Draft
Total Maximum Daily Load (TMDL)
for
Emuckfaw Creek

Assessment Unit ID #AL03150109-0308-100

Pathogens (*E. coli*)

Clay and Tallapoosa Counties

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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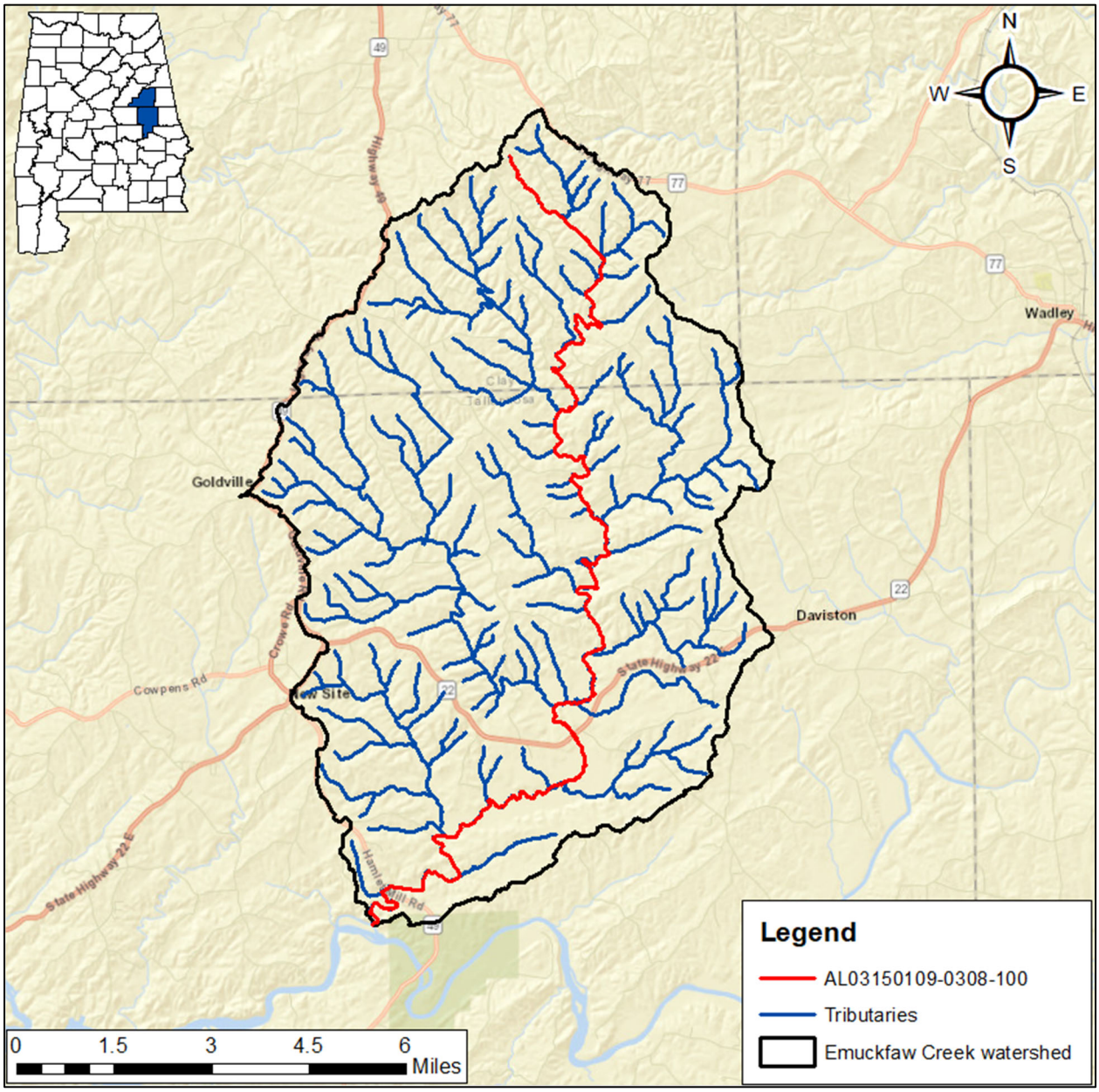
Figure 1-1. Emuckfaw Creek watershed



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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 maximum amount of pollutant a waterbody can assimilate while meeting all applicable water quality standards for the pollutant of concern. All TMDLs include 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).

