FINAL REPORT
March 2012

Total Maximum Daily Load for Biological Impairment

Due to

Organic Enrichment / Low DO for Sowashee Creek

Pascagoula River Basin

Lauderdale County, Mississippi

Prepared By

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FOREWORD

The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's current Section 303(d) List of Impaired Water Bodies. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, modifications to the water quality standards or criteria, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Conversion Factors

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

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^2	hecto	h
10^{-3}	milli	m	10^3	kilo	k
10^{-6}	micro	µ	10^6	mega	M
10^{-9}	nano	n	10^9	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

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TMDL INFORMATION

Table 1. Listing Information

Name	ID	County	HUC	Cause
Sowashee Creek	400811	Lauderdale	03170001	**Organic Enrichment / Low Dissolved Oxygen**
At Meridian: From headwaters to confluence with unnamed tributary at North MWS 4237 Boundary				
Sowashee Creek	400911	Lauderdale	03170001	**Organic Enrichment / Low Dissolved Oxygen**
From confluence with unnamed tributary at South MWS 4237 Boundary to Okatibee Creek				

Table 2. Water Quality Standards

Parameter	Beneficial use	Water Quality Criteria
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 Sowashee Creek

	WLA lbs/day	LA lbs/day	MOS	TMDL lbs/day
TBODu	**3873.98**	**31.91**	**Implicit**	**3905.89**

Table 4. Point Sources for Sowashee Creek

Permit	Facility	Flow MGD	Treatment Type	Receiving Stream
MS0033570	Shell Truck Stop	0.008	Activated sludge	UNT of Nananbe
MS0021237	Meridian Travel Center	0.012	Activated sludge	UNT of Nananbe
MS0053678	Chapel Woods Subdivision	0.0152	Aerated lagoon	UNT of UNT of Sowashee
MS0022641	Briarwood MHP	0.01	Aerated lagoon	UNT of Sowashee
MS0003107	BPB America, Inc./Celotex	0.25	untreated	Sowashee Creek
MS0020117	Meridian POTW	13.0	Activated sludge	Sowashee Creek
MS0055514	Meadows Subdivision	0.038	Aerated Lagoon	UNT of Sowashee Creek
MS0049867	Huntington Park Estates	0.015	septic tanks /rock reed filter	UNT of Sowashee Creek
MS0054887	Price Trailer Park	0.0018	Conventional Lagoon	Nanabe
MS0034843	Rainbow Lakes Subdivision	0.02	Conventional Lagoon	UNT of Nanabe
MS0048763	Northeast Middle School	0.02	Conventional Lagoon	UNT of Sowashee
MS0049689	Northeast High School	0.028	Aerated lagoon	UNT of UNT of Sowashee Creek
MS0049174	Atlas Roofing Corporation	0.955	lagoons/wetlands	Sowashee Creek
MS0030490	Valley Park	0.045	Conventional Lagoon	UNT of Sowashee Creek
MS0042633	Russell Mobile Home Park	0.01	Aerated Lagoon	UNT of Nanabe
MS0043061	Plantation Village Waste Inc	0.032	conventional lagoon	UNT of Sowashee Creek
MS0055735	East Meridian POTW	1.0	batch reactor/uv	Sowashee Creek
MS0023256	Briarwood Hills Apt.	0.015	oxidation ditch	UNT of UNT of Sowashee Creek
MS0042838	Vance MHP	0.012	Conventional lagoon	UNT of Graham
MS0044491	Briarwood Estates	0.15	Conventional lagoon	UNT of Sowashee Creek

EXECUTIVE SUMMARY

Two segments of Sowashee Creek (400811 and 400911) are on the Mississippi 2010 Section 303(d) List of Water Bodies as impaired due to biological impairment. It was determined that (Total Nitrogen (TN), Total Phosphorous (TP) and organic enrichment / low dissolved oxygen are probable primary stressors. This TMDL will provide an allocation for TBODu. TN and TP will be addressed in another TMDL.

The Sowashee Creek Watershed is located in HUC 03170001 near Meridian in Lauderdale County (Figure 1 and Figure 2). It flows for approximately 20 miles in a southwestern direction from its headwaters to the mouth at Okatibee Creek. The critical 7Q10 flow for Sowashee Creek is 3.39 cfs at the mouth.

According to the STREAM model, the current TBODu load in the water body does exceed the assimilative capacity of Sowashee Creek for organic material at the critical conditions. Therefore, reductions are needed for TBODu.

Figure 1. Sowashee Creek near Meridian

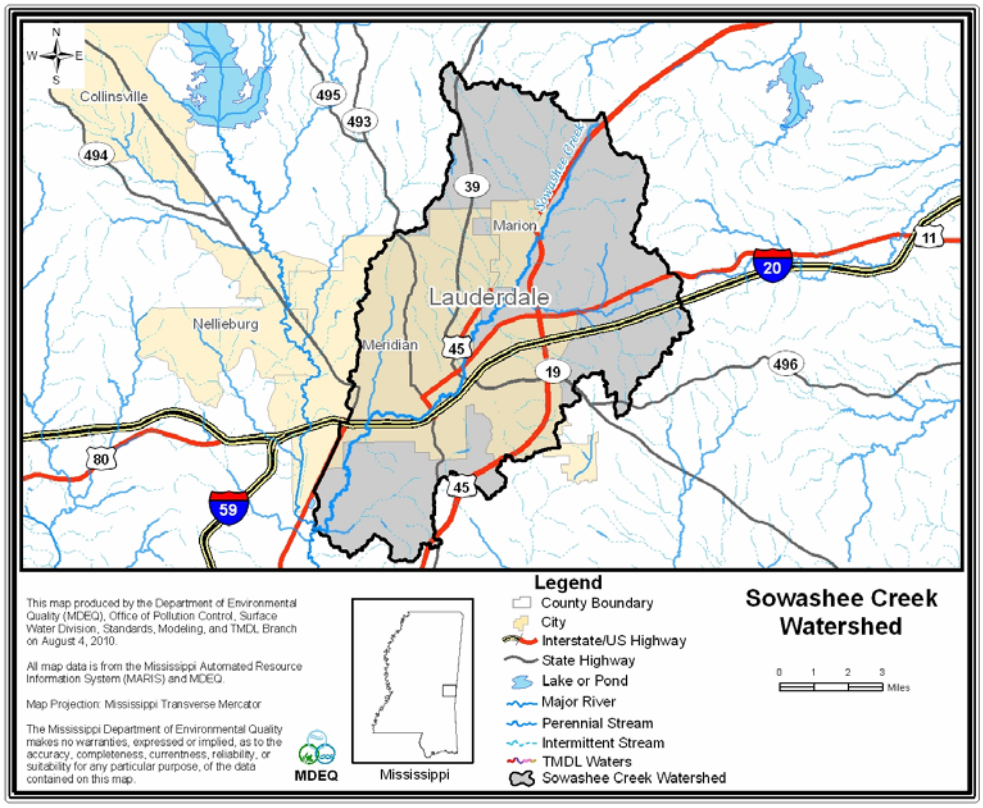


Figure 2. Sowashee Creek Watershed

INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. This TMDL has been developed for the 2010 §303(d) listed segments shown in Figure 3.

