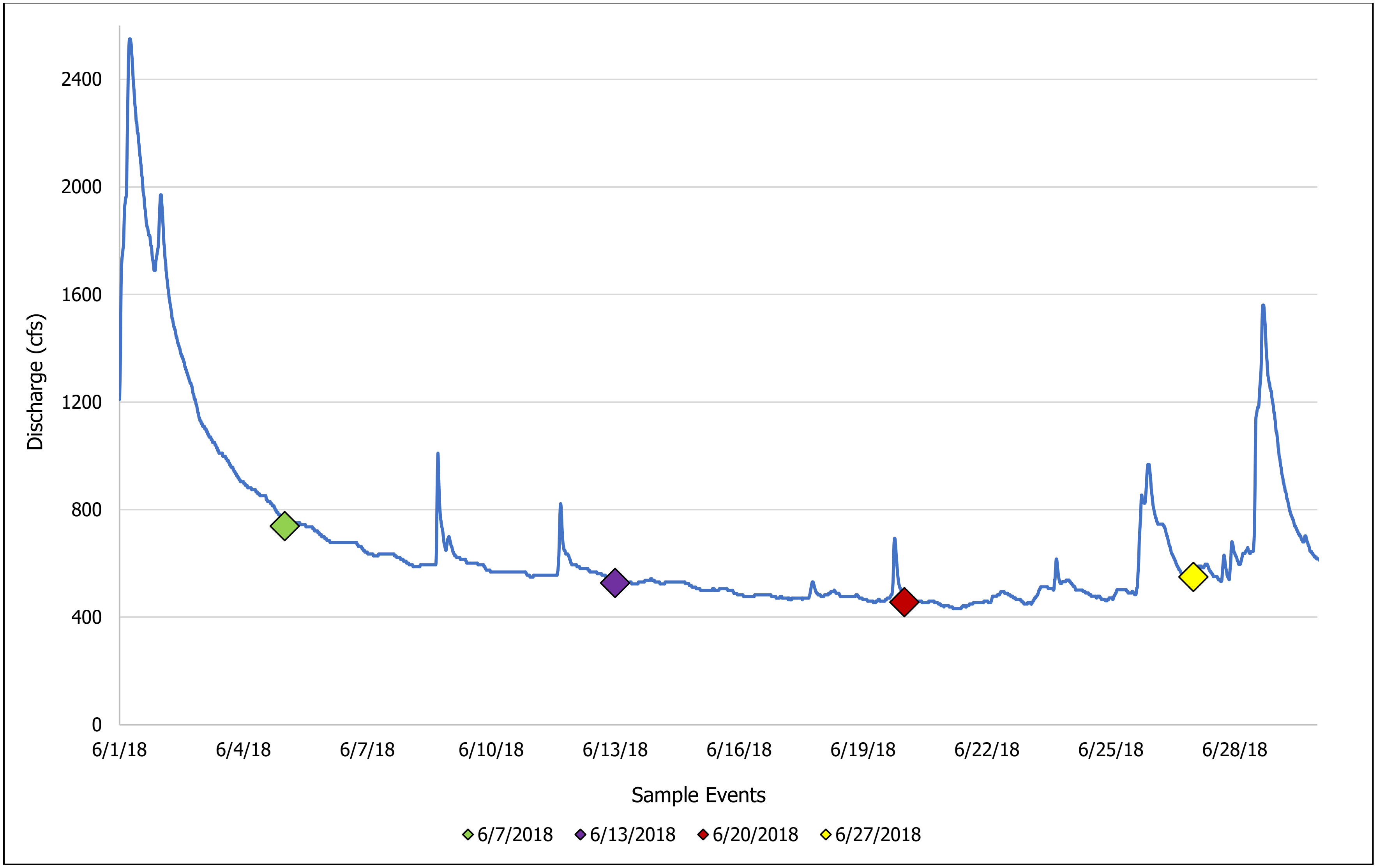

Figure 5. Stream discharge at the USGS Coosawattee River Station during the summer 2018 sampling events.

