Alabama Department of Environmental Management

Final
Total Maximum Daily Load (TMDL)
for

Little Bear Creek

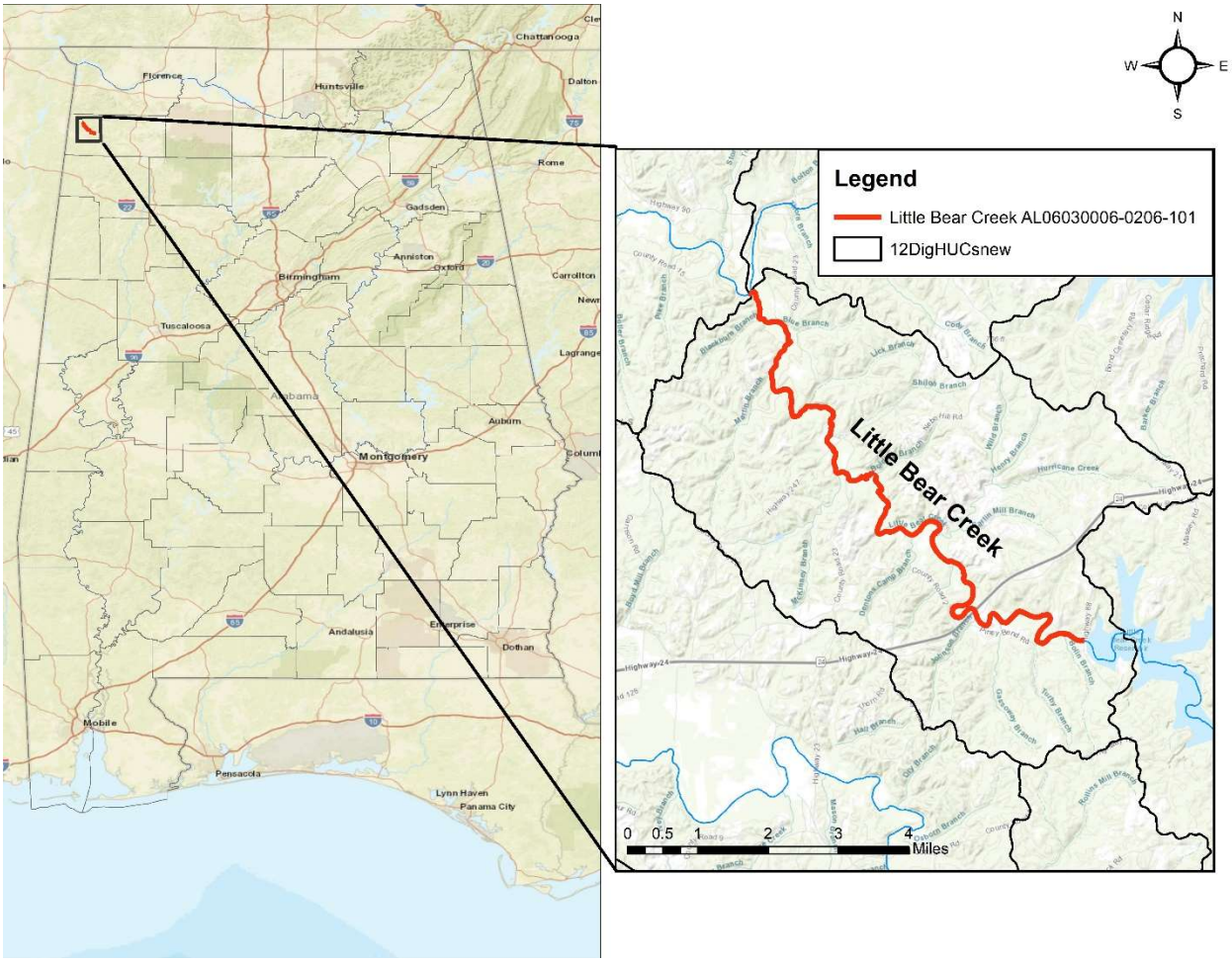
Assessment Unit ID # AL06030006-0206-101

Franklin County

Pathogens (*E. coli*)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
June 2025

Figure 1: Little Bear Creek Watershed



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1.0 Executive Summary

Section 303(d) of the Clean Water Act and the Environmental Protection Agency (EPA) 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 wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Little Bear Creek, located in Franklin County, is a tributary to Cedar Creek. Little Bear Creek is currently included on Alabama's §303(d) list as impaired for pathogens (*E. coli*) from the confluence with Cedar Creek to Little Bear Creek Dam. The listed portion of Little Bear Creek is approximately 11.88 miles in length and has a use classification of Swimming and Other Whole Body Water-Contact Sports/Fish and Wildlife (S/F&W). The total drainage area for the Little Bear Creek watershed is approximately 91 square miles.

