Final

Total Maximum Daily Load (TMDL)

for

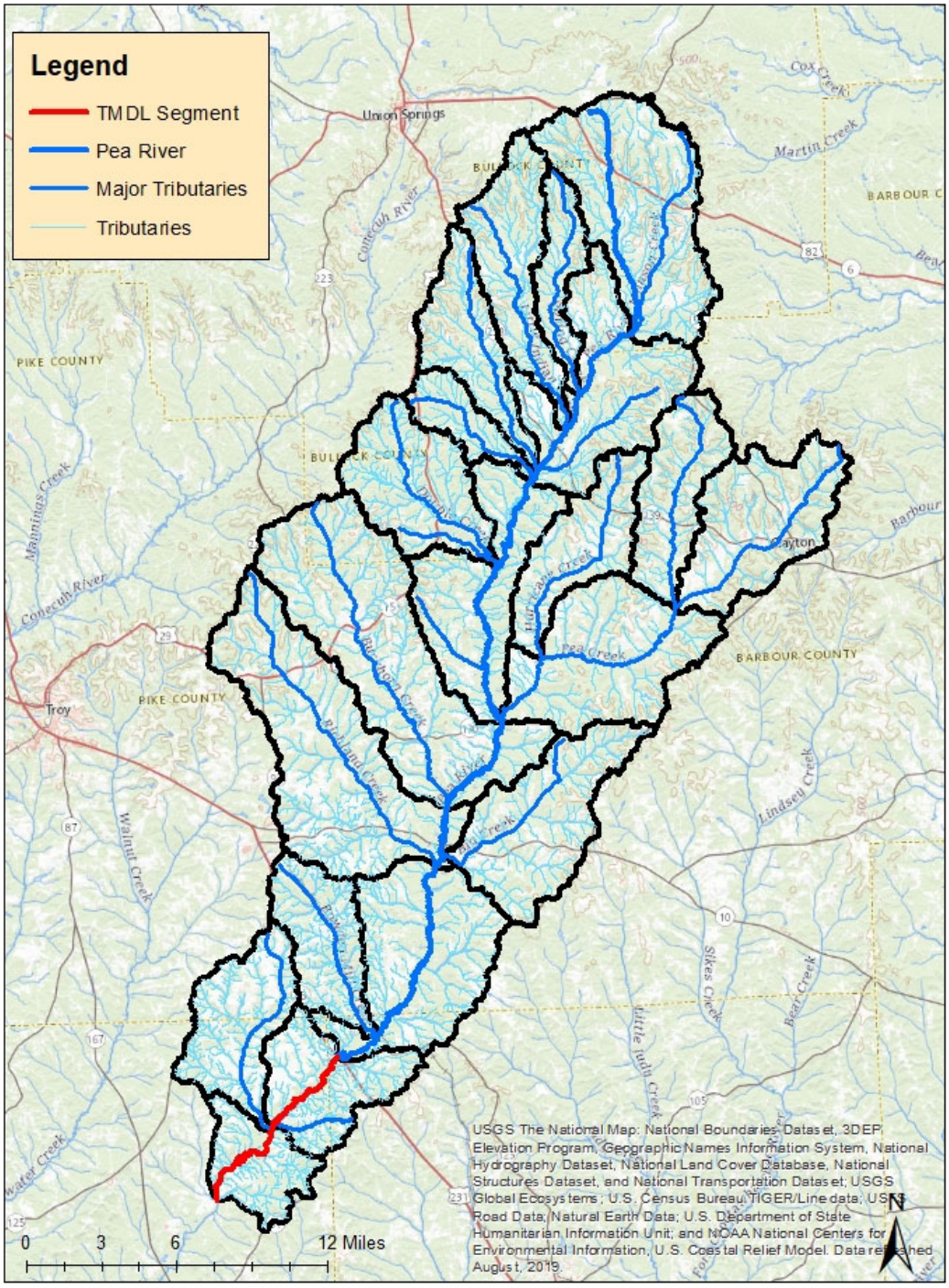
Pea River

Assessment Unit ID # AL03140202-0505-100

Pathogens (*E. coli*)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
July 2021

Figure 1: The Pea River 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 sum of individual wasteload allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Pea River forms in Bullock County and is part of the Choctawhatchee River basin. It flows southwest for approximately 154 miles until it empties into the Choctawhatchee River. This TMDL addresses the segment of the Pea River from Halls Creek to US Highway 231, which is located near Ariton, Alabama. The total drainage area for this segment of the Pea River is 555.5 square miles. The use classifications for this segment of the Pea River are Swimming and Other Whole Body Water-Contact Sports (Swimming) and Fish & Wildlife. Since the criteria for pathogens under the Swimming classification are more stringent than the criteria for the Fish and Wildlife classification, the Swimming criteria will be applied throughout this TMDL.

