FINAL REPORT
JUNE 2007
ID: 107062601

Total Maximum Daily Load

Impairment Due to Nitrogen Pollution and Phosphorus Pollution

for

Indian Creek and Jack Lake Creek

Big Black River Basin
Holmes County, 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	:	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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ID	Name	County	Cause	HUC	Mon/Eval
MS422IE	Indian Creek	Holmes	Nutrients	08060201	Evaluated
Near Goodman from Headwaters to Mouth at Big Black River					
MS422JE	Jack Lake Creek	Holmes	Nutrients	08060201	Monitored
Near Goodman from Headwaters to Mouth at Box Creek					

Table ii. Water Quality Standard

Parameter	Beneficial use	Narrative Water Quality Criteria
Nutrients	Aquatic Life Support	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, 2003)."

Table iii. Total Maximum Daily Load

Water Body Name	Nutrient	WLA (lbs/day)	LA (lbs/day)	MOS	TMDL* (lbs/day)
Indian Creek	TP	0.0	4.63-7.72	implicit	4.63-7.72
	TN	0.0	46.31-54.03	implicit	46.31-54.03
Jack Lake Creek	TP	0.0	14.92-24.87	implicit	14.92-24.87
	TN	0.0	149.23-174.10	implicit	149.23-174.10

*Note: The maximum daily load for each nutrient is based on the target concentrations for TP and TN in Ecoregion 65

EXECUTIVE SUMMARY

This TMDL report has been developed for Indian Creek and Jack Lake Creek. These water bodies are part of the Durant Drainage Area (DA), which was placed on the Mississippi 1996 Section 303(d) List of Impaired Water Bodies due to evaluated causes of impairment for nutrients, pesticides, and sediment. In 2004, MDEQ replaced the Durant DA with three water bodies—Howard Creek, Jack Lake Creek, and Indian Creek. MDEQ delisted Howard Creek in 2004 as monitoring data indicated that water quality standards were being attained. This TMDL report addresses the nutrient impairment for the remaining two water bodies in the Durant DA. Separate TMDL reports will address the sediment and pesticide listings for Jack Lake Creek and Indian Creek. Indian Creek is an evaluated water body and Jack Lake Creek is a monitored water body. An evaluated category indicates that the water body was listed based on anecdotal information and no additional monitoring data are available. For the monitored water body, biological monitoring was completed on Jack Lake Creek, which indicated biological impairment. However, MDEQ was unable to complete a stressor identification study on this water body, which means that the causes of biological impairment have not been determined. Therefore, in order to meet the terms of the Mississippi Consent Decree, the original impairment of nutrients for the Durant DA will be addressed in this TMDL.

This TMDL addresses nutrient pollution and will provide an estimate of the total nitrogen (TN) and total phosphorus (TP) 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 by the NTF.

The water bodies included in this TMDL are located within United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 08060201. HUC 08060201 is located in Webster, Choctaw, Montgomery, Carroll, Attala, and Holmes counties.

1.0 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 report has been developed for the 2006 §303(d) listed segment shown in Figure 3.

This TMDL report has been developed for Indian Creek and Jack Lake Creek. These water bodies are part of the Durant Drainage Area (DA), which was placed on the Mississippi 1996 Section 303(d) List of Impaired Water Bodies due to evaluated causes of impairment for nutrients, pesticides, and sediment. In 2004, MDEQ replaced the Durant DA (MS422E) with three water bodies—Howard Creek (MS422E), Jack Lake Creek (MS422IE), and Indian Creek (MS422JE). MDEQ delisted Howard Creek in 2004 as monitoring data indicated that water quality standards were being attained. This TMDL report addresses the nutrient impairment for the remaining two water bodies in the Durant DA. Separate TMDL reports will address the sediment and pesticide listings for Jack Lake Creek and Indian Creek. Indian Creek is an evaluated water body and Jack Lake Creek is a monitored water body. An evaluated category indicates that the water body was listed based on anecdotal information and no additional monitoring data are available. For the monitored water body, biological monitoring was completed on Jack Lake Creek, which indicated biological impairment. However, MDEQ was unable to complete a stressor identification study on this water body, which means that the causes of biological impairment have not been determined. Therefore, in order to meet the terms of the Mississippi Consent Decree, the original impairment of nutrients for the Durant DA will be addressed.

There are no state criteria in Mississippi for nutrients. The Mississippi Nutrient Task Force in coordination with EPA Region 4 is currently developing these criteria. 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. 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.

