PROPOSED REPORT
November 2006

Total Maximum Daily Load
For Nutrients

In Heron Bayou
Coastal Streams Basin

Jackson County
Mississippi

Prepared By

Mississippi Department of Environmental Quality
Office of Pollution Control
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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 §303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The 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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Name	ID	County	HUC	Cause	Mon/Eval
Heron Bayou	MS118HBE	Jackson	03170009	Nutrients	Evaluated
Near Ocean Springs from Headwaters to Mouth at Davis Bayou					

ii. Water Quality Standard

Parameter	Beneficial use	Water Quality Criteria
Nutrients	Aquatic Life Support	"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 water for any designated use."

iii. NPDES Facilities

There are no NPDES permitted facilities in this water body.

iv. Total Maximum Daily Load for Nutrients*

	NH_3-N (lbs/day)	NO_3-N (lbs/day)	PO_4 (lbs/day)	ON (lbs/day)	OP (lbs/day)
WLA	0	0	0	0	0
LA	17.2	6.9	1.7	88	1.7
MOS	Implicit	Implicit	Implicit	Implicit	Implicit
TMDL	**17.2**	**6.9**	**1.7**	**88.0**	**1.7**

*The State of Mississippi is in the process of developing numeric nutrient criteria in accordance with an EPA approved work plan for nutrient criteria development.

EXECUTIVE SUMMARY

This TMDL has been developed for Heron Bayou which is on the Mississippi 2004 §303(d) List of Water Bodies as an evaluated water body segment. Heron Bayou was originally placed on the §303(d) List based on anecdotal information. Mississippi conducted a survey of district conservationists (DCs) in 1988 and 1989 to find candidate watersheds for future §319 funding opportunities. MDEQ requested each DC identify the watersheds of concern in their county based on available information including land use. Numerous DCs responded to the survey, and MDEQ created Mississippi's §319 List based on these surveys.

As a result of the surveys, Heron Bayou was listed for nutrients. Mississippi currently does not have water quality standards for allowable nutrient concentrations. This TMDL will be developed for nutrients.

Heron Bayou is an estuarine water body located on the Mississippi Gulf Coast in HUC 03170009. The bayou, Photo 1, drains a small suburban area near Ocean Springs before joining Davis Bayou and eventually the eastern side of the Back Bay of Biloxi. The §303(d) Listed segment of Heron Bayou begins at the headwaters in Ocean Springs and ends at the confluence with Davis Bayou. The location of the watershed is shown in Figure 1.