Pea River was first listed on the §303(d) list for pathogens in 2016 based on data collected in 2014 by the Alabama Department of Environmental Management (ADEM), which indicated the river was impaired for *E. coli*. This portion of the Pea River was found to exceed the *E. coli* single sample water quality criterion multiple times at one station.

In 2020, §303(d) sampling studies were performed by ADEM on the Pea River to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2020 data will be used to assess the water quality of the Pea River because it is the most current data and provides the best picture of the current water quality conditions of the stream. The January 2020 edition of *Alabama's Water Quality Assessment and Listing Methodology* section 4.8.2, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody. ADEM collected 15 samples from the Pea River in 2020. According to the data collected, the Pea River was not meeting the pathogen criteria applicable to its use classification of Swimming and Fish and Wildlife. Therefore, a TMDL is necessary for pathogens (*E. coli*) for the Pea River.

A mass balance approach was used for calculating the pathogen TMDL for the Pea River. The mass balance approach utilizes the conservation of mass principle. The TMDL was calculated using the single 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 211.5 colonies/100 ml (235 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 461.1 colonies/100 ml, measured on December 20, 2020, at station PEAC-3. This violation calls for a reduction of 54%. There were no geometric mean exceedances in 2020 at station PEAC-3.

Table 1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion as well as for the point sources discharging in the Pea River watershed. Table 2 lists the TMDL, defined as the maximum allowable *E. coli* loading under critical conditions for the Pea River.

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

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	1.52E+13	6.99E+12	8.24E+12	54%
Ariton Lagoon*	7.92E+07	9.51E+09	0	0%
Clio WWTP*	6.11E+07	3.80E+10	0	0%
Clayton WWTF*	4.14E+08	3.80E+10	0	0%
Louisville WWTP*	0	9.51E+09	0	0%

*Point source allowable loads and load reductions are based on permit limits during the month of the highest in-stream *E. coli* exceedance.

Table 2: *E. coli* TMDL for the Pea River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
7.76E+12	7.76E+11	9.51E+10	NA	0	6.89E+12	54%

NA – Not applicable
a. There are numerous CAFOs in the Pea River watershed. Existing and future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
e. TMDL was established using the single sample *E. coli* criterion of 235 colonies/100ml.

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

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

2.0 Basis for §303(d) Listing

2.1 Introduction

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

The State of Alabama has identified the 10.85 mile segment of the Pea River from US Highway 231 to Halls Creek as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 2016 List of Impaired Waters based on data collected in 2014 and was included on all subsequent lists. The source of the impairment on the 2020 §303(d) list is animal feeding operations and pasture grazing.

2.2 Problem Definition

Waterbody Impaired:	Pea River – U.S. Hwy. 231 to Halls Creek
Impaired Reach Length:	10.85 miles
Impaired Drainage Area:	555.5 square miles
Water Quality Standard Violation:	Pathogens (Single Sample Maximum *E. coli*)
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 Swimming and Other Whole Body Water-Contact Sports (Swimming)/Fish and Wildlife (F&W). Usage of waters in the Swimming 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.

Pathogens Criteria:
Criteria for acceptable bacteria levels for the Swimming use classification are described in ADEM Admin. Code R. 335-6-10-.09(3)(c)6(i),(ii) and (iii) as follows:

(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.

Criteria Exceeded:
Records at ADEM station PEAC-6 from 2014 show that the single sample maximum *E. coli* criterion was exceeded in three out of eight samples.

Table 3: 303(d) Listing Data

Station	Date/Time	*E. coli* (col/100 mL)
PEAC-6	3/20/2014 11:23	1046.2
PEAC-6	4/16/2014 11:51	393.6
PEAC-6	5/8/2014 11:50	74.9
PEAC-6	6/19/2014 11:36	53.8
PEAC-6	7/10/2014 11:09	98.5
PEAC-6	8/12/2014 12:27	51.2
PEAC-6	9/18/2014 11:41	57.6
PEAC-6	10/16/2014 11:07	774.6

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

On December 11, 2009, the Alabama EMC adopted the *E. coli* criteria as the bacterial indicator to assess the levels of bacteria in freshwater. Prior to the adoption of the *E. coli* criteria, the fecal coliform criteria were used by ADEM as the bacterial indicator for freshwater. The *E. coli* criteria were recommended by the EPA as a better correlation to swimming and incidental water contact associated health effects than fecal coliform in the 1986 publication *Quality Criteria for Water*, (EPA 440/5-86-001). As a result of this bacterial indicator change, this TMDL will be developed from *E. coli* data collected at station PEAC-3, which was sampled in 2020.