1.2 Stressor Identification

Indian Creek is an evaluated impaired segment and was listed based on land-use surveys prior to 1996. Jack Lake Creek is an impaired segment that was listed due to failure to meet minimum

water quality criteria for aquatic use support based on biological sampling (MDEQ, 2003). Because of these results, a detailed assessment of the watershed and potential pollutant sources, called a stressor identification report, would normally be developed for this stream. The purpose of a stressor identification report is to identify the stressors and their sources most likely causing degradation of in-stream biological conditions. In order to meet the terms of the Mississippi Consent Decree, the original impairment of nutrients for both Indian Creek and Jack Lake Creek will be addressed in this TMDL.

1.3 Pollutants of Concern: Total Nitrogen and Total Phosphorus

The following is an adaptation of the State of Washington Department of Ecology's *Citizen's Guide to Understanding and Monitoring in Streams and Lakes* and provides a brief description and basic understanding of the pollutants of concern for this TMDL report:

The two primary nutrients of concern are nitrogen and phosphorus. Both elements are measured in several forms. Phosphorus can be reported as total phosphorus (TP) and is found in particulate forms and soluble reactive phosphate (SRP) (also sometimes called phosphate (PO^{-3}_4) or orthophosphate (ortho-P). The latter represent different terms used to describe the fraction of TP that is soluble, and therefore more immediately available to organisms for growth.

Nitrogen can be measured as total nitrogen (TN), total Kjeldahl nitrogen (TKN), nitrate-nitrogen (NO_3^-), nitrite-nitrogen (NO_2^-) [NO_2^- is usually measured as nitrate-nitrite-nitrogen ($NO_3^- – NO_2^-$)], or ammonia-nitrogen (NH_3 or NH_4). As with the case of TP, there are fractions of TN that are more bioavailable. TKN is the organic form of TN, which is less bioavailable for growth versus the readily available component of TKN, which is NH_4. The fractions of NO_3^--NO_2^- and NH_3 or NH_4 represent forms of nitrogen that are more immediately available for growth.

Organically bound TP and TN, while not immediately available, can be converted at predictable rates; and maybe significant drivers of primary productivity. One chemical form of an element can be converted into another. The conditions under which the conversion occurs are influenced by many factors, such as pH, temperature, oxygen concentration, and biological activity. The original form of the nutrient and physical conditions will determine if an increase in total nutrient concentrations will result in higher available nutrient concentrations and therefore, a corresponding immediate increase in growth or productivity. If nutrients enter as organic matter that first needs to be decomposed before it can be utilized for growth, temperature becomes important due to its effect on the rate of decomposition. (During warmer month, nutrients entering the system, as intact organic matter would be decomposed relatively quickly as compared to cold, wet-weather months when decomposition is slow).

These dynamics are further complicated by the fact that increased growth leads to greater numbers of organisms that need even more nutrients. So, as nutrients become available they are immediately utilized.

Increased nutrient concentrations are almost always an impact of pollution. Municipal and industrial discharges usually contain nutrients, and overland flow from developed watersheds contains nutrients from lawn and garden fertilizers as well as the additional organic debris so easily washed from urban surfaces. Agricultural areas also contribute to nutrient increases through poor manure and fertilizing practices and increased erosion from plowed surfaces.

Nutrient loading can typically result in increased algae growth. In flowing stream segments where conditions are right, algae take the form of an attached growth – called periphyton –on rocks, logs, and other substrate. Phytoplankton growth is also a concern in slower flowing streams. Excessive growths of algae can result in exaggerated fluctuations of normal DO cycles and eventually create a DO crash. In addition, unsightly conditions, odors, and poor habitat conditions for aquatic organisms can also be attributed to excessive algae (WDOE, 1994).

1.4 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 uses for the listed segments are fish and wildlife.

1.5 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, 2003)." 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.

1.6 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 Mississippi Benthic Index of Stream Quality (M-BISQ) process or stations that resulted in a biological impairment rating of "fully attaining" were used to evaluate natural variability of the data set (MDEQ, 2003).

The M-BISQ, a regionally calibrated benthic index of biotic integrity, was developed through a partnership between MDEQ and Tetra Tech, Inc. in 2001 from 434 wadeable (perennial, 1st-4th order streams) in the state excluding the Yazoo Delta. This index defined five bioregions for the state, and established the 25th percentile of the least disturbed condition for each bioregion as the threshold of impairment of the state of Mississippi's wadeable streams. The M-BISQ score for the site is 43.21 in the West Bioregion. The impairment threshold for the West Bioregion, defined as the 25th percentile value of the range of M-BISQ scores from least disturbed (LD) sites in the bioregion, is 57.55. Scores above this threshold are assessed as non-impaired.

