Final
Total Maximum Daily Load (TMDL)
for
Uphapee Creek

Assessment Unit ID # AL03150110-0304-100

Pathogens (*E. coli*)

Macon County

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

Figure 1: Uphapee 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 waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Uphapee Creek is currently included on Alabama's §303(d) list for pathogens (*E. coli*) from its source to the Tallapoosa River. Uphapee Creek forms east of the city of Tuskegee and is part of the Tallapoosa River Basin. It flows west through Macon County and into the Tallapoosa River. The total length of Uphapee Creek is 21.16 miles, and the total drainage area of the Uphapee Creek watershed is approximately 420 square miles. Uphapee Creek has a use classification of Fish & Wildlife (F&W).

Uphapee Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM monitoring data collected during 2013-2016 at station UPHM-3. Uphapee Creek has subsequently been listed on the 2020, 2022, and 2024 §303(d) lists of impaired waterbodies.

During 2018-2023, sampling studies were performed by ADEM to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2018-2023 data will be used to assess the water quality of Uphapee Creek because it provides the best picture of the current water quality 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. This TMDL will be developed from *E. coli* data collected at station UPHM-3. This bacterial data is listed in Appendix 7.2, Table 7-2 for reference. ADEM collected 26 *E. coli* samples and conducted two geometric mean studies on Uphapee Creek during 2018-2023. According to the data, Uphapee Creek was not meeting the pathogen criteria applicable to its use classification of F&W. Therefore, this TMDL has been developed for pathogens (*E. coli*) for the listed reach.

A mass balance approach was used for calculating the pathogen TMDL for Uphapee 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 which 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 maximum *E. coli* exceedance at station UPHM-3 (June 9, 2021) with a value of 2419.6 colonies/100 ml. This violation calls for a reduction of 89%.

Table 1-1 is a summary of the estimated existing load, allowable load, and percent reduction for the geometric mean and single sample criteria. Table 1-2 provides the details of the TMDL along

with the corresponding reductions for Uphapee Creek, which are protective of the *E. coli* water quality criteria year-round.

Table 1-1. *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	1.91E+13	2.11E+12	1.69E+13	89%
Geometric Mean Load	1.85E+13	4.82E+12	1.36E+13	74%
Loachapoka High School (AL0043672)	0	1.55E+8	0	0%
Beauregard High School (AL0043656)	0	2.03E+8	0	0%
H.C. Morgan WPCF (AL0050237)	7.52E+10	2.82E+11	0	0%

Table 1-2. *E. coli* TMDL for Uphapee 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)
2.35E+12	2.35E+11	2.82E+11	89%	0	1.83E+12	89%

a. There are no CAFOs in the Uphapee Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Current and future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. Current and future MS4s will be required to document within the entity's stormwater management program plan (SWMPP) the method(s) that with be utilized to demonstrate consistency with the assumptions and requirements of this TMDL. Other NPDES stormwater sources will 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. The 89% reduction for MS4s and other NPDES sources should not be interpreted strictly as a numeric permit limit, but as an effort to implement BMPs to demonstrate reductions of the impairment to the maximum extent practicable.
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 criterion of 298 colonies/100ml.

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 Uphapee 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 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).

The State of Alabama has identified the 21.16 miles of Uphapee Creek as impaired for pathogens. The §303(d) listing for pathogens was originally reported on Alabama's 2018 List of Impaired Waters based on 2013, 2015, and 2016 ADEM monitoring data from station UPHM-3 and was subsequently included on the 2020, 2022, and 2024 lists. The potential sources of the impairment on the 2024 §303(d) list are collection system failure and pasture grazing.

2.2 Problem Definition

Waterbody Impaired:	Uphapee Creek – From Tallapoosa River to its source
Impaired Reach Length:	21.16 miles
Impaired Drainage Area:	420 square miles
Water Quality Standard Violation:	Pathogens (single sample, 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 the F&W 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 places 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:

Uphapee Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM's 2013-2016 *E. coli* data from station UPHM-3. Of the twelve *E. coli* samples collected at station UPHM-3, four violated the applicable single sample maximum criterion of 298 col/100 ml. The listing data can be found in Appendix 7.2, Table 7.1.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

For the purpose of this TMDL, a single sample *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 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

3.2.1 Point Sources in the Uphapee Creek Watershed

A point source can be defined as a discernable, 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 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.

Continuous Point Sources

There are three continuous NPDES-permitted facilities with a discharge to a surface water in the Uphapee Creek watershed. These facilities are shown in Table 3-1 and Figure 3-1. These facilities have daily maximum and monthly average *E. coli* limits. The permit limits are the applicable pathogen criteria for the Fish and Wildlife use classification and are as follows:

Monthly average (May-October): 126 colonies/100ml
Monthly average (November-April): 548 colonies/100ml
Daily maximum (May-October): 298 colonies/100ml
Daily maximum (November-April): 2507 colonies/100ml

Table 3-1 Continuous Point Sources in the Uphapee Creek Watershed

Type	Permit Number	Facility Name	Receiving Stream	Design Flow (MGD)
Municipal	AL0043672	Loachapoka High School	Choctafaula Creek	0.01375
Municipal	AL0043656	Beauregard High School	Chewacla Creek	0.018
Municipal	AL0050237	H.C. Morgan WPCF	Parkerson Mill Creek	25

There are two facilities in the Uphapee Creek watershed that utilize land application systems for their treated wastewater, Notasulga WWTF (AL0070939) and Conway Acres Trailer Park (AL0064955). Since these facilities are not permitted to discharge treated wastewater to a surface water, they will not be given an allocation in this TMDL.

