

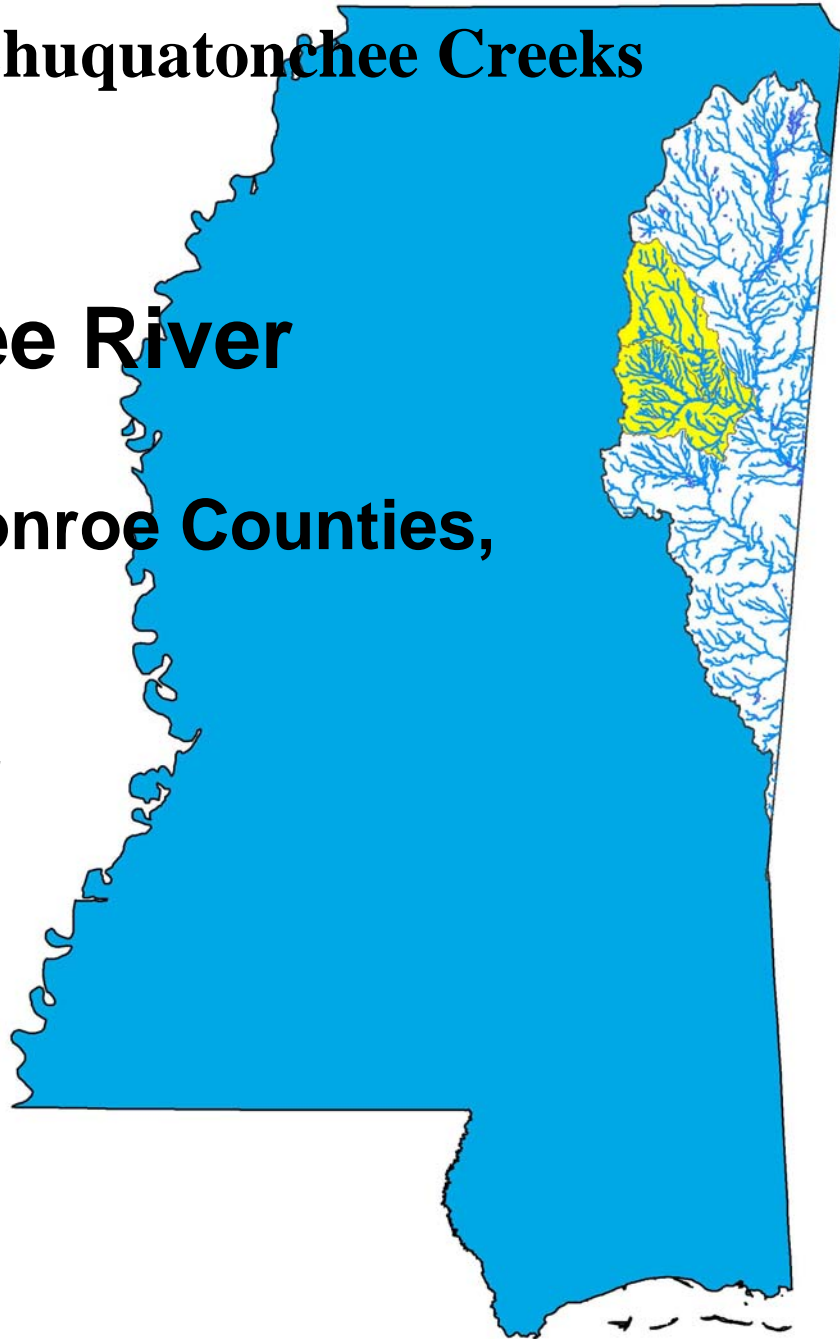
Total Maximum Daily Load Nutrients For Tibbee and Chuquatonchee Creeks

Tombigbee River Basin Clay and Monroe Counties, Mississippi

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 water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Water bodies. 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 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.

Conversion Factors

To convert from	To	Multiply by	To convert from	To	Multiply by
mile ²	acre	640	acre	ft ²	43560
km ²	acre	247.1	days	seconds	86400
m ³	ft ³	35.3	meters	feet	3.28
ft ³	gallons	7.48	ft ³	gallons	7.48
ft ³	liters	28.3	hectares	acres	2.47
cfs	gal/min	448.8	miles	meters	1609.3
cfs	MGD	0.646	tonnes	tons	1.1
m ³	gallons	264.2	µg/l * cfs	gm/day	2.45
m ³	liters	1000	µg/l * MGD	gm/day	3.79

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

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TMDL INFORMATION PAGE

Table 1. Listing Information

Name	ID	County	HUC	Cause	Monitored or Evaluated
Chuquatonchee Creek	MS022E	Monroe, Clay	03160104	Nutrients	Evaluated
Location: Near Siloam from confluence of Houlka Creek and Chuquatonchee River to mouth at Tibbee Creek					
Tibbee Creek	MSTIBBEE	Clay	03160104	Nutrients	Evaluated
Location: From Headwaters at confluence of Line and Chuquatonchee Creeks to the Tenn-Tom Waterway					

Table 2. Water Quality Standards

Parameter	Beneficial use	Water Quality Criteria
Nutrients	Aquatic Life Support	Waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

Table 3. Total Maximum Daily Load for Nutrients

Stream Name		WLA lbs/day	LA lbs/day	MOS	TMDL lbs/day
Chuquatonchee Creek	TN	140	2,487 – 2,925	Implicit	2,627 – 3,065
	TP	61	202 – 377	Implicit	263 – 438
Tibbee Creek	TN	698	4,970 – 5,914	Implicit	5,668 - 6,612
	TP	313	254 – 631	Implicit	567 – 944

Table 4. NPDES Permitted Facilities

Name	NPDES Permit	Watershed
Adams Trailer Park	MS0046281	Tibbee
Alexander High School	MS0038598	Tibbee
Atkinson Laundry and Carwash	MS0049239	Chuquatonchee
Boatman Trailer Park	MS0051446	Tibbee
Camp Tik A Witha	MS0029882	Chuquatonchee
Cantrells Personal Care Home	MS0046787	Tibbee
Community Counseling Services, Opportunity House	MS0049131	Chuquatonchee
Davis Meats Inc	MS0037788	Chuquatonchee
Houston POTW	MS0025071	Chuquatonchee
Josey Creek Missionary Baptist Church	MS0055727	Tibbee
New Houlka POTW, West	MS0025216	Chuquatonchee
Oktibbeha County Lake	MS0021717	Tibbee
Ridge Lakes Apartments	MS0054917	Tibbee
West Clay County School	MS0029459	Tibbee
West Point POTW, Lone Oak	MS0033740	Chuquatonchee
West Point POTW, West	MS0020788	Tibbee
Youngs Fish and Steak House	MS0045705	Chuquatonchee

