FINAL REPORT
December 1999
ID: 699121503

Fecal Coliform TMDL
For
The Tangipahoa River
Southern Independent Streams Basin
Pike & Amite Counties,
Mississippi

December 15, 1999

Prepared By

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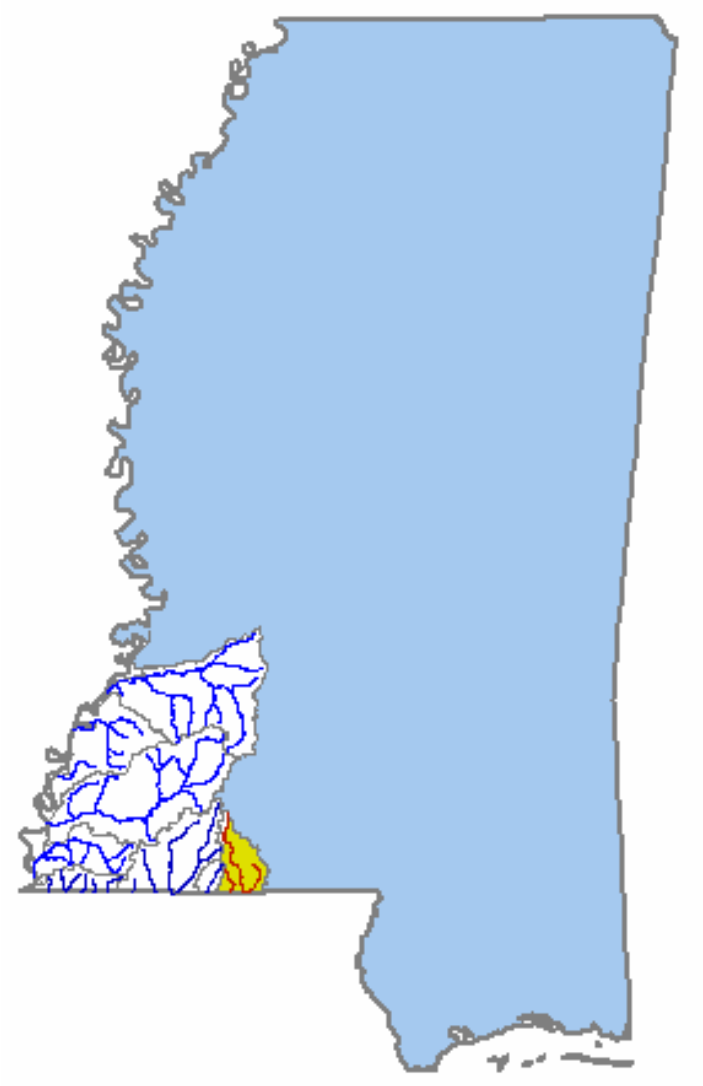


FOREWORD

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. 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. However, the report may also include evaluated segments with insufficient data to indicate impairment. The evaluated waterbody segments in this report were included because they are hydrologically linked to the monitored segment. 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.

CONTENTS

MONITORED SEGMENT IDENTIFICATION

Name:	Tangipahoa River, segment 6
Waterbody ID:	MS481M6
Location:	Near Chatawa: from confluence with Little Tangipahoa River to State Line
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	9 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	113
NPDES Permits:	There are 13 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed (Table 5).
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	1.46E+12 counts per 30 days (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	1.61E+12 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	3.07E+12 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Bala Chitto Creek
Waterbody ID:	MS481M7
Location:	At Osyka: from Emerald to State Line
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	9 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are no NPDES Permits issued for facilities that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	6.05E+11 counts per 30 days (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	6.88E+11 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	12.93E+11 counts per 30 day The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Terrys Creek – Drainage Area
Waterbody ID:	MS482
Location:	Near Osyka: from Community of Terrys Creek to State Line
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	020
Length:	6 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are no NPDES Permits issued for facilities that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	1.95E+11 counts per 30 days (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	2.29E+11 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	4.25E+11 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Little Tangipahoa River, segment 4
Waterbody ID:	MS481M4
Location:	Near Fernwood: from McComb SW Facility (MS0025518) to confluence with Town Creek
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	2 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are 6 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed (included in monitored segment).
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	10.4E+11 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	2.23E+11 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	12.6E+11 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Little Tangipahoa River, segment 5
Waterbody ID:	MS481M5
Location:	Little Tangipahoa River Fernwood to Magnolia: from confluence of Town Creek above Fernwood to Confluence of Tangipahoa River
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	9 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are 6 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	8.61E+11 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	5.19E+11 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	13.8E+11 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Minnehaha Creek – Drainage Area
Waterbody ID:	MS481M1
Location:	Drainage area at Magnolia from just upstream of Magnolia urban area to mouth at Little Tangipahoa River
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	2 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There is 1 NPDES Permit issued for a facility that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	7.29E+10 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	8.01E+10 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	15.3E+10 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Tangipahoa River, segment 2
Waterbody ID:	MS481M2
Location:	Near McComb: from confluence of Devine Creek to Lake Tangipahoa
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	8 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are 4 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	2.24E+11 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	2.58E+11 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	4.82E+11 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Tangipahoa River, segment 3
Waterbody ID:	MS481M3
Location:	From Lake Tangipahoa to confluence of Little Tangipahoa
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	9 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are 4 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	1.15E+12 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	1.32E+12 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	2.47E+12 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Tangipahoa River – Drainage Area
Waterbody ID:	MS481E
Location:	Drainage Area near Osyka
County:	Pike and Amite Counties, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	120 miles – estimated and reported in Mississippi 1996 Section 303(d) List of Impaired Waterbodies
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There are 13 NPDES Permits issued for facilities that may discharge fecal coliform in the watershed (Table 5).
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	1.46E+12 counts per 30 days (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	1.61E+12 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	3.07E+12 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EVALUATED SEGMENT IDENTIFICATION

Name:	Town Creek
Waterbody ID:	MS481M8
Location:	Near Fernwood: From McComb urban limits to mouth at Little Tangipahoa River
County:	Pike County, Mississippi
USGS HUC Code:	08070205
NRCS Watershed:	010
Length:	4 miles
Use Impairment:	Secondary Contact Recreation
Cause Noted:	Fecal Coliform, an indicator for the presence of pathogenic organisms
Priority Rank:	Low
NPDES Permits:	There is 1 NPDES Permit issued for a facility that may discharge fecal coliform in the watershed.
Pollutant Standard:	For the summer months, fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml.
Waste Load Allocation:	71.4E+10 (The TMDL requires all dischargers to meet water quality standards for disinfection.)
Load Allocation:	9.70E+10 counts per 30 days
Margin of Safety:	Implicit in conservative modeling assumptions.
Total Maximum Daily Load (TMDL):	81.1E+10 counts per 30 days The TMDL is a combination of the direct input of fecal coliform from NPDES Permitted dischargers and nonpoint sources due to cows with access to streams, failing septic tanks, and land surface fecal coliform application rates allocated as necessary to meet the fecal coliform standard.

EXECUTIVE SUMMARY

A segment of the Tangipahoa River has been placed on the Mississippi 1998 Section 303(d) List of Waterbodies as an impaired waterbody segment, due to fecal coliform bacteria. Other segments and drainage areas within the Tangipahoa River Watershed have been placed on the list as evaluated waterbodies, due to fecal coliform bacteria, and are also included in this TMDL. The evaluated segments were listed for either Contact Recreation or Secondary Contact Recreation. For these waterbody segments, the applicable state standard specifies that for the summer months, the maximum allowable level of fecal coliform shall not exceed a geometric mean of 200 colony counts per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml. For the winter months, the maximum allowable level of fecal coliform shall not exceed a geometric mean of 2000 colony counts per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 4000 per 100 ml. The difference in the use designations between contact and secondary contact is that the winter limits are not relaxed for contact recreation use.

The Tangipahoa River Watershed is composed of the main branch of the river with several minor tributaries and three main tributaries located in Mississippi. Bala Chitto Creek and Terrys Creek begin in Mississippi and flow into the Tangipahoa River in Louisiana. The Little Tangipahoa River with its tributaries named Town Creek and Minnehaha Creek flow into the Tangipahoa River near Fernwood. This watershed is located in southwest Mississippi in Pike and Amite Counties, and flows south into Louisiana and eventually into Lake Pontchartrain.

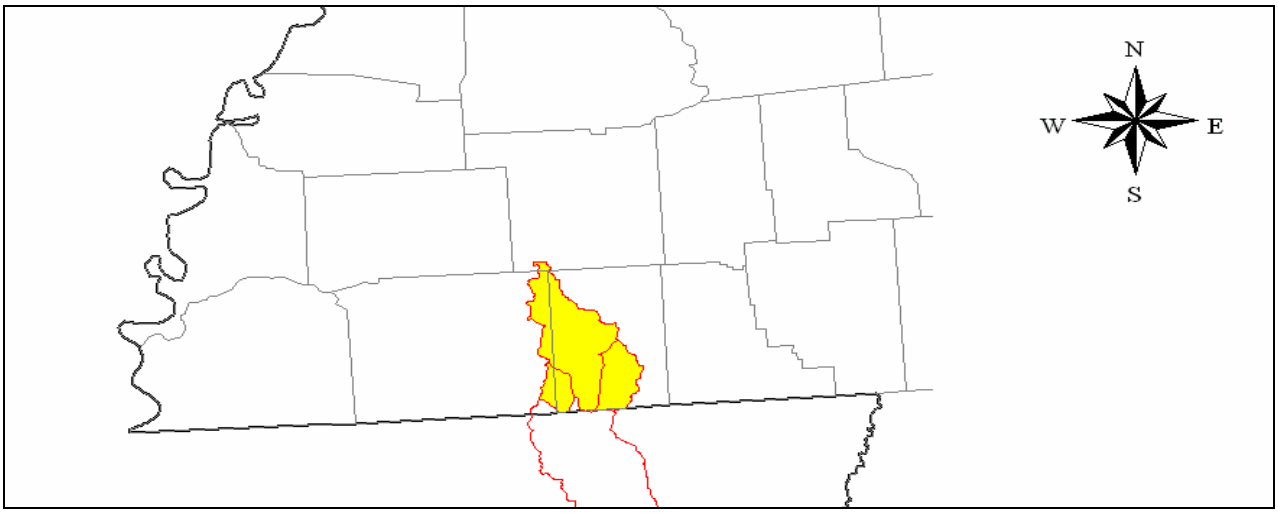
This TMDL Report has been developed for all of the waterbodies and drainage areas within the Tangipahoa River Watershed found on the 303(d) List. The nine-mile long impaired section of the river is in Pike County just north of the State Line. The other waterbodies and drainage areas are shown in Figure 1. The BASINS Nonpoint Source Model (NPSM) was selected as the modeling framework for performing the TMDL allocations for this study. The weather data used for this model were collected at Ruth, MS. The representative hydrologic period used for this TMDL was January 1, 1985, through December 31, 1995.

Fecal coliform loading from nonpoint sources in the watershed were calculated based upon wildlife populations; numbers of cattle, hogs, and chickens; information on livestock and manure management practices for the Southern Independent Rivers Basin; and urban development. The estimated fecal coliform production and accumulation rates due to nonpoint sources for the watershed were incorporated into the model. Also represented in the model were the nonpoint sources such as failing septic systems and cattle that have direct access to tributaries of the Tangipahoa River. There are 13 NPDES Permitted discharges located in the watershed that are known to contribute fecal coliform bacteria to the waterbody. Under existing conditions, output from the model indicates violation of the fecal coliform standard in the stream. After applying a load reduction scenario, there were no violations of the standard in the impaired segment according to the model for the same time period.

The scenario used to reduce the fecal coliform load involves a cooperative effort between all fecal coliform contributors in the Tangipahoa River Watershed. First, all NPDES facilities will be required to disinfect their discharge so that the fecal coliform concentrations do not exceed water quality standards. Monitoring of all permitted facilities in the Tangipahoa River Watershed should be continued to ensure that compliance with permit limits is consistently attained. Second, is the removal of 95% of the cattle=s direct access to tributaries. This could be accomplished by fencing streams in cattle pastures. Education on best management practices is a vital part of achieving this goal. A 50% reduction in the fecal coliform contribution from failing septic tanks is indicated. A 20% failure rate of septic tanks was modeled in the drainage area. A reduction could be accomplished by education on best management practices for septic tank owners. Additionally, users of individual onsite wastewater treatment plants could be educated on the importance of disinfection of the effluent from their treatment plant. Finally, a recent project to improve cattle lagoons and waste management in this watershed has achieved a documented 27% reduction in pollutant loading from the pastureland in this watershed. This TMDL incorporates this recently achieved reduction in this reduction scenario.