Figure 3-1 Map of Continuous Point Sources in the Uphapee Creek Watershed

Any future NPDES-regulated, continuous 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.

Non-Continuous Point Sources

Three of the facilities mentioned above (H.C. Morgan WPCF, Notasulga WWTF, and Conway Acres Trailer Park) are also permitted through the NPDES program to discharge stormwater runoff in the Uphapee Creek watershed. These facilities will be required to comply with the provisions of this TMDL through implementation of Best Management Practices (BMPs) for the permitted stormwater outfalls.

There are currently several NPDES-permitted non-continuous dischargers within the Uphapee Creek watershed, including one mining site and several facilities with NPDES general permits for activities such as construction, asphalt, concrete, metals, etc. These facilities are not required to monitor for *E. coli* and are not considered to be a source of pathogens due to the nature of their processes. No *E. coli* loading to the Uphapee Creek watershed will be attributed to these facilities, and they will not receive an allocation in this TMDL.

Urban areas designated as part of the Municipal Separate Storm Sewer System (MS4) program are regulated by NPDES, and as such, are considered to be point sources by EPA and receive WLAs in TMDLs. The EPA defines an MS4 as *"a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):*

(i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law);
(ii) Designed or used for collecting or conveying stormwater;
(iii) Which is not a combined sewer; and
(iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

During rain events in an urbanized watershed, stormwater runoff has the potential to collect pollutants which are transported through MS4 systems before discharging into state waters. Therefore, in 1990 the EPA developed the NPDES stormwater program, which promulgated rules, in two different phases, in order to address the potential negative water quality effects associated with stormwater runoff. In 1990, the EPA issued Phase I regulations under the NPDES stormwater program, which required both medium and large cities and also counties with populations of 100,000 or more to obtain NPDES permit coverage specifically for their stormwater discharges. In 1999, the second phase of the NPDES stormwater program amended existing regulations in addition to requiring NPDES permits for stormwater discharges from certain small MS4 systems.

There are four MS4 permits within the Uphapee Creek watershed. These permits are listed below in Table 3-2. Contributions from these Phase II MS4 areas will be allocated as MS4 WLAs in the TMDL. Current and future MS4s will be required to demonstrate consistency with the assumptions and requirements of this TMDL through implementation of BMPs on a case-by-case basis.

Table 3-2 MS4 Permits in the Uphapee Creek Watershed

Permit Number	Name	Phase
ALR040003	City of Auburn	II
ALR040018	City of Opelika	II
ALR040012	Lee County	II
ALR040030	Auburn University	II

There are currently no Animal Feeding Operation/Concentrated Animal Feeding Operation (AFO/CAFO) facilities located within the Uphapee Creek watershed. The ADEM AFO/CAFO rules prohibit discharges of pollutants from the facilities and their associated waste land application activities. As a result, future AFOs/CAFOs will receive a waste load allocation of zero.

There are currently no registered sites in the Uphapee 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.

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 Alabama Environmental Permitting and Compliance System (AEPACS) database, it was found that numerous SSOs have been reported in the Uphapee Creek watershed in recent years. During 2018-2024, there were twenty-four SSOs related to the H.C. Morgan WPCF, seven SSOs related to the Opelika Westside WWTP, and five SSOs related to the Opelika Eastside WWTP in the Uphapee Creek watershed. Further details of the SSOs in the watershed are included in Appendix 7.3.

3.2.2 Nonpoint Sources in the Uphapee 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 in the soil and then are washed off during rain events. As the runoff transports the sediment over the land surface, more *E. coli* bacteria are collected and carried to the stream or waterbody. Therefore, there is some net loading of *E. coli* bacteria into the stream as dictated by the watershed hydrology.

Agricultural land can be a source of *E. coli* bacteria. 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 *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, turkey, waterfowl, etc. Wildlife 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 urban areas is potentially attributable to multiple sources including storm water runoff, unpermitted 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.

3.3 Land Use Assessment

Land use for the Uphapee Creek watershed was determined using ArcMap with land use datasets derived from the 2021 National Land Cover Dataset (NLCD). Figure 3-2 and Table 3-3 display the land use areas for the Uphapee Creek watershed. Figure 3-3 is a graph depicting the primary land uses in the Uphapee Creek watershed.

The majority of the Uphapee Creek watershed is forested/natural (75.74%). Other land uses include agriculture (12.42%), developed land (11.02%), and open water (0.83%). Developed land includes both commercial and residential land uses. If not managed properly, agriculture can have significant nonpoint source impacts. Also, septic systems can be a main source of bacteria if not properly installed and maintained.

