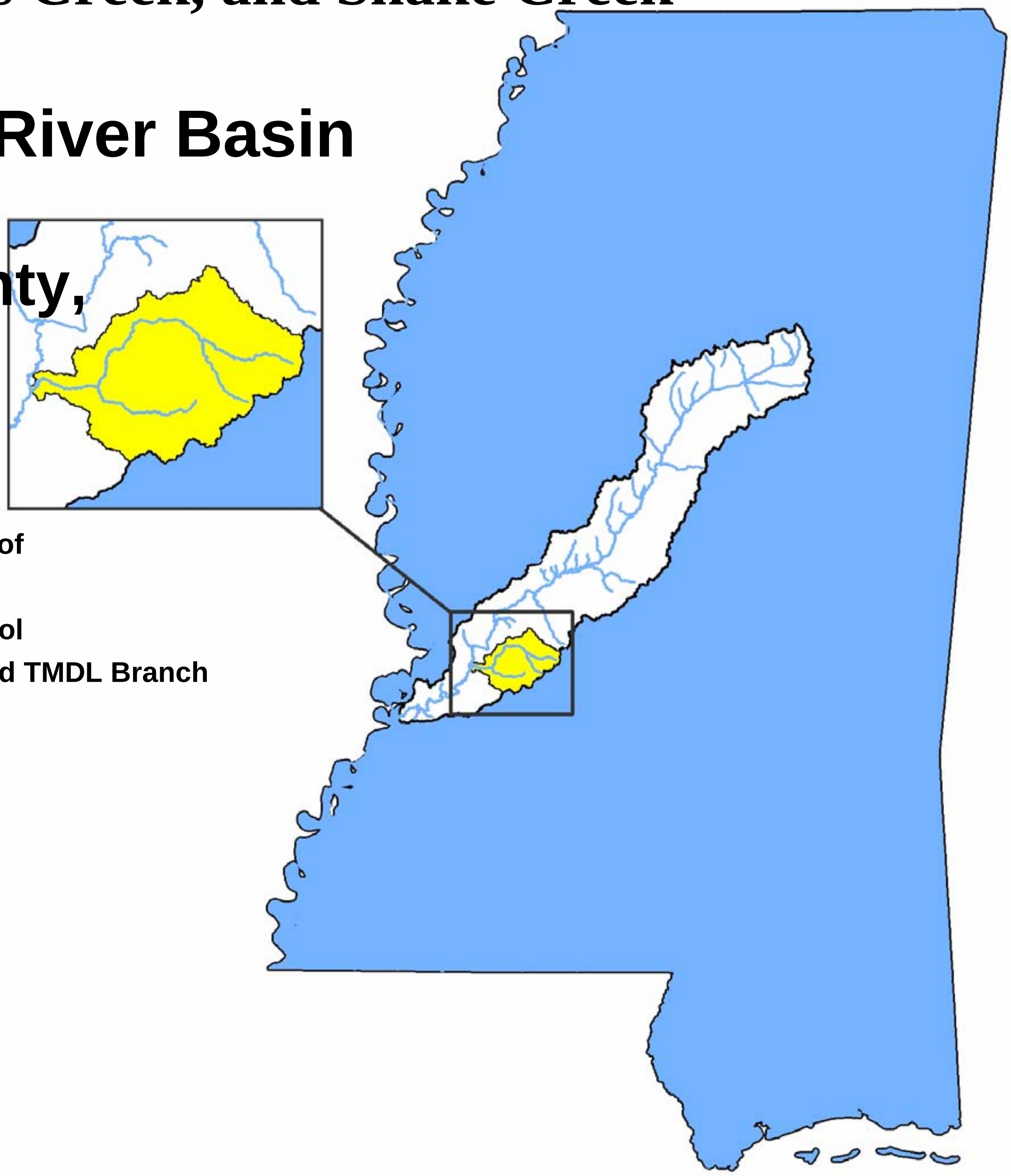
FINAL REPORT
May 2011

Total Maximum Daily Load

Biological Impairment Due to Nutrients and Organic Enrichment / Low Dissolved Oxygen For Fourteen Mile Creek, Bakers Creek, Little Bakers Creek, and Snake Creek

Big Black River Basin

Hinds County, Mississippi



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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	:	10^6	mega	M
10^{-9}	nano	n	10^9	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

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TMDL INFORMATION PAGE

Table 1. Listing Information

Name	ID	County	HUC	Cause	Stressors
Fourteen Mile Creek	MS441FE	Hinds	08060202	Biological Impairment	Nutrients and Organic Enrichment / Low Dissolved Oxygen
Location: Near Newman from headwaters to mouth at Big Black River					
Bakers Creek	109211	Hinds	08060202	Biological Impairment	Nutrients and Organic Enrichment / Low Dissolved Oxygen
Location: From confluence with Fleetwood Creek to confluence with Fourteen Mile Creek					
Little Bakers Creek	109112	Hinds	08060202	Biological Impairment	Nutrients and Organic Enrichment / Low Dissolved Oxygen
Location: From Headwaters to mouth at Bakers Creek					
Snake Creek	109011	Hinds	08060202	Biological Impairment	Nutrients and Organic Enrichment / Low Dissolved Oxygen
Location: Near Clinton from headwaters to mouth at Bakers Creek					

Table 2. Water Quality Standards

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

Table 3. NPDES Facilities

NPDES ID	Facility Name	Permitted Discharge (MGD)	Receiving Water
MS0051772	Raymond POTW	0.150	Fourteen Mile Creek
MS0021032	Bolton POTW	0.210	Bakers Creek
MS0054992	Clinton POTW Southside	3.500	Bakers Creek
MS0036382	Edwards POTW Southeast	0.330	Bakers Creek
MS0036277	Gulf States Canners Inc.	0.098	Little Bakers Creek
MS0043745	Pine Lakes Village	0.021	Unnamed Tributary to Little Bakers Creek
MS0031453	West View Subdivision	0.032	Unnamed Tributary to Little Bakers Creek
MS0054984	Bolton Edwards School	0.0192	Unnamed Tributary to Bakers Creek
MS0031186	United Pentecostal	0.0015	Unnamed Tributary to Bakers Creek
MS0022250	Country Oaks MHP	0.010	Unnamed Tributary to Bakers Creek
MS0025852	Raymond POTW East	0.600	Snake Creek
MS0030015	Central Hinds Academy	0.014	Unnamed Tributary to Snake Creek

Table 4. Total Maximum Daily Load

Pollutant	WLA (lbs/day)	WLAsw (lbs/day)	LA (lbs/day)	MOS	TMDL (lbs/day)
TN	543.56	86.70	1,386.91	Implicit	2,017.17
TP	148.25	8.70	139.80	Implicit	296.75
TBODu	1,247.78	0.24	3.89	Implicit	1,251.91

EXECUTIVE SUMMARY

This TMDL has been developed for Fourteen Mile Creek, Bakers Creek, Little Bakers Creek, and Snake Creek which were placed on the Mississippi Section 303(d) List of Impaired Water Bodies due to evaluated causes of nutrients and organic enrichment/low dissolved oxygen. In this TMDL this collection of water bodies is referred to as the Fourteen Mile Creek Watershed. MDEQ completed biological monitoring on these water bodies which indicated biological impairment. It was determined that nutrients and organic enrichment / low dissolved oxygen are probable primary stressors. This TMDL will provide an estimate of the total nitrogen (TN) and total phosphorus (TP) allowable in the stream and will also provide an allocation for TBODu and nutrients for the 12 point sources included in this TMDL.