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 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 of 235 colonies/100 ml to be exceeded. In addition, a geometric mean target of 113.4 colonies/100 ml will be used for a series of five samples taken at least 24 hours apart over the course of 30 days. This target was also derived by using a 10% explicit margin of safety from the geometric mean criterion of 126 colonies/100 ml. This target is considered protective of water quality standards and should not allow the geometric mean criterion to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Pea River Watershed

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

Continuous Point Sources

There are currently four NPDES-permitted facilities in the Pea River watershed above the impaired reach. They are as follows:

1. Clayton WWTF (Permit Number AL0060461)
2. Louisville WWTP (Permit Number AL0070980)
3. Clio WWTP (Permit Number AL0067181)
4. Ariton Lagoon (Permit Number AL0068551)

The Clayton WWTF is a public municipal facility that is permitted to discharge to Pea Creek, which is classified as Fish and Wildlife. It is located in the upper part of the Pea River watershed. The permit for the Clayton WWTF has summer *E. coli* limits of 126 col/100 ml (monthly average) and 298 col/100 ml (daily maximum) and winter *E. coli* limits of 548 col/100 ml (monthly average) and 2507 col/100 ml (daily maximum). These limits are equivalent to the pathogen criteria for the Fish and Wildlife use classification. This facility will be required to comply with the provisions of this TMDL.

The Louisville WWTP is a public municipal facility that is permitted to discharge to Pea Creek, which is classified as Fish and Wildlife. It is located in the upper part of the Pea River watershed. The permit for the Louisville WWTP has summer *E. coli* limits of 126 col/100 ml (monthly average) and 298 col/100 ml (daily maximum) and winter *E. coli* limits of 548 col/100 ml (monthly average) and 2507 col/100 ml (daily maximum). These limits are equivalent to the pathogen criteria for the Fish and Wildlife use classification. This facility will be required to comply with the provisions of this TMDL.

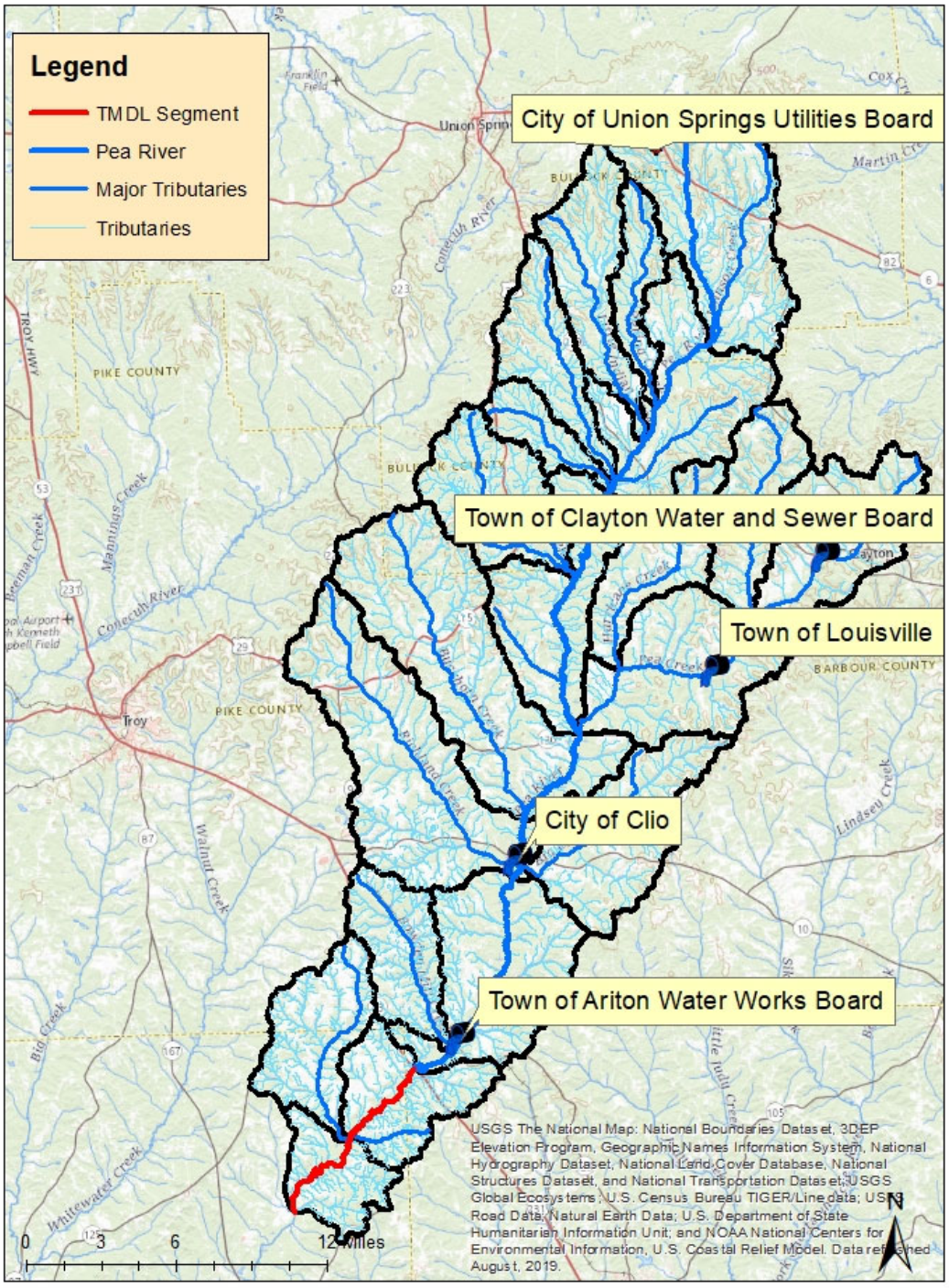
The Clio WWTP is a public municipal facility that is permitted to discharge to a segment of the Pea River classified as Fish and Wildlife. It is located in the upper part of the Pea River watershed. The permit for the Clio WWTP has summer *E. coli* limits of 126 col/100 ml (monthly average) and 298 col/100 ml (daily maximum) and winter *E. coli* limits of 548 col/100 ml (monthly average) and 2507 col/100 ml (daily maximum). These limits are equivalent to the pathogen criteria for the Fish and Wildlife use classification. This facility will be required to comply with the provisions of this TMDL.