Each of the two groups—"least disturbed sites" and "fully attaining sites"—was evaluated separately. 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 four 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 ecoregions.

For the preliminary target concentration range the means of the data at each of the nutrient sites were taken. Then the 75th and percentiles of the means were taken of the nutrient sites in that ecoregion that are fully supporting for aquatic life support according to the M-BISQ scores. For the estimate of the existing concentrations the median was taken of the data from the sites that were not attaining and had nutrient concentrations greater than the target.

2.0 WATER BODY ASSESSMENT

2.1 Water Quality Data

Data from one sampling event are available for Jack Lake Creek. The data were collected in 2002 as part of the biological survey conducted in Jack Lake Creek at M-BISQ Site # 763. This site is on an unnamed tributary to Greens Creek, which is also located in Holmes County. The only in-stream water quality data collected for Jack Lake Creek is presented in Table 1. Although MDEQ attempted to collect data for Indian Creek, there are no in-stream data available for Indian Creek.

Table 1. M-BISQ Data collected in 2002 for Jack Lake Creek

Station ID	Name	NH_3 (mg/l)	DO (mg/l)	TN (mg/l)	TP (mg/l)	Temp (°C)
763	Unnamed tributary of Greens Creek	0.1	7.93	0.89	0.11	8.65

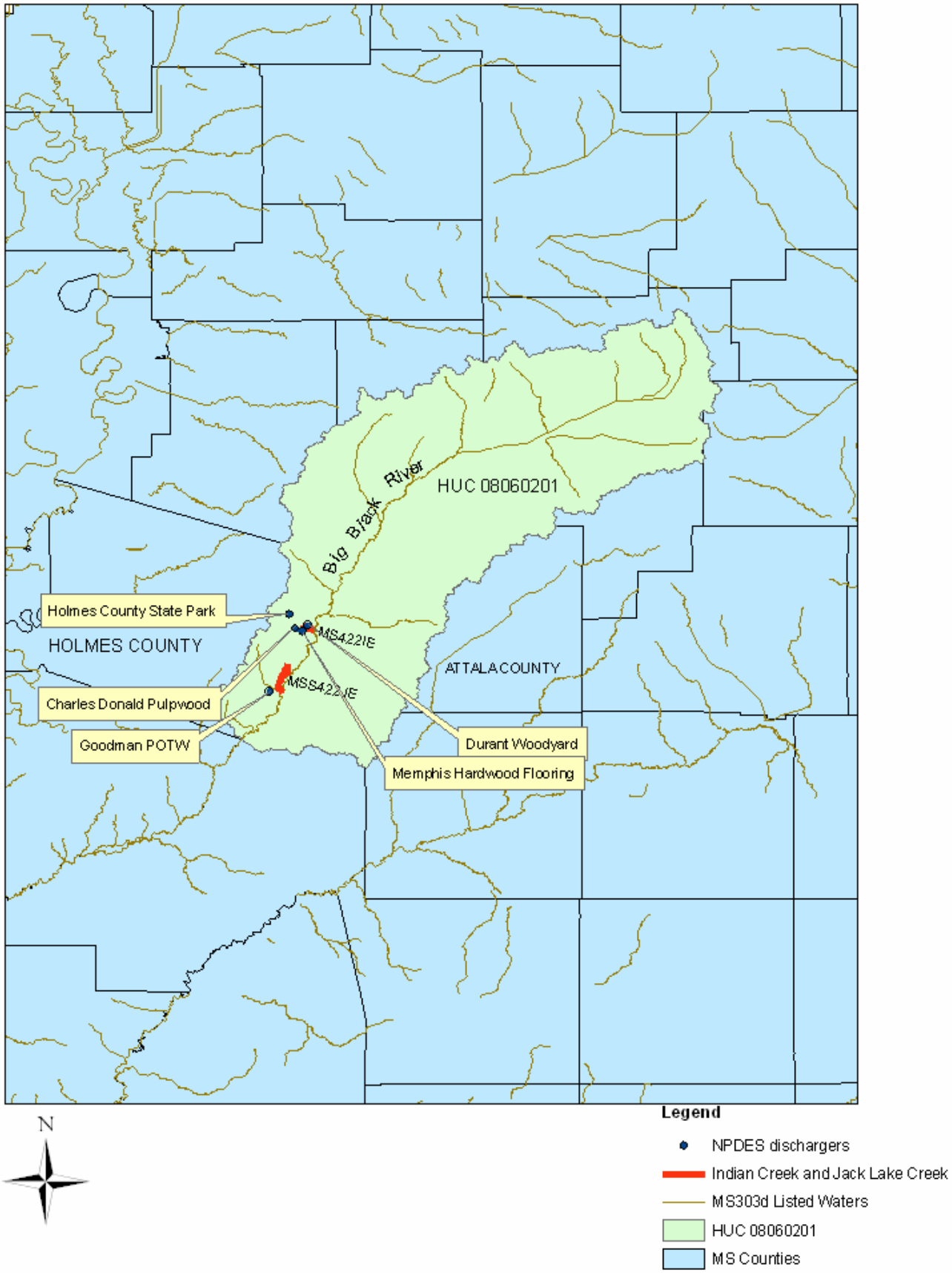
2.2 Assessment of Point Sources

There are numerous point sources in the watersheds for Jack Lake Creek and Indian Creek (Figure 1). None of the point sources in the watershed currently have nutrient limits in their permits. All of the discharges, except for two permitted sources, flow into the Big Black River. There are only two facilities that discharge to the impaired segments in this HUC—(1) Holmes County, which is a sanitary landfill; and (2) the Durant Woodyard. The Holmes County landfill was closed and certified closure includes completion of a final cover and establishing vegetation to prevent erosion. The location of the Holmes County Sanitary Landfill is not presented in the map below as the location of the discharger is not geo-referenced. The Durant Woodyard is out of business. Therefore, there are no point sources that currently discharge into the listed segments addressed in this TMDL.

Table 2. NPDES discharges to the Jack Lake Creek and Indian Creek watersheds

NPDES ID	Facility Name	Maximum Permitted Discharge (MGD)	Facility Type	Receiving Waters
MSS050598	Holmes County-Durant Sanitary Landfill	0.0	Refuse Systems	Unnamed tributary to Indian Creek and Howard Creek
MSR0016105994	Durant Woodyard	0.001	Wood Products	Indian Creek
