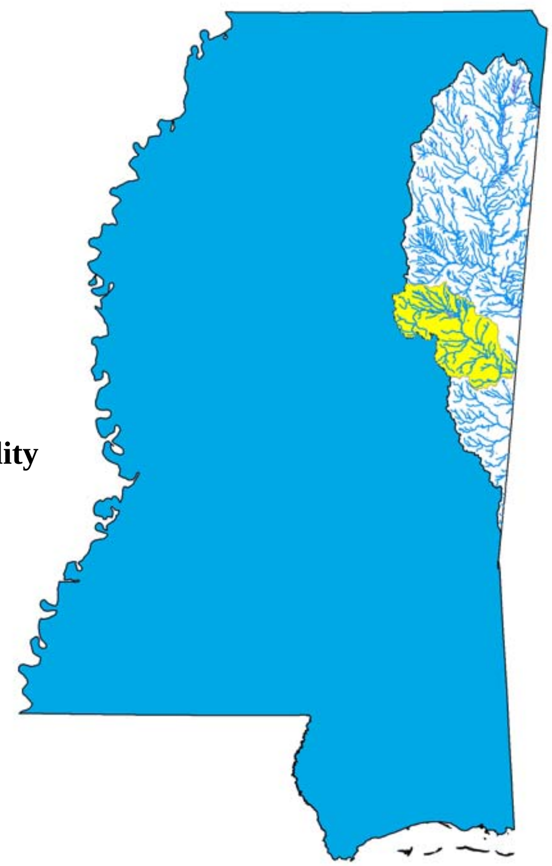
MDEQ FINAL REPORT
June 2009
809062201

Total Maximum Daily Load
For Nutrients and Organic Enrichment / Low DO in the Noxubee River

Tombigbee River Basin
Noxubee and Oktibbeha 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
mile2	acre	640	acre	ft2	43560
km2	acre	247.1	days	seconds	86400
m3	ft3	35.3	meters	feet	3.28
ft3	gallons	7.48	ft3	gallons	7.48
ft3	liters	28.3	hectares	acres	2.47
cfs	gal/min	448.8	miles	meters	1609.3
cfs	MGD	0.646	tonnes	tons	1.1
m3	gallons	264.2	µg/l * cfs	gm/day	2.45
m3	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	102	hecto	h
10-3	milli	m	103	kilo	k
10-6	micro	µ	106	mega	M
10-9	nano	n	109	giga	G
10-12	pico	p	1012	tera	T
10-15	femto	f	1015	peta	P
10-18	atto	a	1018	exa	E

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Name	ID	County	HUC	Evaluated Cause
Noxubee River	MSNOXUBRE	Noxubee and Oktibbeha	03160108	Total Nitrogen, Total Phosphorus, and Organic Enrichment / Low DO

Table 2. Water Quality Standards

Parameter	Beneficial use	Water Quality Criteria
Nutrients (TN and TP)	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.
Dissolved Oxygen	Aquatic Life Support	DO concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l. Natural conditions are defined as background water quality conditions due only to non-anthropogenic sources. The criteria herein apply specifically with regard to substances attributed to sources (discharges, nonpoint sources, or instream activities) as opposed to natural phenomena. Waters may naturally have characteristics outside the limits established by these criteria. Therefore, naturally occurring conditions that fail to meet criteria should not be interpreted as violations of these criteria.

Table 3. Total Maximum Daily Load for Noxubee River

	WLA lbs/day	LA lbs/day	MOS	TMDL lbs/day
Total Nitrogen	1,336	4,516	Implicit	5,852
Total Phosphorous	343	493	Implicit	836
TBODu	3,702	22,884	Implicit	26,586

Table 4. Point Source Loads for Noxubee River

NPDES ID	Facility Name	Permitted Discharge (MGD)	Receiving Water	City	County
MS0020427	Choctaw Lake Recreation Area	0.003	Noxubee River	Ackerman	Choctaw
MS0020796	Macon POTW	0.6	Noxubee River	Macon	Noxubee
MS0025143	Shuqualak POTW	0.12	Shuqualak Creek	Shuqualak	Noxubee
MS0029718	Starkville Country Club	0.009	Skinner/Hollis Creek	Starkville	Oktibbeha
MS0033596	Brooksville POTW	0.24	Joes Creek	Brooksville	Noxubee
MS0036145	Starkville POTW	10.0	Hollis Creek	Starkville	Oktibbeha
MS0036714	Total Environmental Solutions Inc, Sunset Subdivision	0.05	Tobacco Juice Creek	Starkville	Oktibbeha
MS0036862	Chateau Lane Apartments	0.0006	Tobbaco Juice Creek	Starkville	Oktibbeha
MS0037419	Garners Meat Processing	0.025	Dry Creek	Sturgis	Oktibbeha
MS0038601	Moor High School	0.012	Browning Creek	Crawford	Oktibbeha
MS0039560	Crawford POTW	0.06	Wet Water Creek	Crawford	Lowndes
MS0041480	Sturgis POTW	0.088	Town Creek	Sturgis	Oktibbeha
MS0043524	Chimney Apartments	0.001	Tobacco Juice Creek	Starkville	Oktibbeha
MS0045349	Barge Forest Products Company	0.002	Horse Hunter Creek	Macon	Noxubee
MS0045420	Superior Fish Products	0.025	Plum Creek	Macon	Noxubee
MS0048224	Lake Forest Ranch Camp	0.02	Unnamed creek to Sun Creek	Macon	Noxubee
MS0052264	Koch Foods, Brooksville Facility (formerly Pride of the South Catfish)	0.5	Horse Hunter Creek	Brooksville	Noxubee
MS0052892	Browning Creek Development	0.1	Browning Creek	Starkville	Oktibbeha
MS0053180	Montgomery Quarters LLC, Mobile Home Park	0.03	Hollis Creek	Starkville	Oktibbeha
MS0055671	Grand Oaks Subdivision	0.04	Skinner Creek	Starkville	Oktibbeha

EXECUTIVE SUMMARY

The State of Mississippi originally placed Noxubee River on the Mississippi 1996 Section 303(d) List of Impaired Water Bodies due to evaluated causes of pesticides, siltation, nutrients, and organic enrichment (OE)/low dissolved oxygen (Low DO) and pathogens. Mississippi Department of Environmental Quality (MDEQ) was not able to complete biological monitoring on the Noxubee River as it is a non-wadeable stream. This TMDL addresses the impairment due to nutrients, OE/Low DO for the Noxubee River. This TMDL provides an estimate of the total nitrogen (TN) and total phosphorus (TP) allowable in the stream and will also provide an allocation for Total Biochemical Oxygen Demand (TBOD) for the point sources located in the watershed. The TMDL for organic enrichment was quantified in terms of TBODu.

Mississippi does not have numeric water quality standards for allowable nutrient concentrations; however MDEQ is currently working on the development of numeric nutrient criteria to be adopted in State water quality standards. The Nutrient Task Force (NTF) was established to assist the State in this effort, and MDEQ is progressing according to the State's Nutrient Criteria Development Plan, which has been mutually agreed upon with EPA.

In the *1999 Protocol for Developing Nutrient TMDLs*, EPA suggests several methods for the development TMDL targets for nutrients (USEPA, 1999). In accordance with this document, "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." Mississippi's method is based on 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 plan mutually agreed with EPA. The initial phase of the data collection process for wadeable streams in Mississippi is complete. Based on MDEQ's methodology and studies, an annual concentration of 0.7 mg/l is an applicable target for Total Nitrogen and 0.10 mg/l TMDL target for Total Phosphorus in Ecoregion 65.

The DO modeling in comparison to the TMDL for TP indicates a reduction of TP is needed at the Starkville POTW along with a 66.81% reduction of TP from nonpoint sources. A reduction at Koch Foods is needed for Horse Hunter Creek. The allocations proposed for Noxubee River are the results of a water quality model EPA and MDEQ developed for the watershed. The EPA Water Quality Analysis Simulation Program, Version 7 was applied as the in-stream water quality model. The purpose of the modeling exercise was to determine what reductions in nutrient and organic loads would have to occur in order to protect the designated use of the streams, and achieve water quality standards. Point and non-point sources were reduced in the WASP model so that simulated DO concentrations continued to achieve water quality standards and simulated in-stream TN and TP concentrations reflected Ecoregion 65 target levels.

