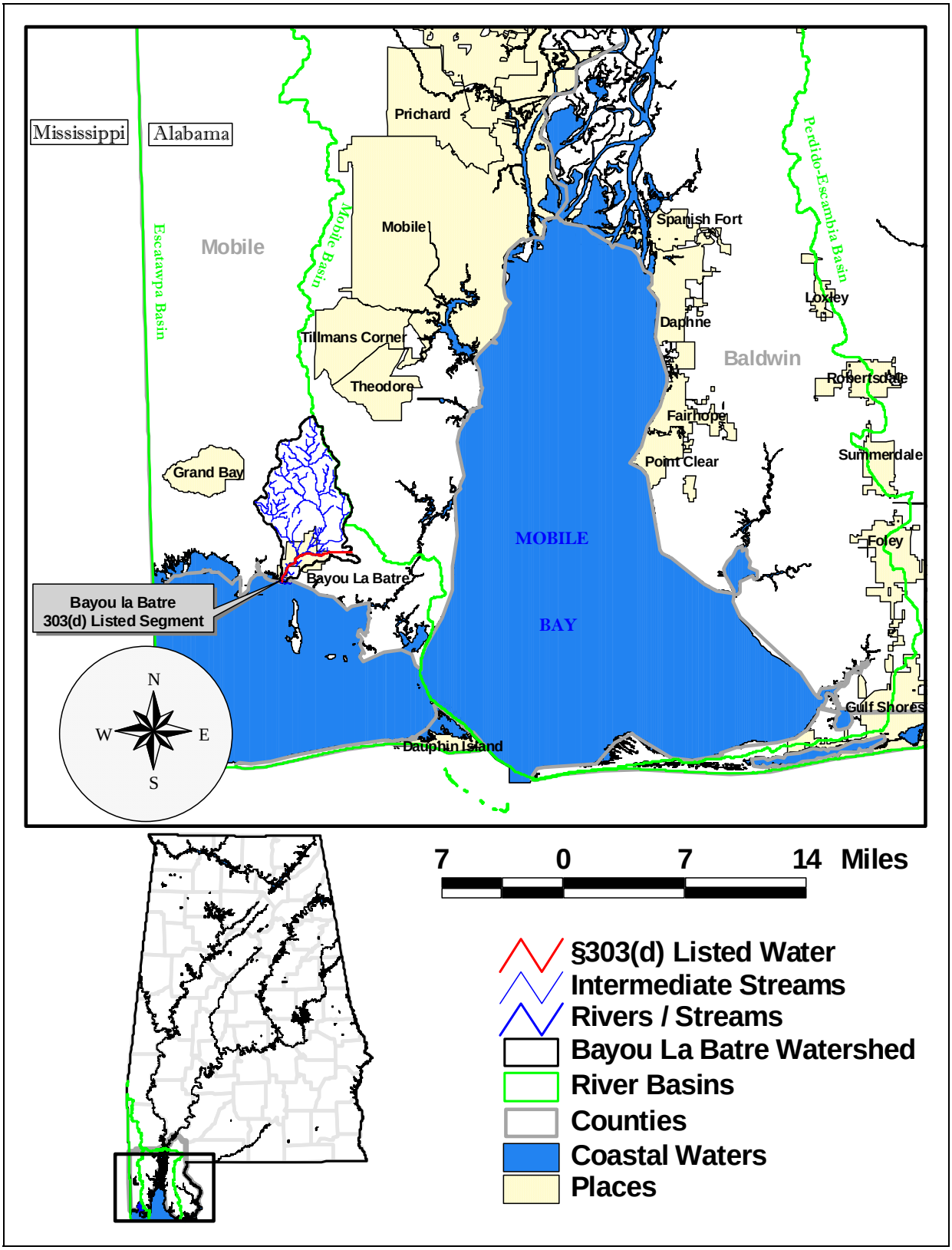
FINAL

Total Maximum Daily Load (TMDL)
for
Bayou La Batre
Assessment Unit ID # AL03170009-0102-100
Pathogens (Enterococci)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
September 2009

Figure 1-1. Listed Portion of Bayou La Batre in the Escatawpa River Basin



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1.0 Executive Summary

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting water quality standards for the pollutant of concern. All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) regulated discharges, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS).

Bayou La Batre was originally placed on Alabama's 1998 §303(d) list of impaired waters for pathogens based on data collected by ADEM in 1995 and 1996. Bayou La Batre is currently on the §303(d) list for pathogens (enterococci) from Portersville Bay to its source. Bayou La Batre is located in the Escatawpa River Basin and forms in southern Mobile county, within the city limits of Bayou La Batre. Bayou La Batre is considered a coastal water and is tidally influenced. The total length of Bayou La Batre is 5.46 miles, all of which is on the §303(d) list. The total drainage area of Bayou La Batre is 30.17 square miles. Bayou La Batre has a use classification of Fish & Wildlife (F&W).