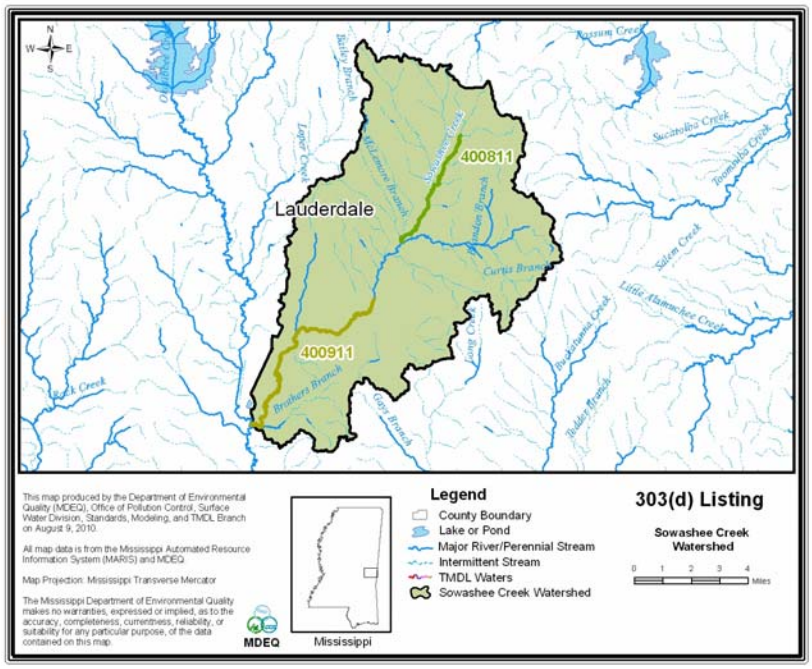


Figure 3. §303(d) Listed Segments of the Sowashee Creek

1.2 Listing History

The impaired segments were listed due to failure to meet minimum water quality criteria for aquatic use support based on biological sampling (MDEQ, 2008). Because of these results, a detailed assessment of the watershed and potential pollutant sources, called a stressor identification report, was developed for this stream. The purpose of the stressor identification process is to identify the stressors and their sources most likely causing degradation of instream biological conditions. The results indicate that nutrients and organic enrichment were probable primary stressors for the Sowashee Creek Watershed (MDEQ, 2010). Nutrients (TN and TP) will be addressed in another report.

1.3 Applicable Water Body Segment Use and Standard

The water use classifications and standard are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007)(WPC-2). The designated beneficial use for Sowashee Creek is Fish and Wildlife.

WATER BODY ASSESSMENT

2.1 Water Quality Data

Dissolved oxygen data for the Sowashee Creek Watershed were gathered and shown in Table 5. Data exist for the §303(d)-listed segment of Sowashee Creek based on samples collected during the §303(d)/M-BISQ monitoring project, MDEQ's nutrient criteria development monitoring, and as part of MDEQ's ambient monitoring program. Although DO violations are not indicated in the most recent data shown below, the stressor identification report identifies DO as a primary cause of impairment due to historical data. The historical data show elevated DO saturation and significant diel swings which are indicative of potential DO problems. The locations of the water quality monitoring stations are shown in Figure 4.

Table 5. Sowashee Creek DO Data

Station	Date	Time	DO (mg/L)	DO (% sat)
111B34	08/28/2007	15:00	9.45	123.6
111B34	07/29/2008	13:15	7.22	92.3
111B41	08/28/2007	13:40	6.48	83.9
111B41	07/28/2008	09:45	7.20	86.4
PA017	02/06/2001	08:15	11.5	91.7
PA017	04/02/2004	13:50	11.1	117.2
PA017	04/15/2004	15:00	10.7	119.6
PA017	08/30/2004	16:00	9.41	115.5
PA017	09/15/2004	14:30	8.61	101
PA017	03/25/2005	09:30	10.6	108.3
PA017	04/22/2005	12:20	10.0	115.3
PA017	08/15/2005	10:00	7.58	101.5
PA017	09/13/2005	09:35	8.29	101.3
PA339	02/04/2003	08:50	9.84	90.2
PA340	02/04/2003	07:25	9.99	92.5
PA351	01/07/2004	14:15	12.6	108.7
PA363	04/02/2004	14:30	11.2	122.9
PA363	04/15/2004	15:35	10.5	119.2
PA363	08/30/2004	16:35	8.95	113.6
PA363	09/15/2004	15:05	8.97	110.1
PA363	03/25/2005	11:00	10.0	108.3
PA363	04/22/2005	13:00	10.2	124.3
PA363	08/15/2005	11:20	7.29	100.2
PA363	09/13/2005	10:40	9.11	120.4
338	2001	-	11.50	91.7
946	2004	-	12.68	108.67

