Final
Total Maximum Daily Load (TMDL)
For
Little Tallapoosa River

Assessment Unit ID # AL03150108-0905-103

Pathogens (E. coli)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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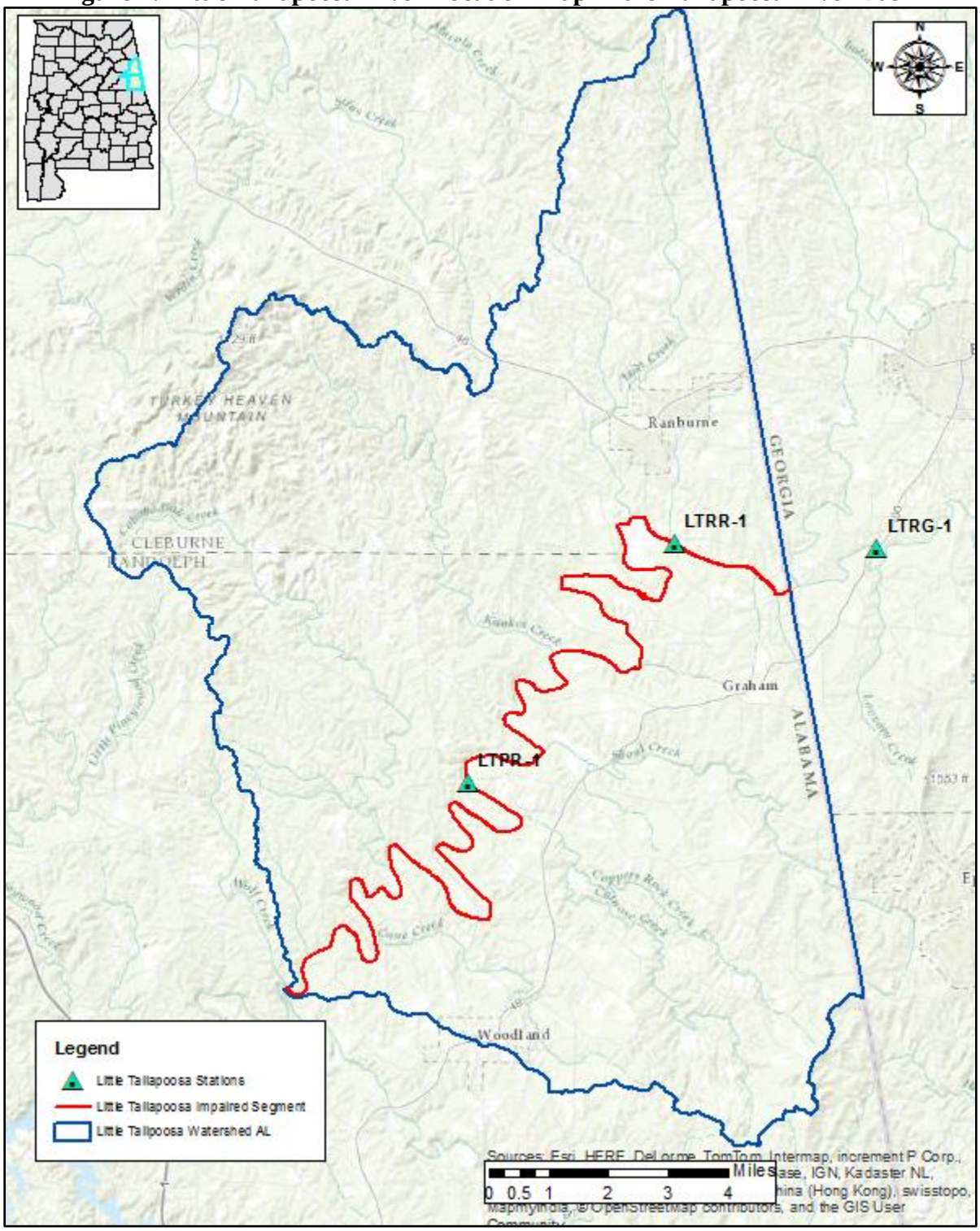
Figure 1: Little Tallapoosa River Location Map in the Tallapoosa River Basin



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1.0 Executive Summary

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Little Tallapoosa River, a part of the Tallapoosa River basin, is currently included on Alabama's §303(d) list as impaired for pathogens (E.coli) from Wolf Creek to the Alabama-Georgia state line. The listed portion of Little Tallapoosa River has a designated use classification of Fish and Wildlife (F&W). The headwater source of the Little Tallapoosa River begins in west Georgia. The river flows in a southwesterly direction entering Alabama through Cleburne and Randolph counties. Little Tallapoosa River flows to Harris Reservoir, ending at the confluence with the Tallapoosa River. The total drainage area for the Little Tallapoosa River watershed, including the portion in the state of Georgia, is approximately 464.7 square miles. Almost three quarters of the watershed (71%) lies within the state of Georgia.

Little Tallapoosa River was first listed for pathogens (fecal coliform) on the §303(d) list in 2010 based on data collected by the Alabama Department of Environmental Management (ADEM) from 2005 to 2009. The exceedances were found at station LTRR-1. This data, which can be found in Table 3, indicated the stream was impaired for fecal coliform. The pathogen indicator for non-coastal waters was changed in December 2009 from fecal coliform to Escherichia coli (E. coli). Due to this change, the Little Tallapoosa River was sampled in 2016 for E. coli, which will be the basis for this TMDL.

In 2016, §303(d) sampling studies were performed by ADEM on Little Tallapoosa River to further assess the water quality of the impaired stream. All of the available and recent bacterial data is listed in Appendix 7.2 for reference. ADEM collected 48 samples from Little Tallapoosa River at the following stations: LTRR-1, LTRG-1, and LTPR-1. Review of the general water quality and intensive E. coli study revealed that the listed segment of Little Tallapoosa River was still not meeting the pathogen criteria applicable to its use classification (F&W). Each station was carefully examined and the data compiled to identify specific areas of impairment and possible sources. All three stations had multiple geometric mean exceedances. Therefore, a TMDL has been developed for the listed segment of Little Tallapoosa River specific to the data collected.

A mass balance approach was used for calculating the pathogen TMDL for Little Tallapoosa River. The mass balance approach utilizes the conservation of mass principle. Existing loads were calculated by multiplying the E. coli concentrations times the respective in-stream flows and a conversion factor. The mass loading was calculated using the single or geometric mean sample exceedance event which resulted in the highest percent reduction. In this case, it was determined that the highest percent reduction was calculated from a geometric mean E. coli exceedance at station LTRR-1 (6/8/2016-6/30/2016) with a value of 439.3 colonies/100 ml. This violation calls for a reduction of 74%. In the same manner as existing loads were calculated, an allowable load

was calculated for the geometric mean E. coli target of 113.4 colonies/100 ml (126 colonies/100 ml – 10% Margin of Safety).

