Alabama Department of Environmental Management

Final

Total Maximum Daily Load (TMDL)
Little Lagoon
Assessment Unit ID # AL03140107-0205-100 (2008)
Assessment Unit ID # AL03140107-0205-102 (2010)
Pathogens (Enterococci)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
August 2010

Figure 1-1. Original Listed Portion of Little Lagoon

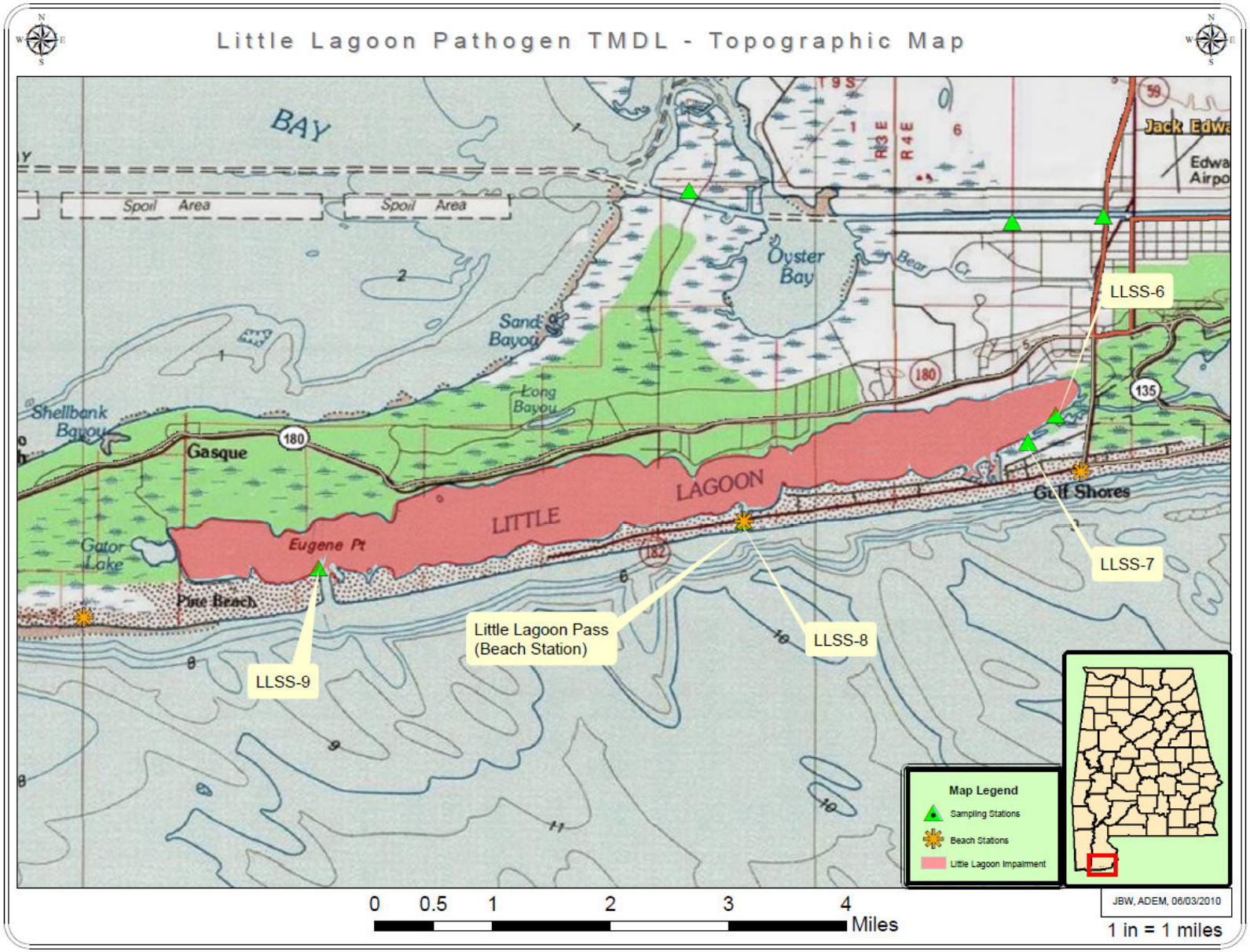


Figure 1-2. Updated Impaired Portion of Little Lagoon

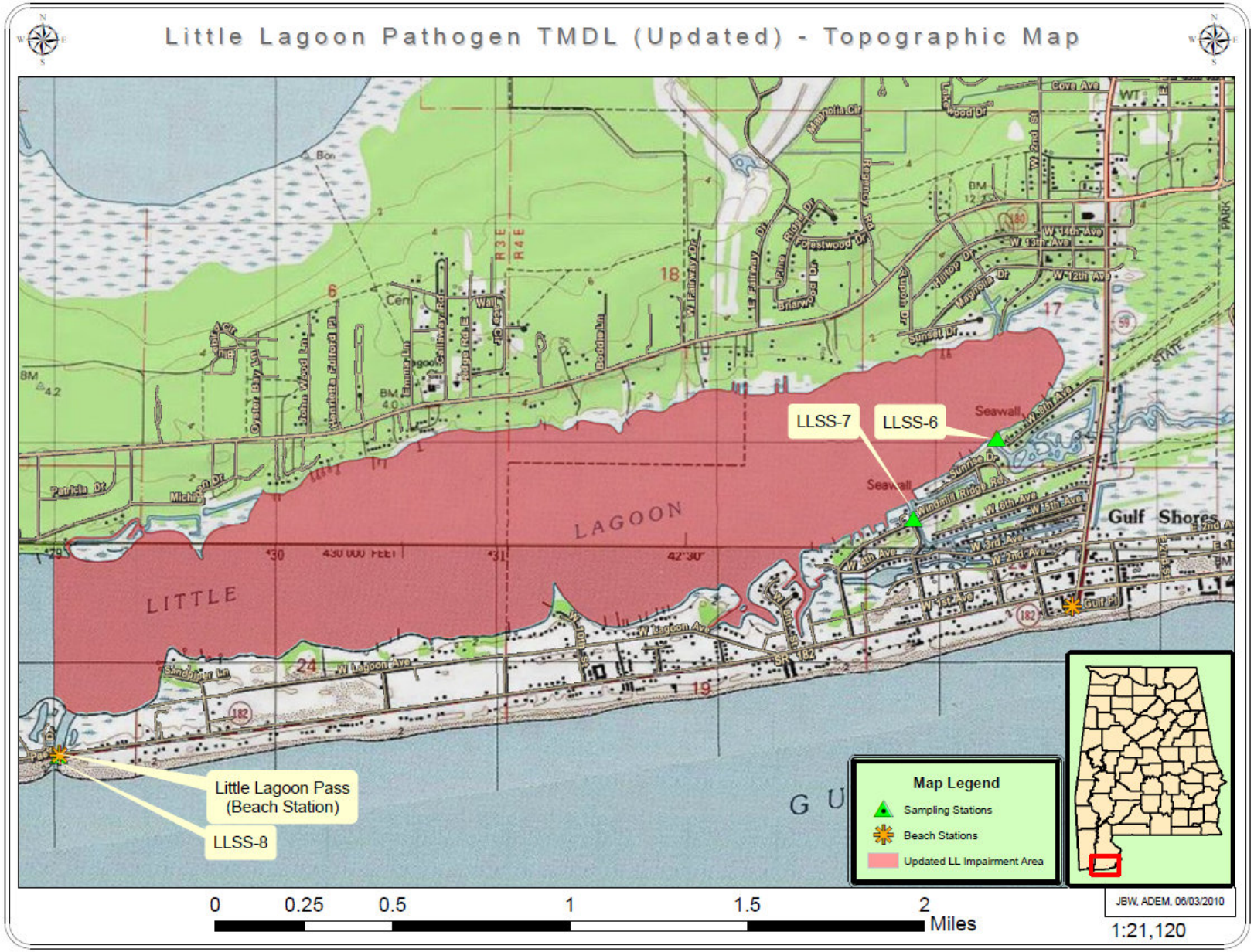


Table of Contents *Page*

List of Figures *Page*

List of Tables *Page*

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) requires states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting all applicable water quality standards for the pollutant of concern. All TMDLs include a waste load 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).

Little Lagoon was originally placed on Alabama's 2006 §303(d) list of impaired waters for pathogens based on data collected by ADEM in 2000. Little Lagoon is currently on the §303(d) list for pathogens (Enterococci) in its entirety. This impairment totals 3.96 square miles of tidally-influenced estuarine ecosystem. Little Lagoon is located in the Perdido-Escambia River Basin in southern Baldwin County. The listed portion of this waterbody holds use classifications of Swimming (S), Shellfish Harvesting (SH), as well as Fish & Wildlife (F&W).