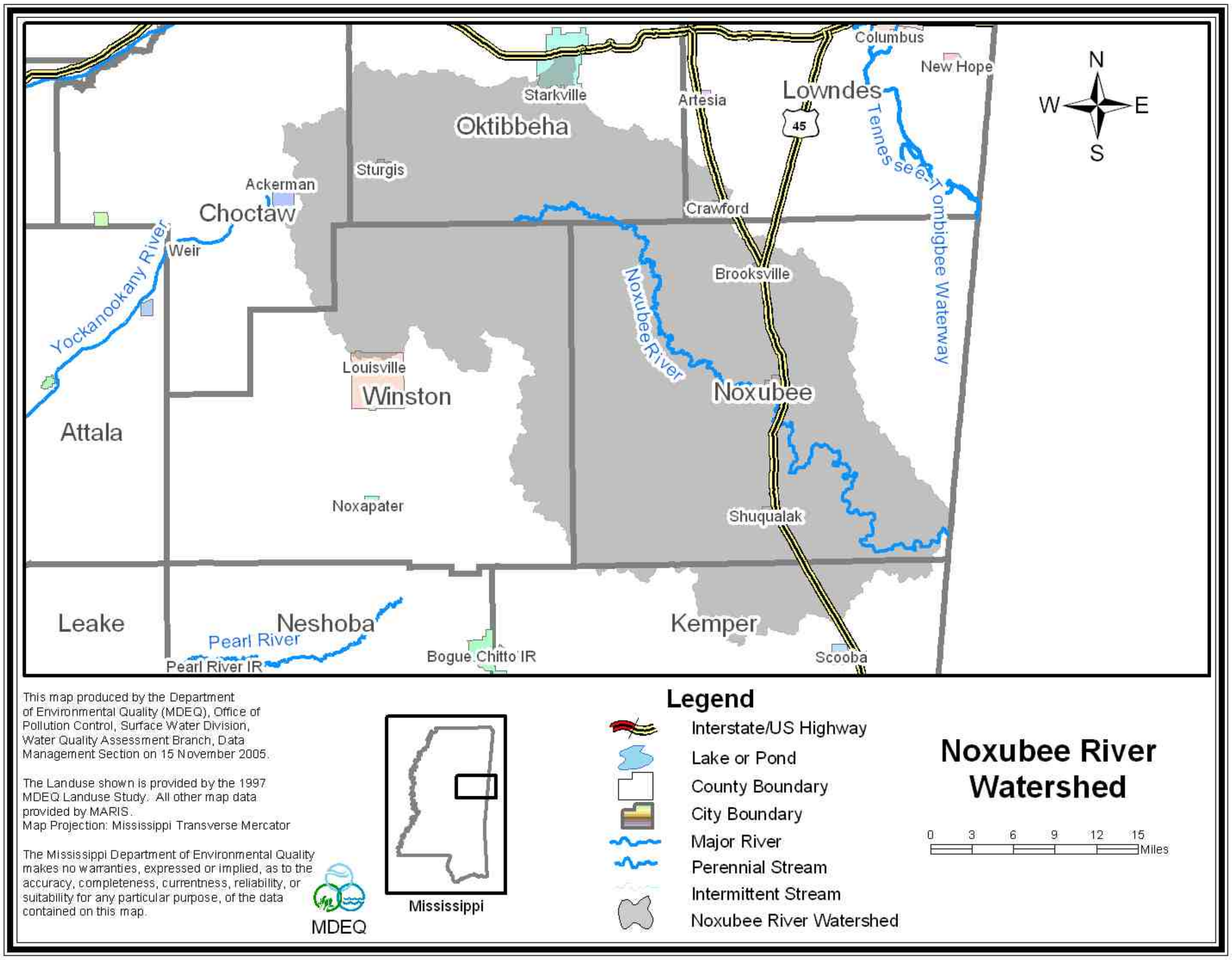

Figure 1. Noxubee River

INTRODUCTION

1.1 Background

The Noxubee River (NOCK-shuh-bee) name is shortened from the original Choctaw *oka*, "water" and *nakshobi*, translated as "to smell as newly caught fish: to stink, as fish." The name actually refers to the strong offensive odor that arises from an overflowed river or creek in the summer time. Persons living near Noxubee are familiar with this odor during a summer freshet (Baca, 2007).

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 2006 §303(d) listed segment shown in Figure 1.

The original listing for Noxubee River was on the 1996 §303(d) list. The listed segment is shown in Figure 2. There were no monitoring data, so the stream remained on the evaluated portion of Mississippi's §303(d) list. Noxubee River is listed as an evaluated water body impaired due to nutrients, organic enrichment (OE)/low dissolved oxygen (DO). Noxubee River is in the Tombigbee River Basin, which comprises east-central Mississippi. The drainage area for the Noxubee River watershed is approximately 697,211 acres (1,089 square miles). The watershed is predominantly comprised of forest and agricultural lands. A chart showing the landuse distribution in the Noxubee River watershed is provided in Figure 4.

1.2 Listing History

The impaired segments were listed due to evaluating the watersheds for potential impairment. 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 mutually agreed upon with EPA Region 4 and is on schedule according to the approved timeline for development of nutrient criteria (MDEQ, 2007).

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, 2007). The designated beneficial use classification for the listed segment is Fish and Wildlife.

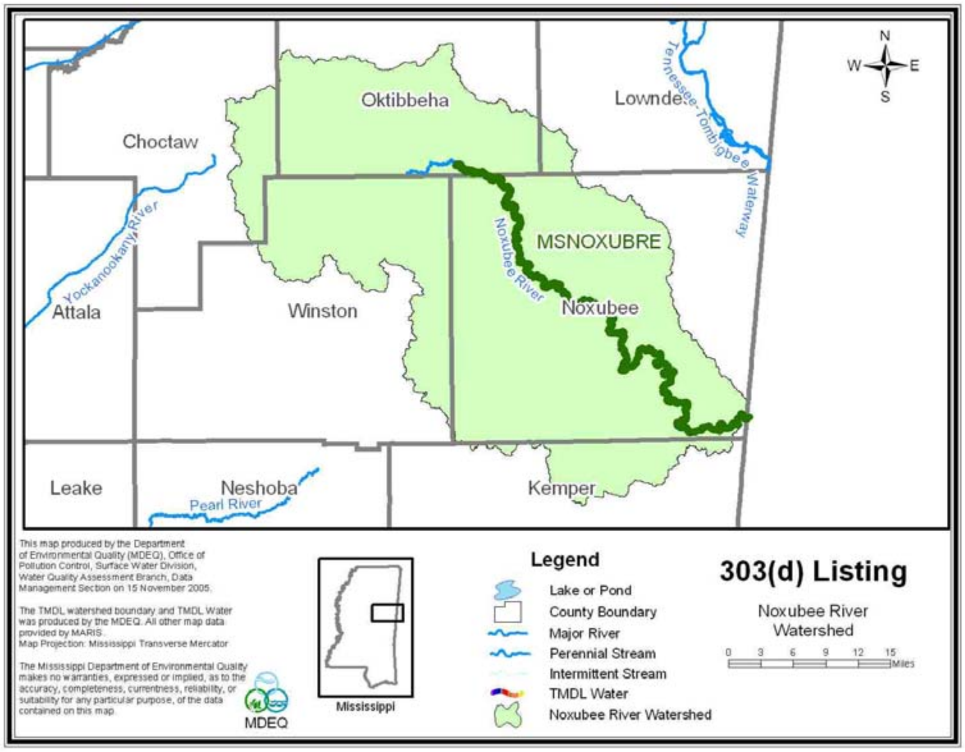

Figure 2. Noxubee River §303(d) Listed Segments

1.4 Applicable Water Body Segment Standards

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, 2007). 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, 2007)."

The standard for dissolved oxygen states, "DO concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l." In addition, the State water quality standard regulations include a natural condition clause which will be used to determine the appropriate DO for the Noxubee River under critical conditions. Natural conditions are defined as background water quality conditions due only to non-anthropogenic sources. The criteria herein apply specifically with regard to substances attributed to sources (discharges, nonpoint sources, or instream activities) as opposed to natural phenomena. Waters may naturally have characteristics outside the limits established by these criteria. Therefore, naturally occurring conditions that fail to meet criteria should not be interpreted as violations of these criteria.

1.5 Nutrient Target Development

Since there are no specific numeric criteria for nutrients in Mississippi, the State's narrative water quality standard must be translated to quantify a level of nutrients that is protective of aquatic life.

In the *1999 Protocol for Developing Nutrient TMDLs*, EPA suggests several methods for the development TMDL targets for nutrients (USEPA, 1999). In accordance with this document, "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." Mississippi's method is based on 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 plan mutually agreed with EPA. The initial phase of the data collection process for wadeable streams in Mississippi is complete.

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 nonpoint source pollution from urban, agricultural, and silvaculture lands as well as point source pollution from NPDES permitted facilities.

Nutrient concentration data were not normally distributed; therefore, the 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 Mississippi 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.