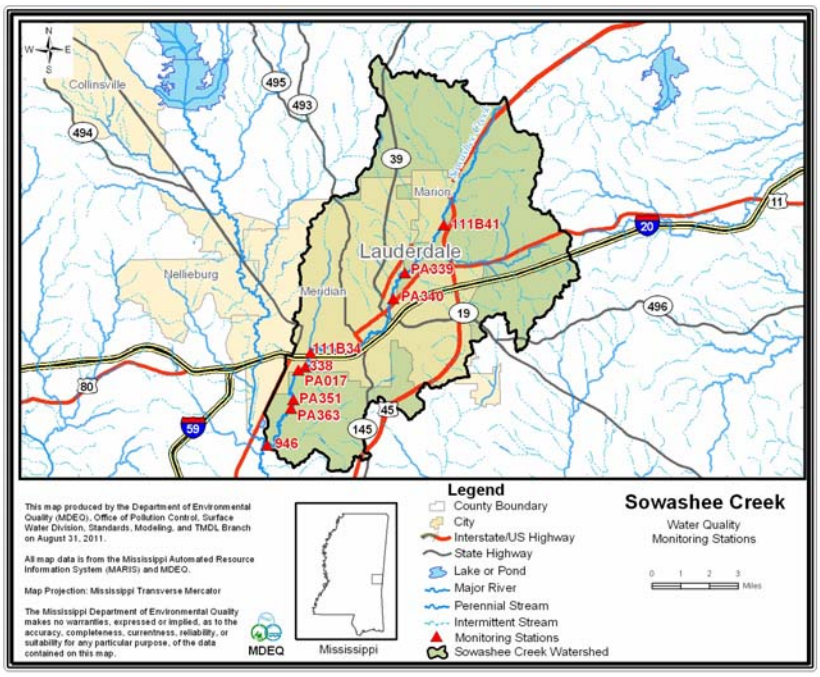


Figure 4. Water Quality Monitoring stations for Sowashee Creek

2.2 Assessment of Point Sources

There are 20 NPDES point sources in the watershed included in the TMDL as shown in Figure 5 below. Two of these facilities, Meridian North and South POTWs, are considered major facilities (permitted flow > 1.0 MDG.) Table 6 lists the point sources and their permitted flows and BOD_5 limits.

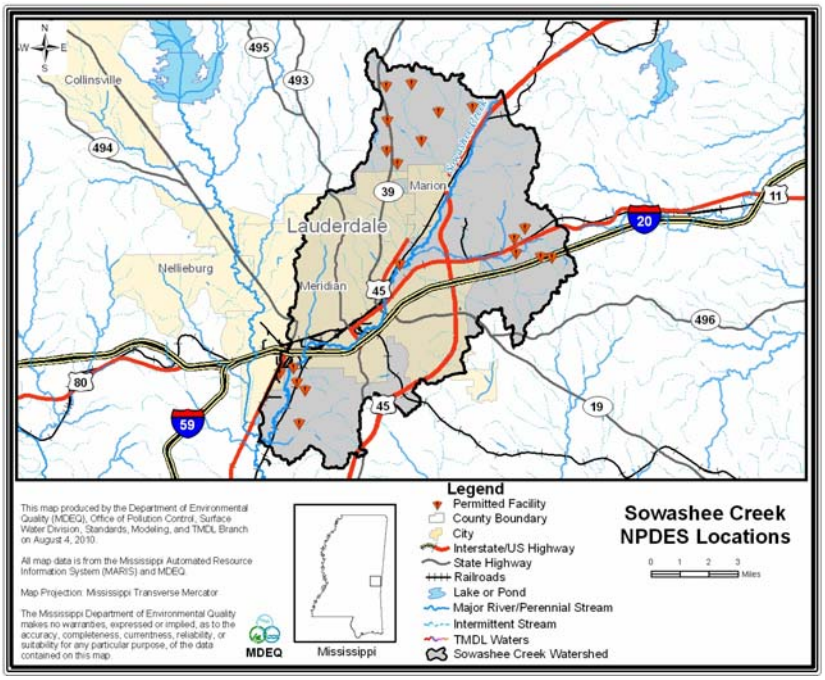


Figure 5. Point Sources in Sowashee Creek

Table 6. Point Sources Loads

Permit	Facility	Flow MGD	TBODu lbs/day
MS0033570	Shell Truck Stop	0.008	5.21
MS0021237	Meridian Travel Center	0.012	7.82
MS0053678	Chapel Woods Subdivision	0.0152	8.60
MS0022641	Briarwood MHP	0.01	5.66
MS0003107	BPB America, Inc.	0.25	141.47
MS0020117	Meridian South POTW	13.0	2736.52
MS0055514	Meadows Subdivision	0.038	21.50
MS0049867	Huntington Park Estates	0.015	8.49
MS0054887	Price Trailer Park	0.0018	1.02
MS0034843	Rainbow Lakes Subdivision	0.02	11.32
MS0048763	Northeast Middle School	0.02	11.32
MS0049689	Northeast High School	0.028	15.84
MS0049174	Atlas Roofing Corporation	0.955	756.01
MS0030490	Valley Park	0.045	25.46
MS0042633	Russell Mobile Home Park	0.01	5.66
MS0043061	Plantation Village Waste Inc	0.032	18.11
MS0055735	East Meridian POTW	1.0	268.05
MS0023256	Briarwood Hills Apt.	0.015	9.78
MS0042838	Vance MHP	0.012	6.79
MS0044491	Briarwood Estates	0.15	84.88
	Total		**4149.50**

2.3 Assessment of Non-Point Sources

Non-point loading of 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 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 Sowashee Creek Watershed is shown Figure 6 and Table 7.