Photo 1. Heron Bayou

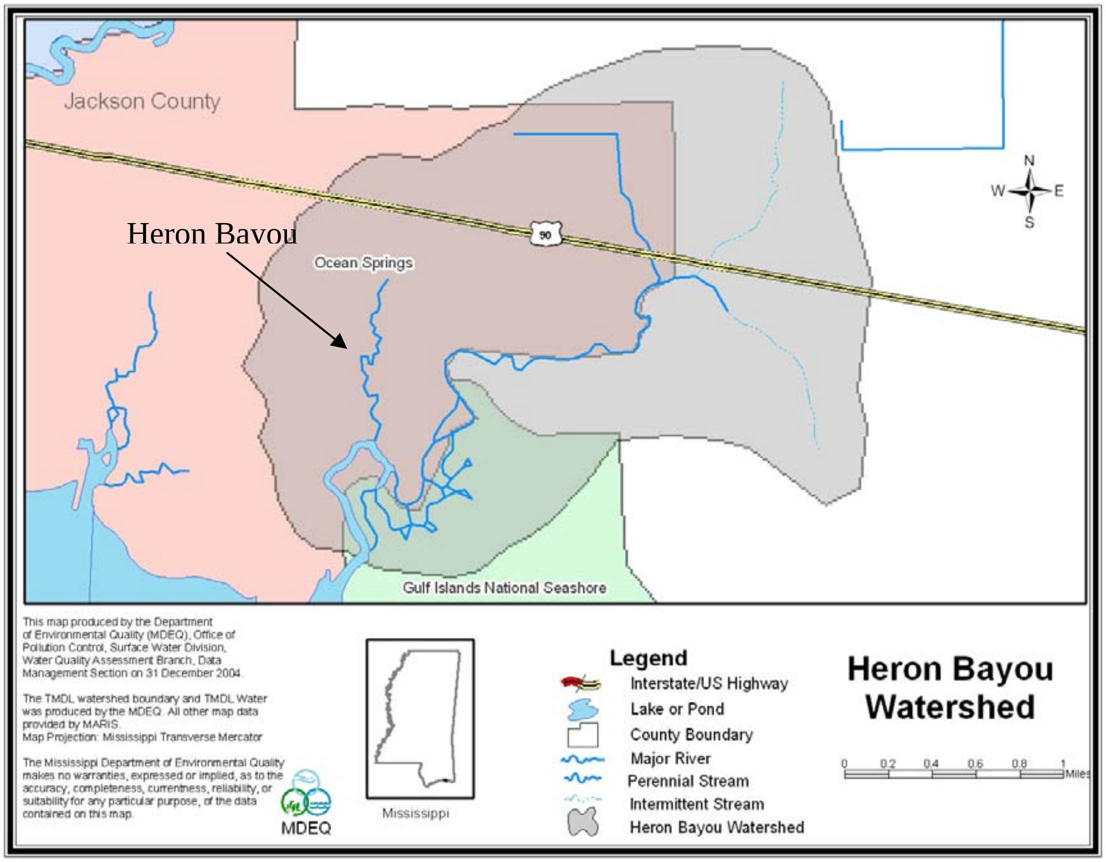

Figure 1. Heron Bayou Watershed

The TMDL for this water body is based on a monitoring and modeling project that studied the Back Bay of Biloxi and its tributaries. The model, which used the DYNHYD and EUTRO5 components of the Water Quality Analysis Simulation Program-5 (WASP5), was developed by the Civil Engineering Department at Mississippi State University, based on water quality studies of the area which were conducted in September 1994 and April-May 1995. The dataset developed from monitoring data collected in 1994 was used for model calibration, and the dataset developed from monitoring data collected in 1995 was used for model verification.

Loading estimates of organic substances from non-point sources in the watershed were based upon background concentrations measured during the model calibration/verification studies of the Back Bay of Biloxi watershed. No NPDES permitted discharges will be allowed in this water body. It is not an appropriate discharge water body due to its small size, tidal influence, and residential and recreational use.

INTRODUCTION

1.1 Background

Heron Bayou was originally placed on the §303(d) List based on anecdotal information. Mississippi conducted a survey of district conservationists (DCs) in 1988 and 1989 to find candidate watersheds for future §319 funding opportunities. MDEQ requested each DC identify the watersheds of concern in their county based on available information including land use. Numerous DCs responded to the survey, and MDEQ created Mississippi's §319 List based on these surveys.

In 1992, MDEQ compiled a §303(d) List based, in part, on the §319 List of watersheds of concern. Therefore, water bodies were included on the §303(d) List based on speculation and not water quality monitoring data. MDEQ uses the term "evaluated" to describe these water bodies that were placed on the §303(d) List without monitoring data. At the time, MDEQ considered the evaluated listings from the §319 survey as a placeholder for future monitoring to determine if there was impairment in the watershed. The surveys asked for the presence of agriculture, urban areas, or forestry in the watershed. MDEQ interpreted potential pollutants present on these land uses and listed several broad potential pollutant categories based on the survey results. Heron Bayou was listed for nutrients, siltation, turbidity, and pathogens based on the survey results. For TMDL development, NH_3-N, NO_3-N, ON, PO_4, and OP are used as nutrients of concern.

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 §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 evaluated §303(d) Listed segment shown in Figure 2.

