Total Maximum Daily Load

Evaluation

for

Two Segments

in the

Ogeechee River Basin

for

Lead

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

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

February 2020

TMDL Action ID: **GAR4_20_02_01** EPA Approval Date: **3/20/2020**

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EXECUTIVE SUMMARY

The State of Georgia assesses its water bodies for compliance with water quality criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These waterbodies are found on Georgia's 2018 305(b) list as required by that section of the CWA that defines the assessment process and are published in *Water Quality in Georgia 2016-2017* (GA EPD, 2018). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

The subset of the water bodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia 2016-2017* (GA EPD, 2018). Water bodies on the 303(d) list are denoted as Category 5, and are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard.

The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

A TMDL is defined as the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body.

The State of Georgia has identified two (2) stream segments located in the Ogeechee River Basin as impaired for lead. The water use classification of the impacted streams is Fishing. The general and specific water quality criteria for Fishing streams are stated in the Water Use Classifications and Water Quality Standards section of the Georgia *Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03, Sections (5) and (6).

The calculation of the lead load at any point in a stream requires the lead concentration and stream flow. The availability of water quality and flow data varies considerably among the listed segments. The Mass Balance Approach was used to determine the current lead load and TMDL. The lead load and required reduction for the listed streams are summarized in the table below.

Lead TMDL Summary for the Impaired Stream Segments in the Ogeechee River Basin

Stream Segment	Criteria	Current Load	WLA[(1)]	WLA_{SW}[(2)]	LA	MOS	TMDL	Reduction
Canoochee River	Chronic	Q x 0.21 µg/L	-	-	1.87×10^{-4} kg/day for the 7Q10 ΣQ_{LA} x 0.19 µg/L for all conditions and flows	Implicit	1.87×10^{-4} kg/day + WLA for the 7Q10 Q_{total} x 0.19 µg/L for all conditions and flows	28.5%
	Acute	Q x 0.21 µg/L	-	-	3.94×10^{-3} kg/day for the 1Q10 ΣQ_{LA} x 4.96 µg/L for all conditions and flows	Implicit	3.94×10^{-3} kg/day + WLA for the 1Q10 Q_{total} x 4.96 µg/L for all conditions and flows	0%
Little Ogeechee River	Chronic	Q x 1.89 µg/L	-	-	2.71×10^{-3} kg/day for the 7Q10 ΣQ_{LA} x 0.31 µg/L for all conditions and flows	Implicit	2.71×10^{-3} kg/day + WLA for the 7Q10 Q_{total} x 0.31 µg/L for all conditions and flows	77.8%
	Acute	Q x 1.89 µg/L	-	-	6.14×10^{-2} kg/day for the 1Q10 ΣQ_{LA} x 7.91 µg/L for all conditions and flows	Implicit	6.14×10^{-2} kg/day + WLA for the 1Q10 Q_{total} x 7.91 µg/L for all conditions and flows	0%

(1) No permitted wastewater treatment facilities with lead limits in watershed
(2) Based on the Draft EPA Interoffice Memorandum on "*Estimating Water Quality Loadings from MS4 Areas,*" dated 12/19/02: "If the critical period is a low flow event, the load from the MS4 does not have to be quantified and a WLA for the storm water sources is not necessary…"

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list, as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia 2016-2017 (*GA EPD, 2018*)*.

The subset of the water bodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia 2016-2017* (GA EPD, 2018). Water bodies on the 303(d) list are denoted as Category 5, and are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard.

The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

A TMDL is defined as the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body.

The State of Georgia has identified two segments in the Ogeechee River Basin as not supporting their designated use due to exceedances of water quality standards for lead. Table 1 presents the streams in the Ogeechee River Basin included on the 2018 303(d) list for exceedance of the lead criteria.

Table 1. Water Bodies Listed for Lead in the Ogeechee River Basin

Reach ID	Water body	Segment	County	Segment Length (miles)	Designated Use
GAR030602030101	Canoochee River	Ga. Hwy. 192 to Fifteen Mile Creek near Metter	Emanuel/ Candler	21	Fishing
GAR030602010201	Little Ogeechee River	Two Mile Creek to Hamburg Mill Pond near Culverton	Hancock/ Washington	9	Fishing

1.2 Watershed Description

The Ogeechee River Basin is located in mid to southeastern Georgia, encompassing approximately 5,540 square miles. (EPD, 2001). It is bordered by the Oconee and Altamaha River

Basins to the west and the Savannah River Basin to the east. The United States Geologic Survey (USGS) has divided the Ogeechee River Basin into four sub-basins, or Hydrologic Units (HUs). These are numbered as HUs 03060201 through 03060204. Figure 1 shows the location of the Ogeechee River Basin in Georgia, and Figure 2 shows the major political boundaries, water features, and U.S.G.S 8-digit HU watersheds within the Ogeechee River Basin. Figure 3 shows the locations of the impaired water bodies within the Ogeechee River Basin.