Table 1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion and the geometric mean criterion. Table 2 lists the TMDL, defined as the maximum allowable E. coli loading under critical conditions for Little Tallapoosa River.

Table 1: E. coli Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load - Single Sample	2.37E+12	1.04E+12	1.33E+12	56%
Nonpoint Source Load - Geometric Mean	1.74E+12	4.49E+11	1.29E+12	74%
Point Source Load	NA[a]	NA[a]	NA[a]	NA[a]

a. No NPDES permitted outfalls in Alabama.

Table 2: E. coli TMDL for Little Tallapoosa River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
4.99E+11	4.99E+10	NA	NA	0	4.49E+11	74%

Note: NA = not applicable
a. Both existing and future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in E. coli loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for E. coli.
e. TMDL was established using the geometric mean criterion of 126 colonies/100 ml.

Compliance with the terms and conditions of existing and future NPDES permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

ADEM will need to verify the possible sources of E. coli located in the watershed within Alabama. ADEM will also have to coordinate with the Georgia Environmental Protection Division (GAEPD) to determine possible sources of E. coli in the Little Tallapoosa River watershed in Georgia. Little Tallapoosa River is currently included on Georgia's §303(d) list as impaired for pathogens (fecal coliform) from Little Tallapoosa Lake to Sharpe Creek. In 2004 and 2009, GAEPD completed

pathogen (fecal coliform) TMDLs for two segments of the Little Tallapoosa River. One of these segments is immediately upstream of Alabama's §303(d) listed segment. Based on the results of this TMDL and the TMDLs completed by Georgia, the two agencies will need to generate a plan that can produce the needed reduction in E. coli using best management practices.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed to targeting the load reductions to improve water quality in the Little Tallapoosa River watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

2.0 Basis for §303(d) Listing

2.1 Introduction

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the total maximum daily load (TMDL) for pollutants causing use impairment. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified 30.78 stream miles of Little Tallapoosa River as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 2010 List of Impaired Waters based on data collected from 2005-2009 and was included on all subsequent lists. The source of the impairment is listed on the 2016 §303(d) list as pasture grazing and sources outside of state.

2.2 Problem Definition

Waterbody Impaired:	Little Tallapoosa River - From Wolf Creek to Alabama-Georgia state line
Impaired Reach Length:	30.78 miles
Impaired Drainage Area:	134.5 sq. miles
Water Quality Standard Violation:	Pathogens (Single Sample Maximum, Geometric Mean)
Pollutant of Concern:	Pathogens (E.coli)
Water Use Classification:	Fish and Wildlife

Usage Related to Classification:
The impaired stream segment is classified as Fish and Wildlife (F&W). Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife

(b) Conditions related to best usage: the waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters: it is recognized that the waters may be used for incidental water contact year-round and whole body water-contact recreation during the months of May through October, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage: the waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming areas and will be considered satisfactory for swimming and other whole body water-contact sports.

E. coli Criteria:
Criteria for acceptable bacteria levels for the F&W use classification are described in ADEM Admin. Code R. 335-6-10-.09(5)(e)7(i) and (ii) as follows:

7. Bacteria:

(i) In non-coastal waters, bacteria of the E. coli group shall not exceed a geometric mean of 548 colonies/100 ml; nor exceed a maximum of 2,507 colonies/100 ml in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.

(ii) For incidental water contact and whole body water-contact recreation during the months of May through October, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean E. coli organism density does not exceed 126 colonies/100 ml nor exceed a maximum of 298 colonies/100 ml in any sample in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 ml nor exceed a maximum of 158 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours. When the geometric bacterial coliform organism density exceeds these levels, the bacterial water quality shall be considered acceptable only if a second detailed sanitary survey and evaluation discloses no significant public health risk in the use of the waters. Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes, are not acceptable for swimming or other whole body water contact sports.

Criteria Exceeded:

Little Tallapoosa River was placed on the §303(d) list for pathogens in 2010 based on data from 2005-2009 at station LTRR-1. Prior to Alabama's 2009 adoption of E.coli as the indicator to assess the levels of bacteria in freshwater, the applicable bacterial indicator was fecal coliform. The geometric mean criterion for noncoastal waters from June to September was 200 col/100 ml, and the single sample maximum criterion for fecal coliform was 2,000 col/100 ml. Station LTRR-1 had geometric mean exceedances of 538 col/100 ml and 437 col/100 ml in July and September of 2007, respectively. There was also one single sample maximum exceedance of 2600 col/ml on July 11, 2007. The two exceedances of the geometric mean criterion resulted in the Little Tallapoosa River being listed as a category 5 waterbody. The source of pathogens was linked to pasture grazing and sources outside of the state. The qualifying data is summarized below in Table 3, and the entire dataset can be found in Appendix 7.2.

Table 3: Data for §303(d) Listing- Ambient Monitoring (2005-2009)

Station ID	Visit Date	Fecal Col (col/100ml)	Fecal Col dc	Single Sample Criteria	Geometric Mean (col/100ml)	Geometric Mean Criteria	Flow (cfs)	Flow Measured
LTRR-1	7/9/2007	220		2000	538.0709498	200	65	YES-USGS
LTRR-1	7/10/2007	830		2000			76	YES-USGS
LTRR-1	7/11/2007	2600	G	2000			151	YES-USGS
LTRR-1	7/12/2007	380		2000			155	YES-USGS
LTRR-1	7/16/2007	250		2000			171	YES-USGS
LTRR-1	9/4/2007	130		2000	436.629446	200	23	YES-USGS
LTRR-1	9/5/2007	340		2000			21	YES-USGS
LTRR-1	9/6/2007	1600	G	2000			19	YES-USGS
LTRR-1	9/10/2007	660	G	2000			13	YES-USGS
LTRR-1	9/12/2007	340		2000			11	YES-USGS

G denotes that the analyte is present, but is above an acceptable level for quantitation

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

On December 11, 2009, the Alabama Environmental Management Commission (EMC) adopted the E. coli criteria as the bacterial indicator to assess the levels of bacteria in freshwater. Prior to the adoption of the E. coli criteria, fecal coliform was used by ADEM as the bacterial indicator for freshwater. The E. coli criteria were recommended by the EPA as a better correlation to swimming and incidental water contact associated health effects than fecal coliform in the 1986 publication *Quality Criteria for Water* (EPA 440/5-86-001). As a result of this bacterial indicator change, this TMDL will be developed from E. coli data collected at stations LTRG-1, LTRR-1, and LTPR-1, even though the 2010 data that prompted the listing of Little Tallapoosa River was based on the fecal coliform criteria.