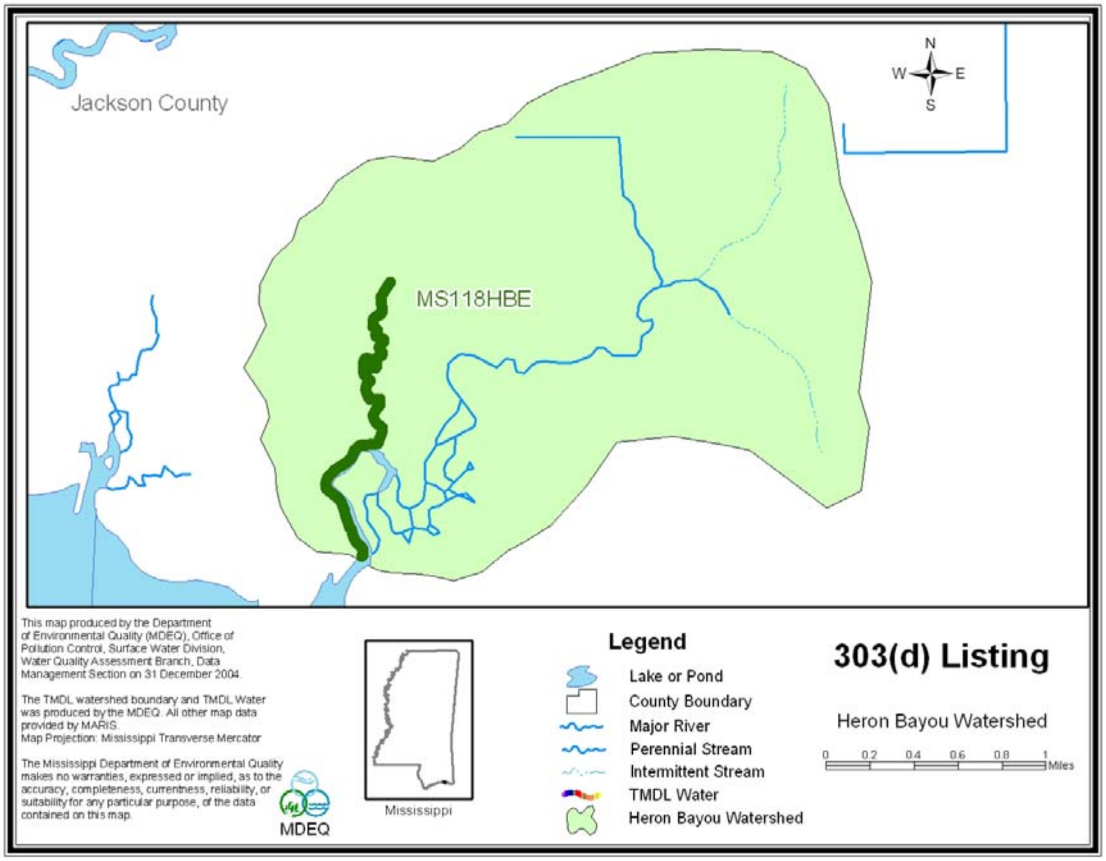

Figure 2. Heron Bayou 303(d) Listed Segment

1.2 Applicable Water Body Segment Use

The water use classifications are established by the State of Mississippi in the document *Water Quality Criteria for Intrastate, Interstate and Coastal Waters* (MDEQ, 2002). The designated beneficial use for the § 303(d) Listed segment of Heron Bayou is fish and wildlife support.

1.3 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, 2002). Numeric criteria for total phosphorus have not been established by MDEQ. Therefore, this TMDL relies on the narrative criteria which state "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 water for any designated use." Mississippi's NTF is currently developing numeric criteria for nutrients.

1.4 Selection of a Critical Condition

The critical condition represents the hydrologic and atmospheric conditions in which the pollutants causing impairment of a water body have their greatest potential for adverse effects. This is difficult to address since this is a tidally influenced water body and there are no discharge pipes. Therefore, a wet year is considered to be a critical condition for this TMDL.

Photo 2. Heron Bayou

1.5 Selection of a TMDL Endpoint

The TMDL for nutrients will be quantified in terms of an annual average concentration for NH_3-N, NO_3-N, ON, PO_4, and OP. These values may be subject to revision as the nutrient criteria development process continues.

WATER BODY ASSESSMENT

This TMDL Report includes an analysis of available water quality data and the identification of all known potential pollutant sources in the Heron Bayou Watershed. The potential non-point pollutant sources were characterized by the best available information, monitoring data, and literature values. There are no NPDES permitted point sources in the watershed.

2.1 Discussion of Instream Water Quality Data

There is a limited amount of data available for the Heron Bayou Watershed. Limited chemical data were collected from station 02480293.90, Heron Bayou near Ocean Springs. Data were collected twice in 1998, as part of MDEQ's ambient surface water monitoring program.

2.2 Assessment of Non-Point Sources

Non-point loading of nutrients in a water body results from the transport of nutrients into waters by overland surface runoff and groundwater infiltration. Non-point pollution sources of concern are storm drainage from a suburban area of Ocean Springs. Other landuses within the drainage basin, such as forested and scrub/barren also contribute to non-point source loading.

The drainage area of Heron Bayou is approximately 3,125 acres (approximately 4.9 square miles). The watershed contains different landuse types, including urban, forest, scrub/barren, and wetlands. The landuse information given below is based on data collected by the State of Mississippi's Automated Resource Information System (MARIS) in 1997. This data set is based on Landsat Thematic Mapper digital images taken between 1992 and 1993. Forest is the dominant landuse within the watershed. Also, a significant portion of the watershed is classified as urban area. The landuse distribution is shown in Table 1 and Figure 3.