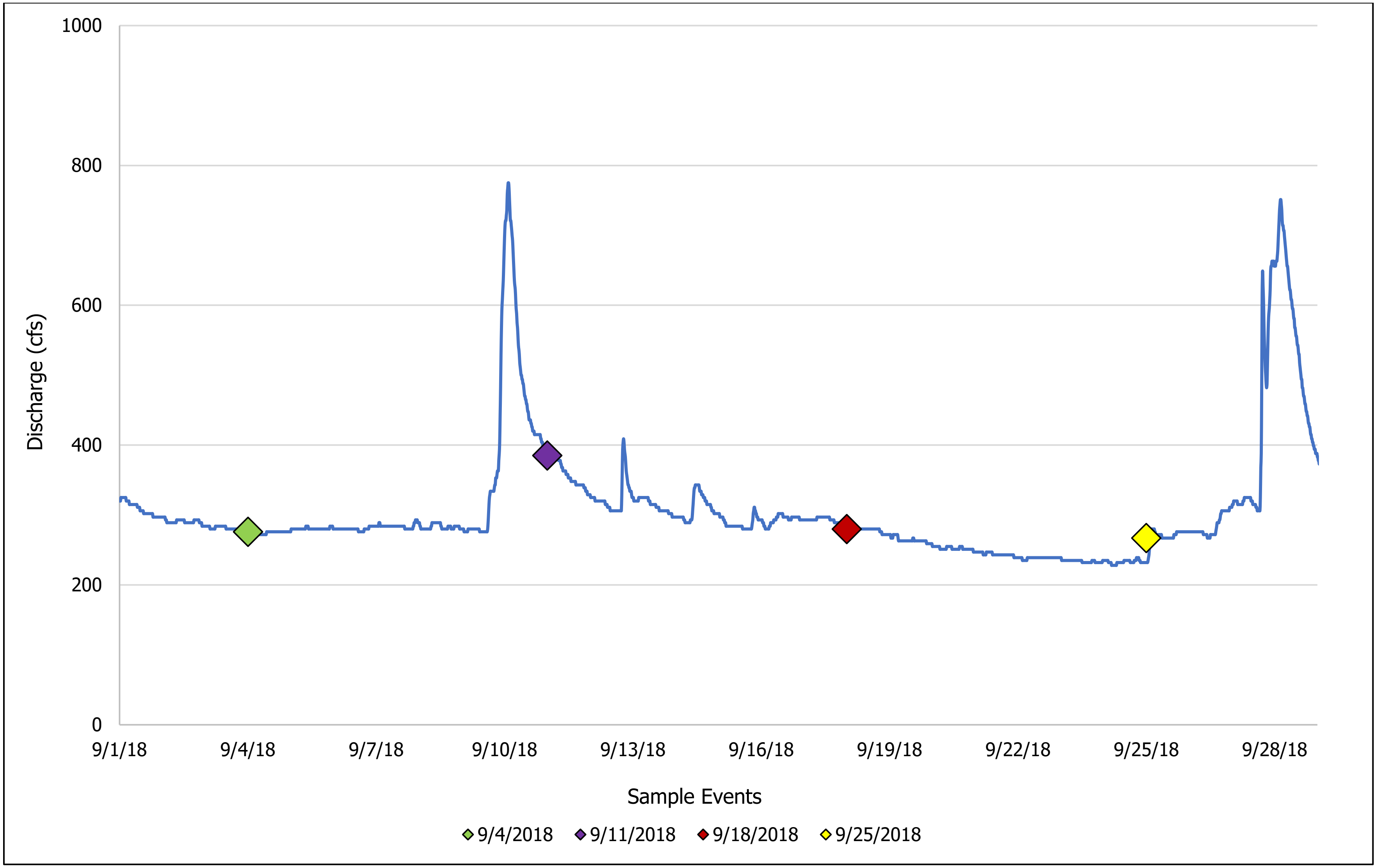

Figure 6. Stream discharge at the USGS Coosawattee River Station during the fall 2018 sampling events.