The Ariton Lagoon is a public municipal facility that is permitted to discharge to a segment of the Pea River classified as Fish and Wildlife. It is located in the upper part of the Pea River watershed. The permit for the Ariton Lagoon has summer *E. coli* limits of 126 col/100 ml (monthly average) and 487 col/100 ml (daily maximum) and winter *E. coli* limits of 548 col/100 ml (monthly average) and 2507 col/100 ml (daily maximum). The current permit is scheduled for reissuance in 2021, and the reissued permit will have limits that are equivalent to the pathogen criteria for the Fish and Wildlife use classification. This facility will be required to comply with the provisions of this TMDL.

The City of Union Springs Utilities Board operates a municipal wastewater treatment facility that discharges to spray fields within the watershed. Since the facility is not permitted to discharge treated wastewater to a surface water of the state, it will not be given an allocation in this TMDL.

Any future NPDES-regulated continuous discharges that are considered by the Department to be a pathogen source will be required to meet the in-stream water quality criteria for pathogens at the point of discharge.

Figure 2: NPDES Permitted Dischargers in the Pea River Watershed



Non-Continuous Point Sources

The watershed for the impaired segment of Pea River contains 49 Concentrated Animal Feeding Operations (CAFOs) and Voluntary Animal Feeding Operations (AFOs). One produces pullets, one produces breeder hens, and the remainder produce broiler hens. 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 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 NPDES storm water dischargers within this portion of the Pea River watershed permitted to discharge pathogens.

Polluted storm water runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit and develop a storm water management program. Currently, there are no MS4 areas located within this portion of the Pea River watershed. Future MS4s will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

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 review of ADEM files it was found that few SSOs have been reported in the watershed in recent years. There have been four SSOs reported by Union Springs. Ariton Lagoon has reported one SSO and Clayton WWTF has reported two SSOs within the last several years. The reported SSOs can be seen below in Table 4.

Table 4: SSOs in the Pea River Watershed

Facility Name	Date	Estimated volume of release (gal)
Union Springs WWTP	4/22/16	> 10,000
Union Springs WWTP	1/24/17	> 10,000
Union Springs WWTP	3/26/20	Between 1,000 and 10,000
Union Springs WWTP	3/6/20	Between 1,000 and 10,000
Ariton Lagoon	9/25/17	Less than 1,000
Clayton WWTF	11/13/17	Between 1,000 and 10,000
Clayton WWTF	11/25/17	Between 10,000 and 25,000 gallons

3.2.2 Nonpoint Sources in the Pea River Watershed

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

Nonpoint sources are believed to be the primary source of *E. coli* bacteria in the Pea River watershed. Land use in this watershed is primarily agriculture and forest. Approximate land use proportions are 17% agricultural and 55% forested, with the remaining 28% further delineated below.

