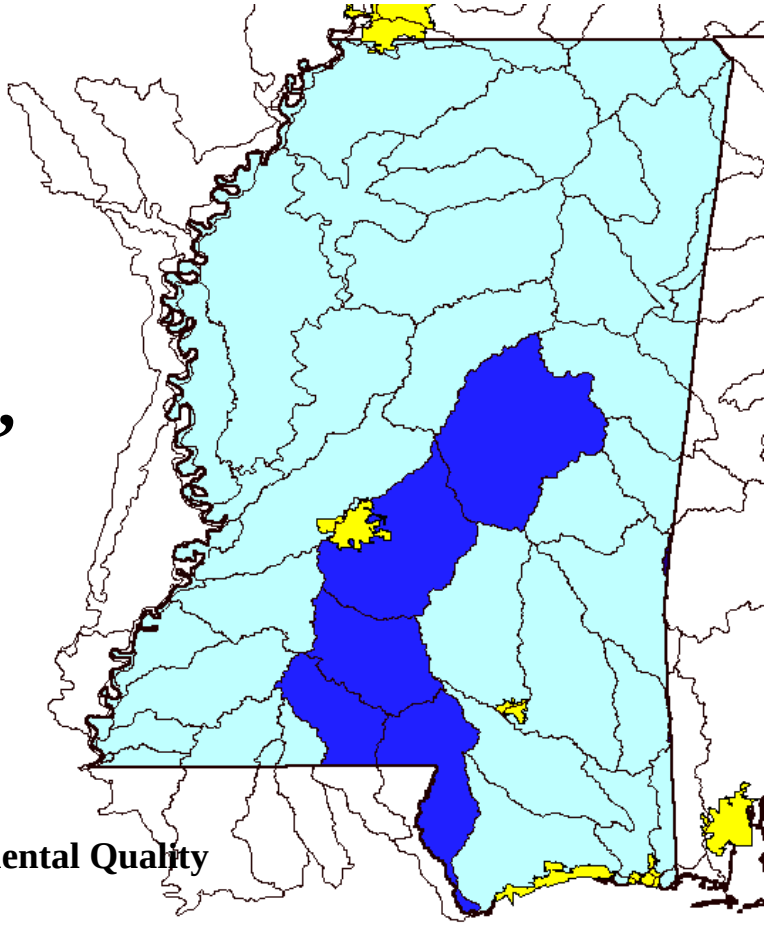
FINAL REPORT
December 2000
ID: 500121501

TMDL For Low pH in the Pearl River Pearl River Basin Neshoba, Leake, Hinds, Rankin, & Hancock Counties, Mississippi



Prepared by
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Office of Pollution Control
TMDL/WLA Section of the Water Quality Assessment Branch

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FOREWORD

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. *(Sierra Club v. Hankinson, No. 97-CV-3683 (N.D> Ga.)*) The report contains one or more Total Maximum Daily Loads (TMDLs) for waterbody segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The segments addressed are comprised of monitored segments that have data indicating impairment. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.0015625	Days	Seconds	86400
Cubic feet	Cu. Meter	0.028316847	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805195	Gallons	Cu feet	0.133680555
Cubic feet	Liters	28.316847	Hectares	Acres	2.4710538
cfs	Gal/min	448.83117	Miles	Meters	1609.344
cfs	MGD	.6463168	Mg/l	ppm	1
Cubic meters	Gallons	264.17205	μg/l * cfs	Gm/day	2.45

CONTENTS

MONITORED SEGMENT IDENTIFICATION

Name:	Pearl River Segment 1
Waterbody ID:	MSUPRLRM1
Location:	At Edinburg: from confluence with Beasha Creek to Confluence with Standing Pine Creek
County:	Neshoba and Leake
USGS HUC Code:	03180001
Length:	18 miles
Use Impairment:	Aquatic Life Support
Cause Noted:	Low pH
Priority Rank:	73
Standards Variance:	None
Pollutant Standard:	The normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit; however, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits, and the Commission on Environmental Quality determines that there will be no detrimental effect on stream usage as a result of the greater pH change.
TMDL Report:	This segment has data that indicate a natural cyclic occurrence of low pH each spring.

MONITORED SEGMENT IDENTIFICATION

Name:	Pearl River Segment 2
Waterbody ID:	MSUMPRLR1M2
Location:	Near Byram: from Jackson POTW outfall to confluence with Big Creek
County:	Border between Hinds and Rankin
USGS HUC Code:	03180002
Length:	12 miles
Use Impairment:	Aquatic Life Support
Cause Noted:	Low pH
Priority Rank:	22
NPDES Permits:	The major POTW for the city of Jackson Mississippi is the primary NPDES permit on this reach of the river.
Standards Variance:	None
Pollutant Standard:	The normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit; however, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits, and the Commission on Environmental Quality determines that there will be no detrimental effect on stream usage as a result of the greater pH change.
TMDL Report:	This segment has data that indicate there is no longer a low pH violation in this segment of the river. The major POTW in this segment has installed a soda ash process to achieve compliance with NPDES Permit requirements for pH.

MONITORED SEGMENT IDENTIFICATION

Name:	East Pearl River
Waterbody ID:	MSLPRLRM1
Location:	At Pearlington: from I-10 bridge to mouth
County:	Hancock County – State line between Mississippi and Louisiana
USGS HUC Code:	03180004
Length:	16 miles
Use Impairment:	Aquatic Life Support
Cause Noted:	Low pH
Priority Rank:	47
Standards Variance:	None
Pollutant Standard:	The normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit; however, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits, and the Commission on Environmental Quality determines that there will be no detrimental effect on stream usage as a result of the greater pH change.
TMDL Report:	This segment of the Pearl River has had a major hydrologic control structure constructed to re-divert flow back into the East fork of the river. Prior to this construction, the flow in the East Pearl dwindled to localized runoff, which converted this portion of the river to a black-water swamp. This impacted the pH levels in the stream. Monitoring is underway to evaluate improvements made to water quality with the new water diversion structure.

EXECUTIVE SUMMARY

Three separate segments of the Pearl River have been placed on the Mississippi 1998 Section 303(d) List of Waterbodies as impaired waterbody segments due to low pH. pH is defined as a measure of acidity and alkalinity of a solution that is a number on a scale on which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher number increasing alkalinity and on which each unit of change represents a tenfold change in acidity or alkalinity and that is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution. The applicable state standard specifies the normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit. However, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits. And, the Commission determines that there will be no detrimental effect on stream usage as a result of the greater pH change. A review of the available monitoring data for the watershed indicates that the levels of pH are sometimes below the normal limits. However, these data indicate that the level of impairment is almost always within 1 pH unit of the standard and is apparently caused by natural conditions.

The Pearl River flows approximately 490 miles in a southeastern direction from its headwaters until it reaches the Mississippi Sound. This TMDL Report has been developed for the sections of the Pearl River found on the monitored portion of the Mississippi 1998 Section 303(d) List.

The pH loading estimates from nonpoint sources in the watershed were from the watershed runoff, the soil acidity, and the acidic contribution from pine needles. There are many active NPDES Permitted discharge located in the watershed and included in the study. Each of these permitted facilities has a pH limit requirement in their NPDES Permit. These are listed in appendix A.

The purpose of this TMDL is to report on the study to determine if the pH levels found in the stream are indeed caused by a controllable source or by natural background. Each of the three segments is unique in the causes associated with low pH in the historical data and are handled separately with this report. The study of low pH in these watersheds indicates that the variance to the standard is due to natural, uncontrollable sources.