Little Lagoon is a waterbody that is 10 miles long and 1/2 mile wide located on the north side of the Gulf of Mexico on the Alabama coast. It is separated from the Gulf by a 1/2 mile wide stretch of beach known in Gulf Shores as the West Beach. Its brackish water is a mix of freshwater inflow from Lake Shelby (just to the east of Little Lagoon) and salt water from the Gulf of Mexico that enters through the pass 3 miles west of Gulf Shores Parkway (AL HWY 59) under the Lee Callaway Bridge on West Beach Boulevard (AL HWY 182).

In 2008, an intensive §303(d) sampling study was performed by ADEM on Little Lagoon for additional water quality assessment. ADEM collected samples from several different stations, including established ADEM monitoring stations (4) as well as near-shore beach monitoring stations (1). The Beach Monitoring Program Stations have been sampled year-round from 2006 to the present. Further review of the general water quality and intensive Enterococci study revealed that Little Lagoon was still not meeting the pathogen criterion applicable to its most stringent use classification (Swimming). Each station was carefully examined and the data compiled to identify specific areas of impairment. In particular, the stations on the easternmost portion of the lagoon showed the highest and most frequent exceedances. These stations showed an unacceptable number of single sample exceedances, while the other stations showed no exceedances. Therefore, this TMDL was developed for the portion of the lagoon specific to the data collected and pertinent information available. Figure 1-2 on page 3 of this document shows an updated impairment boundary that this TMDL will focus on (all waters east of the Little Lagoon Pass). Consequently, and upon further review, the remaining portion of the lagoon will be proposed for delisting since all applicable water quality standards are being attained. The subject

delisting will be developed under a separate report and made available for public review and comment in the near future.

Subsequently, the original assessment unit ID has been updated to reflect the segmentation changes being made to Little Lagoon. The language within the assessment unit revisions uses "segment" which is synonymous with "area" and "portion" throughout this report. The segmentation changes are as follows:

- 2008 Assessment Unit ID for Little Lagoon (entirety): AL03140107-0205-100
- 2010 Assessment Unit ID for Little Lagoon (impaired portion): AL03140107-0205-102
- 2010 Assessment Unit ID for Little Lagoon (future delisting): AL03140107-0205-101

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). In this instance, flow was not a consideration due to the tidal influence, small watershed size, and very localized exceedances. Therefore, a percent reduction was based solely on the highest exceedance value and the percent reduction required in order to meet the criterion applicable to the Swimming (S) use classification.

The percent reduction was determined by taking the highest single sample exceedance, the maximum allowable instream loading for this particular waterbody, and using these values in order to establish a percent reduction for all point sources and non-point sources within the watershed. A localized drainage area was delineated to represent the source(s) of the pollutant causing impairment. The Swimming (S) use classification criterion states a maximum allowable single sample level of 104 colonies/100ml and a maximum allowable geomean of 35 colonies/100ml (*Alabama Department of Environmental Management Water Division – Water Quality Program: Chapter 335-6-11-.02*). The single sample criterion was employed in this instance because it yielded the greatest reduction among the qualified data. The allowable loading, defined as the single sample criterion including the 10% explicit margin of safety (MOS), was calculated using the Enterococci single sample allowable concentration of 94 colonies/100 ml (104 colonies/100 ml – 10% MOS) and the highest exceedance (200 colonies/100ml) to yield a total load reduction of *53%*.

Table 1-1 is a summary of estimated existing and allowable concentrations required to meet the applicable water quality pathogen single sample criterion for the updated Little Lagoon impairment area. Table 1-2 lists the TMDL (maximum allowable) pathogen loadings under critical conditions for the Little Lagoon Impairment.

Table 1-1. Enterococci Concentrations and Required Reductions

Source	Existing Conditions (col/100 ml)	Allowable Conditions (col/100 ml)	Margin of Safety (col/100 ml)	Percent Reduction (%)
Nonpoint Source	200	94	10	53
Point Source	0	0	0	0
Total	200	94	10	53

The TMDL, WLA, LA and MOS values necessary to achieve the applicable Enterococci criteria are provided in Table 1-2 below. Additional TMDL calculations are provided in Appendix C.

Table 1-2. Enterococci TMDL for Impaired Portion of Little Lagoon

TMDL = WLA + LA + MOS					
TMDL	**Margin of Safety (MOS)**	**Waste Load Allocation (WLA)[a]**			**Load Allocation (LA)**
		WWTPs[b]	**MS4s[c]**	**Leaking Collection Systems[d]**	
(col/100ml)	**(col/100ml)**	**(col/day)**	**(% reduction)**	**(col/day)**	**(col/100ml)**
104	10	NA	NA	0	94

a. There are no CAFOs in the subject watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. NA = not applicable, no WWTPs currently located in the Little Lagoon watershed. 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 pathogen loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for pathogens.

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 Little Lagoon 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 determined that only 1.33 square miles of Little Lagoon (east of Little Lagoon Pass) is currently impaired for pathogens. As mentioned before, this is only a portion of the entire lagoon (3.96 square miles) that was originally listed on the 2006 §303(d) list. The §303(d) listing was originally reported on Alabama's 2006 List of Impaired Waters based on intensive field studies performed in 2000. Additional supporting data was gathered during the 2008 sampling season and on-going beach monitoring data from the Department's Coastal Beach Monitoring Program.

2.2 Problem Definition

Waterbody Impaired:	Little Lagoon east of Little Lagoon Pass
Impaired Area:	~1.33 square miles
Contributing Drainage Area:	~2.33 square miles
Water Quality Standard Violation:	Enterococci (Pathogens)
Water Use Classification:	Swimming (S) Shellfish Harvesting (SH) & Fish and Wildlife (F&W)

Usage Related to Classification:
This particular impaired waterbody is classified as Shellfish Harvesting (SH), Swimming (S), and Fish and Wildlife (F&W). 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.

Shellfish Harvesting Criterion:

It should be noted that although this portion of Perdido Bay is classified as SH, the Swimming use classification holds the same single sample and geomean criteria, but is in effect year-round as opposed to the seasonal limits applicable to the SH classification criterion. Furthermore, under the Shellfish Sanitation Program administered by the Alabama Department of Public Health (ADPH), Perdido Bay is defined as an "unclassified" area, therefore is closed to the harvesting of shellfish.

Enterococci Criterion:

Criterion for acceptable bacteria levels for the Swimming & Other Whole-Body Contact Sports (S) use classification is described in ADEM Administrative Code R. 335-6-10-.09(3)(c)6(i-iii):

6. Bacteria:
(i) Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes, are not acceptable for swimming or other whole body water-contact sports.

6. Bacteria (Continued):
(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 Exceeded:

Water quality data collected by ADEM in 2000 was used in listing this portion of Little Lagoon on Alabama's 2006 §303(d) list. Data indicated that it exceeded the single sample maximum criterion for its swimming use classification (year-round). The geometric mean and single sample maximum criterion limits are 35 colonies/100 ml and 104 colonies/100ml, respectively. As previously mentioned, two of the intensive monitoring stations sampled in 2008 showed exceedances. In addition, the beach monitoring station at Little Lagoon Pass also had an exceedance. This dataset included a total of 40 samples from the §303(d) stations and 126 samples from the beach monitoring stations. The complete dataset analyzed for listing this portion of Little Lagoon can be viewed in Appendix B, Figures 7-1 and 7-2.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

The single sample Enterococci allowable concentration of 96 colonies/100 ml will be used for TMDL development. This concentration was derived by using the single sample criterion of 104 colonies/100 ml and a 10% (10.4 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 (year-round) or the single sample maximum of 104 colonies/100 ml to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Little Lagoon Impairment Watershed

Continuous Point Sources
There are no continuous NPDES discharges located in the contributing watershed of the impaired portion of Little Lagoon (See Figure 1-2). 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 specific watershed contributing to the Little Lagoon Impairment is not located within a qualified Municipal Separate Stormwater Sewer System (MS4) area; therefore a WLA is not applicable in this instance.

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 ADEM files it was determined that numerous SSOs have occurred in the Gulf Shores area over time. These overflows typically occur from manholes located in the city and from percolation ponds located at a UIC treatment facility north of Little Lagoon.