Table 1. Landuse Distribution, Heron Bayou Watershed

	Urban	Forest	Cropland	Pasture	Scrub/ Barren	Water	Wetlands	Total
Area (acres)	433	1,877	0	70	470	42	233	3,125
Percentage	14%	60%	0%	2%	15%	1%	8%	100%

As described in *Protocol for Developing Nutrient TMDLs* (USEPA, 1999) using site-specific data collected at monitoring stations upstream of the area of concern can be used to estimate boundary conditions and non-point source loads. Load estimates at the upstream monitoring station can typically be derived from measurements of flow and concentrations of organic materials and nutrients. In the EUTRO5 model developed by MSU for MDEQ's Back Bay of Biloxi WLA model, constant concentrations were specified for each water quality constituent at each upstream boundary. A freshwater inflow study conducted during the period of May 1993 to August 1994, in conjunction with the Back Bay of Biloxi model study, was used as the source of data for the model boundary conditions. Table 2 shows the boundary concentrations established in this model for Heron Bayou.

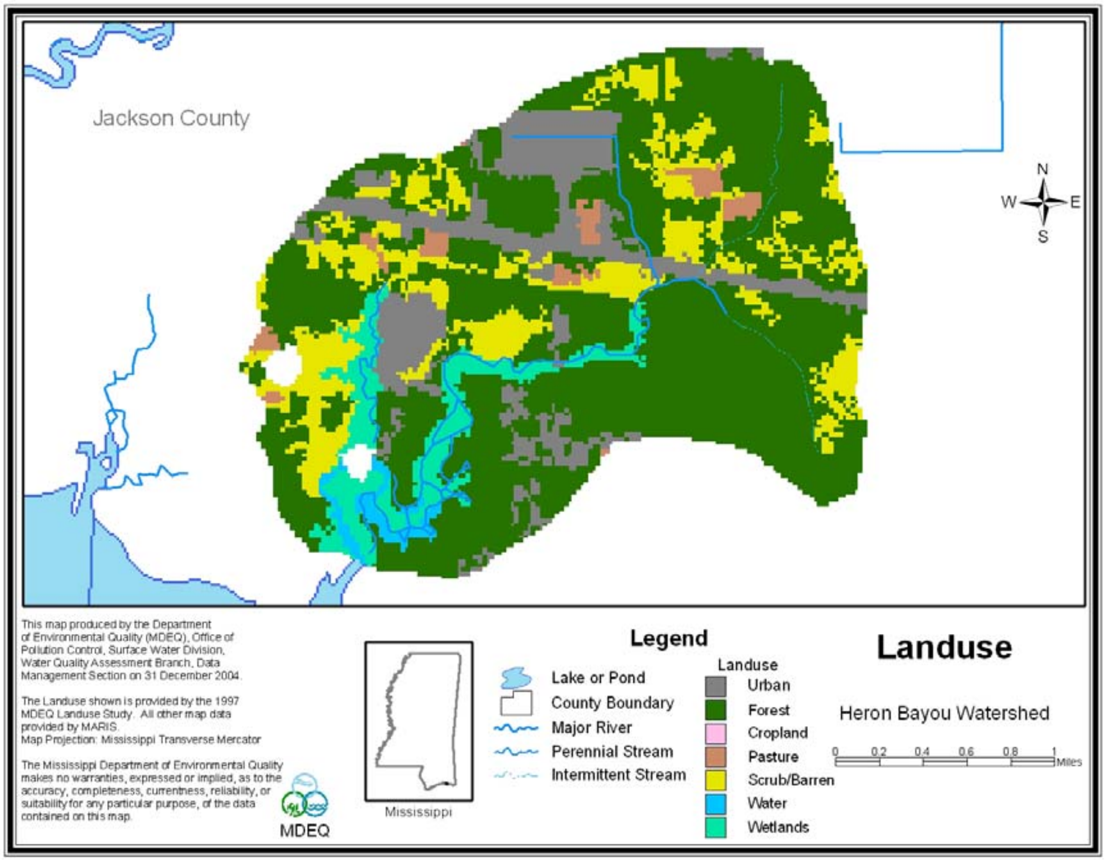

Figure 3. Landuse Distribution for the Heron Bayou Watershed

Table 2. Boundary Conditions, Estimated for Heron Bayou

NH_3-N (mg/l)	NO_3-N (mg/l)	PO_4 (mg/l)	$CBOD_U$ (mg/l)	DO (mg/l)	ON (mg/l)	OP (mg/l)
0.1	0.04	0.01	7.6	5.0	0.51	0.01

Using these boundary conditions, non-point source loads were estimated using the yearly average runoff for the Heron Bayou Watershed. Yearly average runoff was calculated from output from the NPSM for 1995. The year 1995 was chosen because it was a wet-year, and thus would give a greater average daily flow. Figure 4 shows the hydrograph modeled for 1995 for freshwater inflow into Heron Bayou from the watershed. The average flow was 32.0 cfs. The loads shown in Table 3 were calculated by multiplying the flow and boundary concentrations.