Emuckfaw Creek is currently included on Alabama's §303(d) list as impaired for pathogens from the Tallapoosa River to its source. Emuckfaw Creek begins in Clay County, and it flows for approximately 23.51 miles before it converges with the Tallapoosa River in Tallapoosa County. The drainage area of the Emuckfaw Creek watershed is approximately 65.7 square miles. The impaired segment of Emuckfaw Creek (AL03150109-0308-100) is classified as Fish & Wildlife.

Emuckfaw Creek was originally included on the §303(d) list for pathogens (*E. coli*) in 2018. Emuckfaw Creek was sampled in 2016 and was found to exceed Fish and Wildlife bacteriological standards at Alabama Department of Environmental Management (ADEM) sampling station EMKT-14. Due to these exceedances, follow-up sampling was done in 2023 to verify impairment. Sampling in 2023 showed six single sample exceedances and two geometric mean exceedances. Therefore, this *E. coli* TMDL has been developed for the assessment unit listed.

A mass balance approach was used for calculating the pathogen TMDL for Emuckfaw Creek. The mass balance approach utilizes the conservation of mass principle. The TMDL was calculated using the single sample or geometric mean sample exceedance event that resulted in the highest percent reduction. 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 268.2 colonies/100 ml (298 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). In this case, it was determined that the highest percent reduction was calculated from a single sample *E. coli* violation of 657 colonies/100 ml measured on June 21, 2023, at ADEM station EMKT-14. This violation calls for a reduction of 59%. A summary of these calculations can be seen in Table 1-1. Table 1-2 lists the TMDL, defined as the maximum allowable *E. coli* loading under critical conditions for Emuckfaw Creek. The TMDL was calculated based on data from station EMKT-14.

Table 1-1. Existing loads and required reductions for Emuckfaw Creek

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	6.62E+11	2.70E+11	3.92E+11	59%
Geometric Mean Load	9.62E+10	4.91E+10	4.71E+10	49%

Table 1-2. *E. coli* TMDL for Emuckfaw 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
3.0E+11	3.0E+10	N/A	N/A	0	2.7E+11	59%

N/A = not applicable.
a. There are currently three CAFOs in the Emuckfaw Creek watershed. 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 and other NPDES stormwater sources would be required to demonstrate consistency with the assumptions and 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 *E. coli* criterion of 298 colonies/100ml.

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 the use impairment. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and instream 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). 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).

The state of Alabama has identified the entire reach of Emuckfaw Creek (23.51 miles) as impaired for pathogens. Emuckfaw Creek was originally placed on Alabama's 2018 §303(d) list of impaired waterbodies for pathogens (*E. coli*) based on monitoring program data collected in 2016 at station EMKT-14. The sources of impairment, as listed on Alabama's current §303(d) list, are animal feeding operations and pasture grazing.

2.2 Problem Definition

Waterbody Impaired: Emuckfaw Creek, from the Tallapoosa River to its source

Impaired Reach Length: 23.51 miles

Contributing Drainage Area: 65.7 square miles

Water quality Standard Violation: Pathogens (single sample and geometric mean)

Pollutant of Concern: Pathogens (*E. coli*)

Water Use Classification: Fish and Wildlife

Usage Related to Classification:
The impaired portion of Emuckfaw Creek has a use classification of Fish and Wildlife (F&W). Usage of waters for the F&W classification is described in ADEM Admin. Code R. 335-6-10-.09 (5)(a), (b), (c), and (d) as follows:

(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:
E. coli criteria for waters with a F&W 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:
Emuckfaw Creek (AL03150109-0308-100) was placed on Alabama's 2018 §303(d) list for pathogens based on data collected during 2016 at station EMKT-14. *S*ampling at station EMKT-14 during 2016 showed that the *E. coli* criterion was exceeded in two out of eight samples. The table below illustrates the *E. coli* data that was the basis for the listing.