In 2006 and 2007, a §303(d) sampling study was performed by ADEM on Bayou La Batre for additional water quality assessment. ADEM collected 68 samples from Bayou La Batre as a part of this general water quality and intensive enterococci study. The 2006 and 2007 data confirmed that Bayou La Batre was still not meeting the pathogen criterion applicable to its use classification of Fish and Wildlife. Therefore, a TMDL will be developed for pathogens on the listed reach.

A mass balance approach was used for calculating the pathogen TMDL for Bayou La Batre. The mass balance approach utilizes the conservation of mass principle. Loads are calculated by multiplying the enterococci concentrations times respective instream flows times a conversion factor. The existing (impaired) pathogen loading to Bayou La Batre was calculated using a single sample exceedance concentration times the measured flow times a conversion factor. The single sample criterion was used because it yielded the greatest reduction among qualified data. The allowable loading, defined as the single sample criterion including margin of safety, was calculated using the enterococci single sample allowable concentration of 142.2 colonies/100 mL (158 colonies/100 mL – 10% Margin of Safety) times the exceedance flow value times a conversion factor. Reductions to meet the allowable loading were then calculated by subtracting the allowable loading from the existing loading.

Table 1.1 is a summary of estimated existing loads and allowable loads required to meet the applicable water quality pathogen single sample criterion for Bayou La Batre. Table 1.2 lists the TMDL (maximum allowable) pathogen loadings under critical conditions for Bayou La Batre.

Table 1-1. Enterococci Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction %
LA	3.93E+10	9.32E+09	3.00E+10	76%
WLA	NA	NA	NA	NA

Table 1-2. Enterococci TMDL and Percent Reductions for Bayou La Batre

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation(LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(colonies/day)	(colonies/day)	(colonies/day)	(% reduction)	(colonies/day)	(colonies/day)	(% reduction)
1.04E+10	1.04E+09	NA	NA	0	9.32E+09	76%

a. There are no CAFOs in Bayou La Batre watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. 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 fecal coliform loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for fecal coliform.

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 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 Bayou La Batre 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 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 5.46 miles of Bayou La Batre as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 1998 List of Impaired Waters based on 1995 and 1996 data.

2.2 Problem Definition

Waterbody Impaired:	Bayou La Batre from Portersville Bay to its source
Impaired Reach:	5.46 miles
Impaired Drainage Area:	30.17 square miles
Water Quality Standard Violation:	Enterococci (Pathogens)
Water Use Classification:	Fish and Wildlife

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

(a) Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food-processing purposes.

(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 and recreation during June through September, 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.

Enterococci Criterion:
Criterion 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 fecal coliform group shall not exceed a geometric mean of 1,000 col/100 mL; nor exceed a maximum of 2,000 col/100 mL in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 col/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 recreation during June through September, 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 fecal coliform organism density does not exceed 200 col/100 mL in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 col/100 mL nor exceed a maximum of 158 col/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:

Water quality data collected by ADEM in 1995 and 1996 was used by EPA Region 4 for listing Bayou La Batre on Alabama's 1998 §303(d) list. EPA indicated that Bayou La Batre exceeded both the geometric mean criterion and the single sample maximum criterion for incidental water contact and recreational swimming months of June through September. The geometric mean and single sample maximum criterion limits are 35 colonies/100 ml and 158 colonies/100ml respectively. Of the nineteen samples, EPA documented four geometric mean violations and one single sample maximum violation. The complete rationale for EPA's listing can be viewed in Appendix B, Figure 7-1.

The ADEM §303(d) monitoring program collected sixty-eight samples from five stations in 2006 and 2007. The study resulted in four stations with exceedances from June through September. There were three single sample maximum exceedances of 360 colonies/100 mL, 230 colonies/100 ml, and 600 colonies/100 mL, and there were two geometric mean exceedances of 48 colonies/100 ml and 95 colonies/100 mL. This data can be viewed in Appendix B, Table 7-2.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

The single sample enterococci allowable concentration of 142.2 colonies/100 mL will be used for TMDL development. This concentration was derived by using the single sample criterion of

158 colonies/100 mL and a 10% (15.8 colonies/100 mL) explicit margin of safety. This allowable concentration is considered protective of water quality standards and should not allow the geometric mean of 35 colonies/100 mL (June – September), the single sample maximum of 275 colonies/ 100 ml (October – May), or the single sample maximum of 158 colonies/100 mL to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Bayou La Batre Watershed

Continuous Point Sources

There are no continuous NPDES discharges located in the Bayou La Batre watershed. The municipal and industrial facilities located in the Bayou La Batre watershed all discharge to Portersville Bay. However, any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the instream water quality criteria for pathogens at the point of discharge.

Non-Continuous Point Sources

The Bayou La Batre watershed does not lie within a qualified Municipal Separate Stormwater Sewer System (MS4) area, therefore a WLA is not applicable.

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 determined that numerous SSOs have occurred in the Bayou La Batre watershed. From 2003 to the present, Bayou La Batre has reported multiple overflows. These overflows typically occur from manholes located in the city of Bayou La Batre.