Figure 3-2. Land Use Map for the Uphapee Creek Watershed

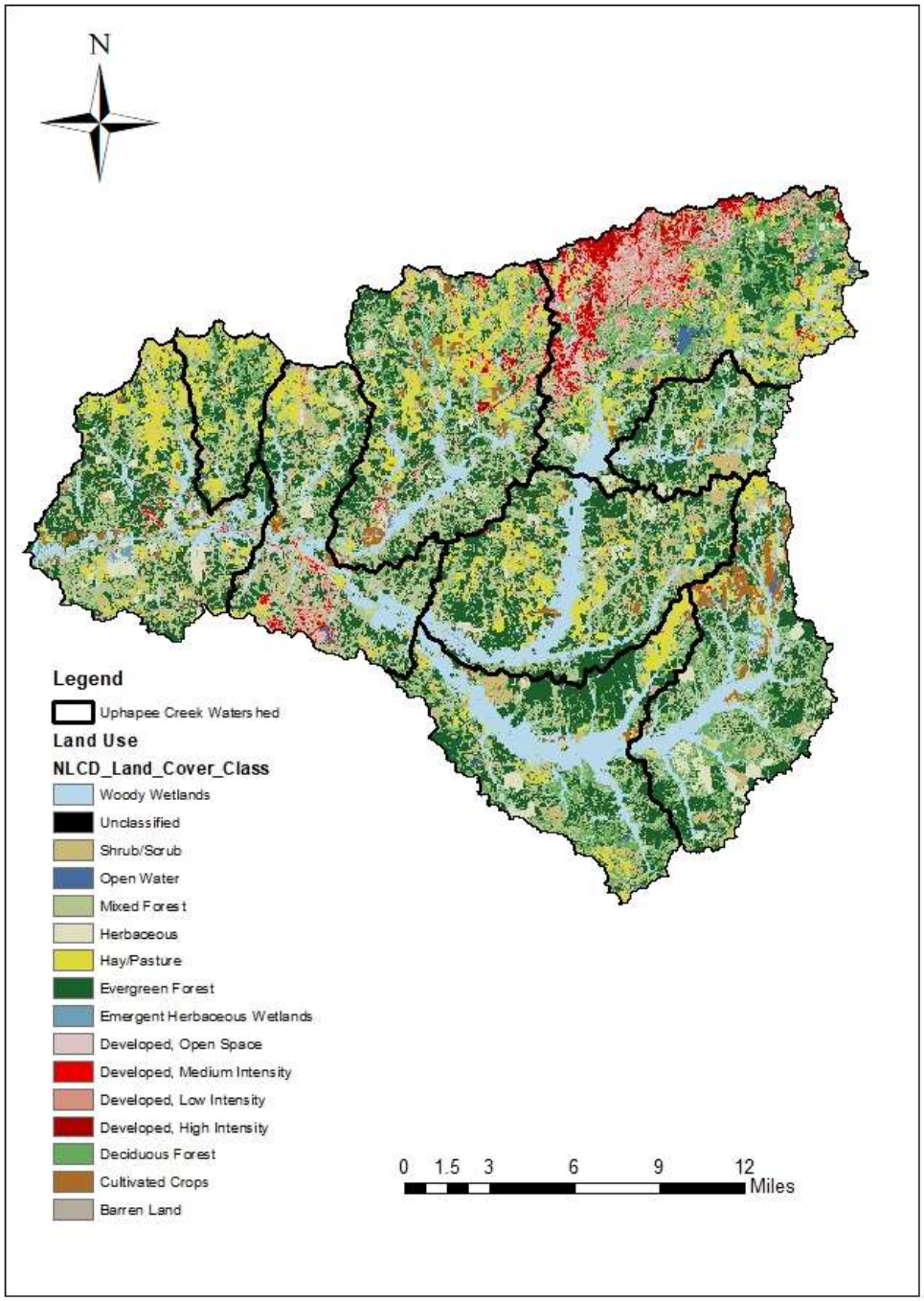
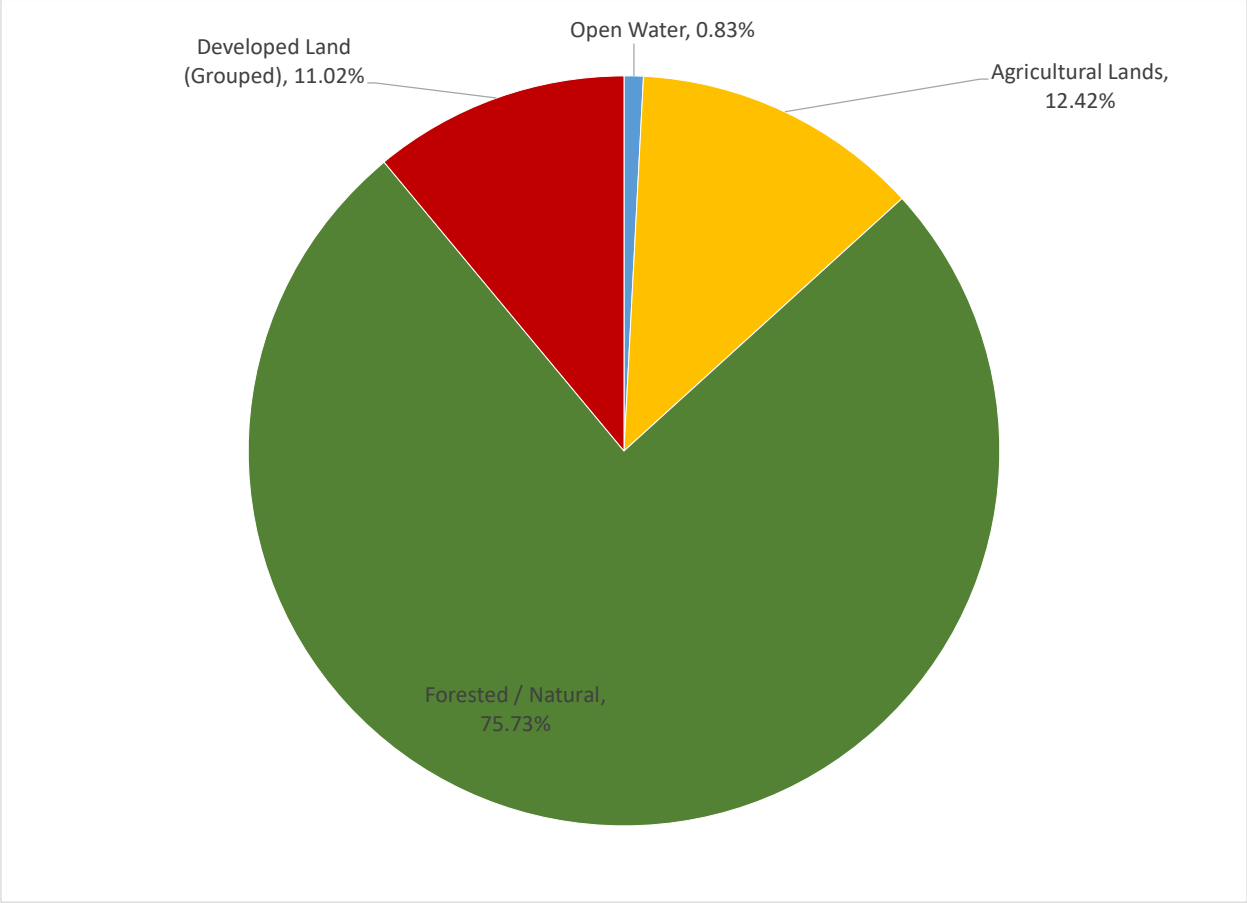