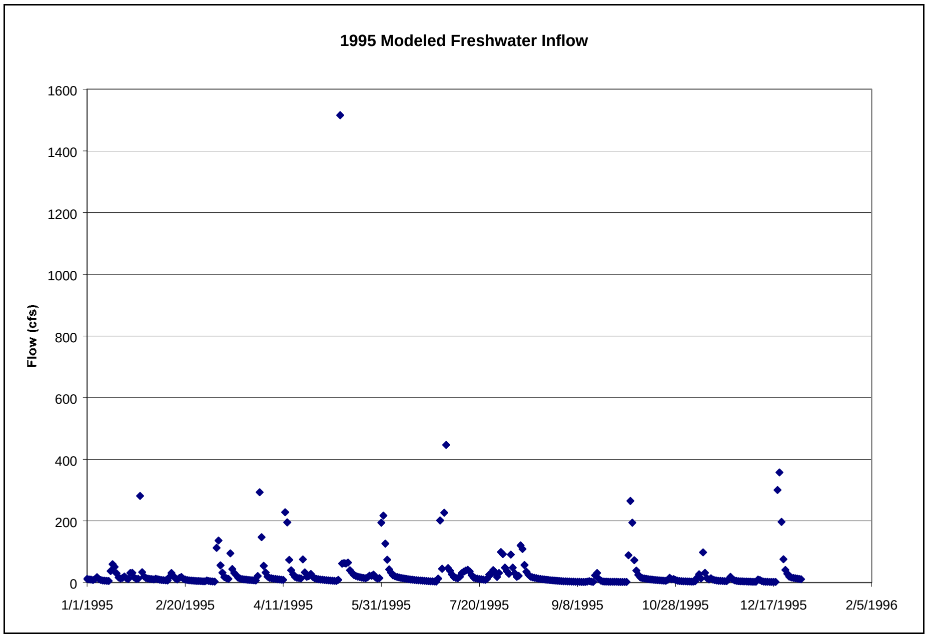

Figure 4. Freshwater Inflow for Heron Bayou, 1995

Table 3. Calculation of Non-Point Source Nutrient Loads

Yearly Average Flow (cfs)	NH_3-N (lbs/day)	NO_3-N (lbs/day)	PO_4 (lbs/day)	ON (lbs/day)	OP (lbs/day)
32.0	17.2	6.9	1.7	88.0	1.7

MODELING PROCEDURE: LINKING THE SOURCES TO THE ENDPOINT

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

3.1 Modeling Framework Selection

The TMDL for Heron Bayou was developed using two computer simulation models. The NPSM model, which simulated the hydrology of the watershed, was used to calculate the yearly average runoff from the watershed. The non-point source loads were input into the Water Quality Analysis Simulation Program 5 (WASP5). WASP5 was used to simulate hydrodynamics, salinity, and water quality conditions in the Back Bay of Biloxi and contributing water bodies including Heron Bayou. The WASP5 model consists of three stand-alone computer programs, DYNHYD, EUTRO5, and TOXI5. These programs can be run in conjunction with the others or separately. The hydrodynamics program, DYNHYD, was used to simulate the movement of water, while the water quality program, EUTRO5, was used to simulate the movement and interaction of the pollutants within the water. This TMDL report gives a brief description of the model setup and application of the models used for developing this TMDL. Detailed information about the NPSM is available in *Better Assessment Science Integrating Point and Nonpoint Sources, BASINS, Version 2.0 User's Manual* (USEPA 1998). Additional details of the model setup and calibration of the WASP5 model are available in *Water Quality and Hydrodynamic Models for Back Bay of Biloxi, Volume I – Model Documentation* (Shindala et al., 1996).