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

3.2.2 Nonpoint Sources in the Bayou La Batre Watershed

Nonpoint sources appear to be a significant source of enterococci bacteria in the Bayou La Batre watershed. Land use in this watershed is characterized mostly by forested, agriculture, and developed land uses. Forest land use covers 51%, agriculture 31%, and developed 12%. The following are examples of how different land uses can contribute to enterococci bacterial loading:

- Agricultural land can be a source of enterococci bacteria due to runoff from pastures, animal operations, improper land application of animal wastes, and animals with access to streams. These mechanisms can significantly contribute to the loading of enterococci bacteria.

- Forested areas can be a source of enterococci bacteria due to the presence of wild animals such as deer, raccoons, turkeys, beavers, waterfowl, etc. Control of these sources is usually limited and may be impractical in most cases. As a result, forested areas are not specifically targeted in this TMDL.

- Developed land can be a source of enterococci bacteria due to storm water runoff, illicit discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, leaking sewer infrastructure, and domestic animals. Illicit discharges refers to non permitted facilities or individuals discharging wastewater through storm drains or directly to the waterbody.

3.3 Land Use Assessment

Land uses for the Bayou La Batre watershed were determined using ArcView. The land use datasets were derived from the 2001 National Land Cover Dataset (NLCD). Figure 3-1 displays land use areas, Figure 3-2 gives an aerial picture, and Table 3-1 displays land use categories and grouped land uses.