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 Little Lagoon Delineated Watershed

Nonpoint sources appear to be the predominant source of Enterococci bacteria in the watershed. Land use in this watershed is characterized mostly by developed areas, forested land, and several other uses. The combined developed area accounts for nearly 67% of the contributing drainage area, while forests cover about 12%, followed by "all other uses" at ~12%, and wetlands at nearly 8%. As mentioned on the 2008 listing document, the land use data supports the premise that urban runoff and sanitary sewer issues are the predominant issue at hand.

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. An illicit discharge refers to non-permitted facilities or individuals discharging wastewater through storm drains and/or directly to the waterbody.

    - The section of Gulf Shores on the east end of Little Lagoon is heavily developed with residential areas, condominiums, and businesses. The Alabama Department of Public Health (ADPH) in Baldwin County was contacted and stated that there were currently no known faulty systems or other problems that could be contributing to this particular pathogen impairment.

3.3 Land Use Assessment

Land uses for the area surrounding the impairment were determined using ArcMap 9.3. The land use datasets were derived from the 2001 National Land Cover Dataset (NLCD). Figure 3-1 displays land use areas of the original listed area (Little Lagoon in its entirety, Figure 3-2 displays an updated representation of land use with a delineated watershed, Figure 3-3 gives an aerial illustration of the original listing, Figure 3-4 displays the updated aerial map, Figures 3-5 and 3-6 show a topographical view of the impairment for the original and updated impairments, respectively, and finally, Figures 3-7 and 3-8 show the impervious surfaces surround Little Lagoon. These maps help to illustrate the contrast between the east and west ends of the lagoon. Furthermore, Table 3-1 and Figures 3-9 & 3-10 display the land use categories and grouped land uses relative to the delineated watershed (See Following Pages for Illustrations).

Note: Due to report formatting, some map elements may not be to scale

Figure 3-1. Land Use Map (Original Listed Area)

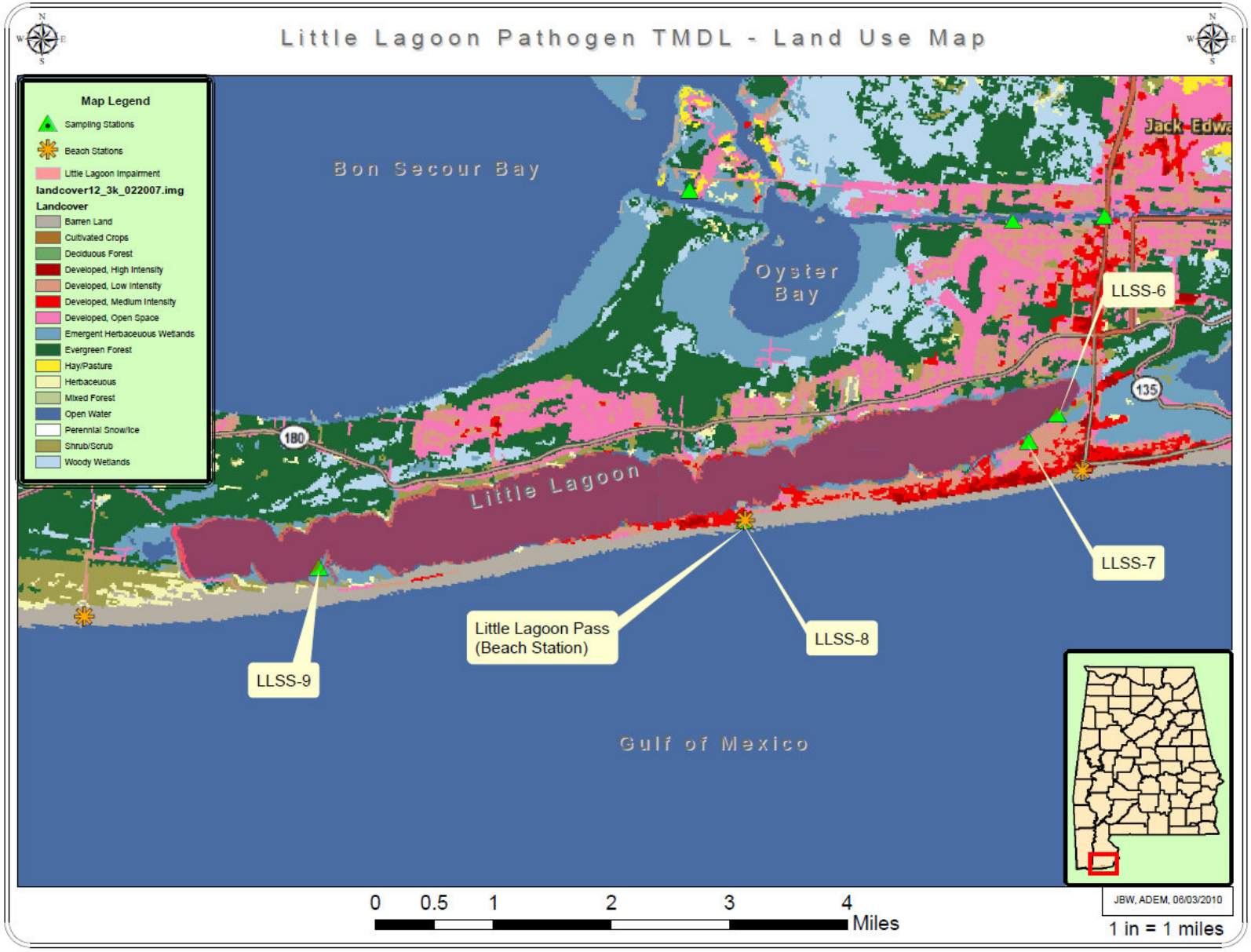


Figure 3-2. Land Use Map (Updated Impaired Area)

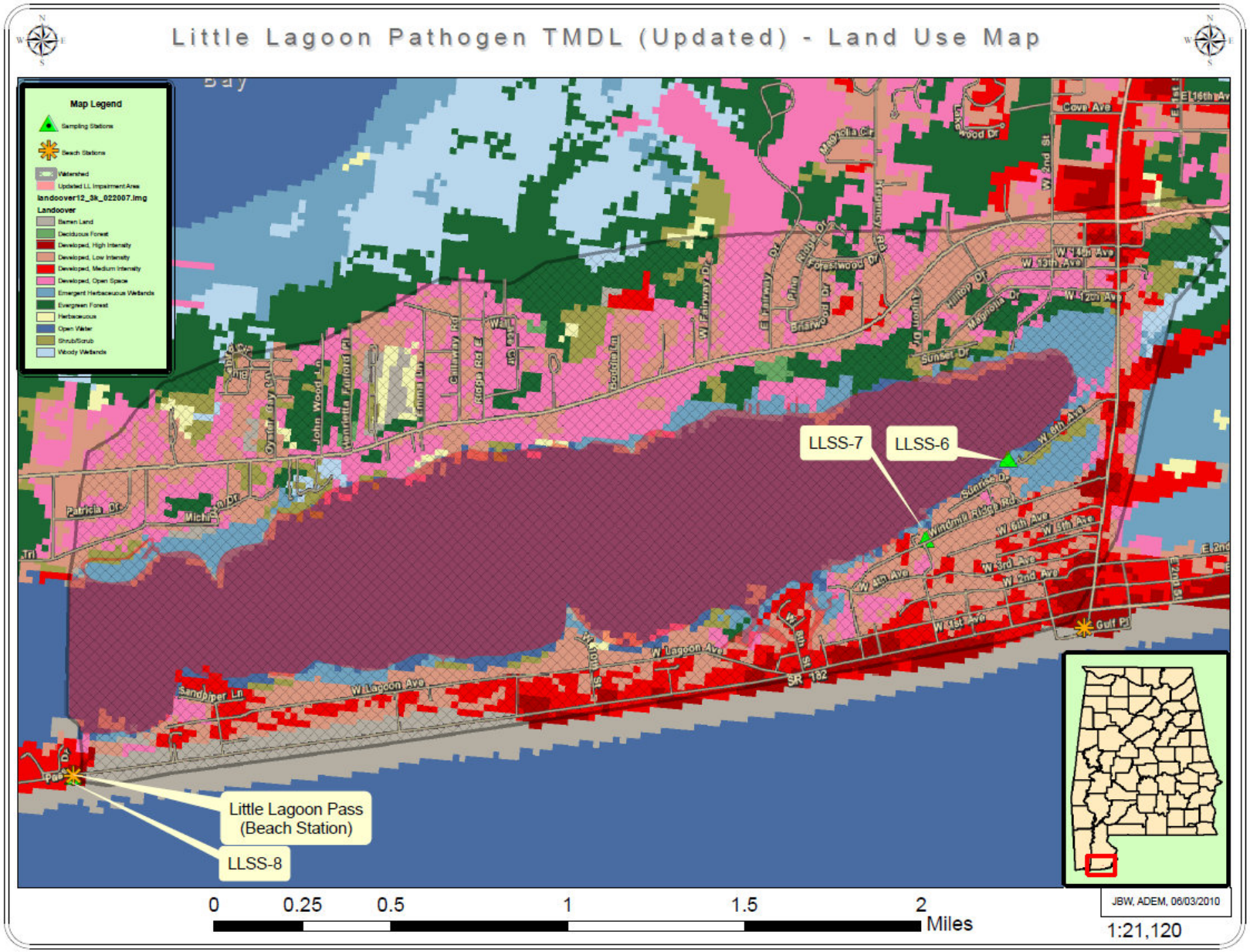


Figure 3-3. Aerial Map (Original Listed Area)