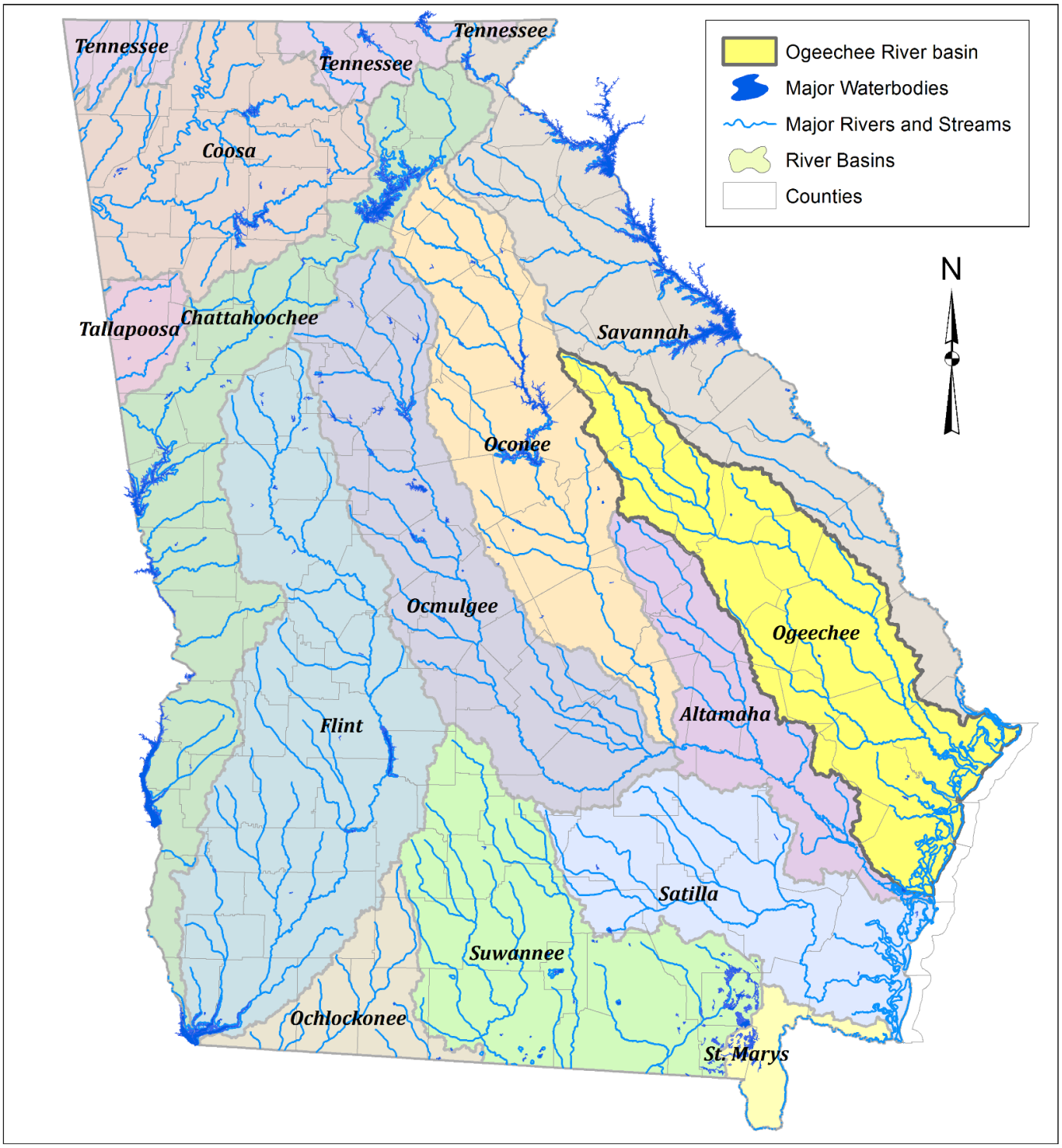

Figure 1. Location of the Ogeechee River Basin in the State of Georgia

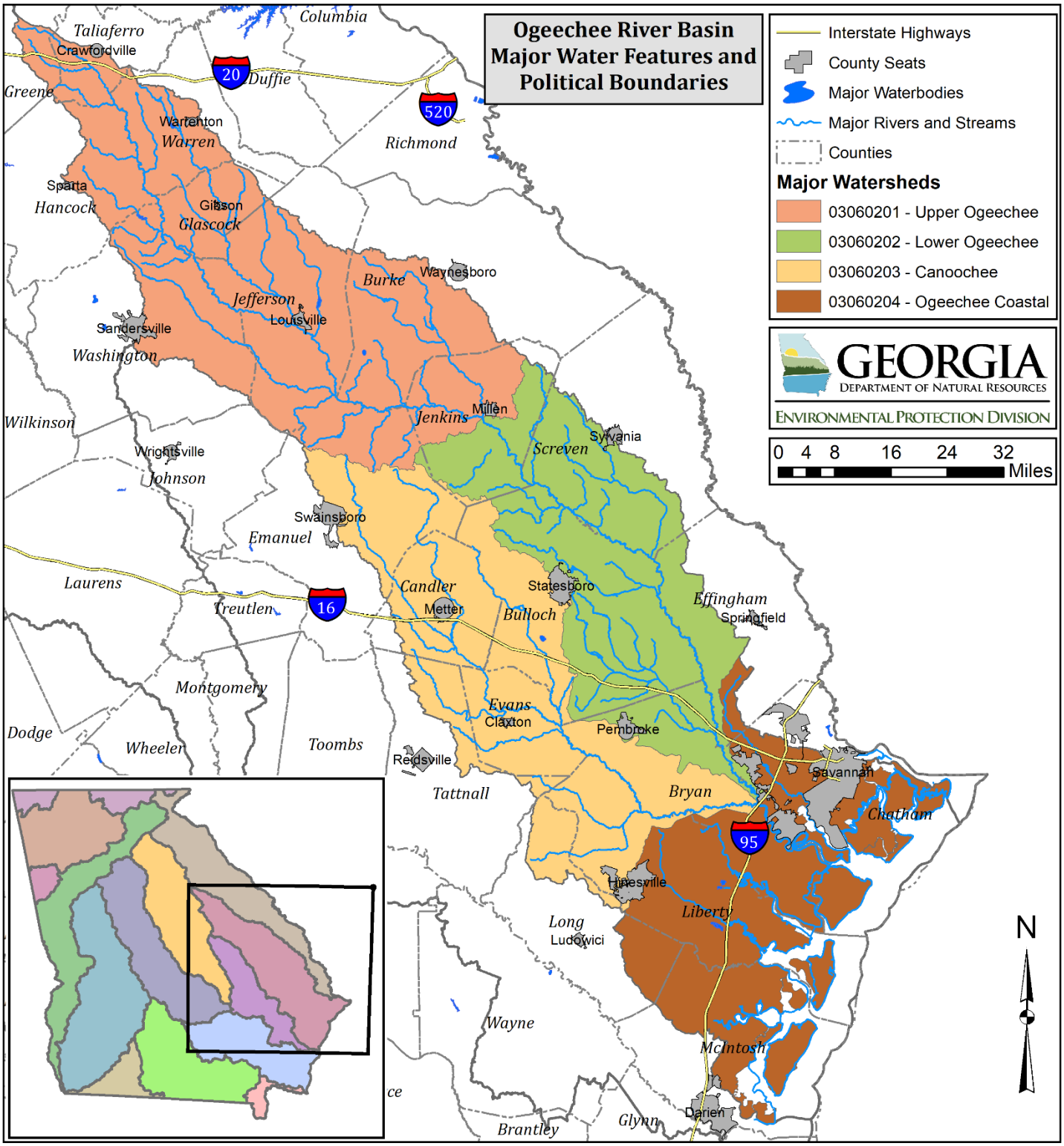

Figure 2. The Major Political Boundaries, Water Features, and U.S.G.S 8-digit Watersheds within the Ogeechee River Basin

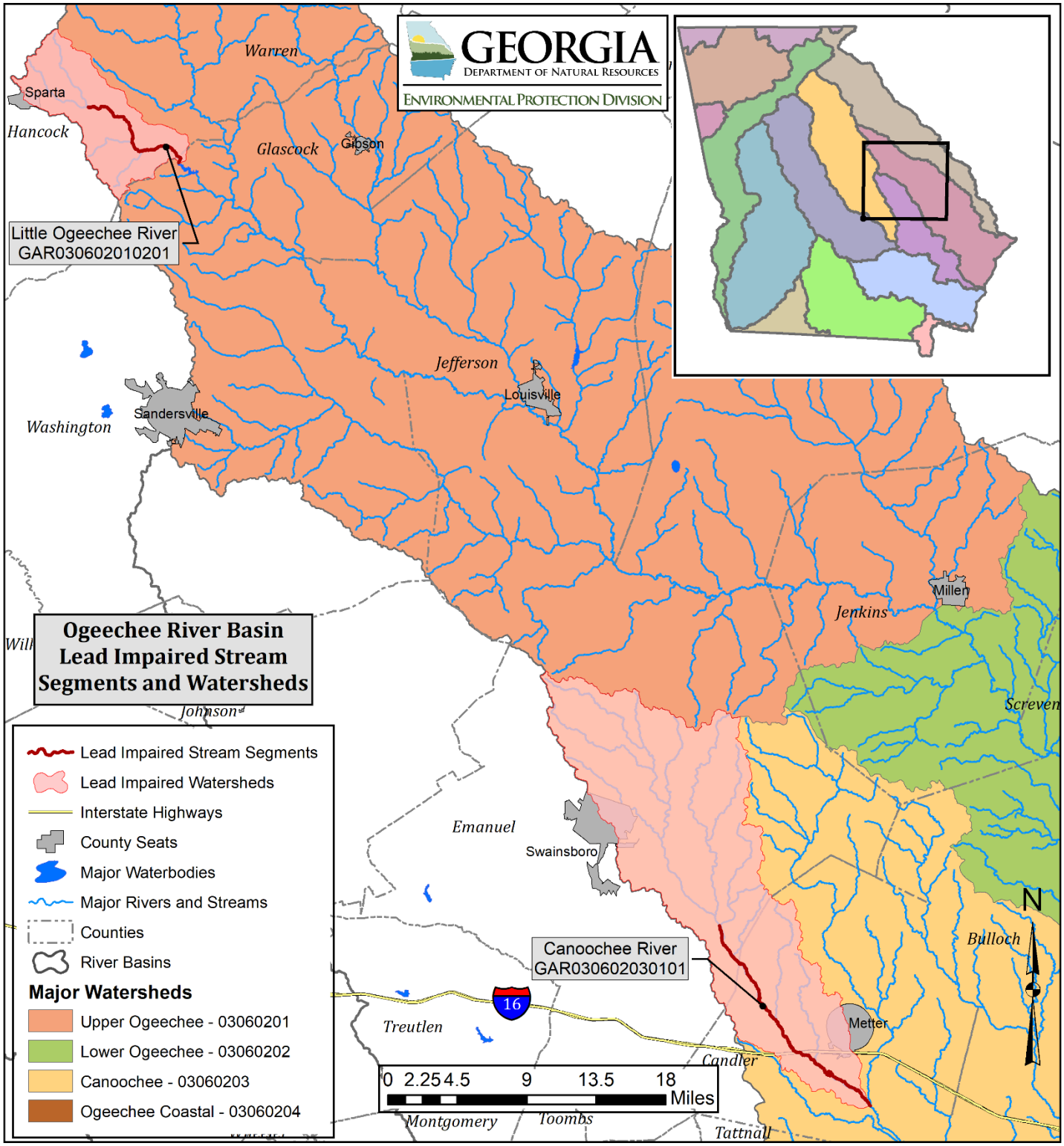

Figure 3. Location of Two 303(d) Stream Segments and their Associated Watersheds Impaired for Lead in the Ogeechee River Basin

The Ogeechee River originates in Greene County, in central Georgia. The headwaters of the Ogeechee River consist of the North and South Forks, which join to form the mainstem. The River then flows approximately 245 miles southeast to the Atlantic Ocean. The Canoochee River originates in Emanuel County and flows southeast to join the Ogeechee River near Richmond Hill. The Ogeechee River Basin contains parts of the Piedmont and Coastal Plain physiographic provinces, which extend throughout the southeastern United States.

The two non-supporting water bodies, the Canoochee River, and Little Ogeechee River are located in the Canoochee sub-basin (HU 03060203) and Upper Ogeechee sub-basin (HU 03060201), respectively. The Canoochee River headwaters originate in Emanuel County, north of the City of Swainsboro, Georgia. The River runs southeast through Emanuel, Candler, Evans, and Liberty Counties, and finally through Bryan County where it empties into the Ogeechee River north of the City of Richmond Hill, Georgia. The headwaters of the Little Ogeechee River are located near the center of Hancock County, north of the City of Sparta, Georgia. The River flows southeast into north Washington County where it joins the Ogeechee River.