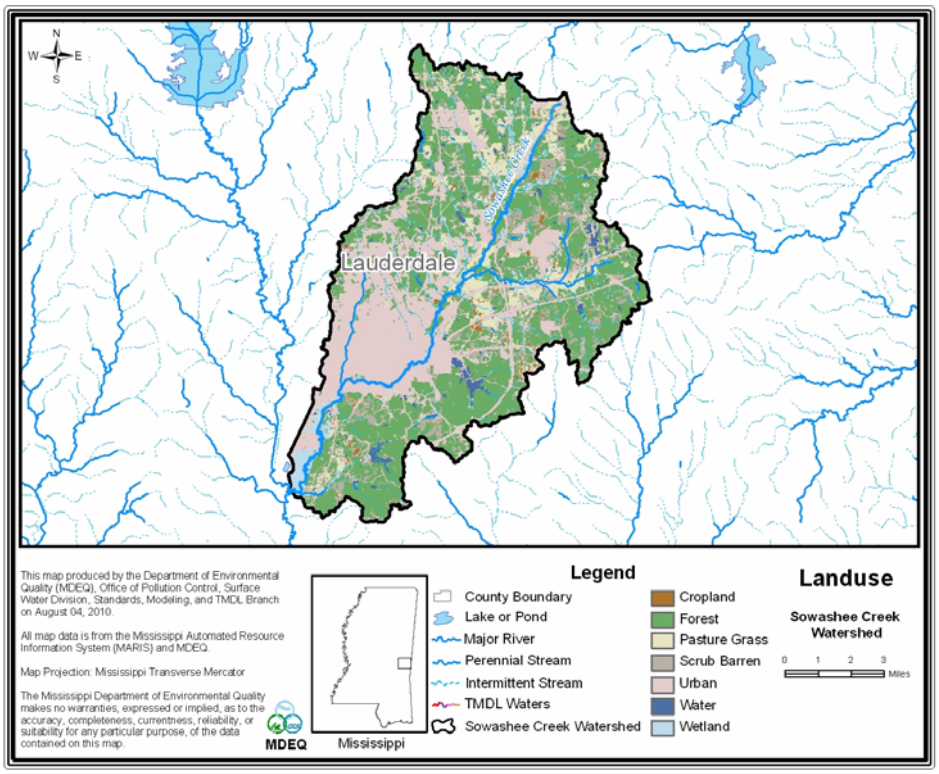


Figure 6. Landuse in the Sowashee Creek Watershed

Table 7. Land Use Distribution (acres)

	Water	Urban	Forest	Scrub/Barren	Pasture	Cropland	Wetland
Area (acres)	1,151	15,945	23,090	6,053	4,761	620	2,221
% Area	2.1%	29.6%	42.9%	11.2%	8.8%	1.2%	4.10%

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

A mathematical model, STeady Riverine Environmental Assessment Model (STREAM), for DO distribution in freshwater streams was used for developing the TMDL. The use of STREAM is promulgated in the *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* (MDEQ, 2010)(WPC-2). This model has been approved by EPA and has been used extensively at MDEQ. A key reason for using the STREAM model in TMDL development is its ability to assess instream water quality conditions in response to point and non-point source loadings.

STREAM is a steady-state, daily average computer model that utilizes a modified Streeter-Phelps DO sag equation. Instream processes that may be simulated by the model include CBODu decay, nitrification, reaeration, sediment oxygen demand, and respiration and photosynthesis of algae. Figure 6 shows how these processes are related in a typical DO model. Reaction rates for the instream processes are input by the user and corrected for temperature by the model. The model output includes water quality conditions in each computational element for DO, CBODu, and NH_3-N concentrations. The hydrological processes simulated by the model include stream velocity and flow from point sources and spatially distributed inputs.

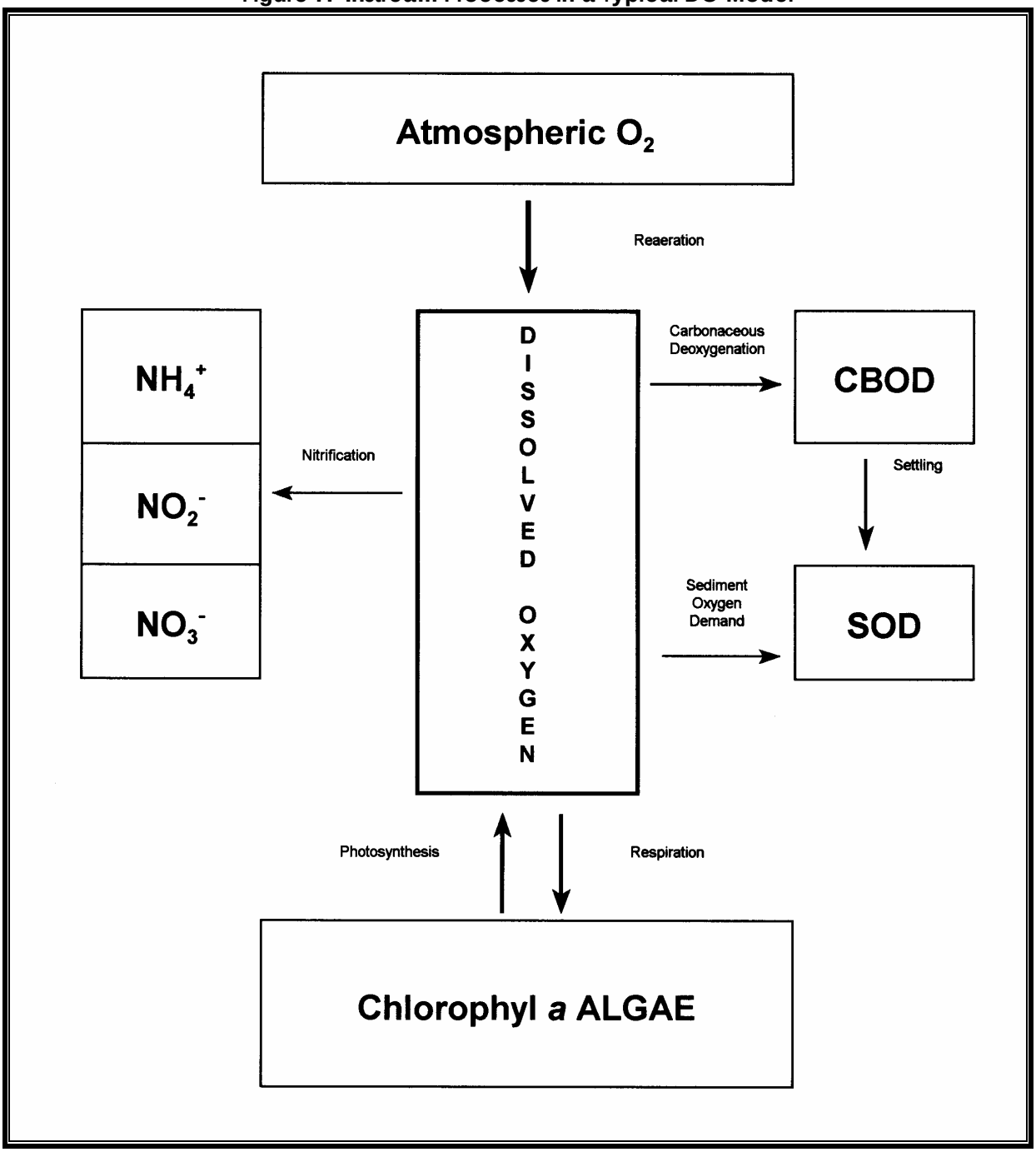
The model was set up to calculate reaeration within each reach using the Tsivoglou formulation. The Tsivoglou formulation calculates the reaeration rate, K_a (day^{-1} base *e*), within each reach according to Equation 2.

$$K_a = C*S*U \qquad \textbf{(Eq. 2)}$$

C is the escape coefficient, U is the reach velocity in mile/day, and S is the average reach slope in ft/mile. The value of the escape coefficient is assumed to be 0.11 for streams with flows less than 10 cfs and 0.0597 for stream flows

equal to or greater than 10 cfs. Reach velocities were calculated using an equation based on slope. The slope of each reach was estimated with the NHD Plus GIS coverage and input into the model in units of feet/mile.