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 bacteria to waterbodies.

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 storm water runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

3.3 Land Use Assessment

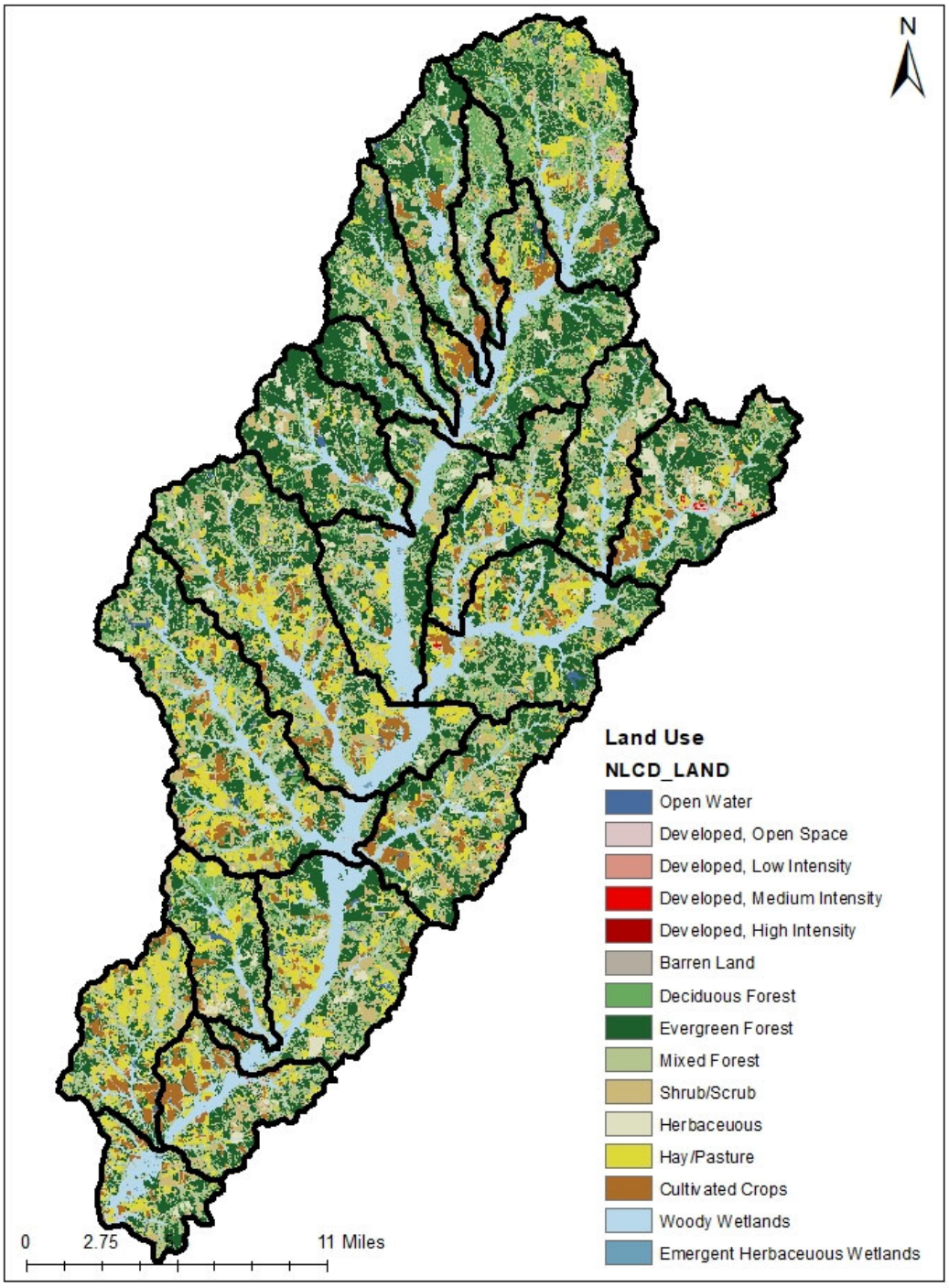
Land use for the Pea River watershed was determined using ArcMap with land use datasets derived from the 2016 National Land Cover Dataset (NLCD). Table 5 depicts the primary land uses in the Pea River watershed. Figure 3 displays the land use areas for the Pea River watershed.