Table 3-3. Land Use Areas for the Uphapee Creek Watershed

Class Description	Mi²	Acres	Percent
Open Water	3.49	2235.55	0.83%
Agricultural Lands	52.23	33427.21	12.42%
Forested / Natural	318.34	203734.91	75.74%
Developed Land (Grouped)	46.32	29642.52	11.02%
TOTALS →	**420.38**	**269040.52**	**100.00%**

Figure 3-3. Graph of Primary Land Uses in the Uphapee Creek Watershed



3.4 Linkage Between Numeric Targets and Sources

The Uphapee Creek watershed's main land use is forested/natural. 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 Uphapee Creek are from the agricultural land uses, unpermitted discharges of wastewater, urban 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.

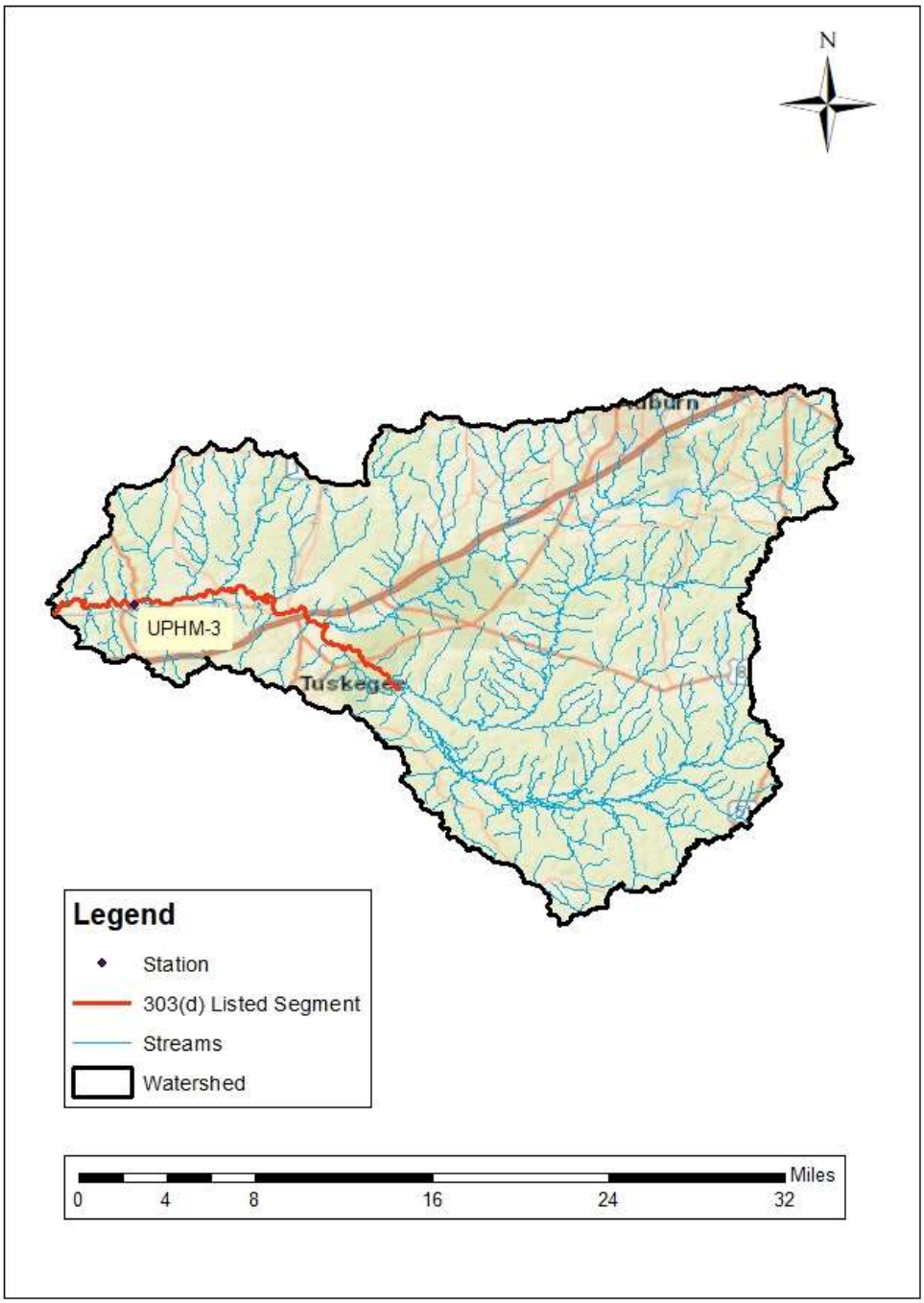
3.5 Data Availability and Analysis

During 2018-2023, ADEM collected water quality data on Uphapee Creek at station UPHM-3. Table 3-4 and Figure 3-4 display the description and location for the ADEM sampling station. As previously mentioned, the 2018-2023 data will be used for this TMDL. The January 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.

Table 3-4. Uphapee Creek Sampling Station Description

ADEM Station	Station Location	Latitude	Longitude
UPHM-3	Uphapee Creek at State Highway 81 (near Tuskegee)	32.48124	-85.79838

Figure 3-4. Map of ADEM Sampling Station on Uphapee Creek



Of the 26 *E. coli* samples collected at station UPHM-3 during 2018-2023, seven violated the applicable single sample maximum criterion of 298 col/100 ml for the Fish & Wildlife use classification. In addition, there were exceedances of the geometric mean criterion of 126 col/100 ml at station UPHM-3 in June 2023 and August 2023. This data can be viewed in Table 3-5 below and in Appendix 7.2, Table 7-2.

Table 3-5. 2018-2023 *E. coli* Data for Uphapee Creek

Station ID	Date	Flow *(cfs)*	*E. coli* Single Sample (col/100ml)	*E. coli dc*	*E. coli* Single Sample Criterion (col/100ml)	*E. coli* Geometric Mean (col/100ml)	*E. coli* Geometric Mean Criterion (col/100ml)