The models developed for this TMDL were not contiguous because of the state line. The tributaries join the main stem of the river in Louisiana. To ease development of the reduction scenario, this project was developed with the State Line in consideration. Figure ES 1 shows the main Tangipahoa Watershed and the two main tributary watersheds. Therefore, three separate models were created and reported on individually.

Figure ES 1. Basin Area Locator Map



The Tangipahoa River Watershed models accounted for seasonal variations in hydrology, climatic conditions, and watershed activities. The use of the continuous simulation model allowed for consideration of the seasonal aspects of rainfall and temperature patterns within the watershed. Calculation of the fecal coliform accumulation parameters and source contributions on a monthly basis accounted for seasonal variations in watershed activities such as livestock grazing and land application of manure.

1.0 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). This TMDL is being developed under the regulations in place in October 1999. 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 fecal coliform. Fecal coliform bacteria are used as indicator organisms. They are readily identifiable and indicate the possible presence of other pathogenic organisms in the waterbody. The TMDL process can be used to establish water quality based controls to reduce pollution from both point and nonpoint sources, and restore and maintain the quality of water resources.

The Mississippi Department of Environmental Quality (MDEQ) has identified a segment of the Tangipahoa River as being impaired by fecal coliform bacteria for a length of nine miles as reported in the Mississippi 1998 Section 303(d) List of Waterbodies. This segment is listed as impaired because monitoring data is available to show that there is impairment in this segment. The impaired segment begins at the confluence with Little Tangipahoa River and ends at the State Line. MDEQ has identified other waterbody segments and drainage areas in the Tangipahoa River Watershed as having potential for the presence of fecal coliform bacteria through evaluation. These are shown in Figure 1, a map of the watershed, and are also listed in Table 1.

In order to analyze the sources of fecal coliform bacteria in the Tangipahoa River Watershed, the entire drainage area was divided into ten separate subwatersheds. The subwatersheds are identified by the stream name or segment number designation for this report. The monitored segment is the most downstream waterbody segment. The remainder of the segments are evaluated waterbody segments. Because most of the evaluated segments flow into the monitored segment, the load and waste load allocations submitted in this TMDL are based on water quality in the monitored segment. The allocations for Terrys Creek and Bala Chitto Creek, which come into the drainage area below the state line, are based on these individual segments.

The drainage area of the watershed area is approximately 250 square miles; and lies within portions of Pike and Amite Counties. The watershed is primarily rural but includes the City of McComb and the smaller towns of Magnolia, Fernwood, and Osyka.

Figure 1 shows the monitored segment of the Tangipahoa in red. Terrys Creek drainage area is pink and the Bala Chitto drainage area is light green. All of the other subwatersheds flow into the monitored segment of the Tangipahoa River. The drainage area for all three sections begins at the headwaters in Mississippi.

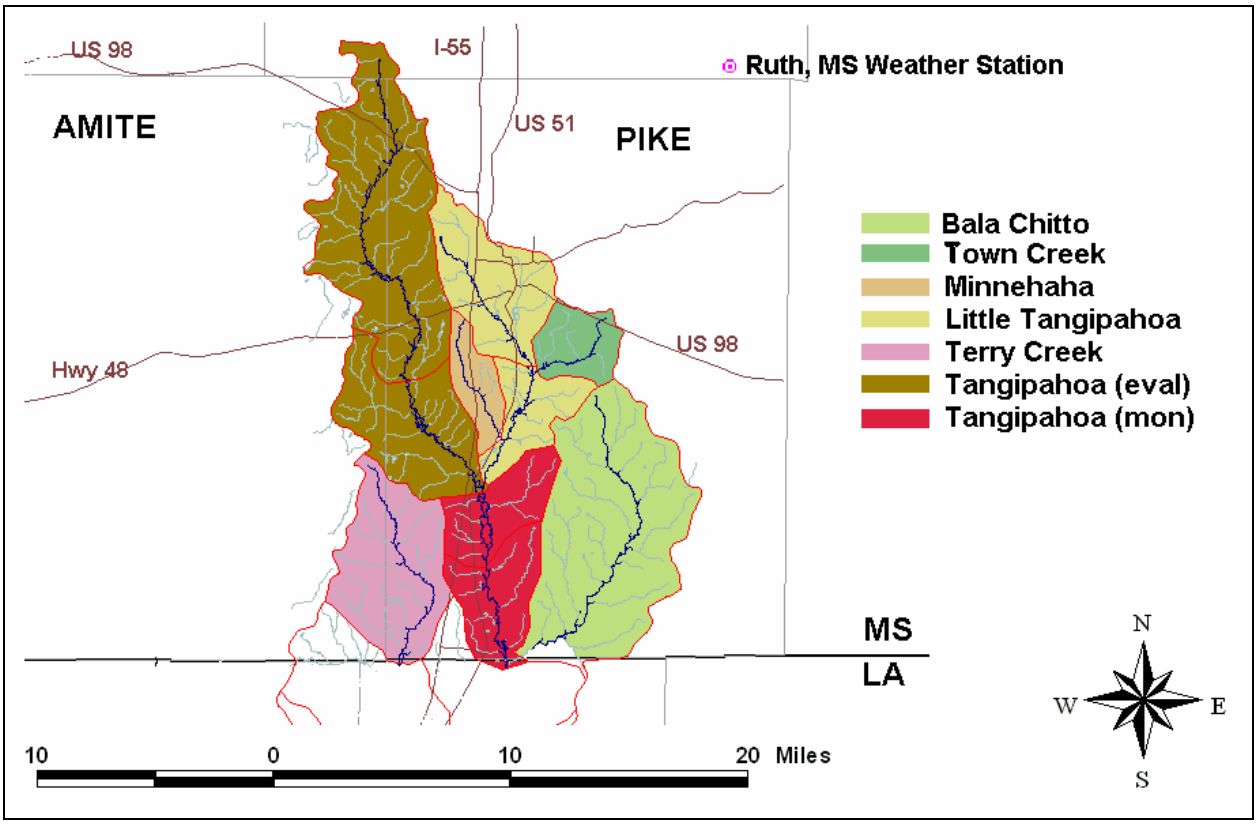


Figure 1. Map of Tangipahoa River Watersheds

The drainage areas shown are located in HUC 08070205. Forests and pastureland are the dominant landuses within this watershed. Figure 2 shows the population centers that have central sewer systems in the watershed. Figure 3 shows the landuse distribution within the drainage areas.

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 uses for the Tangipahoa River as defined by the regulations are Contact Recreation, Secondary Contact Recreation, and Fish and Wildlife Support. The monitored section of the Tangipahoa River has the designated use of Secondary Contact Recreation. The evaluated sections of the Tangipahoa River Watershed have two designated uses, Secondary Contact Recreation and Contact Recreation. Secondary contact recreation is defined as incidental contact with the water, including wading and occasional swimming. Contact Recreation means the waters are to be suitable for recreational purposes, including such water contact activities as swimming and water skiing. The waters shall also be suitable for use for which waters of lower quality will be satisfactory.

Segment Name	Waterbody ID	Use	Location
Tangipahoa River	MS481M6	Sec CR	Near Chatawa: from confluence with Little Tangipahoa River to Louisiana State Line
Bala Chitto Creek	MS481M7	Sec CR	At Osyka: from Emerald to Louisiana State Line
Little Tangipahoa River	MS481M4	Sec CR	Near Fernwood: from McComb SW Facility to confluence with Town Creek
Little Tangipahoa River	MS481M5	Sec CR	Near Fernwood: from confluence of Town Creek above Fernwood to confluence of Tangipahoa River
Minnehaha Creek – DA	MS481M1	Sec CR	Drainage Area at Magnolia from just upstream of Magnolia urban area to mouth at Little Tangipahoa
Tangipahoa River	MS481M2	Sec CR	Near McComb: from confluence of Devine Creek to Lake Tangipahoa
Tangipahoa River	MS481M3	Contact Rec.	From Lake Tangipahoa to confluence of Little Tangipahoa
Tangipahoa River – DA	MS481E	Sec CR	Drainage Area near Osyka
Terrys Creek – DA	MS482M	Sec CR	Near Osyka: from community of Terry's Creek to state line
Town Creek	MS481M8	Sec CR	Near Fernwood: from McComb urban limits to mouth at Little Tangipahoa River

Table 1. TMDL Segments included in this report. (Sec CR = Secondary Contact Recreation)