The majority of the Pea River watershed is forested/natural (approximately 80%) and agriculture (approximately 17%). A further break down of the agricultural land use reveals that about 70% of the agricultural land is pasture/hay, both of which can be utilized for cattle grazing during certain periods throughout the year and, in turn, can contribute to pathogen run-off into streams if proper BMPs are not employed. Developed land, which includes both commercial and residential land uses, is approximately 3.4% of the watershed. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

Table 5: Land Use in the Pea River Watershed

Land Use	**2016**
Open Water	0.77%
Developed Open Space	2.83%
Developed Low Intensity	0.48%
Developed Medium Intensity	0.08%
Developed High Intensity	0.02%
Barren Land (Rock/Sand/Clay)	0.09%
Deciduous Forest	6.12%
Evergreen Forest	28.99%
Mixed Forest	19.86%
Shrub/Scrub	8.45%
Grassland/Herbaceous	3.48%
Pasture/Hay	11.75%
Cultivated Crops	5.05%
Woody Wetlands	11.82%
Emergent Herbaceous Wetlands	0.20%
Total	**100.00%**
Cumulative Land Use	
Developed	3.41%
Forested	54.97%
Agriculture	16.80%
Other	24.82%
Total	**100.00%**

Figure 3: Land Use in the Pea River Watershed



3.4 Linkage between Numeric Targets and Sources

The Pea River watershed has three main land uses, namely forest/natural, agriculture, and developed land. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in the Pea River watershed are from the agricultural land uses 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

ADEM collected monthly water quality data for Pea River at one station (PEAC-3) along the impaired waterbody from May 2020 to December 2020. Fifteen *E. coli* samples were collected in 2020. Intensive bacteria studies were conducted in June/July 2020 and September 2020. A geometric mean was calculated from each of these studies.

A single sample violation occurred at PEAC-3 on May 19, 2020. An *E. coli* concentration of 261.3 colonies/100 ml was measured on this day. A flow of 131.6 cfs was calculated using USGS gauge 02363000 (Pea River near Ariton, Alabama) and the ratio method of drainage areas. A single sample violation also occurred at PEAC-3 on December 2, 2020. An *E. coli* concentration of 461.1 colonies/100 ml was measured, and a flow of 1350 cfs was calculated on this day. No geometric mean violations were recorded.

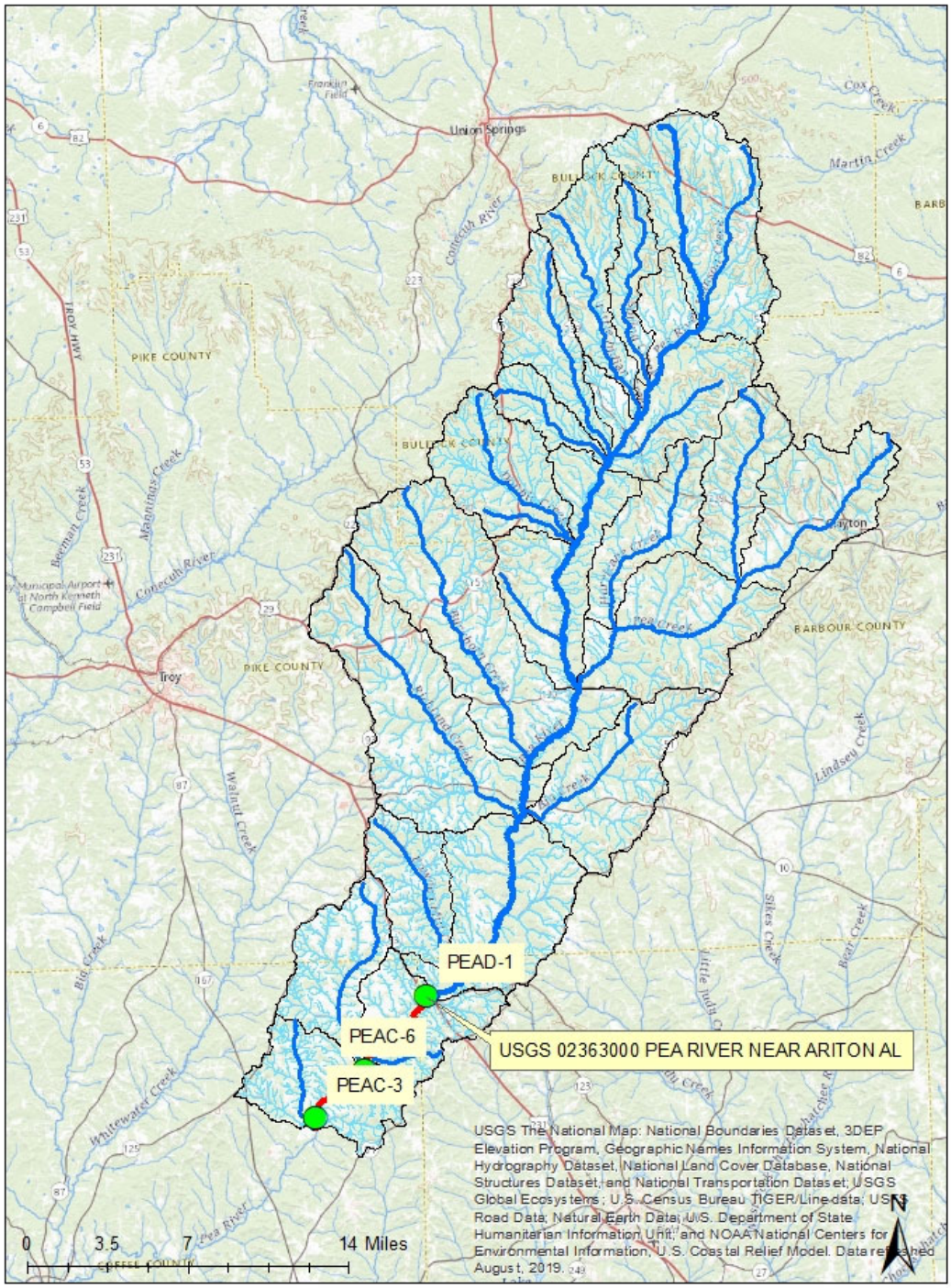
The violation event which results in the largest percentage reduction was selected as the basis for this TMDL. This violation occurred on December 2, 2020 at station PEAC-3, with an *E. coli* concentration of 461.1 col/100ml and a flow of 1350 cfs.