The land use characteristics of the Ogeechee River Basin watersheds were determined using data from the Georgia Land Use Trends (GLUT) for Year 2015. This raster land use trend product was developed by the University of Georgia – Natural Resources Spatial Analysis Laboratory (NARSAL) and follows land use trends for years 1974, 1985, 1991, 1998, 2001, 2005, 2008, and 2015. The raster data sets were developed from Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+). Some of the NARSAL land use types were reclassified, aggregated into similar land use types, and used in the final watershed characterization. Table 2 lists the watershed land use distribution for the drainage areas of the two water bodies.

Table 2. Ogeechee River Watersheds Land Cover Distribution

Land Use Categories	Canoochee River		Little Ogeechee River	
	Acres	Percent	Acres	Percent
Open Water	1,043	0.80%	163	0.50%
Low Intensity Residential	2,932	2.10%	454	1.50%
High Intensity Residential	1,035	0.80%	89	0.30%
High Intensity Commercial, Industrial, Transportation	518	0.40%	40	0.10%
Bare Rock, Sand, Clay	61	0.00%	83	0.30%
Quarries, Strip Mines, Gravel Pits	0	0.00%	297	1.00%
Transitional	7,883	5.70%	1,913	6.20%
Forest	61,607	44.70%	20,899	67.50%
Row Crops	18,043	13.10%	1,475	4.80%
Pasture, Hay	17,011	12.30%	2,278	7.40%
Other Grasses (Urban, recreational; e.g. parks, lawns)	6,512	4.70%	1,438	4.60%
Woody Wetlands	21,170	15.30%	1,800	5.80%
Emergent Herbaceous Wetlands	141	0.10%	14	0.00%
Total	137,956	100.00%	30,943	100.00%

1.3 State Water Planning

The Georgia Legislature enacted the Metropolitan North Georgia Water Planning District Act in 2001 to create the Metropolitan North Georgia Water Planning District (MNGWPD) to preserve and protect water resources in the 15-county metropolitan Atlanta area. The MNGWPD is charged with the development of comprehensive regional and watershed specific water resource management plans to be implemented by local governments in the metropolitan Atlanta area. The MNGWPD issued its first water resource management plan documents in 2003.

In 2004, the Georgia Legislature enacted the Comprehensive State-wide Water Management Planning Act to ensure management of water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens on a state-wide level. GA EPD later developed the 2008 Comprehensive State-wide Water Management Plan, which established Georgia's ten Regional Water Planning Councils (RWPCs) and laid the groundwork for the RWPCs to develop their own Regional Water Plans. Figure 4 shows the boundaries of the RWPCs and the MNGWPD. The listed segment of the Canoochee River is located within the boundaries of the Altamaha Regional Water Planning Region, and the listed segment of the Little Ogeechee River lies within the Upper Oconee Water Planning Region boundaries.

In 2011, each RWPC finished development of individualized Regional Water Plans, which were later adopted following GA EPD review. These Regional Water Plans identify a range of actions or management practices to help meet the state's water quality and water supply challenges. The MNGWPD and each RWPC subsequently updated and revised their respective management plan documents in 2017. Implementation of these plans is critical to meeting Georgia's water resource challenges.

1.4 Water Quality Standards

The water use classification for the listed stream segments in the Ogeechee River Basin is Fishing. The Fishing classification, as stated in Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(6)(a) (EPD, 2018), is established to protect "Propagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality."

Chapter 391-3-6-.03(5)(e)(ii) of Georgia's Rules and Regulations establishes criteria for metals that apply to all waters in the State. The established chronic criterion and acute criterion for dissolved lead are as follows:

$$\text{acute criteria for dissolved lead} = (e^{(1.273[\ln(\text{hardness})] - 1.460)})(1.46203 - [\ln \text{hardness})(0.145712)]) \text{ µg/L}$$

$$\text{chronic criteria for dissolved lead} = (e^{(1.273[\ln(\text{hardness})] - 4.705)})(1.46203 - [\ln \text{hardness})(0.145712)]) \text{ µg/L}$$

The hardness of the water body is used in the above equations and is expressed in mg/L as $CaCO_3$.

The regulation cited above requires that instream concentrations of the dissolved metals shall not exceed the acute criteria, under 1Q10 or higher stream flow conditions, and shall not exceed the chronic criteria indicated above, under 7Q10 or higher stream flow conditions.

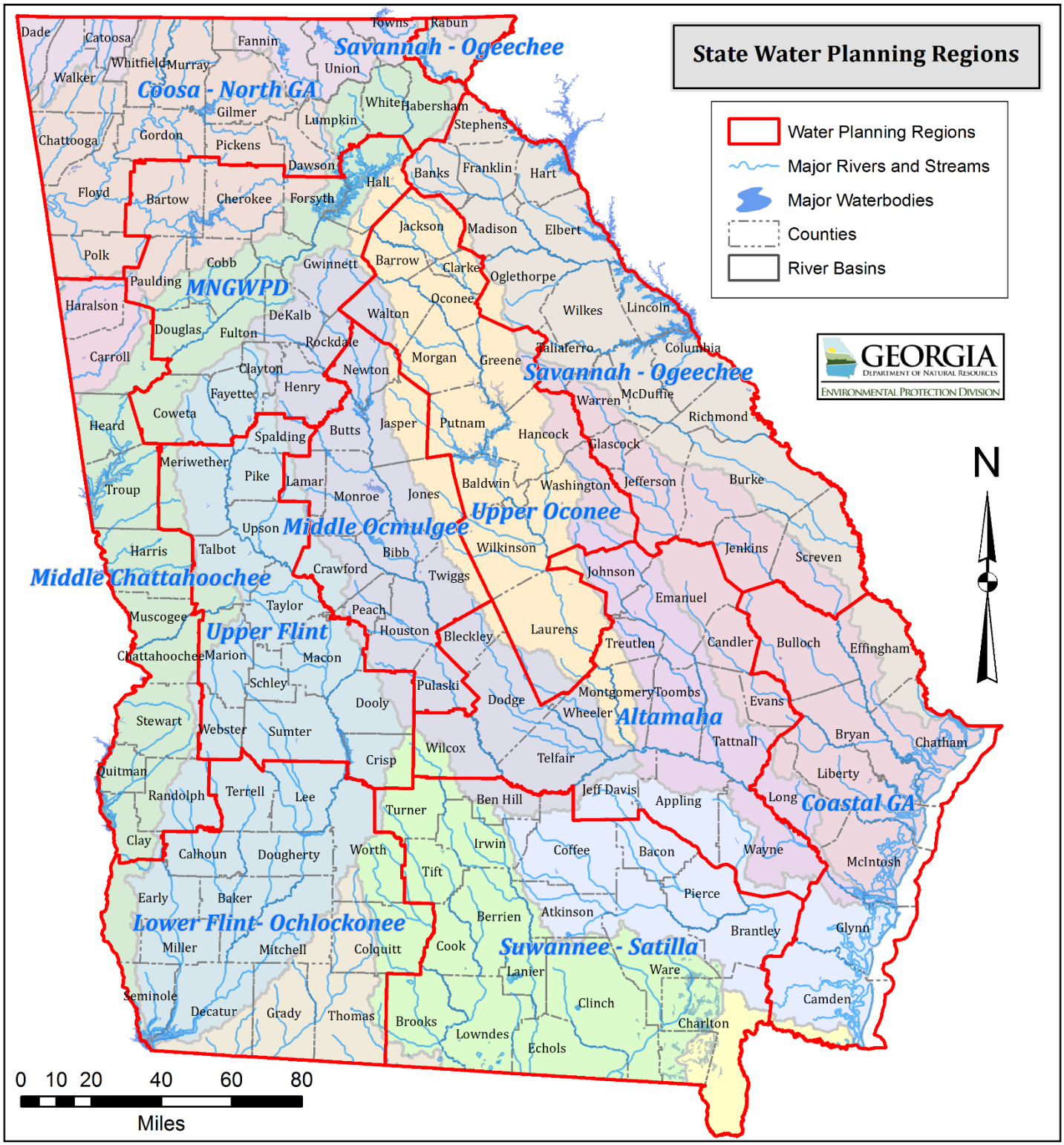

Figure 4. Boundaries of the Regional Water Planning Councils and the Metropolitan North Georgia Water Planning District.

1.5 Background Information for Lead

Lead is a naturally occurring element. The most common man-made sources of lead include lead-based paint in homes and buildings built before 1978, air emissions from industrial sources, plumbing materials, and leaded aviation gasoline. Although commercial and industrial uses of lead have been greatly curtailed, it is still commonly used in batteries, ammunition, metal products (solder and pipes), and for radiation shielding in TV screens and computer monitors, and for devices to shield against X-rays (CCME, 1999; NRC, 1980).

Long term human exposure to low levels of lead can cause anemia, loss of appetite, stomach pain, fatigue, effects on the nervous system, behavioral problems and learning disabilities, seizures, and even death. Young children absorb the metal more easily than adults, and even low-level exposure may harm intellectual development, behavior, size and hearing of infants (CCME, 1999).