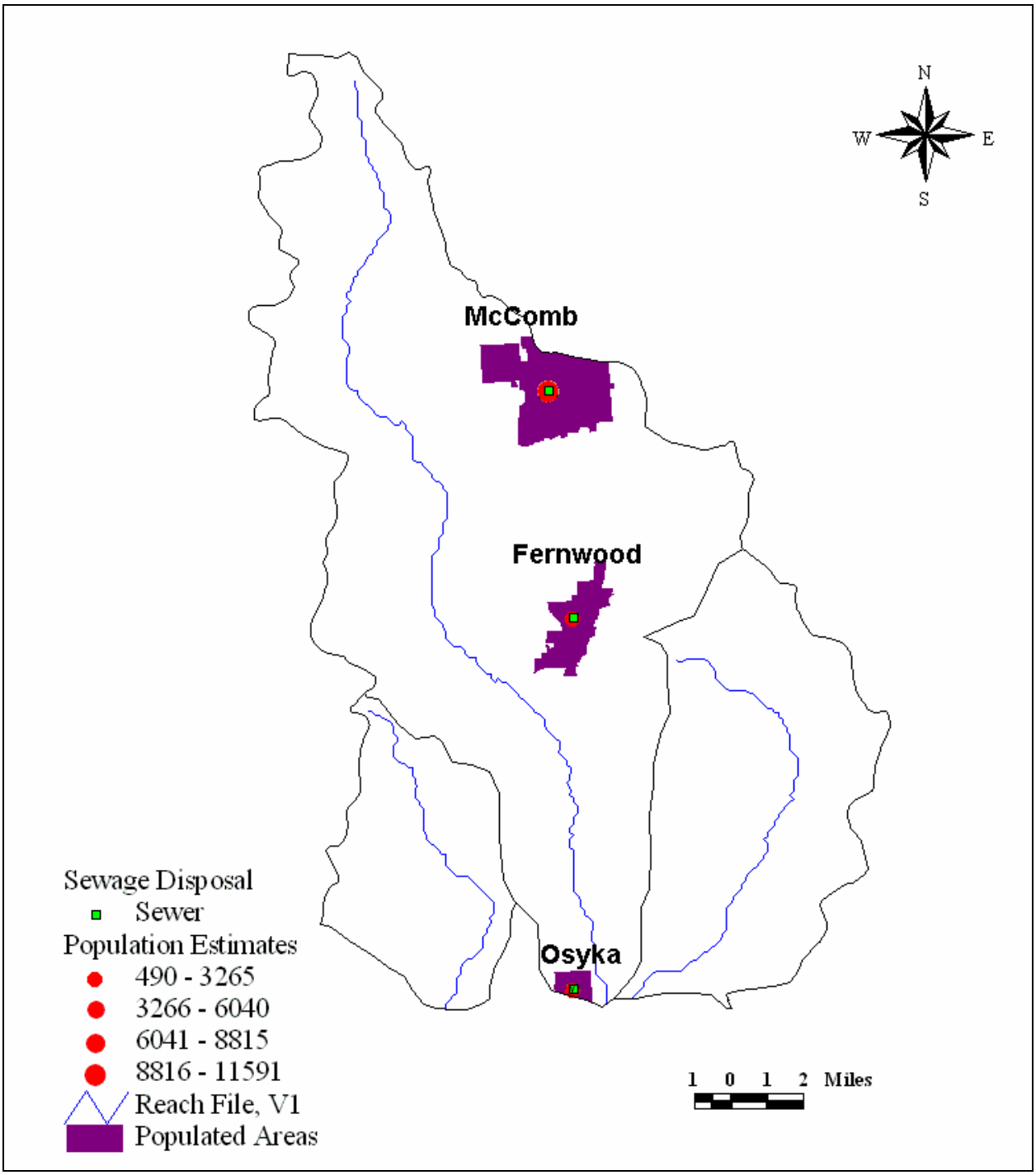


Figure 2. Populated Areas with sewer systems in the watershed

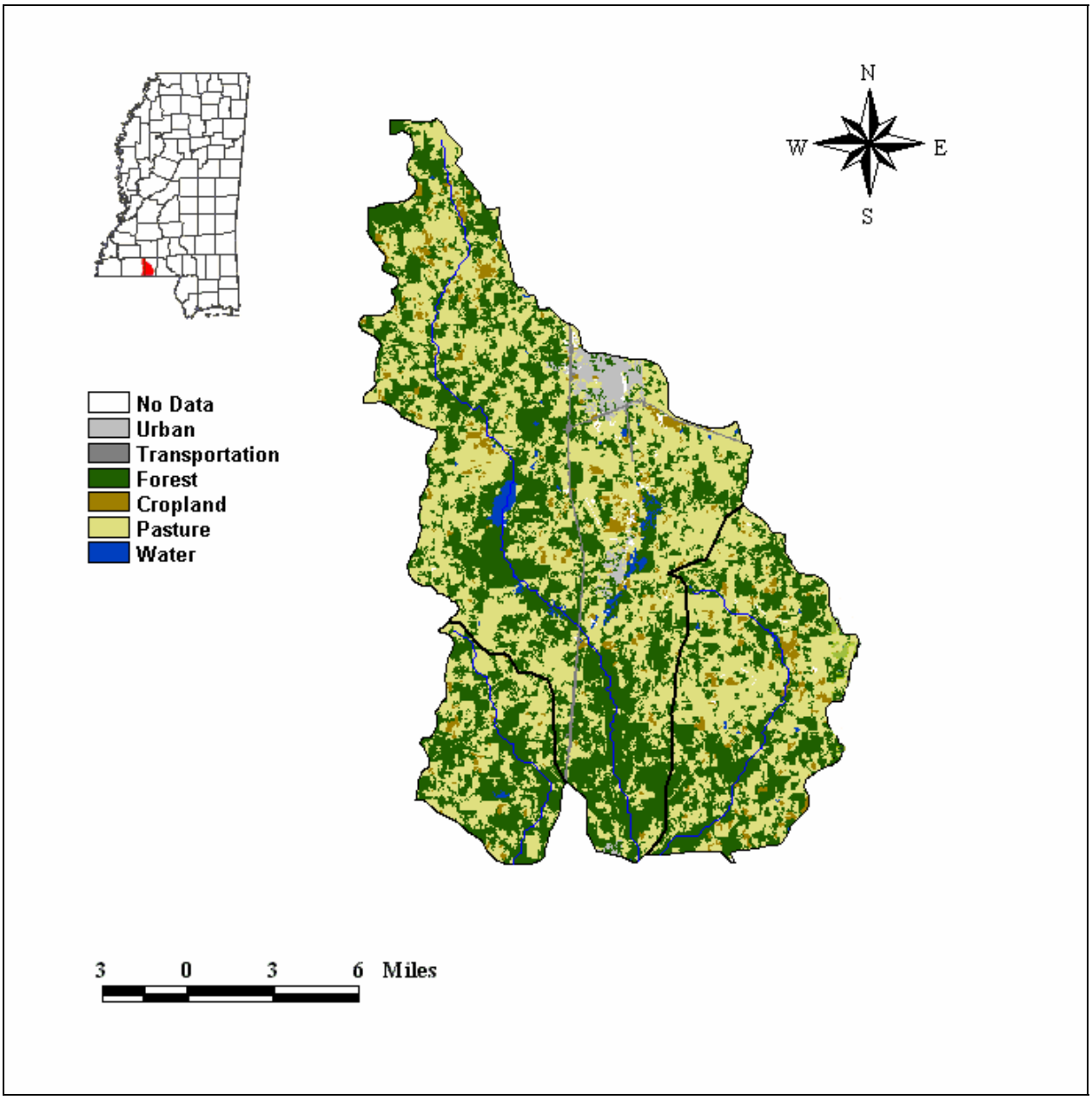


Figure 3. Landuse based on MARIS Coverage, 1997

1.3 Applicable Waterbody Segment Standard

The water quality standard applicable to the use of the waterbody segments and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. The standard states for Secondary Contact Recreation that from May through October the fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, nor shall more than ten percent of the samples examined during any month exceed a colony count of 400 per 100 ml. And, that from November through April the fecal coliform colony counts shall not exceed a geometric mean of 2000 per 100 ml, nor shall more than ten percent of the samples

examined during any month exceed a colony count of 4000 per 100 ml. For Contact Recreation, the winter relaxing of the standards is eliminated. Therefore, since the Contact Recreation standard is more stringent, it has been chosen for the development of this TMDL. This Contact Recreation water quality standard will be used as targeted endpoints to evaluate impairments and establish this TMDL.

2.0 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 waste load 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 fecal coliform target for this TMDL is a 30-day geometric mean of 200 colony counts per 100 ml.

Because fecal coliform may be attributed to both nonpoint and point sources, the critical condition used for the modeling and evaluation of 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. The 1985-1995 period represents both low-flow conditions as well as wet-weather conditions and encompasses a range of wet and dry seasons. Therefore, the 10-year period was selected as representing critical conditions associated with all potential sources of fecal coliform bacteria within the watershed.

2.2 Discussion of Instream Water Quality

Water quality data available for the monitored segment of the Tangipahoa River show that on occasion moderately high levels of fecal coliform bacteria impair the stream. There is one ambient station operated by MDEQ that collected fecal coliform data from 1996 through 1998. Monitoring for flow and fecal coliform continued on a monthly basis at station 07375280 at Osyka, beginning December 9, 1996, and ending December 2, 1998.

Several additional studies were conducted in the area in the late 1980s and early 1990s. These studies concluded the cattle population in the watershed had a direct impact on the fecal coliform loading and the standards violations present at that time. The Louisiana Department of Environmental Quality directed these studies, and MDEQ assisted with the portion of the watershed, which is in Mississippi. The data from these studies are not represented in this TMDL but may be reviewed in those studies. They are listed in the references.

2.2.1 Inventory of Available Water Quality Monitoring Data

The State's 1998 Section 305(b) Water Quality Assessment Report was reviewed for water quality conditions and data available for the watershed. According to the report, the Tangipahoa River is not supporting the use of Secondary Contact Recreation. These conclusions were based on instantaneous data collected at station 07375280. Data collected at the station are listed below in Table 2. Precipitation and temperature averages for the watershed are shown in Table 3.

Date	Flow (cfs)	Temperature	Fecal Coliform
96/12/09	299	13.4	60
97/01/06	395	16.4	60
97/02/10	923	9.9	**5400**
97/03/10	585	17.1	50
97/04/16	513	15.2	150
97/05/12	329	19.5	40
97/06/04	418	21.4	160
97/07/01	1600	25.1	110
97/08/04	337	25.1	50
97/09/02	283	24.8	140
97/10/06		21.3	40
97/11/03		16	140
98/01/05		15	460
98/02/04		12	90
98/03/02		12.2	160
98/04/01		18.2	350
98/06/01		25.2	60
98/07/01		26.6	30
98/08/03		26.1	70
98/09/01		25.3	**600**
98/10/01		23.8	50
98/11/02		20.9	90
98/12/02		17.7	20

Table 2. Fecal Coliform Data reported in Tangipahoa River, Station 07375280
Bold indicates a violation of the Secondary Contact Recreation Standard for Fecal Coliform in Mississippi

Average Precipitation and Temperature at BROOKHAVEN													
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Min. Precip	4.96	2.32	3.56	3.44	1.82	2.67	1.39	1.81	1.05	1.4	2.28	2.91	52.16
Max. Precip	15.13	12.52	8.44	17.65	12.5	7.11	9.2	10.75	6.01	6.04	8.39	7.45	77.12
Mean. Precip	8.86	6.43	5.6	7.91	5.99	4.67	4.81	4.85	2.96	3.17	4.6	4.95	66.2
Min. Temp	36.41	39.97	44.81	50.16	60.06	66.56	69.48	67.67	62.41	51.19	42.66	39.26	52.56
Max. Temp	58.04	63.33	69.38	75.48	82.5	88.25	91.17	91.21	87.67	77.75	66.45	61.05	75.9
Mean Temp	47.24	51.67	57.13	62.83	71.29	77.42	80.35	79.46	75.08	64.5	54.59	50.19	64.25

Table 3. Average Monthly Precipitation and Temperature

2.2.2 Analysis of Instream Water Quality Monitoring Data

A statistical summary of the water quality data discussed above is presented in Table 4. Samples are compared to the instantaneous maximum standard of 400 counts per 100 ml. in the summer months; 4000 counts per 100 ml. in the winter. 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 is in violation.

Station Number	Number of Samples	Minimum Value (counts/100ml)	Maximum Value (counts/100ml)	Number of Exceedances	Percent Instantaneous Exceedance
07375280	23	20	5400	2	9%

Table 4. Statistical Summaries

3.0 SOURCE ASSESSMENT

The TMDL evaluation summarized in this report examined all known potential fecal coliform sources in the Tangipahoa River Watershed. The source assessment was used as the basis of development for the model and ultimate analysis of the TMDL allocation options. In evaluation of the sources, wasteloads 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 representation of the following sources in the model is discussed in Section 4.0.

3.1 Assessment of Point Sources

Point sources of fecal coliform bacteria have their greatest potential impact on water quality during periods of low flow. Thus, a careful evaluation of point sources that discharge fecal coliform bacteria was necessary in order to quantify the degree of impairment present during the low-flow, critical condition. The 13-wastewater treatment plants in the Tangipahoa River Watershed model serve a variety of activities including residential subdivisions, industrial parks, municipalities, and other businesses.

A point source assessment was completed for each subwatershed in the Tangipahoa River drainage area. Figure 1 shows a map of the drainage area of the impaired section of the Tangipahoa River and its division into subwatersheds. Table 5 lists the NPDES Permitted fecal coliform dischargers, along with the permit number and the receiving waterbody.

Once the permitted dischargers were located, the effluent from each source was characterized based on all available monitoring data including permit limits, discharge monitoring reports, and information on treatment types. Discharge monitoring reports (DMRs) were the best data source for characterizing effluent because they report measurements of flow and fecal coliform present in effluent samples. Of the facilities for which they were available, the DMRs for the past five years, 1993 through 1998, were analyzed. When data were available, the fecal coliform concentrations used in the model were calculated by taking an average of fecal coliform concentrations reported in the discharge monitoring reports. If evidence of insufficient treatment existed, best professional judgement was used to estimate a fecal coliform loading rate in the model. The permit limits of each facility included in the Tangipahoa River model are given in Table 5.

Facility Name	Sub Watershed	NPDES Permit	Fecal Coliform (counts/100ml)	Receiving Waterbody
Fernwood Truckstop	MS481M1	MS0050415	200	Minnehaha Creek
Percy Quinn State Park	MS481M3	MS0033120	200	Tangipahoa River
McComb POTW – West	MS481M4	MS0025518	200	Little Tangipahoa River
McComb POTW – East	MS481M4	MS0025526	200	Town Creek
Magnolia POTW – Sth.	MS481M5	MS0026883	200	Little Tangipahoa River
Magnolia POTW – North	MS481M5	MS0026891	200	Little Tangipahoa River
Fernwood POTW	MS481M5	MS0044199	200	Little Tangipahoa River
Pike County Ind. Park	MS481M5	MS0042528	200	Little Tangipahoa River
Fernwood Industries	MS481M5	MS0044598	0*	Little Tangipahoa River
I-55 Welcome Center	MS481M6	MS0024538	200	Tangipahoa River
Haygood Trailer Park	MS481M6	MS0038458	200	Martin Creek
Fernwood Associates	MS481M6	MS0050792	200	Tangipahoa River
Osyka POTW	MS481M6	MS0024759	200	Tangipahoa River

Table 5 Inventory of Point Source Dischargers
* No Limits for Fecal Coliform

3.2 Assessment of Nonpoint Sources

There are many potential nonpoint sources of fecal coliform bacteria for Tangipahoa River, including:

- Failing septic systems
- Wildlife
- Land application of hog and cattle manure
- Grazing animals
- Land application of poultry litter
- Cattle contributions directly deposited instream
- Urban development

The 250 square mile drainage area for the Tangipahoa River Watershed contains many different landuse types, including urban, forests, cropland, pasture, barren, and wetlands. The landuse information is based on data collected by the State of Mississippi's Automated Information System (MARIS, 1997). This data set is based on Landsat Thematic Mapper digital images taken between 1992 and 1993. This classification is based on a modified Anderson level one and two system with additional level two wetland classifications. The contribution of each of these land types to the fecal coliform loading of the Tangipahoa River was considered on a subwatershed basis. Figure 3 on page 5 shows the landuse distribution. Table 6 lists the landuse distribution within each subwatershed in number of acres.

Subwatershed	Forest	Croplands	Pasture	Urban	Total
Tangipahoa River	44906	3582	50061	3823	**102372**
Bala Chitto Creek	15619	1832	19591	0	**37043**
Terrys Creek	9495	406	8183	0	**18085**
Total	**70020**	**5820**	**77835**	**3823**	**157499**

Table 6. Landuse Distribution in Number of Acres

The nonpoint fecal coliform contribution from each landuse was estimated using the latest information available. The MARIS landuse data for Mississippi was utilized by the BASINS model to extract landuse sizes, populations, agriculture census data, and other information. MDEQ contacted several agencies to refine the assumptions made in determining the fecal coliform loading. The Mississippi Department of Wildlife, Fisheries, and Parks provided information of wildlife density in the Tangipahoa River Watershed. The Mississippi State Department of Health was contacted regarding the failure rate of septic tank systems in this portion of the state. Mississippi State University researchers provided valuable information on manure application practices and loading rates for hog farms and cattle operations. The Natural Resources Conservation Service also gave MDEQ information on manure treatment practices and land application of manure.