UPHM-3	6/13/2018	153	151.5	H	298		
UPHM-3	8/8/2018	75.8	70.3	H	298		
UPHM-3	10/17/2018	119	156.5		298		
UPHM-3	6/6/2019	26.7	38.8		298		
UPHM-3	8/6/2019	70.6	90.8		298		
UPHM-3	10/10/2019		95.9		298		
UPHM-3	6/9/2020	127	77.6		298		
UPHM-3	8/5/2020	65.5	20.1	H	298		
UPHM-3	10/29/2020	283	275.5		298		
UPHM-3	6/9/2021	322	2419.6		298		
UPHM-3	8/3/2021	187	579.4		298		
UPHM-3	10/13/2021	410	238.2		298		
UPHM-3	3/22/2023	355	160.7		2507		
UPHM-3	5/3/2023	212	172.3		298		
UPHM-3	6/7/2023	92.7	60.2		298	434.2	126
UPHM-3	6/12/2023	118.3	1297.6		298		
UPHM-3	6/14/2023	75	153.4		298		
UPHM-3	6/20/2023	568	1158.8		298		
UPHM-3	6/22/2023	7830	1112		298		
UPHM-3	7/13/2023	163	109.2		298		
UPHM-3	8/3/2023	68	73.8		298	195.8	126
UPHM-3	8/8/2023	94.3	167.4		298		
UPHM-3	8/10/2023	75.6	387.3		298		
UPHM-3	8/15/2023	118.1	387.3		298		
UPHM-3	8/17/2023	89.6	155.3		298		
UPHM-3	9/6/2023	47.7	110		298		

H = The analytical holding times for analysis are 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 *E. coli* bacteria into streams, resulting in spikes of *E. coli* bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of *E. coli* bacteria on the land surface, resulting in a more uniform loading rate.

Uphapee Creek generally follows the trends described above for the summer months of May through October. The critical condition for this pathogen TMDL was taken to be the one with the highest *E. coli* single sample exceedance value. That value was 2419.6 colonies/100 ml that occurred on June 9, 2021, at station UPHM-3. A flow of 322 cfs was measured for this sampling event. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Uphapee Creek year-round.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the 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 *E. coli* 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 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.