Prior to the banning of lead as an automobile fuel additive in 1996, it commonly entered waterways through settling of particulate exhausts from motor vehicles and runoff from pavements. Lead also enters waterways through corrosion of leaded pipelines, corrosion of leaded paints, and runoff from industrial facilities manufacturing lead products. Aquatic ecosystems exposed to elevated levels of lead demonstrate losses in biodiversity. Decreases in growth and reproductive rates of aquatic animals and plants have been observed. Fish exposed to lead have exhibited blood and neurological changes. Lead shot and sinkers left from recreational hunting and fishing activities can be fatal to waterfowl and other wildlife that ingest these items (CCME, 1999; NRC, 1980).

2.0 WATER QUALITY ASSESSMENT

The impaired stream segments in the Ogeechee River Basin designated use support determination was made for lead based on water quality samples taken by the Georgia Environmental Protection Division (EPD) Watershed Planning and Monitoring Program for years 2010 and 2014.

The water quality data for all the listed segments are provided in Table 3. For comparison with Georgia's instream water quality standards, the total recoverable lead values must be converted to estimated equivalent dissolved concentrations using a calculated translator. The translation is based on total suspended solids (TSS). As the TSS increases, less of the total lead will be in dissolved form. The sample results presented in Table 3 include total recoverable lead, TSS, and the translated dissolved lead concentrations. It also shows the sample hardness values, and the calculated acute and chronic lead criteria for Georgia's instream water quality standards, which are based on the hardness using the equations presented in Section 1.4.

Table 3. Lead Data Collected from Ogeechee River Basin

Location (Site ID)	Date	Measured Total Recoverable Lead (µg/L)	Total Hardness (mg/L as $CaCO_3$)	TSS (mg/L)	Corresponding Dissolved Lead (µg/L)	Acute Criterion (µg/L)	Chronic Criterion (µg/L)
Canoochee River at SR 121 near Metter, GA (RV_02_316)	03/23/2010	1	8.2	4	0.21	3.91	0.15
	06/01/2010	< 1	10	18	ND	4.91	0.19
	09/07/2010	1.4	12	4.8	0.29	6.04	0.24
	12/14/2010	< 1	10	< 1	ND	4.91	0.19
Little Ogeechee River at Shoals Road (SR1098) near Culverton, GA (RV_02_280)	03/18/2014	1.1	7.7	20	0.18	3.64	0.14
	06/12/2014	9.8	20	7.5	1.89	10.79	0.42
	09/18/2014	< 1	17	7.2	ND	8.98	0.35
	12/08/2014	< 1	16	1.9	ND	8.38	0.33

ND = below the laboratory reporting limit

Four samples were collected from the Canoochee River in 2010 at EPD Site RV_02_316, located at the State Route 121 bridge near Metter, Georgia. Lead concentrations were below the laboratory reporting limit in the samples collected in June and September (Table 3). Lead values were greater than the chronic criterion in the samples collected in March and September. No exceedances of the acute criterion were observed.

Four samples were collected from the Little Ogeechee River during 2014 at EPD Site RV_02_280 at the Shoals Road bridge near Culverton, GA. Lead concentrations were below the laboratory reporting limit in the samples collected in September and December (Table 3). Lead concentrations exceeded the chronic criterion in samples collected in March and June. No exceedances of the acute criterion were observed.

The measured exceedances of the lead chronic criterion resulted in the Canoochee River being placed on Georgia's 2014 303(d) list, and the Little Ogeechee River being placed on Georgia's 2016 303(d) list.

3.0 SOURCE ASSESSMENT

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

3.1 Point Source Assessment

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

3.1.1 Wastewater Treatment Facilities

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

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

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

For purposes of this TMDL, NPDES permitted wastewater treatment facilities are considered point sources, and include municipal, industrial, private, and Federal facilities. Currently, there are no municipal NPDES permitted wastewater treatment facilities discharging into the Canoochee River watershed, and two industrial NPDES permitted facilities in the Little Ogeechee watershed. Neither of these facilities have permit limits or monitoring requirements that include lead or lead compounds. These facilities are summarized in Table 4.

Effluent sampling for lead should be incorporated into each facility's NPDES permit in order to evaluate if each discharge contributes to the violation of the lead water quality criteria. Facility effluent monitoring should be performed periodically over a period not to exceed one permit cycle and utilize analytical methods that have a sufficiently low method detection limit so that comparisons to the water quality criteria may be made.

Table 4. NPDES Permitted Facilities Discharging Upstream of Impaired Segments in the Ogeechee River Basin

Water Body	NPDES Permittees	Permit No.	Permit Type
Little Ogeechee River	Aggregates USA, LLC (Sparta Quarry)	GA0039004	Industrial
	Hanson Aggregates Southeast, LLC (Sparta Quarry	GA0046493	Industrial

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

3.1.2 Regulated Storm Water Discharges

Certain sources of storm water runoff are covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe pollutant limits, storm water NPDES permits establish controls that are intended to reduce the quantity of pollutants that storm water picks up and carries into storm sewer systems during rainfall events. Currently, regulated storm water discharges include those associated with industrial activities, construction sites one acre or greater, large and medium municipal separate storm sewer systems (MS4s), and small MS4s serving urbanized areas.

3.1.2.1 Industrial General Storm Water NPDES Permit

Storm water discharges associated with industrial activities are currently covered under Georgia's General Industrial Storm Water NPDES Permit (GAR050000). This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), preparation of a Storm Water Pollution Prevention Plan (SWPPP), and annual reporting. The Industrial General Permit requires that storm water discharging into an impaired stream segment or within one linear mile upstream of, and within the same watershed as, any portion of an impaired stream segment identified as "not supporting" its designated use(s), must satisfy the requirements of Appendix C of the permit if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to storm water as a result of industrial activity at the site. If a facility is covered under Appendix C of the Industrial General Permit, then benchmark monitoring for the pollutant(s) of concern is required. One facility is located in the Canoochee River watershed that is covered under the Industrial General Permit and is considered to have the potential for discharging lead based on their SIC Code, Sector designation, and required benchmark sampling, as shown in Table 5. There are no facilities within the Little Ogeechee Watershed covered under the Industrial General Permit considered to have the potential for discharging lead based on their SIC Code and Sector designation.

Table 5. Industrial General Permit Facilities That Are Potential Sources for Lead in Storm Water Runoff

Facility Name	SIC Code	Sector No.	Type of Business	Watershed	Facility Status
Southern Metals Recycling	5093-01	N2	Metals collection, sorting, recycling	Canoochee River	active

Source: Nonpoint Source Program, GA DNR, 2019

3.1.2.2 MS4 NPDES Permits

The collection, conveyance, and discharge of diffuse storm water to local water bodies by a public entity are regulated in Georgia by the NPDES MS4 permits. These MS4 permits have been issued under two phases. Phase I MS4 permits cover medium and large cities, and counties with populations over 100,000. Each individual Phase I MS4 permit requires the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990).

Small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. All municipal Phase II permittees are authorized to discharge under Storm Water General Permit GAG610000. Department of Defense facilities are authorized to discharge under Storm Water General Permit GAG480000. GDOT owned or operated facilities are authorized to discharge under Storm Water General Permit GAG410000. Under these general permits, each permittee must design and implement a SWMP that incorporates BMPs that focus on public education and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction storm water management, and pollution prevention in municipal operations.

There are no MS4 permittees located within the Canoochee River or Little Ogeechee River drainages.

3.2 Nonpoint Source Assessment

In general, nonpoint sources cannot be identified as entering a water body through a discrete conveyance at a single location. In urban areas, a large portion of the storm water contribution may enter waterways as point sources from MS4 NPDES permitted outfalls, or from industrial sites covered under the Georgia Industrial General Permit. The remainder of the storm water runoff will come from nonpoint sources.

Potential nonpoint sources include the following:

- Storm water runoff as overland flow from improper disposal of waste materials;
- Deposition of particulates from air emissions;
- Contaminated groundwater seepage;
- Leaking or overflowing sanitary sewer lines;
- Failing septic systems;
- Leachate from landfills within the watershed;
- Storm water runoff from private outfalls not covered under NPDES MS4 permits;

- Storm water runoff from industrial sites not currently included under the Georgia General Industrial Permit;
- Residual from banned leaded gasoline
- Lead from banned and legal sources related to hunting and fishing activities

An assessment of the potential sources of lead in impaired stream segments was performed using available resources, which included the following databases:

- USEPA Toxics Release Inventory (TRI)
- USEPA Superfund Enterprise Management System (SEMS)
- USEPA Brownfields Program
- EPD Brownfields Public Record
- EPD Hazardous Site Inventory (HSI)
- EPD Inventory of Permitted Solid Waste Disposal Facilities

3.2.1 Toxic Release Inventory (TRI)

The TRI is a database maintained by the USEPA that provides information about facilities that handle toxic chemicals. Facilities in certain industry sectors that manufacture, process, or otherwise use these chemicals in amounts above established levels, must report how each chemical is managed. The TRI contains information about releases of these chemicals to the environment, including air emissions, surface water discharges, releases to the land, and off-site transport to disposal facilities.