3.2.1 Failing Septic Systems

Septic systems have a potential to deliver fecal coliform bacteria loads to surface waters due to malfunctions, failures, and direct pipe discharges. 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.

Another consideration is the use of individual onsite wastewater treatment plants. These treatment systems are in wide use in Mississippi. They can adequately treat wastewater when properly maintained. However, these systems do not typically receive the maintenance needed for proper, long-term operation. These systems require some sort of disinfection to properly operate. When this expense is ignored, the water does not receive adequate disinfection prior to release.

3.2.2 Wildlife

Wildlife present in the Tangipahoa River Watershed contributes to fecal coliform bacteria on the land surface. In the Tangipahoa River model, all wildlife was accounted for by considering contributions from deer. Estimates of deer population were designed to account for the deer combined with all of the other wildlife contributing to the area. An upper limit of 45 deer per square mile was used as the estimate. It was assumed that the wildlife population remained constant

throughout the year, and that wildlife was present on all land classified as pastureland, cropland, and forest. It was also assumed that the wildlife and the manure produced by the wildlife were evenly distributed throughout these land types.

3.2.3 Land Application of Hog and Cattle Manure

In the Southern Independent Streams Basin processed manure from confined hog and dairy cattle operations is typically collected in lagoons and routinely applied to pastureland during March through May and October through November. This manure is a potential contributor of bacteria to receiving waterbodies due to runoff produced during a rain event. Hog farms in the Southern Independent Streams Basin operate by either keeping the animals confined by or allowing hogs to graze in a small pasture or pen. For this model, it was assumed that all of the hog manure produced by either farming method was applied evenly to the available pastureland. Application rates of hog manure to pastureland from confined operations varied monthly according to management practices currently used in this area.

The dairy farms that are currently operating in the Tangipahoa River Watershed only confine the animals for a limited time during the day. The model assumed a confinement time of four hours per day, during which time the cattle are milked and fed. During all other times, dairy cattle are allowed to graze on pasturelands. The manure collected during confinement is applied to the available pastureland in the watershed. Like the hog farms, application rates of dairy cow manure to pastureland vary monthly according to management practices currently used in this area.

3.2.4 Grazing Beef and Dairy Cattle

Grazing cattle deposit manure on pastureland where it is available for wash-off and delivery to receiving waterbodies. Beef cattle have access to pastureland for grazing all of the time. However, dairy cattle can spend four hours per day confined in milking barns, and the remainder of their time grazing on pastureland. Manure produced by grazing beef and dairy cows is directly deposited onto pastureland.

3.2.5 Land Application of Poultry Litter

There are a considerable number of chickens produced in this area of the State each year. In these counties, poultry farming operations use houses in which chickens are confined all of the time. The litter produced by the chickens is collected and is routinely applied as a fertilizer to pastureland in the watershed. Application rates of the litter vary monthly.

Predominantly, two kinds of chickens are raised on farms in the basin, broilers and layers. For the broiler chickens, the amount of growth time from when the chicken is born to when it is sold off the farm is approximately 48 days or 1.6 months. Layer chickens remain on farms for ten months or longer. More than 93% of the chickens raised in this area are broilers. For the model, a weighted average of growth time was determined to account for both types of chickens. An average growth

time of 52 days, or 1/7 of a year, was used. To determine the number of chickens on farms on any given day, the yearly population of chickens sold was divided by seven.

3.2.6 Cattle Contributions Directly Deposited Instream

Cattle often have direct access to flowing and intermittent streams that run through pastureland. These small streams are tributaries of larger streams. Fecal coliform bacteria deposited in these streams by grazing cattle are modeled as a direct input of bacteria to the stream. Due to the general topography in the Tangipahoa River Watershed, it was determined that all land slopes in the watershed are such that cattle are able to access the intermittent streams in all pastures. In order to determine the amount of bacteria introduced into streams from cattle, it was assumed that all grazing cattle spent one half of one percent of their time loafing in the streams. Thus, the model assumes that percentage of the manure produced by grazing beef and dairy cows are deposited directly in the stream.

3.2.7 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 fecal coliform loading in Tangipahoa River was considered. Municipalities within the Tangipahoa River Watershed include McComb, Magnolia, Fernwood, and Osyka. Fecal coliform contributions from urban areas may come from storm water runoff, runoff from construction sites, and runoff contribution from improper disposal of materials such as household toxic materials and litter.

4.0 MODELING PROCEDURE: 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. In this section, the selection of the modeling tools, setup, and model application are discussed.

4.1 Modeling Framework Selection

The BASINS model platform and the NPSM model were used to predict the significance of fecal coliform sources to fecal coliform levels in the Tangipahoa River Watershed. BASINS is a multipurpose environmental analysis system for use in performing watershed and water quality-based studies. A geographic information system (GIS) provides the integrating framework for BASINS and allows for the display and analysis of a wide variety of landscape information such as landuses, monitoring stations, point source discharges, and stream descriptions. The NPSM model simulates nonpoint source runoff from selected watersheds, as well as the transport and flow of the pollutants through stream reaches. A key reason for using BASINS as the modeling framework is its ability to integrate both point and nonpoint sources in the simulation, as well as its ability to assess instream water quality response.

4.2 Model Setup

The Tangipahoa River TMDL model includes the impaired segment of the creek as well as the drainage areas that are upstream of the segment. Thus, all upstream contributors of bacteria are accounted for in the model. The Bala Chitto Creek and Terrys Creek models were run independently of the Tangipahoa model and their results are shown in separate graphs. These two main tributaries flow into the Tangipahoa in Louisiana. The land use and area from Louisiana is not included in the model output.

4.3 Source Representation

Both point and nonpoint sources were represented in this model. Due to die-off rates and overland transportation assumptions, the fecal coliform loading from point and nonpoint sources must be addressed separately. There are 13 NPDES Permitted facilities in the basin that contribute fecal coliform bacteria to the watershed. The load of fecal coliform from the effluent discharge was added as a direct input into the appropriate reach in the model. Fecal coliform loading rates for point sources are input to the model as flow in cubic feet per second and fecal coliform contribution in colony counts per hour.

The nonpoint sources are represented in the model with two different methods. The first of these methods is a direct fecal coliform loading to the Tangipahoa River. Other sources are represented as an application rate to the land in the watershed. For these sources, fecal coliform accumulation rates in counts per acre per day were calculated for each subwatershed on a monthly basis and input to the model for each landuse. Fecal coliform contributions from forests and wetlands were considered at the same time, and all forest and wetland contributions were combined for model input. Urban and barren areas were combined and input into the model in the same manner.

Appendix A contains a portion of the Fecal Coliform Spreadsheet used by MDEQ to quantify point and nonpoint sources of bacteria for the model. The model inputs for fecal coliform loading due to point and nonpoint sources have been calculated using assumptions about land management, septic systems, farming practices, and permitted point source contributions. Each of the potential bacteria sources is covered in the fecal coliform spreadsheet. The spreadsheet also contains a reference page that lists the literature references used to generate the fecal coliform loading rates.

4.3.1 Failing Septic Systems

The number of failing septic systems determined for use in the model was estimated based on the county population that does not have sewers. Based on the best available information, a failure rate of 20% was assumed. The percentage of septic tanks per county and the assumed failure rate has been used to calculate the estimated number of failing septic tanks per watershed. The number of failing septic tanks also incorporates an estimate for the failing onsite wastewater treatment systems in the area.

Discharges from failing septic systems were quantified based on several factors including the estimated population served by the septic systems, an average daily discharge of 100 gallons per person per day, and a septic system effluent fecal coliform concentration of 10^4 counts per 100 ml.

4.3.2 Wildlife

Based on information provided by the Mississippi Department of Wildlife, Fisheries, and Parks, the deer population throughout the watershed was estimated to be 30 to 45 animals per square mile. For the model, the upper limit of 45 deer per square mile was used to account for the deer and all other wildlife contributing to fecal coliform accumulation in the area. The wildlife contribution in counts per acre per day is calculated by multiplying a loading rate by the number of animals. The loading rate used in the model was estimated to be 5.00E+08 counts per day per animal.

4.3.3 Land Application of Hog and Cattle Manure

The fecal coliform spreadsheet was used to estimate the amount of waste and the concentration of fecal coliform bacteria contained in hog and dairy cattle manure produced by confined animal feeding operations. The livestock count per county is based upon the 1997 Census of Agriculture data. The county livestock count is used to estimate the number of livestock on a subwatershed scale. This is calculated by multiplying the county livestock figures with the area of the county within the subwatershed boundaries. This estimate is made with the assumption that the livestock

are uniformly distributed throughout the county. A fecal coliform production rate in counts per day per animals was multiplied by the number of confined animals to quantify the amount of bacteria produced. The manure produced by these operations is collected in lagoons and applied evenly to all pastureland. Manure application rates to pastureland vary on a monthly basis. This monthly variation is incorporated into the model by using monthly loading rates.

The studies completed in the early 1990s indicated the majority of the impairment from fecal coliform was coming from the dairy industry in the watershed. Since that time, many of the dairies have closed and on those that remain, significant reduction from runoff has been accomplished with best management practices. The MSU Extension Service estimates that a 27% reduction has been achieved due to the best management practices that have already been installed. These practices include fencing the streams and lagoon systems for the barn wastewater.

4.3.4 Grazing Beef and Dairy Cattle

The model assumes that the manure produced by grazing beef and dairy cattle is evenly spread on pastureland throughout the year at varying rates. The fecal coliform content of manure produced by grazing cattle is estimated by multiplying the number of grazing cattle by a fecal coliform production of 5.40E+09 counts per day per animal. The resulting fecal coliform loads are in the units of counts per acre per day.

4.3.5 Land Application of Poultry Litter

The concentration of bacteria, which accumulates in the dry litter where poultry waste is collected, is estimated with the fecal coliform spreadsheet. This is done by multiplying the daily number of chickens on farms by a fecal coliform production rate in counts per day per animal. The chicken population was determined from the 1997 Census of Agriculture Data for the number of chickens sold from each county per year. Litter application to pastureland varies monthly, and is modeled with a monthly loading rate.

4.3.6 Cattle Contributions Deposited Directly Instream

The contribution of fecal coliform from cattle to a stream is represented as a direct input into the stream by the model. In order to estimate the point source loading produced by grazing beef and dairy cattle with access to streams, it is assumed that one half of one percent of the number of grazing cattle in each subwatershed are standing in a stream at any given time. When cattle are standing in a stream, their fecal coliform production is estimated as flow in cubic feet per second and a concentration in counts per hour. The fecal coliform concentration has been calculated using the number of cows in the stream and a bacteria production rate of 5.40E+09 counts per animal per day.

4.3.7 Urban Development

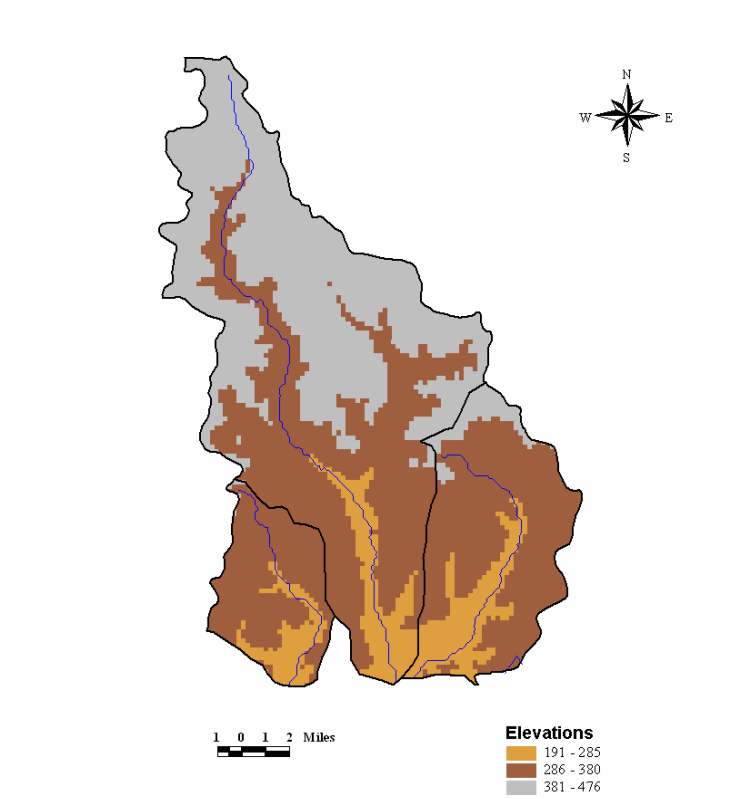
The MARIS landuse data divide urban land into several categories. For the Tangipahoa River Watershed, the urban land is divided into different categories: high density, low density, and transportation. For the model, fecal coliform buildup rates for each category were determined by

using literature values from Horner, 1992. The literature value accounts for all of the potential fecal coliform sources in each urban category. In the model, fecal coliform loading rates on urban land are input as counts per acre per day.