Table 1 Monitoring Station Information

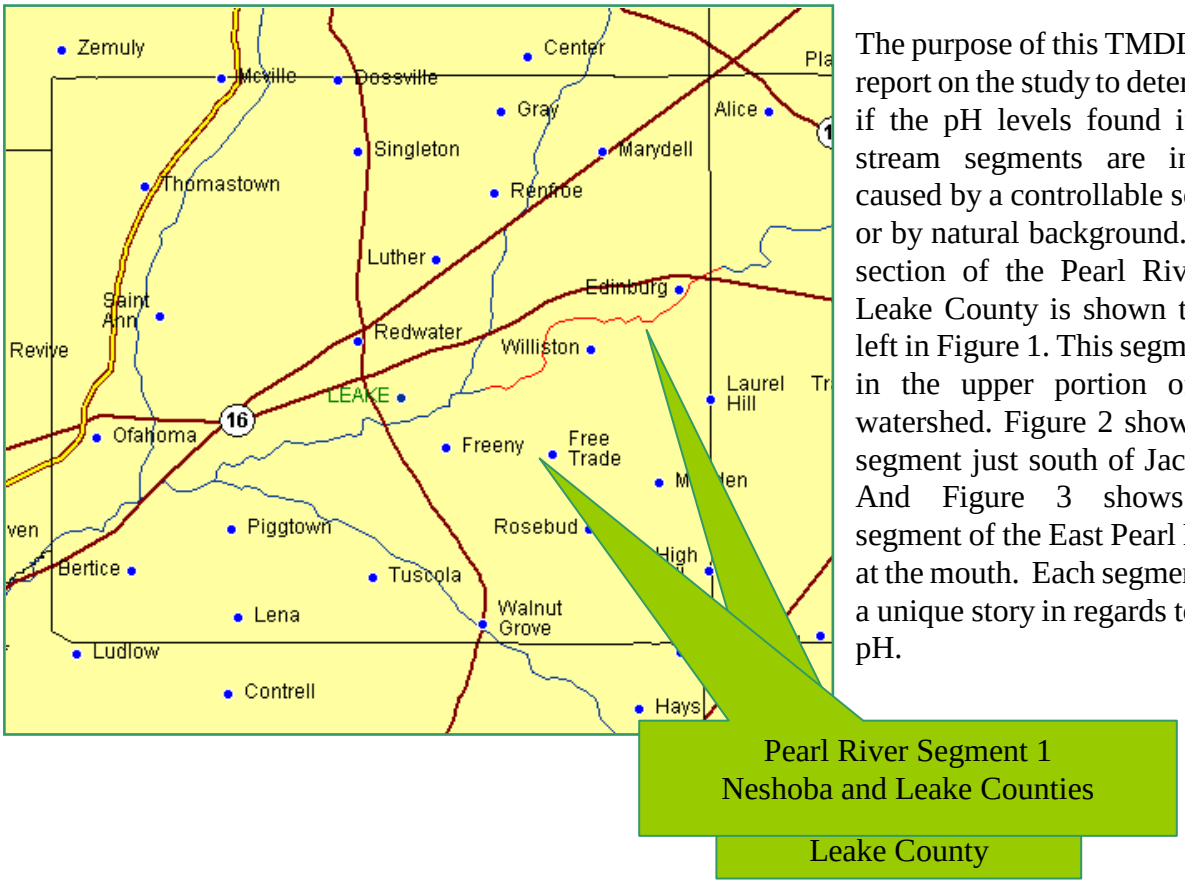
Segment Name	Segment ID	Station ID	Location
Pearl River – Leake	MSUPRLRM1	D02482000	At Edinburg at Hwy 16
Pearl River – Jackson	MSUMPRLR1M2	D02486500	Near Byram at Old Swinging Bridge 0.2 miles east of Old Byram
East Pearl River	MSLPRLRM1	D02492668	At Pearlington at Hwy 90 1.0 miles southwest of Pearlington

INTRODUCTION

1.1 Background

The identification of waterbodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those waterbodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired waterbodies through the establishment of pollutant specific allowable loads. The pollutant of concern for this TMDL is slightly acidic water as indicated by measurements of low pH.

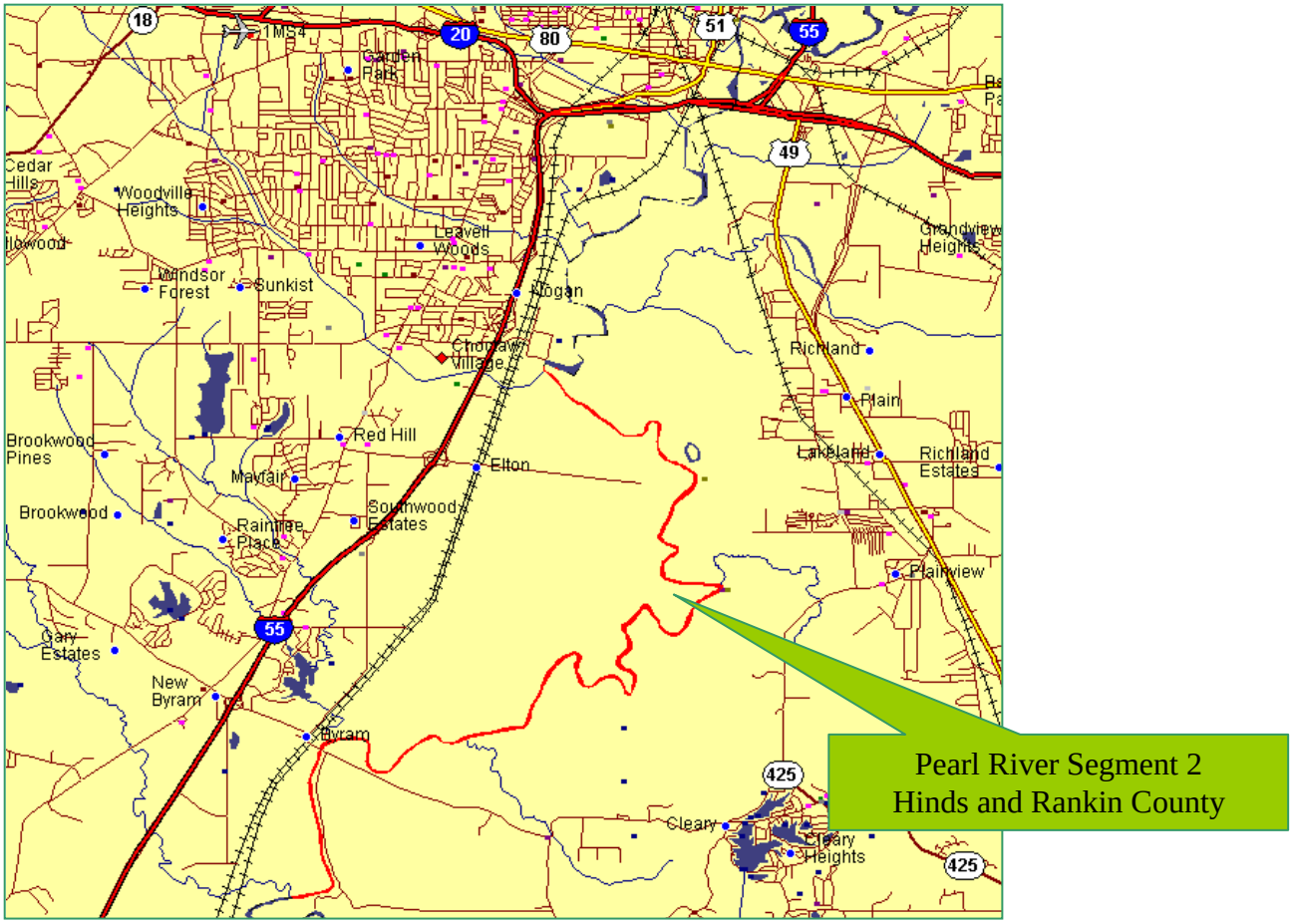
The Mississippi Department of Environmental Quality (MDEQ) has listed three segments of the Pearl River as being impaired due to low pH as reported in the Mississippi 1998 Section 303(d) List of Waterbodies. These are listed in Table 1. These segments were originally listed because monitoring data showed that the pH level was not within the water quality standards' approved range. However, for this indicator, natural background contributions do not necessarily indicate impairment.



The purpose of this TMDL is to report on the study to determine if the pH levels found in the stream segments are indeed caused by a controllable source or by natural background. The section of the Pearl River in Leake County is shown to the left in Figure 1. This segment is in the upper portion of the watershed. Figure 2 shows the segment just south of Jackson. And Figure 3 shows the segment of the East Pearl River at the mouth. Each segment has a unique story in regards to low pH.

The Pearl River rises in east central Mississippi, flows southwesterly to Jackson, then continues southeasterly to the Mississippi Sound. The river is about 490 miles long and drains an area of about 8,000 square miles. More than 60 percent of the basin is forested, and about 30 percent is farmed. Agriculture, silviculture, and industry are the principal land uses. Upstream of Jackson, the Pearl River flows into the Ross Barnett Flood Control Reservoir, which is used extensively for recreation. The river is also used as water supply for the City of Jackson.

Each of these three segments is included in this report, however, each has an individual rational for the violation of the standard reported herein. Care will be taken within the TMDL report to specifically identify each segment and its sources and rational.