One facility included on the TRI is located within the lead-impaired segment of the Canoochee River watershed. However, this facility has had no reported releases of lead or lead compounds into the environment through air stack emissions, water discharges, and land disposal above established reportable levels.

3.2.2 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites

The Comprehensive Environmental Response, Compensation, and Liability Act, otherwise known as CERCLA or Superfund, along with the Superfund Amendments and Reauthorization Act (SARA) of 1986, provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. CERCLA authorizes two kinds of response actions. Short-term removals address releases or threatened releases requiring prompt response. Long-term remedial response actions permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. The long-term response actions can be conducted only at sites listed on EPA's National Priorities List (NPL). EPA maintains SEMS (formerly CERCLIS), which is a list of active and former Superfund sites for all States in the U.S. A total of five sites with lead contamination were included in SEMS that are located within the impaired stream segment watershed of the Canoochee River. Information for these sites is provided in Table 6. No CERCLA sites were located within the impaired segment watershed of the Little Ogeechee River.

Table 6. CERCLA Sites in the Canoochee River Watershed with Lead Contamination

Facility Name	Watershed	Media Contaminated	Type of Business	Facility Status	CERCLA Status
Chemetron Fire Systems (formerly Figgie Fire Systems)	Canoochee River	groundwater, soil	manufacture, sales fire suppression systems	active	Non-NPL archived
Former Automatic Sprinkler Co Of America	Canoochee River	groundwater, soil	manufacture, sales fire suppression systems	active	Non-NPL archived
Swainsboro Print Works	Canoochee River	soil	cloth printing	closed	Non-NPL active
Twin City Manufacturing Company (currently Stitch-N-Print, Inc.)	Canoochee River	groundwater	clothes manufacture	active	Non-NPL archived
Wilson Enterprises, Inc. (currently Dealers Supply Garden Center)	Canoochee River	surface water, soil	farm, garden, lawn machinery	active	Non-NPL active

USEPA SEMS, 2019
NPL = National Priorities List

3.2.3 Hazardous Site Index (HSI)

The HSI is maintained by EPD. Industrial sites are placed on the list by EPD when there has been a known release into the environment of a regulated substance above a reportable quantity that may pose a risk to human health and the environment. There are no sites that are included on the HSI within the watersheds of the impaired segments of the Canoochee River or Little Ogeechee River known to have released lead or lead compounds above a reportable quantity as determined by EPD.

3.2.4 Brownfields

A brownfield is a property on which activities, often by former owners or tenants, have resulted in the presence or potential presence of a hazardous substance, pollutant, or contaminant. EPA maintains a list of known brownfields that have been identified as potential candidates for cleanup activities through its Brownfields program, and for sites where cleanup operations are underway or have been completed. Georgia has developed a public record of Brownfields located within the State through funding provided by the EPA. The Brownfield public record is maintained by EPD's Land Protection Branch Brownfield Development Unit.

There are no properties on EPA's Brownfields list or EPD's Brownfield Public Record that are located within the watersheds of the lead-impaired segments of the Canoochee River or Little Ogeechee River.

3.2.5 Solid Waste Disposal Facilities

Leachate from landfills may contain dissolved lead or lead compounds that could at some point reach surface waters. Sanitary landfills receive household wastes that may include household

and yard chemicals and relatively small amounts of construction and demolition wastes generated from private homeowner activities. Designated construction/demolition landfills receive the vast majority of wastes from these activities. Older sanitary landfills were not lined and most have been closed. Those landfills that are not lined and remain active, operate as construction/demolition landfills. Currently, active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling. There is one known landfill located within the watershed of the lead-impaired segment of the Little Ogeechee River, as shown in Table 7. This landfill is no longer active and has been closed. Groundwater monitoring data for this landfill shows lead not to be a parameter of concern. A permit application has been submitted for the construction of a sanitary landfill to be located in the watershed of the lead-impaired segment of the Canoochee River.

Table 7. Landfills In Watersheds of 303(d) Listed Segments in the Ogeechee River Basin

Name	Permit No.	Landfill Type	County	Status	Watershed
Sparta - Fairmont/Stockade Rds	070-002D(SL)	Sanitary	Hancock	Closed	Little Ogeechee River

Source: EPD Land Protection Branch – Solid Waste Management Program, 2019

3.2.6 Land Application Systems

Many smaller communities and industrial facilities use land application systems (LAS) for treatment of their wastewaters. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying the wastewater, resulting in surface runoff from the field. If not properly bermed, this runoff may discharge to nearby surface waters. There is one municipal permitted LAS located in the Canoochee River watershed. This facility does not have lead limits in the permit, and is currently not considered a source. There are no permitted LAS systems located within the Little Ogeechee River watershed.

3.3 Additional Potential Sources

There are other potential sources of lead that can sometimes be significant. Former sources of lead that have since been banned by Federal mandates include:

- Lead-based paints
- Lead water lines
- Leaded gasoline
- Lead shot used for waterfowl hunting

Although these materials are no longer produced, many still exist in the environment and may continue to act as nonpoint sources. Fishing tackle products and ammunition other than that used for hunting waterfowl are still allowed to contain lead and are considered not to be significant sources.

4.0 TMDL DEVELOPMENT APPROACH

The process of developing lead TMDLs for the Ogeechee River Basin listed water bodies includes the determination of the following:

- The current critical lead load to the impaired water bodies under existing conditions;
- The TMDL for similar conditions under which the current load was determined; and
- The percent reduction in the current critical lead load necessary to achieve the TMDL.

An important component of TMDL development is to establish relationships between source loadings and in-stream water quality. In this section, the mathematical modeling techniques used to develop the TMDL are discussed.

4.1 Steady-State Approach

Steady-state models are applied for "critical" environmental conditions that represent extremely low assimilative capacity. Critical environmental conditions correspond to drought flows. The assumption behind steady-state modeling is that point and nonpoint source discharge concentrations that protect water quality during low-flow critical conditions will be protective for most environmental conditions that occur. Mass balance equations are used to model the critical conditions and calculate allocations.

4.2 Critical Conditions

The critical flow conditions for these TMDLs occur when the ratio of effluent or contaminated storm water to stream flow is the greatest. The TMDLs are presented in two ways: first, as total daily mass loads for the low flow conditions; and second, loads as a function of the total flow at any given time.

In the first case, total daily mass loads for the low flow conditions are given. Minimum flows are represented by the 1-day, 10-year minimum (1Q10) statistical flow value and 7-day, 10-year minimum (7Q10) statistical flow. It is assumed that these are the critical conditions for aquatic life. The 1Q10 and the acute criteria provide protection of the acute standard, and the 7Q10 and chronic criteria provide protection of the chronic standard.

Available flow data for the impaired stream segments is limited. Therefore, the critical 1Q10 and 7Q10 flows were developed using 1Q10 and 7Q10 data determined by the USGS for nearby streams (Gotvald, 2016). These streams had relatively similar watershed characteristics, including land use, slope, and drainage area. The critical stream flows for the impaired stream segments were estimated by first calculating the average productivity values (i.e., ratio of flow and drainage area) for the 1Q10 and 7Q10 flows of the nearby streams. The 1Q10 and 7Q10 critical flows for impaired stream segments were estimated by determining the product of the average productivity values and impaired stream segments drainage areas. These calculations are presented in Appendix A. Table 8 provides the estimated 1Q10 and 7Q10 flows associated with each this segment.

Table 8. Minimum Flows Associated with Lead Impaired Segments in the Ogeechee River Basin

Stream Segment	1Q10		7Q10	
	cfs	MGD	cfs	MGD
Canoochee River	0.3	0.21	0.4	0.26
Little Ogeechee River	3.2	2.05	3.6	2.31

In the second case, the TMDLs are expressed as equations that show the loads as a function of the total flow at any given time. Since instantaneous samples are used to evaluate compliance with the standards, as well as the need for a TMDL, this flow dependent load, or concentration approach, is more meaningful. This approach considers seasonal variability and makes it easier to evaluate compliance with the TMDL.

The general equations for the critical load and the TMDL are:

$$L_{critical} = C_{critical} \times Q_{est}$$

Where:
- $L_{critical}$ = current critical lead load
- $C_{critical}$ = lead concentration
- Q_{est} = instantaneous flow

and:

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

Where:
- TMDL = total maximum daily lead load
- $C_{criterion}$ = lead criterion
- Q_{est} = estimated instantaneous flow

Since instantaneous samples are used to evaluate compliance with the standards, as well as the need for a TMDL, this flow dependent load, or concentration approach makes it easier to evaluate compliance with the TMDL.

The difference between the current critical load and the TMDL represents the load reduction required for the impaired water body to meet the appropriate instream lead standard. If a single sample exceeds the lead criterion, then the TMDL is based on the criteria exceedance requiring the largest load reduction. The percent load reduction can be expressed as follows:

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

For the impaired water bodies in the Ogeechee River Basin, there were no exceedances of the acute lead criterion. Therefore, the critical loads were evaluated against the chronic criterion.