Figure 3-1. Land Use Map for the Bayou La Batre Watershed

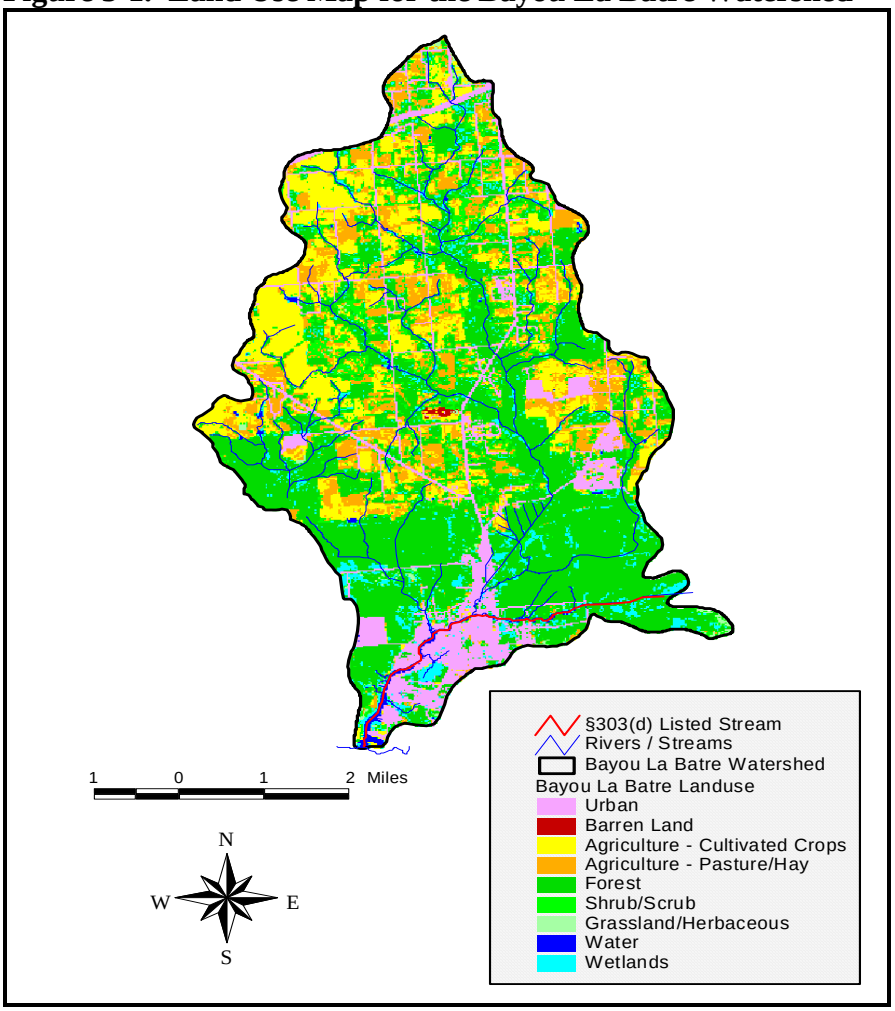

Figure 3-2. Aerial Picture of Bayou La Batre Watershed

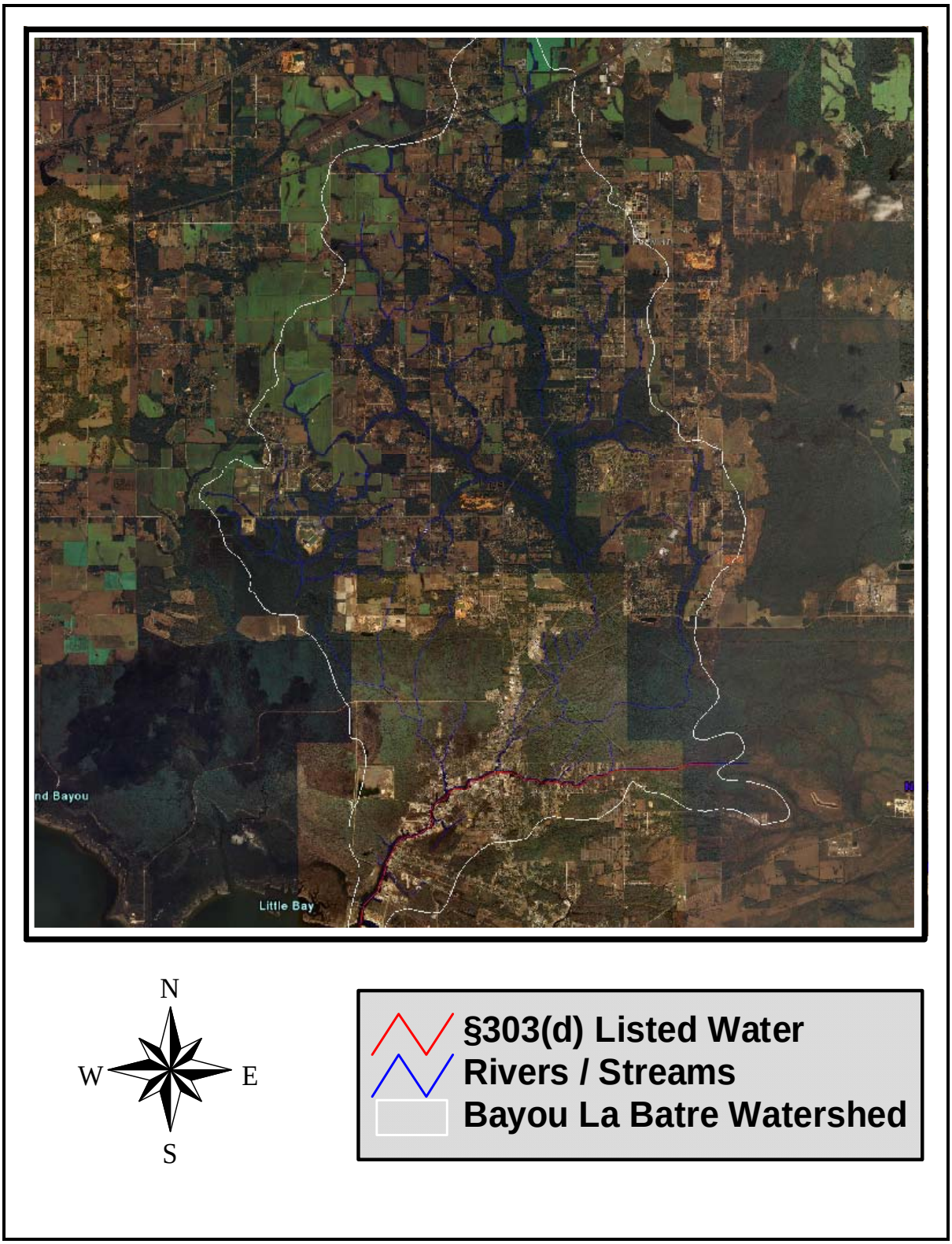

Table 3-1. Land Use Areas for the Bayou La Batre Watershed

Land Use	Acres	Sq. Miles	Percentages
Open Water	1270	0.20	1
Low Intensity Residential	14438	2.26	7
High Intensity Residential	5853	0.91	3
High Intensity Commercial	2300	0.36	1
Developed	322	0.05	1
Bare Rock / Sand / Clay	187	0.03	0
Deciduous Forest	2847	0.44	1
Evergreen Forest	70191	10.97	36
Mixed Forest	4510	0.70	2
Evergreen Shrubland	19824	3.10	10
Grassland / Herbaceous	1272	0.20	1
Pasture / Hay	27792	4.34	14
Row Crops	31146	4.87	16
Wetlands	10708	1.67	6
Total	192659	30.10	100

Grouped Landuses	Acres	Sq. Miles	Percentages
Agriculture	58938	9.21	31
Forest	97371	15.21	51
Developed	22913	3.58	12
Other	13437	2.10	6
Total	192659	30.10	100

3.4 Linkage Between Numeric Targets and Sources

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 Bayou La Batre are from agricultural land uses and sewer overflows. Individual loads and reductions will not be calculated for the range of nonpoint sources, but rather, the loadings and reductions will be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

ADEM has collected monthly water quality data for Bayou La Batre at BLB-1 since 1978. Data collected in 1995 and 1996 were highlighted by EPA as having violations of the single sample maximum criterion and geometric mean criterion. These violations resulted in EPA placing Bayou La Batre on the 1998 §303(d) list. Section 4.8.2 of ***Alabama's Water Quality Assessment and Listing Methodology*** provides the Department's rationale to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. This data can be viewed in Appendix B, Table 7.1.