Table 2-1. Data from EMKT-14 from 2016 (basis of listing)

EMKT-14			
Visit Date	***E. coli* (col/100 mL)**	***E. coli* Qualifier***	**Flow (ft^3/s)**
3/15/2016	86	H	52.2
4/5/2016	107.1	H	53.7
5/3/2016	98.8	H	36.4
6/7/2016	209.8	H	18.9
7/5/2016	150	H	8.9
8/9/2016	307.6	H	5.7
9/13/2016	410.6	H	2.5
10/11/2016	167	H	-

*H denotes that the holding times for analysis were exceeded.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

A single sample maximum *E. coli* target of 268.2 colonies/100 ml will be used for this TMDL. 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 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 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 Emuckfaw Creek 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, leaking sewer systems in urban areas, and illicit discharges. 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 *E. coli* can flow into the stream or leach into the groundwater.

3.2.1.1 Continuous Point Sources

There are currently no continuous NPDES discharges located in the Emuckfaw Creek watershed. Any future continuous NPDES-regulated discharges that are considered by the Department to be a pathogen source will be required to meet the instream water quality criteria for pathogens at the point of discharge.

3.2.1.2 Non-Continuous Point Sources

There are currently no NPDES-regulated stormwater sources in the Washington Creek watershed. In addition, the Emuckfaw Creek watershed is not located within a Municipal Separate Stormwater Sewer System (MS4) area. The Emuckfaw Creek watershed currently contains three Voluntary Animal Feeding Operations (AFOs)/Concentrated Animal Feeding Operations (CAFOs). All three sites produce broilers. 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.

Future NPDES-regulated stormwater discharges will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

3.2.2 Nonpoint sources in the Emuckfaw Creek watershed

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

Agricultural land can be a source of *E. coli* bacteria. Runoff from pastures, animal feeding operations, improper land application of animal wastes, and animals with direct access to streams are all mechanisms that can contribute *E. coli* 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, turkeys, beavers, and waterfowl. Wildlife deposit feces onto land surfaces where they 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 urban areas is potentially attributable to multiple sources including storm water runoff, illicit discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. Septic systems may be direct or indirect sources of bacterial pollution via ground and surface waters. Onsite septic systems have the potential to deliver *E. coli* bacteria to surface waters due to system failure and malfunction.

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 for the watershed was determined using ArcMap with land use datasets derived from the 2021 National Land Cover Dataset (NLCD). Figure 3-1 displays the land use areas for the Emuckfaw Creek watershed. Table 3-1 depicts the primary land uses in the Emuckfaw Creek watershed. Figure 3-2 shows the grouped land uses for the watershed.

The majority of the watershed is forested/natural lands, which make up 90.45% of the watershed area. The remaining land uses are agricultural lands (5.74%), developed land (3.75%), and open water (0.06%). Developed land includes both commercial and residential land uses.