The acute and chronic criteria for metals are expressed as the dissolved fraction. The criteria are calculated based on the hardness of the receiving stream (see Section 1.3 for equations). A lower

hardness results in a higher proportion of metal in the dissolved form, resulting in a more conservative criterion.

In order to convert measured total recoverable lead concentrations to estimated dissolved lead concentrations, a translator is calculated. This translator is dependent on the instream TSS concentration. As the TSS concentration increases, a smaller percent of the metal is in the dissolved form. The equations used to calculate the translator are taken from EPA guidance (USEPA, 1994; USEPA, 1996). The ratio of the total measured metal concentration (C_t) to the calculated dissolved concentration (C_d) is the translator. The equations are provided below for reference.

$$C_t/C_d = 1 + K_d \times TSS \times (10^{-6}\ kg/mg)$$

Where: K_d = partition coefficient for lead (L/kg)
TSS = total suspended solids concentration (mg/L)

The partition coefficient for lead:

$$K_d = K_{po} \times TSS^a$$

Where: K_{po} * = 2.8×10^6
a * = -0.8

* Note: It is important to note that the authors of EPA's "*Technical Guidance Manual*" derived the above values for the 'K_{po}' coefficient and the 'a' exponent based on the statistical analysis of 2,253 data records collected from rivers and streams distributed throughout the United States.

Instream TSS data are also available for the listed segments. Table 9 shows the average TSS and corresponding translator, average hardness, and dissolved acute and chronic criterion for the each of the impaired stream segments.

Results for sample analyses of metals are commonly reported as a total (or total recoverable) concentration. Because the criteria are for the dissolved fraction of the metals, Georgia Regulation 391-3-6-.03(5)(e)(ii) (EPD, 2015) allows USEPA's "Guidance Document of Dynamic Modeling and Translators, August 1993" (USEPA, 1994) to be used for "translating" the total recoverable concentration to the dissolved form. In addition, Georgia Regulation 391-3-6-.06(4)(d)5.(ii)(b)(2) allows methods from this EPA guidance document to be used to translate dissolved criteria concentrations into total recoverable permit limits. Metals effluent permit limitations are required to be expressed as total recoverable metal per 40 CFR §122.45(c).

Table 9. Instream Dissolved Acute and Chronic Criteria for Lead for the Impaired Stream Segments in the Ogeechee River Basin

Stream Segment	Average Values for calculating Pb criterion			Dissolved Pb Acute Criterion (µg/L)	Dissolved Pb Chronic Criterion (µg/L)
	TSS (mg/L)	Translator	Total Hardness (mg/L as $CaCO_3$)		
Canoochee River	7.0	0.195	10.1	4.96	0.19
Little Ogeechee River	9.2	0.186	15.2	7.91	0.31

5.0 ALLOCATIONS

A TMDL is the amount of a pollutant that can be assimilated by the receiving water body without exceeding the applicable water quality standard. The TMDLs for lead are based on the acute and chronic instream standards for these metals. A TMDL is the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given water body. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, which accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For lead the TMDLs are expressed as mass per day and as a concentration. A TMDL is expressed as:

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

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

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

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

5.1 Waste Load Allocations

5.1.1 Wastewater Treatment Facilities

The waste load allocation (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources represented by municipal and industrial wastewater treatment systems that have NPDES effluent limits. The facilities with NPDES discharge permits that discharge upstream of the impaired segments are summarized in Table 10. Currently, there are no NPDES-permitted wastewater treatment facilities with lead limits or monitoring requirements that discharge into the impaired streams.

Effluent sampling for lead should be incorporated into each facility's NPDES permit in order to evaluate if each discharge contributes to the violation of the lead water quality criteria. Facility effluent monitoring should be performed periodically over a period not to exceed one permit cycle and utilize analytical methods that have a sufficiently low method detection limit so that comparisons to the water quality criteria may be made.

Table 10. NPDES Permitted Facilities Discharging Upstream of Impaired Segments in the Ogeechee River Basin

Water Body	NPDES Permittees	Permit No.	Permit Type
Little Ogeechee River	Aggregates USA, LLC (Sparta Quarry)	GA0039004	Industrial
	Hanson Aggregates Southeast, LLC (Sparta Quarry	GA0046493	Industrial

In the future, if any wastewater treatment facilities are permitted to discharge lead to the impaired stream segments in the Ogeechee River Basin, the WLA loads will be calculated using the effluent design flow. Since some NPDES permits do not have a flow limitation, a TMDL expressed only in mass per day is not appropriate. It is more accurate and conservative to assign a wasteload allocation as a concentration. The mass limit for any value of flow (Q) will then be calculated by multiplying flow times concentration. The WLA requires that the effluent concentration from each point source not exceed the allowable instream metal concentration at the end of pipe without any dilution. The WLA is represented by the equation:

$$WLA = \Sigma Q_{WLA} \times \text{metal criterion (acute or chronic)}$$

where: ΣQ_{WLA} = sum of all current, potential, and future NPDES permitted wastewater treatment discharges

5.1.2 Regulated Storm Water Discharges

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

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

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

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

$WLA_{SW} = Q_{WLASW} \times$ metal criterion (acute or chronic)

where: WLA_{SW} = Wasteload Allocation for permitted storm water runoff from all MS4 urban areas
Q_{WLASW} = runoff from all MS4 urban areas conveyed through permitted storm water structures
ΣQ_{urban} = sum of all permitted storm water runoff from all MS4 urban areas

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

5.2 Load Allocations

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

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

It is not known how much of the lead contributions to the impaired stream segments are from nonpoint sources. Generally, there are two types of load allocations in the creek: 1) loads associated with the accumulation of metals on land surfaces that are washed off during storm events, and; 2) loads independent of precipitation, such as seepage of contaminated groundwater, leachate from landfills, failing septic systems, leaking sewer system collection lines, and background loads. Available data suggests that lead introduced to the impaired stream segments are both from storm water runoff and from other sources not related to storm events. At this time, it is not possible to partition the various sources of load allocations. In the future, after additional data has been collected, it may be possible to partition the load allocation by source.

The instream concentrations of hardness used to determine the lead criteria, along with historical low-flow data, are used to determine the load allocations for the impaired stream segments under critical conditions. The Canoochee River and Little Ogeechee River tend to have soft water with a water hardness of no more than 20 mg/L as $CaCO_3$. The load allocations during 1Q10 and 7Q10 flow conditions are calculated as follows:

To protect against the acute effects of dissolved metals:

allowable loading (kg/d) = dissolved acute criterion (µg/L) x 1Q10 (MGD) x units conversion

where: units conversion = 3.785 L/gallon x 10^{-9} kg/µg

dissolved acute criterion = $(e^{(1.273[\ln(\text{hardness})] - 1.460)})(1.46203 - [\ln \text{hardness})(0.145712)])$ µg/L

To protect against the chronic effects of dissolved metals:

allowable loading (kg/d) = dissolved chronic criterion (µg/L) x 7Q10 (MGD) x units conversion

where: units conversion = 3.785 L/gallon x 10^{-9} kg/µg

dissolved chronic criterion = $(e^{(1.273[\ln(\text{hardness})] - 4.705)})(1.46203 - [\ln \text{hardness})(0.145712)])$ µg/L

The critical conditions load allocations for lead, using the representative instream hardness values given Table 9, are presented in Table 11.

Table 11. Load Allocations (LA) for Dissolved Lead under Critical Conditions for the Impaired Stream Segments in the Ogeechee River Basin

Stream Segment	Criteria	Dissolved Pb Criteria Concentration (µg/L)	Critical Flow (MGD)	Allowable Load Allocation (kg/day)
Canoochee River	Acute	4.96	0.21	3.94×10^{-3}
	Chronic	0.19	0.26	1.87×10^{-4}
Little Ogeechee River	Acute	7.91	2.05	6.14×10^{-2}
	Chronic	0.31	2.31	2.71×10^{-3}

5.3 Seasonal Variation

The low flow critical conditions incorporated in this TMDL are assumed to represent the most critical design conditions and provide year-round protection of water quality. The base flow of a stream will generally range from low flows during critical conditions to higher flows at other times. Runoff from storm events will contribute additional flow to the stream. Seasonal variability in flow is addressed by expressing the TMDL as a concentration, as well as a load associated with different flows. The LA for all flows and conditions can be described by the following equation:

$LA = Q_{LA}$ x metal criterion (acute or chronic)

$Q_{LA} = [Q_{Total} - (\Sigma Q_{WLA} + \Sigma Q_{WLASW})]$

where:
- LA = load allocation
- Q_{LA} = flow from all nonpoint sources
- Q_{Total} = total flow in the creek
- ΣQ_{WLA} = sum of all current, potential, and future NPDES permitted wastewater treatment discharges
- ΣQ_{WLASW} = sum of all permitted storm water runoff from MS4 urban areas

5.4 Margin of Safety

The MOS is a required component of TMDL development. As specified by section 303(d) of the CWA, the margin of safety must account for any lack of knowledge concerning the relationship between effluent limitations and water quality. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations.

The MOS was implicitly incorporated into the TMDLs through the use of the critical conditions established in Section 4.2 of this report. Through the use of low flow conditions and conservative hardness values the margin of safety for these TMDLs adequately accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality.