For the purpose of this TMDL, a single sample maximum E. coli target of 268.2 colonies/100 ml will be used. This target was derived by using a 10% explicit margin of safety from the single sample maximum criterion of 298 colonies/100 ml. This target is considered protective of water

quality standards and should not allow the single sample maximum to be exceeded. In addition, a geometric mean target of 113.4 colonies/100 ml will be used for a series of five samples taken at least 24 hours apart over the course of 30 days. This target was also derived by using a 10% explicit margin of safety from the geometric mean criterion of 126 colonies/100 ml. This target is considered protective of water quality standards and should not allow the geometric mean criterion to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Little Tallapoosa River Watershed

A point source can be defined as a discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source contributions can typically be attributed to municipal wastewater facilities, illicit discharges, and leaking sewer systems in urban areas. Municipal wastewater treatment facilities are permitted through the National Pollutant Discharge Elimination System (NPDES) process administered by ADEM. In urban settings, sewer lines typically run parallel to streams in the floodplain. If a leaking sewer line is present, high concentrations of bacteria can flow into the stream or leach into the groundwater. Illicit discharges are found at facilities that are discharging bacteria when not permitted, or when the pathogens criterion established in the issued NPDES permit is not being upheld.

There are no NPDES regulated point sources in the Alabama portion of the Little Tallapoosa River watershed that would contribute to the E. coli loading. In addition, the Alabama portion of the Little Tallapoosa River watershed does not presently qualify as a municipal separate storm sewer system (MS4) area as defined as an urban area serving 50,000 residents or greater. Therefore, the WLA portion of the TMDL will be zero. Any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the in-stream water quality criteria for pathogens at the point of discharge. It is not believed that there are point sources in the Georgia portion of the watershed contributing to the pathogen impairment; however, if it is determined that point source reductions in the Georgia portion of the watershed are needed, the Department will coordinate with GAEPD to determine the necessary reductions.

3.2.2 Nonpoint Sources in the Little Tallapoosa River Watershed

Nonpoint sources of bacteria do not have a defined discharge point, but rather occur over the entire length of a stream or waterbody. On the land surface, bacteria can accumulate over time and be washed into streams or waterbodies during rain events. Therefore, there is some net loading of bacteria into streams as dictated by the watershed hydrology.

Agricultural land is commonly a large source of E. coli bacteria. Confined livestock or confined animal feeding operations (CAFOs) produce a considerable amount of waste in a limited area. A significant number of CAFOs are located in the Little Tallapoosa watershed. Runoff from pastures, animal feeding areas, improper land application of animal wastes, and animals with direct access to streams are all mechanisms that can contribute bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, E. coli loads can be calculated as a direct source into the stream.

E. coli bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkey, waterfowl, etc. Wildlife will deposit feces onto land surfaces, where it can be transported during rainfall events to nearby streams. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases. As a result, forested areas are not specifically targeted in this TMDL.

E. coli loading from developed areas is potentially attributable to multiple sources including stormwater runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

The nature and extent of bacterial sources in the watershed will be identified more specifically during the implementation phase of the TMDL.

3.3 Land Use Assessment

Land use percentages for the Little Tallapoosa River watershed were determined from the 2011 National Land Cover Dataset (NLCD). The total drainage area of the Little Tallapoosa River watershed is approximately 464.7 square miles. The portion of this watershed in Alabama is 29% of the total area, and the remaining 330.2 square miles (71%) are located in Georgia. The watershed's land use percentages in Alabama are shown in Figure 2. Table 4 lists the various land uses and their associated percentages for both the Georgia and Alabama portions. Figure 3 is a map of land use within the entire Little Tallapoosa watershed, and Figure 4 is a map of the watershed's land use in Alabama.

As can be seen from an inspection of the table and map, the predominant land uses in the entire watershed are 48.35% forested and 28.34% agriculture. The Alabama portion is 48.83% forested land and 32.27% agriculture. Alabama has a slightly larger percentage of grasslands and shrubs than Georgia, and Georgia has more developed land. Developed land includes both commercial and residential land uses. 32.2% of the watershed in Alabama is hay/pasture, which can be utilized for cattle grazing during certain periods throughout the year and, in turn, contribute to pathogen run-off into streams if proper BMPs are not employed.

Figure 2: Pie Chart of Land Use Distribution in the Alabama Portion of the Little Tallapoosa River Watershed