Mississippi does not have water quality standards for allowable nutrient concentrations. MDEQ currently is working on the development of criteria for nutrients. A concentration of 1.12 mg/l is an applicable target for TN and 0.16 mg/l for TP for water bodies located in Ecoregion 74. MDEQ is presenting these concentrations as preliminary target values for TMDL development which is subject to revision after the development of numeric nutrient criteria.

The Fourteen Mile Creek Watershed is located in HUC 08060202 near Newman. Fourteen Mile Creek flows for 27.5 miles in a westerly direction from its headwaters to the confluence with the Big Black River in Hinds County. The critical 7Q10 flow for Fourteen Mile Creek is 0.2 cfs.

The TMDL for organic enrichment was quantified in terms of total ultimate biochemical oxygen demand (TBODu). The limited total nutrient data and estimated ecoregion concentrations indicate a reduction of phosphorus is needed. Tables 15-18 present the estimated loads, the target loads, and the reductions needed to meet the TMDLs.

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 2008 §303(d) listed segment shown in Figure 1.

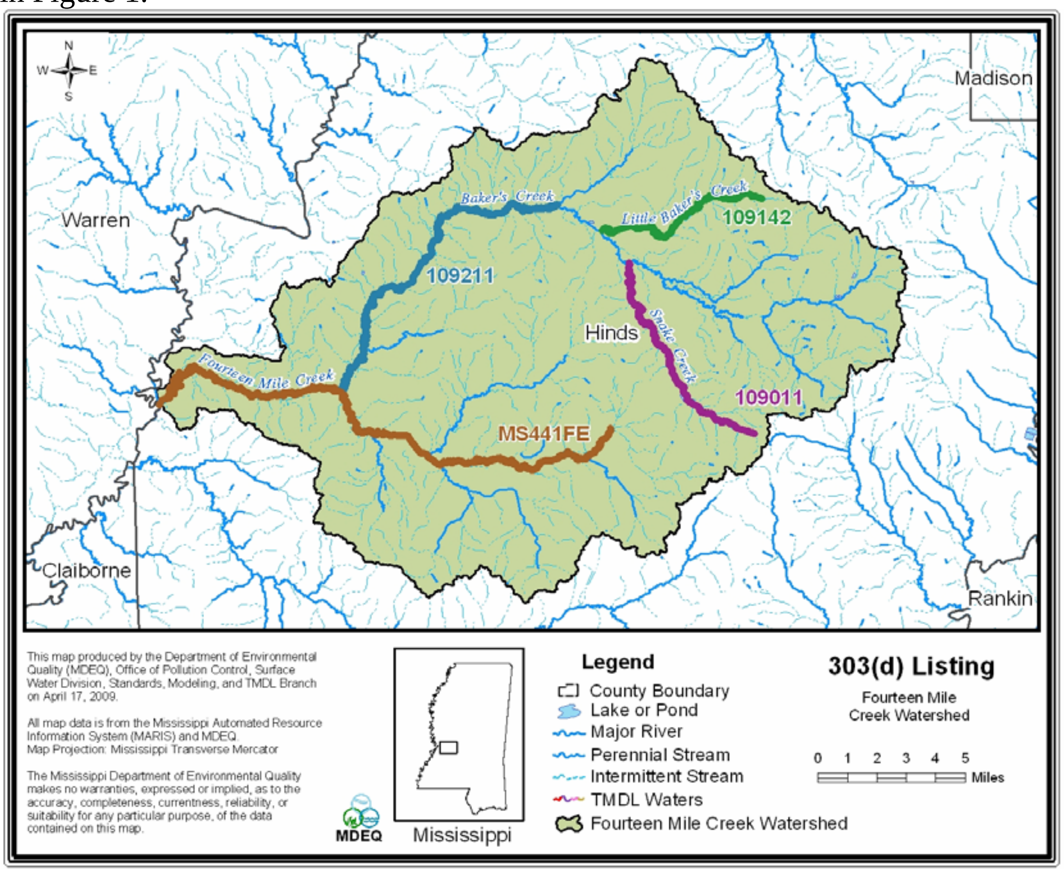


Figure 1. Fourteen Mile Creek Watershed §303(d) Segments

The original listing for Fourteen Mile Creek was on the 1996 303(d) list. There were no monitoring data, so the stream remained on the evaluated portion of Mississippi's §303(d) list. MDEQ began a biological monitoring program, the M-BISQ (Mississippi Benthic Index of Stream Quality), to monitor these and other evaluated streams to confirm water quality based on the health of the biology in the stream. Fourteen Mile Creek was confirmed as impaired based on the biology.

1.2 Stressor Identification

The impaired segments were listed due to failure to meet minimum water quality criteria for aquatic use support based on biological sampling (MDEQ, 2007). 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 Fourteen Mile Creek Watershed (MDEQ, 2010).

There are no state criteria in Mississippi for nutrients. These criteria are currently being developed by MDEQ. MDEQ proposed a work plan for nutrient criteria development that has been agreed to by EPA and is on schedule according to the plan (MDEQ, 2010). Data were collected for wadeable streams to calculate the nutrient targets.

For this TMDL, MDEQ is presenting preliminary targets for TN and TP. An annual concentration of 1.12 mg/l is an applicable target for TN and 0.16 mg/l for TP for water bodies located in Ecoregion 74. However, MDEQ is presenting these concentrations as preliminary target values for TMDL development which is subject to revision after the development of nutrient criteria, when the criteria work is complete.

1.3 Applicable Water Body Segment Use

The water use classifications are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007). The designated beneficial use for the listed segment is fish and wildlife.

1.4 Applicable Water Body Segment Standard

The water quality standard applicable to the use of the water body and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007).