ADEM collected water quality data on Bayou La Batre in 2006 and 2007 as part of ADEM's §303(d) Monitoring Program at Stations BLBM-1, BLBM-2, BLB-1, BLBM-3, and BLBM-4. Figure 3-3 and Table 3-2 display locations and list descriptions for the ADEM stations. During

this study, 68 samples were collected. Of the enterococci samples collected, there were exceedances of both the single sample maximum criterion of 158 colonies/100 ml and the geometric mean criterion 35 colonies/100 ml for incidental water contact and recreational swimming months of June through September. There were three single sample maximum exceedances of 380 colonies/100 mL, 230 colonies/100 ml, and 600 colonies/100 mL and there were two geometric mean exceedances of 48 colonies/100 ml and 95 colonies/100 mL. The necessary flow data to calculate loading for Bayou La Batre could not collected at each station due to the nature of the tidally influenced waterbody. Therefore, flow data for Bayou La Batre was calculated using the ratio method with Carl's Creek flow data from station BLBM-3. This data can be viewed in Appendix B, Table 7.2 and Table 7.3.

Figure 3-3. Map of ADEM Sampling Stations on Bayou La Batre

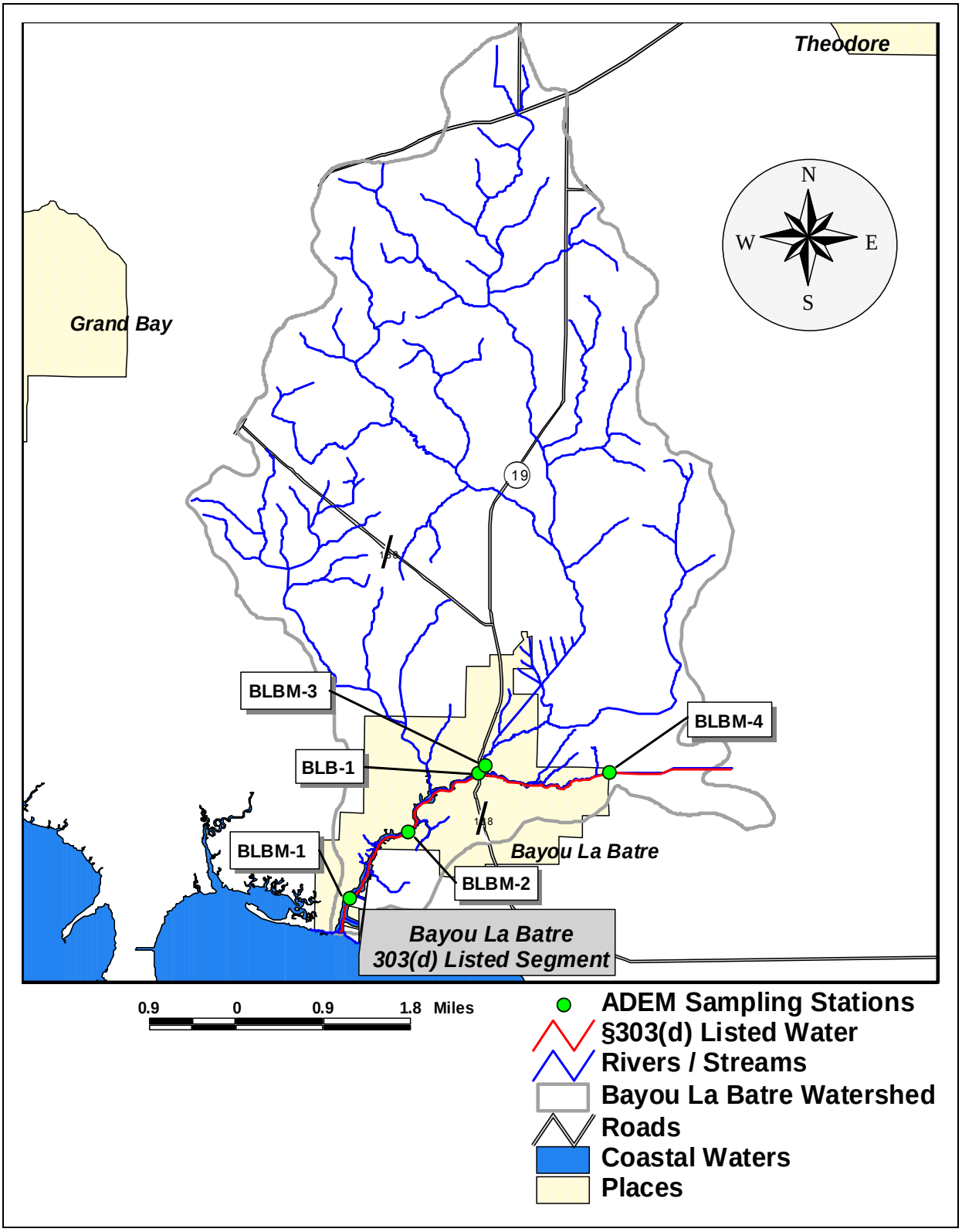

Table 3-2. Bayou La Batre Sampling Station Descriptions

Year	Station ID	Data Source	Station Location	Latitude	Longitude
2006 - 2007	BLBM-1	ADEM	Bayou La Batre in channel next to light approx 0.4 mi upstream of mouth	30.3867	-88.2700
2006-2007	BLBM-2	ADEM	Bayou La Batre in channel off end Seafood House Rd	30.3969	-88.2600
2006-2007	BLB-1	ADEM	Bayou La Batre @ AL Hwy 188	30.4059	-88.2481
2006-2007	BLBM-3	ADEM	Carl's Creek @ East Davenport Rd	30.4071	-88.2469
2006-2007	BLBM-4	ADEM	Bayou La Batre @ corner of Davenport Rd and Hemley Rd	30.4062	-88.2254