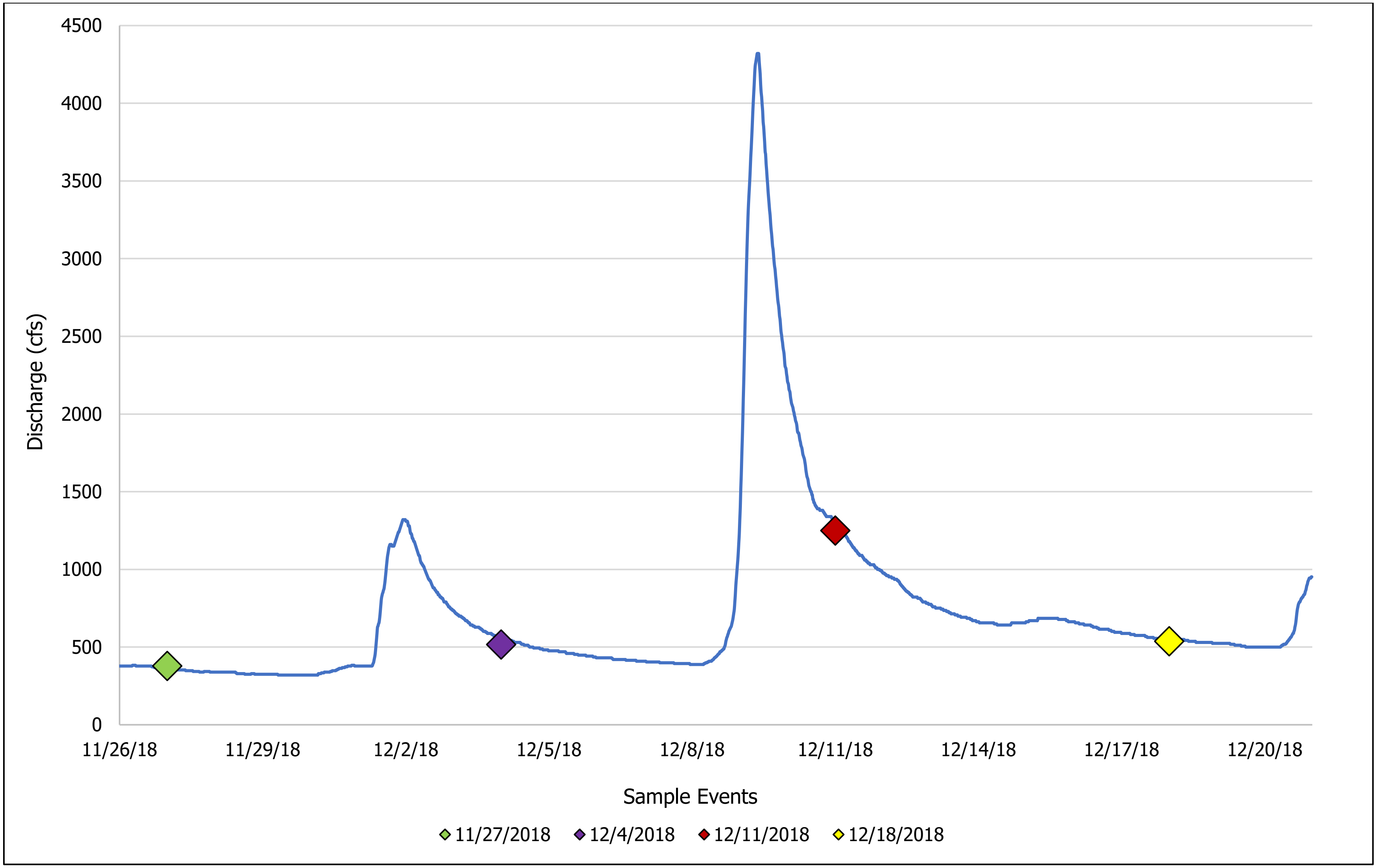

Figure 6. Stream discharge at the USGS Coosawattee River Station during the winter 2018 sampling events.