EXECUTIVE SUMMARY

This TMDL has been developed for Tibbee and Chuquatonchee Creeks which were placed on the Mississippi 1996 Section 303(d) List of Impaired Water Bodies due to evaluated causes of pesticides, siltation, nutrients, and organic enrichment - low dissolved oxygen. MDEQ completed TMDLs for the pesticides and siltation causes. The nutrients and organic enrichment - low dissolved oxygen causes remained on the evaluated list. Recent monitoring was conducted and the organic enrichment - low dissolved oxygen causes have been delisted. This TMDL will provide an estimate of the total nitrogen (TN) and total phosphorus (TP) allowable in the stream.

Mississippi does not have water quality standards for allowable nutrient concentrations. MDEQ currently has a Nutrient Task Force (NTF) working on the development of criteria for nutrients. An annual concentration range of 0.6 to 0.7 mg/l is an applicable target for TN and 0.06 to 0.10 mg/l for TP for water bodies located in Ecoregion 65. MDEQ is presenting these ranges as preliminary target values for TMDL development which is subject to revision after the development of numeric nutrient criteria. The nutrient data and estimated ecoregion concentrations indicate reductions of nutrients are needed.

The Tibbee Creek Watershed contains the Chuquatonchee Creek Watershed and is the entire HUC 03160104 near West Point in Clay, Chickasaw, Lowndes, and Oktibbeha Counties. Tibbee Creek flows for 24 miles in a southeast direction from the confluence of Chuquatonchee and Line Creeks to the confluence with the Tenn-Tom Waterway. The Chuquatonchee Creek Watershed is located in HUC 03160104 near Siloam in Monroe and Clay Counties. The impaired segment of Chuquatonchee Creek flows for 15 miles in a southerly direction. Chuquatonchee Creek begins from intermittent headwaters in Chickasaw County and flows to the confluence with Tibbee Creek.

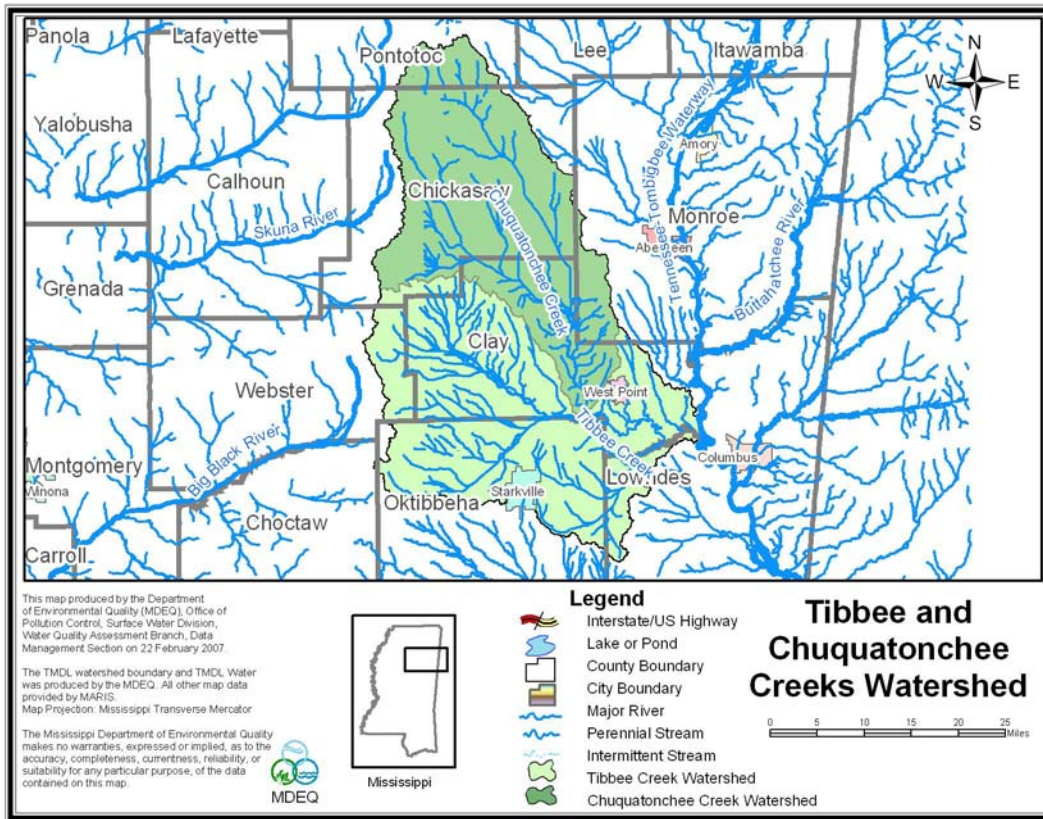


Figure 1. Tibbee and Chuquatonchee Creeks

INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies 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 water bodies through the establishment of pollutant specific allowable loads. This TMDL has been developed for the 2004 §303(d) listed segment shown in Figure 2.