MS0052311	Charles Donald Pulpwood, Inc	0.001	Logging	Big Black River
MS0026921	Goodman POTW, Inc.	0.228	Sewerage Systems	Big Black River
MS0046205	Memphis Hardwood Flooring Company, Durant	0.0	Sawmills and Planning Mills	Big Black River
MS0027324	Holmes County State Park	0.013	Sporting and Recreational Camps	Box Creek

Figure 1: Map representing the impaired segments and NPDES permitted discharges



2.3 Assessment of Non-Point Sources

TN 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. In agricultural areas, studies have indicated that human activities have increased nitrate concentrations in ground water. In urban areas, it is likely that nitrogen sources are relatively localized when compared with the generally more intensive and widespread use of fertilizers on cropland. The greater the percentage of impervious surfaces in a watershed (usually more predominant in urban areas) generally results in surface runoff of nutrient-laden water, rather than seepage to ground water (USGS, 1999). 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 may be a limiting nutrient in 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). Table 3 presents an estimate of typical nutrient loading ranges associated with various land uses.

Table 3. 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 946,336 acre drainage area of HUC 08060201 contains many different landuse types, including forest, cropland, pasture, and urban areas as shown in Table 4. The dominant landuse within the HUC is forest. The landuse information for the watershed is based on 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. The MARIS data are classified on a modified Anderson level one and two system with additional level two wetland classifications. Landuse for each impaired water body, Jack Lake Creek and Indian Creek, are presented in Table 4. The dominant landuses within the Jack Lake Creek and Indian Creek watershed are forest.

Table 4: Landuse Distribution for Indian Creek and Jack Lake Creek (in acres)

Water body	Urban	Forest	Cropland	Pasture/ Grass	Scrub/ Barren	Wetland	Water	Total (acres)
Durant Drainage Area	825	18703	4392	4888	85	7502	708	37103
Jack Lake Creek	34	3525	860	1120	8	50	11	5608
Indian Creek	719	8806	2270	2330	63	3551	518	18258

2.4 Estimated Existing Loads for Total Nitrogen and Total Phosphorus

The estimated existing TN 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. Given the lack of in-stream data for the water bodies and to be conservative, the targeted reductions will be based on the estimated existing TN level for impaired streams in Ecoregion 65. The target concentration for TN for Ecoregion 65 is 0.6 to 0.7 mg/l.