4.4 Stream Characteristics

The stream characteristics given below describe the impaired section of the Tangipahoa River. This section begins at the confluence of the Little Tangipahoa River and ends at the State Line. The channel geometry and lengths for the impaired segment of the Tangipahoa River are based on data available within the BASINS modeling system. The characteristics of the modeled section are as follows.

- Segment MS481M6
- Call Impaired
- Use Secondary
- Length 9 miles
- Average Depth 1.1 ft.
- Average Width 45.4 ft.
- Mean Flow 212.9 cfs
- Mean Velocity 1.3 f/s
- 7Q10 Flow 51.1 cfs
- Slope .00141



4.5 Selection of Representative Modeling Period

The model was run for an 11-year modeling period, from January 1, 1985, through December 31, 1995. The first year of data were used to stabilize the model. Results from the model were evaluated for the time period from January 1, 1986, until December 31, 1995. Because this 10-year time span is used, a margin of safety is implicitly applied. Seasonality and critical conditions are accounted for during the extended time frame of the simulation.

The critical condition for fecal coliform impairment from nonpoint source contributors occurs after a heavy rainfall that is preceded by several days of dry weather. The dry weather allows a build up of fecal coliform bacteria, which is then washed off the ground by a heavy rainfall. By using the 10-year time period, many such occurrences are captured in the model results. Critical conditions for point sources, which occur during low flow and low dilution conditions, are simulated as well.

4.6 Model Calibration Process

Several assumptions were made to determine the fecal coliform loading rates from the nonpoint source contributors. Many of these assumptions were incorporated into the fecal coliform spreadsheet. An effort was made to contact researchers and agricultural experts to give as much validity as possible to the assumptions made within the BASINS model. A data set was applied to various gages in the basin as a means of hydrologic calibration and validation. The weather data used for this model were collected at Ruth, MS. The representative hydrologic period used for the TMDL was January 1, 1986, through December 31, 1995.

4.7 Existing Loading

Appendix B includes three sets of graphs of the model results showing the instream fecal coliform concentrations for the impaired segment of the Tangipahoa River and the evaluated segments of Terrys Creek and Bala Chitto Creek. The graphs show a 30-day geometric mean of the data. The straight line at 200 counts per 100 ml indicates the water quality standard for the stream during the summer.

5.0 ALLOCATION

The allocation for this TMDL involves a wasteload allocation for point sources and a load allocation for nonpoint sources necessary for attainment of water quality standards in segment MS481M6. Point source contributions enter the stream directly in the appropriate reach. The nonpoint fecal coliform sources used in the model have two different transportation methods. Cows in the stream and failing septic tanks were modeled as direct inputs to the stream. The other nonpoint source contributions were applied to land area on a counts per day per acre basis. The fecal coliform bacteria applied to land are subject to a die-off rate and an absorption rate before it enters the stream. The TMDL was calculated based on modeling estimates that are referenced in Appendix B.

5.1 Wasteload Allocations

Point sources within the watershed discharging at their current level are subject to reduction from their current level of fecal coliform contribution. The contribution of point sources was considered on a subwatershed basis for the model. Within each subwatershed, the modeled contribution of each discharger was based on the facility's discharge monitoring data and other records of past performance. In several cases, the fecal coliform contribution attributed to the model from a facility is much greater than the permitted limit of 200 counts per 100 ml. As part of this TMDL, all wastewater treatment facilities will be required to meet water quality standards at the end of pipe. All wastewater treatment facilities with current NPDES Permits that meet water quality standards should take steps to comply with their current permits. Table 7 lists the point source contributions, on a subwatershed basis, along with their existing load, allocated load, and percent reduction.

Sub Watershed	Existing Flow (cfs)	Existing Load (counts/hr)	Allocated Flow (cfs)	Allocated Load (counts/hr)	Percent Reduction
Tangipahoa	0.447	1.23E+08	0.447	9.09E+07	26.1%
Little Tangipahoa	3.024	5.70E+08	3.024	5.70E+08	0%
Town Creek	4.303	8.75E+08	4.303	8.75E+08	0%
Martin Creek	0.028	5.67E+06	0.028	5.67E+06	0%
Minnehaha	0.023	5.67E+08	0.023	4.72E+06	99.2%
Totals	**7.825**	**2.14E+09**	**7.825**	**1.55E+09**	**27.7%**

Table 7. Wasteload Allocation from NPDES Permitted Facilities

One facility in particular has undergone a major transformation in the past 4 years. Fernwood Truckstop was using a septic tank for treatment. Unfortunately, the treatment system failed. And during the time-span used in the model, raw untreated septic sewage was being discharged into an unnamed tributary of Minnehaha Creek. MDEQ entered into an agreed order with the facility to

install an adequate treatment facility that was accomplished in 1996. This improvement is reflected in the 99.2 percent improvement shown in Table 7 for Minnehaha Creek.

5.2 Load Allocations

Nonpoint sources that contribute to fecal coliform accumulation within the Tangipahoa River Watershed are subject to reduction from their current level of contribution. Reductions in the load allocation for this TMDL involve two different types of nonpoint sources: cattle access to streams and septic tanks. Contributions from both of these sources are input into the model in a manner similar to point source input, with a flow and fecal coliform concentration in counts per hour. Table 8 lists the nonpoint source contributions due to cattle access to streams, on a subwatershed basis, along with their existing load, allocated load, and percent reduction. Table 9 gives the same parameters for contributions due to septic tank failure. The septic tank failures in reality are both point and nonpoint source contributions and have been calculated as equal contributors to the WLA and the LA component of the TMDL calculation.

Sub Watershed	Existing Flow (cfs)	Existing Load (counts/hr)	Allocated Flow (cfs)	Allocated Load (counts/hr)	Percent Reduction
Tangipahoa	1.43E-04	5.47E+09	7.16E-06	2.73E+08	95%
Bala Chitto	5.65E-05	2.16E+09	2.83E-06	1.08E+08	95%
Terrys Creek	2.25E-05	8.60E+08	1.13E-06	4.3E+07	95%
Total	**2.22E-04**	**8.49E+09**	**1.11E-05**	**4.24E+08**	**95%**

Table 8. Loading Rates for Nonpoint Source Contribution of Cattle Access to Streams.

Sub Watershed	Existing Flow (cfs)	Existing Load (counts/hr)	Allocated Flow (cfs)	Allocated Load (counts/hr)	Percent Reduction
Tangipahoa	3.80E-01	3.87E+09	1.90E-01	1.93E+09	50%
Bala Chitto	1.65E-01	1.68E+09	8.26E-02	8.41E+08	50%
Terrys Creek	5.34E-02	5.43E+08	2.67E-02	2.72E+08	50%
Total	**5.98E-01**	**6.09E+09**	**2.99E-01**	**3.04E+09**	**50%**

Table 9. Loading Rates for Failing Septic Tanks (50% for WLA, 50% for LA)

Nonpoint fecal coliform loading due to cattle grazing; land application of manure produced by confined dairy cattle, hogs, and poultry; wildlife; and urban development are also included in the load allocation. The loading rates are constant throughout the year for forest, cropland, and urban land. The loading rates for pastureland vary for each month. In the reduction scenario a credit has been taken of 27% as reported by the MSU extension service. The scenario for the load allocation

includes a 95% reduction in contributions from cows in the stream, and a 50% reduction from failing septic tanks. The scenario also requires all permitted dischargers to meet water quality standards for disinfection.

This scenario could be achieved by supporting BMP projects that promote fencing around streams in pastures, and by supporting education projects that encourage homeowners to properly maintain their septic tanks by routinely pumping them out, repairing broken field lines, and disinfecting the effluent from small individual onsite wastewater treatment plants.

5.3 Incorporation of a Margin of Safety

The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit. Running the model for 10 years with no violations of the water quality standard provides the primary component of the MOS. Ensuring compliance with the standard throughout all of the critical condition periods represented during the 10 years is a conservative practice. Another component of the MOS is the conservative assumption that in the model all of the fecal coliform bacteria discharged from failing septic tanks reaches the stream, while it is likely that only a portion of the bacteria will reach the stream due to filtration and die off during transport.

5.4 Seasonality

For many streams in the state, fecal coliform limits vary according to the seasons. Also, several NPDES Permits have seasonal limits. The monitored segment of the stream is designated for the use of secondary contact recreation. For this use, the pollutant standard varies seasonally.

Because the model was established for a 10-year time span, it took into account all of the seasons within the calendar years from 1986 to 1995. The extended time period allowed the simulation of many different atmospheric conditions such as rainy and dry periods and high and low temperatures. It also allowed seasonal critical conditions to be simulated.

The model was run with the 2000 count per 100 ml. seasonal limit for the dischargers and no violations were noted that were above the winter limits. This is shown in graph B-7 in Appendix B. Therefore, the model accounts for various seasons with different limits.

6.0 IMPLEMENTATION

6.1 Follow-Up 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 South Independent Streams Basin, the Tangipahoa River may receive follow-up monitoring to identify the improvement in water quality from the implementation of the strategies in this TMDL.

6.2 Reasonable Assurance

The fecal coliform reduction scenario used by this TMDL includes requiring all NPDES Permitted dischargers of fecal coliform to meet water quality standards for disinfection, along with reducing 75% of the cattle access to streams and 50% of the failing septic tanks in the watershed. A reduction of 27% from land use sources has already been achieved through the introduction of best management practices. Reasonable assurance for the implementation of the TMDL has been considered for both point and nonpoint source contributors.

The TMDL will not impact existing or future NPDES Permits as long as the effluent is disinfected to meet water quality standards for fecal coliform bacteria. MDEQ will not approve any NPDES Permit application that does not plan to meet water quality standards for disinfection. Education projects that teach best management practices should be used as a tool for reducing nonpoint source contributions. These projects may be funded by CWA Section 319 nonpoint source grants.

6.3 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 McComb. 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 by the Commission on Environmental Quality and for submission of this TMDL to EPA Region IV for final approval.

APPENDIX A

The following documents comprise a section of the spreadsheet used to estimate all of the fecal coliform loading used in the models. The spreadsheet consists of several sheets, each dealing with a different aspect of the estimation. The final sheets bring all of the inputs into one format for model input.

This sheet contains information relevant to cattle farming in the study area.

Dairy

Cattle

Dairy cattle are assumed to be either kept in feedlots or allowed to graze (depending on the milking/feeding schedule, which is four hours per day). When grazing, a certain percentage are assumed to have direct access to streams.
Dairy cattle waste is therefore either applied as manure to Cropland and Pastureland, contributed directly to Pastureland, or contributed directly to streams (referred to as Cattle in Streams).

Beef

Cattle

Beef cattle are assumed to be either kept in feedlots or allowed to graze (depending on the season). When grazing, a certain percentage are assumed to have direct access to streams.
Beef cattle waste is therefore either applied as manure to Cropland and Pastureland, contributed directly to Pastureland, or contributed directly to streams (referred to as Cattle in Streams).

	Beef Cattle Grazing	***Dairy Cattle Grazing***	***Assumed Cattle Access to Streams***
Month	**Percentage of Time not Confined (0.0 or 1.0)**	**Percentage of Time not Confined (0.0 or 1.0)**	**Percentage of Time (0.0 to 1.0)**
January	1.00	0.75	0.000
February	1.00	0.75	0.000
March	1.00	0.75	0.005
April	1.00	0.75	0.005
May	1.00	0.75	0.005
June	1.00	0.75	0.005
July	1.00	0.75	0.005
August	1.00	0.75	0.005
Sept.	1.00	0.75	0.005
October	1.00	0.75	0.005
November	1.00	0.75	0.005
December	1.00	0.75	0.000

Month	Total Beef Cattle Grazing Days	Total Dairy Cattle Grazing Days
January	31	23.25
February	28	21
March	31	23.25
April	30	22.5
May	31	23.25
June	30	22.5
July	31	23.25
August	31	23.25
Sept.	30	22.5
October	31	23.25
November	30	22.5
December	31	23.25
Total Grazing Days:	**365**	**273.75**

The total number of animals in the 9 subwatersheds are as follows.