5.5 TMDL Results

The TMDL for any condition will be based on the flow of creek, instream hardness, as well as the discharge flow of a permitted discharger. The TMDLs for lead are summarized in Table 12.

Table 12. Lead TMDL Summary for the Impaired Stream Segments in the Ogeechee River Basin

Stream Segment	Criteria	Current Load	WLA	WLA_{SW}*	LA	MOS	TMDL	Reduction
Canoochee River	Chronic	Q x 0.21 µg/L	-	-	1.87×10^{-4} kg/day for the 7Q10 ΣQ_{LA} x 0.19 µg/L for all conditions and flows	Implicit	1.87×10^{-4} kg/day + WLA for the 7Q10 Q_{total} x 0.19 µg/L for all conditions and flows	28.5%
	Acute	Q x 0.21 µg/L	-	-	3.94×10^{-3} kg/day for the 1Q10 ΣQ_{LA} x 4.96 µg/L for all conditions and flows	Implicit	3.94×10^{-3} kg/day + WLA for the 1Q10 Q_{total} x 4.96 µg/L for all conditions and flows	0%
Little Ogeechee River	Chronic	Q x 1.89 µg/L	-	-	2.71×10^{-3} kg/day for the 7Q10 ΣQ_{LA} x 0.31 µg/L for all conditions and flows	Implicit	2.71×10^{-3} kg/day + WLA for the 7Q10 Q_{total} x 0.31 µg/L for all conditions and flows	77.8%
	Acute	Q x 1.89 µg/L	-	-	6.14×10^{-2} kg/day for the 1Q10 ΣQ_{LA} x 7.91 µg/L for all conditions and flows	Implicit	6.14×10^{-2} kg/day + WLA for the 1Q10 Q_{total} x 7.91 µg/L for all conditions and flows	0%

* Based on the Draft EPA Interoffice Memorandum on "*Estimating Water Quality Loadings from MS4 Areas,*" dated 12/19/02: "If the critical period is a low flow event, the load from the MS4 does not have to be quantified and a WLA for the storm water sources is not necessary…"

6.0 RECOMMENDATIONS

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

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

6.1 Monitoring

The Canoochee River was sampled by EPD in 2010 at SR 121 near Metter, Georgia (RV_02_316), for metals. Exceedances of the chronic criteria for lead were observed and the Canoochee River from State Highway 192 to Fifteen Mile Creek was placed on the 303(d) list.

The Little Ogeechee River was sampled by EPD in 2014 at SR 1098 (Shoals Road) near Culverton, Georgia (RV_02_280), for metals. Exceedances of the chronic criteria for lead were observed and the Little Ogeechee River from Two Mile Creek to Hamburg Mill Pond was placed on the 303(d) list.

It is recommended that EPD water quality sampling be continued on the Canoochee River and the Little Ogeechee River to monitor lead concentrations at the locations that are detailed above. Water quality sampling locations should also be added upstream of the previously sampled locations to aid in lead source assessment.

Effluent sampling for lead should be incorporated into each facility's NPDES permit in order to evaluate and characterize each discharge. Facility effluent monitoring should be performed periodically over a period not to exceed one permit cycle and utilize analytical methods that have a sufficiently low method detection limit so that comparisons to the water quality criteria may be made.

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

6.2 Management Practices

Based on findings of the source assessment, there are potential point and nonpoint sources for lead to the impaired stream segments. These are discussed in more detail in Section 3. Potential point and nonpoint sources within the Canoochee River watershed include permitted storm water runoff from an industrial site, and non-permitted runoff from existing and former

industrial Superfund sites where improper management and disposal of waste materials were practiced. Potential legacy sources of lead that are currently under Federal bans include lead-based paints, lead water lines, leaded gasoline, and lead shot from waterfowl hunting.

Management practices are recommended to reduce lead source loads to the impaired stream segments, with the result of achieving the instream standard criteria for these metals. These recommended management practices include:

- Compliance with future NPDES treated wastewater permit requirements;
- Compliance with NPDES Industrial General Permit requirements, including where applicable, achieving benchmarks for monitored constituents;
- Ensure storm water management plans are in place and being implemented by the local governments, and by the industrial facilities located in the watershed;
- Continue working with Federal, State, and local agencies and owners of sites where cleanup measures are necessary, and in developing control measures to prevent future releases of constituents of concern;
- Implementation of recommended Water Quality management practices in the *Altamaha Regional Water Plan* (2017), and the *Upper Oconee Regional Water Plan* (2017);
- Application of Best Management Practices (BMPs) appropriate to both urban and rural land uses, where applicable.

6.2.1 Point Source Approaches

Point sources are defined as discharges of treated wastewater or storm water into rivers and streams at discrete locations. The NPDES permit program provides a basis for municipal, industrial, and stormwater permits, monitoring and compliance with permits limitations, and appropriate enforcement actions for violations. In accordance with EPD rules and regulations, all discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times.

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

6.2.2 Nonpoint Source Approaches

Nonpoint sources cannot be identified as entering a water body through a discrete conveyance at a single location. The diffuse and varied nature of nonpoint sources (e.g., agriculture, construction, mining, silviculture, urban runoff) create a challenge for their effective control. EPD is the lead agency for implementing the State's Nonpoint Source Management Program, as described in Georgia's *Statewide Nonpoint Source Management Plan* (EPD, 2014b). The Program is designed to comply with the Clean Water Act of 1987 with administrative guidance from the USEPA. The *Statewide Nonpoint Source Management Plan* combines regulatory and nonregulatory approaches, in cooperation with other Federal, State and local governments,

State colleges and universities, businesses and industries, nonprofit organizations, and individual citizens. Georgia will continue working with local governments, agricultural, and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission to foster the implementation of BMPs that address nonpoint source pollution. The following sections describe Federal and State programs in place and recommendations which should minimize the potential for nonpoint source loads of lead and lead compounds in Georgia's surface waters.

6.2.2.1 Waste Management

The Resource Conservation and Recovery Act (RCRA) gives the USEPA the authority to control hazardous waste from the "cradle-to-grave." In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. In Georgia, government and businesses that generate or store hazardous waste are regulated by the Hazardous Waste Management Programs of the Land Protection Branch (LPB) of EPD. EPD, in turn, passes on the information to regional and national EPA offices. EPA maintains the Toxics Release Inventory, a database of industrial facilities that have had releases of hazardous chemicals at reportable quantities (TSI). Facilities that handle lead compounds will continue to be monitored under these programs.

The Comprehensive Environmental Response, Compensation, and Liability Act, otherwise known as CERCLA or Superfund, along with the Superfund Amendments and Reauthorization Act (SARA) of 1986, provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. EPA maintains SEMS (formerly CERCLIS), which is a list of active and former Superfund sites for all States in the U.S. These sites are normally managed at the State Level, including cleanup actions. In Georgia, this is the responsibility of the LPB under its Hazardous Waste Management Programs. Several industrial sites within impaired stream segment watersheds have been placed on the Georgia Hazardous Site Inventory as a result of releases of regulated substances in reportable quantities considered hazardous to human health and the environment. EPD's Response and Remediation Program has been working with the owners towards cleanup of the sites, and implementing BMPs that will minimize these releases.

The LPB manages the disposal and treatment of solid waste through the permitting of municipal and industrial solid waste landfills, and oversees surface mining permitting and reclamation. The Industrial and Municipal Solid Waste Unit of the LPB is responsible for the permitting, review of site suitability reports, construction, and closure of all publicly and privately-owned solid waste handling facilities. Owners and/or operators of municipal solid waste landfills must conduct groundwater monitoring and evaluate the data to determine if established standards have been exceeded. All exceedances must be reported to EPD. The monitoring reports must be accompanied by a statement certifying that constituents which have established standards have been complied with or are non-compliant. It is recommended that monitoring of the groundwater continues to include periodic analysis for the presence of metals including lead.

6.2.2.2 Brownfields

EPAs Brownfields program identifies properties as candidates for cleanup activities that potentially have the presence of hazardous substances. EPD's Land Protection Branch Brownfield Development Unit maintains a Public Record of brownfields located within the State. In the future, EPA will designate properties as brownfields when appropriate and determine whether cleanup actions are necessary prior to their future use.

6.2.2.3 Urban Sources

The Canoochee River and Little Ogeechee River watersheds are largely rural in nature. However, small urbanized areas exist in both watersheds, and runoff from these areas may be sources of lead and lead compounds. Urban sources can best be addressed using a strategy that involves public participation and intergovernmental coordination to reduce the discharge of pollutants to the maximum extent practicable. Management practices, control techniques, public education, and other appropriate methods and provisions may be employed. In addition to water quality monitoring programs, discussed in Section 6.1, the following activities and programs conducted by cities, counties, and state agencies are recommended:

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

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

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

6.3 Reasonable Assurance

Currently, there are no NPDES permitted wastewater treatment facilities with permit limits that include lead or lead compounds discharging in the impaired stream segment watersheds. Should there, in the future, be applicants for discharge permits, EPD will determine whether the applicants have a reasonable potential of discharging lead levels equal to or greater than the allocated loads. The results of this reasonable potential analysis will determine the specific type of requirements in an individual facility's NPDES permit. As part of its analysis, EPD will use its EPA approved 2003 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary. If effluent limitations are determined to be necessary, they should be established in accordance with *Georgia Rules and Regulations for Water Quality Control*, Section 391-3-6-.06(4)(d)5.(ii)(b)(2) (EPD, 2015), to protect against chronic and acute effects.