3.6 Critical Conditions

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

The data collected by ADEM in 2005 and 2006 in the Bayou La Batre watershed follows this trend. The single sample exceedance values were accompanied by an increase in flow.

3.7 Margin of Safety

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

An explicit MOS was incorporated in this TMDL. The explicit MOS includes the uncertainty of the enterococci data used in this analysis and the uncertainty of selecting an appropriate critical condition from the existing enterococci loads. A margin of safety was applied to the TMDL by reducing the criterion concentration by ten percent and calculating a mass loading allowable concentration with measured flow data. The single sample criterion was reduced by ten percent to achieve the allowable concentration of 142.2 colonies/100 mL.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual waste load allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). As discussed earlier, the MOS is explicit in this TMDL. A TMDL can be denoted by the equation:

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

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

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

4.2 Load Calculations

A mass balance approach was used to calculate the pathogen TMDL for Bayou La Batre. The mass balance approach utilizes the conservation of mass principle. Total existing mass loads were calculated by multiplying the highest enterococci concentration times the corresponding stream flow. The single sample criterion was used because it yielded the greatest reduction among qualified data. The highest geometric mean load calculation was calculated and can be viewed in Appendix C. Allowable loads were calculated for the single sample criterion of 158 colonies/100ml. The TMDL was based on a single sample violation that produced percent reductions of enterococci loads necessary to achieve applicable water quality criteria.

Existing Conditions

The **single sample** mass loading was calculated by multiplying a single sample exceedance concentration of 600 colonies/100 ml times the estimated flow for that day. This load was calculated based on measurements at BLBM-4 on 7/6/2006 and can be found in Table 7-2, Appendix B. The estimated stream flow, determined by the drainage area ratio of stream flows measured at station BLBM-3, for that sampling event was 2.68 cfs. The product of these two values and a conversion factor gives the total mass loading (colonies per day) of enterococci to Bayou La Batre under a single sample exceedance conditions.

$$\frac{2.68\,\text{ft}^3}{\text{s}} \times \frac{600\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\ \ 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.93 \times 10^{10}\ \text{colonies}}{\text{day}}$$

Allowable Conditions

The **allowable loads** to the watershed were calculated under the same physical conditions as discussed above. This is done by taking the product of the flow used for the violation event times the conversion factor times the allowable concentration which are as follows:

For the **single sample** fecal concentration of 142.2 colonies/100 mL. The allowable enterococci loading is:

$$\frac{2.68\ \text{ft}^3}{\text{s}} \times \frac{142.2\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{9.32 \times 10^{09}\ \text{colonies}}{\text{day}}$$

The explicit margin of safety of 15.8 colonies/100 mL equals a daily loading of:

$$\frac{2.68\,\text{ft}^3}{\text{s}} \times \frac{15.8\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.04 \times 10^{09}\ \text{colonies}}{\text{day}}$$

The difference in the pathogen loading between the existing conditions (violation event) and the allowable conditions converted to a percent reduction represents the total load reduction needed to achieve the enterococci water quality criterion. The TMDL was calculated as the total daily enterococci load to Bayou La Batre as evaluated at station BLBM-4. Table 4-1 shows the results of the enterococci TMDL and percent reductions for each criterion. Since the single sample violation yielded the greatest reduction it will be used to develop the Bayou La Batre TMDL.

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Table 4-1. 2006 Enterococci Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction %
NPS Load Single Sample	3.93E+10	9.32E+09	3.00E+10	76%
NPS Load Geometric Mean	95 col/100 mL	35 col/100 mL	60 col/100 mL	63.2%
Point Source	NA	NA	NA	NA

The TMDL, WLA, LA and MOS values necessary to achieve the applicable enterococci criteria are provided in Table 4-2 below. Additional TMDL calculations are provided in Appendix C.

Table 4-2. Enterococci TMDL and Percent Reductions for Bayou La Batre

TMDL	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)
1.04E+10	1.04E+09	NA	NA	0	9.32E+09	76%

a. There are no CAFOs in Bayou La Batre watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. 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 fecal coliform loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for fecal coliform.

4.3 TMDL Summary

Bayou La Batre was placed on Alabama's §303(d) list in 1998 based on a 1995 and 1996 study. ADEM performed monitoring in 2005 and 2006 indicated impairment.