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.

For the preliminary target concentration range the means of the data at each of the nutrient sites were taken. Then the 75^{th} and 90^{th} 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. In Ecoregion 65, 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 is an applicable target for TP.

1.6 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 commonly are measured in several forms. Phosphorus can be reported as TP, which includes a particulate form and a dissolved form. The dissolved form is measured and reported as soluble reactive phosphate (SRP), phosphate (PO_4^{-3}), or orthophosphate (ortho-P); all different terms used to describe the fraction of TP that is soluble, and therefore more immediately available to organisms for growth.

Nitrogen can be reported as TN, either measured directly or calculated from its constituents, which are organic-N, ammonia-N (unionized or ionized), nitrite-N, and nitrate-N. Of these, organic-N and ammonia-N are measured as total Kjeldahl nitrogen (TKN), and nitrite+nitrogen (NO_2^-), nitrate-nitrogen (NO_3^-), are usually measured as nitrate-nitrite-nitrogen (NO_3^- + NO_2^-). As is the case with TP, there are fractions of TN that are more bioavailable. TKN includes the organic form of TN, which is less immediately bioavailable for growth versus the more readily available component of TKN, which is NH_3 or NH_4^+. Together, the fractions of NH_3 or NH_4^+ and NO_3^- + NO_2^- represent forms of nitrogen that are most immediately available for growth.

Organically bound TP and TN, while not immediately available, can be converted to bioavailable forms at predictable rates; and may be significant drivers of primary productivity. One chemical form of an element can be converted into another, and 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 the prevailing 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 the stream as organic matter, they have to decompose before they can be utilized for additional growth. That process, which requires oxygen and temperature, becomes important due to its effect on the rate of decomposition. That is, 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 often immediately utilized.

Increases in anthropogenic nutrient concentrations and their impacts are considered nutrient 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 significantly contribute to nutrient increases through poor manure management, fertilizing practices, and increased nutrient bearing soil erosion from plowed surfaces.

Increased nutrient loading typically results in increased algal growth, where sufficient conditions of light, temperature, substrate and flow (residence time) are met. And, the resulting enhanced growth in algal biomass will occur locally and/or downstream. In flowing stream segments where conditions are right, attached forms of algae tend to dominate, i.e., periphyton attached to rocks, logs, aquatic macrophytes, and other substrate. In slower flowing streams, algae suspended in the water column, i.e., phytoplankton, may tend to dominate. Excessive growths of algae, both periphyton and phytoplankton, can adversely affect other aquatic life through habitat/life cycle disruption and exaggerated fluctuations of normal dissolved oxygen cycles; eventually resulting in a DO crash. In addition, unsightly conditions, odors and poor habitat conditions for aquatic organisms can also be attributed to excessive algae (WDOE, 1994).

1.7 Selection of a Flows to Use for TMDL

Low DO typically occurs during seasonal low-flow, high-temperature periods during the late summer and early fall. Elevated oxygen demand is of primary concern during low-flow periods because the effects of minimum dilution and high temperatures combine to produce the worst-case potential effect on water quality (USEPA, 1997). The flow at critical conditions for organics is typically defined as the 7Q10 flow, which is the lowest flow for seven consecutive days expected during a 10-year period. The critical low flow period for Noxubee River at Macon is 32 cfs (Station 02448000) and was determined based on Techniques for Estimating 7-Day, 10-Year Low-Flow Characteristics on Streams in Mississippi (Telis, 1992). The annual average flow for the Noxubee River at Geiger, Alabama (02448500) is 1550 cfs. This flow was used to determine the nutrient load estimates and projected reduction for total phosphorus.

WATER BODY ASSESSMENT

2.1 Noxubee River Water Quality Data

Nutrient data for the Noxubee River were collected in between December 1996-August 2001. The data are presented in Table 5.

Table 5. Noxubee River In-Stream Nutrient Data

Date	Time	Temperature, Water (^{o}C)	DO (mg/L)	TN	TP
8-Aug-00	10:30	21.4	6.1	0.9	0.09
2-Jun-99	14:00	27.86	6.4	1.38	0.11
10-Apr-01	12:00	31.8	6.82	1.08	0.3
17-Jul-97	12:00	7.3	6.9	1.02	0.15
3-Aug-99	13:05	21.76	6.9	0.61	0.16
6-Oct-98	12:00	7.9	6.9	1.83	0.35
16-Aug-01	13:40	26.5	6.97	3.07	0.14
29-Nov-00	13:54	5	7.05	1.61	0.39
5-Aug-98	13:00	3.6	7.6	0.71	0.15
3-Feb-99	13:15	14.02	7.9	0.59	0.04
29-Sep-97	12:30	23.5	7.9	0.59	0.09
2-Nov-99	12:45	4.52	8.8	2.02	0.2
13-Apr-98	12:20	15.2	9	0.35	0.08
15-Apr-97	12:45	17.1	9.5	0.91	0.14
3-May-00	13:20	30.5	9.6	0.71	0.09
18-Dec-96	12:50	26.2	9.7	0.62	0.05
8-Nov-01	15:25	14	10.25	0.89	0.11
10-Jan-01	12:50	16.8	10.86	0.43	0.05
21-Jan-98	12:20	27.9	11.2	0.71	0.12
15-Jan-97	12:10	29.5	12.5	0.59	0.1
2-Feb-00	13:25	10	12.6	2.27	0.32
MAXIMUM VALUE		31.80	12.60	3.07	0.39
MINIMUM VALUE		3.60	6.10	0.35	0.04
AVERAGE		18.21	8.64	1.09	0.15

2.2 Assessment of Point Sources

An important step in assessing pollutant sources in the Noxubee River watershed is locating the NPDES permitted sources. There are twenty facilities with active permits permitted to discharge into the Noxubee River watershed. MDEQ only used the active facilities in the model. The active facilities and their permitted discharges are presented in Table 6.

Figure 3. NPDES dischargers in the Noxubee River watershed included in the water quality model

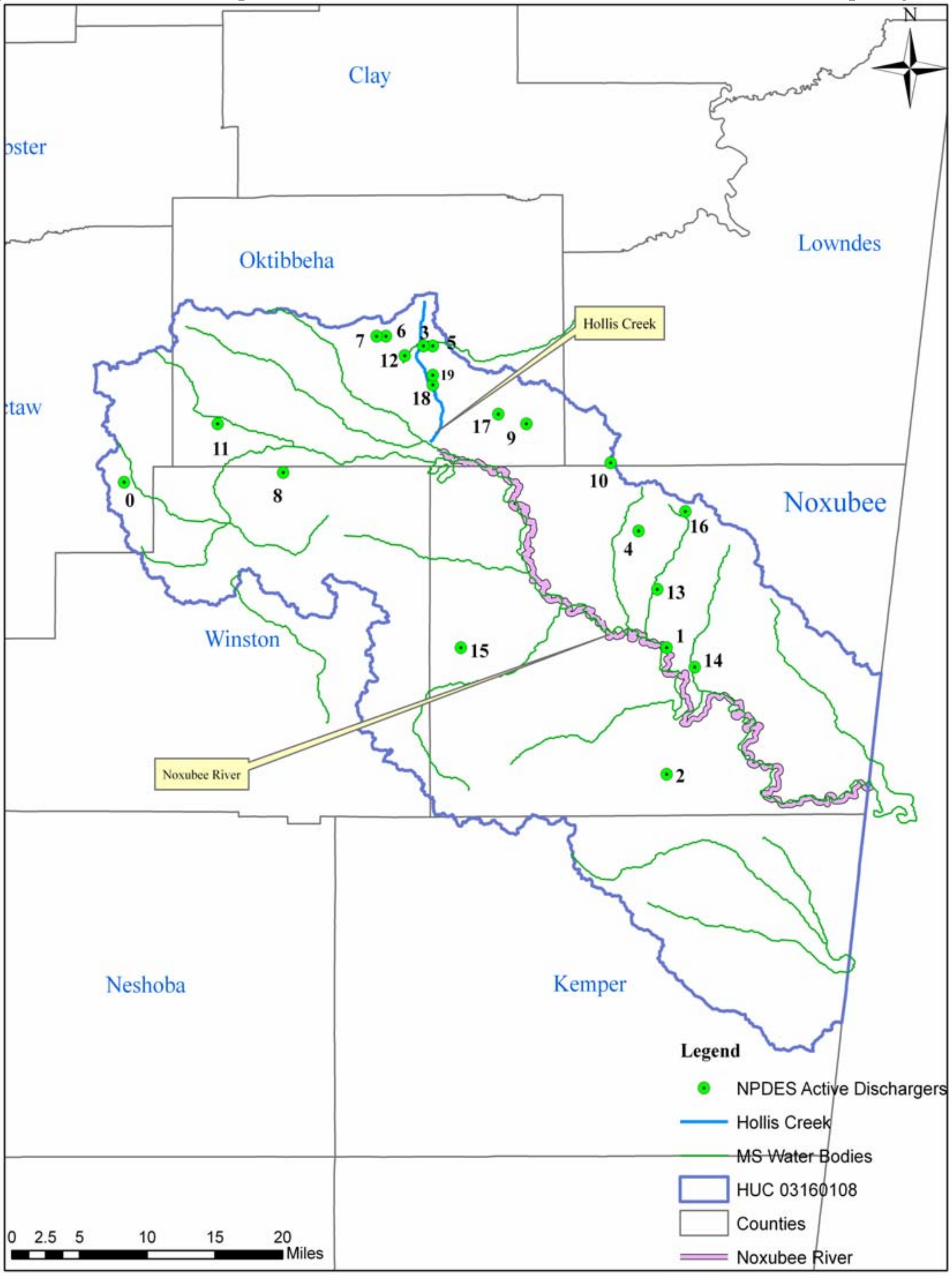

Table 6. NPDES facilities used in the Noxubee River watershed water quality model. The map numbers correspond to the facilities identified in Figure .