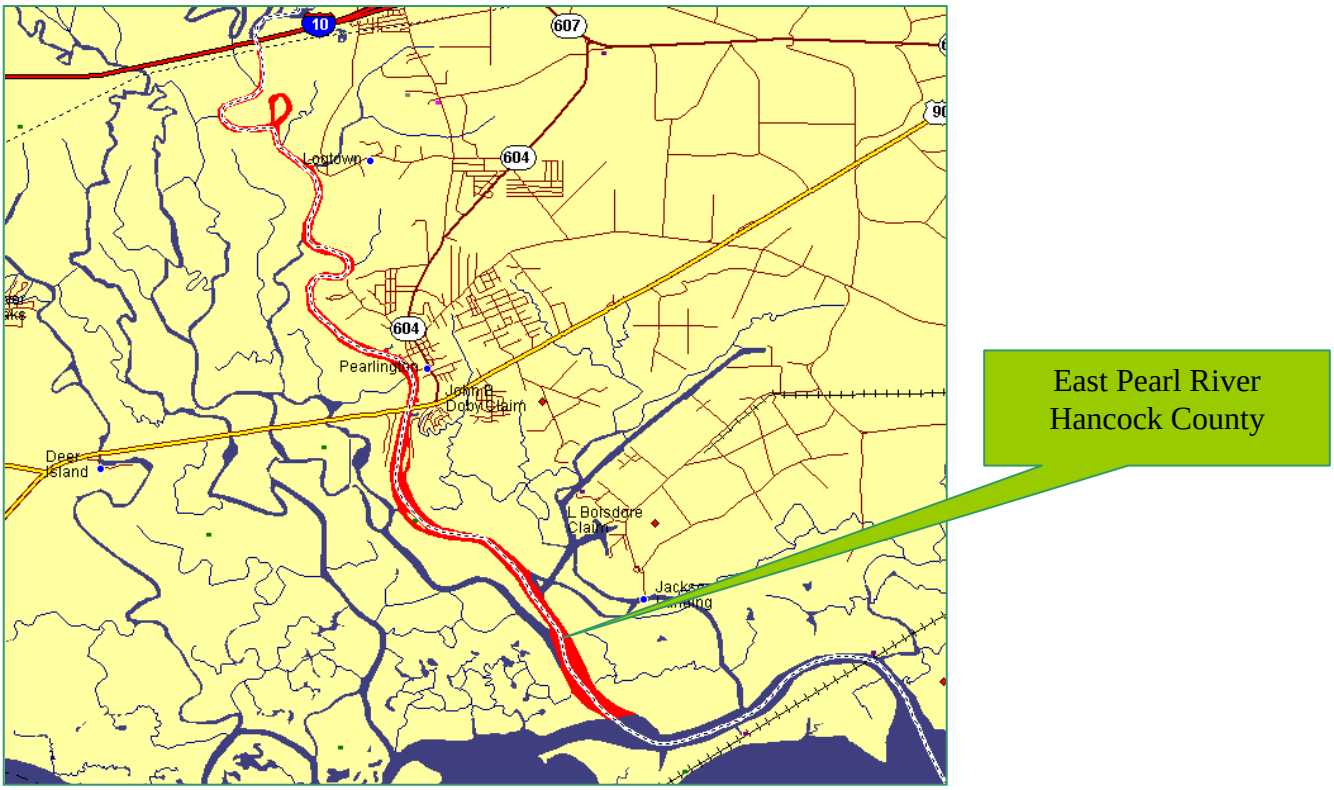


1.2 Applicable Waterbody Segment Use

Designated beneficial uses and water quality standards are established by the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* regulations. The designated use for Pearl River in segment 1 in Leake County as defined by the regulations is Fish and Wildlife. For the Pearl River below the Ross Barnett Reservoir the designated use is Contact Recreation. The Ross Barnett Reservoir has a designated use of drinking water supply for the City of Jackson.

1.3 Applicable Waterbody Segment Standard

The water quality standard applicable to the use of the waterbody and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. The standard states that the normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit. However, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits. And the Commission determines that there will be no detrimental effect on stream usage as a result of the greater pH change. It is our opinion that each of the Pearl River segments should be covered by the 1.0 unit allowable for the natural background exclusion.



1.4 Review of Endangered Species

MDEQ has researched the endangered species listings for this area, comparison to the segments, and the potential for low pH to be an impact and findings. The "ringed map" or "sawback" turtle occurs in the main channel of the Pearl River from its mouth upstream to Neshoba County, Mississippi, and in the Bogue Chitto River from its confluence with the Pearl River upstream to near Franklinton, Louisiana. There are no confirmed collections outside the main stream of these two rivers. The highest population per kilometer is upstream of the Ross Barnett Reservoir where the area of habitat per kilometer of stream length is much larger.

The decline of this turtle is attributed primarily to habitat alteration due to channel modification for flood control, navigation, and impoundment and to water quality degradation from siltation and

pollution. Habitat modification has occurred in 21% of the turtle's range in the Pearl River System. Impoundments eliminate the turtle's habitat by inundation. Channel modification for flood control and navigation may eliminate basking and nesting sites, change water flows, harm the food source, and increase turbidity and siltation. Channel modification of tributary streams may increase turbidity and siltation in the Pearl River as much as or more than if the main channel is modified. Turbidity, siltation, and water quality degradation likely impact the turtle indirectly by adversely affecting the food source of snails and insects. As far as pH is concerned, it is not likely that the turtle is directly sensitive to the minor natural changes in pH. However, the changes in pH in all likelihood may have a negative impact on the food supply of the turtle and would indirectly threaten the turtle's survival.

Careless shooting of basking turtles and collecting pose a threat, especially as the population declines from other factors. Collecting for scientific and educational purposes is declining, but collecting for commercial purposes is a more serious threat. The ringed sawback turtle has been advertised for retail sale at $28 each. Educational brochures describing the different species of turtles and their place in the ecosystem may help reduce the shooting of turtles. Collecting can be, and likely has been, reduced by law enforcement and the threat of penalty.

TMDL ENDPOINT AND WATER QUALITY ASSESSMENT

2.1 Selection of a TMDL Endpoint and Critical Condition

One of the major components of a TMDL is the establishment of instream numeric endpoints, which are used to evaluate the attainment of acceptable water quality. Instream numeric endpoints, therefore, represent the water quality goals that are to be achieved by implementing the load and wasteload reductions specified in the TMDL. The endpoints allow for a comparison between observed instream conditions and conditions that are expected to restore designated uses. The instream target for low pH is that the normal pH of the waters shall be 6.5 to 9.0 and shall not be caused to vary more than 1.0 unit. However, should the natural background pH be outside the 6.5 to 9.0 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.5 to 9.0 limits. The language in our standard is difficult to interpret, however, the 1.0 unit allowance for natural background should apply to each of these segments. If that is the case, there is no longer any impairment for low pH.

Because pH variance may be attributed to both nonpoint and point sources, the critical condition used for studying the stream response was represented by a multi-year period. Critical conditions for waters impaired by nonpoint sources generally occur during periods of wet-weather and high surface runoff. But, critical conditions for point source dominated systems generally occur during low-flow, low-dilution conditions.

2.2 Discussion of Instream Water Quality

Water quality data available for the monitored segment of the Pearl River show that low levels of pH have been found in the stream. There are three ambient stations operated by MDEQ that have pH monitoring data available that show an impairment. The segment in Leake County is appears to be impaired due to natural sources of acidic soils and decaying pine needles. The data indicate a low pH cycle each spring. The first significant spring rains could cause this.

The segment below the Jackson POTW is influenced by the POTW. An upgrade to the facility was required by MDEQ under the terms of an ex-parte order requiring improvements in the operation of the POTW. The City of Jackson has made the necessary upgrades to the POTW. The data indicate that there have been no violations of the pH standard in the stream for the last 4 years. This segment should be delisted from the next Mississippi Section 303(d) List of Waterbodies.

The segment at the mouth is influenced by the black-water swamps in the area. This section may have also been impaired due to the loss of flow from the Pearl River. The river splits into the East and West forks near Walkiah Bluff. A hydrological modification structure has been installed to ensure adequate flow in the East Pearl River to support aquatic life and maintain water quality. A long-term ambient monitoring station has been added to the river to investigate improvements in water quality brought by the increase in the flow.

There is not enough information available to specifically determine the cause of the low pH in the Leake County waterbody segment or in the Hancock County waterbody segment. It is our contention

that the natural processes and soil conditions would lead to the conclusion that this low pH is caused by natural sources. This is further substantiated by the cyclic nature of the data.

2.2.1 Inventory of Available Water Quality Monitoring Data

The State's 1998 Section 305(b) Water Quality Assessment Report was reviewed to assess water quality conditions and data available for the watershed. According to the report, the Pearl River is not supporting the use of Aquatic Life Support for low pH in two segments. The segment near Jackson was partially supporting the use due to low pH. By including more recent data not available when the 1998 305(b) report was completed, the Pearl River segment 2 is now fully supporting. These conclusions were based on instantaneous data collected at the stations listed in Table 2. Data collected at these stations are listed below in Table 3.

Table 2 pH monitoring stations for the Pearl River with violations

Segment Name	Segment ID	Station ID	Location
Pearl River – Leake	MSUPRLRM1	D02482000	At Edinburg at Hwy 16
Pearl River – Jackson	MSUMPRLR1M2	D02486500	Near Byram at Old Swinging Bridge 0.2 miles east of Old Byram
East Pearl River	MSLPRLRM1	D02492668	At Pearlington at Hwy 90 1.0 miles southwest of Pearlington

2.2.2 Analysis of Instream Water Quality Monitoring Data

A statistical summary of the water quality data discussed above is presented in Table 3. The percent exceedance was calculated by dividing the number of exceedances by the total number of samples and does not represent the amount of time that the water quality was in violation. Each of the data sets for the segments is shown in the following tables and charts. In no case was a violation beyond the 1.0 unit mentioned in the standards for acceptance of natural background. The data for Pearl River Segment 2 below the Jackson POTW is within the 10% limit to call the water fully supporting according to the current water quality standards and this water's impairment listing in the 303(d) list should be delisted.