Little Bear Creek was placed on Alabama's 2020 §303(d) list for pathogens (*E. coli*) based upon water quality data collected by ADEM during 2017. An evaluation of the available monthly water quality samples indicated that Little Bear Creek was not meeting the pathogen criteria applicable to its use classification (S/F&W). Additional *E. coli* sampling was conducted in 2023 to further evaluate the impaired segment. The results of this sampling will be utilized in this TMDL.

A mass balance approach was used for calculating the pathogen TMDL for Little Bear Creek. 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. In the same manner as existing loads were calculated, allowable loads were calculated for the single sample *E. coli* target of 211.5 colonies/100 ml (235 colonies/100 ml-10% Margin of Safety) and geometric mean *E. coli* target of 113.4 colonies/100 ml (126 colonies/100 ml – 10% Margin of Safety). The TMDL was calculated using the single sample or geometric mean sample exceedance event which resulted in the highest percent reduction.

Table 1.1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion and the geometric mean criterion for Little Bear Creek. Table 1.2 lists the TMDL, defined as the maximum allowable *E. coli* loading under critical conditions for Little Bear Creek.

Table 1.1: Little Bear Creek - *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	6.80E+12	5.09E+11	6.29E+12	93%
Geometric Mean Load	7.66E+11	3.56E+11	4.10E+11	54%

Table 1.2: *E. coli* TMDL for Little Bear Creek

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	Stormwater (MS4s and other NPDES sources)[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
5.65E+11	5.65E+10	NA	NA	0	5.09E+11	93%

Note: NA = not applicable

a. Current 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 and other NPDES-permitted stormwater sources will demonstrate consistency with the requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis.

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 single sample maximum criterion of 235 colonies/100 ml.

Compliance with the terms and conditions of existing and future National Pollutant Discharge Elimination System (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.

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 Bear Creek 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 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).

2.2 Problem Definition

Waterbody Impaired:	Little Bear Creek – from Cedar Creek to Little Bear Creek Dam
Assessment Unit ID:	AL06030006-0206-101
Impaired Reach Length:	11.88 miles
Impaired Drainage Area:	91 sq. miles
Water Quality Standard Violation:	Pathogens (Single Sample Maximum, Geometric Mean)
Pollutant of Concern:	Pathogens (*E. coli*)
Water Use Classification:	Swimming and Other Whole Body Water-Contact Sports / Fish and Wildlife

Usage Related to Classification:
The impaired stream segment is classified as both Swimming and Other Whole Body Water-Contact Sports (S) and Fish & Wildlife (F&W).

Usage of waters in the Swimming and Other Whole Body Water-Contact Sports classification is described in ADEM Admin. Code r. 335-6-10-.09(3)(a) and (b).

(a) Best usage of waters: swimming and other whole body water contact sports.

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

Usage of waters in the Fish and Wildlife 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 Swimming and Other Whole Body Water-Contact Sports use classification are described in ADEM Admin. Code r. 335-6-10-.09(3)(c)6(i), (ii) and (iii) as follows:

6. Bacteria:

(i) 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.

(ii) In all other areas, 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 235 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 104 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 mean bacterial 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.

(iii) The policy of nondegradation of high quality waters shall be stringently applied to bacterial quality of recreational waters.

Criteria for acceptable bacteria levels for the Fish and Wildlife 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.

<u>Little Bear Creek - Criteria Exceeded:</u>

Little Bear Creek was placed on Alabama's 2020 §303(d) list for pathogens based upon data collected during 2017 at ADEM station LBRF-4. The basis for the addition to the list was that the applicable single sample *E. coli* criterion was exceeded in two out of eight samples. The table below illustrates the 2017 *E. coli* data for LBRF-4.