Map Number	NPDES ID	Facility Name	Permitted Discharge (MGD)	Receiving Water	City	County
0	MS0020427	Choctaw Lake Recreation Area	0.003	Noxubee River	Ackerman	Choctaw
1	MS0020796	Macon POTW	0.6	Noxubee River	Macon	Noxubee
2	MS0025143	Shuqualak POTW	0.12	Shuqualak Creek	Shuqualak	Noxubee
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19	MS0055671	Grand Oaks Subdivision	0.04	Skinner Creek	Starkville	Oktibbeha

2.3 Evaluation of TBODu

The TMDL for DO will be quantified in terms of organic enrichment. Organic enrichment is measured in terms of total ultimate biochemical oxygen demand (TBODu). TBODu represents the oxygen consumed by microorganisms while stabilizing or degrading carbonaceous and nitrogenous compounds under aerobic conditions over an extended time period. The carbonaceous compounds are referred to as CBODu, and the nitrogenous compounds are referred to as NBODu. CBOD is the carbonaceous portion of that demand that occurs in the first stage of decomposition as organic matter is converted to carbon dioxide. TBODu is equal to the sum of NBODu and CBODu (see Equation 1).

$$\textbf{TBODu = CBODu + NBODu} \qquad \textbf{(Equation 1)}$$

Organic material discharged to a stream from an NPDES permitted point source is typically quantified as 5-day biochemical oxygen demand (BOD_5). BOD_5 is a measure of the oxidation of carbonaceous and nitrogenous material over a 5-day incubation period. However, oxidation of nitrogenous material, called nitrification, usually does not take place within the 5-day period because the bacteria that are responsible for nitrification are normally not present in large numbers and have slow reproduction rates (Metcalf and Eddy, 1991). Thus, BOD_5 is generally considered equal to $CBOD_5$.

Because permits for point source facilities are written in terms of BOD_5 while TMDLs are typically developed using CBODu, a ratio between the two terms is needed (see Equation 2).

$$\textbf{CBODu} = \textbf{CBOD}_5 * \textbf{Ratio} \qquad \textbf{(Equation 2)}$$

The CBODu to $CBOD_5$ ratios are given in *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2001). These values are recommended for use by MDEQ regulations when actual field data are not available. A CBODu to $CBOD_5$ ratio of 1.5 is appropriate for the smaller facilities located in the Noxubee River watershed. A ratio of 2.5 was used for meat processors and a ratio of 2.3 was used for facilities with advanced treatment capabilities.

In order to determine the NBODu, the ammonia nitrogen (NH_3-N) loads were converted to an oxygen demand using a factor of 4.57 pounds of oxygen per pound of ammonia nitrogen (NH_3-N) oxidized to nitrate nitrogen (NO_3-N). First, the NH_3-N concentration had to be converted into pounds per day. Equation 3 was used to calculate the ammonia nitrogen load from the ammonia nitrogen concentration. Once the load was calculated, it was multiplied by a factor of 4.57 to obtain the NBODu values. Using this factor is a conservative assumption because it assumes that all of the ammonia is converted to nitrate through nitrification.

$$\textbf{NH}_3\textbf{-N lbs/day} = \textbf{NH}_3\textbf{-N (mg/l)} * \textbf{Flow (MGD)} * \textbf{8.34 (conversion factor)} \qquad \textbf{(Equation 3)}$$

The sum of CBODu and NBODu is equal to the point source load of TBODu. For facilities that do not have a permit limit for NH_3-N, an assumed value of 2.0 mg/L was used to calculate the NBODu load for the facility. The maximum permitted load of TBODu from the existing point source is given in Table 7.

Table 7. Point Sources, Maximum Permitted Loads for TBODu and WLAs

NPDES	Facility	Flow	BOD5 (mg/L)	CBOD5 (mg/L)	NH3-N (mg/L)	CBODu:CBOD5 Ratio	CBODu (lbs/day)	NH3-N (lbs/day)	NBODu (lbs/day)	TBODu (lbs/day)
MS0020427	Choctaw Lake Recreation Area	0.0038	30	30	2.645	1.5	1.4	0.08	0.4	1.8
MS0020796	Macon POTW	0.6	40	40	2.645	1.5	300.2	13.24	60.5	360.7
MS0025143	Shuqualak POTW	0.12	17	17	2.645	1.5	25.5	2.65	12.1	37.6
MS0029718	Starkville Country Club	0.009	30	30	2.645	1.5	3.4	0.20	0.9	4.3
MS0033596	Brooksville POTW	0.24	10	10	4	1.5	30.0	8.01	36.6	66.6
MS0036145	Starkville POTW	10	10	10	2	2.3	1918.2	166.80	762.3	2680.5
MS0036714	Total Environmental Solutions Inc, Sunset Subdivision	0.05	30	30	2.645	1.5	18.8	1.10	5.0	23.8
MS0036862	Chateau Lane Apartments	0.0006	30	30	2.645	1.5	0.2	0.01	0.1	0.3
MS0037419	Garners Meat Processing	0.004	10	10	2	2.5	0.8	0.07	0.3	1.1
MS0038601	Moor High School	0.012	30	30	2.645	1.5	4.5	0.26	1.2	5.7
MS0039560	Crawford POTW	0.06	15	15	2	1.5	11.3	1.00	4.6	15.8
MS0041840	Sturgis POTW	0.088	30	30	2.645	1.5	33.0	1.94	8.9	41.9
MS0043524	Chimney Apartments	0.00125	30	30	2.645	1.5	0.5	0.03	0.1	0.6
MS0045349	Barge Forest Products Company	0.0012	30	30	2	1.5	0.5	0.02	0.1	0.5

NPDES	Facility	Flow	BOD5 (mg/L)	CBOD5 (mg/L)	NH3-N (mg/L)	CBODu:CBOD5 Ratio	CBODu (lbs/day)	NH3-N (lbs/day)	NBODu (lbs/day)	TBODu (lbs/day)
MS0057550	Superior Fish Products (aka Saul Catfish Processors)	0.11	66	66	30	2.5	60.5	27.52	125.8	186.3
MS0048224	Lake Forest Ranch Camp	0.02	30	30	2.645	1.5	7.5	0.44	2.0	9.5
MS0052264	Koch Foods, Brooksville Facility (formerly Pride of the South Catfish)	0.5	14	14	2	2.5	146.0	8.34	38.1	184.1
MS0052892	Browning Creek Development	0.1	30	30	2.645	1.5	37.5	2.21	10.1	47.6
MS0053180	Montgomery Quarters LLC, Mobile Home Park	0.03	30	30	2.645	1.5	11.3	0.66	3.0	14.3
MS0055671	Grand Oaks Subdivision	0.04	30	30	2.645	1.5	15.0	0.88	4.0	19.0
Total										3702.0

2.4 Assessment of Nonpoint Sources

Nonpoint 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. 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. 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 nonpoint 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).