Figure 3-4. Aerial Map (Updated Impaired Area)

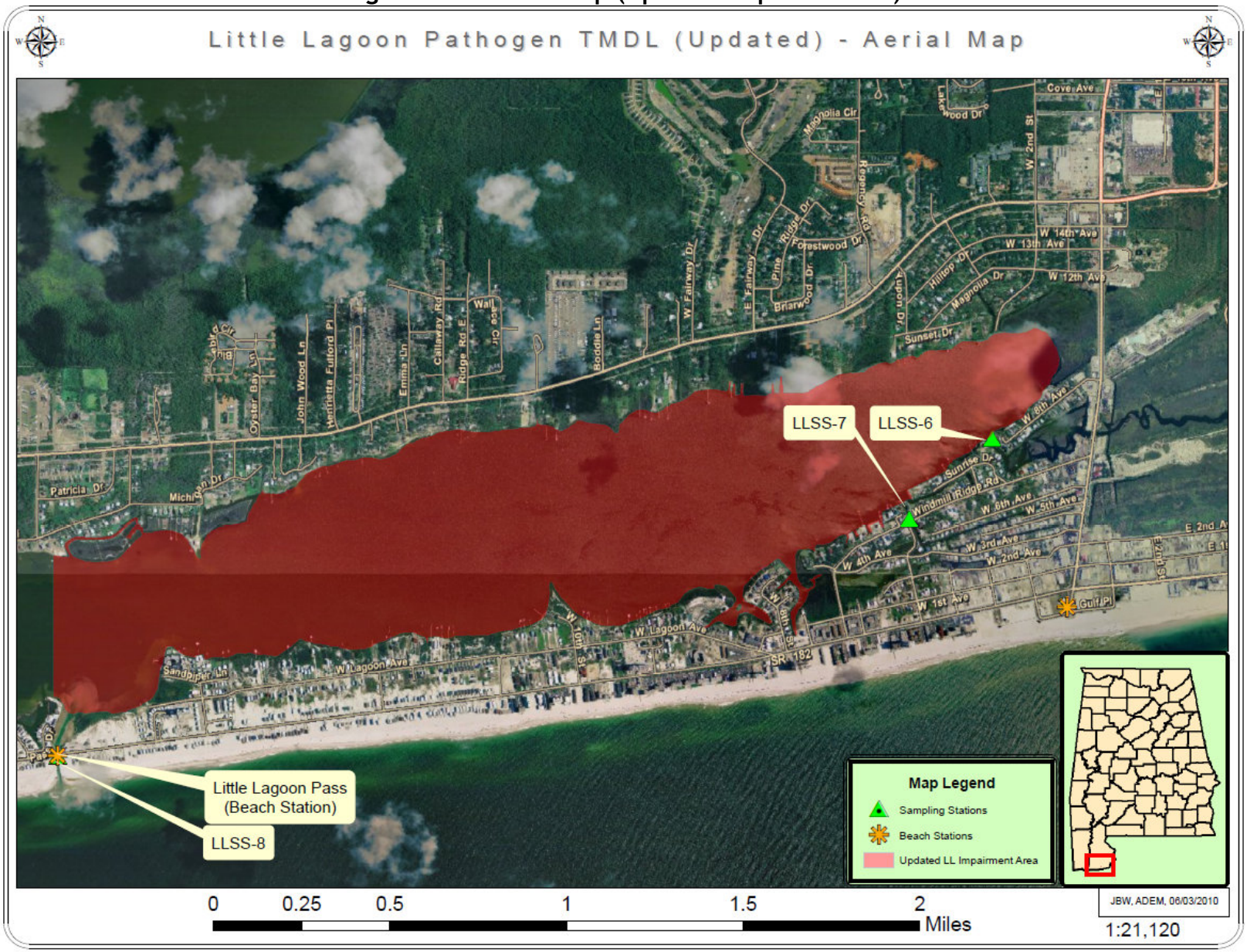


Figure 3-5. Topographic View (Original Listed Area)

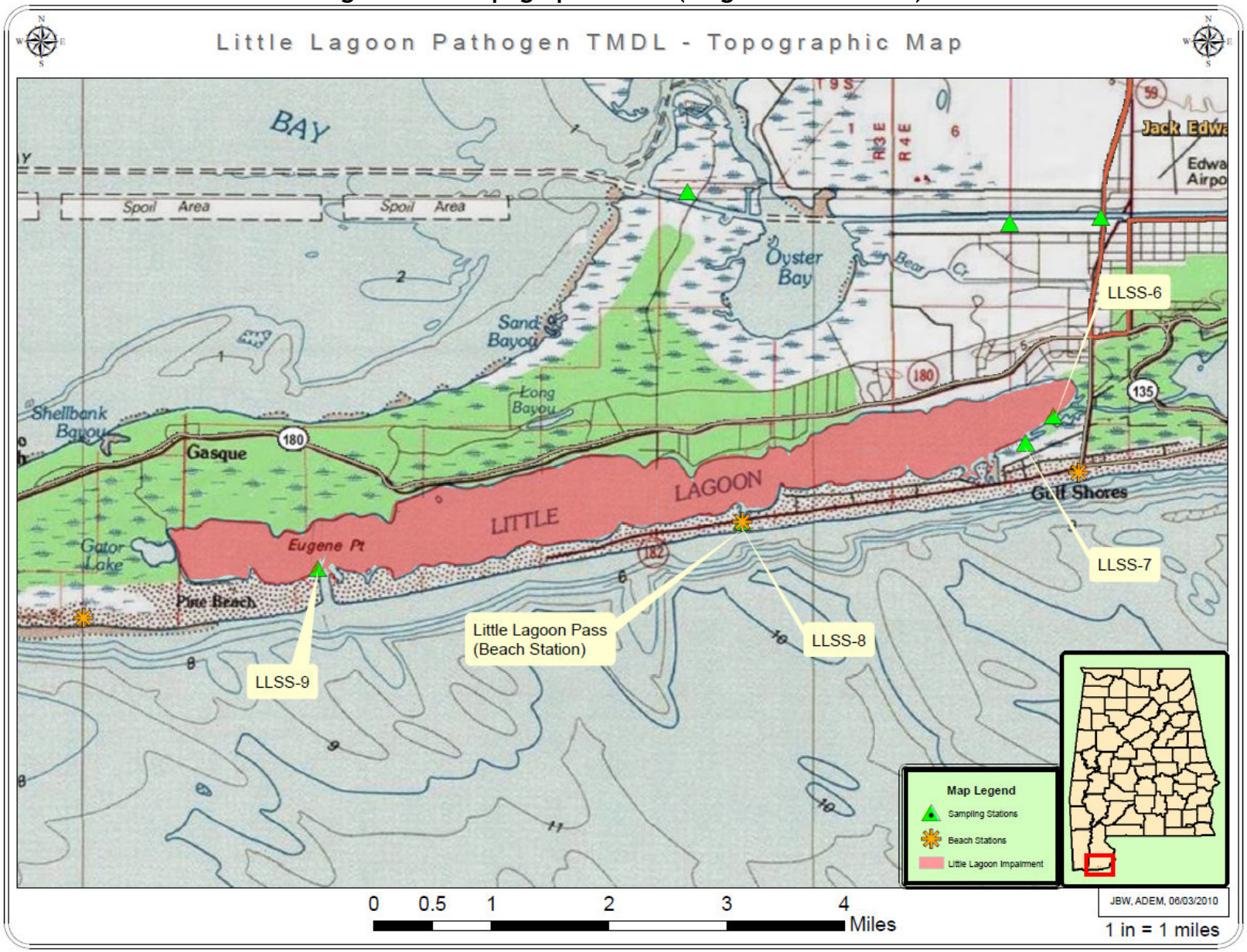


Figure 3-6. Topographic View (Updated Impaired Area)