Table 3 pH Data Statistical Summary

Segment Name	pH Data Points	Violations	Percent Violations	Exceeds 1.0 unit natural
Pearl River – Leake	49	11	22.4%	0
Pearl River – Jackson	48	3	6.3%	0
East Pearl River	85	15	17.6%	0

Table 4 pH Data from Edinburg – Pearl River Segment 1, Leake County

Collection Date	Collection Time	Water Temp	Flow, Instant	Maximum Depth	pH	Exceedance
01/10/1994	12:45 PM	7	1290		7.91	
03/07/1994	2:15 PM	16	2800		6.01	X
05/02/1994	11:00 AM	20	234		7.49	
06/20/1994	10:30 AM	27.5	305		6.96	
08/23/1994	9:30 AM	24.8	126		7.35	
11/07/1994	1:15 PM	18	134		7.83	
01/09/1995	10:00 AM	7.8	1680		7.35	
03/08/1995	11:10 AM	11	4790		6.45	X
04/18/1995	10:00 AM	18.6	471		6.96	
07/11/1995	2:30 PM	31	98		7.73	
09/11/1995	9:30 AM	17	16		6.96	
11/07/1995	1:00 PM	17	284		8.69	
01/08/1996	10:30 AM	4	1840		6.9	
03/05/1996	10:35 AM	14	402		6.23	X
05/06/1996	10:00 AM	24	452		6.17	X
07/08/1996	12:45 PM	30	19		6.92	
09/10/1996	2:36 PM	26.7	104		7.5	
12/17/1996	11:05 AM	10.5	910		7.1	
01/14/1997	10:55 AM	3.5	5300		6.7	
02/20/1997	12:55 PM	12.3	4300		6.9	
03/19/1997	1:50 PM	15.7	1830	5	7.2	
04/24/1997	1:15 PM	17.7	292	4	7.1	
05/20/1997	1:05 PM	22.4	156	4	7.1	
06/12/1997	1:05 PM	24	1660	5	6.9	
07/10/1997	12:30 PM	27	357		6.7	
08/07/1997	12:10 PM	26.7	278	4	6.7	
09/10/1997	1:30 PM	25.9	56	2.5	7.3	
10/13/1997	1:15 PM	23		2	8.5	
11/13/1997	1:40 PM	11			7.4	
01/13/1998	1:20 PM	11.3		5	5.9	X
02/17/1998	12:45 PM	11.4		5	6.2	X
03/17/1998	1:20 PM	14.2		5	6.2	X
04/29/1998	2:16 PM	19.4		4	6.4	X
06/15/1998	1:30 PM	29.7		3	6.8	
07/14/1998	1:35 PM	25.9		3.5	6.6	
08/13/1998	1:40 PM	27.9		3	6.8	
09/09/1998	12:20 PM	25.8		2	7.1	
10/19/1998	1:35 PM	21.7		2	7	
11/10/1998	1:50 PM	15.5		3	7	
12/10/1998	12:45 PM	13.8		3.5	7	
01/20/1999	3:00 PM	11.1		4	5.9	X
02/09/1999	1:30 PM	16.8		4	6	X

03/09/1999	3:10 PM	13		5	5.89	X
05/11/1999	2:45 PM	23.0		4	6.9	
06/07/1999	1:36 PM	27.7		4	7	
07/15/1999	15:45	27.2		5	7	
08/04/1999	3:20 PM	29.2		3	7	
09/02/1999	3:50 PM	27.1		2	7.1	
10/05/1999	3:25 PM	20.5		2	7.3	

Table 5 Meta Data for Table 4

Station ID	**02482000**	**Agency 21MSWQ**	
Waterbody	Pearl River	Location At Edinburg At Hwy 16	
Latitude	32.7993	Longitude	-89.3351
County	Leake	State	MS
BasinID	03180001	Basin Name	Pearl River
Waterbody Type	Stream	Salinity	Fresh
Designated Use	Fish & Wildlife	Retrieval Date	04/18/2000

Chart 1 Pearl River pH Data at Edinburg

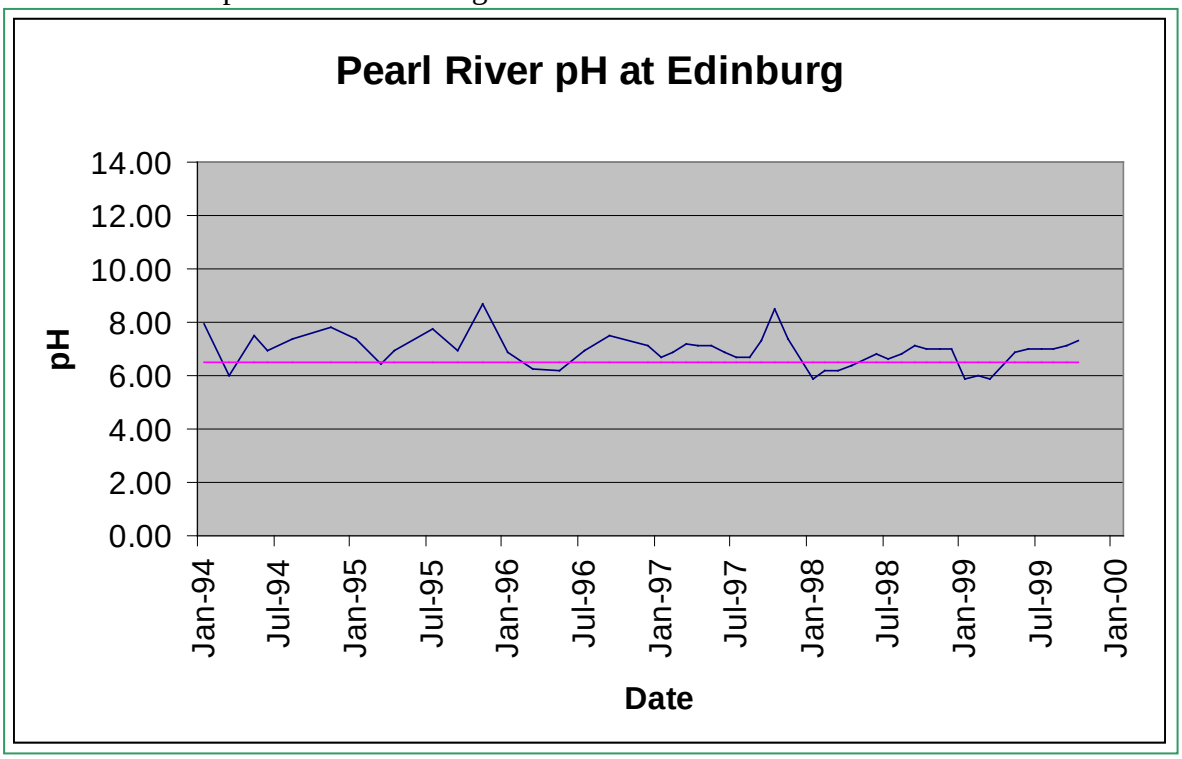


Table 6 pH Data from Pearl River Segment 2 – Hinds / Rankin County below Jackson POTW

Collection Date	Collection Time	Water Temp	Flow, Instant	Maximum Depth	pH	Exceedance
01/10/1994	9:45 AM	6	6000		5.98	X
03/08/1994	7:15 AM	13.9	9090		7.37	
05/02/1994	9:15 AM	20.9	570		6.5	
06/20/1994	10:00 AM	29.5	460		8.26	
08/23/1994	10:40 AM	28	490		8.52	
01/09/1995	10:00 AM	9.5	5000		6.89	
04/18/1995	8:55 AM	22	1200		6.93	
07/10/1995	7:00 AM	16	600		6.54	
09/12/1995	1:55 PM	28	400		8.51	
11/06/1995	3:00 PM	20	430		6.76	
01/11/1996	10:00 AM	8	7040		8.32	
03/04/1996	10:30 AM	19	1060		7.9	
05/14/1996	9:50 AM	24	625		6.65	
07/11/1996	10:00 AM	27	400		6.4	X
09/09/1996	2:10 PM	29.5	400		7.7	
12/11/1996	12:10 PM	14.1	390		7.5	
01/07/1997	12:10 PM	11.9	4900		7.6	
02/11/1997	11:40 AM	8.6	13200		7.3	
03/11/1997	11:40 AM	17.4	11500	5	7.4	
04/17/1997	12:45 PM	18	2100	4	6.8	
05/13/1997	11:15 AM	21.3	450	4	7.3	
06/05/1997	11:20 AM	24.4	11500	5	7.2	
07/02/1997	11:40 AM	28.4	4100	4	6.9	
08/06/1997	11:20 AM	29.8	900	3	7.2	
09/03/1997	11:40 AM	29.4	410	1	7.3	
10/06/1997	12:20 PM	25.8		2.5	7.3	
11/04/1997	12:20 PM	15.6		3.5	7.3	
01/07/1998	11:10 AM	13		5	7	
02/10/1998	10:40 AM	10.4		5	6.5	
03/05/1998	10:30 AM	12.6		5	6.6	
04/14/1998	11:20 AM	19.1		4	6.9	
06/10/1998	11:20 AM	27.7		3.5	7.1	
07/09/1998	11:50 AM	31.8		2	7.2	
08/11/1998	12:00 PM	30.3		3	7.3	
09/02/1998	11:00 AM	29		2	7.4	
10/12/1998	12:15 PM	22.5		2	7.6	
11/03/1998	12:05 PM	20.7		2.5	7.2	
12/03/1998	11:00 AM	17.7		2.5	7.2	
01/13/1999	12:35 PM	7.7		4.5	6.8	
02/04/1999	1:30 PM	14.7		5.0	6.3	X
03/02/1999	3:00 PM	13.6		5.0	6.77	
03/31/1999	2:00 PM	15.5		3.0	6.9	