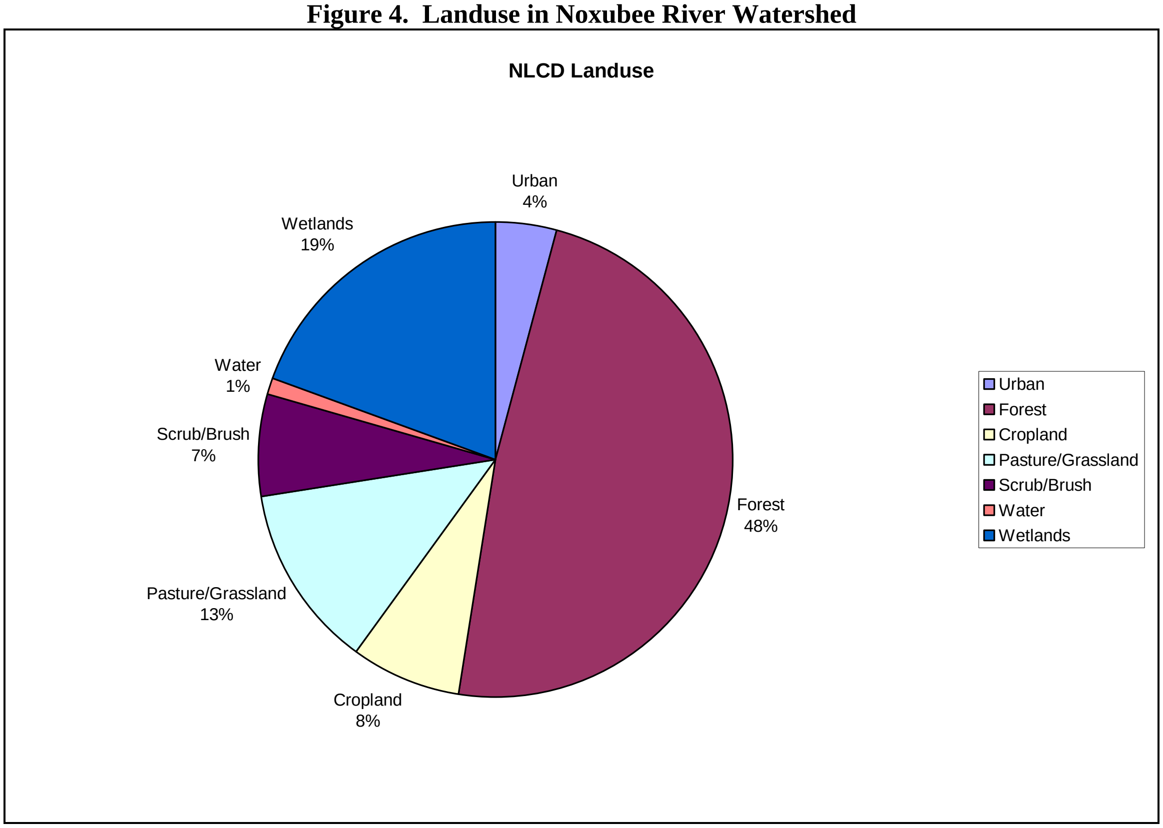
Watersheds with a large number of failing septic tanks may also deliver significant loadings of phosphorus to a water body. All domestic wastewater contains phosphorus which comes from humans and the use of phosphate containing detergents.

The watershed contains mainly Forest but also has different landuse types, including urban, water, and wetlands. The land use information for the watershed is based on the National Land Cover Database (NLCD). The landuse distribution for the Noxubee River Watershed is shown in Table 8 and Figure 4. The NLCD landuse map is shown in Figure 5. By multiplying the landuse category size by the estimated nutrient load, the watershed specific estimate can be calculated. Table 9 presents the estimated loads, the target loads, and the reductions needed to meet the nutrient TMDL.

Table 8. Landuse in Noxubee River Watershed

Landuse	Noxubee River	
	Percentage	**Area (acres)**
Urban	4.2%	29053
Forest	48.3%	337049
Cropland	7.6%	52901
Pasture/Grassland	12.5%	87351
Scrub/Brush	6.8%	47198
Water	1.2%	8161
Wetlands	19.4%	135498
Total	100%	**697211**

Figure 4. Landuse in Noxubee River Watershed



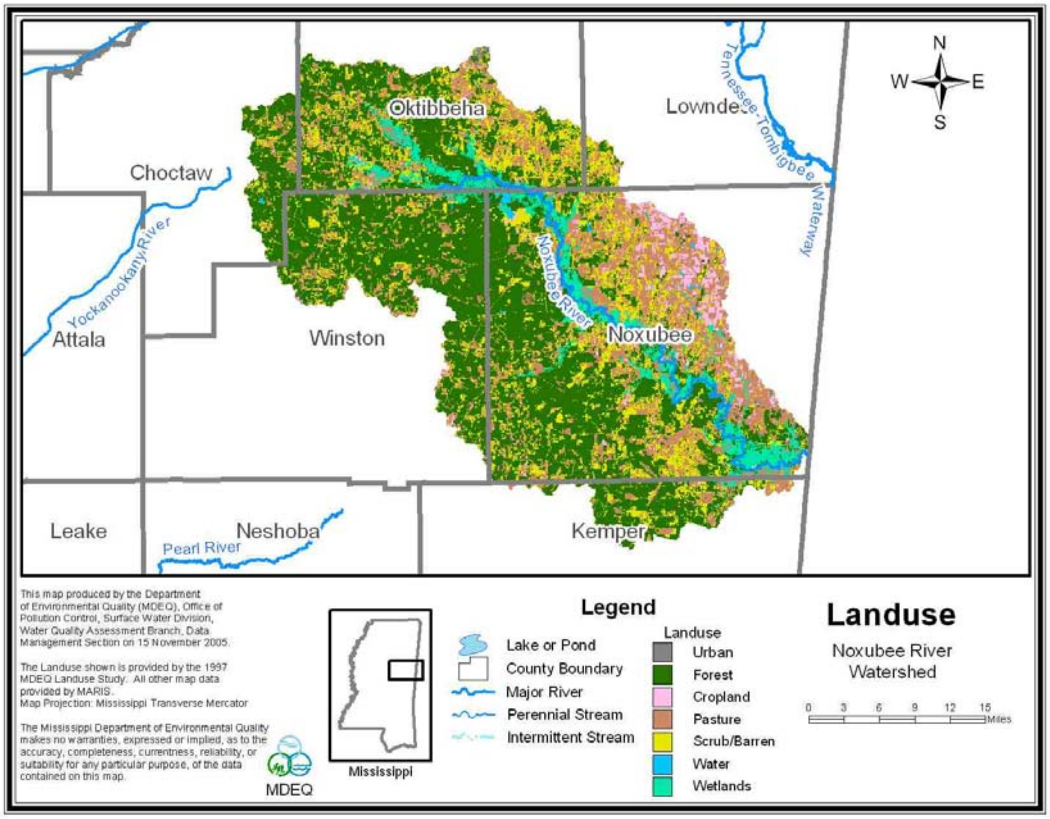


Figure 5. Noxubee River Watershed Landuse

2.4 Estimated Existing Load for Total Nitrogen and Total Phosphorus

To determine the estimated load, the load estimate values presented in Table 9 were multiplied by the land use values given in Table 8. The values were taken from a USDA report estimating the nutrient runoff. The reductions needed to meet the target for TP 66.81%. No reduction is needed for TN according to the mass balance calculations. Table 10 shows the TP and TN estimated loads for each point source. The total TN load is in line with the estimated watershed load. The TP load appears to be too high and needs to be reduced from nonpoint source and from point source loads. To accomplish this reduction, this TMDL recommends including a NPDES permit limit for TP for the Starkville POTW MS0036145 of 247 lbs. per day. The TMDL is 836 lbs. per day. The load allocation estimate is 493 lbs. per day. The remaining allowable load for point sources is 343 lbs. per day. The current estimated point source load is 580 lbs per day (see Table 11). By reducing the Starkville limit from and estimated load of 484 lbs per day to 247 lbs per day, the sum of the waste load allocation and the load allocation will equal the TMDL.

Table 9. TMDL Calculations and Watershed Sizes

Water body	**Noxubee River**		**Water**	**Urban**	**Scrub/Barren**	**Forest**	**Pasture/Grass**	**Cropland**	**Wetland**	**Total**
		Acres	8161.4	29053.2	47197.7	337049.2	87350.5	52900.2	135498.3	697211
Land Use	**TN kg/mile2**	Percent	1.17%	4.17%	6.77%	48.34%	12.53%	7.59%	19.43%	100.00%
Forest	111.3	Miles^2 in watershed	12.8	45.4	73.7	526.6	136.5	82.7	211.7	1089.4
Pasture	777.2	Flow in cfs based on area	1550.0	cfs						
Cropland	5179.9									
Urban	296.4	TN Load kg/mi^2 annual avg	257.4	296.4	111.3	111.3	777.2	5179.9	265.2	
Water	257.4	TP Load kg/mi^2 annual avg	257.4	3.1	62.1	62.1	777.2	2589.9	265.2	
Wetland	265.2									
aquaculture	111.3	TN Load kg/day	9.0	36.9	22.5	160.6	290.6	1173.0	153.8	1846.4
		TP Load kg/day	9.0	0.4	12.5	89.6	290.6	586.5	153.8	1142.5
Land Use	**TP kg/mile2**									
Forest	62.1	TN target concentration	0.7	mg/l						
Pasture	777.2	TP target concentration	0.1	mg/l						
Cropland	2589.9									
Urban	3.1	TN estimated concentration	0.49	mg/l						
Water	257.4	TP estimated concentration	0.30	mg/l						
Wetland	265.2									
aquaculture	62.1	TN target load	5852.49	lbs/day						
		TP target load	836.07	lbs/day						
		TN estimated load per day	4070.71	lbs/day						
		TP estimated load per day	2518.73	lbs/day						
		TN reduction needed	NA							
		TP reduction needed	66.81%							

The land use calculations are based on 2004 data. The nutrient estimates are based on USDA ARS. The TMDL targets are based on EPA guidance for calculation of targets when considering all available data.