6.0 CONCLUSIONS

Based on the results from the baseline assessments, the watersheds of UT02 and all of the Flat Creek watershed (FC01, FC02, and FC03) have been identified as high priority watersheds for the implementation of best management practices (BMPs). Station UT02 is located in an area dominated by urban land use and impervious surfaces; therefore, stormwater runoff associated with urban land use are the most likely source of fecal coliform in this watershed. During dry weather conditions, potential sources of fecal coliform in the Flat Creek watershed are failing or improperly managed septic systems, illicit discharges, livestock access to the stream, and stream buffer encroachment. For wet weather events, potential sources in the Flat Creek basin are stormwater runoff from nonpoint sources such as residential and agricultural land use.

Elevated fecal coliform concentrations also exceeded the warm weather water quality standard at stations CTR01, ER01, CR01, CR02, CR03, TC01. Stations CRT01 and ER01 are located upstream of the WMP project area and were sampled to establish fecal coliform concentrations upstream of the Coosawattee River watershed assessment area. Elevated fecal coliform concentrations at station CR01 are likely attributed to upstream watershed inputs as well as stormwater runoff from urban land use associated the Cities of Ellijay and East Ellijay. Stations CR02 and CR03 are located within the Coosawattee River Resort, and potential bacterial sources are likely attributed to failing or improperly maintained septic systems, illicit discharges, stream buffer encroachment, and feces associated with geese, deer, and canines. For the Tails Creek watershed (station TC01) potential sources include stormwater runoff associated with agricultural land use and buffer encroachment. For the WMP, best management practices (BMPs) should be selected that will address a variety of pollution sources including bacteria, nutrients, and sediment.

7.0 REFERENCES

Georgia Department of Natural Resources (GA DNR). 2004. Total Maximum Daily Load (TMDL) Evaluation for Fifty-Eight Stream Segments in the Coosa River Basin for Fecal Coliform. Submitted by: Georgia Department of Natural Resources, Environmental Protection Department. January 2004.

APPENDIX D. HISTORIC AND 2018 FECAL COLIFORM DATA, FORMULAS, AND CALCULATIONS

Station CR01 historic warm weather fecal coliform monitoring data.

Station	Date	Fecal Coliform
		MPN/100 mL
CR01	5/7/96	6,350
	6/4/96	330
	6/25/96	3,300
	8/6/96	2,200
	9/3/96	330
	10/8/96	7,000
	5/15/01	1,700
	5/22/01	490
	5/29/01	3,300
	6/12/01	130
	8/28/01	130
	9/5/01	2,400
	9/10/01	1,300
	9/18/01	490
	10/2/01	170
	10/4/01	110
	10/9/01	170
	10/15/01	1,700
	7/8/02	110
	7/15/02	490
	7/22/02	3,300
	8/5/02	4,600
	5/28/03	130
	6/3/03	700
	6/10/03	9,200
	6/17/03	2,300
	7/22/03	1,100
	7/29/03	490
	8/5/03	1,700
	8/12/03	270
	7/8/04	1,600
	7/13/04	800
	7/20/04	500
	8/4/04	53
	9/14/04	1,400
	9/20/04	800
	9/27/04	110
	10/4/04	27
	5/10/05	130
	5/24/05	80
	5/31/05	130
	6/9/05	9,000
	8/15/05	170
	5/8/06	800
	5/15/06	300

Station CR01 historic warm weather fecal coliform monitoring data. (continued)

Station	**Date**	**Fecal Coliform** MPN/100 mL
CR01	5/22/06	5,000
	6/5/06	80
	6/26/06	9,000
	8/21/06	170
	8/28/06	140
	9/11/06	170
	9/18/06	20
	6/21/07	700
	6/26/07	80
	7/12/07	300
	7/19/07	230
	8/14/07	40
	8/20/07	230
	8/28/07	130
	9/12/07	1,300
	7/15/08	1,400
	7/22/08	110
	8/6/08	20
	8/12/08	40
	9/16/08	20
	9/24/08	80
	10/8/08	1,700
	10/15/08	20
	5/6/09	24,000
	5/13/09	300
	5/20/09	170
	6/3/09	20
	8/5/09	170
	8/20/09	300
	8/27/09	300
	9/2/09	300
	6/24/10	500
	7/8/10	40
	7/15/10	230
	7/22/10	30,000
	8/11/10	170
	8/19/10	3,000
	8/25/10	500
	9/2/10	140
	9/8/10	170
	6/23/11	13,000
	7/7/11	3,000
	7/14/11	230
	7/21/11	700