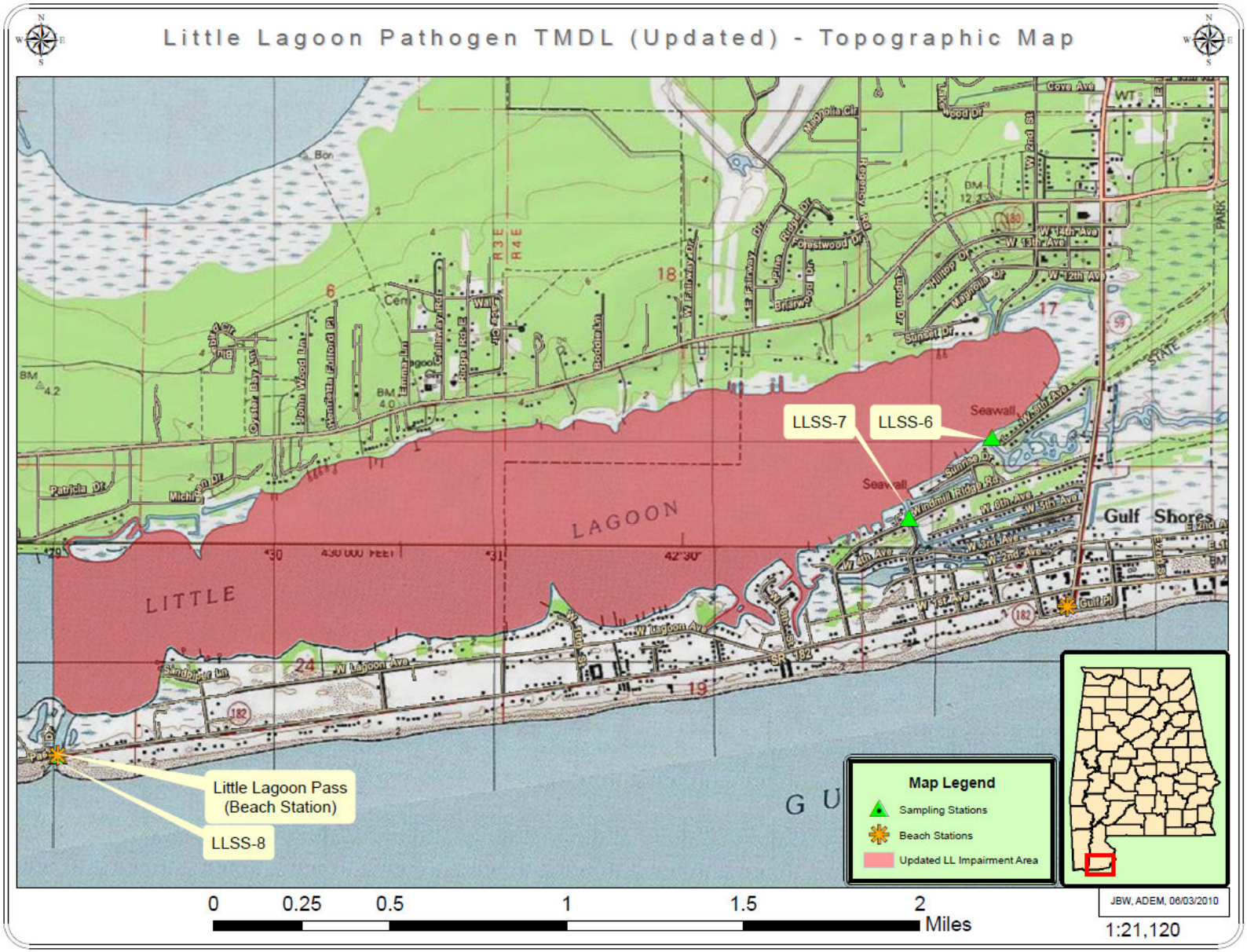


Figure 3-7. Impervious Surfaces Map (Original Listed Area)

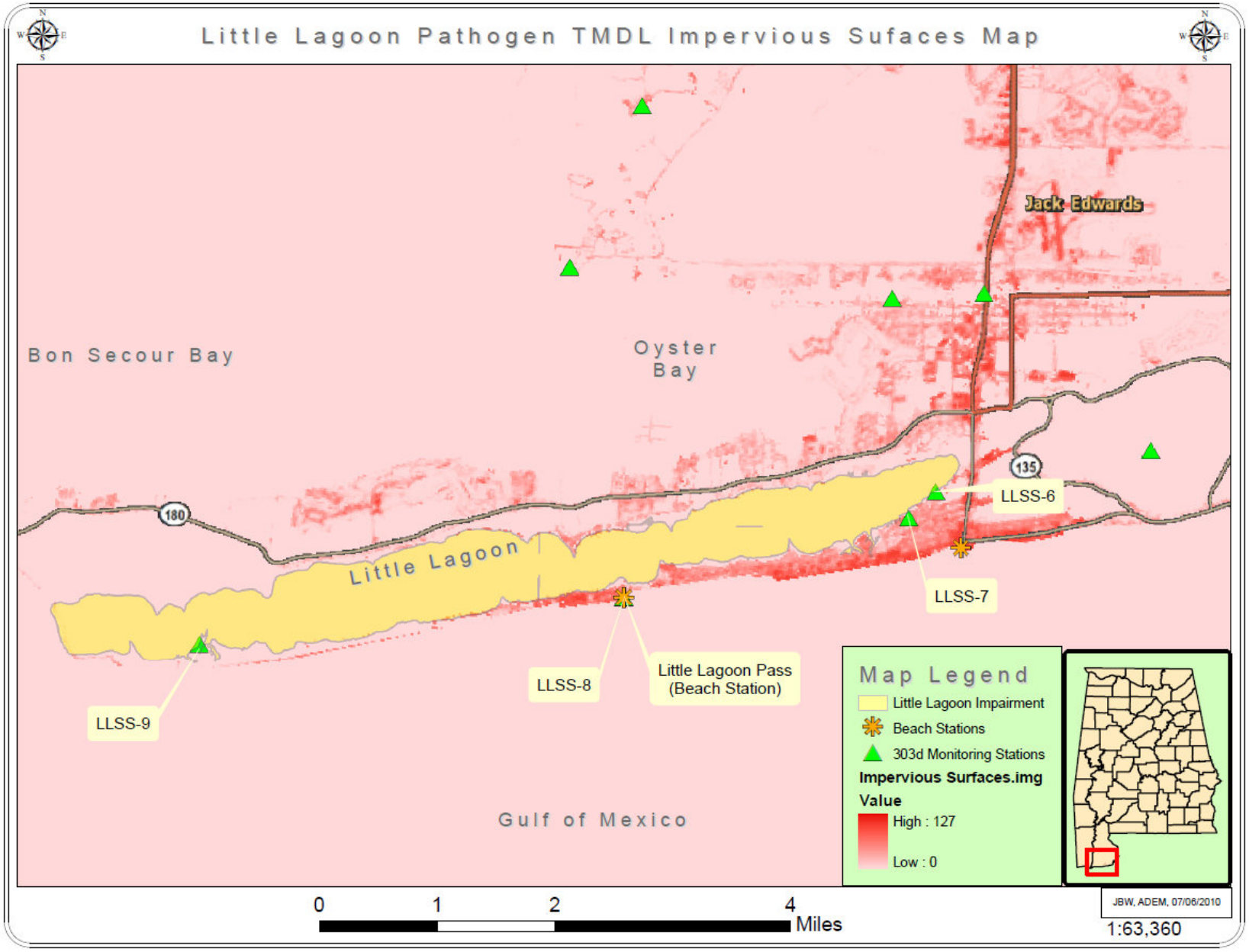


Figure 3-8. Impervious Surfaces Map (Updated Impaired Area)