Table 10. Estimated TN and TP Loads

Permit	Facility	Flow MGD	TN Load	TP Load
MS0036145	Starkville	10	959.10	484.24
MS0052264	Koch Foods	0.5	47.96	24.21
MS0033596	Brooksville	0.24	23.02	11.62
MS0025143	Shuqualak	0.12	11.51	5.81
MS0057550	Superior Fish	0.11	10.55	5.33
MS0052892	Browning Creek	0.1	9.59	4.84
MS0020796	Macon	0.6	57.55	29.05
MS0041840	Sturgis	0.088	8.44	4.26
MS0020427	Choctaw Lake	0.0038	0.36	0.18
MS0029718	Starkville CC	0.009	0.86	0.44
MS0036714	TESI	0.05	4.80	2.42
MS0036862	Chateau Lane	0.0006	0.06	0.03
MS0037419	Garners	0.004	0.38	0.19
MS0038601	Moor HS	0.012	1.15	0.58
MS0039560	Crawford	0.06	5.75	2.91
MS0043524	Chimney	0.00125	0.12	0.06
MS0045349	Barge	0.0012	0.12	0.06
MS0048224	Lake Forest	0.02	1.92	0.97
MS0053180	Montgomery	0.03	2.88	1.45
MS0055671	Grand Oaks	0.04	3.84	1.94
			1149.95	580.60

WATERSHED MODELING

3.1 WASP Model Description and Setup

MDEQ utilized the Water Quality Analysis Simulation Program (WASP7) to study the nutrient and organic loading in the watershed. WASP7 is an enhancement of the original WASP (Di Toro et al., 1983; Connolly and Winfield, 1984; Ambrose, R.B. et al., 1988). This model helps users interpret and predict water quality responses to natural phenomena and manmade pollution for various pollution management decisions. WASP is a dynamic compartment-modeling program for aquatic systems, including both the water column and the underlying benthos. WASP allows the user to investigate 1, 2, and 3 dimensional systems, and a variety of pollutant types. The time varying processes of advection, dispersion, point and diffuse mass loading and boundary exchange are represented in the model. WASP also can be linked with hydrodynamic and sediment transport models that can provide flows, depths velocities, temperature, salinity and sediment fluxes (http://www.epa.gov/athens/wwqtsc/html/wasp.html).

3.2 Model Results

The Noxubee River watershed model was assembled to simulate the existing condition including the estimated loads of TN, TP, and TBODu both from point sources and from nonpoint sources. The output from the model was compared to DO standard and gave a reasonable result.

The model output shown in Figures 6, 7, and 8 is the simulated dissolved oxygen for scenarios in a segment downstream of the point source. In Figure 6, the model output is shown in blue above the water quality standard of 5.0 mg/l. The flow is shown in red. At the current permit limits as shown in Table 8, there is no violation of the water quality standard in the river. Figure 6 shows model segment 9, which is the critical segment. Figure 7 shows the critical segment for Koch Foods in Horse Hunter Creek. This permit had to be reduced to meet water quality in this tributary. The reduced limits are given in Table 7. Figure 8 shows the segment below the Macon POTW outfall. No reduction of Macon is needed to continue to meet water quality in Noxubee River.

Analysis of the model scenarios shows the dissolved oxygen concentrations associated with natural conditions are expected to be attained with the addition of the existing point sources. This finding demonstrates the existing point source does not significantly affect the instream dissolved oxygen concentrations. However, there is a significant improvement in water quality when the nonpoint nutrient loads are reduced to acceptable ecoregion loading levels as observed by the comparison of the existing load to the natural condition with point sources. Therefore, control of the nonpoint sources is critical to improve the water quality in the Noxubee River.

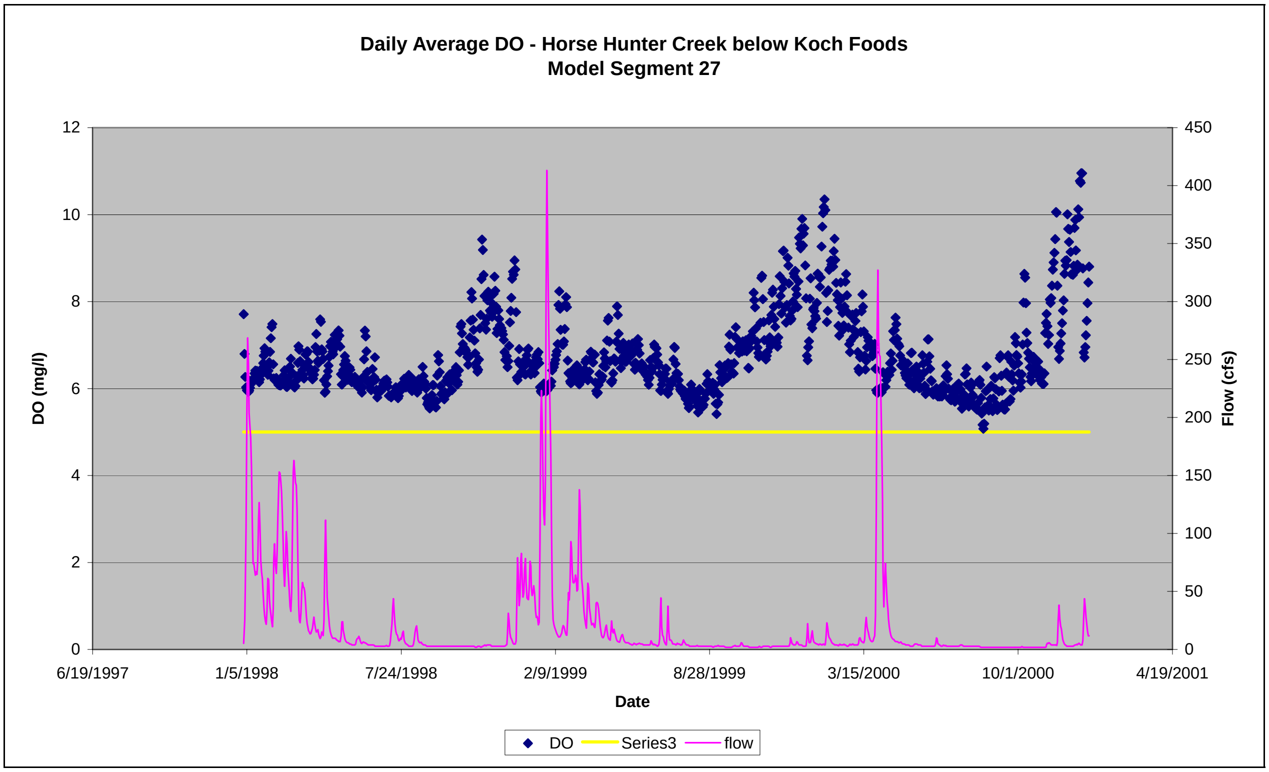


Figure 6. Model Output for DO –Noxubee River Existing Conditions with Point Sources