Table 6: ADEM Water Quality Data

STATION	VISIT DATE	Flow cfs	E. coli (MPN/DL) mpn/dl	Geometric Mean Calculations
PEAC-3	5/19/2020 14:05	131.6*	261.3	
PEAC-3	6/8/2020 9:17	104.9	78	
PEAC-3	6/9/2020 10:47	164.7	35.4	
PEAC-3	6/11/2020 10:30	*	193.5	55.97641372
PEAC-3	6/16/2020 11:04	111	18.5	
PEAC-3	7/8/2020 10:16	128.4	55.6	
PEAC-3	8/4/2020 9:53	66.5	26.6	
PEAC-3	9/8/2020 10:50	43.3	104.6	
PEAC-3	9/9/2020 10:29	63.3	90.8	
PEAC-3	9/10/2020 10:30	47.7	145.5	116.8140157
PEAC-3	9/14/2020 10:38	107.6	118.7	
PEAC-3	9/23/2020 11:17	*	132.6	
PEAC-3	10/20/2020 9:11	129.4	86	
PEAC-3	11/5/2020 9:10	214.7	88.4	
PEAC-3	12/2/2020 10:17	1350.0*	461.1	

*Indicates flow not measured by ADEM and was calculated using USGS Gauge 02363000 (Pea River near Ariton AL) and drainage area ratio method.

Figure 4: ADEM Sampling Stations on the Pea River



3.6 Critical Conditions/Seasonal Variation

The *E. coli* single sample maximum criterion of 235 colonies/100 ml and geometric mean criterion of 126 colonies/100 ml for the Swimming use classification are applicable year-round. 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 461.1 colonies/100 ml and occurred on December 2, 2020, at station PEAC-3. A flow of 1350 cfs was calculated for this sampling event. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in the Pea River 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 or calculated 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 for point sources (WLAs), 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:

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

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 the Pea River. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the *E. coli* concentration times the instream flow times a conversion factor. Existing loads were calculated for the highest single sample exceedance. In the same manner, allowable loads were calculated for the single sample criterion of 235 col/100 ml. There were no geometric mean exceedances. The TMDL was based on the violation that produced the highest percent reduction of *E. coli* loads necessary to achieve applicable water quality criteria.