Table 2.2.1: Data for §303(d) Listing- Ambient Monitoring (2017)

Station	Date_Time	Flow (cfs)	*E. coli* (col/100 ml)	Single Sample Max Criterion
LBRF-4	3/21/2017 16:34	31.4	38.9	235
LBRF-4	4/13/2017 9:56		20.6	235
LBRF-4	6/1/2017 10:35	18	178.5	235
LBRF-4	6/28/2017 10:23	13.7	160.7	235
LBRF-4	7/13/2017 10:40	13.6	96	235
LBRF-4	8/8/2017 9:34	42	2419.6	235
LBRF-4	9/21/2017 10:19	19.1	613.1	235
LBRF-4	10/19/2017 9:57	78.1	150.8	235

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

For the purpose of this TMDL, a single sample maximum *E. coli* target of 211.5 colonies/100 ml will be used. This target was derived by using a 10% explicit margin of safety from the Swimming and Other Whole Body Water-Contact Sports single sample maximum criterion of 235 colonies/100 ml. This target is considered protective of water quality standards and should not allow the single sample maximum criterion to be exceeded. In addition, a geometric mean target of 113.4 colonies/100 ml will be used for a series of at least five samples taken no less than 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

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.

3.2.1 Continuous Point Sources

Currently, there are no NPDES-regulated continuous point source discharges located within the Little Bear Creek watershed.

3.2.2 Non-Continuous Point Sources

There are currently two NPDES storm water general permits within the Little Bear Creek watershed. The facilities listed below in table 3.2.2.1 are not required to monitor for pathogens under their current NPDES permit and are not considered to be a source of pathogens due to the nature of their processes. Therefore, no *E. coli* loading to the Little Bear Creek watershed will be attributed to these facilities, and they will not receive an allocation in this TMDL.

Table 3.2.2.1: NPDES Facilities in the Little Bear Creek Watershed

Permit Number	Facility Name	Permitting Program	General Permit Activity
ALG850176	Grissom Gravel Pit	Mining General Permit	Sand and Gravel
ALG150177	M/J Feed Mill AL, LLC	Industrial General Permit	Food and Related Substances

There is currently one Animal Feeding Operation/Concentrated Animal Feeding Operation (AFO/CAFO), a broiler farm, located within the Little Bear Creek watershed. AFOs/CAFOs are required to implement and maintain effective best management practices (BMPs) that meet or exceed Natural Resources Conservation Service (NRCS) technical standards and guidelines, and the ADEM AFO/CAFO rules currently prohibit point source discharges of pollutants from these facilities and their associated land application activities. As a result, current and future AFOs/CAFOs will receive a waste load allocation of zero.

There are currently no registered sites in the Little Bear Creek watershed where land application of by-products for beneficial use is present. Beneficial use sites are regulated by ADEM's Land Division and are required to implement appropriate BMPs and agronomic application rates to protect the environment.

3.2.3 Municipal Separate Storm Sewer Systems

Currently, there are no urban areas designated as Municipal Separate Storm Sewer System (MS4) regulated areas located within the Little Bear Creek watershed.

3.2.4 Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) have the potential to severely impact water quality and can often result in the violation of water quality standards. It is the responsibility of the NPDES wastewater discharger or collection system operator for non-permitted "collection only" systems to ensure that releases do not occur. Unfortunately, releases to surface waters from SSOs are not always preventable or reported. From a review of the Department's records, there have been no reported SSOs in the Little Bear Creek watershed in the last several years.

3.2.5 Nonpoint Sources

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 can be a source of *E. coli* bacteria. Stormwater runoff from pastures and animal feeding areas can be a source of *E. coli*. In addition, improper land application of animal wastes and animals with direct access to streams are 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 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 bacteria 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 Bear Creek watershed were determined from the 2021 National Land Cover Dataset (NLCD). The total drainage area of the Little Bear Creek watershed is approximately 91 square miles. Table 3.3.1 lists the various land uses and their associated percentages for the Little Bear Creek watershed. A pie chart illustrating the major cumulative land use types for the Little Bear Creek watershed is shown in Figure 3.3.1.