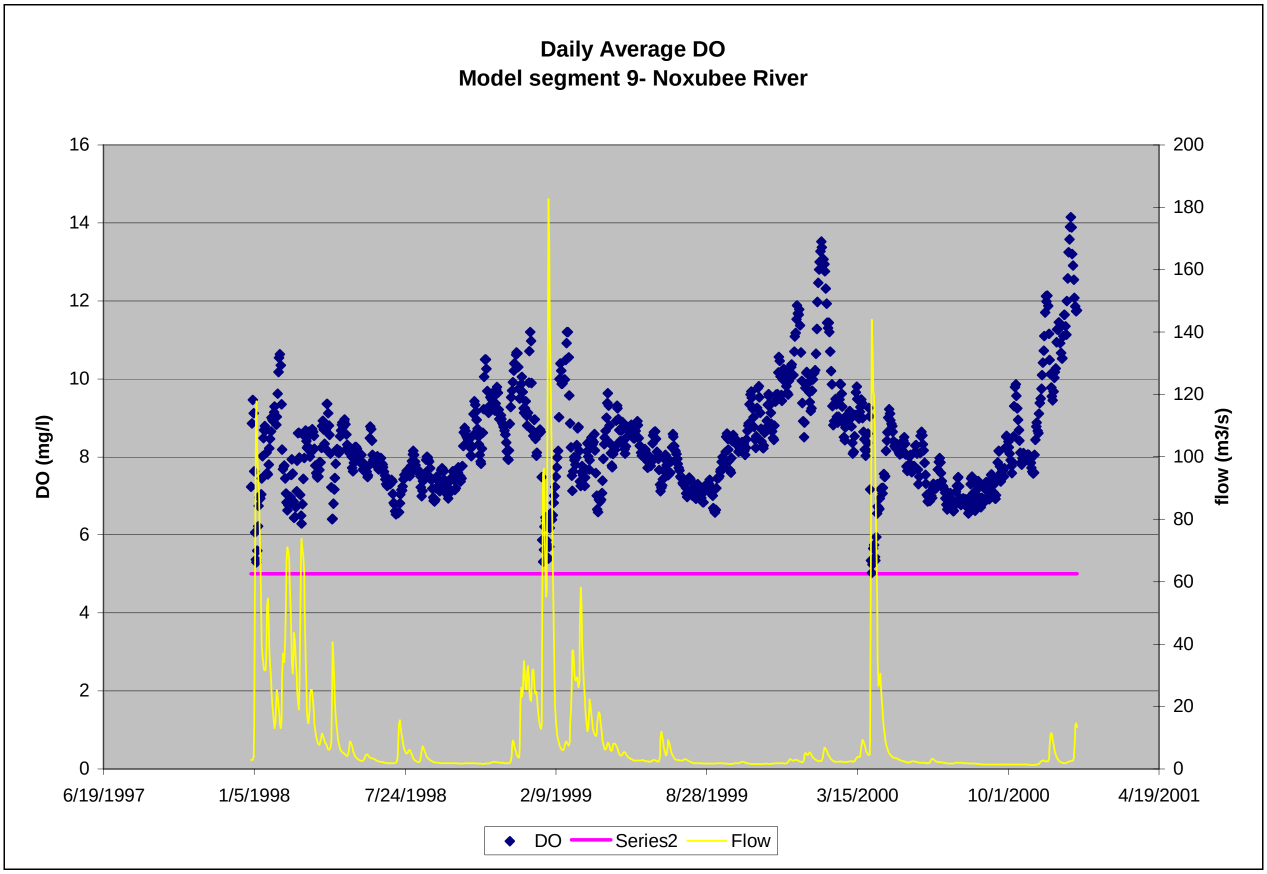


Figure 7 Critical condition for Koch Foods in Horse Hunter Creek

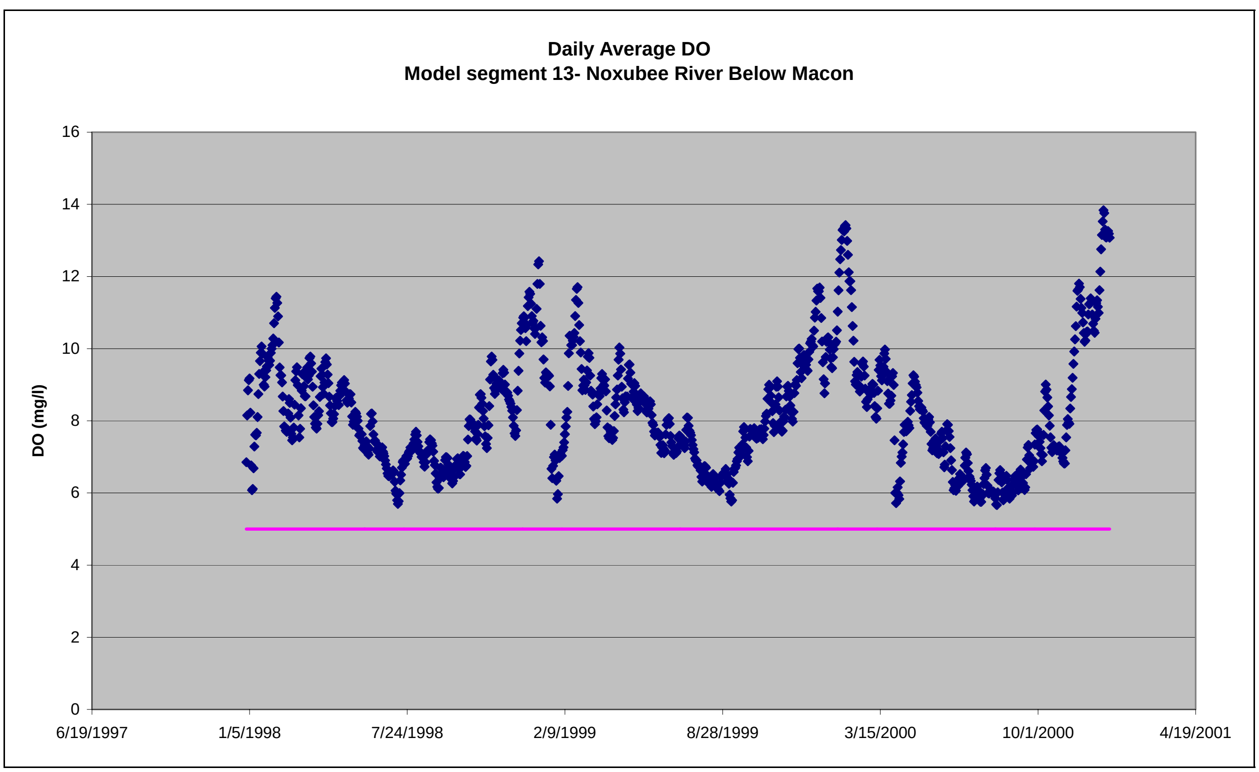


Figure 8 Macon Critical Segment in Noxubee River

ALLOCATION

The TMDL process quantifies the amount of a pollutant that can be assimilated in a water body, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (WLA), nonpoint source loads (LA), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and WQS achieved. 40 CFR §130.2 (i) states that TMDLs are expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measures.

The TMDLs for Noxubee River are expressed as the loads of TBOD, TN, and TP loading that are expected to achieve the DO standard in the “critical zone” of the Noxubee River. The critical zone is the river reach, based on the model, where the DO hits its lowest concentration. The in-stream target concentrations for TN and TP are 0.7 and 0.1 mg/L, respectively, and are expressed as average annual concentrations.

4.1 Wasteload Allocation

The WLA for this TMDL recommends a NPDES Permit reduction for Koch Foods and a new TP limits for Starkville POTW. The WLAs are expressed separately for continuous discharge facilities (e.g., waste water treatment plants) and MS4 areas, as the former discharges during all weather conditions whereas the latter discharges in response to storm events. There are no MS4 areas in the Noxubee River watershed. The sum of the WLAs is shown in Table 3 as a part of the TMDL calculations.

4.2 Load Allocation

The primary mode for transport of nutrients and BOD to streams is during a storm event. Modification of the land surface from a pervious land cover to an impervious surface results in higher peak flow rates that wash nutrient and BOD-enriched water into the stream. The load allocation calls for reductions in average annual total phosphorus loadings from nonpoint sources throughout the watershed equal to the percent reductions provided in Table 10. This reduction is expected to allow DO concentrations to attain standards and nutrient loads to attain the targets.

4.3 Determination of Watershed Load Reductions

The TMDL scenario was achieved by reducing effluent concentration from Koch Foods. Total phosphorus reduction is also needed to meet the target for TP. Best management practices (BMPs) should be encouraged in the watershed to reduce potential BOD, TN, and TP loads from nonpoint sources. The watershed should be considered a priority for riparian buffer zone restoration and any nutrient reduction BMPs. For land disturbing activities related to silvaculture, 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.

4.4 Margin of Safety

TMDLs shall include a margin of safety (MOS) that takes into account any lack of knowledge about the pollutant loading and in-stream water quality. In this case the measured water quality was used directly to determine the reduction to meet the water quality standard. In this case the lack of knowledge concerns the data, and how well it represents the true water quality. There are two methods for incorporating a MOS in the analysis: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. An implicit MOS was incorporated in the analyses through the use of conservative daily time series modeling assumptions.