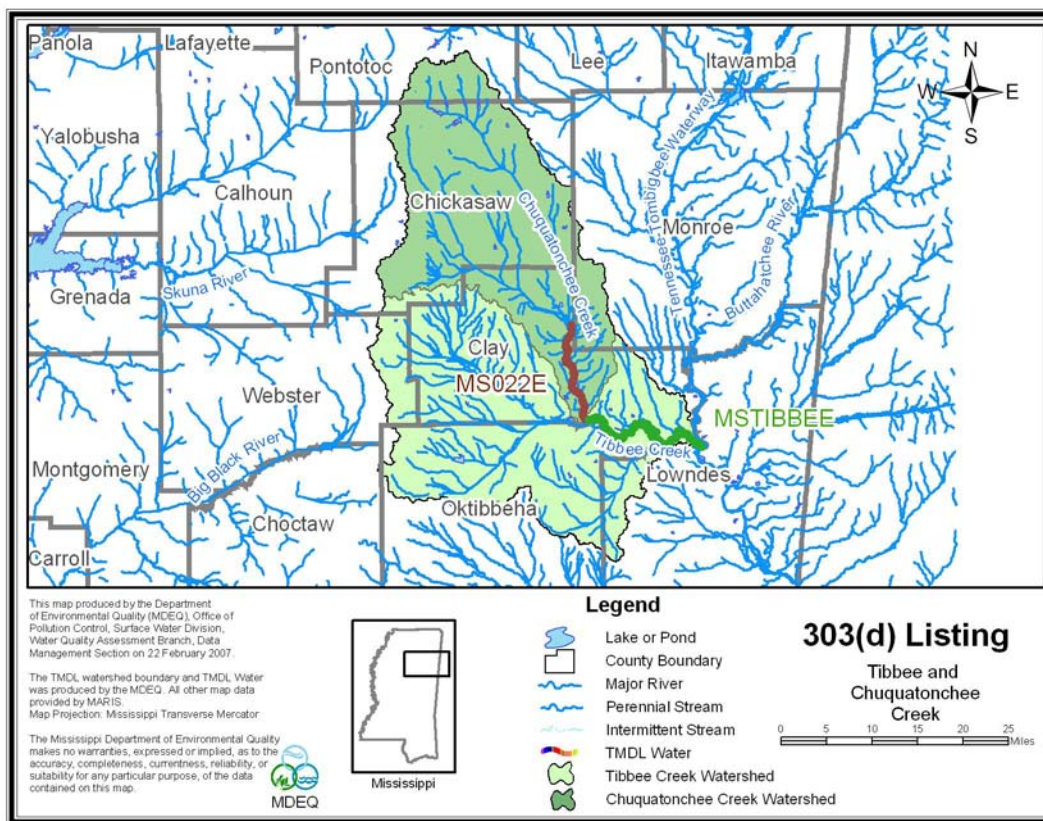


Figure 2. Tibbee and Chuquatonchee Creeks §303(d) Segments

The original listing for Chuquatonchee Creek was for the Spring Creek Drainage Area (MS022E). In 1998, MDEQ changed the practice of listing drainage areas. There were no monitoring data, so the streams remained on the evaluated portion of Mississippi’s §303(d) list.

1.2 Preliminary Nutrient Criteria

There are no state criteria in Mississippi for nutrients. These criteria are currently being developed by the Mississippi Nutrient Task Force in coordination with EPA Region 4. MDEQ proposed a work plan for nutrient criteria development that has been approved by EPA and is on

schedule according to the approved plan in development of nutrient criteria (MDEQ, 2004). Data were collected for wadeable streams to calculate the nutrient criteria.

For this TMDL, MDEQ is presenting preliminary target ranges for TN and TP. The limited data available are greater than these ranges for TN and TP. An annual concentration range of 0.6 to 0.7 mg/l is an applicable target for TN and 0.06 to 0.10 mg/l for TP for water bodies located in Ecoregion 65. However, MDEQ is presenting these ranges as preliminary target values for TMDL development which is subject to revision after the development of nutrient criteria, when the work of the NTF is complete.

1.3 Applicable Water Body Segment Use

The water use classifications are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2003). The designated beneficial use for the listed segments is fish and wildlife.

1.4 Applicable Water Body Segment Standard

The water quality standard applicable to the use of the water body and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2003).

Mississippi's current standards contain a narrative criteria that can be applied to nutrients which states "Waters shall be free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, taste, total suspended or dissolved solids, sediment, turbidity, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated use (MDEQ, 2002)." In the 1999 Protocol for Developing Nutrient TMDLs, EPA suggests several methods for the development of numeric criteria for nutrients (USEPA, 1999). In accordance with the 1999 Protocol, "The target value for the chosen indicator can be based on: comparison to similar but unimpaired waters; user surveys; empirical data summarized in classification systems; literature values; or professional judgment." MDEQ believes the most economical and scientifically defensible method for use in Mississippi is a comparison between similar but unimpaired waters within the same region. This method is dependent on adequate data which are being collected in accordance with the EPA approved plan. The initial phase of the data collection process for wadeable streams is complete.

1.5 Nutrient Target Development

Nutrient data were collected quarterly at 99 discrete sampling stations state wide where biological data already existed. These stations were identified and used to represent a range of stream reaches according to biological health status, geographic location (selected to account for ecoregion, bioregion, basin and geologic variability) and streams that potentially receive non-point source pollution from urban, agricultural, and silviculture lands as well as point source pollution from NPDES permitted facilities.

Nutrient concentration data were not normally distributed; therefore, data were log transformed for statistical analyses. Data were evaluated for distinct patterns of various data groupings (stratification) according to natural variability. Only stations that were characterized as “least disturbed” through a defined process in the M-BISQ process (M-BISQ 2003) or stations that resulted in a biological impairment rating of “fully attaining” were used to evaluate natural variability of the data set. Each of these two groups was evaluated separately (“least disturbed sites” and “fully attaining sites”). Some stations were used in both sets, in other words, they were considered “least disturbed” and “fully attaining”. The number of stations considered “least disturbed” was 30 of 99, and the number of stations considered “fully attaining” was 53 of 99.

Several analysis techniques were used to evaluate nutrient data. Graphical analyses were used as the primary evaluation tool. Specific analyses used included; scatter plots, box plots, Pearson’s correlation, and general descriptive statistics.

In general, natural nutrient variability was not apparent based on box plot analyses according to the 4 stratification scenarios. Bioregions were selected as the stratification scheme to use for TMDLs in the Pascagoula Basin. However, this was not appropriate for some water bodies in smaller bioregions. Therefore, MDEQ now uses ecoregions as a stratification scheme for the water bodies in the remainder of the state.

In order to use the data set to determine possible nutrient thresholds, nutrient concentrations were evaluated as to their correlation with biological metrics. That thorough evaluation was completed prior to the Pascagoula River Basin TMDLs. The methodology and approach were verified. The same methodology was applied to the subsequent bioregions and ecoregions.