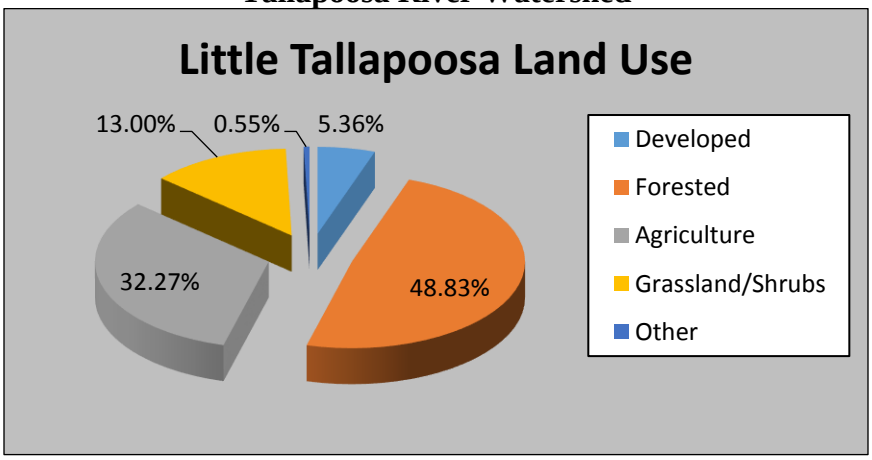


Table 4: Land Use (2011) Data in the Little Tallapoosa River Watershed

	Alabama			Georgia			Combined Watershed		
Land Cover	acres	sq. miles	%	acres	sq. miles	%	acres	sq. miles	%
Open Water	243.7447	0.380851	0.28%	2944.063	4.600098	1.39%	3187.808	4.98095	1.07%
Developed, Open Space	3372.84	5.270063	3.92%	15723.76	24.56838	7.44%	19096.6	29.83844	6.42%
Developed, Low Intensity	937.1719	1.464331	1.09%	10280.2	16.06282	4.86%	11217.37	17.52715	3.77%
Developed, Medium Intensity	251.9734	0.393708	0.29%	2963.634	4.630678	1.40%	3215.607	5.024386	1.08%
Developed, High Intensity	49.14926	0.076796	0.06%	1423.105	2.223601	0.67%	1472.254	2.300397	0.50%
Barren Land	228.6219	0.357222	0.27%	461.2469	0.720698	0.22%	689.8688	1.07792	0.23%
Deciduous Forest	28113.15	43.9268	32.66%	59088.53	92.32583	27.96%	87201.69	136.2526	29.32%
Evergreen Forest	13058.36	20.40368	15.17%	34724.51	54.25704	16.43%	47782.87	74.66073	16.07%
Mixed Forest	424.3294	0.663015	0.49%	1257.198	1.964372	0.59%	1681.527	2.627387	0.57%
Shrub/Scrub	6191.917	9.674871	7.19%	10984.08	17.16263	5.20%	17176	26.8375	5.78%
Herbaceous	5000.77	7.813704	5.81%	8277.981	12.93435	3.92%	13278.75	20.74805	4.46%
Hay/Pasture	27717.51	43.30862	32.20%	56495.41	88.27407	26.73%	84212.92	131.5827	28.32%
Cultivated Crops	57.37787	0.089653	0.07%	16.67961	0.026062	0.01%	74.05748	0.115715	0.02%
Woody Wetlands	405.2034	0.63313	0.47%	6361.382	9.93966	3.01%	6766.586	10.57279	2.28%
Emergent Herbaceous Wetlands	30.91288	0.048301	0.04%	315.1335	0.492396	0.15%	346.0464	0.540697	0.12%
TOTAL	86083.04	134.5047	100.00%	211316.9	330.1827	100.00%	297400	464.6874	100.00%
Cumulative Land Use									
Developed	4611.135	7.204898	5.36%	30390.7	47.48547	14.38%	35001.83	54.69037	11.77%
Forested	42031.96	65.67493	48.83%	101746.8	158.9793	48.15%	143778.7	224.6542	48.35%
Agriculture	27774.89	43.39827	32.27%	56512.09	88.30014	26.74%	84286.98	131.6984	28.34%
Grassland/Shrubs	11192.69	17.48857	13.00%	19262.06	30.09697	9.12%	30454.75	47.58555	10.24%
Other	472.3666	0.738073	0.55%	3405.31	5.320797	1.61%	3877.676	6.05887	1.30%
TOTAL	86083.04	134.5047	100.00%	211316.9	330.1827	100.00%	297400	464.6874	100.00%

Figure 3: Land Use Map of the Little Tallapoosa River Watershed

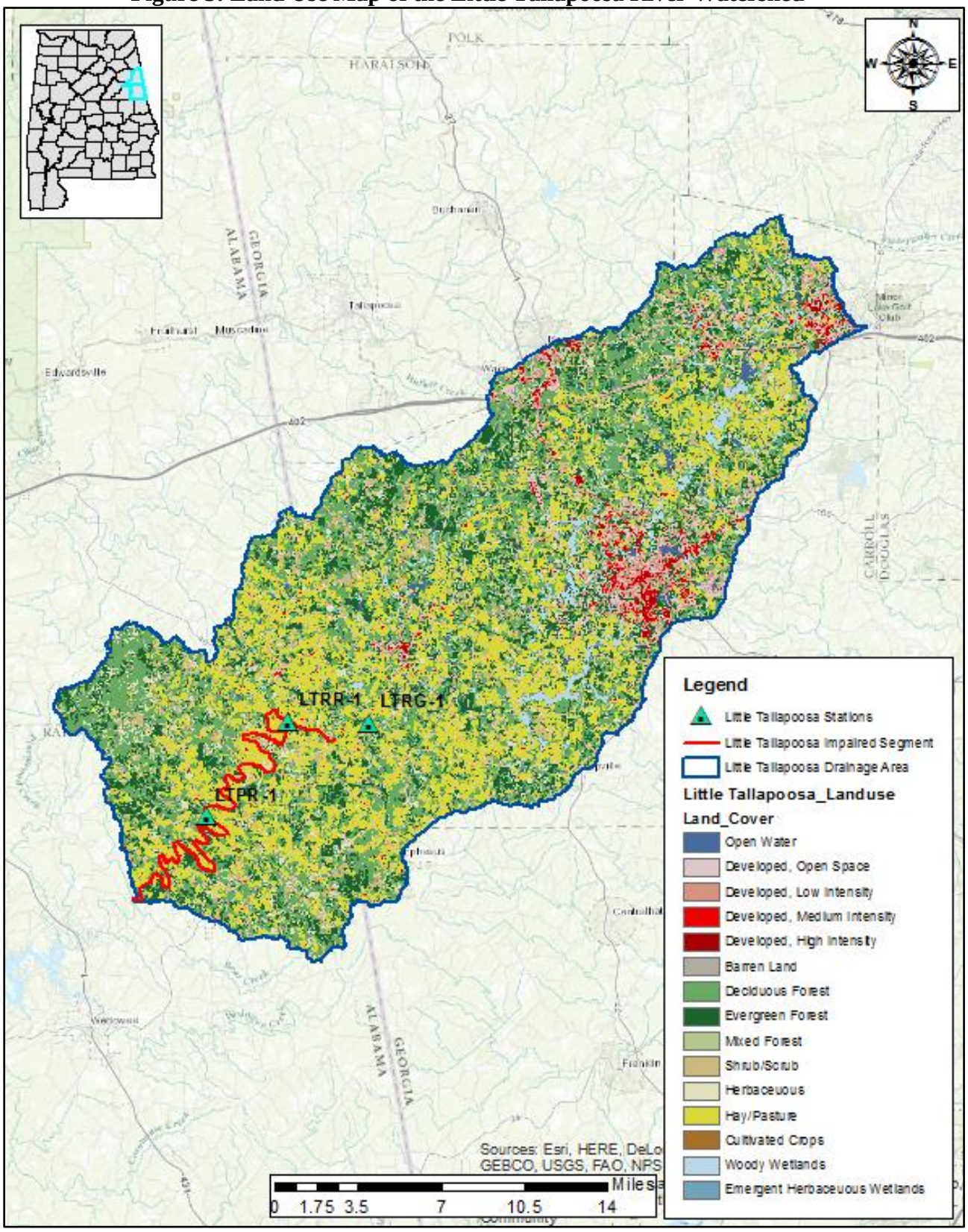
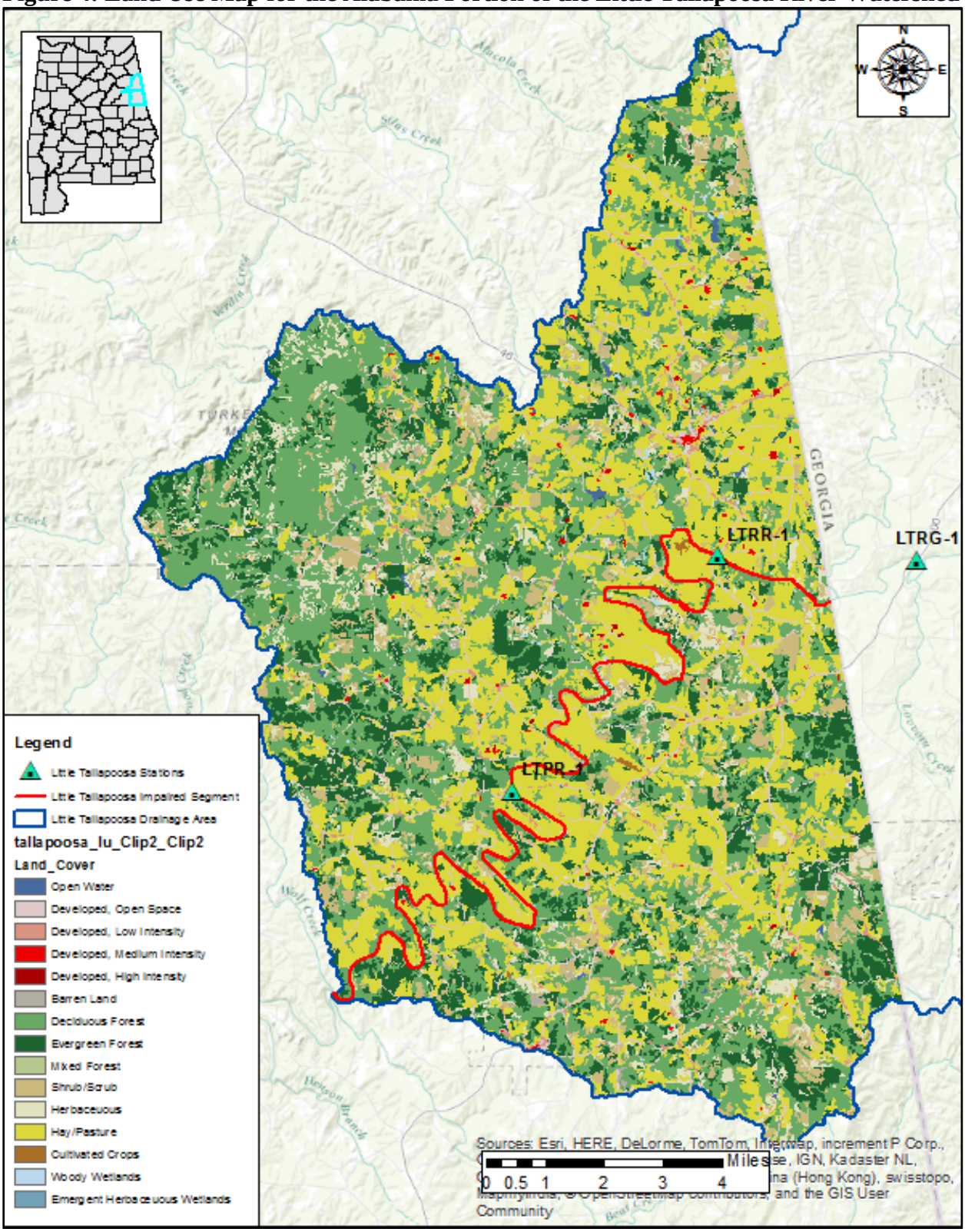