4.0 TMDL Development

4.1 Definition of a TMDL

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). 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:

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

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 Uphapee 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 instream 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 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.

Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest single sample exceedance concentration of 2419.6 colonies/100 ml times the measured flow at the time the sample was collected. This concentration was measured at UPHM-3 on June 9, 2021. The stream flow was calculated to be 322 cfs at the time of the violation. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Uphapee Creek.

$$\frac{322\ \text{ft}^3}{s} \times \frac{2419.6\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{1.91 \times 10^{13}\text{colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 434.2 colonies/100 ml times the average of the five measured stream flows. This concentration was calculated based on measurements at UPHM-3 between June 7, 2023, and June 22, 2023, which are shown above in Table 3-5. The average stream flow was determined to be 1737 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Uphapee Creek under the geometric mean exceedance condition.

$$\frac{1737\ \text{ft}^3}{s} \times \frac{434.2\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{1.85 \times 10^{13}\text{colonies}}{\text{day}}$$

The **continuous point sources** mass loading was calculated by taking the average discharge flow from the month of June 2021 (since this is when the highest exceedance occurred) and multiplying that value by the reported maximum daily *E. coli* value for the same month for each facility. These numbers were found in the June 2021 Discharge Monitoring Reports (DMRs) submitted by the facilities.

Loachapoka High School (AL0043672):

The facility reported no discharge during June 2021. Therefore, the existing load for this facility is zero.

Beauregard High School (AL0043656):

The facility reported no discharge during June 2021. Therefore, the existing load for this facility is zero.

H.C. Morgan WPCF (AL0050237):

$$8.111\ \text{MGD} \times \frac{1.55\ \text{ft}^3}{\text{s} * \text{MGD}} \times \frac{245\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755\ 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{7.52\ \times 10^{10}\ \text{colonies}}{\text{day}}$$

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 flow used for the violation event times the conversion factor times the allowable concentration.

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

$$\frac{322\ \text{ft}^3}{s} \times \frac{268.2\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{2.11 \times 10^{12}\text{colonies}}{\text{day}}$$

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

$$\frac{322\ \text{ft}^3}{s} \times \frac{29.8\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{2.35 \times 10^{11}\text{colonies}}{\text{day}}$$

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

$$\frac{1737\ \text{ft}^3}{s} \times \frac{113.4\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{4.82 \times 10^{12}\text{colonies}}{\text{day}}$$

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

$$\frac{1737\ \text{ft}^3}{s} \times \frac{12.6\ \text{colonies}}{100\text{ml}} \times \frac{24{,}465{,}755\ 100\text{ml} * s}{\text{ft}^3 * \text{day}} = \frac{5.35 \times 10^{11}\text{colonies}}{\text{day}}$$

The WLA for the continuous point sources was calculated by multiplying the design flow of each facility times the applicable instream single sample *E. coli* criterion. The product of these two values times the conversion factor gives the appropriate loading.

Loachapoka High School (AL0043672):

$$0.01375\ \text{MGD} \times \frac{1.55\ \text{ft}^3}{\text{s} * \text{MGD}} \times \frac{298\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755\ 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.55 \times 10^8\ \text{colonies}}{\text{day}}$$

Beauregard High School (AL0043656):

$$0.018\ \text{MGD} \times \frac{1.55\ \text{ft}^3}{\text{s} * \text{MGD}} \times \frac{298\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755\ 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.03 \times 10^8\ \text{colonies}}{\text{day}}$$

H.C. Morgan WPCF (AL0050237):

$$25\ \text{MGD} \times \frac{1.55\ \text{ft}^3}{\text{s} * \text{MGD}} \times \frac{298\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755\ 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.82 \times 10^{11}\ \text{colonies}}{\text{day}}$$

The difference in the pathogen loading between the existing condition (violation event) and the allowable condition 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 Uphapee Creek as evaluated at station UPHM-3. Table 4-1 shows the existing and allowable *E. coli* loads and required reductions for the Uphapee Creek watershed.

Table 4-1. *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	1.91E+13	2.11E+12	1.69E+13	89%
Geometric Mean Load	1.85E+13	4.82E+12	1.36E+13	74%
Loachapoka High School (AL0043672)	0	1.55E+08	0	0%
Beauregard High School (AL0043656)	0	2.03E+08	0	0%
H.C. Morgan WPCF (AL0050237)	7.52E+10	2.82E+11	0	0%

From Table 4-1, compliance with the single sample criterion of 298 colonies/100 ml requires a reduction in the *E. coli* load of 89%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criterion are provided in Table 4-2 below.

Table 4-2. *E. coli* TMDL for Uphapee 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)
2.35E+12	2.35E+11	2.82E+11	89%	0	1.83E+12	89%

a. There are no CAFOs in the Uphapee Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Current and future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. Current and future MS4s will be required to document within the entity's stormwater management program plan (SWMPP) the method(s) that with be utilized to demonstrate consistency with the assumptions and requirements of this TMDL. Other NPDES stormwater sources will 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. The 89% reduction for MS4s and other NPDES sources should not be interpreted strictly as a numeric permit limit, but as an effort to implement BMPs to demonstrate reductions of the impairment to the maximum extent practicable.
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 criterion of 298 colonies/100ml.