The applicable standard specifies that the dissolved oxygen (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. 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)." In the 1999 Protocol for Developing Nutrient TMDLs, EPA suggests several methods for the development of numeric criteria for nutrients (USEPA, 1999). In accordance with the 1999 Protocol, "The target value for the chosen indicator can be based on: comparison to similar but unimpaired waters; user surveys; empirical data summarized in classification systems; literature values; or professional judgment." MDEQ believes the most economical and scientifically defensible method for use in Mississippi is a comparison between similar but unimpaired waters within the same region. This method is dependent on adequate data which are being collected in accordance with the EPA approved plan. The initial phase of the data collection process for wadeable streams is complete.

1.5 Nutrient Target Development

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

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

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

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

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

For the preliminary target concentration for each ecoregion, the 90th percentiles were derived for station mean values of nutrient sites found to be fully supporting of aquatic life support according to the M-BISQ scores.

WATER BODY ASSESSMENT

2.1 Fourteen Mile Creek Water Quality Data

Nutrient and dissolved oxygen data for the Fourteen Mile Creek Watershed were gathered and reviewed from several studies such as the Ambient Monitoring Program, Nutrient Criteria Development, and the §303(d)/M-BISQ monitoring project. The data are given in Table 5. The locations of the monitoring stations are shown in Figure 2.

Table 5. Fourteen Mile Creek Nutrient Data

Station	Date	TN (mg/l)	TP (mg/l)	D.O. (mg/l)
304	3/2/05	1.91	0.18	10.13
BB34	9/30/99	4.08	1.13	8.08
BB34	2/15/00	2.94	0.76	8.55
BB34	4/6/00	2.18	0.41	9.57
BB34	6/29/00	4.19	0.96	3.7
BC-1	11/16/98	1.61	0.44	7.4
BC-1	10/4/00	0.18	0.04	9.07
BC-1	10/5/00	0.15	0.03	5.69
BB035	9/30/99	6.37	1.84	4.12
BB035	2/12/00	2.00	0.53	9.18
BB035	4/6/00	1.46	0.29	11.4
BB035	6/29/00	3.97	1.37	3.01
1024	1/25/06	1.49	0.43	9.75
881	2/18/03	1.31	0.11	11.41
882	2/18/03	1.98	0.25	9.83
303	1/7/01	2.6	0.3	10.93

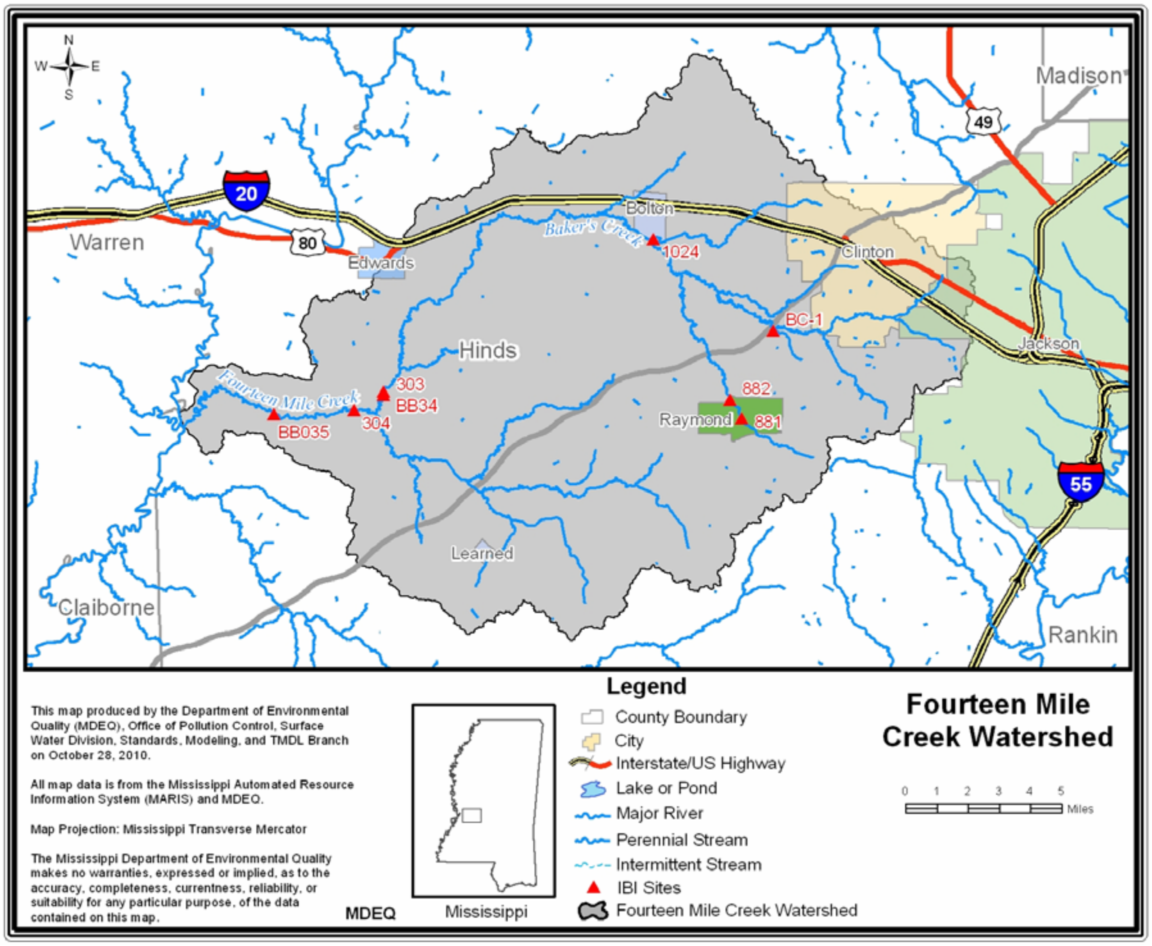


Figure 2. Fourteen Mile Creek Watershed Water Quality Monitoring Station

2.2 Assessment of Point Sources

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of nutrients in the watershed and the amount of pollutant loading contributed by each of these sources. Under the CWA, sources are broadly classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Point sources can be described by two broad categories: 1) NPDES regulated municipal and industrial wastewater treatment plants (WWTPs) and 2) NPDES regulated activities, which include construction activities and municipal storm water discharges (Municipal Separate Storm Sewer Systems [MS4s]). For the purposes of this TMDL, all sources of nutrient loading not regulated by NPDES permits are considered nonpoint sources.