Station CR01 historic warm weather fecal coliform monitoring data. (continued)

Station	**Date**	**Fecal Coliform** MPN/100 mL
CR01	8/10/11	300
	8/18/11	130
	9/1/11	8,000
	9/7/11	2,200
	6/21/12	300
	7/5/12	70
	7/12/12	8,000
	7/19/12	800
	8/8/12	110
	8/16/12	230
	8/30/12	220
	9/5/12	210
	7/17/13	110
	7/23/13	800
	7/30/13	300
	8/13/13	2,300
	9/19/13	300
	9/25/13	22,000
	10/22/13	700
	10/24/13	60
	10/28/13	170
	10/30/13	40
CR01 Total Historic Geomean		431

Station TC01 historic warm weather fecal coliform monitoring data.

Station	**Date**	**Fecal Coliform** MPN/100 mL
TC01	5/15/01	130
	5/22/01	490
	5/30/01	80
	6/12/01	90
	8/29/01	40
	9/6/01	570
	9/10/01	460
	9/19/01	1,400
	10/2/01	81
	10/3/01	110
	10/9/01	170
	10/15/01	130
TC01 Total Historic Geomean		182

Baseline fecal coliform data collected at stations CR01, TC01, and the Flat Creek watershed during the 2018 warm weather monitoring period.

Station	Date	Fecal Coliform MPN/100 mL
CR01	6/5/2018	270
	6/13/2018	40
	6/20/2018	300
	6/27/2018	800
	9/4/2018	40
	9/11/2018	300
	9/18/2018	130
	9/25/2018	500
CR01 2018 Geomean		194

Station	Date	Fecal Coliform MPN/100 mL
TC01	6/5/2018	40
	6/13/2018	80
	6/20/2018	170
	6/27/2018	1,400
	9/4/2018	80
	9/11/2018	220
	9/18/2018	140
	9/25/2018	2,200
TC01 2018 Geomean		212

Station	Date	Fecal Coliform MPN/100 mL
FC01	6/5/2018	2,400
	6/13/2018	16,000
	6/20/2018	1,700
	6/27/2018	3,000
	9/4/2018	9,000
	9/11/2018	9,000
	9/18/2018	3,000
	9/25/2018	1,300
FC02	6/5/2018	230
	6/13/2018	330
	6/20/2018	2,200
	6/27/2018	1,100
	9/4/2018	2,400
	9/11/2018	500
	9/18/2018	800
	9/25/2018	500
FC03	6/5/2018	500
	6/13/2018	230
	6/20/2018	110
	6/27/2018	800

Baseline fecal coliform data collected at stations CR01, TC01, and the Flat Creek watershed during the 2018 warm weather monitoring period. (continued)

Station	Date	Fecal Coliform MPN/100 mL
FC03	9/4/2018	130
	9/11/2018	300
	9/18/2018	80
	9/25/2018	1,100
Flat Creek 2018 Geomean		933

$$\textbf{Geometric Mean} = \left((S1*S2*S3.....Sn)^{(1/n)}\right)-1$$

where n = number of individual grab samples in a data set

S= individual grab sample

	Station	2018	Historic
n=	CR01	8	111
	TC01	8	12
	Flat Creek	8	12

$$\textbf{Percent Difference} = \frac{\text{(2018 geomean - total historic geomean)}}{\text{total historic geomean}}$$

Station	Historic total Geomean	2018 Geomean	Percent Difference
CR01	431	194	-55%
TC01	182	212	17%
FC01	182	933	413%