Figure 3-1. Land use for the Emuckfaw Creek watershed

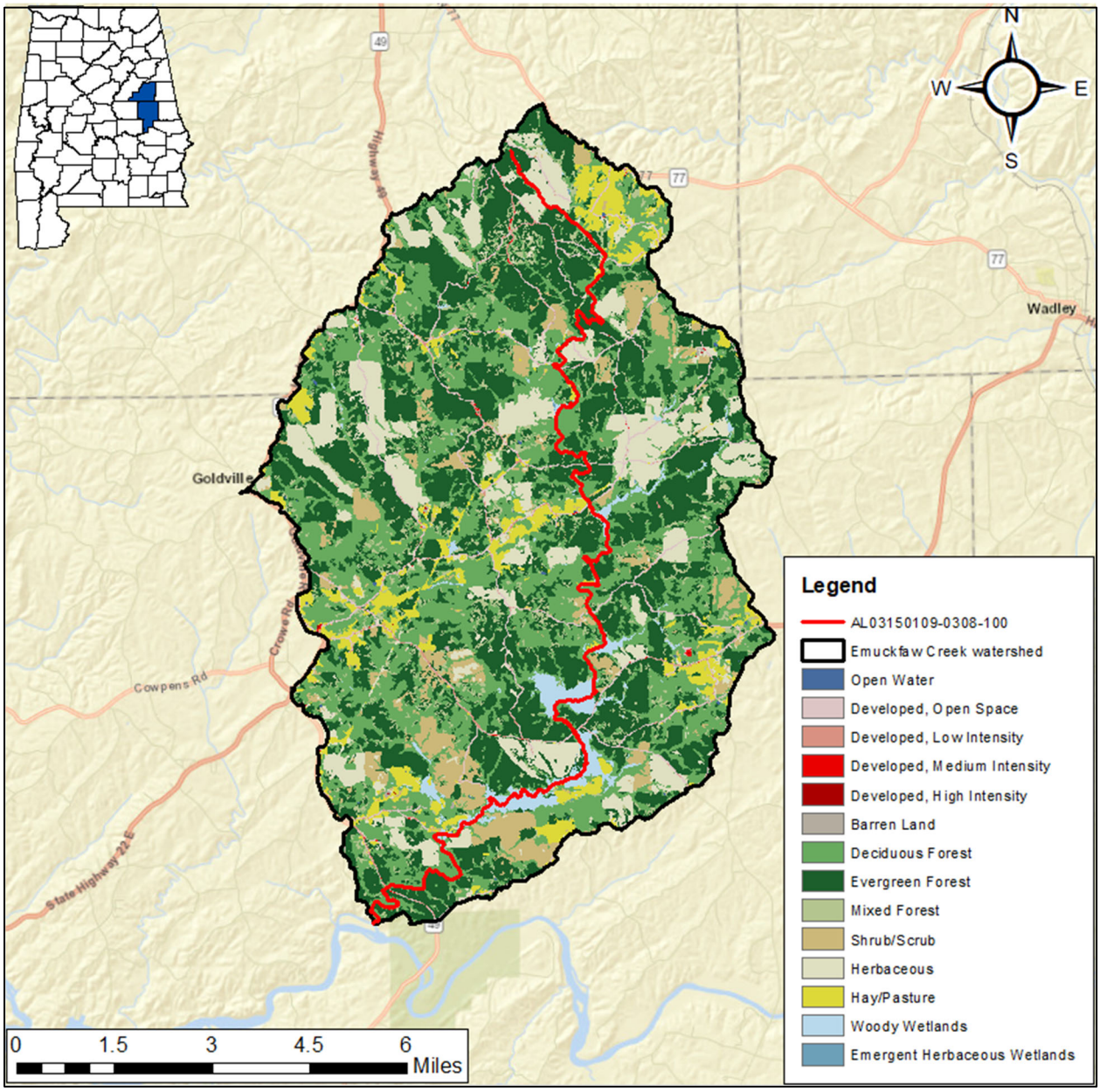
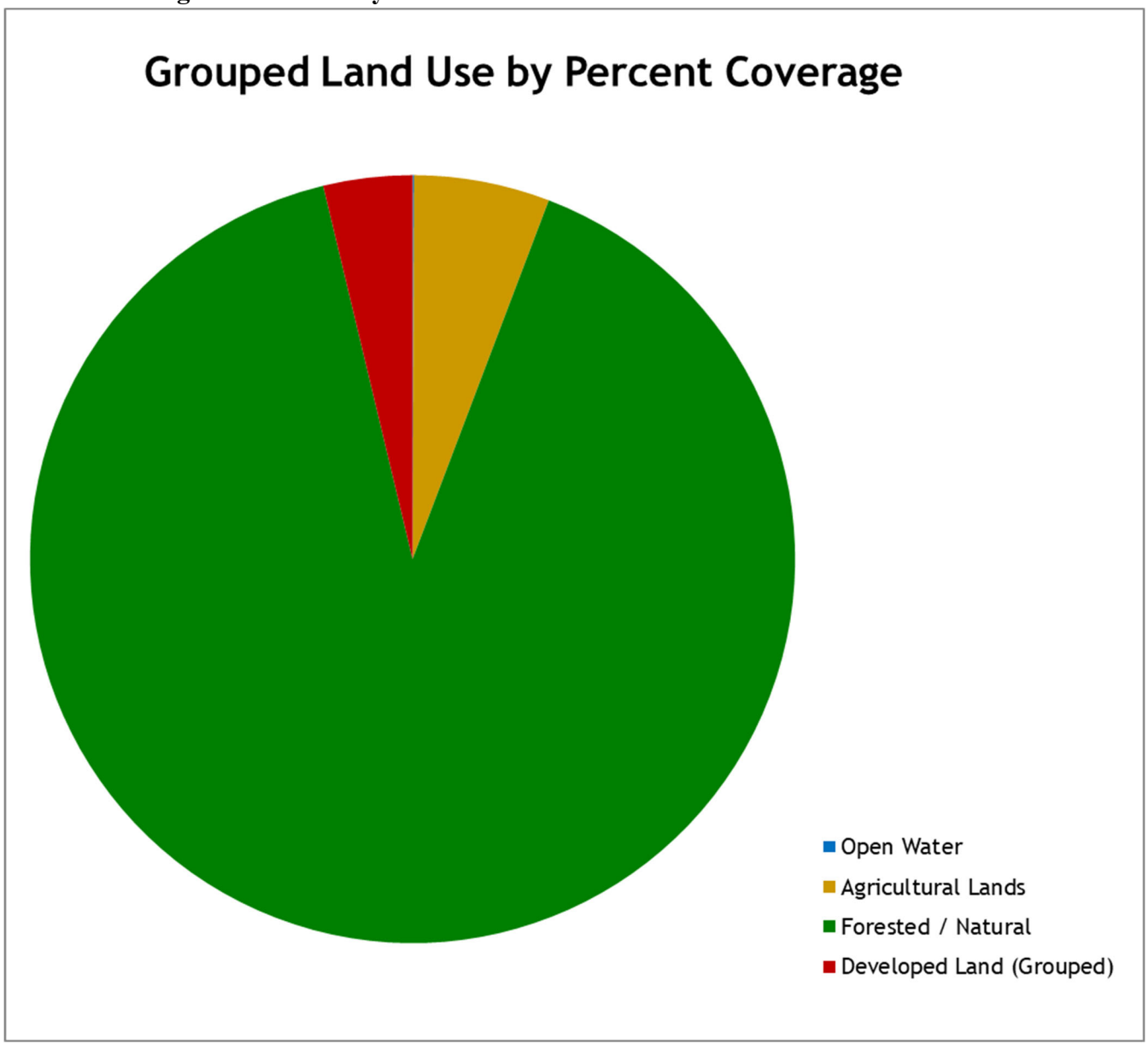