Fecal contributions from these animals are used to derive loading estimates for all landuses except for Built-up.
The number input for Poultry should be "Chickens Sold" from tbl_lstock2.dbf divided by 7.

Agricultural Animals

SUBSHED	BEEF COWS	SWINE (HOGS)	DAIRY COWS	POULTRY	CATTLE	BEEF FOR RATIO	MILK FOR RATIO
Tangipahoa	4566	174	2553	573904	7119	2820	1577
Terry	734	23	381	88452	1115	455	236
Bala chitto	1761	79	1064	232293	2825	1087	657
TOTAL	7061	276	3998	894649	11059	4362	2470

Wildlife

The deer population is the only major wildlife source considered. The same deer density is assumed for all subwatersheds.

Deer/sq. mile	45
Deer/acre	.0703125

These data accessed from the following references are used in the remaining worksheets.

From ASAE

Animal	Total Manure prod (lb/day per 1,000 lb animal)	Typical Animal Mass (lb)	Manure prod per animal (lb/day)	Fecal Coliform (#/day E10 per 1,000 lb animal)	Fecal Coliform (#/day)	Manure prod (lb/yr)	Fecal Coliform (#/day)
Beef cow	40	794	32	13	1.03E+11	11587	5.71E+10
Dairy cow	86	1411	121	7.2	1.02E+11	44290	1.83E+11
Hog	84	134	11	8	1.08E+10	4123	1.08E+10
Sheep	40	60	2	20	1.19E+10	869	1.19E+10
Chicken	64	4	0	3.4	1.35E+08	93	1.35E+08
Broiler	85	2	0	3.4	6.75E+07	62	6.75E+07
Turkey	47	15	1	0.62	9.29E+07	257	9.29E+07
Duck	110	3	0	81	2.50E+09	124	2.50E+09

From Metcalf & Eddy

Estimated Fecal Coliform Production Rates by Animal

Animal	#/day	Reference	
Cow	5.40E+09	Metcalf & Eddy, 1991	pg. 101
Hog	8.90E+09	Metcalf & Eddy, 1991	
Sheep	1.80E+10	Metcalf & Eddy, 1991	
Chicken	2.40E+08	Metcalf & Eddy, 1991	
Turkey	1.30E+08	Metcalf & Eddy, 1991	
Duck	1.10E+10	Metcalf & Eddy, 1991	
Deer	5.00E+08	BPJ	
Geese	4.90E+10	LIRPB, 1982	

From: Horner, 1992

Fecal Coliform Loading Rates by Landuse

	median #/ha-y	#/acre/day
Road	1.80E+08	2.00E+05
Commercial	5.60E+09	6.21E+06
Single family low density	9.30E+09	1.03E+07
Single family high density	1.50E+10	1.66E+07
Multifamily residential	2.10E+10	2.33E+07

POINT SOURCES FOR EACH SUBWATERSHED (Point Sources\Loads)

	Cattle in Streams		Septic Tanks		Dischargers		Fresh Water	Total	
	Flow (cfs)	Fecal (#/hr)	Flow (cfs)	Fecal (#/hr)	Flow (cfs)	Fecal (#/hr)	Flow (cfs)	Flow (cfs)	Fecal (#/hr)
Tangipahoa	7.16E-06	2.73E+08	1.90E-01	1.93E+09	7.83E+00	2.14E+09	9.00E+00	1.70E+01	4.35E+09
Terry	1.13E-06	4.30E+07	2.67E-02	2.72E+08	0.00E+00	0.00E+00	3.00E+00	3.03E+00	3.15E+08
Bala chitto	2.83E-06	1.08E+08	8.26E-02	8.41E+08	0.00E+00	0.00E+00	3.00E+00	3.08E+00	9.49E+08

LANDUSE AREAS (for verification purposes only)

SUBSHED	CROP	FOREST	URBAN	PASTURE	TOTAL
Tangipahoa	3582	44906	3823	50061	**102372**
Terry	406	9495	0	8183	**18085**
Bala chitto	1832	15619	0	19591	**37043**
TOTAL	**5820**	**70020**	**3823**	**77835**	**157499**

SCENARIOS

Source	% Reduced*
Cattle Access	95
Septic Failure	50
Pastureland	27

Dischargers Effluent Concentration Level =
(enter concentration used for current run,
i.e. estimated for modeling period, maximum currently
permitted, maximum recommended permitted, etc…)

PASTURELAND AND CROPLAND - ACCUM (Data Editor\PERLND\PQAL\Monthly Input\MON-ACCUM)

Monthly Input - ACCUM

	Tangipahoa		Added	Terry		Bala chitto	
	Pasture	Cropland	Pasture	Pasture	Cropland	Pasture	Cropland
January	5.36E+08	3.52E+07	5.71E+08	5.17E+08	3.52E+07	5.41E+08	3.52E+07
February	5.36E+08	3.52E+07	5.71E+08	5.17E+08	3.52E+07	5.41E+08	3.52E+07
March	5.33E+08	3.52E+07	5.69E+08	5.14E+08	3.52E+07	5.38E+08	3.52E+07
April	1.23E+09	3.52E+07	1.26E+09	1.16E+09	3.52E+07	1.26E+09	3.52E+07
May	9.37E+08	3.52E+07	9.72E+08	8.91E+08	3.52E+07	9.59E+08	3.52E+07
June	9.51E+08	3.52E+07	9.86E+08	9.04E+08	3.52E+07	9.73E+08	3.52E+07
July	8.03E+08	3.52E+07	8.38E+08	7.66E+08	3.52E+07	8.19E+08	3.52E+07
August	6.68E+08	3.52E+07	7.03E+08	6.40E+08	3.52E+07	6.78E+08	3.52E+07
Sept	8.12E+08	3.52E+07	8.47E+08	7.74E+08	3.52E+07	8.28E+08	3.52E+07
October	1.07E+09	3.52E+07	1.11E+09	1.02E+09	3.52E+07	1.10E+09	3.52E+07
November	5.33E+08	3.52E+07	5.69E+08	5.14E+08	3.52E+07	5.38E+08	3.52E+07
December	5.36E+08	3.52E+07	5.71E+08	5.17E+08	3.52E+07	5.41E+08	3.52E+07

PASTURELAND AND CROPLAND - SQOLIM (Data Editor\PERLND\PQAL\Monthly Input\MON-SQOLIM)

Monthly Input - SQOLIM

	Tangipahoa		Added	Terry		Bala chitto	
	Pasture	Cropland	Pastureland	Pasture	Cropland	Pasture	Cropland
January	2.14E+09	1.41E+08	2.28E+09	2.07E+09	1.41E+08	2.16E+09	1.41E+08
February	2.14E+09	1.41E+08	2.28E+09	2.07E+09	1.41E+08	2.16E+09	1.41E+08
March	2.13E+09	1.41E+08	2.27E+09	2.06E+09	1.41E+08	2.15E+09	1.41E+08
April	4.92E+09	1.41E+08	5.06E+09	4.66E+09	1.41E+08	5.05E+09	1.41E+08
May	3.75E+09	1.41E+08	3.89E+09	3.57E+09	1.41E+08	3.84E+09	1.41E+08
June	3.80E+09	1.41E+08	3.94E+09	3.62E+09	1.41E+08	3.89E+09	1.41E+08
July	3.21E+09	1.41E+08	3.35E+09	3.06E+09	1.41E+08	3.27E+09	1.41E+08
August	2.67E+09	1.41E+08	2.81E+09	2.56E+09	1.41E+08	2.71E+09	1.41E+08
Sept	3.25E+09	1.41E+08	3.39E+09	3.10E+09	1.41E+08	3.31E+09	1.41E+08
October	4.29E+09	1.41E+08	4.43E+09	4.07E+09	1.41E+08	4.40E+09	1.41E+08
November	2.13E+09	1.41E+08	2.27E+09	2.06E+09	1.41E+08	2.15E+09	1.41E+08
December	2.14E+09	1.41E+08	2.28E+09	2.07E+09	1.41E+08	2.16E+09	1.41E+08

URBAN AND FOREST - ACQOP & SQOLIM (Data Editor\PERLND\PQAL\QUAL-INPUT\ACQOP & SQOLIM)

ACQOP for all months

	Urb & Bar	For & Wet
Tangipahoa	7.73E+06	3.52E+07
Terry	0.00E+00	3.52E+07
Bala chitto	0.00E+00	3.52E+07

SQOLIM for all months

	Urb & Bar	For & Wet
Tangipahoa	3.09E+07	1.41E+08
Terry	0.00E+00	1.41E+08
Bala chitto	0.00E+00	1.41E+08

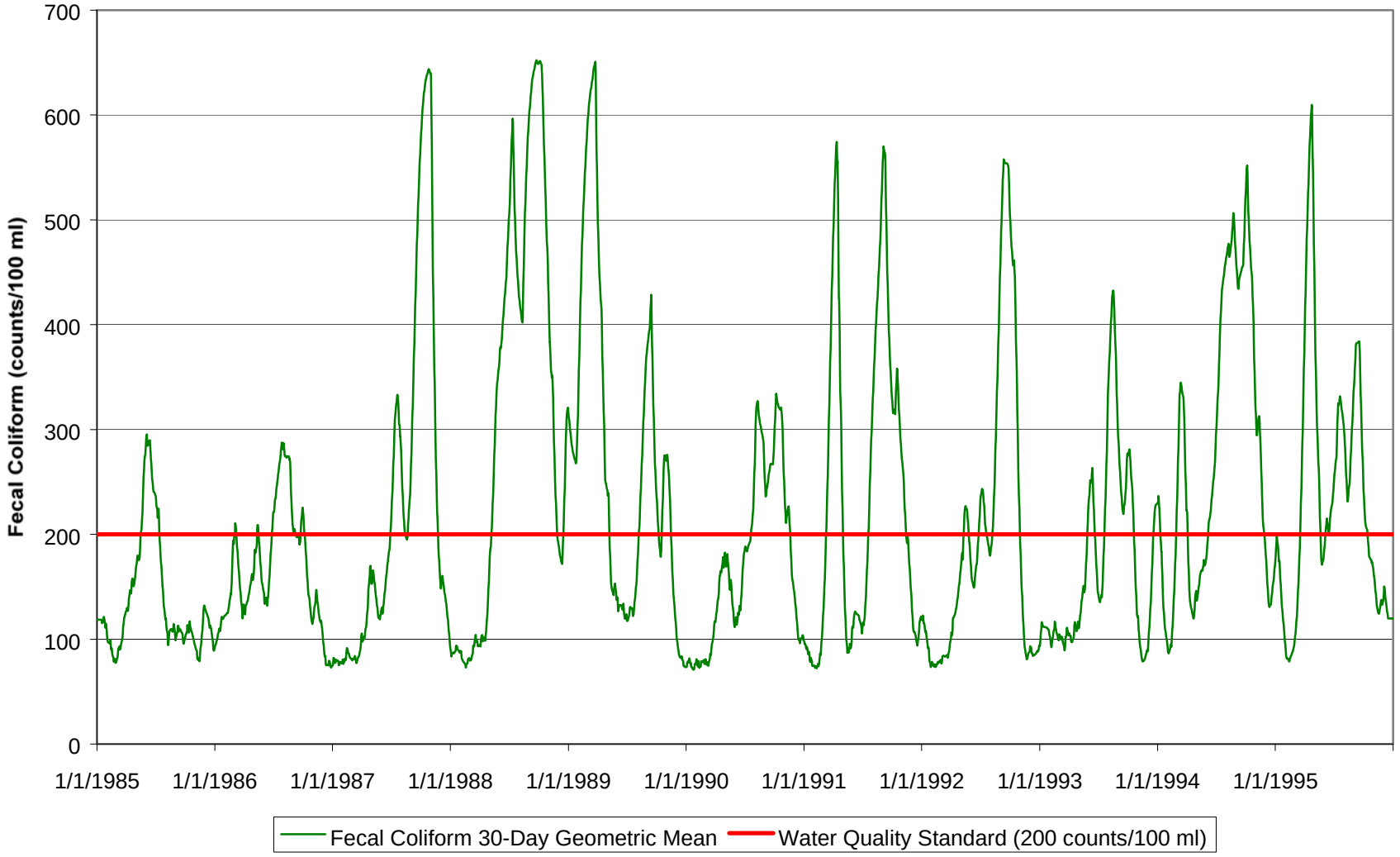
APPENDIX B

This appendix contains printouts of the various model run results. All fecal coliform graphs represent a 10-year time period, from January 1, 1986, to December 31, 1995. Graph B-1 shows the modeled fecal coliform 30-day geometric mean for the impaired segment with the current fecal coliform estimated loading. Graph B-2 shows the modeled fecal coliform 30-day geometric mean for the impaired segment with the reduction scenario estimated loading. Graphs B-3, B-4, B-5, and B-6 are similar to the previous graphs for the Bala Chitto Creek and Terrys Creek watersheds. Graph B-7 shows the computer generated fecal coliform loading with the NPDES facilities set at the winter limit of 2000 colony counts per 100 ml. Since the output stays well below the limit of 2000, then the seasonality of the model is accepted as adequate.