Fourteen Mile Creek is located within a Phase II MS4 county. Therefore, MDEQ has established a method to estimate the stormwater waste load allocation (WLAsw). The WLAsw = LA * % Urban Area in the MS4 in watershed *70%. The intent of the stormwater NPDES permit is not to treat the water after collection, but to reduce the exposure of stormwater runoff to pollutants by implementing various controls. Stormwater NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment. (GA, 2009) The TMDL loads were then calculated, using Equation 1. There are two MS4s located within the Fourteen Mile Creek Watershed: MS4 Stormwater Management Program City of Clinton (MSRMS4027), and MS4 Stormwater Management Program Hinds County (MSRMS4019).

Waste Load Allocation stormwater (WLAsw) = LA * % Urban Area in MS4 within watershed * 70%
(Equation 1)

Nutrient loadings from NPDES regulated construction activities and MS4s are considered point sources to surface waters. These discharges occur in response to storm events and are included in the WLAsw portion of this TMDL. As of March 2003, discharge of storm water from construction activities disturbing more than one acre must obtain an NPDES permit. The purpose of the NPDES permit is to eliminate or minimize the discharge of pollutants from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit varies. The target for these areas is the same range as the TMDL target for the watershed. The WLAs provided to the NPDES regulated construction activities and MS4s will be implemented as best management practices (BMPs) as specified in Mississippi's General Storm Water Permits for Small

Construction, Construction, and Phase I & II MS4 permits. Properly designed and well-maintained BMPs are expected to provide attainment of water quality standards.

Table 6. NPDES Permitted Facilities Treatment Types

Name	NPDES Permit	Treatment Type	Discharge (MGD)	BOD_5 (mg/l)	NH_3-N mg/L
Raymond POTW	MS0051772	Biolac Aeration Facility	0.15	10	2
Bolton POTW	MS0021032	Conventional Lagoon	0.21	45	-
Clinton POTW Southside	MS0054992	Activated Sludge/ Oxidation Ditch	3.5	10	2
Edwards POTW Southeast	MS0036382	Conventional Lagoon	0.33	30	-
Gulf States Canners Inc.	MS0036277	Aerated Lagoon/ Wetlands Treatment	0.098	6.5	2
Pine Lakes Village	MS0043745	Conventional Lagoon	0.021	30	-
West View Subdivision	MS0031453	Conventional Lagoon	0.032	30	-
Bolton Edwards School	MS0054984	Conventional Lagoon	0.0192	30	-
United Pentecostal	MS0031186	Conventional Lagoon	0.015	30	-
Country Oaks MHP	MS0022250	Activated Sludge System	0.01	30	-
Raymond POTW East	MS0025852	Partially Aerated Lagoon	0.6	40	-
Central Hinds Academy	MS0030015	Conventional Lagoon	0.014	30	-

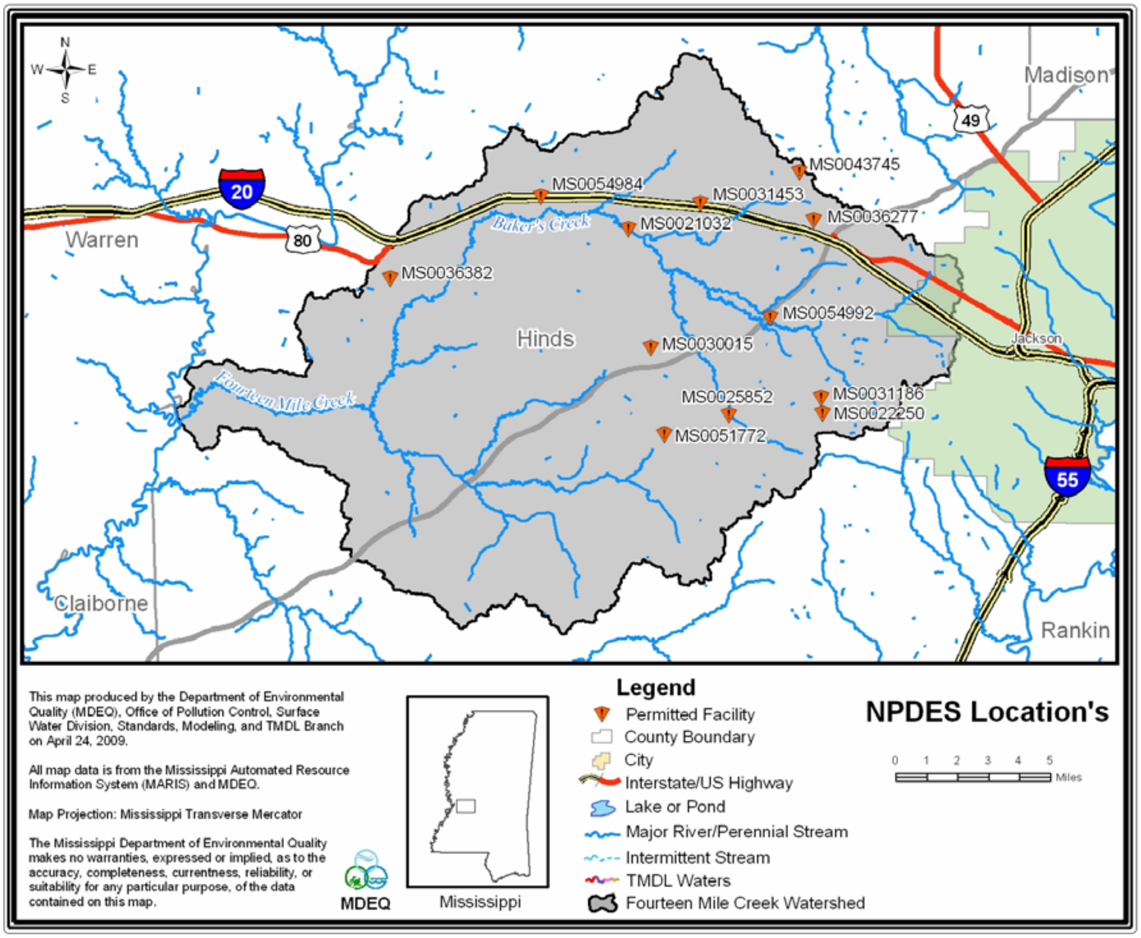


Figure 3. Fourteen Mile Creek Watershed Point Sources

2.3 Assessment of Non-Point Sources

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

Unlike nitrogen, phosphorus is primarily transported in surface runoff when it has been sorbed by eroding sediment. Phosphorus may also be associated with fine-grained particulate matter in the atmosphere and can enter streams as a result of dry fallout and rainfall (USEPA, 1999).

However, phosphorus is typically not readily available from the atmosphere or the natural water supply (Davis and Cornwell, 1988). As a result, phosphorus is typically the limiting nutrient in most non-point source dominated rivers and streams, with the exception of watersheds which are dominated by agriculture and have high concentrations of phosphorus contained in the surface runoff due to fertilizers and animal excrement or watersheds with naturally occurring soils which are rich in phosphorus (Thomann and Mueller, 1987).