Table 3.3.1: Little Bear Creek Watershed Land Use (2021 NLCD)

2021 NLCD Land Cover	NLCD Legend	Area (square miles)	%
Open Water	11	2.46	2.71%
Developed, Open Space	21	2.74	3.01%
Developed, Low Intensity	22	1.19	1.31%
Developed, Medium Intensity	23	0.37	0.40%
Developed, High Intensity	24	0.06	0.07%
Barren Land	31	0.20	0.22%
Deciduous Forest	41	39.66	43.58%
Evergreen Forest	42	15.04	16.53%
Mixed Forest	43	6.88	7.56%
Shrub/Scrub	52	2.73	3.00%
Herbaceuous	71	3.59	3.94%
Hay/Pasture	81	15.38	16.90%
Cultivated Crops	82	0.13	0.15%
Woody Wetlands	90	0.53	0.59%
Emergent Herbaceuous Wetlands	95	0.05	0.05%
Cumalative Land Cover	**NLCD Legend**	**Area (square miles)**	**%**
Open Water	11	2.46	2.71%
Developed	21,22,23,24	4.36	4.79%
Barren Land	31	0.20	0.22%
Forested	41,42,43	61.59	67.67%
Grassland/Shrub	52,71	6.32	6.94%
Agriculture	81,82	15.51	17.04%
Wetlands	90,95	0.58	0.64%

Figure 3.3.1: Little Bear Creek Watershed Cumulative Land Use Distribution

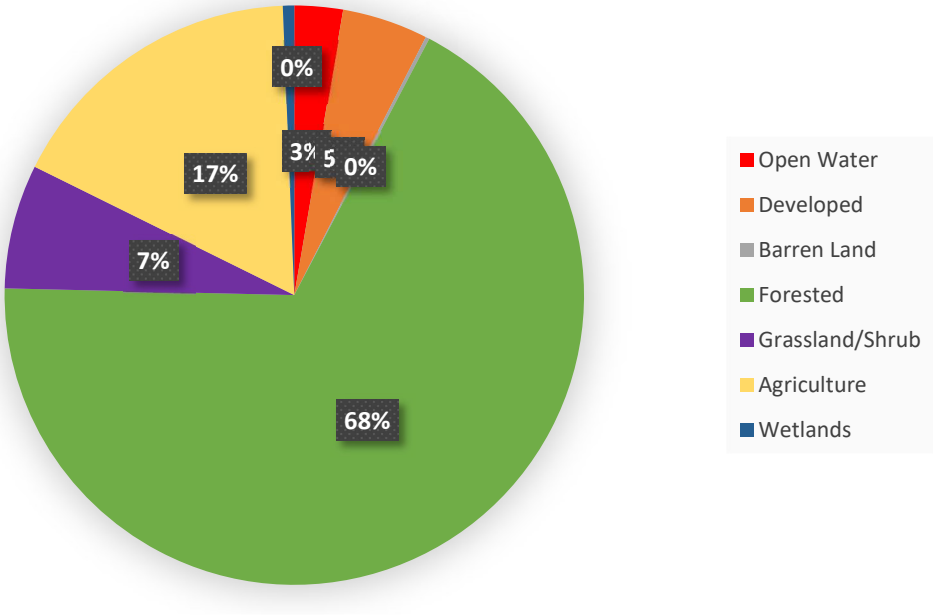
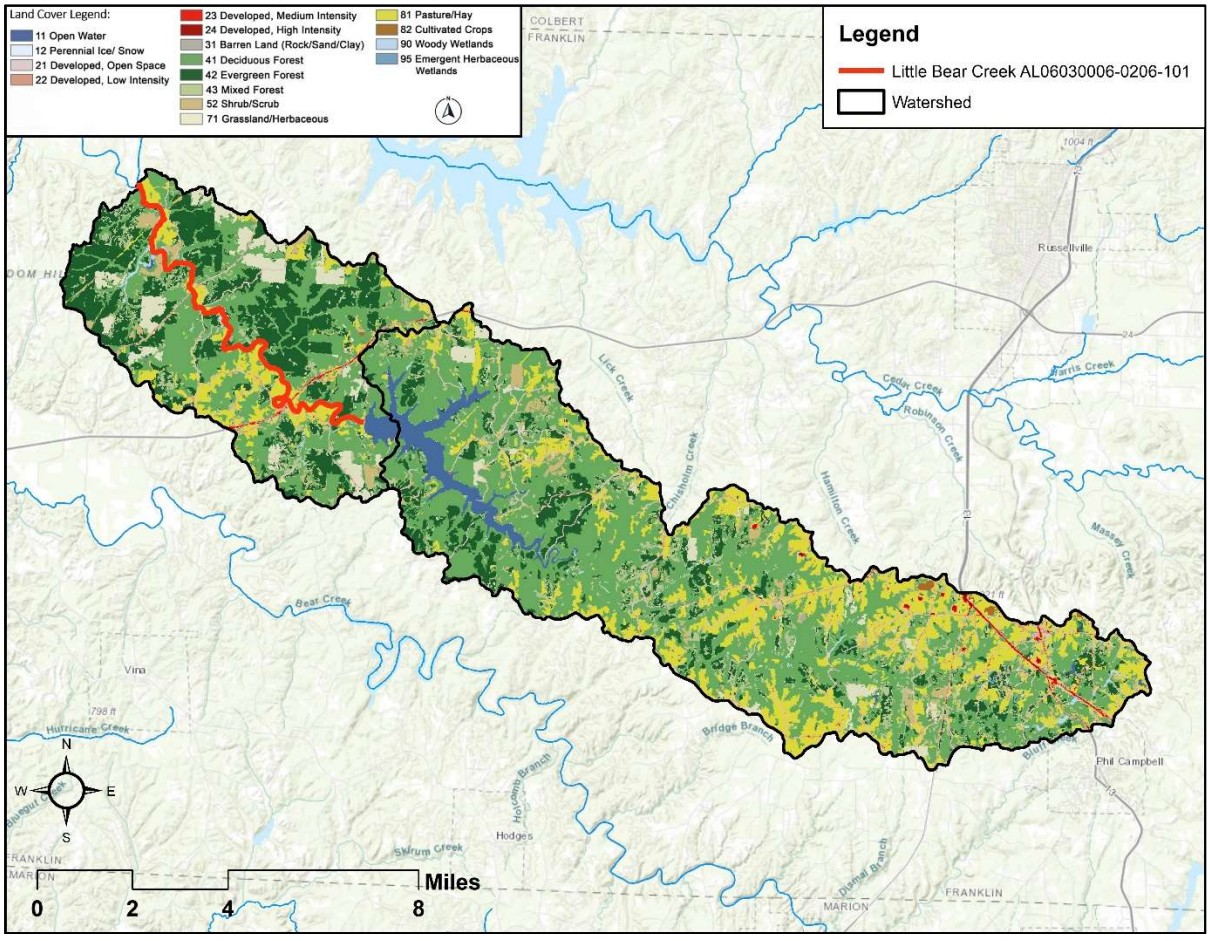