Table 3-1. Land use areas for the Emuckfaw Creek watershed

Class Description	Mi²	Acres	Percent
Open Water	0.04	26.91	0.06%
Developed, Open Space	1.89	1210.94	2.88%
Developed, Low Intensity	0.47	300.46	0.71%
Developed, Medium Intensity	0.05	31.58	0.08%
Developed, High Intensity	0.01	5.34	0.01%
Barren Land	0.05	29.80	0.07%
Deciduous Forest	19.96	12776.58	30.40%
Evergreen Forest	22.55	14432.98	34.34%
Mixed Forest	3.25	2077.61	4.94%
Shrub/Scrub	4.04	2584.01	6.15%
Herbaceous	7.91	5060.37	12.04%
Hay/Pasture	3.77	2410.76	5.74%
Cultivated Crops	0.00	0.00	0.00%
Woody Wetlands	1.68	1072.83	2.55%
Emergent Herbaceous Wetlands	0.01	9.34	0.02%
TOTALS →	**65.67**	**42029.51**	**100.00%**
Class Description	**Mi²**	**Acres**	**Percent**
Open Water	0.04	26.91	0.06%
Agricultural Lands	3.77	2410.76	5.74%
Forested / Natural	59.40	38013.72	90.45%
Developed Land (Grouped)	2.47	1578.11	3.75%
TOTALS →	**65.67**	**42029.51**	**100.00%**

Figure 3-2. Primary land uses for the Emuckfaw Creek watershed



3.4 Linkage Between Numeric Targets and Sources

The predominant land use coverage in the Emuckfaw Creek watershed is forested/natural, followed by agriculture and developed land. The most likely sources of pathogen loadings are from the agricultural land uses and possibly septic system failures. 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 non-point sources. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

During 2023, ADEM conducted sampling on Emuckfaw Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the data from 2023 will be used to assess the water quality of Emuckfaw Creek because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2024 edition of *Alabama's Water Quality Assessment and Listing Methodology*, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody.