Watersheds with a large number of failing septic tanks may also deliver significant loadings of phosphorus to a stream. All domestic wastewater contains phosphorus which comes from humans and the use of phosphate containing detergents. Table 14 presents typical nutrient loading ranges for various land uses.

The Fourteen Mile Creek Watershed is approximately 255 square miles. The watershed contains many different landuse types, including urban, forest, cropland, pasture, water, and wetlands. The land use information for the watershed is based on the National Land Cover Database (NLCD). Forest is the dominant landuse within this watershed. By multiplying the landuse category size by the estimated nutrient load, the watershed specific estimate can be calculated. The landuse distribution for the Fourteen Mile Creek Watershed is shown in Table 7 and Figure 4.

Table 7. Landuse Distribution for Fourteen Mile Creek Watershed

In Acres	Urban	Forest	Cropland	Pasture	Scrub/Barren	Water	Wetlands
Fourteen Mile (Acres)	13643	55732	21045	39727	19431	1692	11852
Percentage	8.4	34.1	12.9	24.4	11.9	1.0	7.3

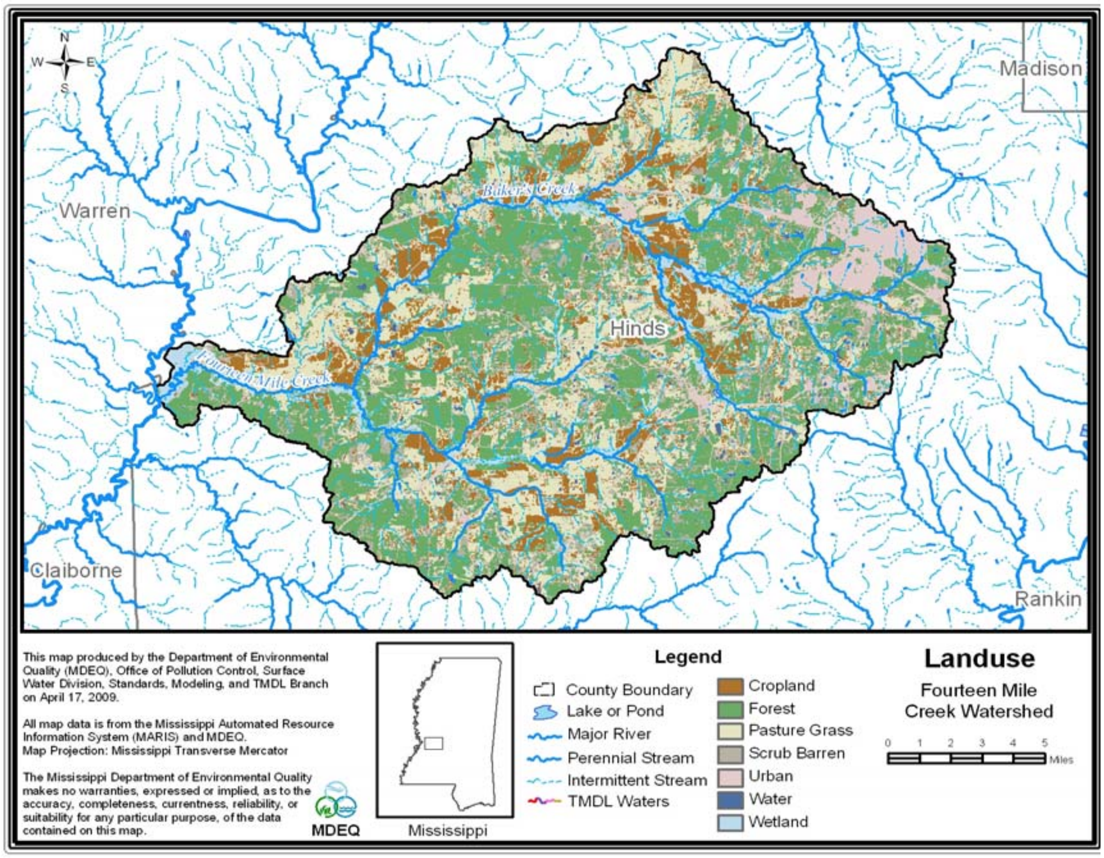


Figure 4. Landuse in Fourteen Mile Creek Watershed

2.4 Estimated Existing Load for Total Nitrogen

The estimated existing total nitrogen concentration is based on the average concentrations measured in runoff from various landuses. The target concentration for TN for Ecoregion 74 is 1.12 mg/l. The estimated existing concentration is 0.79 mg/. Therefore, no nitrogen reduction is needed.

The average annual flow in the watershed was calculated by utilizing the flow vs. watershed area graph shown in Figure 5. All available gages were compared to the watershed size. A very strong correlation between flow and watershed size was developed for the Big Black River Basin. The equation for the line that best fits the data was then used to estimate the annual average flow for the Fourteen Mile Creek Watershed. The TMDL target TN and TP loads were then calculated, using Equation 2 and the results are shown in Table 8.

Nutrient Load (lb/day) = Flow (cfs) * 5.394 (conversion factor)* Nutrient Concentration (mg/l) (Equation 2)

Table 8. Estimated Existing Total Nitrogen Load for Fourteen Mile Creek Watershed

Stream	Area (sq miles)	Average Annual Flow (cfs)	TN (mg/l)	TN (lbs/day)
Fourteen Mile Creek Watershed	255	345.3	0.79	1471.12

The existing TN load consists of both point and non-point components. Since many treatment facilities in Mississippi do not have permit limits for nitrogen, nor are they currently required to report effluent nitrogen concentrations, MDEQ used an estimated effluent concentration based on literature values for different treatment types. Table 9 shows the median effluent nitrogen concentrations for four conventional treatment processes. The appropriate concentration for each of the facilities was then used in Equation 2 to estimate the TN load from point sources, Table 10.