05/04/1999	2:00 PM	23.6		3.0	7.0	
06/03/1999	1:25 PM	28.7		2.5	7.2	
07/06/1999	2:30 PM	30.7		3.5	7.5	
08/04/1999	1:20 PM	31.1		3.0	7.4	
09/01/1999	1:30 PM	28.6		1.0	7.3	
10/04/1999	1:30 PM	24.3		3.0	7.3	

Table 7 Meta Data for Table 6

Station ID	**02486500**	**Agency 21MSWQ**	
Waterbody	Pearl River	Location Near Byram	
Latitude	32.1766	Longitude	-90.2433
County	Hinds/Rankin	State	MS
BasinID	03180002	Basin Name	Pearl River
Waterbody Type	Stream	Salinity	Fresh
Designated Use	Recreation	Retrieval Date	04/18/2000

Chart 2 Pearl River pH Data at Byram

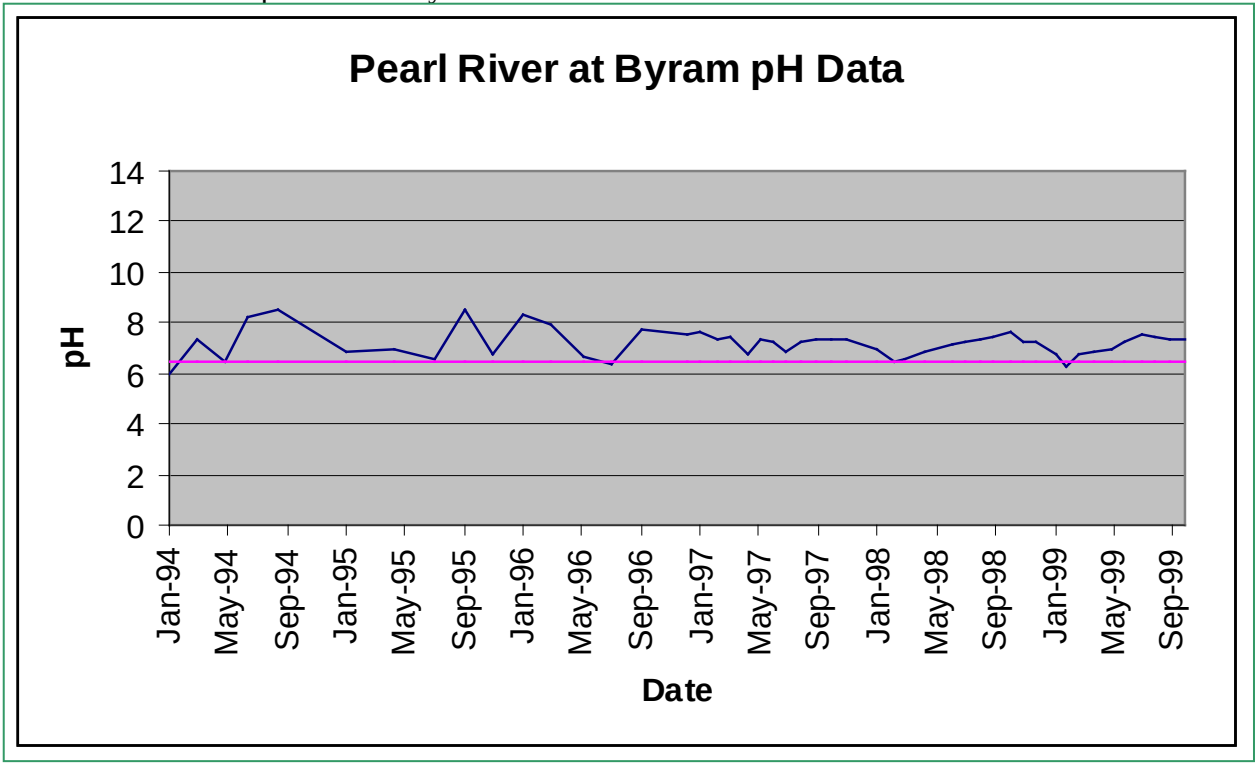


Table 8 pH Data from East Pearl River Hancock County

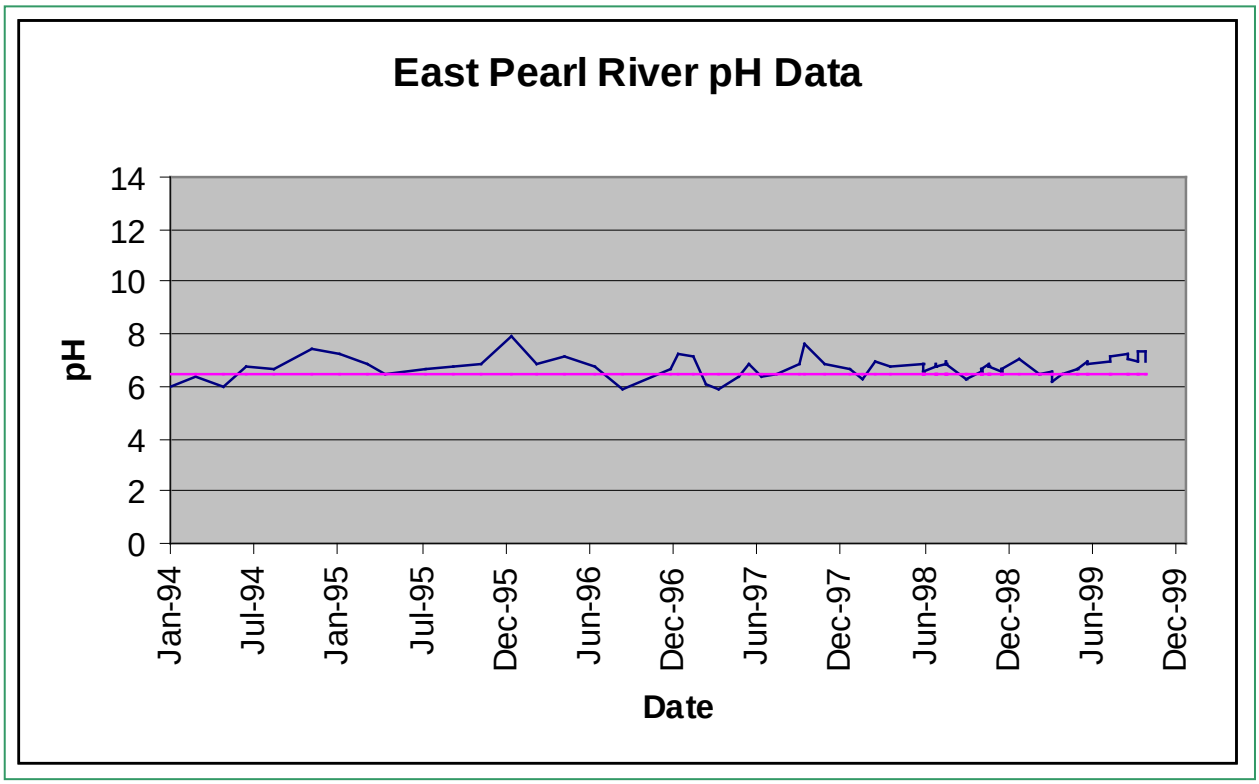
Collection Date	Collection Time	Water Temp	Flow, Instant	Maximum Depth	pH	Exceedance
01/10/1994	11:30 AM	10.5			6	X
03/07/1994	11:55 AM	17			6.4	X
05/04/1994	11:15 AM	23.3			6	X
06/21/1994	11:30 AM	28			6.8	
08/22/1994	11:45 AM	28.5			6.7	
11/08/1994	11:00 AM	23			7.4	
01/10/1995	11:00 AM	15			7.2	
03/07/1995	11:00 AM	14.8			6.9	
04/18/1995	11:20 AM	21			6.5	
07/11/1995	11:00 AM	32			6.7	
09/12/1995	12:25 PM	28			6.8	
11/06/1995	12:15 PM	18			6.9	
01/10/1996	11:00 AM	13			7.9	
03/06/1996	10:25 AM	15.3			6.9	
05/07/1996	10:25 AM	23			7.1	
07/10/1996	10:30 AM	31			6.8	
09/09/1996	11:45 AM	29			5.9	X
12/18/1996	8:35 AM	12.2			6.67	
01/07/1997	11:58 AM	16.2			7.22	
02/04/1997	11:48 AM	14.4			7.16	
03/04/1997	12:07 PM	17			6.04	X
04/02/1997	11:40 AM	18.9			5.91	X
05/12/1997	11:22 AM	20.3			6.33	X
06/05/1997	10:51 AM	23.7			6.82	
07/01/1997	10:58 AM	26.5			6.4	X
08/04/1997	11:25 AM	28.8			6.5	
09/22/1997	11:20 AM	30.2		28	6.83	
10/01/1997	7:28 AM	27.8		27	7.58	
11/17/1997	12:46 PM	14.3		29	6.83	
01/06/1998	8:58 AM	13.3		38	6.67	
02/03/1998	8:37 AM	11.7			6.28	X
03/03/1998	8:45 AM	13.2		12.7	6.98	
04/06/1998	1:18 PM	20.1		7.5	6.74	
06/15/1998	8:58 AM	29.4		5.8	6.83	
06/15/1998	8:59 AM			5.8	6.81	
06/15/1998	9:00 AM			11.6	6.54	
06/15/1998	9:01 AM			17.3	6.57	
06/15/1998	9:02 AM			22.6	6.57	
07/13/1998	8:41 AM	31.1		7.3	6.78	
07/13/1998	8:42 AM			7.3	6.78	
07/13/1998	8:43 AM			14.9	6.8	
07/13/1998	8:44 AM			22.4	6.82	