A mass balance approach was used to calculate the enterococci TMDL for Bayou La Batre. Based on the TMDL analysis, it was determined that a 76% reduction 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 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 Bayou La Batre 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 management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, the ADEM water quality resources are concentrated in one of the five basin groups. One goal is to continue to monitor §303(d) listed waters. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed. This monitoring will occur in each basin according the schedule shown.

Table 5-1. §303(d) Follow Up Monitoring Schedule

River Basin Group	Year to be Monitored
Tennessee	2009
Alabama / Coosa / Tallapoosa	2010
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2011
Black Warrior / Cahaba	2012
Chattahoochee / Chipola / Escatawpa / Perdido-Escambia	2013

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL was made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. 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 finalization of this TMDL and subsequent submission to EPA Region 4 for final review and approval.

Appendix A
References

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criterion.

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2007. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, December 2005.

Alabama Department of Environmental Management, 1998 - 2008 §303(d) List. ADEM.

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

Appendix B
Water Quality Data

Table 7-1. Historical ADEM Pathogen Data Collected on Bayou La Batre

Station ID	Date	Fecal Coliform (col/100ml)
BLB-1	6/6/1995	220
BLB-1	7/11/1995	1720
BLB-1	8/29/1995	40
BLB-1	9/26/1995	30
BLB-1	10/17/1995	178
BLB-1	11/7/1995	265
BLB-1	12/11/1995	81
BLB-1	1/10/1996	8
BLB-1	2/5/1996	536
BLB-1	3/5/1996	160
BLB-1	4/2/1996	131
BLB-1	5/16/1996	161
BLB-1	6/12/1996	460
BLB-1	7/8/1996	>2400
BLB-1	8/20/1996	235
BLB-1	9/12/1996	83
BLB-1	10/7/1996	>240
BLB-1	11/5/1996	300
BLB-1	12/4/1996	110

Table 7-2. ADEM Pathogen Data Collected on Bayou La Batre

Station ID	Date	Enterococci (col/100mL)	Enterococci Geometric mean (col/100mL)
BLB-1	6/20/2006	2	
BLB-1	7/5/2006	18	
BLB-1	7/11/2006	16	
BLB-1	7/12/2006	360	
BLB-1	7/18/2006	30	23
BLB-1	8/17/2006	88	
BLB-1	8/22/2006	78	
BLB-1	9/7/2006	8	
BLB-1	9/12/2006	88	
BLB-1	9/14/2006	54	48
BLB-1	10/11/2006	28	
BLB-1	11/14/2006	4	
BLB-1	3/26/2007	6	

Station ID	Date	Enterococci (col/100mL)	Enterococci Geometric mean (col/100mL)
BLB-1	6/21/2007	110	
BLBM-1	6/19/2006	2	
BLBM-1	7/5/2006	16	
BLBM-1	7/11/2006	4	
BLBM-1	7/12/2006	2	
BLBM-1	7/18/2006	4	4
BLBM-1	8/16/2006	10	
BLBM-1	8/22/2006	26	
BLBM-1	9/7/2006	4	
BLBM-1	9/12/2006	28	
BLBM-1	9/13/2006	60	18
BLBM-1	10/12/2006	6	
BLBM-1	11/14/2006	20	
BLBM-1	3/27/2007	8	
BLBM-1	6/21/2007	6	
BLBM-2	6/19/2006	26	
BLBM-2	7/5/2006	10	
BLBM-2	7/11/2006	36	
BLBM-2	7/12/2006	8	
BLBM-2	7/18/2006	18	17
BLBM-2	8/16/2006	18	
BLBM-2	8/22/2006	2	
BLBM-2	9/7/2006	2	
BLBM-2	9/12/2006	92	
BLBM-2	9/13/2006	120	15
BLBM-2	10/12/2006	2	
BLBM-2	11/14/2006	22	
BLBM-2	3/27/2007	120	
BLBM-3	6/21/2006	10	
BLBM-3	7/5/2006	32	
BLBM-3	7/11/2006	14	
BLBM-3	7/12/2006	30	
BLBM-3	8/17/2006	72	
BLBM-3	8/22/2006	100	
BLBM-3	9/7/2006	48	
BLBM-3	9/12/2006	230	
BLBM-3	9/14/2006	98	95
BLBM-3	10/12/2006	24	
BLBM-3	11/14/2006	6	
BLBM-3	3/28/2007	12	

Station ID	Date	Enterococci (col/100mL)	Enterococci Geometric mean (col/100mL)
BLBM-3	7/18/2007	70	
BLBM-3	9/7/2007	54	
BLBM-4	6/21/2006	18	
BLBM-4	7/6/2006	600	
BLBM-4	7/11/2006	36	
BLBM-4	7/12/2006	4	
BLBM-4	7/18/2006	18	31
BLBM-4	8/18/2006	2	
BLBM-4	8/22/2006	44	
BLBM-4	9/7/2006	24	
BLBM-4	9/12/2006	20	
BLBM-4	9/14/2006	60	19
BLBM-4	10/12/2006	2	
BLBM-4	11/15/2006	40	
BLBM-4	3/28/2007	30	