For the preliminary target concentration range per each ecoregion, the 75th and 90th percentiles were derived from the mean nutrient value at each site found to be fully supporting of aquatic life support according to the M-BISQ scores. For the estimate of the existing concentrations the 50th percentile (median) was derived for station mean value at each of the sites that were not attaining and had nutrient concentrations greater than the target.

WATER BODY ASSESSMENT

2.1 Tibbee and Chuquatonchee Creeks Water Quality Data

Nutrient data for the Tibbee and Chuquatonchee Creeks Watershed were gathered and reviewed. The data are given in Table 5. Data exist for the §303(d)-listed segment of Tibbee Creek based on samples collected at ambient station #2440950 from 1996 to 2001. Additionally, in 2006, nutrient data were collected at two special study stations, #303DF62 on Tibbee Creek and #A0250007 on Chuquatonchee Creek. The locations of the water quality monitoring stations are shown in Figure 3.

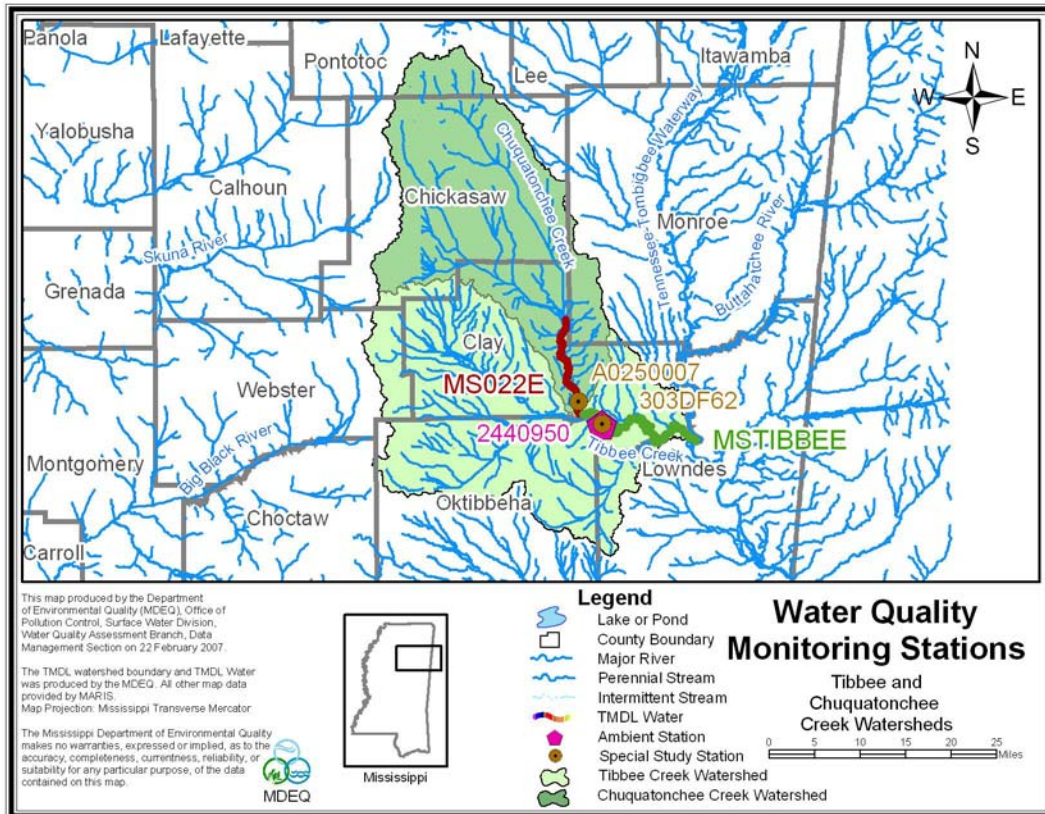


Figure 3. Tibbee and Chuquatonchee Creeks Water Quality Monitoring Stations

Table 5. Nutrient Data

Station ID	Program	Water Body	Date	Time	TP (mg/l)	TN(mg/l)
2440950	Ambient	Tibbee Creek	12/4/1996	13:30	0.27	0.87
			1/22/1997	9:30	0.10	0.60
			2/12/1997	8:45	0.14	0.22
			3/5/1997	11:00	0.13	0.89
			4/3/1997	13:30	0.05	0.49
			5/5/1997	12:00	0.11	1.49
			6/10/1997	11:40	0.17	0.82
			7/1/1997	12:30	0.30	1.11
			8/4/1997	12:15	0.12	0.79
			9/9/1997	12:15	0.03	0.45
			10/13/1997	12:30	0.07	0.60
			11/18/1997	11:50	0.07	0.54
			12/9/1997	12:05	0.08	0.41
			1/7/1998	12:15	0.25	1.78
			2/26/1998	11:55	0.16	0.78
			3/4/1998	11:30	0.13	0.50
			5/27/1998	10:30	0.09	0.80
			6/9/1998	11:35	0.11	0.75
			7/14/1998	12:10	0.46	2.20
			8/13/1998	12:30	0.92	2.92
			9/30/1998	8:30	0.09	0.86
			10/26/1998	11:35	0.11	1.26
			12/9/1998	10:06	0.13	0.34
			1/11/1999	11:30	0.16	0.77
			2/16/1999	11:31	0.10	0.76
			3/2/1999	12:30	0.16	0.92
			3/30/1999	11:30	0.06	0.44
			5/5/1999	11:20	0.31	0.77
			6/3/1999	12:00	0.10	0.55
			7/1/1999	12:50	0.13	0.87
			8/11/1999	12:00	0.08	0.82
			9/16/1999	11:15	0.10	1.34
			10/27/1999	10:30	0.13	0.58
			11/8/1999	13:00	0.06	0.70
			12/14/1999	12:20	0.09	0.46
			1/19/2000	13:10	0.09	0.56
			2/24/2000	12:25	0.12	0.82
			4/10/2000	11:15	0.17	0.85
			5/3/2000	9:10	0.08	0.62
			6/9/2000	14:20	0.20	1.49
7/13/2000	13:35	0.06	0.57			
11/28/2000	10:44	0.23	2.84			
11/28/2000	10:44	0.32	1.78			
4/10/2001	13:15	0.11	0.66			
5/21/2001	12:25	0.15	0.62			
6/20/2001	11:05	0.28	0.76			
7/18/2001	11:25	0.13	0.87			
9/18/2001	11:10	0.14	0.79			
10/22/2001	10:45	0.08	0.66			
11/6/2001	9:50	0.07	0.30			
12/11/2001	10:05	0.11	0.67			
Average					0.16	0.89