Table 9. Median Nitrogen Concentrations in Wastewater Effluents

	Treatment Type			
	Primary	Trickling Filter	Activated Sludge	Stabilization Pond
No. of plants sampled	55	244	244	149
Total N (mg/l)	22.4 ± 1.30	16.4 ± 0.54	13.6 ± 0.62	11.5 ± 0.84

Source: After Ketchum, 1982 in EPA 823-B-97-002 (USEPA, 1997)

Table 10. NPDES Permitted Facilities Treatment Types with Nitrogen Estimates

Facility Name	Treatment Type	Permitted Discharge (MGD)	TN concentration estimate (mg/l)	TN Load estimate (lbs/day)
Raymond POTW	Biolac Aeration Facility	0.15	13.6	17.01
Bolton POTW	Conventional Lagoon	0.21	11.5	20.14
Clinton POTW Southside	Activated Sludge/ Oxidation Ditch	3.5	13.6	396.98
Edwards POTW Southeast	Conventional Lagoon	0.33	11.5	31.65
Gulf States Canners Inc.	Aerated Lagoon/ Wetlands Treatment	0.098	11.5	9.40
Pine Lakes Village	Conventional Lagoon	0.021	11.5	2.01
West View Subdivision	Conventional Lagoon	0.032	11.5	3.07
Bolton Edwards School	Conventional Lagoon	0.0192	11.5	1.84
United Pentecostal	Conventional Lagoon	0.015	11.5	1.44
Country Oaks MHP	Activated Sludge System	0.01	13.6	1.13
Raymond POTW East	Partially Aerated Lagoon	0.6	11.5	57.55
Central Hinds Academy	Conventional Lagoon	0.014	11.5	1.34

The annual average TN point source load is estimated to be 543.56 lbs/day. The annual average target load based on the target TN concentration of 1.12 mg/l and an annual average flow of 345.3 cfs is 2017.17 lbs/day. The point source load is 26.9% of the total load. Therefore, 73.1% of the TN target load is from non-point sources. Because the TN target load is higher than the estimated existing TN load and because the majority of the load is from non-point sources, no TN reductions are needed from these facilities. However, TN limits will be capped at estimated existing loads for these permitted facilities.

2.5 Estimated Existing Load for Total Phosphorus

The estimated existing total phosphorous concentration is based on the average concentrations measured in runoff from various landuses. The target concentration for TP for Ecoregion 74 is 0.16 mg/l. The estimated existing concentration is 0.89 mg/l. To convert the estimated existing total phosphorous concentration to a total phosphorous load, the average annual flow was estimated based on flow data as shown above. The existing TP load was then calculated using Equation 2.

Table 11. Estimated Existing Total Phosphorus Load for Fourteen Mile Creek Watershed

Stream	Area (sq miles)	Average Annual Flow (cfs)	TP (mg/l)	TP (lbs/day)
Fourteen Mile Creek Watershed	255	345.3	0.89	1653.29

The existing TP load consists of both point and non-point components. Since many treatment facilities in Mississippi do not have permit limits for phosphorous, nor are they currently required to report effluent phosphorous concentrations, MDEQ used an estimated effluent concentration based on literature values for different treatment types. Table 12 shows the median effluent phosphorous concentrations for four conventional treatment processes. The appropriate concentration for each of the facilities was then used in Equation 2 to estimate the TP load from point sources, Table 13.

Table 12. Median Phosphorous Concentrations in Wastewater Effluents

	Treatment Type			
	Primary	Trickling Filter	Activated Sludge	Stabilization Pond
No. of plants sampled	55	244	244	149
Total P (mg/l)	6.6 ± 0.66	6.9 ± 0.28	5.8 ± 0.29	5.2 ± 0.45

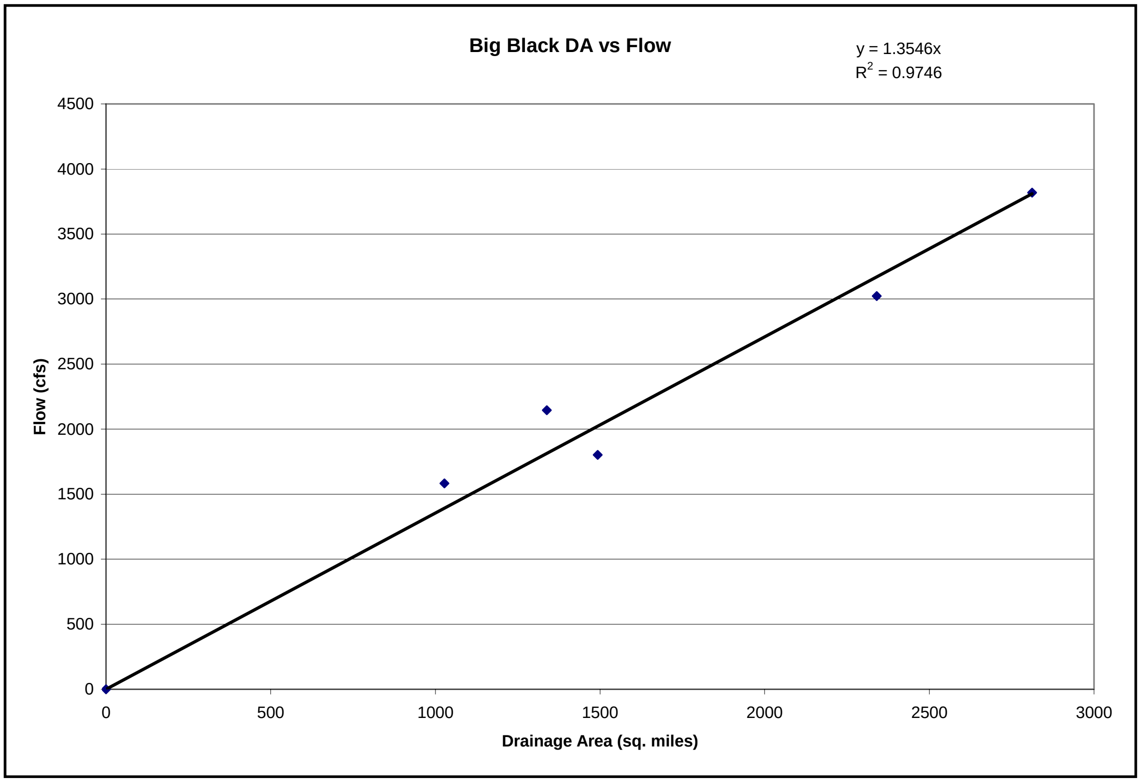
Source: After Ketchum, 1982 in EPA 823-B-97-002 (USEPA, 1997)

Table 13. NPDES Permitted Facilities Treatment Types with Phosphorous Estimates

Facility Name	Treatment Type	Permitted Discharge (MGD)	TP concentration estimate (mg/l)	TP Load estimate (lbs/day)
Raymond POTW	Biolac Aeration Facility	0.15	5.8	7.26
Bolton POTW	Conventional Lagoon	0.21	5.2	9.11
Clinton POTW Southside	Activated Sludge/ Oxidation Ditch	3.5	5.8	169.30
Edwards POTW Southeast	Conventional Lagoon	0.33	5.2	14.31
Gulf States Canners Inc.	Aerated Lagoon/ Wetlands Treatment	0.098	5.2	4.25
Pine Lakes Village	Conventional Lagoon	0.021	5.2	0.91
West View Subdivision	Conventional Lagoon	0.032	5.2	1.39
Bolton Edwards School	Conventional Lagoon	0.0192	5.2	0.83
United Pentecostal	Conventional Lagoon	0.015	5.2	0.65
Country Oaks MHP	Activated Sludge System	0.01	5.8	0.48
Raymond POTW East	Partially Aerated Lagoon	0.6	5.2	26.02
Central Hinds Academy	Conventional Lagoon	0.014	5.2	0.61