4.5 Critical Conditions and Seasonal Variation

The critical conditions can be defined as the environmental conditions requiring the largest reduction to meet standards. By achieving the reduction for critical conditions, water quality standards should be achieved during all other times. Critical conditions are accounted in the water quality model by selecting the segment requiring the greatest reductions in pollutant loads. By targeting this segment for reductions all other segments in the model meet water quality standards.

Seasonal variation must also be considered to ensure that water quality standards will be met during all seasons of the year. Seasonal variation was considered by targeting the growing season as this is when the greatest nutrient loadings enter the creek. In addition, the model was run for seven years and accounts for numerous seasons.

CONCLUSION

Nutrients were addressed through an estimate of a preliminary total phosphorous concentration target and a preliminary total nitrogen concentration target. Based on the estimated existing and target total phosphorus concentrations, this TMDL recommends a 66.81 % reduction of the nonpoint total phosphorus loads entering these water bodies to meet the preliminary target of 0.10 mg/l. In addition, the Starkville POTW needs to limit the discharge of TP to 247 lbs per day. The implementation of BMP activities should reduce the nutrient load entering the creeks. This will provide improved water quality for organic enrichment and the support of aquatic life in the water bodies, and will result in the attainment of the applicable water quality standards. Koch Foods needs to limit the effluent to 14-2-6 (BOD_5 - NH_3-N - DO) to protect the water quality in the Noxubee River tributary Horse Hunter Creek. The remaining permit limits are protective of the water quality standards.

5.1 Next Steps

MDEQ's Basin Management Approach and Nonpoint Source Program emphasize restoration of impaired waters with developed TMDLs. During the watershed prioritization process to be conducted by the Tombigbee River Basin Team, this TMDL will be considered as a basis for implementing possible restoration projects. The basin team is made up of state and federal resource agencies and stakeholder organizations and provides the opportunity for these entities to work with local stakeholders to achieve quantifiable improvements in water quality. Together, basin team members work to understand water quality conditions, determine causes and sources of problems, prioritize watersheds for potential water quality restoration and protection activities, and identify collaboration and leveraging opportunities. The Basin Management Approach and the Nonpoint Source Program work together to facilitate and support these activities.

The Nonpoint Source Program provides financial incentives to eligible parties to implement appropriate restoration and protection projects through the Clean Water Act's Section 319 Nonpoint Source (NPS) Grant Program. This program makes available around $1.6M each grant year for restoration and protections efforts by providing a 60% cost share for eligible projects.

Mississippi Soil and Water Conservation Commission (MSWCC) is the lead agency responsible for abatement of agricultural NPS pollution through training, promotion, and installation of BMPs on agricultural lands. USDA Natural Resource Conservation Service (NRCS) provides technical assistance to MSWCC through its conservation districts located in each county. NRCS assists animal producers in developing nutrient management plans and grazing management plans. MDEQ, MSWCC, NRCS, and other governmental and nongovernmental organizations work closely together to reduce agricultural runoff through the Section 319 NPS Program.

Mississippi Forestry Commission (MFC), in cooperation with the Mississippi Forestry Association (MFA) and Mississippi State University (MSU), have taken a leadership role in the development and promotion of the forestry industry Best Management Practices (BMPs) in Mississippi. MDEQ is designated as the lead agency for implementing an urban polluted runoff control program through its Stormwater Program. Through this program, MDEQ regulates most construction activities. Mississippi Department of Transportation (MDOT) is responsible for implementation of erosion and sediment control practices on highway construction.

Due to this TMDL, projects within this watershed will receive a higher score and ranking for funding through the basin team process and Nonpoint Source Program described above.

5.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper. 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@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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Appendix 1 – Model Report detailing changes made to the EPA developed model for this stream.

Memorandum

TO: Greg Jackson, PE, BCEE
Mississippi Department of Environmental Quality

FROM: Laura Sheely, PE
FTN Associates, Ltd.

DATE: June 10, 2008

RE: Noxubee River Model Results
FTN No. 3120-709B

Introduction

This memo presents the results of the WASP water quality model for the Noxubee River, located near Macon, MS. Environmental Protection Agency (EPA) Region 4 developed the model input data set for the Noxubee River. At the Mississippi Department of Environmental Quality's (MDEQ) request, FTN Associates, Ltd. (FTN) used this model with limited modifications to calculate wasteload allocations (WLAs) for two NPDES permitted point sources located in the Noxubee River watershed. FTN also determined the allowable organic pollutant and nutrient loads (in terms of total biochemical oxygen demand (TBODu), total nitrogen (TN) and total phosphorous (TP)) for the Noxubee River.

The model developed by EPA included the main stem of the Noxubee River, beginning south of Starkville and ending at the MS/AL state line, for a total distance of 110 miles (177 km). Tributaries of the Noxubee River; Hollis Creek, Joes Creek, and Horse Hunter Creek were also included in the model. The model was set up to simulate dissolved oxygen (DO) levels in the Noxubee River in response to oxidation of carbonaceous and nitrogenous loads from point and nonpoint sources. The model also simulates the cycling of nutrients (nitrogen and phosphorous) and algal growth and their effect on DO.

Model Review

Based on our review of the EPA model, we believe that the model results should be interpreted with caution because the model contains a significant amount of uncertainty. This is due to lack of calibration data and the high degree of complexity in the simulation. For example, simulating the full nutrient-algal cycle in WASP requires the user to specify a large number of coefficients such as algal growth rates, algal half saturation coefficients, algal settling rates, and many others. The values of these coefficients in the Noxubee River model were based on a set of assumed values typically used in waters in Mississippi. However, these values were not specifically calibrated for the Noxubee River.

The model segmentation of the Noxubee River and its tributaries is an additional cause of uncertainty. This is because the model developed by EPA Region 4 contained extremely large model segments of up to 16 miles in length. Smaller model segments are needed in order to more accurately predict the impact of point source discharges in the receiving stream. In order to address this concern, FTN modified the model segmentation in two of the model segments located downstream of point source discharges. However, the segmentation in the remaining areas of the model was not changed.

Model Modifications

At MDEQ's request, we ran the model with limited modifications to the original version of the model developed by EPA Region 4. The modifications include the following:

1. Segment 12 (segment below Macon POTW) was divided into smaller segments of 1 mile in length in order to provide greater resolution for the model output.
2. Segment 21 (segment below Koch Foods) was divided into smaller segments of 0.5 mile in length.
3. Flows going into segment 9 were removed so that the modeled flows and flows measured daily at the USGS gage at Macon more closely matched.
4. Three permits were initially included in the model: Starkville POTW, Brooksville POTW, and Koch Foods, Brooksville Facility (formerly Pride of the South Catfish). There are 17 additional point sources located in the Noxubee River watershed. These sources were added as loads, based on their monthly average permit limits, into the appropriate segments of the model. Macon POTW, which discharges into the Noxubee River was one of the added point sources.
5. The model period was adjusted to a 3 year period beginning on January 1, 1998 and ending on December 31, 2000. The critical period for low-flow conditions was determined to occur during the month of August 2000. The flow for August 2000 approximated the 7Q10 flow in the Noxubee River.
6. All WASP kinetic parameters were set to be consistent with the values in a spreadsheet provided by EPA Region 4. The only exception to this was the decay rate for CBOD decay. This rate was set at 0.3 (per day at 20 C), which is consistent with MDEQ Regulations.

Results – Waste Load Allocations

The WLA results for Koch Foods, Brooksville Facility and the Macon POTW are presented in Table 1. The WLA represents the allowable permit limits that allow attainment of water quality standards during critical conditions.

Table 1. WLAs for Koch Foods, Brooksville Facility and Macon POTW.

Facility	**Flow (MGD)**	**BOD5 (mg/L)**	**Ammonia Nitrogen (mg/L)**	**DO (mg/L)**
Koch Foods, Brooksville Facility	0.5	12	2	6
Macon POTW	0.6	40	3	6

Results – Maximum Allowable Loads

In addition to the WLAs, MDEQ requested FTN to determine allowable pollutant loads for the Noxubee River. These loads are presented in Table 2. These loads represent the maximum allowable loads of TBODu, TN, and TP that can be placed in the Noxubee River that will allow attainment of water quality criteria for DO during critical conditions. Concentrations used for non-point source loads were derived by EPA Region 4 based on water quality data and assumed nutrient partitioning fractions. The loads are given as point source and nonpoint source components, calculated on an annual average basis.

Table 2. Allowable pollutant loads for the Noxubee River.

	Nonpoint Source Load	**Point Source Load**	**Total Load**
TBODu (lbs/day)	22,884	3,702	26,586
TN (lbs/day)	2,526	1,336	3,862
TP(lbs/day)	620	573*	1,193

*Prior to TMDL reduction
LHS/bls

Appendix 2 – Model Input

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