Figure 4: Land Use Map for the Alabama Portion of the Little Tallapoosa River Watershed



3.4 Linkage between Numeric Targets and Sources

The major land usages in the Little Tallapoosa River watershed are forested and agricultural land. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in the Little Tallapoosa River watershed are from the agriculture land uses. It is not considered a logical approach to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for the various nonpoint sources. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

In 2016, §303(d) sampling studies were performed by ADEM on Little Tallapoosa River to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2016 data will be used to assess the water quality of Little Tallapoosa River because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2016 edition of *Alabama's Water Quality Assessment and Listing Methodology* section 4.8.2, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody. Also, as a result of the EMC's adoption of the E. coli criteria as the new bacterial indicator, this TMDL will be developed from E. coli data.

In 2016, ADEM collected monthly water quality data for the Little Tallapoosa River watershed at the following three stations: LTPR-1, LTRG-1, and LTRR-1. The stations collectively produced 48 samples that were adequate for geometric mean calculations and single sample analysis. All three stations had geometric mean exceedances both in June and August. There were a total of seven single sample exceedances. Location descriptions for all stations can be found in Table 5. A complete list of available data used in this report and pictures of each station can be found in Appendices 7.2-7.3. Sample locations are shown in Figure 5.

Station LTRR-1, located approximately 2.21 miles downstream of the Georgia state line, had the most single sample exceedances (five) and the highest geometric mean exceedance. LTPR-1, the most downstream station on the impaired segment, had two single sample exceedances. LTRG-1, a station located in Georgia, had no single sample exceedances.

Sampling between June 8 and June 30 yielded a geometric mean violation of 439.31 colonies/100 ml at Station LTRR-1. As an implicit margin of safety, this value was selected to represent the existing condition. The average of the flows taken during this sampling period was calculated to be 162 cfs, which was used for geometric mean load calculations. The highest observed single-sample exceedance of 613.1 col/100 ml was collected on June 20 at station LTRR-1.