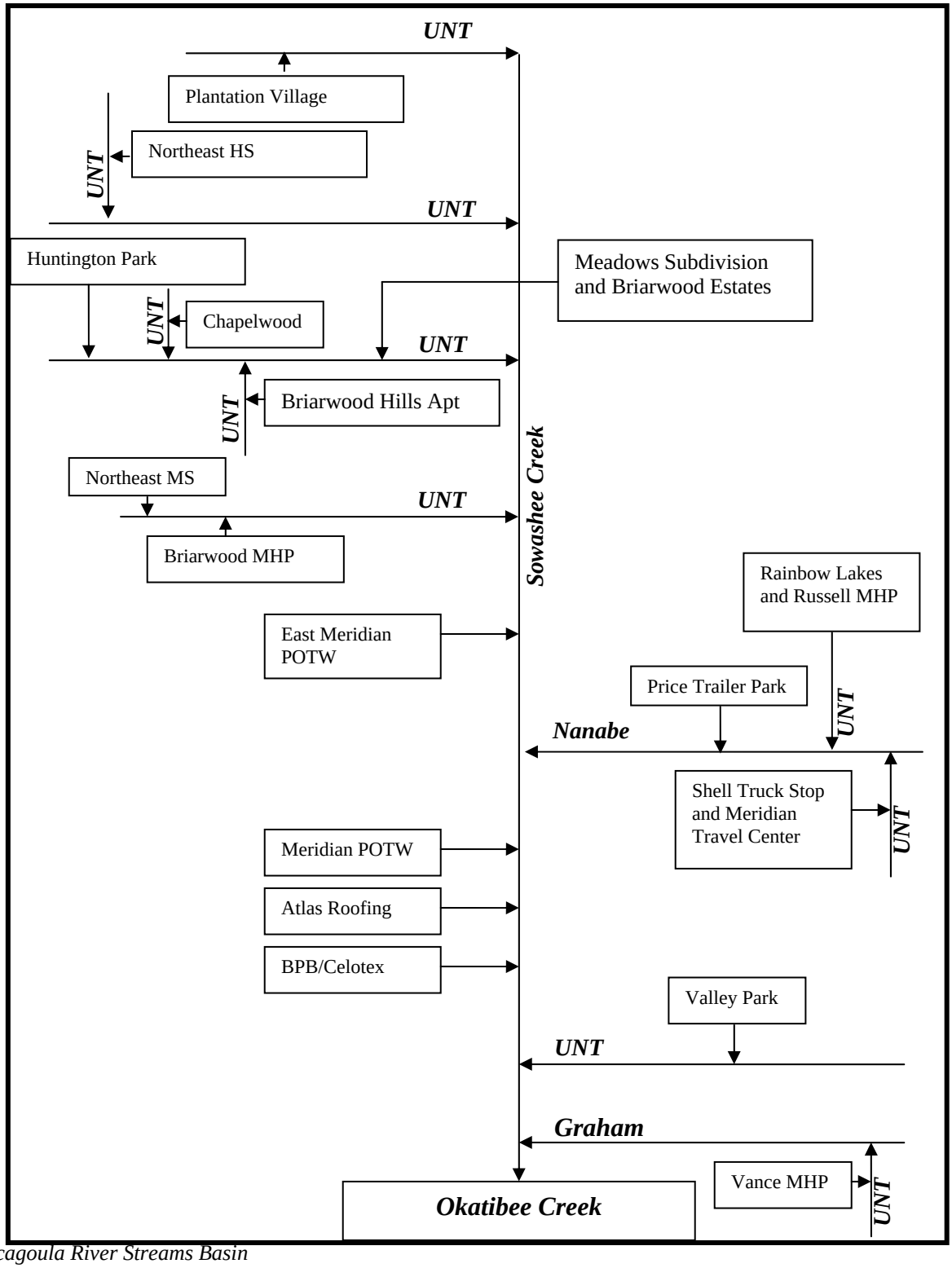
Figure 7. Instream Processes in a Typical DO Model



3.2 Model Setup

The model for this TMDL includes the §303(d) listed segment of Sowashee Creek, beginning at the headwaters and ending with the confluence of Okatibee Creek. A diagram showing the model setup is shown in Figure 8.

Figure 8. Sowashee Creek Model Setup (Note: Not to Scale)



The modeler divided the streams into reaches for modeling purposes. Reach divisions were made at locations where there is a significant change in hydrological and water quality characteristics, such as the confluence of a point source or tributary. Within each reach, the modeled segments were divided into computational elements of 0.1 mile. The simulated hydrological and water quality characteristics were calculated and output by the model for each computational element.

The STREAM model simulates flow and temperature conditions, which were determined to be the critical condition for this TMDL. The temperature used in the model is 26°C. The headwater instream DO was assumed to be 85% of saturation at the stream temperature. The instream CBODu decay rate, K_d, is set at 20°C as 0.3 day^{-1} (base e). The model adjusts the K_d rate based on temperature, according to Equation 3.

$$K_{d(T)} = K_{d(20°C)}(1.047)^{T-20} \qquad \textbf{(Eq. 3)}$$

Where K_d is the CBODu decay rate and T is the assumed instream temperature. The assumptions regarding the instream temperatures, background DO saturation, and CBODu decay rate are required by the *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). The rates for photosynthesis, respiration, and sediment oxygen demand were set to zero because data for these model parameters are not available.

The flow for the Sowashee Creek watershed was modeled at critical conditions based on the 7Q10 calculated using the gages from the USGS Water-Resources Investigation Report 90-4130 Low-Flow and Flow Duration Characteristics of Mississippi Streams (Telis, 1991). The 7Q10 flow is 3.39 cfs.

3.3 Source Representation

Both point and non-point sources were represented in the model. The loads from the NPDES permitted point source were added as a direct input into the appropriate reaches. Spatially distributed loads, which represent non-point sources of flow, $CBOD_5$, and ammonia-nitrogen were distributed evenly into each reach.