Table 5 cont. Nutrient Data

Station ID	Program	Water Body	Date	Time	TP (mg/l)	TN (mg/l)
A0250007	Special Study	Chuquatonchee Creek	9/7/2006	7:06	0.06	0.96
			9/18/2006	11:00	0.10	1.33
			9/27/2006	12:30	0.14	1.00
			Average		0.10	1.10
303DF62	Special Study	Tibbee Creek	9/6/2006	11:45	0.04	1.14
			9/18/2006	10:05	0.09	1.35
			9/27/2006	11:15	0.13	1.17
			Average		0.09	1.22

2.2 Assessment of Point Sources

An important step in assessing pollutant sources in the Tibbee and Chuquatonchee Creeks Watershed is locating the NPDES permitted sources. There are 18 facilities permitted to discharge organic material into the McCrary Creek watershed, Table 6. The effluent from the facilities was characterized based on all available data including information on its wastewater treatment system, permit limits, and discharge monitoring reports. Bryan Foods Inc., MS0001783, has shut down its facility which discharged into an unnamed tributary of Town Creek as of March 30, 2007. Bryan Foods Inc. is currently in negotiations with MDEQ to close out their NPDES permit. This facility was not included in the TMDL.

Table 6. NPDES Permitted Facilities

Name	NPDES Permit	Treatment Type	Permitted Discharge (MGD)	Watershed
Adams Trailer Park	MS0046281	aerobic treatment unit	0.001	Tibbee
Alexander High School	MS0038598	conventional lagoon	0.015	Tibbee
Atkinson Laundry and Carwash	MS0049239	septic tank and sand filter	0.002	Chuquatonchee
Boatman Trailer Park	MS0051446	activated sludge system	0.002	Tibbee
Camp Tik A Witha	MS0029882	septic tank and sand filter	0.001	Chuquatonchee
Cantrells Personal Care Home	MS0046787	aerated treatment unit	0.002	Tibbee
Community Counseling Services, Opportunity House	MS0049131	aerobic treatment unit	0.001	Chuquatonchee
Davis Meats Inc	MS0037788	septic tank into 2 lagoons	0.000	Chuquatonchee
Houston POTW	MS0025071	oxidation ditch and UV disinfection	0.990	Chuquatonchee
Josey Creek Missionary Baptist Church	MS0055727	aerated treatment unit	0.001	Tibbee
New Houlika POTW, West	MS0025216	conventional lagoon, disinfection	0.200	Chuquatonchee
Oktibbeha County Lake	MS0021717	conventional lagoon	0.008	Tibbee
Ridge Lakes Apartments	MS0054917	conventional lagoon, disinfection	0.096	Tibbee
West Clay County School	MS0029459	activated sludge system	0.012	Tibbee
West Point POTW, Lone Oak	MS0033740	aerated lagoon, disinfection	0.085	Chuquatonchee
West Point POTW, West	MS0020788	aerated lagoon, sand filtration	3.500	Tibbee
Youngs Fish and Steak House	MS0045705	conventional lagoon	0.003	Chuquatonchee

2.3 Assessment of Non-Point Sources

Non-point loading of nutrients and organic material in a water body results from the transport of the pollutants into receiving waters by overland surface runoff, groundwater infiltration, and atmospheric deposition. The two primary nutrients of concern are nitrogen and phosphorus. Total nitrogen is a combination of many forms of nitrogen found in the environment. Inorganic nitrogen can be transported in particulate and dissolved phases in surface runoff. Dissolved inorganic nitrogen can be transported in groundwater and may enter a stream from groundwater infiltration. Finally, atmospheric gaseous nitrogen may enter a stream from atmospheric deposition.

Unlike nitrogen, phosphorus is primarily transported in surface runoff when it has been sorbed by eroding sediment. Phosphorus may also be associated with fine-grained particulate matter in the atmosphere and can enter streams as a result of dry fallout and rainfall (USEPA, 1999). However, phosphorus is typically not readily available from the atmosphere or the natural water supply (Davis and Cornwell, 1988). As a result, phosphorus is typically the limiting nutrient in most non-point source dominated rivers and streams, with the exception of watersheds which are dominated by agriculture and have high concentrations of phosphorus contained in the surface runoff due to fertilizers and animal excrement or watersheds with naturally occurring soils which are rich in phosphorus (Thomann and Mueller, 1987).

Watersheds with a large number of failing septic tanks may also deliver significant loadings of phosphorus to a stream. All domestic wastewater contains phosphorus which comes from humans and the use of phosphate containing detergents. Table 7 presents typical nutrient loading ranges for various land uses.

Table 7. Nutrient Loadings for Various Land Uses

Landuse	Total Phosphorus [lb/acre-y]			Total Nitrogen [lb/acre-y]		
	Minimum	Maximum	Median	Minimum	Maximum	Median
Roadway	0.53	1.34	0.98	1.2	3.1	2.1
Commercial	0.61	0.81	0.71	1.4	7.8	4.6
Single Family-Low Density	0.41	0.57	0.49	2.9	4.2	3.6
Single Family-High Density	0.48	0.68	0.58	3.6	5.0	5.2
Multifamily Residential	0.53	0.72	0.62	4.2	5.9	5.0
Forest	0.09	0.12	0.10	1.0	2.5	1.8
Grass	0.01	0.22	0.12	1.1	6.3	3.7
Pasture	0.01	0.22	0.12	1.1	6.3	3.7

Source: Horner et al., 1994 in Protocol for Developing Nutrient TMDLs (USEPA 1999)

The drainage area of Chuquatonchee Creek is approximately 517 square miles and the drainage area of Tibbee Creek is approximately 1,117. The watershed contains many different landuse types, including forest, cropland, pasture, water, and wetlands. The landuse information given below is based on data collected by the State of Mississippi's Automated Resource Information System (MARIS) 1997. This data set is based on Landsat Thematic Mapper digital images taken between 1992 and 1993. Forest and pasture are the dominant landuses within this watershed. The landuse distribution for Tibbee and Chuquatonchee Creeks is shown in Table 8 and Figure 4.