All industrial sites that have a storm water discharge associated with their primary industrial activity are required to submit a Notice of Intent under the NPDES General Industrial Permit. This authorizes them to discharge storm water in accordance with the conditions and monitoring requirements established in the Industrial General Permit. Storm water from industrial sites that discharge within one linear mile of a 303(d) listed stream and that potentially might contain the listed constituent must be monitored to determine that benchmarks are met. Also, this permit requires implementation of BMPs.

EPD is working with local governments to foster the implementation of best management practices to address nonpoint sources. In addition, public education efforts will be targeted to individual stakeholders to provide information regarding the use of best management practices to protect water quality.

6.4 Public Participation

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

7.0 INITIAL TMDL IMPLEMENTATION PLAN

This plan identifies applicable State-wide programs and activities that may be employed to manage point and nonpoint sources of lead loads for the impaired stream segments in the Ogeechee River Basin. Local watershed planning and management initiatives will be fostered, supported, or developed through a variety of mechanisms. Implementation may be addressed by watershed improvement projects, assessments for Section 319 (h) grants, the local development of watershed protection plans, or "Targeted Outreach" initiated by EPD. These initiatives will supplement or possibly replace this initial implementation plan. Implementation actions should also be guided by the recommended management practices and actions contained within each applicable Regional Water Plan developed as part of Georgia's Comprehensive State-wide Water Management Plan implementation (Georgia Water Council, 2008).

7.1 Impaired Segments

This initial plan is applicable to the lead impaired stream segments in the Ogeechee River Basin, which were added to Georgia's 303(d) list available on EPD's website (epd.georgia.gov). The following table summarizes the descriptive information provided in the 303(d) list.

Water Bodies Listed for Lead in the Ogeechee River Basin

Reach ID	Water body	Segment	County	Segment Length (miles)	Designated Use
GAR030602030101	Canoochee River	Ga. Hwy. 192 to Fifteen Mile Creek near Metter	Emanuel/ Candler	21	Fishing
GAR030602010201	Little Ogeechee River	Two Mile Creek to Hamburg Mill Pond near Culverton	Hancock/ Washington	9	Fishing

The current water quality standard [*State of Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (EPD, 2015) states that instream concentrations shall not exceed the acute criteria under 1-day, 10-year minimum flow (1Q10) or higher stream flow conditions, and shall not exceed the chronic criteria under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions. The acute and chronic criteria for these metals are determined using the following equations:

$$\text{acute criteria for dissolved lead} = (e^{(1.273[\ln(\text{hardness})] - 1.460)})(1.46203 - [\ln \text{hardness})(0.145712)]) \ \mu g/L$$

$$\text{chronic criteria for dissolved lead} = (e^{(1.273[\ln(\text{hardness})] - 4.705)})(1.46203 - [\ln \text{hardness})(0.145712)]) \ \mu g/L$$

These criteria are expressed in terms of the dissolved fraction in the water column and are a function of total hardness. Exceedances of these criteria are violations of the water quality standards for these metals, and are the basis for adding a stream segment to the 303(d) listing.

7.2 Potential Sources

An important part of the TMDL analysis is the identification of potential source categories. A source assessment characterizes the known and suspected sources for lead in the watershed. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from that pollutants are or may be discharged to surface waters. Point sources of lead include storm water discharges through permitted storm water systems. Nonpoint sources of these metals are diffuse and cannot be identified as entering the water body at a single location. These sources generally involve land use activities that contribute the metals to streams during rainfall events. However, other potential nonpoint sources exist such as deposition of particulates from air emissions, and seepage of contaminated groundwater.

No point sources were identified within the Canoochee River watershed. Two NPDES point sources were identified within the Little Ogeechee watershed. Both NPDES discharges are industrial facilities with primary standard industrial classification (SIC) code of 1423, which is described as crushed and broken granite. None of these facilities have permit limits or monitoring requirements that include lead or lead compounds.

Potential nonpoint sources for lead include: non-permitted storm runoff from industrial sites, runoff from improper disposal of waste materials, illicit discharges into storm sewer systems, leachate from operating and closed landfills, overflows from sanitary sewer lines, and leaking septic systems. Residual sources of lead that have since been banned by Federal mandates include lead-based paints, lead water lines, and leaded gasoline. Also, in rural areas outdoor activities that can be sources include fishing tackle products and hunting ammunition.

7.3 Management Practices and Activities

The NPDES permit program provides a basis for municipal, industrial, and storm water permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations. In accordance with EPD rules and regulations, all discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times.

EPD is responsible for administering and enforcing laws to protect the waters of the State and is the lead agency for implementing the State's Nonpoint Source Management Program. Georgia is working with federal, county, and local governments, and other State and county agencies to foster implementation of BMPs that address nonpoint source pollution. The following management practices are recommended to reduce lead loads to the impaired stream segments:

- Sustain compliance with the Industrial General Storm Water NPDES Permit;
- Ensure that storm water management plans are in place and being implemented by the local governments, and by the industrial facilities located in the watershed. These Plans are designed to control storm water runoff and to identify and implement BMPs to reduce the discharge of pollutants associated with storm water;
- Implementation of recommended Water Quality management practices in the *Altamaha Regional Water Plan* (2017), and the *Upper Oconee Regional Water Plan* (2017);

- EPD should continue working with Federal, State, and local agencies and owners of sites where further cleanup measures are necessary, and in developing control measures to prevent future releases of lead or lead compounds.

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

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

- Adoption of local ordinances (i.e. septic tanks, storm water, etc.) that address local water quality;

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

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

7.4 Monitoring

EPD encourages local governments and municipalities to develop water quality monitoring programs. These programs can help pinpoint various pollutant sources, as well as verify the 303(d) stream segment listings. EPD recommends that monitoring of lead, total hardness, and TSS be continued for the Canoochee River and the Little Ogeechee River to determine if implementation of BMPs results in the improvement of water quality over time. EPD is available to assist in completing a monitoring plan, preparing a Sampling Quality Assurance Plan (SQAP), and/or providing necessary training as needed.

7.5 Future Action

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

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

EPD will work to support watershed improvement projects that address non-point source

pollution. This is a process whereby EPD and/or Regional Commissions or other agencies or local governments, under a contract with EPD, will develop a Watershed Management Plan intended to address water quality at the small watershed level (HUC 10 or smaller). These plans will be developed as resources and willing partners become available. The development of these plans may be funded via several grant sources, including but not limited to, Clean Water Act Section 319(h), Section 604(b), and/or Section 106 grant funds. These plans are intended for implementation upon completion.

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

1) An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load allocations or achieve water quality standards. Sources should be identified at the subcategory level with estimates of the extent to which they are present in the watershed (e.g., X numbers industrial sites needing upgrading, Y acres of contaminated soils needing remediation, or Z linear miles of eroded stream bank needing restoration);

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

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

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

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

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

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

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

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

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

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

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

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

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Appendix A

Estimation of 1Q10 and 7Q10 Flows for Canoochee River And Little Ogeechee River

Calculation of Average 1Q10 and 7Q10 Estimates for Streams in the Ogeechee River Basin based on USGS reported 1Q10 and 7Q10 values for nearby stream gages with known drainage areas.

Source: Gotvald, A.J., 2016, Selected low-flow frequency statistics for continuous-record streamgages in Georgia, 2013: U.S. Geological Survey Scientific Investigations Report 2016–5037, 20 p., http://dx.doi.org/10.3133/sir20165037.

Stream	Gage No	Drainage Area (sq miles)	7Q10 (cfs)	7Q10 Productivity Factor (cfs/sq miles)	1Q10 (cfs)	1Q10 Productivity Factor (cfs/sq miles)
Canoochee River near Claxton, Ga	02203000	555	1.04	0.001874	0.83	0.001496
Canoochee River at SR 121 near Metter, Ga (1)	-	215.6	0.4	-	0.3	-
Williamson Swamp Creek at Davisboro, Ga	02201000	109	8.04	0.07376	7.16	0.06569
Little Ogeechee River at Shoals Road (SR 1098) near Culverton, Ga (2)	-	48.4	3.6	-	3.2	-

(1) Using the reported 1Q10 and 7Q10 for the Canoochee River gage to calculate the 1Q10 and 7Q10 of the 303(d) listed segment of the Canoochee River using productivity factors.
(2) Using the reported 1Q10 and 7Q10 for the Williamson Swamp Creek gage to calculate the 1Q10 and 7Q10 of the 303(d) listed segments of the Little Ogeechee River using productivity factors.