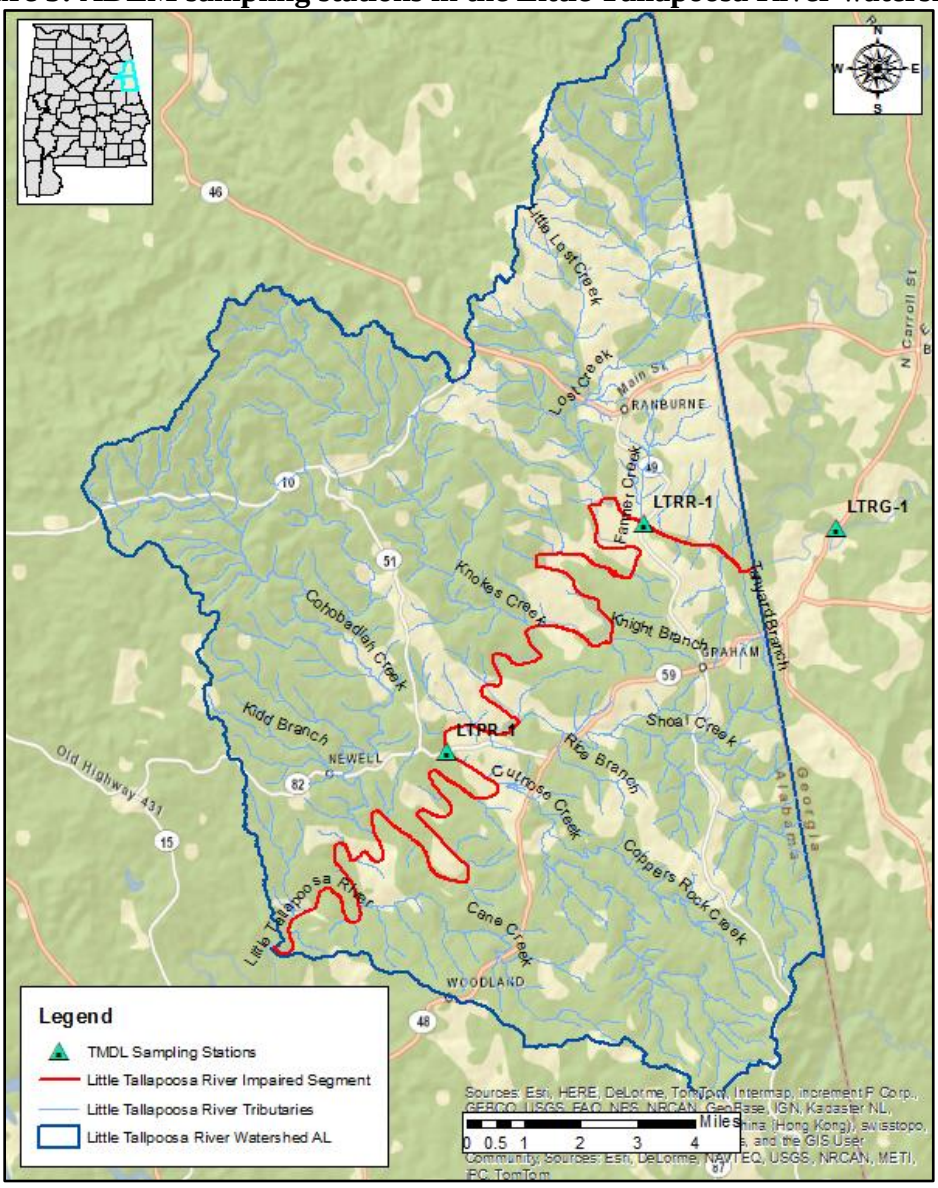
Table 5: ADEM Sampling Stations in the Little Tallapoosa River Watershed

Station Name	Agency Name	Latitude	Longitude	Description
LTRG-1	ADEM	33.492778	-85.279167	Little Tallapoosa River near Bowdon, GA at GA HWY 100 (USGS station 02413210)
LTRR-1	ADEM	33.49466	-85.33788	Little Tallapoosa River at Randolph County Rd 49
LTPR-1	ADEM	33.43722	-85.39917	Little Tallapoosa River at Randolph County Rd 82

Table 6: E. coli Exceedances on Little Tallapoosa River Segment AL03150108-0905-103

Station ID	Visit Date	E Coli	Single Sample Criteria	E Coli Geomean	Geometric Mean Criteria	Flow cfs
LTPR-1	6/8/2016	290.9	298			388
LTPR-1	6/20/2016	**435.2**	298			160
LTPR-1	6/23/2016	172.2	298	202.0912	126	110
LTPR-1	6/29/2016	98.8	298			77
LTPR-1	6/30/2016	156.5	298			76
LTPR-1	8/10/2016	111.2	298			46
LTPR-1	8/16/2016	261.3	298			33
LTPR-1	8/18/2016	238.2	298	213.2167	126	30
LTPR-1	8/23/2016	**325.5**	298			49
LTPR-1	8/25/2016	195.6	298			44
LTRG-1	6/8/2016	248.1	298			278
LTRG-1	6/20/2016	154.1	298			74
LTRG-1	6/23/2016	98.7	298	155.2333	126	56
LTRG-1	6/29/2016	198.9	298			46
LTRG-1	6/30/2016	120.1	298			43
LTRG-1	8/10/2016	150	298			35
LTRG-1	8/16/2016	190.4	298			25
LTRG-1	8/18/2016	191.8	298	181.1824	126	25
LTRG-1	8/23/2016	214.2	298			40
LTRG-1	8/25/2016	166.4	298			34
LTRR-1	6/8/2016	**461.1**	298			391
LTRR-1	6/20/2016	**613.1**	298			158
LTRR-1	6/23/2016	**435.2**	298	439.3066	126	110
LTRR-1	6/29/2016	**488.4**	298			77
LTRR-1	6/30/2016	272.3	298			74
LTRR-1	7/6/2016	**344.8**	298			50
LTRR-1	8/10/2016	261.3	298			46
LTRR-1	8/16/2016	193.5	298			33
LTRR-1	8/18/2016	185	298	225.8842	126	30
LTRR-1	8/23/2016	275.5	298			49
LTRR-1	8/25/2016	228.2	298			44

Figure 5: ADEM sampling stations in the Little Tallapoosa River watershed



3.6 Critical Conditions

Critical conditions typically occur during the summer months (May-October). This can be explained by the nature of storm events in the summer versus the winter. In summer, periods of dry weather interspersed with thunderstorms allow for the accumulation and washing off of bacteria into streams, resulting in spikes of bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of bacteria on the land surface, resulting in a more uniform loading rate.

The impaired portion of the Little Tallapoosa River watershed generally follows the trends described above for the summer months of May through October. The maximum geometric mean concentration of 439.3 colonies/100 ml at LTRR-1 will be used to estimate the TMDL pathogen

loadings to the Little Tallapoosa River under critical conditions. The highest E. coli geometric mean exceedance value occurred June 8, 2016 through June 30, 2016. An average flow of 162 cfs was calculated for LTRR-1 during this sampling period.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the TMDL analysis: 1) by implicitly incorporating the MOS using conservative model assumptions to develop allocations, or 2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

Both an explicit and implicit MOS were incorporated into this TMDL. The MOS accounts for the uncertainty associated with the limited availability of data used in this analysis. An explicit MOS was applied to the TMDL by reducing the appropriate target criterion concentration by ten percent and calculating a mass loading target with measured flow data. The single sample E. coli maximum value of 298 colonies/100 ml was reduced by 10% to 268.2 colonies/100 ml, while the geometric mean criterion was reduced in the same fashion to 113.4 colonies/100 ml. An implicit MOS was also incorporated in the TMDL by basing the existing condition on the highest measured E. coli concentration that was collected during critical conditions.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). The margin of safety can be included either explicitly or implicitly and accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. As discussed earlier, the MOS is both explicit and implicit in this TMDL. A TMDL can be denoted by the equation:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the pathogen TMDL for Little Tallapoosa River. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the E. coli concentration times the in-stream flow times a conversion factor. Existing loads were calculated for the highest geometric mean sample exceedance and the

highest single sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion of 298 col/100 ml and the geometric mean criterion of 126 col/100 ml. The TMDL was based on the violation that produced the highest percent reduction of E. coli loads necessary to achieve applicable water quality criteria, whether it be the single sample or geometric mean sample.

Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest E. coli single sample exceedance concentration of 613.1 colonies/100 ml by the measured flow on the day of the exceedance. The calculation for the existing condition was based on the measurement at LTRR-1 on June 20, 2016, which can be found in Appendix 7.2, Table 10. The product of the concentration, measured flow, and a conversion factor gives the total mass loading (colonies per day) of E. coli to Little Tallapoosa River under the single sample exceedance condition.

$$\frac{158\ \text{ft}^3}{\text{s}} \times \frac{613.1\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.37 \times 10^{12}\text{colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 439.31 colonies/100 ml times the average flow of the five samples. This concentration was calculated based on measurements at LTRR-1 between June 8, 2016, and June 30, 2016, and can be found in Appendix 7.2, Table 10. The average stream flow was determined to be 162 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of E. coli to Little Tallapoosa River under the geometric mean exceedance condition.

$$\frac{162\ \text{ft}^3}{\text{s}} \times \frac{439.31\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.74 \times 10^{12}\text{colonies}}{\text{day}}$$

Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the single sample and geometric mean criteria. This was done by taking the product of the measured flow for the violation event, the allowable concentration, and the conversion factor.

For the **single sample** E. coli target concentration of 268.2 colonies/100 ml, the allowable E. coli loading is:

$$\frac{158\ \text{ft}^3}{\text{s}} \times \frac{268.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.04 \times 10^{12}\text{colonies}}{\text{day}}$$

The explicit margin of safety of 29.8 colonies/100 ml equals a daily loading of:

$$\frac{158\ \text{ft}^3}{\text{s}} \times \frac{29.8\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.15 \times 10^{11} \text{colonies}}{\text{day}}$$

For the **geometric mean** E. coli target concentration of 113.4 colonies/100 ml, the allowable E. coli loading is:

$$\frac{162\ ft^3}{s} \times \frac{113.4\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100 mL * s}{ft^3 * day} = \frac{4.49 \times 10^{11} colonies}{day}$$

The explicit margin of safety of 12.6 colonies/100 ml equals a daily loading of:

$$\frac{162\ ft^3}{s} \times \frac{12.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{4.99 \times 10^{10} colonies}{day}$$

The difference between the existing conditions (violation event) and the allowable conditions converted to a percent reduction represents the total load reduction needed to achieve the E. coli water quality criteria. The TMDL was calculated as the total daily E. coli load to Little Tallapoosa River as evaluated at station LTRR-1. Table 7 shows the existing and allowable E. coli loads and required reductions for the Little Tallapoosa River watershed.

Table 7: E. coli Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load - Single Sample	2.37E+12	1.04E+12	1.33E+12	56%
Nonpoint Source Load - Geometric Mean	1.74E+12	4.49E+11	1.29E+12	74%
Point Source Load	NA[a]	NA[a]	NA[a]	NA[a]

a. No NPDES permitted outfalls in Alabama.

From Table 7, compliance with the geometric mean criterion of 126 colonies/100 ml requires a reduction of 74% in the E. coli load. The TMDL, WLA, LA and MOS values necessary to achieve the applicable E. coli criteria are provided in Table 8 below.

Table 8: E. coli TMDL for Little Tallapoosa River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
4.99E+11	4.99E+10	NA	NA	0	4.49E+11	74%

Note: NA = not applicable
a. Both existing and future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in E. coli loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for E. coli.
e. TMDL was established using the geometric mean criterion of 126 colonies/100 ml.

4.3 TMDL Summary

Little Tallapoosa River was placed on Alabama's §303(d) list in 2010 based on data collected from 2005 to 2009. In 2016, ADEM collected additional water quality data with E. coli serving as the primary pathogen indicator. The data collected by ADEM in 2016 confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the E. coli TMDL for Little Tallapoosa River. Based on the TMDL analysis, it was determined that a 74% reduction in E. coli loading was necessary to achieve compliance with applicable water quality standards.

Compliance with the terms and conditions of existing and future NPDES sanitary and storm water permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed to targeting the load reductions to improve water quality in the Little Tallapoosa River watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

ADEM will need to verify the possible sources of E. coli located in the watershed within Alabama. ADEM will also have to coordinate with the Georgia Environmental Protection Division (GAEPD) to determine possible sources of E. coli in the Little Tallapoosa River watershed in Georgia. Little Tallapoosa River is currently included on Georgia's §303(d) list as impaired for pathogens (fecal coliform) from Little Tallapoosa Lake to Sharpe Creek. In 2004 and 2009, GAEPD completed pathogen (fecal coliform) TMDLs for two segments of the Little Tallapoosa River. One of these segments is immediately upstream of Alabama's §303(d) listed segment. Based on the results of this TMDL and the TMDLs completed by Georgia, the two agencies will need to generate a plan that can produce the needed reduction in E. coli using best management practices.

5.0 Follow up monitoring

ADEM has adopted a statewide approach to water quality management. Each year, ADEM's water quality resources are divided among multiple priorities statewide including §303(d) listed waterbodies, waterbodies with active TMDLs, and other waterbodies as determined by the Department. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices and load reductions in the watershed.

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL was made available on ADEM's Website: www.adem.state.al.us. The public could also request paper or electronic copies of the TMDL by contacting Ms. Kimberly Minton at 334-271-7826 or kminton@adem.alabama.gov. The public was given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period became part of the administrative record. ADEM considered all comments received by the public prior to final completion of this TMDL and subsequent submission to EPA Region 4 for final approval.

7.0 Appendices

7.1 References

ADEM Administrative Code, 2017. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2017. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2016. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, 2016.

Alabama's §303(d) List and Fact Sheet. 2010, 2012, 2014, 2016. ADEM.

Alabama Department of Environmental Management (ADEM), Laboratory Data Qualification SOP #4910 Revision 6.2, 10.12.16.

United States Environmental Protection Agency, 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Office of Water. EPA 440/4-91-001.

United States Environmental Protection Agency, 1986. Quality Criteria for Water. Office of Water. EPA 440/4-91-001.