Table 8. Landuse Distribution

In Acres	Urban	Forest	Cropland	Pasture	Scrub/Barren	Water	Wetlands
Tibbee Creek	4,915	193,170	57,090	234,687	161,977	5,357	55,692
Percentage	1	27	8	33	22	1	8
Chuquatonchee Creek	1,655	81,616	43,327	118,617	61,674	1,531	20,548
Percentage	1	25	13	36	19	0	6

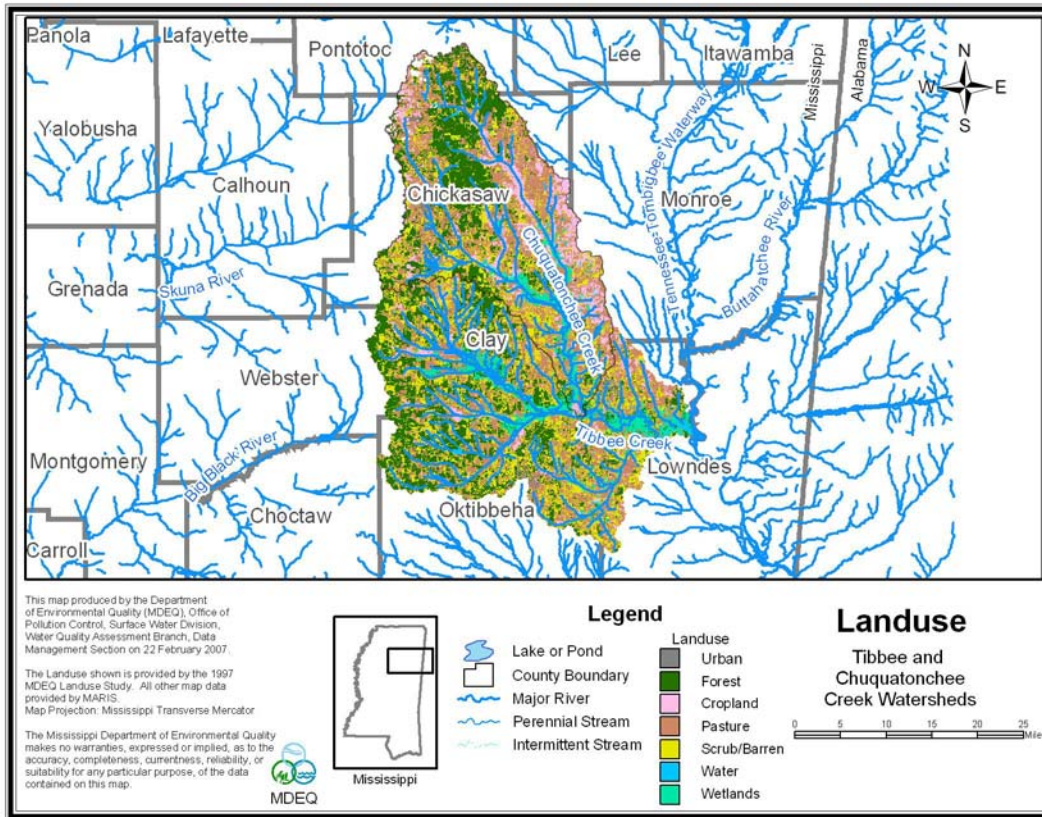


Figure 4. Landuse

2.4 Estimated Existing Load for Total Nitrogen

The estimated existing total nitrogen concentration is based on the median total nitrogen concentrations measured in wadeable streams in Ecoregion 65 with impaired biology and elevated nutrients, which is 1.38 mg/l. The concentration found in Tibbee Creek during the ambient monitoring is generally below this level, with an average of 0.89 mg/l. The special study total nitrogen data has averages of 1.22 mg/l for Tibbee Creek and 1.10 mg/l for Chuquatonchee Creek. The targeted reductions for both Tibbee and Chuquatonchee Creeks will be based on the estimated total nitrogen level for impaired streams in Ecoregion 65.

To convert the estimated existing total nitrogen concentration to a total nitrogen load, the average annual flow for Tibbee and Chuquatonchee Creeks was estimated based on USGS monitoring station 02440500 on Chuquatonchee Creek near West Point, Mississippi. The annual average flow for Chuquatonchee Creek at the USGS gage is 791 cfs, with a drainage area of 505 square miles. To estimate the amount of flow in Tibbee and Chuquatonchee Creeks, a drainage *Tombigbee River Basin*

area ratio for the 02440500 gage watershed was calculated (791 cfs / 505 square miles = 1.57 cfs/square mile). The ratio was then multiplied by the drainage areas in square miles of the impaired segments. Thus, the annual average flow in Tibbee Creek is estimated as 1754.2 cfs and Chuquatonchee Creek is estimated as 811.7 cfs. The existing TN load was then calculated, using Equation 1 and is shown in Table 9.

Nutrient Load (lb/day) = Flow (cfs) * 5.394 (conversion factor)* Nutrient Concentration (mg/L)
(Eq. 1)

Table 9. Estimated Existing Total Nitrogen Load

Stream	Area (sq miles)	Average Annual Flow (cfs)	TN (mg/l)	TN (lbs/day)
Chuquatonchee Creek	517	811.7	1.38	6,042
Tibbee Creek	1,117	1,751.2	1.38	13,035

The TN point source load for Tibbee Creek is estimated to be 490 lbs/day and the TN point source load for Chuquatonchee Creek is estimated to be 140 lbs/day, Table 10. The annual average total load based on the estimated total nitrogen concentration of 1.38 mg/l and an annual average flow of 1751.2 cfs for Tibbee Creek is 13,035 lbs/day. For Tibbee Creek, the point source load is 3.8% of the total load. Therefore, 96.2% of the estimated existing TN load in Tibbee Creek is from non-point sources. For Chuquatonchee Creek, the annual average total load based on the estimated total nitrogen concentration of 1.38 mg/l and an annual average flow of 811.7 cfs is 6,042 lbs/day; the point source load is 140lbs/day or 2.7% of the total load. Therefore, 97.3% of the estimated existing TN load in Chuquatonchee Creek is from non-point sources.