3.2 Model Setup

The BASINS model platform and the NPSM model were used to model the watershed hydrology and loads contributed from the Heron Bayou watershed. BASINS is a multipurpose environmental analysis system for use in performing watershed and water quality-based studies. A geographic information system (GIS) provides the integrating framework for BASINS and allows for the display and analysis of a wide variety of landscape information such as landuses, monitoring stations, and stream descriptions. The calibrated NPSM model simulated non-point source runoff from selected subwatersheds in order to isolate the major stream reaches and to allow for the relative contribution of non-point sources to be addressed within each subwatershed. The weather data used for the NPSM were collected at several locations in the study area. The representative hydrologic period used for the NPSM was a wet year, 1995, as determined by an analysis of mean annual rainfall distributions at several weather stations including Biloxi, Gulfport Naval Center, Merril, Ocean Springs, Saucier Experimental Forest Station, Vancleave, and Wiggins Ranger Station.

WASP5 is a dynamic model that can be used to simulate water quality processes in aquatic systems. The model incorporates the time-varying processes of advection, dispersion, and boundary exchange in simulating both the water column and benthic systems. In order to set up the water quality portion of the model, the Back Bay of Biloxi and its major tributaries were divided into 641 segments. Figure 5 shows the segment locations and numbers for the Back Bay of Biloxi, enlarged for Heron Bayou and the surrounding area.

The representative hydrologic period used for the WASP5 Model was a low-flow, high-temperature period in August – September 1994. Both point and non-point sources were represented in the model. However, there were no point sources discharging directly into Heron Bayou. Non-point source pollutant loadings for Heron Bayou were added as a direct input into the appropriate segment of the EUTRO model (segment 386, as shown in Figure 5). Loads were represented as a constant source, and input into the model in units of lbs/day.

3.3 Model Calibration Process

The first step in calibrating a water quality model is to calibrate the hydrodynamics of the model. During the calibration process, several important hydrodynamic parameters were adjusted, and output from trial model runs was analyzed. After the adjustments were completed, output from the hydrodynamic model was compared to observed data by producing temporal profiles of observed and predicted measurements of tide level and flow velocity. The profiles are available in *Water Quality and Hydrodynamic Models for Back Bay of Biloxi, Volume II – Calibration/Verification, 1994/1995 Data* (Shindala et al., 1996). The profiles show that the predicted tide levels and flow velocity reasonably match the observed data at several points within the Back Bay of Biloxi system.

Calibration of the water quality model began after completion of the hydrodynamic calibration. In order to conduct the calibration, organic material and nutrient contributions from all sources were estimated or measured, hydrologic transport processes were superimposed, and then water quality modeling was performed to allow adjustments in parameters and sources as part of the calibration process. Water quality calibration is an iterative process; the model predictions are the integrated results of all the assumptions used in developing the model input and in representing the physical and chemical processes occurring in the water body. Difference in model predictions and the observations require the model user to reevaluate these assumptions, in terms of both the estimated model input and model parameters, and consider the accuracy and uncertainty in the observations. Graphs which show comparisons between monitoring data and model output are shown in *Water Quality and Hydrodynamic Models for Back Bay of Biloxi, Volume II – Calibration/Verification, 1994/1995 Data* (Shindala et al., 1996). Examination of the graphs in this document shows that the model, in general, reproduces most of the observed water quality data but does not predict every data point.

3.4 Selection of a Representative Modeling Period

The NPSM model was run for a period representing a wet year, January through December 1995. A wet year was chosen for the representative modeling period, because it would predict a higher than usual amount of runoff from the watershed, which would increase the estimated non-point source loads.