Figure 3.3.2: 2021 NLCD Map of the Little Bear Creek Watershed



3.4 Linkage between Numeric Targets and Sources

The predominant land use in the Little Bear Creek watershed is forest (68%), followed by agriculture (17%). 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 Little Bear Creek are the agricultural land uses, stormwater runoff, and failing septic systems.

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.

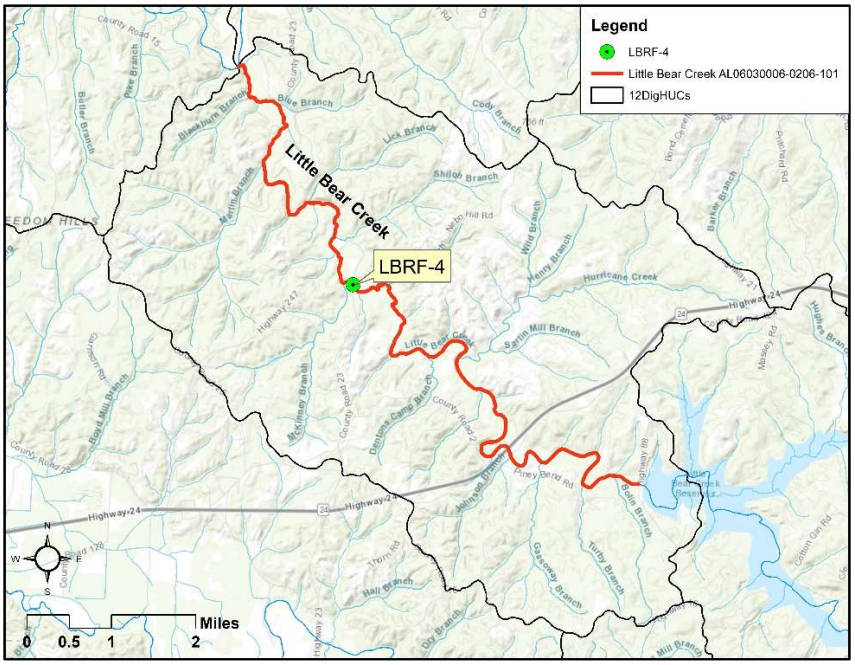
3.5 Data Availability and Analysis

In 2023, ADEM collected monthly (March – October) *E. coli* samples in Little Bear Creek at station LBRF-4. In addition, intensive bacteria studies were performed during the months of June and August at station LBRF-4. Each intensive bacteria study consisted of collecting at least five *E. coli* bacteria samples over a thirty-day time window, with a minimum of 24 hours between each sample collection. A geometric mean was calculated from each intensive bacteria study. The table and figure below depict the ADEM sampling station in the Little Bear Creek watershed.

Table 3.5.1: ADEM Station Description

Station	Latitude	Longitude	Description
LBRF-4	34.48833	-88.03556	Little Bear Creek at Franklin Co. Rd. 23 NE of Red Bay (NW 1/4)

Figure 3.5.1: ADEM Sampling Station



A total of 14 individual *E. coli* samples were collected at station LBRF-4 during 2023, and two of the samples exceeded the single sample maximum criterion of 235 colonies/100 ml. Furthermore, both the June and August *E. coli* geometric means violated the geometric mean criterion of 126 colonies/100 ml. A summary of the *E. coli* results is provided below in Table 3.5.2. All *E. coli* criteria exceedances are highlighted in red.

Table 3.5.2: *E. coli* Data for Little Bear Creek

Station ID	Date_Time	Flow (cfs)	*E. coli* (col/100 ml)	*E. coli* dc*	Single Sample Criterion (col/100 ml)	Calculated Geometric Mean (col/100 ml)	Geometric Mean Criterion (col/100 ml)
LBRF-4	4/4/2023 13:26	43.5	55.6	H	235		
LBRF-4	6/8/2023 10:30	40.9	156.5		235	190.0	126
LBRF-4	6/12/2023 10:10	39.1	105.8		235		
LBRF-4	6/15/2023 10:10	88.2	770.1		235		
LBRF-4	6/21/2023 13:20	78	125.9		235		
LBRF-4	6/26/2023 10:20	50.2	154.1		235		
LBRF-4	6/28/2023 14:42	36.2	54.6	H	235		
LBRF-4	8/3/2023 10:00	37.5	81.6		235		
LBRF-4	8/7/2023 10:10	124.3	172.5		235	244.1	126
LBRF-4	8/9/2023 14:11		125.9	H	235		
LBRF-4	8/14/2023 11:15	192.3	100.8		235		
LBRF-4	8/21/2023 10:25	98.4	140.1		235		
LBRF-4	8/28/2023 10:10	98.3	2827.2		235		
LBRF-4	10/10/2023 13:31		104.3		235		

**H indicates that the analytical holding times for analysis were exceeded.*

3.6 Critical Conditions/Seasonal Variation

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 Little Bear Creek watershed generally follow the trends described above for the summer months of May through October. The critical condition was taken to be the one with the highest *E. coli* single sample exceedance value. The single sample concentration of 2827.2 colonies/100 ml collected on August 28, 2023, will be used to estimate the TMDL pathogen loadings in Little Bear Creek under critical conditions. A streamflow of 98.3 cfs was measured at station LBRF-4 during this sampling event. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Little Bear Creek year-round.

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.

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 235 colonies/100 ml was reduced by 10% to 211.5 colonies/100 ml, while the geometric mean criterion was reduced in the same fashion to 113.4 colonies/100 ml.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual wasteload 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 explicit in this TMDL. A TMDL can be denoted by the equation:

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

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions. Pathogen 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 Bear Creek. 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 single sample exceedance and the highest geometric mean sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion of 235 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.

4.2.1 Little Bear Creek - Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest *E. coli* single sample exceedance concentration of 2827.2 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 LBRF-4 on August 28, 2023, which can be found above in Table 3.5.2. The product of the concentration, measured flow, and a conversion factor gives the total mass loading (colonies per day) of *E. coli* in Little Bear Creek under the single sample exceedance condition.

$$\frac{98.3\ \text{ft}^3}{\text{s}} \times \frac{2827.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{6.80 \times 10^{12}\text{colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 244.1 colonies/100 ml times the average of the five measured daily stream flows. This concentration was calculated based on measurements at LBRF-4 between August 7, 2023, and August 28, 2023, and can be found above in Table 3.5.2. The average stream flow was calculated to be 128.3 cfs. The product of the concentration, average flow, and the conversion factor gives the total mass loading (colonies per day) of *E. coli* in Little Bear Creek under the geometric mean exceedance condition.