ADEM collected 14 *E. coli* samples on Emuckfaw Creek at station EMKT-14 during 2023. Of the 14 samples, there were six single sample exceedances along with two geometric mean exceedances. The 2023 data can be seen below in Table 3-2. A description of station EMKT-14 and a map displaying the location of EMKT-14 within the Emuckfaw Creek watershed can be seen in Table 3-3 and Figure 3-3, respectively.

Table 3-2. ADEM *E. coli* data on Emuckfaw Creek at EMKT-14

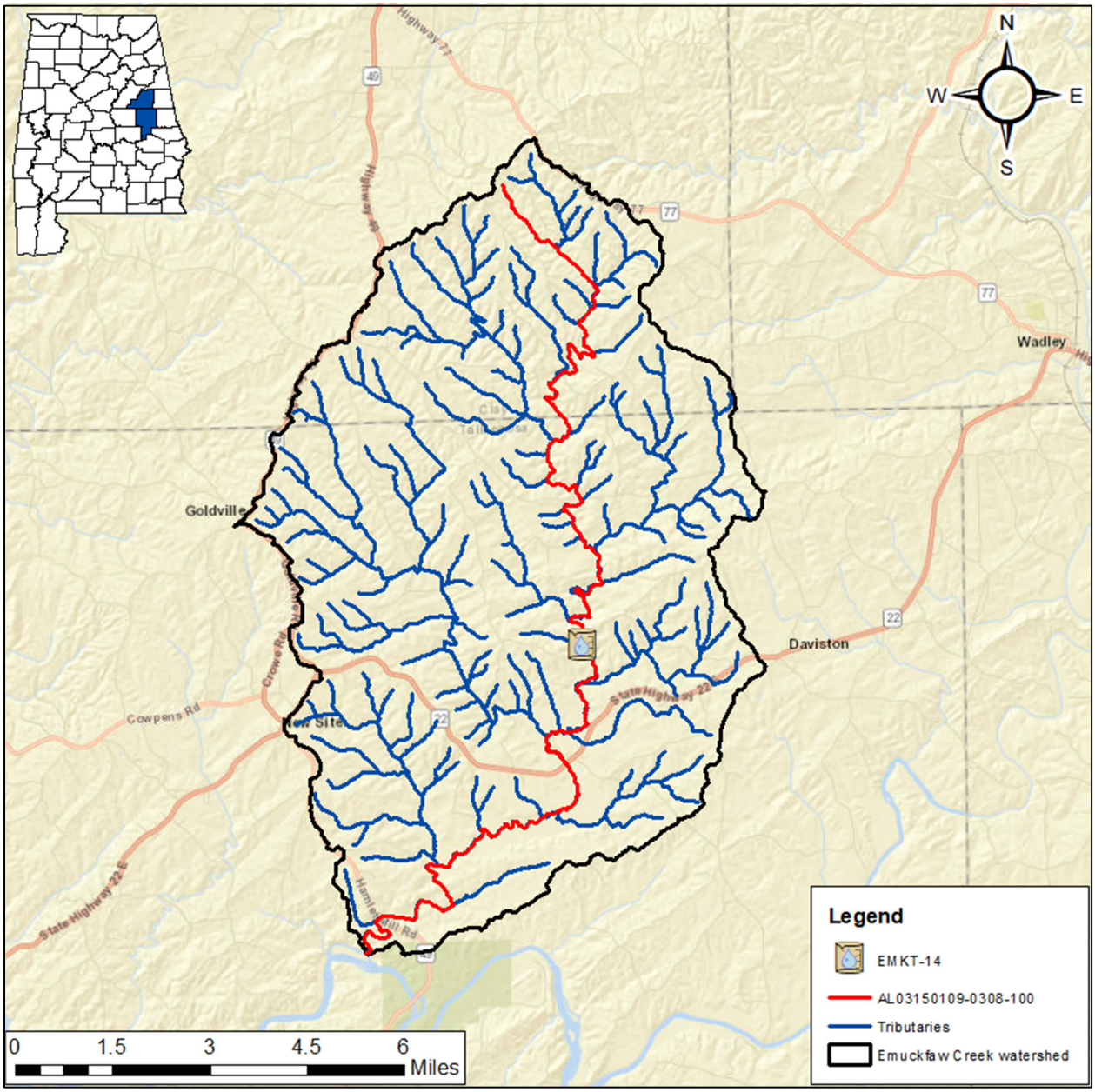
EMKT-14				
Visit Date	***E. coli* (col/100 mL)**	***E. coli* Qualifier***	**Geometric Mean (col/100 mL)**	**Flow (ft^3/s)**
3/22/2023	76.7	-	-	45.6
5/9/2023	74.9	H	-	10.5
6/6/2023	76.7	-	189.6	8.1
6/8/2023	56.5	-		20.4
6/13/2023	139.6	-		20.4
6/21/2023	657	-		41.2
6/26/2023	616	-		44.8
7/5/2023	160.7	H	-	22.1
8/2/2023	75.9	-	222.5	7.7
8/7/2023	517.2	-		15.7
8/9/2023	135.4	-		14.3
8/14/2023	449.4	-		29.3
8/16/2023	228.2	-		21.4
9/6/2023	248.1	H	-	9.5