The annual average TP point source load is estimated to be 235.12 lbs/day. The annual average target load based on the target total phosphorous concentration of 0.89 mg/l and an annual average flow of 345.3 cfs is 296.75 lbs/day. The point source load is 79.0% of the total target load. Therefore, 21% of the estimated target load is from non-point sources. Because the point source TP load represents a significant portion of the target TP load, permit limit reductions for phosphorus are needed for the significant NPDES permitted facilities.

Figure 5. Big Black River Basin Drainage Area to Flow Comparison



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. STREAM is an updated version of the AWFWUL1 model, which had been used by MDEQ for many years. The use of AWFWUL1 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, 1994). 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.

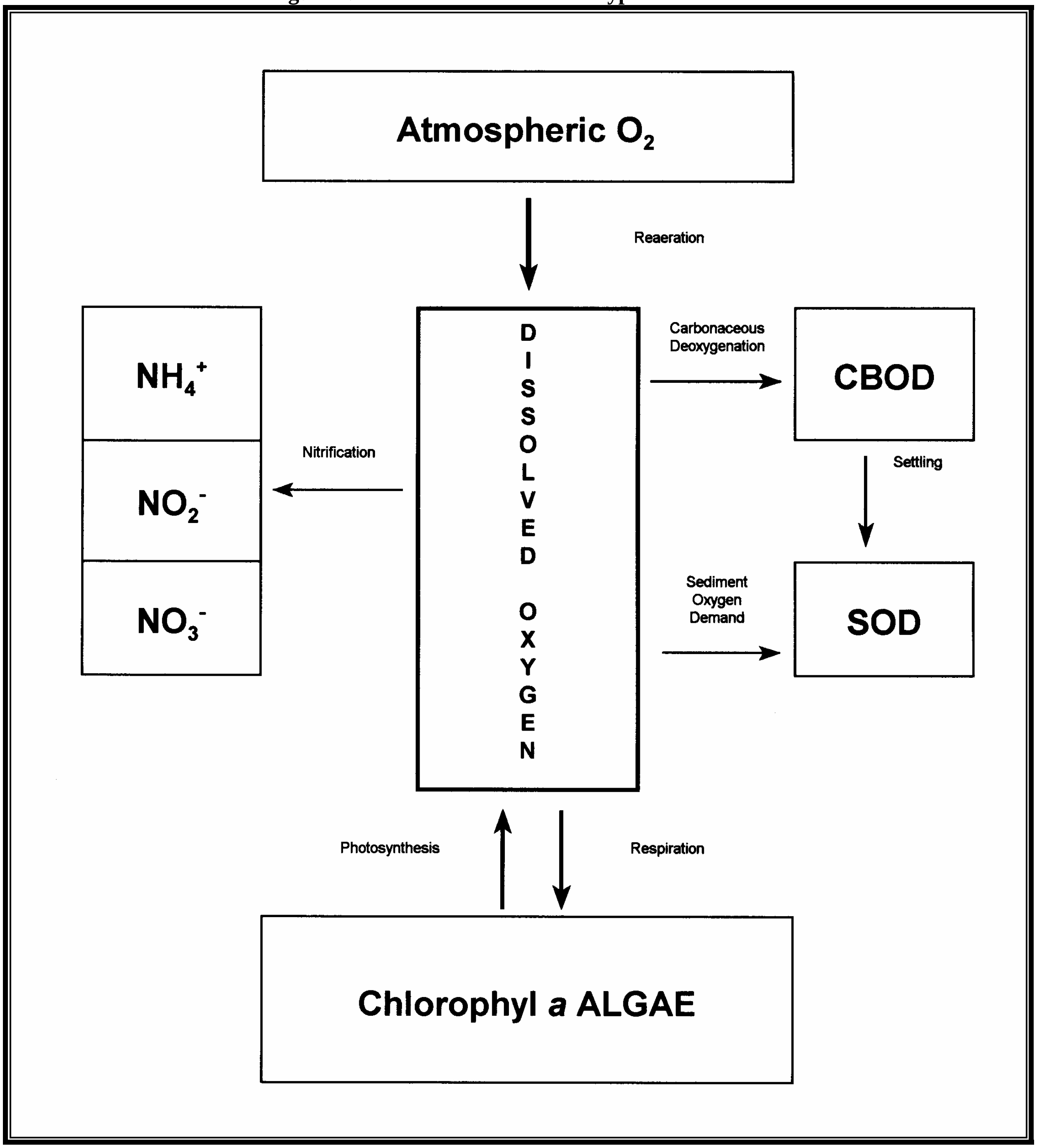
STREAM is a steady-state, daily average computer model that utilizes a modified Streeter-Phelps DO sag equation. Instream processes simulated by the model include CBODu decay, nitrification, reaeration, sediment oxygen demand, and respiration and photosynthesis of algae. Figure 6 shows how these processes 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 3.

$$\mathbf{K_a = C*S*U} \qquad \textbf{(Eq. 3)}$$

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.