4.3 TMDL Summary

Uphapee Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM's 2013-2016 *E. coli* data from station UPHM-3. During 2018-2023, ADEM collected water quality data that confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the *E. coli* TMDL for Uphapee Creek. Based on the TMDL analysis, it was determined that a 89% 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 stormwater 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 Uphapee 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
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. 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, 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. 2013-2021, 2023. ADEM.

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

Alabama Department of Environmental Management, 2018, 2020, 2022, & 2024 §303(d) Lists and Fact Sheets. ADEM.

Alabama Department of Environmental Management (ADEM), Laboratory Data Qualification SOP #4910 Revision 7.2, 2022.

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. 2013-2016 ADEM Pathogen Data Collected on Uphapee Creek

STATION ID	DATE	Flow (cfs)	*E. coli* (col/100 ml)	*E. coli* dc
UPHM-3	5/6/2013	335	396.8	
UPHM-3	7/11/2013	2870	2599	
UPHM-3	9/11/2013	103	36.4	
UPHM-3	6/5/2014	128	63.1	
UPHM-3	8/7/2014	49	13.5	
UPHM-3	10/9/2014	26	33.6	
UPHM-3	6/10/2015	381	2599.4	
UPHM-3	7/29/2015		36.4	
UPHM-3	10/29/2015	39	42	
UPHM-3	6/9/2016	54	73.8	
UPHM-3	8/3/2016	585	4839.2	G
UPHM-3	10/5/2016	11	72.8	

G = The actual number was probably greater than the number reported.

Table 7-2. 2017-2023 ADEM Pathogen Data Collected on Uphapee Creek

STATION ID	DATE	Flow (cfs)	Single Sample *E. coli* (col/100 ml)	*E. coli* dc	Geometric mean *E. coli* (col/100 ml)
UPHM-3	5/8/2017	182	71.2	H	
UPHM-3	7/12/2017	322	613.1	H	
UPHM-3	9/13/2017	578	1841.7	H	
UPHM-3	6/13/2018	153	151.5	H	
UPHM-3	8/8/2018	75.8	70.3	H	
UPHM-3	10/17/2018	119	156.5		
UPHM-3	6/6/2019	26.7	38.8		
UPHM-3	8/6/2019	70.6	90.8		
UPHM-3	10/10/2019		95.9		
UPHM-3	6/9/2020	127	77.6		
UPHM-3	8/5/2020	65.5	20.1	H	
UPHM-3	10/29/2020	283	275.5		
UPHM-3	6/9/2021	322	2419.6		
UPHM-3	8/3/2021	187	579.4		
UPHM-3	10/13/2021	410	238.2		
UPHM-3	3/22/2023	355	160.7		
UPHM-3	5/3/2023	212	172.3		
UPHM-3	6/7/2023	92.7	60.2		434.2
UPHM-3	6/12/2023	118.3	1297.6		
UPHM-3	6/14/2023	75.0	153.4		
UPHM-3	6/20/2023	568	1158.8		
UPHM-3	6/22/2023	7830	1112		
UPHM-3	7/13/2023	163	109.2		
UPHM-3	8/3/2023	68.0	73.8		195.8
UPHM-3	8/8/2023	94.3	167.4		
UPHM-3	8/10/2023	75.6	387.3		
UPHM-3	8/15/2023	118.1	387.3		
UPHM-3	8/17/2023	89.6	155.3		
UPHM-3	9/6/2023	47.7	110		

H = The analytical holding times for analysis are exceeded.