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 $CBOD_5$ while TMDLs are typically developed using CBODu, a ratio between the two terms is needed, Equation 4.

$CBODu = CBOD_5 * F\ Ratio$ **(Eq. 4)**

The CBODu to $CBOD_5$ F ratios are given in *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). These values are recommended for use by MDEQ regulations when actual field data are not available. The value of the ratio depends on the wastewater treatment type.

In order to convert the ammonia nitrogen (NH_3-N) loads to an oxygen demand, a factor of 4.57 pounds of oxygen per pound of ammonia nitrogen (NH_3-N) oxidized to nitrate nitrogen (NO_3-N) was used. Using this factor is a conservative modeling assumption because it assumes that all of the ammonia is converted to nitrate through nitrification. The oxygen demand caused by nitrification of ammonia is equal to the NBODu load. The sum of CBODu and NBODu is equal to the point source load of TBODu. The permitted loads of TBODu from the existing point sources used in the STREAM model are given in Table 8.

Table 8. Point Sources, Maximum Permitted Model Inputs

Permit	Facility	Flow MGD	CBOD5 mg/L	CBODu lbs/day	NH3-N mg/L	NBODu lbs/day	TBODu lbs/day
MS0033570	Shell Truck Stop	0.008	30	4.60	2*	0.61	5.21
MS0021237	Meridian Travel Center	0.012	30	6.91	2*	0.91	7.82
MS0053678	Chapel Woods Subdivision	0.0152	30	5.70	5*	2.90	8.60
MS0022641	Briarwood MHP	0.01	30	3.75	5*	1.91	5.66
MS0003107	BPB America, Inc.	0.25	30	93.83	5*	47.64	141.47
MS0020117	Meridian POTW	13	7	1745.56	2	990.96	2736.52
MS0055514	Meadows Subdivision	0.038	30	14.26	5*	7.24	21.50
MS0049867	Huntington Park Estates	0.015	30	5.63	5*	2.86	8.49
MS0054887	Price Trailer Park	0.0018	30	0.68	5*	0.34	1.02
MS0034843	Rainbow Lakes Subdivision	0.02	30	7.51	5*	3.81	11.32
MS0048763	Northeast Middle School	0.02	30	7.51	5*	3.81	11.32
MS0049689	Northeast High School	0.028	30	10.51	5*	5.34	15.84
MS0049174	Atlas Roofing Corporation	0.955	45	537.62	6	218.39	756.01
MS0030490	Valley Park	0.045	30	16.89	5*	8.58	25.46
MS0042633	Russell Mobile Home Park	0.01	30	3.75	5*	1.91	5.66
MS0043061	Plantation Village Waste Inc	0.032	30	12.01	5*	6.10	18.11
MS0055735	East Meridian POTW	1.0	10	191.82	2	76.23	268.05
MS0023256	Briarwood Hills Apt.	0.015	30	8.63	2*	1.14	9.78
MS0042838	Vance MHP	0.012	30	4.50	5*	2.29	6.79
MS0044491	Briarwood Estates	0.15	30	56.30	5*	28.59	84.88
	Total			**2737.96**		**1411.54**	**4149.50**

* Assumed concentrations based upon treatment types—2 mg/L for advanced treatment, 5 mg/L for secondary treatment

Direct measurements of background concentrations of CBODu were not available for Sowashee Creek. Because there were no data available, the background concentrations of CBODu and NH_3-N were estimated based on *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). According to these regulations, the background concentration used in modeling for BOD_5 is 1.33 mg/l and for NH_3-N is 0.1 mg/l. These concentrations were also used as estimates for the CBODu and NH_3-N levels of water entering the water bodies through non-point source flow and tributaries.

Non-point source flows were included in the model to account for water entering due to groundwater infiltration, overland flow, and small, unmeasured tributaries. These flows were estimated based on USGS data for the 7Q10 flow condition in the Sowashee Creek watershed. The non-point source loads were assumed to be distributed evenly throughout the stream reaches.

3.4 Model Calibration

The model used to develop the Sowashee Creek TMDL was not calibrated due to the limited amount of instream monitoring data collected during critical conditions. Future monitoring is essential to improve the accuracy of the model and the results.