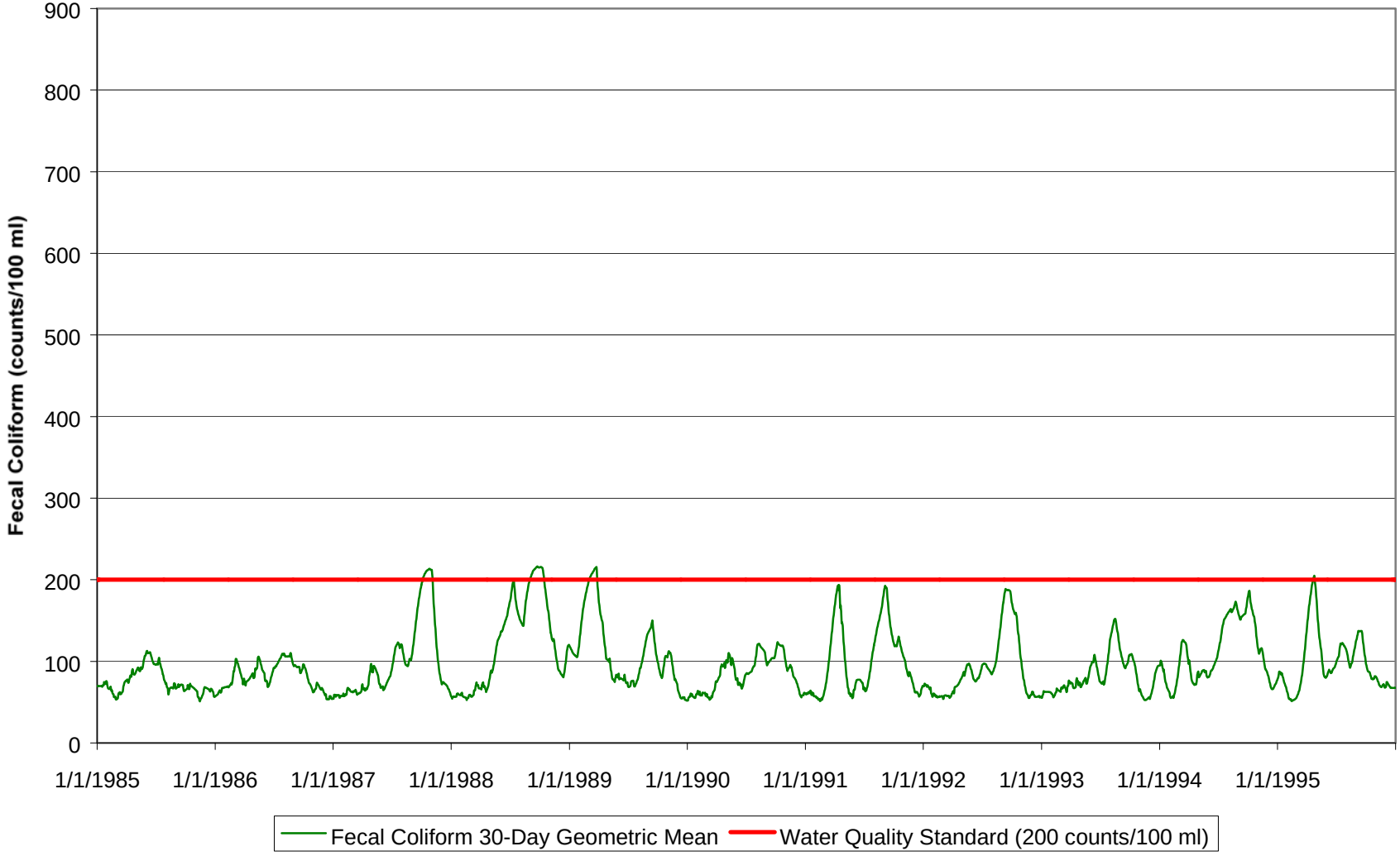
The TMDLs calculated in this report represent the maximum fecal coliform load that can be assimilated by the waterbody segment during the critical 30-day period that will maintain water quality standards. The calculations of these TMDLs are based on the critical hydrologic flow condition that occurred during the modeled time span. The graphs showing the 30-day geometric mean of instream fecal coliform concentrations representing the allocated loading scenario (Graph B2, B4 and B6) were used to identify the critical condition. The TMDL calculation includes the sum of the loads from all identified point and nonpoint sources applied or discharged within the modeled watershed.

An individual TMDL calculation was prepared for each waterbody segment and drainage area included in this report. The numerical values for the wasteload allocation (point sources) and load allocation (nonpoint sources) for each waterbody segment or drainage area can be found on the waterbody segment identification pages at the beginning of this report.

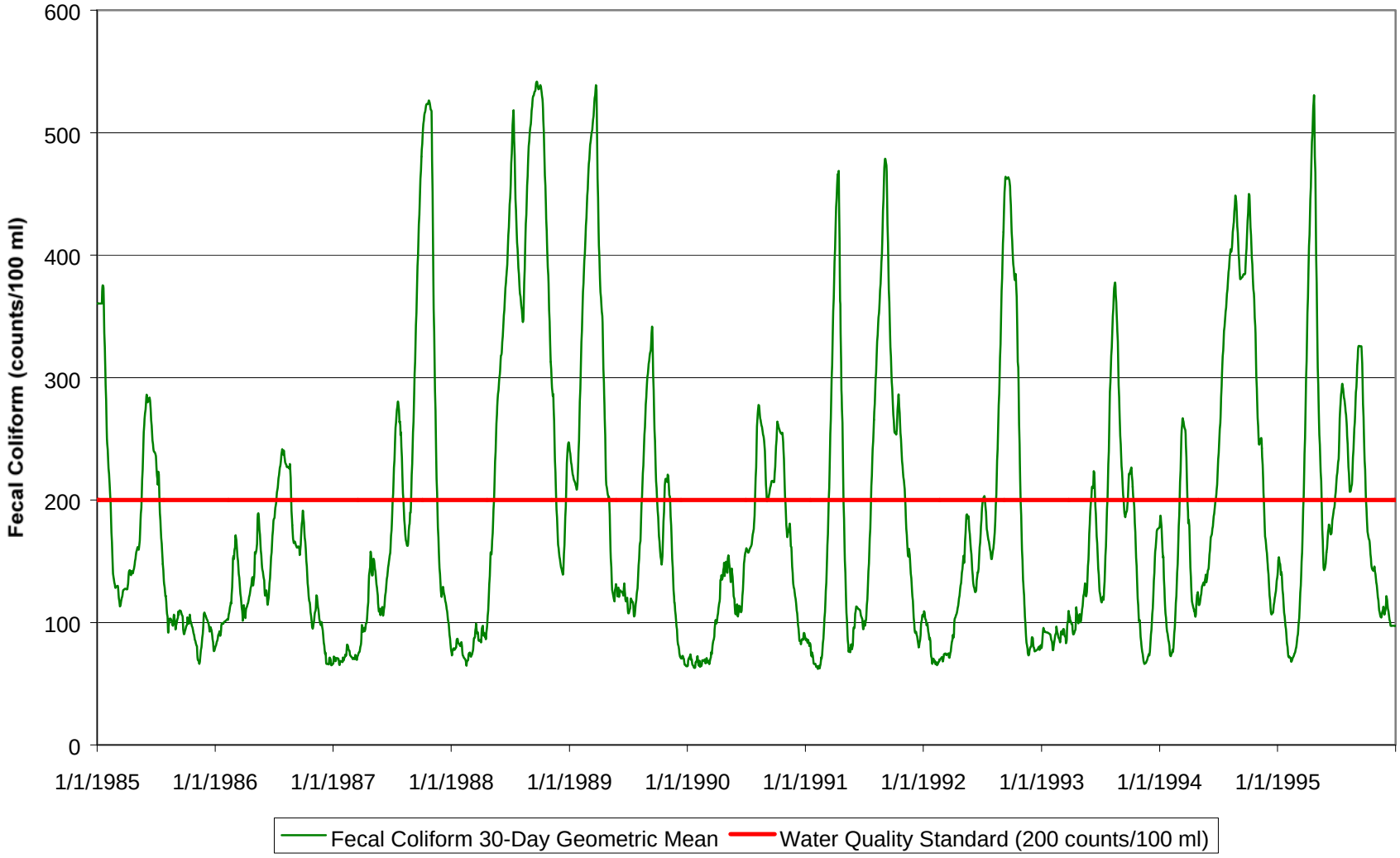
Graph B-1 Modeled Fecal Coliform Concentrations Under Existing Conditions for Tangipahoa River



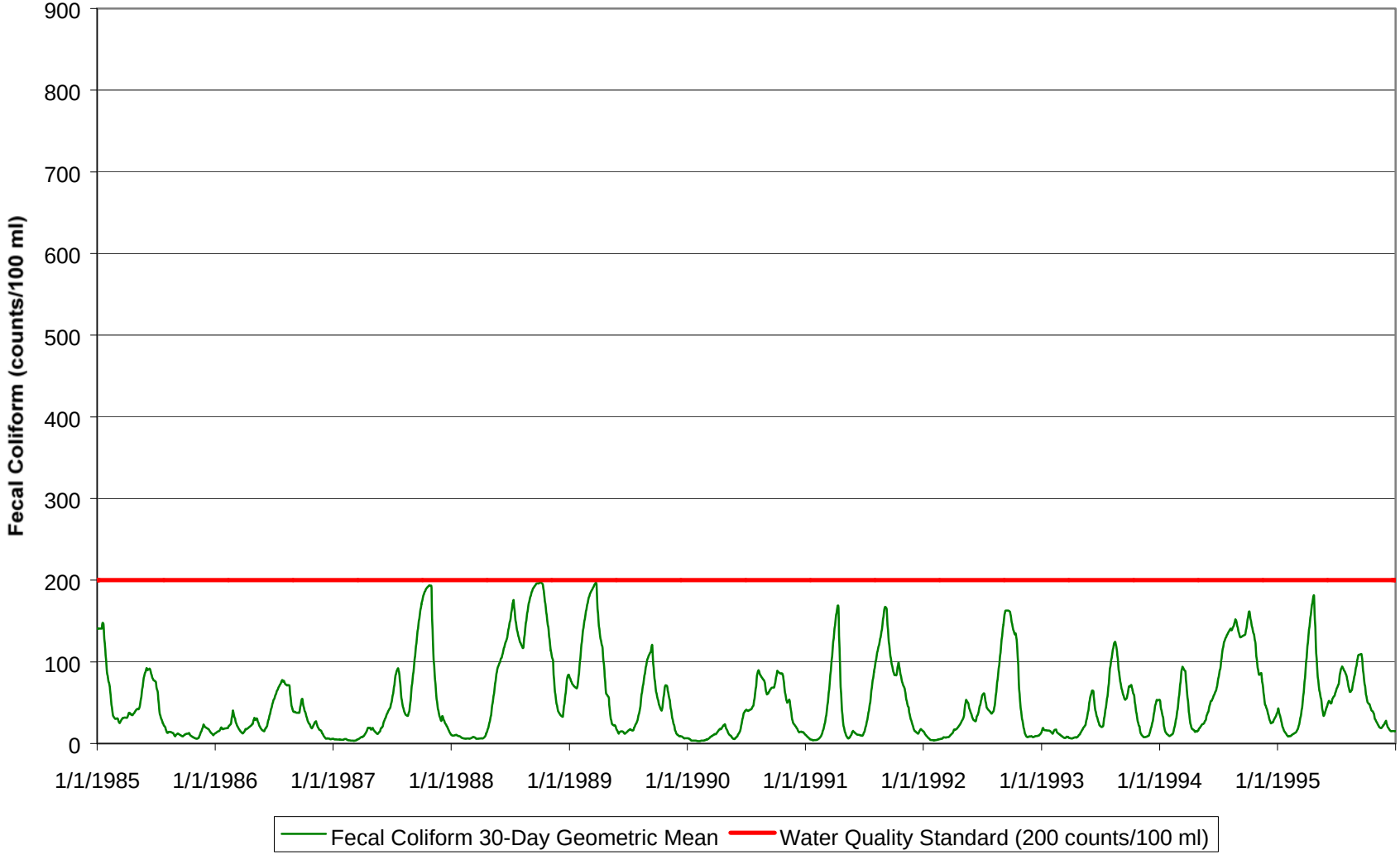
Graph B-2 Modeled Fecal Coliform Concentrations After Application of Reduction Scenario for Tangipahoa River