7.3 Sanitary Sewer Overflows (SSOs)

Table 7-3. 2018-2024 SSOs in the Uphapee Creek Watershed

Permit Number	Facility/Site Name	SSO Began Date and Time	SSO Stopped Date and Time	SSO Volume	SSO Latitude	SSO Longitude
AL0050130	Opelika Westside WWTP	12/11/2020 7:30	12/11/2020 8:00	1,500 gallons	32.60368	-85.35017
AL0050130	Opelika Westside WWTP	6/25/2021 17:00	6/27/2021 0:00	10,000 < gallons <= 25,000	32.615	-85.406
AL0050130	Opelika Westside WWTP	3/28/2022 10:00	3/28/2022 10:45	<=1,000 gal	32.60446	-85.37562
AL0050130	Opelika Westside WWTP	9/6/2022 6:30	9/6/2022 7:00	<=1,000 gal	32.60639	-85.41556
AL0050130	Opelika Westside WWTP	12/28/2022 7:10	12/28/2022 7:30	<=1,000 gallons	32.6145	-85.38393
AL0050130	Opelika Westside WWTP	8/26/2023 6:00	8/26/2023 6:45	1,000 < gallons <= 10,000	32.60752	-85.40601
AL0050130	Opelika Westside WWTP	6/12/2024 10:20	6/12/2024 11:40	10,000 < gallons <= 25,000	32.61414	-85.39891
AL0050237	H.C. Morgan WPCF	3/18/2019 14:00	3/18/2019 14:15	750 gallons	32.5792	-85.48488
AL0050237	H.C. Morgan WPCF	4/7/2019 9:20	4/7/2019 10:30	750 gallons	32.60296	-85.47455
AL0050237	H.C. Morgan WPCF	5/7/2019 19:50	5/7/2019 20:10	60 gallons	32.61562	-85.45505
AL0050237	H.C. Morgan WPCF	7/28/2019 17:15	7/28/2019 21:00	112 gallons	32.61922	-85.45666
AL0050237	H.C. Morgan WPCF	8/13/2019 14:15	8/13/2019 14:30	75 gallons	32.60557	-85.49514
AL0050237	H.C. Morgan WPCF	9/12/2019 8:40	9/12/2019 9:00	500 gallons	32.58006	-85.47762
AL0050237	H.C. Morgan WPCF	1/15/2020 9:10	1/15/2020 9:40	150 gallons	32.59844	-85.45193
AL0050237	H.C. Morgan WPCF	1/16/2020 13:55	1/16/2020 14:20	1,875 gallons	32.59633	-85.52983
AL0050237	H.C. Morgan WPCF	2/6/2020 6:45	2/7/2020 16:25	404,000 gallons	32.54032	-85.54937
AL0050237	H.C. Morgan WPCF	1/13/2021 12:00	1/13/2021 14:00	1,200 gallons	32.60186	-85.48175
AL0050237	H.C. Morgan WPCF	2/15/2021 10:30	2/15/2021 15:30	600 gallons	32.60147	-85.47377
AL0050237	H.C. Morgan WPCF	9/1/2021 16:30	9/1/2021 17:10	600 gallons	32.59941	-85.45111
AL0050237	H.C. Morgan WPCF	12/2/2021 18:40	12/2/2021 19:45	325 gallons	32.61212	-85.45853
AL0050237	H.C. Morgan WPCF	3/11/2022 18:30	3/11/2022 20:40	650 gallons	32.61175	-85.45799
AL0050237	H.C. Morgan WPCF	3/28/2023 15:40	3/28/2023 16:25	225 gallons	32.60028	-85.46568
AL0050237	H.C. Morgan WPCF	4/5/2023 12:05	4/5/2023 13:50	3,150 gallons	32.57411	-85.50278
AL0050237	H.C. Morgan WPCF	6/21/2023 12:50	6/21/2023 13:30	80 gallons	32.59869	-85.47109
AL0050237	H.C. Morgan WPCF	7/12/2023 7:37	7/12/2023 8:07	320 gallons	32.57633	-85.46487
AL0050237	H.C. Morgan WPCF	10/6/2023 7:18	10/6/2023 9:22	100 gallons	32.61349	-85.4598
AL0050237	H.C. Morgan WPCF	10/22/2023 13:05	10/22/2023 15:10	850 gallons	32.61169	-85.45797
AL0050237	H.C. Morgan WPCF	2/12/2024 7:55	2/12/2024 9:20	425 gallons	32.60312	-85.45333
AL0050237	H.C. Morgan WPCF	2/12/2024 8:35	2/12/2024 13:25	8,700 gallons	32.59104	-85.47162

Table 7-3. 2018-2024 SSOs in the Uphapee Creek Watershed (cont.)

Permit Number	Facility/Site Name	SSO Began Date and Time	SSO Stopped Date and Time	SSO Volume	SSO Latitude	SSO Longitude
AL0050237	H.C. Morgan WPCF	3/9/2024 9:00	3/9/2024 11:00	1,800 gallons	32.60296	-85.47455
AL0050237	H.C. Morgan WPCF	5/31/2024 9:00	5/31/2024 11:15	675 gallons	32.61922	-85.45667
AL0059218	Opelika Eastside WWTP	4/25/2019 7:32	4/25/2019 8:10	<=1,000 gallons	32.595	-85.358
AL0059218	Opelika Eastside WWTP	9/20/2020 11:16	9/20/2020 13:20	10,000 < gallons <= 25,000	32.60423	-85.37655
AL0059218	Opelika Eastside WWTP	9/21/2021 7:10	9/21/2021 10:12	1,000 < gallons <=10,000	32.59825	-85.35665
AL0059218	Opelika Eastside WWTP	11/23/2021 8:00	11/23/2021 14:00	25,000 < gallons <= 50,000	32.60115	-85.37916
AL0059218	Opelika Eastside WWTP	7/19/2024 15:08	7/19/2024 15:45	10,000 < gallons <= 25,000	32.59954	-85.37672

7.4 Uphapee Creek Watershed Photos (June 5, 2024)

Photo 7-1 Uphapee Creek at UPHM-3 (Highway 81), Looking Upstream

Photo 7-2 Uphapee Creek at UPHM-3 (Highway 81), Looking Downstream

Photo 7-3 Uphapee Creek at Highway 199, Looking Upstream

Photo 7-4 Uphapee Creek at Highway 199, Looking Downstream

Photo 7-5 Uphapee Creek at Highway 49, Looking Upstream

Photo 7-6 Uphapee Creek at Highway 49, Looking Downstream

Photo 7-7 Uphapee Creek at Highway 29, Looking Upstream

Photo 7-8 Uphapee Creek at Highway 29, Looking Downstream

Photo 7-9 Uphapee Creek at County Road 91, Looking Upstream

Photo 7-10 Uphapee Creek at County Road 91, Looking Downstream