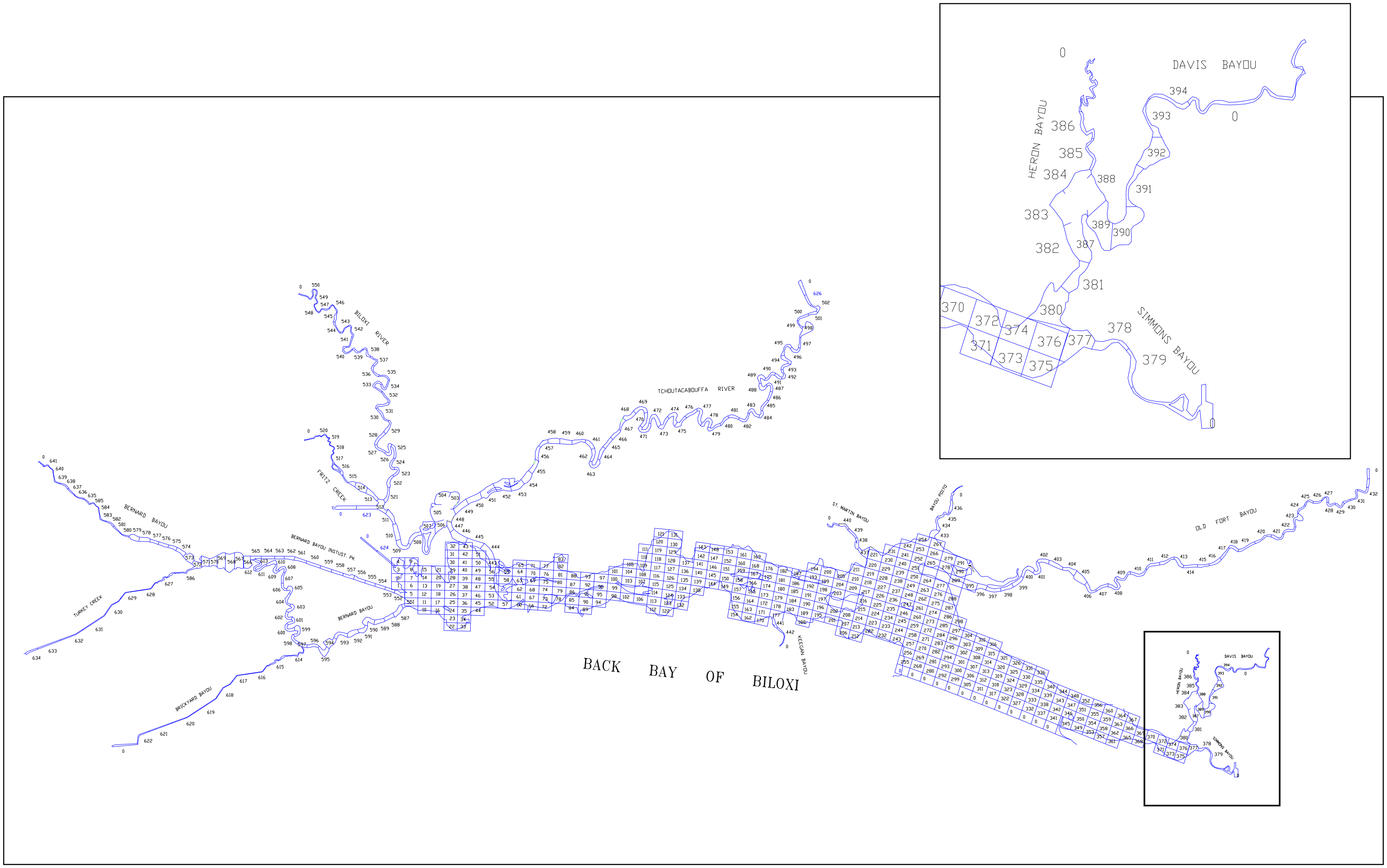

Figure 5. Back Bay of Biloxi and Heron Bayou Model Segments

ALLOCATION

The allocation for this TMDL involves a load allocation (LA) for non-point sources and an implicit margin of safety (MOS), which will result in continued attainment of water quality standards in Heron Bayou. The wasteload allocation specified in this TMDL is zero because this water body currently has no NPDES Permits. At the current loads, water quality standards are attained and no reductions are necessary.

4.1 Wasteload Allocation

Federal regulations require that effluent limits developed to protect water quality criteria are consistent with the assumptions and requirements of any available wasteload allocation prepared by the state and approved by EPA. The contribution of load from point sources was included in the Back Bay model used for this study based on the facilities' current NPDES permit limits and available discharge monitoring data. However, none of these facilities discharge directly into Heron Bayou. Thus, the waste load allocation for this TMDL is zero.

4.2 Load Allocation

The load allocation developed for this TMDL is an estimation of the contribution of all non-point sources in the watershed. Estimates of non-point sources were estimated based on data collected during the intensive studies of the Back Bay of Biloxi Watershed.

Table 4. Load Allocation for Nutrients

NH_3-N (lbs/day)	NO_3-N (lbs/day)	PO_4 (lbs/day)	ON (lbs/day)	OP (lbs/day)
17.2	6.9	1.7	88.0	1.7

4.3 Incorporation of a Margin of Safety

The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit.

4.4 Seasonality

The NPSM model was run for a representative wet year, and took into account all of the seasons within the calendar year. This time period allowed the simulation of many different atmospheric conditions such as rainy and dry periods and high and low temperatures. It also allowed seasonal critical conditions to be simulated.

4.5 Calculation of the TMDL

The TMDL was calculated based on this equation.