Table 10. NPDES Permitted Facilities Treatment Types with Nitrogen Estimates

Facility Name	NPDES	Treatment Type	Permitted Discharge (MGD)	TN concentration estimate (mg/l)	TN Load estimate (lbs/day)
Adams Trailer Park	MS0046281	aerobic treatment unit	0.001	13.6	0.11
Alexander High School	MS0038598	conventional lagoon	0.015	11.5	1.44
Atkinson Laundry and Carwash	MS0049239	septic tank and sand filter	0.002	11.5	0.21
Boatman Trailer Park	MS0051446	activated sludge system	0.002	13.6	0.17
Camp Tik A Witha	MS0029882	septic tank and sand filter	0.001	11.5	0.10
Cantrells Personal Care Home	MS0046787	aerated treatment unit	0.002	13.6	0.17
Community Counseling Services, Opportunity House	MS0049131	aerobic treatment unit	0.001	13.6	0.11
Davis Meats Inc	MS0037788	septic tank into 2 lagoons	0.000	11.5	0.00
Houston POTW	MS0025071	oxidation ditch and UV disinfection	0.990	13.6	112.35
Josey Creek Missionary Baptist Church	MS0055727	aerated treatment unit	0.001	13.6	0.11
New Houlika POTW, West	MS0025216	conventional lagoon, disinfection	0.200	11.5	19.19
Oktibbeha County Lake	MS0021717	conventional lagoon	0.008	11.5	0.72
Ridge Lakes Apartments	MS0054917	conventional lagoon, disinfection	0.096	11.5	9.21
West Clay County School	MS0029459	activated sludge system	0.012	13.6	1.36
West Point POTW, Lone Oak	MS0033740	aerated lagoon, disinfection	0.085	11.5	8.16
West Point POTW, West	MS0020788	aerated lagoon, sand filtration	3.500	11.5	335.87
Youngs Fish and Steak House	MS0045705	conventional lagoon	0.003	11.5	0.24

2.5 Estimated Existing Load for Total Phosphorus

The estimated existing total phosphorous concentration is based on the median total phosphorous concentrations measured in wadeable streams in Ecoregion 65 with impaired biology and elevated nutrients, which is 0.18 mg/l. The concentration found in Tibbee Creek during the ambient monitoring is generally below this level, with an average of 0.16 mg/l. The special study total nitrogen data has averages of 0.09 mg/l for Tibbee Creek and 0.10 mg/l for Chuquatonchee Creek. The targeted reductions for both Tibbee and Chuquatonchee Creeks will be based on the estimated total phosphorous level for impaired streams in Ecoregion 65.

To convert the estimated existing total phosphorus concentration to a total phosphorus load, the average annual flow for Tibbee and Chuquatonchee Creeks was estimated based on USGS *Tombigbee River Basin*

monitoring station 02440500 on Chuquatonchee Creek near West Point, Mississippi. As previously described, the annual average flow in Tibbee Creek is estimated as 1754.2 cfs and Chuquatonchee Creek is estimated as 811.7 cfs. The existing TP load was then calculated, using Equation 1 and shown in Table 11.

Table 11. Estimated Existing Total Phosphorus Load

Stream	Area (sq miles)	Average Annual Flow (cfs)	TP (mg/l)	TP (lbs/day)
Chuquatonchee Creek	517	811.7	0.18	788
Tibbee Creek	1,117	1,751.2	0.18	1,700

The TP point source load for Tibbee Creek is estimated to be 218 lbs/day and the TP point source load for Chuquatonchee Creek is estimated to be 61 lbs/day, Table 12. The annual average total load based on the average total phosphorous concentration of 0.18 mg/l and an annual average flow of 1751.2 cfs for Tibbee Creek is 1,700 lbs/day. For Tibbee Creek, the point source load is 12.8% of the total load. Therefore, 87.2% of the estimated existing TP load in Tibbee Creek is from non-point sources. For Chuquatonchee Creek, the annual average total load based on the average total phosphorous concentration of 0.18 mg/l and an annual average flow of 811.7 cfs is 788 lbs/day; the point source load is 61 lbs/day or 7.7% of the total load. Therefore, 92.3% of the estimated existing TP load in Chuquatonchee Creek is from non-point sources.

Table 12. NPDES Permitted Facilities Treatment Types with Phosphorus Estimates

Facility Name	NPDES	Treatment Type	Permitted Discharge (MGD)	TP concentration estimate (mg/l)	TP Load estimate (lbs/day)
Adams Trailer Park	MS0046281	aerobic treatment unit	0.001	5.8	0.05
Alexander High School	MS0038598	conventional lagoon	0.015	5.2	0.65
Atkinson Laundry and Carwash	MS0049239	septic tank and sand filter	0.002	5.2	0.10
Boatman Trailer Park	MS0051446	activated sludge system	0.002	5.8	0.07
Camp Tik A Witha	MS0029882	septic tank and sand filter	0.001	5.2	0.04
Cantrells Personal Care Home	MS0046787	aerated treatment unit	0.002	5.8	0.07
Community Counseling Services, Opportunity House	MS0049131	aerobic treatment unit	0.001	5.8	0.05
Davis Meats Inc	MS0037788	septic tank into 2 lagoons	0.000	5.2	0.00
Houston POTW	MS0025071	oxidation ditch and UV disinfection	0.990	5.8	47.91
Josey Creek Missionary Baptist Church	MS0055727	aerated treatment unit	0.001	5.8	0.05
New Houlka POTW, West	MS0025216	conventional lagoon, disinfection	0.200	5.2	8.68
Oktibbeha County Lake	MS0021717	conventional lagoon	0.008	5.2	0.33
Ridge Lakes Apartments	MS0054917	conventional lagoon, disinfection	0.096	5.2	4.17
West Clay County School	MS0029459	activated sludge system	0.012	5.8	0.58
West Point POTW, Lone Oak	MS0033740	aerated lagoon, disinfection	0.085	5.2	3.69
West Point POTW, West	MS0020788	aerated lagoon, sand filtration	3.500	5.2	151.87
Youngs Fish and Steak House	MS0045705	conventional lagoon	0.003	5.2	0.11

ALLOCATION

The allocation for this TMDL involves a wasteload allocation and a load allocation for non-point sources necessary for attainment of water quality standards in Tibbee and Chuquatonchee Creeks. The nutrient portion of this TMDL is addressed through initial estimates of the existing and target TN and TP concentrations.