07/13/1998	8:45 AM			28.7	6.76	
08/03/1998	7:50 AM				6.86	
08/03/1998	7:51 AM			7.7	6.86	
08/03/1998	7:52 AM			15.1	6.9	
08/03/1998	7:53 AM			22.4	6.91	
08/03/1998	7:54 AM			30.9	6.87	
08/03/1998	7:55 AM	30.7		7.7	6.86	
09/17/1998	8:55 AM	26.8		7.8	6.3	X
09/17/1998	8:59 AM	26.8		7.8	6.3	X
10/20/1998	8:44 AM	25		7.7	6.61	
10/20/1998	8:46 AM	24.8			6.56	
10/20/1998	8:47 AM	25		7.7	6.61	
10/20/1998	8:48 AM	25.3		15.6	6.69	
10/20/1998	8:49 AM	25.4		22.6	6.71	
10/20/1998	8:50 AM	25.4		30.3	6.71	
11/02/1998	8:32 AM	23		5.2	6.82	
11/02/1998	8:33 AM	22.9		5.2	6.8	
11/02/1998	8:34 AM			10.5	6.77	
11/02/1998	8:35 AM	22.8		15.5	6.77	
11/02/1998	8:36 AM	22.8		20.9	6.78	
12/01/1998	8:12 AM	20		7.1	6.53	
12/01/1998	8:13 AM	20		7.1	6.53	
12/01/1998	8:14 AM	20.2		14.3	6.64	
12/01/1998	8:15 AM	20.3		21.1	6.65	
12/01/1998	8:16 AM	20.3		28.7	6.68	
01/08/1999	10:20 AM	8.13			7.07	
02/22/1999	10:15 AM	15.36		0	6.44	X
02/22/1999	10:15 AM	15.38		29.6	6.48	X
03/18/1999	1:00 PM	14.11		28.75	6.55	
03/18/1999	1:00 PM	14.10		0	6.21	X
04/07/1999	10:45 AM	20.3		7.1	6.46	X
05/12/1999	10:40 AM	25.17		29.9	6.65	
05/12/1999	10:40 AM	25.69		0	6.62	
06/04/1999	12:05 PM	27.8		31.1	7.0	
06/04/1999	12:05 PM	28.8		0	6.9	
07/22/1999	1:30 PM	29.2		28.1	7.0	
07/22/1999	1:30 PM	28.9		0	7.1	
08/27/1999	10:00 AM	31.67		1.3	7.24	
08/27/1999	10:00 AM	31.48		29.0	7.03	
09/17/1999	9:05 AM	28.91		26.0	6.99	
09/17/1999	9:05 AM	28.93		1.5	7.29	
10/07/1999	8:00 AM	25.32		29.0	7.37	
10/07/1999	8:00 AM	24.84		0	7.00	

Table 9 Meta Data for Table 8

Station ID	02486500	Agency 21MSWQ	
Waterbody	Pearl River	Location At Pearlington At Hwy 90	
Latitude	30.239	Longitude	-89.6146
County	Hancock	State	MS
BasinID	03180004	Basin Name	Pearl River
Waterbody Type	Estuary	Salinity	Sat
Designated Use	Recreation	Retrieval Date	04/18/2000

Chart 3 East Pearl River pH Data



SOURCE ASSESSMENT

It is recognized that many of the sources for low pH in the stream are natural. These sources are considered uncontrollable, and this TMDL does not attempt to address any type of controlling strategy for these sources.

The TMDL evaluation summarized in this report examined all known controllable and uncontrollable pH-altering sources in the Pearl River Watershed. In evaluation of the sources, loads were characterized by the best available information, monitoring data, literature values, and local management activities. This section documents the available information and interpretation for the analysis. The Pearl River was studied as three separate reaches each with specific problems, controllable and uncontrollable.

3.1 Assessment of Point Sources

Point sources have their greatest potential impact on water quality during periods of low-flow. Thus, a careful evaluation of point sources was necessary in order to quantify the degree of impairment present during the low-flow, critical-condition period. Appendix A lists the all of the dischargers in the watershed, along with the NPDES Permit number. The only segment historically impacted for low pH by a point source is the segment near the Jackson POTW.

The segment below the Jackson POTW was influenced by the POTW. An upgrade to the facility was required by MDEQ under the terms of an ex-parte order requiring improvements in the operation of the POTW. The City of Jackson has made the necessary upgrades to the POTW.

All NPDES Permits shown in Appendix A include requirements for pH limits to meet water quality standards. Any future permits will also include this pH requirement.

3.2 Assessment of Nonpoint Sources

There are potential nonpoint sources from storm water runoff that could contribute to an alteration of pH in Pearl River, including:

- Land Application of Chicken Litter
- Acidic Soil
- Pine Needle Decay
- Urban Development
- Assessment of Loss of water flow in the East Pearl River

The 8,000 square mile drainage area of the Pearl River contains many different landuse types, including urban, forests, cropland, pasture, barren, and wetlands. The watershed is very rural in nature however; it contains a large portion of the city of Jackson and several smaller cities. Forest is the dominant landuse within this watershed.

Septic systems have a potential to deliver pH-altering loads (either higher pH or lower pH) to surface waters due to malfunctions, failures, and direct pipe discharges. Household chemicals and waste products could be introduced into the environment by a failing septic system. Properly operating septic systems treat wastewater and dispose of the water through a series of underground field lines. The water is applied through these lines into a rock substrate, thence into underground absorption. The systems can fail when the field lines are broken, or when the underground substrate is clogged or flooded. A failing septic system's discharge can reach the surface, where it becomes available for wash-off into the stream. Another potential problem is a direct bypass from the system to a stream. In an effort to keep the water off the land, pipes are occasionally placed from the septic tank or the field lines directly to the creek, which can be represented as a point source. The nonpoint source contribution from septic tanks is un-quantifiable for pH; however, controlling this source of pollution is a goal of this TMDL.

3.2.1 Land Application of Chicken Litter

In the Pearl River Basin processed manure from chicken houses could be a source of pH alteration in the stream. Poultry litter is a potential contributor of a pH-altering load to streams in the watershed when a rain event washes a portion of it to a receiving waterbody. It is assumed that poultry litter from chicken houses is applied to the available pastureland. While there are some alternative uses of poultry litter, such as utilization as cattle feed, almost all of the litter in the state is currently used for fertilizer.

3.2.2 Acidic Soil

Soil acidity has long been reported as a major fertility problem in the southeastern United States. To combat this problem, farmers typically apply appropriate amounts of lime to counteract the acidity, in order to increase crop production. In 1957, 216,012 tons of lime were used in Mississippi; however, by 1979 800,000 tons of lime were used on agricultural fields in Mississippi (Vanderford, 1975). Still, this was only 40% of the amount of lime necessary to adequately combat the historically acid soils for increased crop production.

A great deal of water infiltrates through the soils of humid regions such as the coastal areas of Mississippi. As water moves through the soils, hydrogen ions combine with carbon dioxide and other compounds to form weak acids, such as carbonic acid. When rainfall events occur, these weak acids will leach the lime from the soils. As this leaching from rain water occurs, calcium and other bases are gradually removed, leaving soils more acidic than before.[1]

3.2.3 Pine Needle Decay

Vast numbers of coniferous trees within the basin also contribute to the acidity of surrounding waterbodies due to the decay of the pine needles. Duffy *et al.* (1989) examined the nutrient flux in a pine forest following simulated rainfall. The pH of their simulated rainfall ranged from 3.94 – 5.18 on four different plots; however, the pH of the ensuing runoff water ranged from 4.34 – 5.0.