TMDL = WLA + LA + MOS

In this equation, WLA is the wasteload allocation, LA is the load allocation, and MOS is the margin of safety. The wasteload allocation has been set to zero. The load allocation includes the estimated contributions from surface runoff, as given in Table 4. The margin of safety for this TMDL is implicit and derived from the conservative loading assumptions used in setting up the model.

Table 5. TMDL for Nutrients in Heron Bayou

	NH_3-N (lbs/day)	NO_3-N (lbs/day)	PO_4 (lbs/day)	ON (lbs/day)	OP (lbs/day)
WLA	0	0	0	0	0
LA	17.2	6.9	1.7	88	1.7
MOS	Implicit	Implicit	Implicit	Implicit	Implicit
TMDL	**17.2**	**6.9**	**1.7**	**88.0**	**1.7**

4.6 Reasonable Assurance

This component of the TMDL development does not apply to this TMDL Report. There are no point sources (WLA) requesting a reduction based on promised LA components and reductions.

CONCLUSION

This TMDL is based on assumed values for non-point source loads of nutrients entering Heron Bayou. New NPDES permitted dischargers will not be allowed in this water body. It is not an appropriate discharge water body due to its small size, tidal influence, and residential and recreational use.

5.1 Future Monitoring

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Coastal Streams Basin, the Back Bay of Biloxi Watershed may receive additional monitoring to identify any changes or improvements in water quality. Any request for modification of this TMDL will require additional monitoring to validate the modeling results.

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 TMDL 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. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or Greg_Jackson@deq.state.ms.us.

At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public hearing. If a public hearing is deemed appropriate, the public will be given a 30-day notice of the hearing to be held at a location near the watershed. That public hearing would be an official hearing of the Mississippi Commission on Environmental Quality, and would be transcribed.

All comments should be directed in writing to Greg Jackson at Greg_Jackson@deq.state.ms.us or Greg Jackson, 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.

REFERENCES

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DEFINITIONS

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

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

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

Biological Impairment: Condition in which at least one biological assemblages (e.g. , fish, macroinvertebrates, or algae) indicates less than full support with moderate to severe modification of biological community noted.

Calibrated Model: A model in which reaction rates and inputs are significantly based on actual measurements using data from surveys on the receiving water body.

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

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

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

Dissolved Oxygen: The amount of oxygen dissolved in water. It also refers to a measure of the amount of oxygen that is available for biochemical activity in a water body. The maximum concentration of dissolved oxygen in a water body depends on temperature, atmospheric pressure, and dissolved solids.

First Order Kinetics: Describes a reaction in which the rate of transformation of a pollutant is proportional to the amount of that pollutant in the environmental system.

Groundwater: Subsurface water in the zone of saturation. Groundwater infiltration describes the rate and amount of movement of water from a saturated formation.

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

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

Load Allocation (LA): The portion of receiving water's loading capacity attributed to or assigned to non-point sources (NPS) or background sources of a pollutant

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

Mass Balance: An equation that accounts for the flux of mass going into a defined area and the flux of mass leaving a defined area, the flux in must equal the flux out.

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

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

Photosynthesis: The biochemical synthesis of carbohydrate based organic compounds from water and carbon dioxide using light energy in the presence of chlorophyll.

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

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

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

Reaeration: The net flux of oxygen occurring from the atmosphere to a body of water across the water surface.

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

Storm Runoff: Rainfall that does not evaporate or infiltrate the ground because of impervious land surfaces or a soil infiltration rate than rainfall intensity, but instead flows into adjacent land or water bodies or is routed into a drain or sewer system.

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

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

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

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

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

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

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

ABBREVIATIONS

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

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

BMP ....Best Management Practice

CWA ....Clean Water Act

DO...Dissolved Oxygen

DYNHYD5 ....Dynamic Estuary Model Hydrodynamics Program - 5

EPA ....Environmental Protection Agency

EUTRO5 ....Eutrophication Model - 5

GIS ....Geographic Information System

HUC ....Hydrologic Unit Code

LA .... Load Allocation

MARIS...Mississippi Automated Resource Information System

MDEQ.. Mississippi Department of Environmental Quality

MGD .... Million Gallons per Day

MOS.. Margin of Safety

NPDES... National Pollution Discharge Elimination System

NPSM.. Non-Point Source Model

TKN ....Total Kjeldahl Nitrogen

TN ....Total Nitrogen

TP .... Total Phosphorous

USGS ....United States Geological Survey

WLA .... Waste Load Allocation