3.1 Wasteload Allocation

There are currently 18 NPDES permits issued for the Tibbee and Chuquatonchee Creeks Watershed. Although this wasteload allocation is based on the current conditions of Tibbee and Chuquatonchee Creeks, it is not intended to prevent the issuance of permits for future facilities. Future permits will be considered in accordance with Mississippi's *Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification*.

The NPDES permitted facilities are included in the wasteload allocation, Table 13. Table 13 gives the estimated load of TN and TP from the point sources as described in Section 2.4 and Section 2.5. As discussed in Section 2.2, Bryan Foods Inc. has recently shut down its facility in this watershed. This has resulted in an estimated 30% reduction in the point source load of TP and TN in the watershed. Because these water bodies are on the evaluated list, the majority of the loading in the watershed is due to nonpoint sources, and the nutrient estimates from point sources are based on literature values, this TMDL does not recommend further reduction to point sources at this time. However, MDEQ is recommending quarterly nutrient monitoring for these facilities.

Table 13. Nutrient Wasteload Allocation

Facility Name	Existing Estimated TN Point Source Load (lbs/day)	Allocated Average TN Point Source Load (lbs/day)	Existing Estimated TP Point Source Load (lbs/day)	Allocated Average TP Point Source Load (lbs/day)	Percent Reduction
Adams Trailer Park	0.11	0.11	0.05	0.05	0
Alexander High School	1.44	1.44	0.65	0.65	0
Atkinson Laundry and Carwash	0.21	0.21	0.10	0.10	0
Boatman Trailer Park	0.17	0.17	0.07	0.07	0
Camp Tik A Witha	0.10	0.10	0.04	0.04	0
Cantrells Personal Care Home	0.17	0.17	0.07	0.07	0
Community Counseling Services, Opportunity House	0.11	0.11	0.05	0.05	0
Davis Meats Inc	0.00	0.00	0.00	0.00	0
Houston POTW	112.35	112.35	47.91	47.91	0
Josey Creek Missionary Baptist Church	0.11	0.11	0.05	0.05	0
New Houlika POTW, West	19.19	19.19	8.68	8.68	0
Oktibbeha County Lake	0.72	0.72	0.33	0.33	0
Ridge Lakes Apartments	9.21	9.21	4.17	4.17	0
West Clay County School	1.36	1.36	0.58	0.58	0
West Point POTW, Lone Oak	8.16	8.16	3.69	3.69	0
West Point POTW, West	335.87	335.87	151.87	151.87	0
Youngs Fish and Steak House	0.24	0.24	0.11	0.11	0

3.2 Load Allocation

Best management practices (BMPs) are recommended in this watershed to reduce potential TN and TP loads from non-point sources. This watershed should be considered a priority for riparian buffer zone restoration and nutrient reduction BMPs. For land disturbing activities related to silviculture, construction, and agriculture, it is recommended that practices, as outlined in “Mississippi’s BMPs: Best Management Practices for Forestry in Mississippi” (MFC, 2000), “Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater” (MDEQ, et. al, 1994), and “Field Office Technical Guide” (NRCS, 2000), be followed, respectively.

3.3 Incorporation of a Margin of Safety

The margin of safety is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving water body. 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 TMDL is implicit.

3.4 Calculation of the TMDL

Equation 1 was used to calculate the TMDL for TN and TP. The target concentration was used with the average flow for the watershed to determine the TMDL. The TMDL was then

compared to the estimated existing load previously calculated. The estimated existing total nitrogen concentration indicates needed reductions of 49% to 56%. The estimated existing total phosphorous concentration indicates needed reductions of 44% to 67%.

Table 14. TN and TP Total Maximum Daily Load

Stream	TN Concentration (mg/l)	TN Load (lbs/day)	TP Concentration (mg/l)	TP Load (lbs/day)
Chuquatonchee Creek	0.6 – 0.7	2,627 – 3,065	0.06 – 0.10	263 – 438
Tibbee Creek	0.6 – 0.7	5,668 – 6,612	0.06 – 0.10	567 – 944

3.5 Seasonality and Critical Condition

This TMDL accounts for seasonal variability by requiring allocations that ensure year-round protection of water quality standards, including during critical conditions.

CONCLUSION

Nutrients were addressed through an estimate of a preliminary total phosphorous concentration target range and a preliminary total nitrogen concentration target range. Based on the estimated existing and target total nitrogen concentrations, this TMDL recommends a 49% - 56% reduction of the nitrogen loads entering these streams to meet the preliminary target range of 0.6 to 0.7 mg/l. Based on the estimated existing and target total phosphorous concentrations, this TMDL recommends a 44% - 67% reduction of the phosphorous loads entering these streams to meet the preliminary target range of 0.06 to 0.10 mg/l. Because only between 2.3% and 12.8% of the existing TN and TP loads for Tibbee and Chuquatonchee Creeks are estimated to be due to point sources, these water bodies are on the evaluated list, and the nutrient estimates for point sources are based on literature values, this TMDL does not recommend percent reductions from the NPDES permits. Additionally, with the closing of the Bryan Foods Inc. facility, there has been a recent 30% reduction in the point source loads of nutrients in the watershed. It is recommended that the Tibbee and Chuquatonchee Creeks Watershed be considered as a priority watershed for riparian buffer zone restoration and any nutrient reduction BMPs. The implementation of these BMP activities should reduce the nutrient load entering the creeks. This will provide improved water quality for the support of aquatic life in the water bodies and will result in the attainment of the applicable water quality standards.

4.1 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. The public will be given an opportunity to review the TMDLs and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. Anyone wishing to become a member of the TMDL mailing list should contact Kay Whittington at Kay_Whittington@deq.state.ms.us.

All comments should be directed to Kay Whittington at Kay_Whittington@deq.state.ms.us or Kay Whittington, MDEQ, PO Box 10385, Jackson, MS 39289. All comments received during the public notice period and at any public hearings become a part of the record of this TMDL and will be considered in the submission of this TMDL to EPA Region 4 for final approval.

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