7.2 Water Quality Data

Table 9: Fecal Coliform Data for Station LTRR-1 (2005-2009)

Station ID	Visit Date	Fecal Col (col/100ml)	Fecal Col dc	Single Sample Criteria	Geometric Mean (col/100ml)	Geometric Mean Criteria	Flow (cfs)	Flow Measured
LTRR-1	6/8/2005	420	H	2000			942	NO-NOT REQUIRED
LTRR-1	8/2/2005	70	H	2000			594	NO-NOT REQUIRED
LTRR-1	10/26/2005	130	H	2000			152.9	NO-NOT REQUIRED
LTRR-1	8/8/2006	49	H	2000			68	YES-USGS
LTRR-1	10/10/2006	67	H	2000			66.7	YES-USGS
LTRR-1	3/14/2007	125	H	2000			295	YES-USGS
LTRR-1	4/10/2007	410		2000			2.55	YES-USGS
LTRR-1	5/9/2007	290		2000			2.24	YES-USGS
LTRR-1	6/20/2007	260		2000			54	YES-USGS
LTRR-1	7/9/2007	220		2000			65	YES-USGS
LTRR-1	7/10/2007	830		2000			76	YES-USGS
LTRR-1	7/11/2007	2600	G	2000			151	YES-USGS
LTRR-1	7/12/2007	380		2000			155	YES-USGS
LTRR-1	7/16/2007	250		2000	538.07095	200	171	YES-USGS
LTRR-1	7/25/2007	20	J	2000			123	YES-USGS
LTRR-1	8/30/2007	80	J	2000			35	YES-USGS
LTRR-1	9/4/2007	130		2000			23	YES-USGS
LTRR-1	9/5/2007	340		2000			21	YES-USGS
LTRR-1	9/6/2007	1600	G	2000			19	YES-USGS
LTRR-1	9/10/2007	660	G	2000			13	YES-USGS
LTRR-1	9/12/2007	340		2000	436.62945	200	11	YES-USGS
LTRR-1	9/18/2007	260		2000			33	YES-USGS
LTRR-1	10/17/2007	390		2000			5.4	YES-USGS
LTRR-1	6/17/2008	150	H	2000			76	YES-USGS
LTRR-1	8/12/2008	83	H	2000			12	YES-USGS
LTRR-1	10/15/2008	190		2000			24	YES-USGS
LTRR-1	6/16/2009	93		2000			245	YES-USGS
LTRR-1	8/6/2009	150		2000			110	YES-USGS
LTRR-1	10/15/2009	390		2000			2290	YES-USGS

H denotes that the holding times for analysis were exceeded.
G denotes that the analyte is present, but is above an acceptable level for quantitation
J denotes that the determined value is an estimate

Table 10: E. coli Data for Station LTPR-1

Station ID	Visit Date	Single Sample (col/100ml)	E. Coli Dc	Single Sample Criteria	E. Coli Geometric Mean (col/100ml)	Geometric Mean Criteria	Flow (cfs)
LTPR-1	3/16/2016	198.9		2507			645
LTPR-1	4/6/2016	307.6		2507			562
LTPR-1	5/4/2016	201.4		298			407
LTPR-1	6/8/2016	290.9		298			388
LTPR-1	6/20/2016	435.2		298			160
LTPR-1	6/23/2016	172.2		298			110
LTPR-1	6/29/2016	98.8		298			77
LTPR-1	6/30/2016	156.5		298	202.0912026	126	76
LTPR-1	7/6/2016	84.2		298			50
LTPR-1	8/10/2016	111.2		298			46
LTPR-1	8/16/2016	261.3		298			33
LTPR-1	8/18/2016	238.2		298			30
LTPR-1	8/23/2016	325.5		298			49
LTPR-1	8/25/2016	195.6		298	213.2166716	126	44
LTPR-1	9/14/2016	261.3		298			14
LTPR-1	10/12/2016	35		298			17

Table 11: E. coli Data for Station LTRG-1

Station ID	Visit Date	Single Sample (col/100ml)	E. Coli Dc	Single Sample Criteria	E. Coli Geometric Mean (col/100ml)	Geometric Mean Criteria	Flow (cfs)
LTRG-1	3/16/2016	137.4		2507			380
LTRG-1	4/6/2016	204.6		2507			403
LTRG-1	5/4/2016	172.3		298			262
LTRG-1	6/8/2016	248.1		298			278
LTRG-1	6/20/2016	154.1		298			74
LTRG-1	6/23/2016	98.7		298			56
LTRG-1	6/29/2016	198.9		298			46
LTRG-1	6/30/2016	120.1		298	155.2332926	126	43
LTRG-1	7/6/2016	228.2		298			34
LTRG-1	8/10/2016	150		298			35
LTRG-1	8/16/2016	190.4		298			25
LTRG-1	8/18/2016	191.8		298			25
LTRG-1	8/23/2016	214.2		298			40
LTRG-1	8/25/2016	166.4		298	181.1823628	126	34
LTRG-1	9/14/2016	160.7		298			13
LTRG-1	10/12/2016	112.6		298			6

Table 12: E. coli Data for Station LTRR-1

Station ID	Visit Date	Single Sample (col/100ml)	E. Coli Dc	Single Sample Criteria	E. Coli Geometric Mean (col/100ml)	Geometric Mean Criteria	Flow (cfs)
LTRR-1	3/16/2016	209.8		2507			645
LTRR-1	4/6/2016	344.8		2507			562
LTRR-1	5/4/2016	214.3		298			407
LTRR-1	6/8/2016	461.1		298			391
LTRR-1	6/20/2016	613.1		298			158
LTRR-1	6/23/2016	435.2		298			110
LTRR-1	6/29/2016	488.4		298			77
LTRR-1	6/30/2016	272.3		298	439.3065963	126	74
LTRR-1	7/6/2016	344.8		298			50
LTRR-1	8/10/2016	261.3		298			46
LTRR-1	8/16/2016	193.5		298			33
LTRR-1	8/18/2016	185		298			30
LTRR-1	8/23/2016	275.5		298			49
LTRR-1	8/25/2016	228.2		298	225.8842083	126	44
LTRR-1	9/14/2016	155.3		298			14
LTRR-1	10/12/2016	290.9		298			17

7.3 Little Tallapoosa River Watershed Photos

Figure 6: At Station LTPR-1: Upstream View of Little Tallapoosa River @ Randolph CR 82 (6/8/2016)

Figure 7: At Station LTPR-1: Downstream View of Little Tallapoosa River @ Randolph CR 82 (6/8/2016)

Figure 8: At Station LTRR-1: Upstream View of Little Tallapoosa River @ Randolph CR 49 (6/8/2016)

Figure 9: At Station LTRR-1: Downstream View of Little Tallapoosa River @ Randolph CR 49 (6/8/2016)

Figure 10: At Station LTRG-1: Upstream View of Little Tallapoosa River @ GA HWY 100 (6/8/2016)

Figure 11: At Station LTRG-1: Downstream View of Little Tallapoosa River @ GA HWY 100 (6/8/2016)