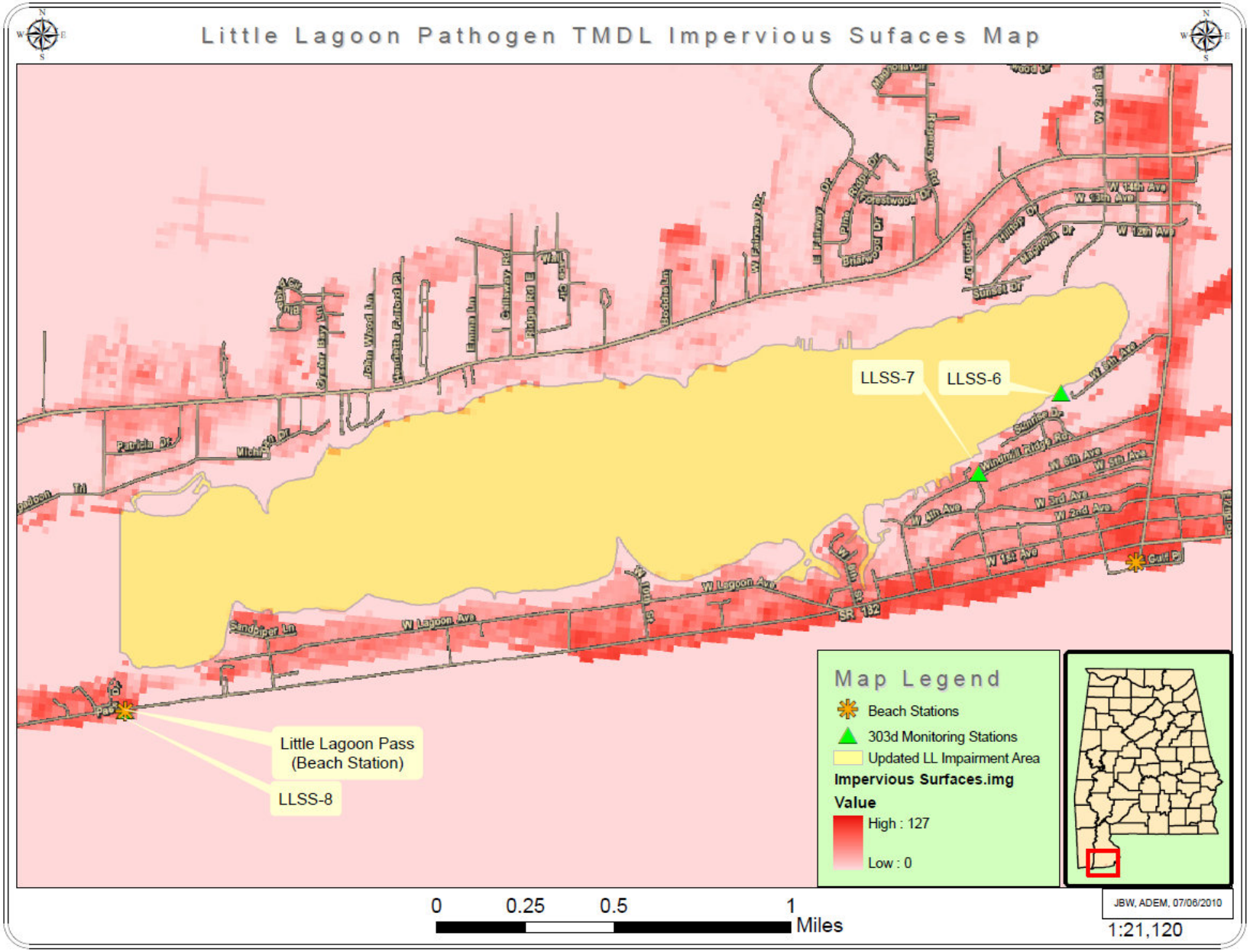


Table 3-1. Land Use Areas for Delineated Watershed (Ungrouped & Grouped)

Land Cover (Ungrouped)				
Cover Type	**Count**	**Percent**	**Area (mi²)**	**Area (ac)**
Developed (Low Intensity)	2237	32.3%	0.491	314.2
Developed (Open Space)	1447	20.9%	0.318	203.2
Developed (Medium Intensity)	784	11.3%	0.172	110.1
Evergreen Forest	726	10.5%	0.159	102.0
Emergent Herbacious Wetlands	550	7.9%	0.121	77.2
Barren Land	402	5.8%	0.088	56.5
Shrub / Scrub	352	5.1%	0.077	49.4
Developed (High Intensity)	231	3.3%	0.051	32.4
Herbacious	83	1.2%	0.018	11.7
Woody Wetlands	79	1.1%	0.017	11.1
Deciduous Forest	28	0.4%	0.006	3.9
TOTALS:	**6919**	**100.0%**	**1.51842**	**971.8**

Land Cover (Grouped)				
Cover Type	**Count**	**Percent**	**Area (mi²)**	**Area (ac)**
Developed	4699	67.9%	1.031	660.0
Other	837	12.1%	0.184	117.6
Forest	833	12.0%	0.183	117.0
Wetlands	550	7.9%	0.121	77.2
TOTALS:	**6919**	**100.0%**	**1.51842**	**971.8**

Figure 3-9. Land Use Areas for Delineated Watershed (Ungrouped)

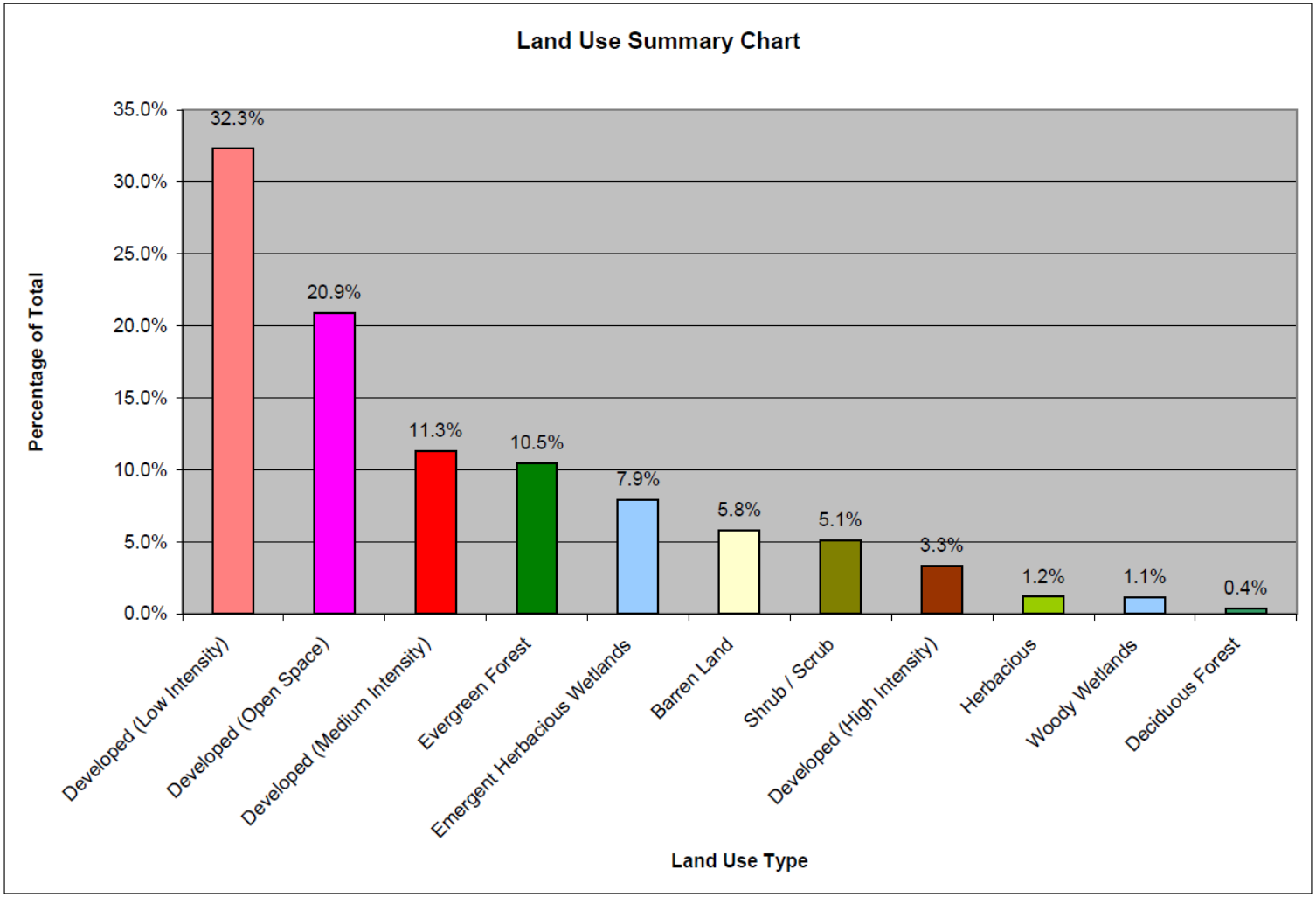
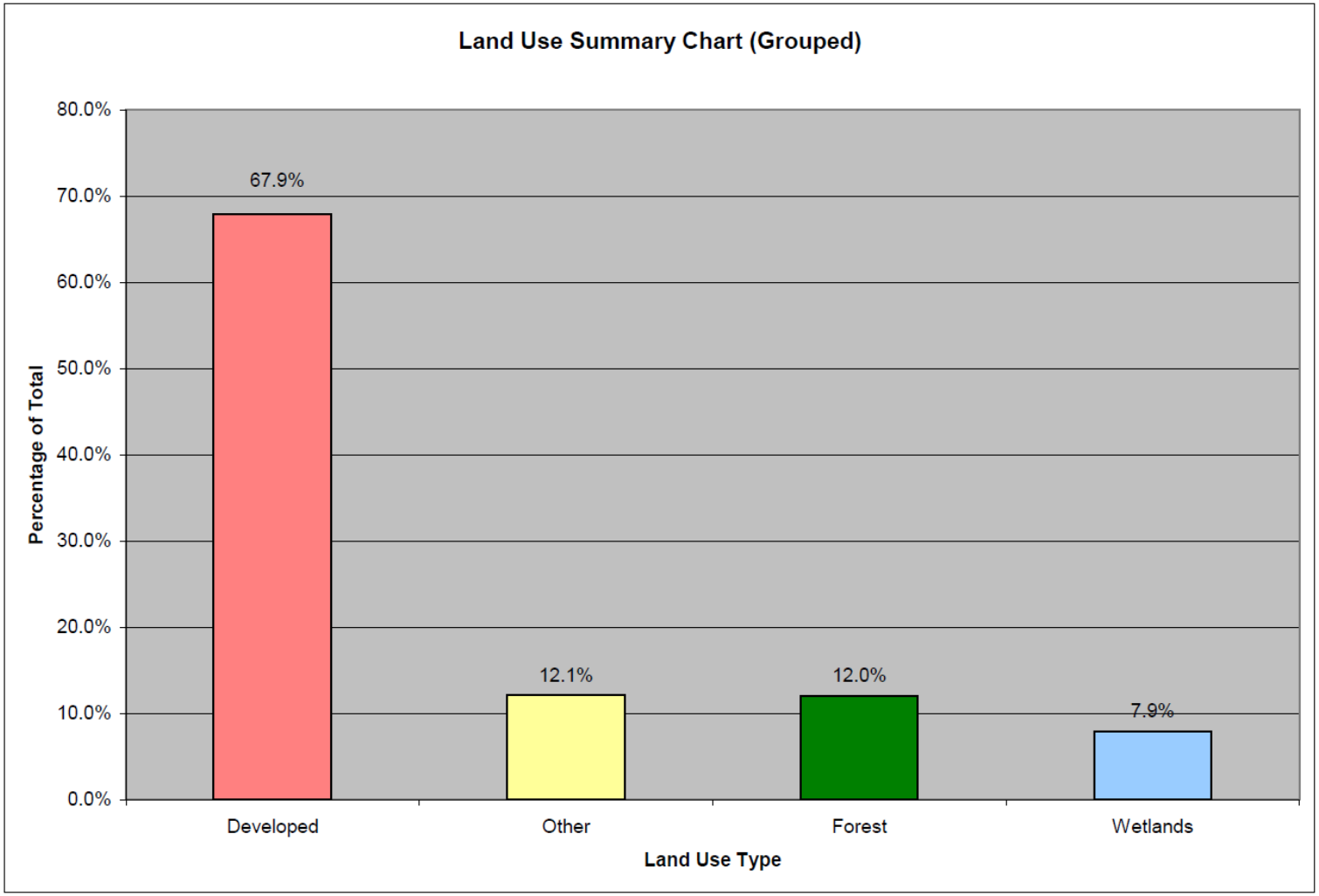