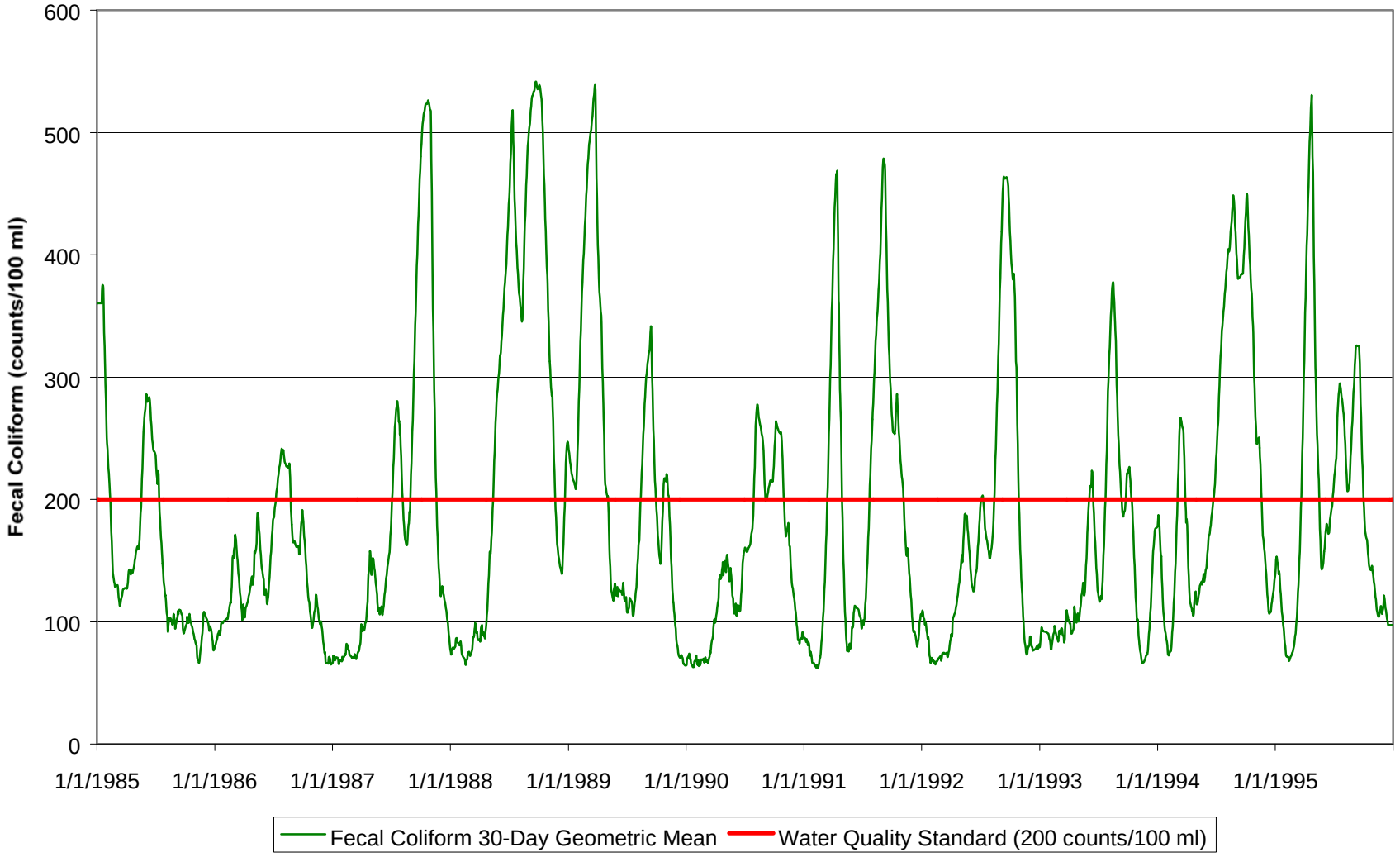
Graph B-3 Modeled Fecal Coliform Concentrations Under Existing Conditions for Bala Chitto Creek



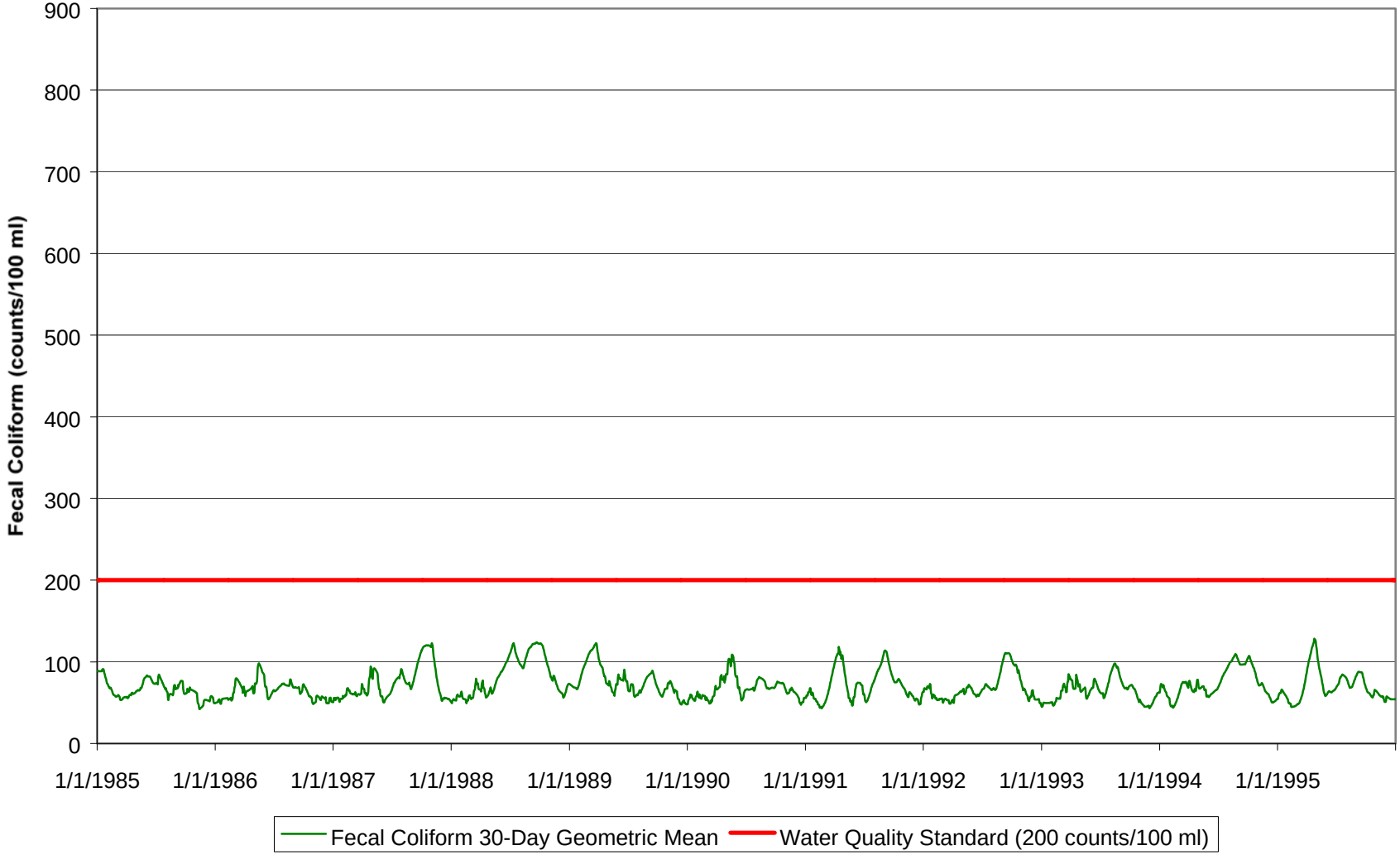
Graph B-4 Modeled Fecal Coliform Concentrations After Application of Reduction Scenario for Bala Chitto Creek



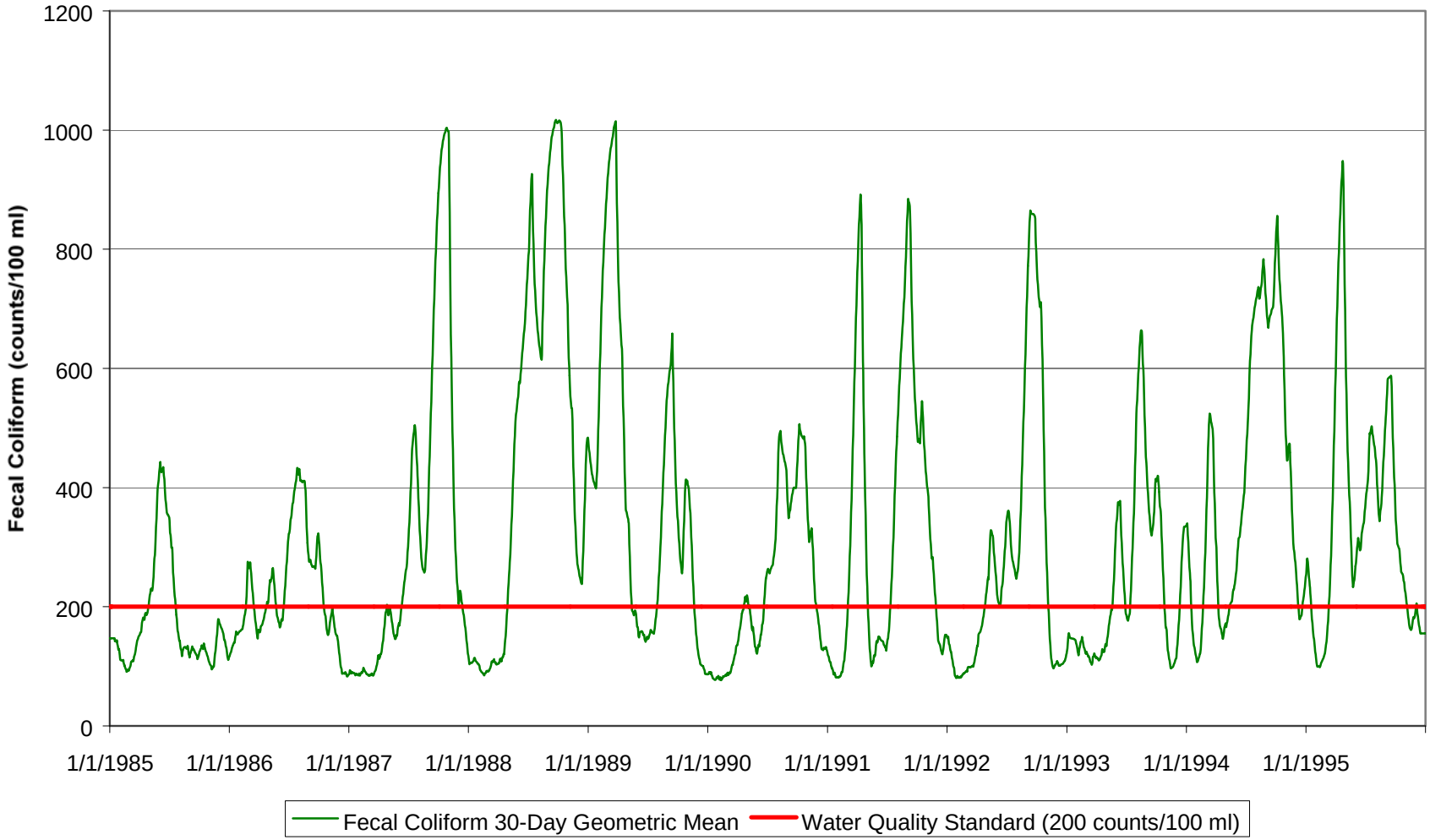
Graph B-5 Modeled Fecal Coliform Concentrations Under Existing Conditions for Terrys Creek



Graph B-6 Modeled Fecal Coliform Concentrations After Application of Reduction Scenario for Terrys Creek



Graph B-7 Modeled Fecal Coliform Concentrations Under Winter Limits for all NPDES Permitted Dischargers for Tangipahoa River



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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.

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.

Fecal coliform bacteria: a group of bacteria that normally live within the intestines of mammals, including humans. Fecal coliform bacteria are used as an indicator of the presence of pathogenic organisms in natural water.

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

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. The load allocation is the value assigned to the summation of all cattle and land applied fecal coliform that enter a receiving waterbody. It also contains a portion of the contribution from septic tanks.

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.

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.

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.

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.

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. It also contains a portion of the contribution from septic tanks

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.).

Watershed: the area of land draining into a stream at a given location.

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

LDEQ ..... Louisiana Department of Environmental Quality

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

RF(3) ..... Reach File 3

USGS ..... United States Geological Survey

WLA ..... Waste Load Allocation