1 National Sedimentation Laboratory, Water Quality and Ecological Processes Research Unit, Report on the Causes of acid pH in the Yazoo Basin, Dr. Charles Cooper, 2000.

Assuming you have a rainfall, which itself is slightly acidic, encountering acidic pine needles, which then travels though acidic soils, one can safely deduce the surrounding receiving water will likewise be acidic in nature.[2]

3.2.4 Urban Development

Urban areas include land classified as urban and barren. Even though only a small percentage of the watershed is classified as urban, the contribution of the urban areas to pH alteration in Pearl River was considered. Stormwater runoff contributions from urban areas may come from construction sites, residential subdivisions, and runoff contribution from improper disposal of materials such as household toxic materials. Due to the low percentage of urban area in the watershed, 12.5%, this source of lower pH is considered to be very minor.

3.2.5 Assessment of Loss of water flow in the East Pearl River

A significant concern of MDEQ and the residents of the lower Peal River Basin, Pearl River County, is the loss of flow in the historic channel of the lower Pearl River near Picayune, Mississippi. Since the turn of the century, Wilson Slough has progressively captured an increasing amount of flow from the Pearl River, diverting it to the West Pearl River via the Bogue Chitto River. This loss of flow became critical in August of 1990. For the first time, flow completely ceased around the Walkiah Bluff area causing a major fish and mussel kill. This loss of flow continued through Wilson Slough and was measured at 92% during the summer of 1995. Concurrent with and compounding this loss of flow during periods of low flow is increased sedimentation in the historic channel. This has obstructed the channel, thereby reducing the volume of water past Wilson Slough at all stages. Hydrographic models had projected that, if unchecked, there would be no flow past Wilson Slough during periods of low flow by as early as 1997.

This reduction in flow has caused the loss or degradation of many of the system's unique environmental features and several miles of aquatic habitat. This is of particular concern since much of the area is shallow, sandy or gravel bottom substrate with excellent mussel habitat. As this reduction in flow occurs at higher and higher stages, there is also concern that wetlands along the historic channel are drying. Water-oriented recreation and commercial fishing have been adversely affected or curtailed because of this condition. The boat ramp and water park at Walkiah Bluff are unusable.

MDEQ and the Vicksburg District of the Corps of Engineers (COE) worked cooperatively to evaluate the feasibility of restoring dependable flows during low-flow conditions from Wilson Slough, through Walkiah Bluff to Holmes Bayou. This investigation was conducted under the authority of Section 307D of the Water Resources Development Act of 1990. The Act establishes a demonstration program for determining the feasibility of wetland restoration, enhancement and creation.

2 Ibid.

The feasibility study involved several independent evaluations, including Hydraulics and Hydrology, Water Quality, Fisheries, Mussels, Terrestrial, Wetlands, Endangered Species, HTRW (hazardous, toxic or radiological waste) and Cultural Resource Evaluations.

Since the Pearl River is the boundary between the States of Mississippi and Louisiana, and borders a National Wildlife Refuge, an unprecedented amount of cooperation between a number of State, Federal and local entities was required. A steering committee has been established with representatives from MDEQ, LDEQ, MS DWF&P, LA Game & Fish & Wildlife, MS Wildlife Federation, LA Wildlife Federation and local sportsmen's clubs from both states. This Committee will investigate and recommended mutually beneficial solution to the problems identified in the area.

Plans were developed which called for a flow restricting structure to be constructed at the head of what is referred to as Wilson Slough (it is actually an old bendway of the Pearl River) and closures to be constructed in four other breakouts or distributaries between Wilson Slough and Walkiah Bluff.[3]

Walkiah Bluff Diversion Structure

Plans for the project were designed by a local engineering firm under contract to the Corps. Construction began in late June 1998 and the final inspection was held on November 19, 1998. It is anticipated that it will require two to four years for the original channel to redevelop.

Shortly after final inspection, rock slippage was observed downstream of the structure. In January 1999 the contractor was directed to investigate the causes and develop corrective action. An ambient monitoring site in this area will be added to the fixed station network to document the anticipated recovery in the area.

3 MDEQ. Mississippi 1998 Water Quality Assessment, Federal Clean Water Act Section 305(b) Report. p. 235-236.

LINKING THE SOURCES TO THE ENDPOINT

Establishing the relationship between the instream water quality target and the source loading is a critical component of TMDL development. It allows for the evaluation of management options that will achieve the desired source load reductions. The link can be established though a range of techniques, from qualitative assumptions based on sound scientific principles to sophisticated modeling techniques. Ideally, the linkage will be supported by monitoring data that allow the TMDL developer to associate certain waterbody responses to flow and loading conditions.

4.1 Source Representation

Both point and nonpoint sources were represented in this study. There were many NPDES Permitted facilities in the Pearl River Watershed. These are shown in Appendix A.

4.1.1 Land Application of Chicken Litter

The contribution due to land application of poultry litter was considered in the Pearl River Watershed nonpoint source assessment. Variable monthly loading rates of litter are applied to pastureland. This litter then becomes available for surface water runoff during storm events. This could be a controllable source of pH alteration in the watershed.

4.1.2 Acidic Soil

A great deal of water infiltrates through the soils of humid regions. As water moves through the soils, hydrogen ions combine with carbon dioxide and other compounds to form weak acids, such as carbonic acid. When rainfall events occur, these weak acids will leach the lime from the soils. As this leaching from rain water occurs, calcium and other bases are gradually removed, leaving soils more acidic than before. These sources are considered uncontrollable and are not accounted for in this TMDL.

4.1.3 Pine Needle Decay

Vast numbers of coniferous trees within the basin also contribute to the acidity of surrounding waterbodies due to the decay of the pine needles. Assuming you have a rainfall, which itself is slightly acidic, encountering acidic pine needles, which then travels though acidic soils, one can safely deduce the surrounding receiving water will likewise be acidic in nature. These sources are considered uncontrollable and are not accounted for in this TMDL.

4.1.4 Urban Development

The Pearl River watershed contains many urban areas. However, overall the area remains sparsely populated. The watershed can be considered rural and urban. The pH-altering sources are controllable; however, there is only a very limited amount of urban area in the watershed.

ALLOCATION

The allocation for this TMDL involves a wasteload permit limits for NPDES point sources necessary for attainment of water quality standards in the Pearl River. Point source contributions enter the stream directly. Nonpoint sources contributions occur as a result of rainfall events. This TMDL will only consider allocations for controllable sources of low pH.

5.1 Wasteload Allocations

The contribution of point sources was considered on a watershed basis. Effluent pH levels from each point source that impacts the 303(d)-listed segments of the Pearl River (see Appendix A) shall be 6.5 to 9.0 standard units and shall not cause the pH in the receiving waters to vary more than 1.0 standard unit. Regarding implementation of these allocations to the NPDES permits, MDEQ will use its Reasonable Potential Procedures to determine appropriate monitoring requirements and/or limitations.

5.2 Load Allocations

For each of the 303(d)-listed segments of the Pearl River, the pH of waters originating from nonpoint sources shall be 6.5 to 9.0 standard units and shall not cause the receiving waters to vary more than 1.0 standard unit. Nonpoint loading due to acidic soil, pine needle decay, and urban development are included in the load allocation. This TMDL has been completed for the acidic property of the water. pH is an indicator of the acidic or alkalinity properties of water. It is not a classic pollutant. Control of the pH range can be achieved by dilution or by source load manipulation.

One step that should be encouraged by this TMDL is the reduction of failing septic tanks in the watershed. This reduction in septic tank failures will lead to a reduction in the overall pollution reaching the Pearl River. This might be achieved by supporting BMP projects that promote education projects that encourage homeowners to properly maintain their septic tanks by routinely pumping them out, ensuring that improper chemicals are not disposed of in the septic tank, repairing broken field lines, and properly maintaining the effluent from individual onsite wastewater treatment plants.

5.3 Incorporation of a Margin of Safety

The margin of safety shall account for the lack of knowledge concerning the relationship between pollutant loads and the quality of the receiving waterbody. The wasteload allocation and load allocation suggested in sections 5.1 and 5.2 of this report establish that effluent from all point sources and waters originating from all nonpoint sources must individually meet the water quality standards for pH. As long as pH levels from point sources and nonpoint sources are consistent with the specified wasteload allocation and load allocation, the pH in each of the 303(d)-listed segments of the Pearl River will be consistent with water quality standards. Therefore, a margin of safety for these pH TMDLs has been considered but was determined to be unnecessary, because there is no lack of knowledge concerning the relationship between the allocations to pollutant loads and the resulting quality of the receiving waters.