*H denotes that the holding times for analysis were exceeded.

Table 3-3. ADEM monitoring station on Emuckfaw Creek

Station	Waterbody	Latitude	Longitude	Description
EMKT-14	Emuckfaw Creek	33.0553°	-85.6946°	Emuckfaw Creek at Bill Price Road in Tallapoosa County

Figure 3-3. ADEM station EMKT-14 on Emuckfaw Creek



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 Emuckfaw Creek watershed generally follows the trends described above for the summer months of May through October. The maximum single sample concentration of 657 colonies/100 ml at station EMKT-14 will be used to estimate the TMDL pathogen loading to Emuckfaw Creek under critical conditions. The highest *E. coli* single sample exceedance value occurred on June 21, 2023, with a flow of 41.2 cfs.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: 1) implicitly incorporate 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 or calculated flow data. The single sample *E. coli* maximum criterion 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.

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). As discussed earlier, the MOS is explicit in this TMDL. A TMDL can be denoted by the following equation:

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

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 *E. coli* TMDL for Emuckfaw 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 estimated in-stream flow times a conversion factor. Existing loads were calculated for the highest geometric mean exceedance and the highest single sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion and the geometric mean criterion. There were both single sample and geometric

mean violations; the TMDL was based on the violation that produced the highest calculated percent reduction to achieve applicable water quality criteria.

Existing Conditions

The single sample mass loading was calculated by multiplying the highest *E. coli* single sample exceedance concentration of 657 colonies/100 ml by the measured flow on the day of the exceedance. The measured flow on this date was 41.2 cfs. The calculation for the existing condition was based on the measurement at EMKT-14 on June 21, 2023. The product of the concentration times the flow times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Emuckfaw Creek under the single sample exceedance condition.

$$\frac{41.2\ ft^3}{s} \times \frac{657\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{6.62 \times 10^{11}\ colonies}{day}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 222.5 colonies/100 ml times the average flow of the five samples. This concentration was calculated based on measurements at EMKT-14 between August 2, 2023, and August 16, 2023. The average stream flow for the five samples utilized in the geometric mean calculation was 17.7 cfs. The product of the concentration times the flow times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Emuckfaw Creek under the geometric mean exceedance condition.

$$\frac{17.7\ ft^3}{s} \times \frac{222.5\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{9.62 \times 10^{10} colonies}{day}$$

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 flow and the allowable concentration. This value was then multiplied by the conversion factor to calculate the allowable load.

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

$$\frac{41.2\ \text{ft}^3}{\text{s}} \times \frac{268.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.7 \times 10^{11}\text{colonies}}{\text{day}}$$

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

$$\frac{41.2\ ft^3}{s} \times \frac{29.8\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.0 \times 10^{10} colonies}{day}$$

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

$$\frac{17.7\ ft^3}{s} \times \frac{113.4\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100mL * s}{ft^3 * day} = \frac{4.91 \times 10^{10} colonies}{day}$$

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

$$\frac{17.7\ ft^3}{s} \times \frac{12.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{5.45 \times 10^{9} colonies}{day}$$

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 Emuckfaw Creek as evaluated at station EMKT-14. Table 4-1 shows the existing and allowable *E. coli* loads and required reductions at EMKT-14.