Table 7-3. ADEM Flow Data Collected on Bayou La Batre

Station ID	Date	Flow (cfs)	Instrument
BLBM-3	7/5/2006	50.207	ADCP
BLBM-3	7/11/2006	-7.807	ADCP
BLBM-3	7/12/2006	41.4025	ADCP
BLBM-3	7/18/2006	-44.207	ADCP
BLBM-3	8/17/2006	3.976	ADCP
BLBM-3	8/22/2006	-2.417	ADCP
BLBM-3	9/7/2006	-5.084	ADCP
BLBM-3	9/12/2006	-49.341	ADCP
BLBM-3	10/12/2006	-47.262	ADCP
BLBM-3	11/14/2006		ADCP
BLBM-3	3/28/2007	5.303	ADCP
BLBM-3	9/14/2007	7.556	ADCP

Figure 7-1. EPA Rationale For 1998 §303(d) Listing of Bayou La Batre

STATE: AL
WATERBODY: BAYOU LA BATRE RIVER
LOCATION: @ AL HWY 188

REFERENCE DOCUMENTS: _____
Trend Station _____
BLB-1

SUMMARY OF INFORMATION USED IN USE SUPPORT DETERMINATION			
Water Use Classification	Fish & Wildlife (F&W) Estuarine		
Pollutant of Concern	Fecal Coliforms		
State Water Quality Standard	Fish & Wildlife (F&W) 1000/100 ml geo mean; 2000 max; 200/100 ml max geometric mean June-Sept; except for coastal waters with 100/100 ml max.		
EPA Water Quality Criterion			
Other Measures Applied	Review for Fecal Coliform data: All data reviewed: 19 values in 1995-6 evaluated as most pertinent. Geo mean ('95-'96) = 175.3; Geo mean ('96) = 191.7 Only one value exceeded 2000 (>2400/100 ml) Geo mean ('95 summer) = 145.9; Geo mean ('96 summer) = 383.1		
Period of Record for Review	October 1990 to December 1996		
Data Represents Critical Season	□ not applicable	□ no, but necessary	XX□ yes, ___ to ___; ___ to ___; ___ to ___
Previous §305(b)/303(d) Listing			
WQ Standard - No. of Violations	2 (1 max, 1 geomean) of 4 values from 19 samples		

USE SUPPORT DETERMINATION - §305(b) GUIDANCE		
□ Fully Supporting	□ Partially Supporting	XX □ Not Supporting

LISTING DETERMINATION	
Continue Inclusion on §303(d) List XX	
Removal from §303(d) List is Justified	

Other Materials/References Consulted: _____

Reviewer: David W. Hill

Date of Review Completion: 1/29/99

Appendix C
Calculations

Figure 7-2. Load Calculations

Load Reduction and TMDL Calculations for Bayou La Batre

Flow measured at Bayou La Batre for single sample max:	2.68 cfs	
Single sample Enterococci concentration measured:	600 col/100 mL	
Allowable Enterococci maximum concentration minus MOS:	142.2 col/100mL	= 15.8 - 10%
Margin of saftey for the maximum criteria	15.8 col/100mL	= 10% of criteria
Design Flow of Point Source:	0 MGD	
Allowabel Enterococci for point source:	158 col/100mL	

Load Calculations:

Load = Enterococci Conc * Measured Flow * Conversion Factor

Load = colonies of Enterococci/day — Measured Flow = cfs

Enterococci Conc = colonies/100 mL — Conversion Factor = 24465755 (ml-s/ft3-day)

Current Load:

Nonpoint source load (LA)	3.93E+10	colonies/day
Point source load (WLA)	0.00E+00	colonies/day
Current load =	3.93E+10	colonies/day

Target Load:

Nonpoint source load (LA)	9.32E+09	colonies/day
Point source load (WLA)	0.00E+00	colonies/day
Target load =	9.32E+09	colonies/day

Margin of Saftey:

MOS load = 1.04E+09 colonies/day

Source	Current Load (col/day)	Target Load (col/day)	Required Reduction (col/day)	Reduction %	Final Load (col/day)
LA	3.93E+10	9.32E+09	3.00E+10	76%	9.32E+09
WLA	0.00E+00	0.00E+00	0.00E+00	0%	0.00E+00
Total	3.93E+10	9.32E+09	3.00E+10	76%	9.32E+09

Total Maximum Daily Load (TMDL): TMDL = WLA + LA + MOS

TMDL	WLA	LA	MOS
1.04E+10	0.00E+00	9.32E+09	1.04E+09

Percent Reduction to Achieve the Enterococci Standard:

Total reduction: 76% = (current load - target load) / current load

The following assumptions are made for calculating the allowable load.

The water quality single sample maximum criteria for Enterococci is 158 col/100 mL.

To account for an explicit Margin of Safety (MOS) a target concentration of 142.2 col/100 ml was used to calculate the allowable load.

Highest Geometric Mean Calculation

$$\left(\frac{95\ \text{colonies}}{100\ \text{mL}} - \frac{35\ \text{colonies}}{100\ \text{mL}}\right) / \frac{95\ \text{colonies}}{100\ \text{mL}} * 100 = 63.2\%$$