Figure 3-10. Land Use Areas for Delineated Watershed (Grouped)



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 this delineated watershed are from urban runoff, SSOs, failing septic tanks, and/or agricultural operations. 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

The Beach Monitoring Station at Little Lagoon Pass has been collecting water quality data in the listed waterbody since August of 2006. In addition to this beach monitoring data, part of the Department's Coastal Program, ADEM conducted intensive §303(d) studies on 4 stations within the impairment. 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 & 7-2.

ADEM collected water quality data in Little Lagoon from 2006 to 2010 as part of ADEM's §303(d) Monitoring Program at Stations LLSS-6, LLSS-7, LLSS-8, & LLSS-9, as well as ADEM/ADPH's Beach Monitoring Station dubbed "Little Lagoon Pass". Figure 3-5 and Table 3-2 display locations and list descriptions for the ADEM stations. During this study, a total of 166 samples were collected; 40 of which from the §303(d) stations, and 126 samples from the Beach Monitoring Station. Of the Enterococci samples collected, there were exceedances for the single sample maximum criterion of 104 colonies/100 ml, but not the geometric mean criterion 35 colonies/100 ml for the Swimming (S) use classification. There were a total of 4 single sample exceedances, with the highest being 200 colonies/100 ml. In contrast, there were no exceedances of available geomeans. As a result, the single sample exceedance of 200 colonies/100ml was utilized to develop the TMDL since it resulted in the highest percent reduction of the applicable Enterococci criteria.

Table 3-2. Little Lagoon Pathogen TMDL Sampling Station Descriptions

Year	Station ID	Data Source	Station Description / Location	Latitude	Longitude
2008	LLSS-6	ADEM	East Portion of Little Lagoon near inflow from Lake Shelby	30.2547°	-87.6936°
2008	LLSS-7	ADEM	Southeast portion of Little Lagoon	30.2514°	-87.6975°
2008	LLSS-8	ADEM	@ Little Lagoon Pass	30.2414°	-87.7378°
2008	LLSS-9	ADEM	Southwest portion of Little Lagoon	30.4050°	-87.4307°
2006-present	Little Lagoon Pass	ADEM/ ADPH	Beach Monitoring Station @ Little Lagoon Pass	30.2353°	-87.7981°

3.7 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 bacteria into streams, resulting in spikes of bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up bacteria on the land surface, resulting in a more uniform loading rate. The data collected by ADEM from 2006-present in Little Lagoon follow this trend as well. Also, the summer criterion is typically more stringent than the winter criterion (though in this case, the criterion remains the same throughout the year due to the swimming use classification).

3.8 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.

Both an explicit and implicit MOS was incorporated into this TMDL. The MOS accounts for the uncertainty associated with the limited availability of Enterococci data used in this analysis. An explicit MOS was applied to the TMDL by reducing the Enterococci single sample mean criterion concentration by ten percent and calculating a mass loading target with measured flow data. The single sample mean criterion was reduced by ten percent to achieve a target concentration of 96 colonies/100 mL. An implicit MOS was incorporated in the TMDL by basing the existing condition on the highest measured Enterococci concentration that was collected during critical conditions.

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 both implicit and explicit in this TMDL.

A TMDL can be denoted by the equation:

TMDL = WLAs + 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). In this instance, flow was not a consideration due to the tidal influence, small watershed size, and very localized exceedances. Therefore, a percent reduction was based solely on the highest exceedance value and the percent reduction required in order to meet the criterion applicable to the Swimming (S) use classification.

4.2 Load Calculations

A percent reduction approach was utilized to calculate the pathogen TMDL for the Little Lagoon Impairment listed herein. The following equation was used to calculate the appropriate load reduction:

$$= \frac{(\text{Highest Exceedance} - \text{Single Sample Criterion w/ MOS})}{\text{Highest Exceedance}} \times 100\%$$

The single sample criterion was used because it yielded the greatest reduction among the available data. Allowable concentrations were calculated for the single sample criterion of 104 colonies/100ml. The TMDL was based on a single sample violation that produced percent reductions of Enterococci necessary to achieve applicable water quality criteria.

Allowable Conditions Calculation:

$$\frac{(200 \text{ col}/100 \text{ ml} - 94 \text{ col}/100 \text{ ml})}{200 \text{ col}/100 \text{ ml}} \times 100\% = 53\%$$

The difference in the pathogen concentrations 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. Table 4-1 provides the existing conditions, allowable conditions, margin of safety and percent reduction for the point and nonpoint sources. Since the single sample violation yielded the greatest reduction it will be used to develop the Little Lagoon Pathogen TMDL.

Table 4-1. Enterococci Concentrations and Required Reductions

Source	Existing Conditions (col/100 ml)	Allowable Conditions (col/100 ml)	Margin of Safety (col/100 ml)	Percent Reduction (%)
Nonpoint Source	200	94	10	53
Point Source	0	0	0	0
Total	200	94	10	53

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 for Impaired Portion of Little Lagoon

TMDL = WLA + LA + MOS					
TMDL	**Margin of Safety (MOS)**	**Waste Load Allocation (WLA)[a]**			**Load Allocation (LA)**
		WWTPs[b]	**MS4s[c]**	**Leaking Collection Systems[d]**	
(col/100ml)	**(col/100ml)**	**(col/day)**	**(% reduction)**	**(col/day)**	**(col/100ml)**
104	10	NA	NA	0	94

a. There are no CAFOs in the subject watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. NA = not applicable, no WWTPs currently located in the Little Lagoon watershed. 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 pathogen loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for pathogens.