5.4 Seasonality

The charts of the data indicates a definite cyclic trend to pH in the stream. The theory is that the coniferous trees shed their needles, which decay and with springtime stormwater runoff alter the pH in the stream. This uncontrollable natural cyclic process will not be address by this TMDL. Seasonality is classically thought of as differing approaches to the pollutant based on variations in temperature or in rainfall. Seasonality for this within this TMDL is not based on changes between the seasons, temperature fluctuations, or rainfall events. By looking at several years worth of data, a cycle or trend is established that shows lower pH in the springtime. This corresponds to early rainfall events in the spring bringing the first acidic load from decaying coniferous trees. It is our contention that this is a natural event and is uncontrollable.

CONCLUSION

The reduction scenario used in this TMDL included requiring all NPDES Permitted dischargers to meet water quality standards for pH. Also another goal of the TMDL is reducing the pollution load from failing septic tanks in the watershed. Appendix A lists the dischargers in this watershed, along with the NPDES Permit number.

The TMDL will not impact existing or future NPDES Permits as long as the effluent meets water quality standards for pH. MDEQ will not approve any NPDES Permit application that does not plan to meet water quality standards for pH. CWA Section 319 Nonpoint Source (NPS) Grants may fund these projects. MDEQ produced guidance for future Section 319 project funding will encourage NPS restoration projects that attempt to address TMDL related issues within Section 303(d)/TMDL watersheds in Mississippi.

This TMDL is for low pH. This is an indicator of water quality and is not in and of itself a pollutant. Manipulation of the pH value in the context of a TMDL calculation is meaningless. However, the effort to reduce controllable sources of lower pH producing pollution in the stream wherever possible is meaningful. That controllable source reduction is the goal for this TMDL.

6.1 Future Monitoring

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Pearl River Basin, the Pearl River will receive additional monitoring to identify any change in water quality. These identified monitoring stations are currently included with our ambient monitoring network and monitoring will continue at these sites. Additionally, by completion of this TMDL, NPS projects proposed for this watershed that address pH will receive priority consideration for future Section 319 funding.

6.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper and a newspaper in Gulfport. The public will be given an opportunity to review the TMDL and submit comments. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public hearing.

If a public hearing is deemed appropriate, the public will be given a 30-day notice of the hearing to be held at a location near the watershed. That public hearing would be an official hearing of the Mississippi Commission on Environmental Quality, and would be transcribed. All comments received during the public notice period and at any public hearings become a part of the record of this TMDL. All comments will be considered in the ultimate approval of this TMDL and for submission of this TMDL to EPA Region IV for final approval.

DEFINITIONS

Ambient stations: a network of fixed monitoring stations established for systematic water quality sampling at regular intervals, and for uniform parametric coverage over a long-term period.

Assimilative capacity: the capacity of a body of water or soil-plant system to receive wastewater effluents or sludge without violating the provisions of the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters and Water Quality regulations.

Background: the condition of waters in the absence of man-induced alterations based on the best scientific information available to MDEQ. The establishment of natural background for an altered waterbody may be based upon a similar, unaltered or least impaired, waterbody or on historical pre-alteration data.

Calibrated model: a model in which reaction rates and inputs are significantly based on actual measurements using data from surveys on the receiving waterbody.

Coniferous: an order (Coniferales) of mostly evergreen trees and shrubs including forms (as pines) with true cones and other (as yews) with an arillate fruit.

Controllable Sources: Sources of pollutants that can be modified or controlled with regulatory requirements and/or best management practices.

Critical Condition: hydrologic and atmospheric conditions in which the pollutants causing impairment of a waterbody have their greatest potential for adverse effects.

Daily discharge: the "discharge of a pollutant" measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily average" is calculated as the average.

Designated Use: use specified in water quality standards for each waterbody or segment regardless of actual attainment.

Discharge monitoring report: report of effluent characteristics submitted by a NPDES Permitted facility.

Effluent standards and limitations: all State or Federal effluent standards and limitations on quantities, rates, and concentrations of chemical, physical, biological, and other constituents to which a waste or wastewater discharge may be subject under the Federal Act or the State law. This includes, but is not limited to, effluent limitations, standards of performance, toxic effluent standards and prohibitions, pretreatment standards, and schedules of compliance.

Effluent: treated wastewater flowing out of the treatment facilities.

Geometric mean: the *n*th root of the product of *n* numbers. A 30-day geometric mean is the 30th root of the product of 30 numbers.

Impaired Waterbody: any waterbody that does not attain water quality standards due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment.

Land Surface Runoff: water that flows into the receiving stream after application by rainfall or irrigation. It is a transport method for nonpoint source pollution from the land surface to the receiving stream.

Load allocation (LA): the portion of a receiving water's loading capacity attributed to or assigned to nonpoint sources (NPS) or background sources of a pollutant.

Loading: the total amount of pollutants entering a stream from one or multiple sources.

Nonpoint Source: pollution that is in runoff from the land. Rainfall, snowmelt, and other water that does not evaporate become surface runoff and either drains into surface waters or soaks into the soil and finds its way into groundwater. This surface water may contain pollutants that come from land use activities such as agriculture; construction; silviculture; surface mining; disposal of wastewater; hydrologic modifications; and urban development.

NPDES permit: an individual or general permit issued by the Mississippi Environmental Quality Permit Board pursuant to regulations adopted by the Mississippi Commission on Environmental Quality under Mississippi Code Annotated (as amended) §§ 49-17-17 and 49-17-29 for discharges into State waters.

pH: a measure of acidity and alkalinity of a solution that is a number on a scale on which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher number increasing alkalinity and on which each unit of change represents a tenfold change in acidity or alkalinity and that is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution.

Point Source: pollution loads discharged at a specific location from pipes, outfalls, and conveyance channels from either wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream.

Pollution: contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the State, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance, or leak into any waters of the State, unless in compliance with a valid permit issued by the Permit Board.

Publicly Owned Treatment Works (POTW): a waste treatment facility owned and/or operated by a public body or a privately owned treatment works which accepts discharges which would otherwise be subject to Federal Pretreatment Requirements.

Scientific Notation (Exponential Notation): mathematical method in which very large numbers or very small numbers are expressed in a more concise form. The notation is based on powers of ten. Numbers in scientific notation are expressed as the following: *4.16 x 10^(+b)* and *4.16 x 10^(-b) [same as 4.16E4 or4.16E-4]*. In this case, *b* is always a positive, real number. The *10^(+b)* tells us that the decimal point is *b* places to the right of where it is shown. The *10^(-b)* tells us that the decimal point is *b* places to the left of where it is shown.
For example: $2.7X10^{4} = 2.7E+4 = 27000$ and $2.7X10^{-4} = 2.7E-4 = 0.00027$.

Sigma (Σ): shorthand way to express taking the sum of a series of numbers. For example, the sum or total of three amounts 24, 123, 16, ($\mathbf{d}_1$, $\mathbf{d}_2$, $\mathbf{d}_3$) respectively could be shown as:

$$\sum_{i=1}^{3} d_i = d_1+d_2+d_3 = 24 + 123 + 16 = 163$$

Total Maximum Daily Load or TMDL: the calculated maximum permissible pollutant loading to a waterbody at which water quality standards can be maintained.

Regression Coefficient: an expression of the functional relationship between two correlated variables that is often empirically determined from data, and is used to predict values of one variable when given values of the other variable.

Waste: sewage, industrial wastes, oil field wastes, and all other liquid, gaseous, solid, radioactive, or other substances which may pollute or tend to pollute any waters of the State.

Wasteload allocation (WLA): the portion of a receiving water's loading capacity attributed to or assigned to point sources of a pollutant.

Water Quality Standards: the criteria and requirements set forth in *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. Water quality standards are standards composed of designated present and future most beneficial uses (classification of waters), the numerical and narrative criteria applied to the specific water uses or classification, and the Mississippi antidegradation policy.

Water quality criteria: elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports the present and future most beneficial uses.

Waters of the State: all waters within the jurisdiction of this State, including all streams, lakes, ponds, wetlands, impounding reservoirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, situated wholly or partly within or bordering upon the State, and such coastal waters as are within the jurisdiction of the State, except lakes, ponds, or other surface waters which are wholly landlocked and privately owned, and which are not regulated under the Federal Clean Water Act (33 U.S.C.1251 et seq.).

ABBREVIATIONS

7Q10.....Seven-Day Average Low Stream Flow with a Ten-Year Occurrence Period

BASINS ..... Better Assessment Science Integrating Point and Nonpoint Sources

BMP .....Best Management Practice

CWA .....Clean Water Act

DMR ..... Discharge Monitoring Report

EPA.....Environmental Protection Agency

GIS ..... Geographic Information System

HUC .....Hydrologic Unit Code

LA .....Load Allocation

MARIS..... State of Mississippi Automated Information System

MDEQ..... Mississippi Department of Environmental Quality

MOS..... Margin of Safety

NRCS .....National Resource Conservation Service

NPDES..... National Pollution Discharge Elimination System

NPSM.....Nonpoint Source Model

RF3..... Reach File 3

USGS ..... United States Geological Survey

WLA .....Waste Load Allocation

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Appendix A

The following table lists the NPDES Permits currently in the EPA Permit Compliance System (PCS). These permits and limits contained herein are for permitted facilities in the Pearl River Basin.