To convert the estimated existing TN concentration to a TN load, the average annual flow was estimated based on flow data from the USGS gage located on the Big Black River at West, Mississippi (07289350). To estimate the amount of flow in the Durant Drainage Area, a drainage area ratio was calculated (1636 cfs/1027 square miles = 1.59 cfs/square miles). The ratio was then multiplied by the drainage area (in square miles) of the impaired segment. The drainage area for Indian Creek is 9 square miles and Jack Lake Creek is 29 square miles. The existing TN load was then calculated, using Equation 1.

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

The estimated existing TP concentration is based on the median TP concentrations measured in wadeable streams in Ecoregion 65 with impaired biology and elevated nutrients, which is 0.18 mg/l. To be conservative, the targeted reductions will be based on the estimated existing TP level for impaired streams in Ecoregion 65. The target concentration for TP for Ecoregion 65 is 0.06 to 0.10 mg/l.

To convert the estimated existing TP concentration to a TP load, the average annual flow was estimated based on the drainage areas for each water body as previously discussed. The existing TP load was then calculated, using Equation 2 and the TP concentration.

TP Load (lb/day) = Flow (cfs) * 5.394 (conversion factor)* TP Concentration (mg/L) (**Eq. 2)**

Table 5: Estimated Existing TP and TN Loads for Jack Lake Creek and Indian Creek

Stream	Area (sq miles)	Average Annual Flow (cfs)	TN Concentration (mg/l)	TN Load (lbs/day)	TP Concentration (mg/l)	TP Load (lbs/day)
Jack Lake Creek	29	46.11	1.38	343.23	.18	44.77
Indian Creek	9	14.31	1.38	106.52	.18	13.89

3.0 ALLOCATION

The allocation for this TMDL report involves wasteload allocations and load allocations for non-point sources necessary for attainment of water quality standards in Jack Lake Creek and Indian Creek.

3.1 Wasteload Allocation

There are no point sources that are currently discharging into the impaired segments of Indian Creek and Jack Lake Creek. Therefore, the waste load allocations for TP and TN have been set to zero. 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.*

3.2 Load Allocation

Best management practices (BMPs) should be encouraged in the watershed to reduce potential TN loads from non-point sources. The watersheds should be considered a priority for riparian buffer zone restoration and any nutrient reduction BMPs.

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 assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for these TMDLs is implicit. An implicit MOS is appropriate and a conservative approach for these TMDLs as only non-impaired streams in Ecoregion 65 for TN and TP were used in the development of the nutrient targets.

3.4 Calculation of the TMDL

Equations 1 and 2 were used to calculate the existing loads and the targeted maximum loads for TP and TN in Indian Creek and Jack Lake Creek. The target concentrations were used with the average flows for the watersheds to determine the TMDL. The TMDL was then compared to the estimated existing load previously calculated and the limited data available.

The estimated TN and TP target loads for Jack Lake Creek and Indian Creek are presented in Table 6. The Jack Lake Creek TMDL for TN is 149.23-174.10 lbs/day. The Jack Lake Creek TMDL for TP is 14.92-24.87 lbs/day. The estimated existing TN and TP loads in Jack Lake Creek are 343.23 and 44.77 pounds per day, respectively. The TMDL calls for a maximum reduction of approximately 49% for TN and 44% for TP.

Table 6: Target TP and TN Loads for Jack Lake Creek and Indian Creek

Stream	Area (sq miles)	Average Annual Flow (cfs)	Target TN Concentration (mg/l)	TN Load (lbs/day)	Target TP Concentration (mg/l)	TP Load (lbs/day)
Jack Lake Creek	29	46.11	0.6 to 0.7	149.23-174.10	0.06 to 0.10	14.92-24.87
Indian Creek	9	14.31	0.6 to 0.7	46.31-54.03	0.06 to 0.10	4.63-7.72

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.

4.0 CONCLUSION

Nutrients were addressed through an estimate of a preliminary total phosphorous and total nitrogen concentration target range. To meet the targeted nutrient ranges in both Jack Lake Creek and Indian Creek, there needs to be approximately 49% to 57% reduction in TN loads and approximately 44% to 67% reduction in TP loads. It is recommended that the Jack Lake Creek and Indian Creek drainage areas be considered as priority watersheds 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, P0 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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