Table 4-1. Emuckfaw Creek - *E. coli* loads and required reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	6.62E+11	2.70E+11	3.92E+11	59%
Geometric Mean Load	9.62E+10	4.91E+10	4.71E+10	49%

From Table 4-1, compliance with the single sample criterion of 298 colonies/100 ml requires a reduction of 59% in the *E. coli* load. The TMDL, WLA, LA, and MOS values necessary to achieve the applicable *E. coli* criteria are provided below in Table 4-2.

Table 4-2. *E. coli* TMDL for Emuckfaw Creek (AL03150109-0308-100)

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
3.0E+11	3.0E+10	N/A	N/A	0	2.7E+11	59%

N/A = not applicable.
a. There are currently three CAFOs in the Emuckfaw Creek watershed. 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 and other NPDES stormwater sources would be required to demonstrate consistency with the assumptions and 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 *E. coli* criterion of 298 colonies/100ml.

4.3 TMDL Summary

Emuckfaw Creek was placed on Alabama's §303(d) list in 2018 based on data collected in 2016. Additional data collected by ADEM in 2023 confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the *E. coli* TMDL for Emuckfaw Creek. Based on the TMDL analysis, it was determined that a 59% 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 in the Emuckfaw Creek watershed. 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 the schedule shown in Table 5-1.

Table 5-1: Follow-up monitoring schedule

River Basin Group	Years to be Monitored
Black Warrior, Blackwater, Chattahoochee, Chipola, Choctawhatchee, Escambia, Perdido, Tennessee (Wheeler), Yellow	2024/2027
Coosa, Escatawpa, Tennessee (Guntersville), Tombigbee	2025/2028
Alabama, Cahaba, Mobile, Tallapoosa, Tennessee (Pickwick and Wilson)	2026/2029

6.0 Public Participation

As part of the public participation process, this TMDL will be placed on public notice and made available for review and comment. The public notice will be prepared and published in four 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 will be made available on ADEM's Website: www.adem.alabama.gov. The public may 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 will be 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 will become part of the administrative record. ADEM will consider 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, 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's Monitoring Program. 2016, 2023. ADEM.

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

Alabama's §303(d) List and Fact Sheet. 2018, 2020, 2022. 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 Water Quality Data

Table 7-1. ADEM monitoring data at EMKT-14 (2016, 2023)

EMKT-14				
Visit Date	***E. coli* (col/100 mL)**	***E. coli* Qualifier***	**Geometric Mean (col/100 mL)**	**Flow (ft^3/s)**
3/15/2016	86	H	-	52.2
4/5/2016	107.1	H	-	53.7
5/3/2016	98.8	H	-	36.4
6/7/2016	209.8	H	-	18.9
7/5/2016	150	H	-	8.9
8/9/2016	307.6	H	-	5.7
9/13/2016	410.6	H	-	2.5
10/11/2016	167	H	-	-
3/22/2023	76.7	-	-	45.6
5/9/2023	74.9	H	-	10.5
6/6/2023	76.7	-	189.6	8.1
6/8/2023	56.5	-		20.4
6/13/2023	139.6	-		20.4
6/21/2023	657	-		41.2
6/26/2023	616	-		44.8
7/5/2023	160.7	H	-	22.1
8/2/2023	75.9	-	222.5	7.7
8/7/2023	517.2	-		15.7
8/9/2023	135.4	-		14.3
8/14/2023	449.4	-		29.3
8/16/2023	228.2	-		21.4
9/6/2023	248.1	H	-	9.5

*H denotes that the holding times for analysis were exceeded.

7.3 Emuckfaw Creek Photographs

EMKT-14, looking upstream (August 2016)

EMKT-14, looking downstream (August 2016)

EMKT-14, looking upstream (May 2023)

EMKT-14, looking downstream (May 2023)