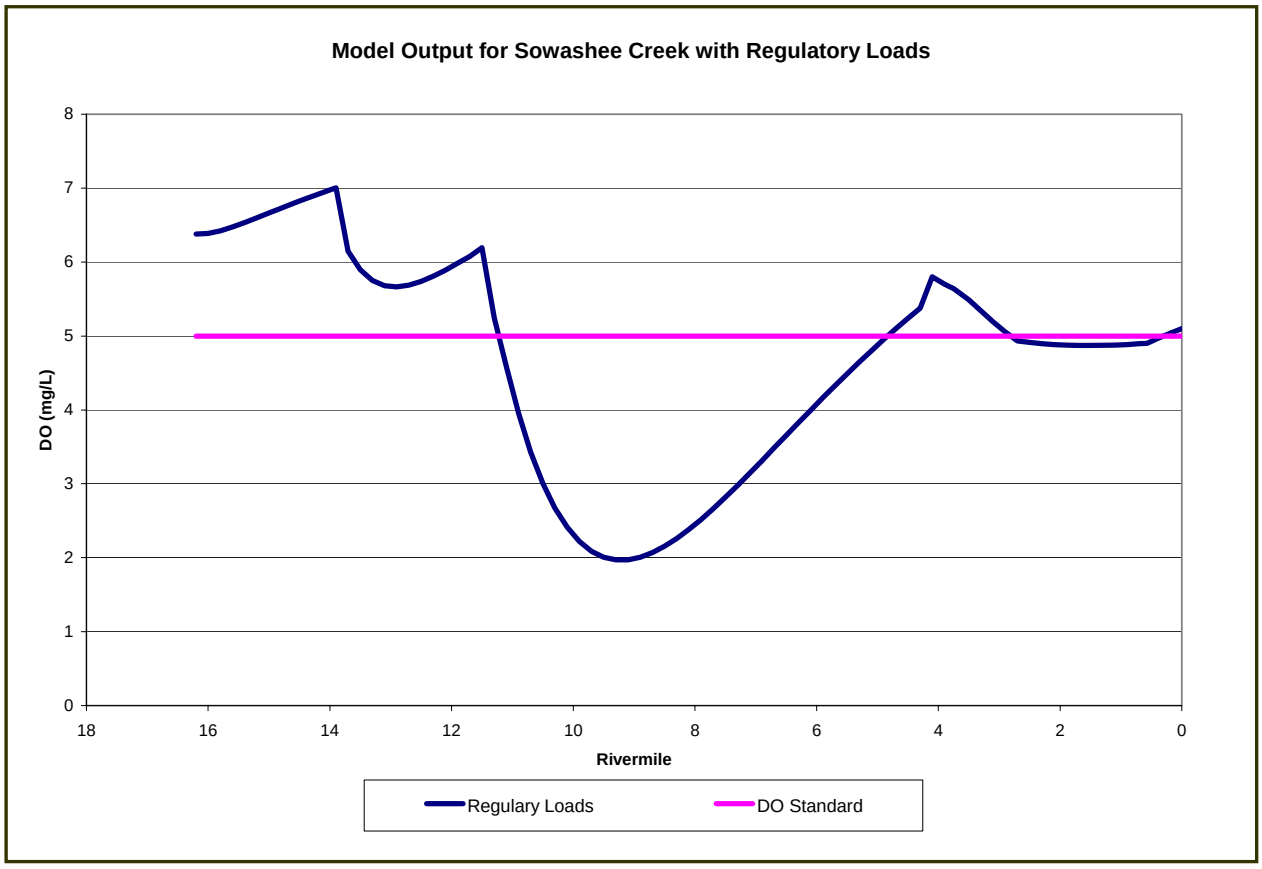
3.5 Model Results

Once the model setup was complete, the model was used to predict water quality conditions in Sowashee Creek. The model was first run under regulatory load conditions. Under regulatory load conditions, the loads from the NPDES permitted point sources were based on their current loads at the 7Q10 flow conditions.

3.5.1 Regulatory Load Scenario

As shown in the figure, the model predicts that the DO does go below the standard of 5.0 mg/l using the permit based allowable loads, thus reductions are needed to meet the current TMDL. The model results are shown in Figure 9.

Figure 9. Model Output for DO in Sowashee Creek, Estimated Regulatory Load Scenario



3.5.2 Maximum Load Scenario

The graph of the regulatory model output shows that the predicted DO does fall below the DO standard in Sowashee Creek during critical conditions. Thus, reductions of the loads of TBODu are necessary. Calculating the maximum allowable load of TBODu involved decreasing the point source loads until the modeled DO was at 5.0 mg/l. The maximum load scenario model results are shown in Figure 10.

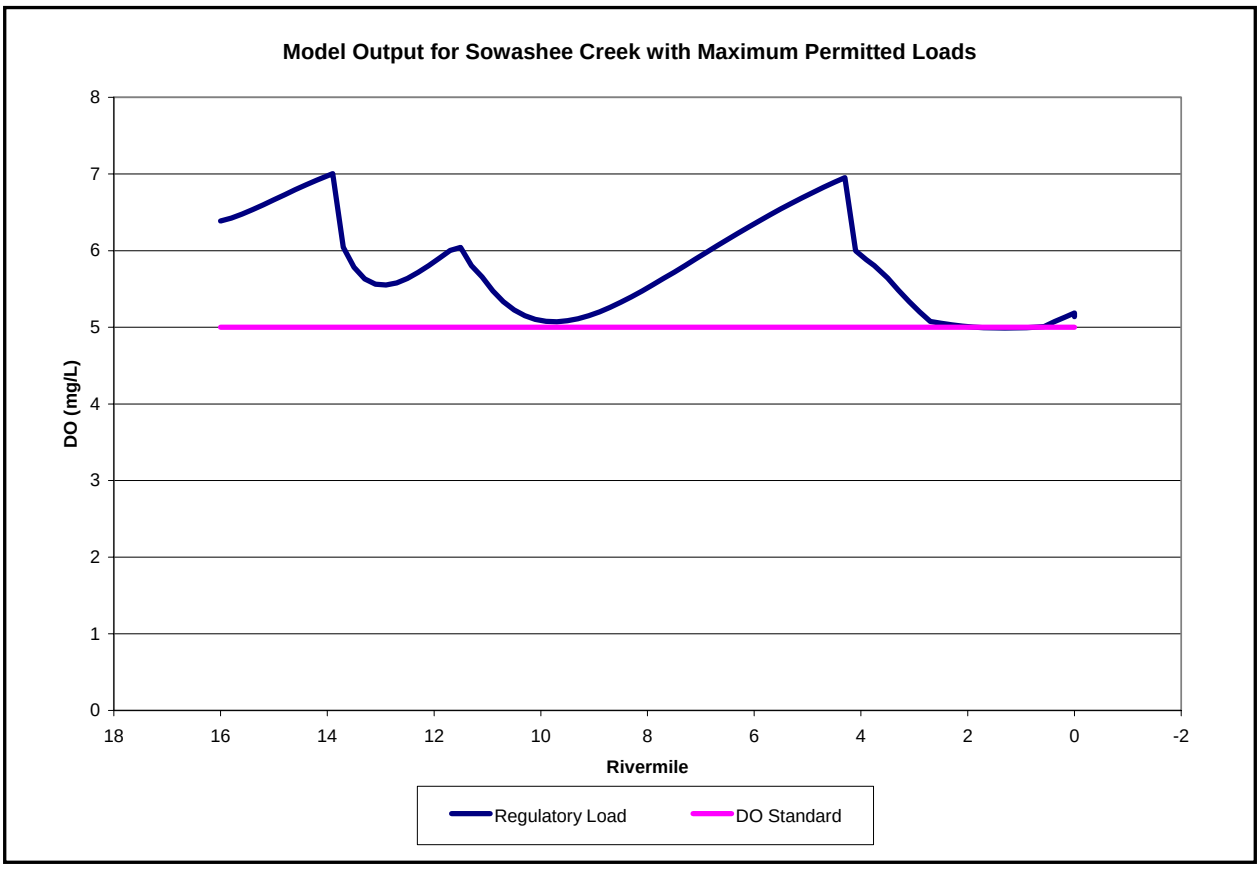


Figure 10. Model Output for DO in Sowashee Creek, Maximum Load Scenario

ALLOCATION

4.1 Wasteload Allocation

Model results indicate that reductions are needed from several of the point sources to help Sowashee Creek meet water quality standards. It is noted that the East Meridian POTW is currently under a phased NPDES Permit status. Phase II of the permit will transition the permit from limits of 10-2-6 to 2-1-6. However, as of 2009, the city of Meridian approved a contract to sell water from both the Meridian POTWs to Mississippi Power. The water will be used as a coolant at the Mississippi Power Kemper County plant. Upon removal of this source from Sowashee Creek, it is anticipated that the DO water quality standard for Sowashee Creek will be attained. The South Facility will maintain the permit, but will rarely discharge. The only discharge will be during planned maintenance at the Mississippi Power Facility or during an emergency situation. At all times, the NPDES limits given will be protective of water quality in Sowashee Creek. The wasteload allocations for this TMDL are given in Table 9.