Existing Conditions

The **single sample** mass loading was calculated by multiplying the *E. coli* single sample exceedance concentration of 461.1 colonies/100 ml by the estimated flow of 1350 cfs. This concentration was measured at PEAC-3 on December 2, 2020. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to the Pea River under the single sample exceedance condition.

$$\frac{1{,}350\ \text{ft}^3}{\text{s}} \times \frac{461.1\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.52 \times 10^{13}\text{colonies}}{\text{day}}$$

The **continuous point sources** mass loading was calculated by taking the average discharge flow from each facility for the month of December 2020 (since this is when the highest exceedance occurred) and multiplying that by the facility's reported maximum daily *E. coli* value for the same month and the conversion factor. The flows and *E. coli* values were found in the December 2020 Discharge Monitoring Reports (DMRs) submitted by the facilities. A loading was calculated for each point source included in the TMDL.

Ariton Lagoon:

$$0.036\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{58\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{7.92 \times 10^7 colonies}{day}$$

Clio WWTP:

$$0.179\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{9\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{6.11 \times 10^7 colonies}{day}$$

Clayton WWTF:

$$0.182\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{60\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{4.14 \times 10^8 colonies}{day}$$

Louisville WWTP:
This facility reported no discharge during December 2020. Therefore, the existing load for this facility is zero.

Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the single sample criterion. This was done by taking the product of the estimated 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 211.5 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{1{,}350\ \text{ft}^3}{\text{s}} \times \frac{211.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{6.99 \times 10^{12}\text{colonies}}{\text{day}}$$

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

$$\frac{1{,}350\ \text{ft}^3}{\text{s}} \times \frac{23.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{7.76 \times 10^{11}\text{colonies}}{\text{day}}$$

The **point source** allowable loading was calculated by multiplying the design flow of each of the continuous dischargers in the Pea River watershed by their applicable daily maximum permit limit and the conversion factor. Since these facilities all discharge to waters with the Fish and Wildlife use classification and the instream violation causing the largest percent reduction occurred in December, the winter single sample maximum criterion for Fish and Wildlife waters is applicable. The loadings from all sources were added together for the total point source allowable loading.

Ariton Lagoon:

$$0.1\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{2{,}507\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{9.51 \times 10^9 colonies}{day}$$

Clio WWTP:

$$0.4\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{2{,}507\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.80 \times 10^{10} colonies}{day}$$

Clayton WWTF:

$$0.4\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{2{,}507\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.80 \times 10^{10} colonies}{day}$$

Louisville WWTP:

$$0.1\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{2{,}507\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{9.51 \times 10^9 colonies}{day}$$

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 the Pea River as evaluated at station PEAC-3. Table 7 shows the *E. coli* loads and required reductions for the Pea River watershed.

Table 7: *E. coli* Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	1.52E+13	6.99E+12	8.24E+12	54%
Ariton Lagoon*	7.92E+07	9.51E+09	0	0%
Clio WWTP*	6.11E+07	3.80E+10	0	0%
Clayton WWTF*	4.14E+08	3.80E+10	0	0%
Louisville WWTP*	0	9.51E+09	0	0%

*Point source allowable loads and load reductions are based on permit limits during the month of the highest in-stream *E. coli* exceedance.

From Table 7, compliance with the single sample *E. coli* maximum criterion of 235 colonies/100 ml requires a reduction in the *E. coli* nonpoint source load of 54%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criterion are provided in Table 8 below.

Table 8: *E. coli* TMDL for the Pea River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
7.76E+12	7.76E+11	9.51E+10	NA	0	6.89E+12	54%

NA – Not applicable
a. There are numerous CAFOs in the Pea River watershed. Both existing and future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
e. TMDL was established using the single sample *E. coli* criterion of 235 colonies/100ml.

4.3 TMDL Summary

The Pea River was placed on Alabama's §303(d) list for pathogens in 2016 based on data collected by ADEM in 2014. In 2020, 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 the Pea River. Based on the TMDL analysis, it was determined that a 54% 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 towards targeting the load reductions to improve water quality in the Pea River 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 statewide approach to water quality management. Each year, ADEM's water quality resources are divided among multiple priorities statewide including §303(d) listed waterbodies, waterbodies with active TMDLs, and other waterbodies as determined by the Department. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices and load reductions in the watershed.

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who 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, 2017. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

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

Alabama's Monitoring Program. 2014, 2020. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, January 2020.

Alabama Department of Environmental Management, 2016, 2018, 2020 §303(d) Lists and Fact Sheets. ADEM.

Alabama Department of Environmental Management (ADEM) Laboratory Data Qualification SOP#4910 Revision 6.2, October 2016.

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 Station Photographs

Station PEAC-3, Looking Downstream (7/8/2020)

Station PEAC-3, Looking Upstream (7/8/2020)