4.3 TMDL Summary

This portion of Little Lagoon was placed on Alabama's §303(d) list in 2006 based on data collected from 2000. ADEM performed §303(d) intensive monitoring in 2008 and also performed ongoing beach monitoring as part of the Department's Coastal Program. These results indicated an impairment of the waterbody.

A percent reduction approach was used to calculate the Enterococci TMDL for the impaired portion of Little Lagoon. Based on the TMDL analysis, it was determined that a 53% 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 Perdido Bay 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
Alabama / Coosa / Tallapoosa	2010
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2011
Black Warrior / Cahaba	2012
Chattahoochee / Chipola / Escatawpa / Perdido-Escambia	2013
Tennessee	2014

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.

Comprehensive Sanitary Survey of Alabama's Area I Shellfish Growing Water in Mobile & Baldwin Counties. 2007. Alabama Department of Public Health – Seafood Branch.

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. Beach Monitoring Station Data (Little Lagoon Pass)

ADEM/ADPH Beach Monitoring Program
Microbiological Analyses
Little Lagoon Pass, Gulf of Mexico
Latitude: 30.24139° N
Longitude: 87.73778° W

most recent advisory
see advisory key below

Date Collected	Enterococcus Count/100 ml *	Enterococcus Geo. Mean
05/24/10	< 1	1.43
05/17/10	< 1	xxxx
05/10/10	< 1	xxxx
05/03/10	6	xxxx
04/27/10	< 1	xxxx
03/03/10	4	xxxx
02/02/10	< 1	xxxx
01/04/10	4	xxxx
12/01/09	21	xxxx
11/02/09	< 1	xxxx
10/05/09	23	3.44
09/28/09	< 1	1.84
09/21/09	3	2.29
09/14/09	7	2.63
09/08/09	< 1	1.78
08/31/09	1	1.78
08/24/09	3	1.78
08/17/09	6	1.43
08/10/09	< 1	1.00
08/03/09	< 1	1.62
07/27/09	1	1.62
07/20/09	1	1.62
07/13/09	< 1	1.62
07/06/09	11	1.62
06/29/09	< 1	1.38
06/22/09	< 1	1.38
06/15/09	< 1	1.38
06/08/09	< 1	1.38
06/02/09	5	1.38
05/26/09	1	1.15
05/18/09	< 1	1.15
05/11/09	< 1	xxxx
05/04/09	< 1	xxxx
04/28/09	< 2	xxxx
04/20/09	< 1	xxxx
03/02/09	1	xxxx
02/02/09	< 1	xxxx
01/05/09	2	xxxx
12/01/08	1	xxxx
11/03/08	1	xxxx
10/06/08	1	xxxx
09/22/08	1	3.06
09/15/08	5	3.06
09/08/08	3	2.55
09/02/08	1	2.55
08/26/08	18	4.12
08/18/08	< 1	2.31
08/11/08	2	2.31
08/04/08	3	2.01
07/28/08	11	3.00

Date Collected	Enterococcus Count/100 ml *	Enterococcus Geo. Mean
07/21/08	< 1	4.06
07/14/08	< 1	4.66
07/07/08	< 1	6.15
06/30/08	22	6.15
06/23/08	50	3.31
06/16/08	2	1.52
06/09/08	4	1.32
06/03/08	< 1	1.00
05/27/08	1	1.00
05/19/08	< 1	1.00
05/12/08	< 1	xxxx
05/05/08	< 1	xxxx
04/29/08	1	xxxx
04/21/08	< 1	xxxx
03/03/08	9	xxxx
02/11/08	< 1	xxxx
01/07/08	< 1	xxxx
12/03/07	< 1	xxxx
11/05/07	< 1	xxxx
10/16/07	4	xxxx
09/24/07	4	1.89
09/17/07	2	1.43
09/10/07	3	1.93
09/04/07	1	1.93
08/27/07	< 1	3.96
08/20/07	< 1	6.00
08/13/07	9	12.67
08/06/07	3	8.16
07/30/07	36	6.55
07/23/07	8	4.72
07/16/07	42	3.12
07/09/07	< 1	1.48
07/02/07	1	1.48
06/25/07	7	1.48
06/18/07	< 1	1.00
06/11/07	1	1.87
06/05/07	< 1	4.58
05/29/07	1	4.58
05/21/07	1	6.21
05/14/07	23	xxxx
05/08/07	2	xxxx
05/07/07	> 200	xxxx
04/30/07	< 1	xxxx
04/10/07	8	xxxx
03/14/07	< 1	xxxx
02/14/07	< 1	xxxx
01/09/07	2	xxxx
12/12/06	< 1	xxxx
11/07/06	20	xxxx
10/19/06	< 1	xxxx
09/25/06	19	5.20
09/18/06	5	xxxx
09/11/06	1	xxxx
09/05/06	8	xxxx
08/28/06	5	xxxx

Note: Geometric mean is calculated from no fewer than 5 samples collected at a given station over not more than a 30 day period at intervals not less than 24 hrs.
ADEM coastal whole body water contact standard for fecal coliform = 100col/100ml (geo. mean).
ADPH and EPA whole body water contact guidelines for enterococci = 104 col/100ml (single sample max)
All fecal coliform analyses performed by ADEM Mobile Branch Lab using EPA standard method 9222D.
All enterococci analyses performed by ADPH Mobile Laboratory using EPA standard method 1600

nd: no data

Advisory Key

The most recent testing of water from this site revealed enterococci levels within the recommended EPA standards. Water quality is acceptable.

The most recent testing of water from this site revealed Enterococci levels over the EPA recommended threshold. There may be an increased risk of illness associated with swimming at this site. Because elevated bacteria levels are often transient and usually fall quickly, this site is now being retested. The status will be revised to red or green based on the results of the retest.

Repeat testing of this site has again revealed Enterococci levels over the EPA recommended threshold. There may be an increased risk of illness associated with swimming at this site. Because elevated bacteria levels have persisted, a public health advisory will be issued. This site will be retested.

Table 7-2. ADEM ALAWADR §303(d) Sampling Station Data

LLSS-6	6/23/2008	1100		120	
LLSS-6	6/25/2008	120		52	
LLSS-6	8/27/2008	120		2	L
LLSS-6	9/4/2008	250		180	
LLSS-6	6/18/2008	30	J	12	J
LLSS-6	6/5/2008	4	J	2	L
LLSS-6	9/10/2008	52		2	L
LLSS-6	6/30/2008	54		4	J
LLSS-6	9/15/2008	60		4	J
LLSS-6	9/22/2008	92		46	
LLSS-7	6/25/2008	12	J	2	J
LLSS-7	9/15/2008	120	J	68	
LLSS-7	6/5/2008	2	L	2	L
LLSS-7	6/23/2008	26	J	4	J
LLSS-7	9/22/2008	32	J	14	J
LLSS-7	9/4/2008	330		140	
LLSS-7	6/30/2008	4	J	10	J
LLSS-7	6/18/2008	8	J	2	J
LLSS-7	9/10/2008	8	J	2	L
LLSS-7	8/27/2008	92		2	L
LLSS-8	8/27/2008	180		2	L
LLSS-8	6/5/2008	2	J	2	L
LLSS-8	6/18/2008	2	L	2	J
LLSS-8	6/25/2008	2	J	2	L
LLSS-8	6/30/2008	2	J	2	L
LLSS-8	6/23/2008	4	J	26	J
LLSS-8	9/10/2008	6	J	2	L
LLSS-8	9/22/2008	8	J	2	J
LLSS-8	9/4/2008	80		38	J
LLSS-8	9/15/2008	80		20	J
LLSS-9	6/5/2008	2	L	2	L
LLSS-9	6/18/2008	2	J	2	L
LLSS-9	6/23/2008	2	L	2	L
LLSS-9	6/25/2008	2	L	2	L
LLSS-9	6/30/2008	2	J	2	L
LLSS-9	8/27/2008	2	L	4	J
LLSS-9	9/10/2008	2	J	2	L
LLSS-9	9/22/2008	2	J	2	L
LLSS-9	9/4/2008	4	J	6	J
LLSS-9	9/15/2008	4	J	2	J