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* (2010)(WPC-2).

Table 9. TMDL Loads for TBODu

Permit	Facility	Flow MGD	CBOD5 mg/L	CBODu lbs/day	NH3-N mg/L	NBODu lbs/day	TBODu lbs/day	% reduction
MS0033570	Shell Truck Stop	0.008	30	4.60	2	0.61	5.21	0%
MS0021237	Meridian Travel Center	0.012	30	6.91	2	0.91	7.82	0%
MS0053678	Chapel Woods Subdivision	0.0152	30	5.70	5	2.90	8.60	0%
MS0022641	Briarwood MHP	0.01	30	3.75	5	1.91	5.66	0
MS0003107	BPB America, Inc.	0.25	27	84.44	5	47.64	132.08	6.6%
MS0020117	Meridian POTW	13	7	1745.56	2	990.96	2736.52	0%
MS0055514	Meadows Subdivision	0.038	25	11.88	2	7.24	19.13	11%
MS0049867	Huntington Park Estates	0.015	25	4.69	2	2.86	7.55	11%
MS0054887	Price Trailer Park	0.0018	30	0.68	5	0.34	1.02	0%
MS0034843	Rainbow Lakes Subdivision	0.02	30	7.51	5	3.81	11.32	0%
MS0048763	Northeast Middle School	0.02	30	7.51	5	3.81	11.32	0%
MS0049689	Northeast High School	0.028	30	10.51	5	3.20	13.71	13.4%
MS0049174	Atlas Roofing Corporation	0.955	40	477.88	6	218.39	696.27	7.9%
MS0030490	Valley Park	0.045	30	16.89	5	8.58	25.46	0%
MS0042633	Russell Mobile Home Park	0.01	30	3.75	5	1.91	5.66	0%
MS0043061	Plantation Village Waste Inc	0.032	30	12.01	5	6.10	18.11	0%
MS0055735	East Meridian POTW	1.0	2	38.36	1	38.11	76.48	100%
MS0023256	Briarwood Hills Apt.	0.015	30	8.63	5	1.14	9.78	0%
MS0042838	Vance MHP	0.012	30	4.50	5	2.29	6.79	0%
MS0044491	Briarwood Estates	0.15	25	46.91	2	28.59	75.50	11%
	Total			**2502.69**		**1371.30**	**3873.98**	

4.2 Incorporation of a Margin of Safety

The margin of safety is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving water body. The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit.

4.3 Calculation of the TMDL

The STREAM model was used to calculate the TBODu TMDL. The allocations for TBODu are given in Table 10. These allocations are established to attain the applicable water quality standards.

Table 10. TMDL Loads

	WLA lbs/day	LA lbs/day	MOS	TMDL lbs/day
TBODu	**3873.98**	**31.91**	**Implicit**	**3905.89**

4.4 Seasonality and Critical Condition

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

CONCLUSION

The model results indicate that Sowashee Creek is not meeting water quality standards for dissolved oxygen at the present loading of TBODu. A reduction from the facilities is necessary to help meet water quality standards. It is noted that the Meridian North POTW is currently under a phased NPDES Permit status. However, as of 2009, the city of Meridian approved a contract to sell water from both the Meridian POTWs to Mississippi Power. The water will be used as a coolant at the Mississippi Power Kemper County plant. Upon removal of this source from Sowashee Creek, it is anticipated that the DO water quality standard for Sowashee Creek will be attained. The South Facility will maintain the permit, but will rarely discharge. The only discharge will be during planned maintenance at the Mississippi Power Facility or during an emergency situation. At all times, the NPDES limits given will be protective of water quality in Sowashee Creek.

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 Pascagoula 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 Greg Jackson at Greg_Jackson@deq.state.ms.us.

All comments should be directed to Greg_Jackson@deq.state.ms.us MDEQ, PO Box 2261, Jackson, MS 39225. 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

Davis and Cornwell. 1988. *Introduction to Environmental Engineering.* McGraw-Hill.

MDEQ. 2007. *Mississippi's Plan for Nutrient Criteria Development*. Office of Pollution Control.

MDEQ. 2007. *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. Office of Pollution Control. (WPC-2)

MDEQ. 2010. *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.* Office of Pollution Control. (WPC-1)

MDEQ. 2011. Mississippi List of Water Bodies, Pursuant to Section 303(d) of the Clean Water Act. Office of Pollution Control.

Metcalf and Eddy, Inc. 1991. *Wastewater Engineering: Treatment, Disposal, and Reuse 3rd ed*. New York: McGraw-Hill.

MFC. 2000. *Mississippi's BMPs: Best Management Practices for Forestry in Mississippi*. Publication # 107.

NRCS. 2000. *Field Office Technical Guide Transmittal No. 61*.

Shields, F.D. Jr., Cooper, C.M., Testa, S. III, Ursic, M.E., 2008. *Nutrient Transport in the Yazoo River Basin, Mississippi*. USDA ARS National Sedimentation Labortory, Oxford, Mississippi.

Telis, Pamela A. 1992. *Techniques for Estimating 7-Day, 10-Year Low Flow Characteristics for Ungaged Sites on Water bodys in Mississippi*. U.S. Geological Survey, Water Resources Investigations Report 91-4130.

Thomann and Mueller. 1987. *Principles of Surface Water Quality Modeling and Control*. New York: Harper Collins.

USEPA. 1997. *Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication*. United States Environmental Protection Agency, Office of Water, Washington, D.C. EPA 823-B-97-002.

USEPA. 1999. *Protocol for Developing Nutrient TMDLs*. EPA 841-B-99-007. Office of Water (4503F), United States Environmental Protection Agency, Washington D.C. 135 pp.

USEPA. 2000. Nutrient Criteria Technical Guidance Manual Rivers and Streams. United States Environmental Protection Agency, Office of Water, Washington, D.C. EPA-822-B-00-002.