$$\frac{128.3\ \text{ft}^3}{\text{s}} \times \frac{244.1\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{7.66 \times 10^{11}\text{colonies}}{\text{day}}$$

4.2.2 Little Bear Creek - 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 211.5 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{98.3\ \text{ft}^3}{\text{s}} \times \frac{211.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{5.09 \times 10^{11}\text{colonies}}{\text{day}}$$

The explicit margin of safety of 23.5 colonies/100 ml equals a daily loading of:

$$\frac{98.3\ \text{ft}^3}{\text{s}} \times \frac{23.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{5.65 \times 10^{10}\text{colonies}}{\text{day}}$$

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

$$\frac{128.3\ ft^3}{s} \times \frac{113.4\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100mL * s}{ft^3 * day} = \frac{3.56 \times 10^{11} colonies}{day}$$

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

$$\frac{128.3\ ft^3}{s} \times \frac{12.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.96 \times 10^{10} colonies}{day}$$

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 in Little Bear Creek. Table 4.2.1 below depicts the existing and allowable *E. coli* loads and required reductions for the Little Bear Creek watershed.

Table 4.2.1: Little Bear Creek - *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	6.80E+12	5.09E+11	6.29E+12	93%
Geometric Mean Load	7.66E+11	3.56E+11	4.10E+11	54%

From Table 4.2.1, compliance with the single sample maximum criterion of 235 colonies/100 ml requires a reduction of 93% in the *E. coli* load. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criteria are provided in Table 4.2.2 below.

Table 4.2.2: *E. coli* TMDL for Little Bear Creek

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	Stormwater (MS4s and other NPDES sources)[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
5.65E+11	5.65E+10	NA	NA	0	5.09E+11	93%

Note: NA = not applicable

a. Current 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 and other NPDES-permitted stormwater sources will demonstrate consistency with the requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis.

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 single sample maximum criterion of 235 colonies/100 ml.

4.3 TMDL Summary

Little Bear Creek was placed on Alabama's §303(d) list for pathogens in 2020 based on data collected in 2017 at station LRBF-4. A mass balance approach was used to calculate the *E. coli* TMDL for Little Bear Creek. Based on the TMDL analysis, it was determined that a 93% 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 will be implemented through voluntary measures/best management practices (BMPs). Cooperation and active participation by the general public and various other groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. Therefore, TMDL implementation activities for nonpoint sources will be coordinated through interaction with local entities and may be eligible for CWA §319 grants through the Department's Nonpoint Source Unit.

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. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

5.0 Follow-up Monitoring

ADEM has adopted a basin approach to water quality monitoring, an approach that divides Alabama's sixteen major river basins into three groups. Each year, ADEM's water quality resources are concentrated in one of the three basin groups and are divided among multiple priorities 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. This monitoring will occur in each basin according to the schedule shown in Table 5.1.

Table 5.1: Follow-up Monitoring Schedule

River Basin Group	Years to be Monitored
Coosa, Escatawpa, Tennessee (Guntersville), Tombigbee	2025/2028
Alabama, Cahaba, Mobile, Tallapoosa, Tennessee (Pickwick and Wilson)	2026/2029
Black Warrior, Blackwater, Chattahoochee, Chipola, Choctawhatchee, Escambia, Perdido, Tennessee (Wheeler), Yellow	2027/2030

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 four newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL were made available on ADEM's website: www.adem.alabama.gov. 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. No written comments were received during the public notice period.

7.0 Appendices

7.1 References

ADEM Administrative Code, 2021. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2021. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama Department of Environmental Management (ADEM), *Alabama's Water Quality Assessment and Listing Methodology*, 2024.

Alabama's §303(d) List and Fact Sheet. 2018, 2020, 2022, 2024. ADEM.

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 Little Bear Creek Watershed Photos

Figure 7.2.1: At Station LBRF-4: Upstream View (6/15/2023)

Figure 7.2.2: At Station LBRF-4: Downstream View (6/15/2023)

Figure 7.2.3: At Station LBRF-4: Upstream View (8/28/2023)

Figure 7.2.4: At Station LBRF-4: Downstream View (8/28/2023)