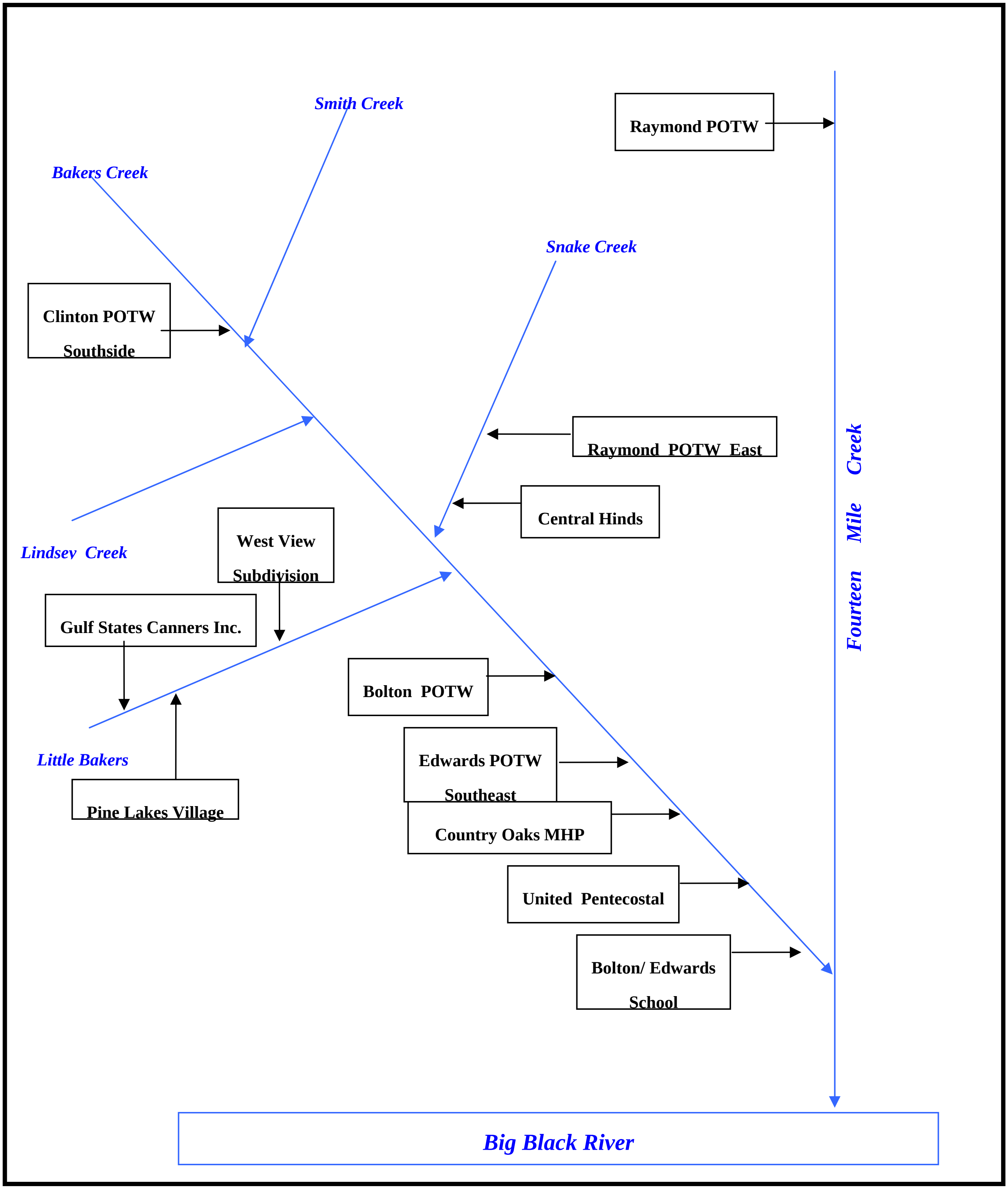
Figure 6. Instream Processes in a Typical DO Model



3.2 Model Setup

The model for this TMDL includes the §303(d) listed segments in the Fourteen Mile Creek Watershed as well as several tributaries. A diagram showing the model setup is shown in Figure 7.

Figure 7. Fourteen Mile Creek Watershed Model Setup (Note: Not to Scale)



The water bodies were divided 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 was setup to simulate flow and temperature conditions, which were determined to be the critical condition for this TMDL. MDEQ Regulations state that when the flow in a water body is less than 50 cfs, 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 at K_d at 20°C was input as 0.3 day^{-1} (base e) as specified in MDEQ regulations. The model adjusts the K_d rate based on temperature, according to Equation 4.

$$\mathbf{K_{d(T)} = K_{d(20°C)}(1.047)^{T-20}} \qquad \textbf{(Eq. 4)}$$

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 *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, 2009). Also based on MDEQ Regulations, the rates for photosynthesis, respiration, and sediment oxygen demand were set to zero because data for these model parameters are not available.

3.3 Source Representation

Both point and non-point sources were represented in the model. The loads from the NPDES permitted point sources were added as direct inputs into the appropriate reach as flows in MGD and concentrations of $CBOD_5$ and ammonia nitrogen in mg/l. Spatially distributed loads, which represent non-point sources of flow, $CBOD_5$, and ammonia-nitrogen were distributed evenly into each computational element of the modeled water body.

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 5.

$$\mathbf{CBODu = CBOD_5 * Ratio} \qquad \textbf{(Eq.5)}$$

The CBODu to $CBOD_5$ ratios are given in *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, 2009). 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 to be used in the STREAM model are given in Table 14.

Table 14. Point Sources, Maximum Permitted Model Inputs

Permit	Facility	Ratio	Flow MGD	CBODu (lbs/day)	NBODu (lbs/day)	TBODu (lbs/day)
MS0051772	Raymond POTW	1.5	0.15	18.81	11.46	30.27
MS0021032	Bolton POTW	1.5	0.21	118.51	16.05	134.56
MS0054992	Clinton POTW Southside	2.3	3.5	673.04	267.46	940.50
MS0036382	Edwards POTW Southeast	1.5	0.33	124.16	25.22	149.38
MS0036277	Gulf States Canners Inc.	2.3	0.098	12.25	7.49	19.74
MS0043745	Pine Lakes Village	1.5	0.021	7.90	1.60	9.50
MS0031453	West View Subdivision	1.5	0.032	12.04	2.45	14.49
MS0054984	Bolton Edwards School	1.5	0.0192	7.22	1.47	8.69
MS0031186	United Pentecostal	1.5	0.015	5.64	1.15	6.79
MS0022250	Country Oaks MHP	1.5	0.01	3.76	0.76	4.52
MS0025852	Raymond POTW East	1.5	0.6	300.98	45.85	346.83
MS0030015	Central Hinds Academy	1.5	0.014	5.27	1.07	6.34
			Total	**1289.58**	**382.03**	**1671.61**

Direct measurements of background concentrations of CBODu were not available for The Fourteen Mile Creek Watershed. Because there were no data available, the background concentrations of CBODu and NH_3-N were estimated based on *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, 2009). 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. The non-point source loads were assumed to be distributed evenly on a river mile basis throughout the modeled reaches.

3.4 Model Calibration

The model used to develop the Fourteen Mile Creek Watershed TMDL was calibrated using the limited amount of instream monitoring data collected during critical conditions available. Future monitoring is essential to improve the accuracy of the model and the results.

3.5 Model Results

Once the model setup and calibration were complete, the model was used to predict water quality conditions in the listed segments in the Fourteen Mile Creek Watershed and its tributaries. 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 location and loads shown in Table 15.

3.5.1 Regulatory Load Scenario

As shown in the figures, 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 regulatory load scenario model results are shown in Figures 8, 9, 10, 11, 12, and 13.

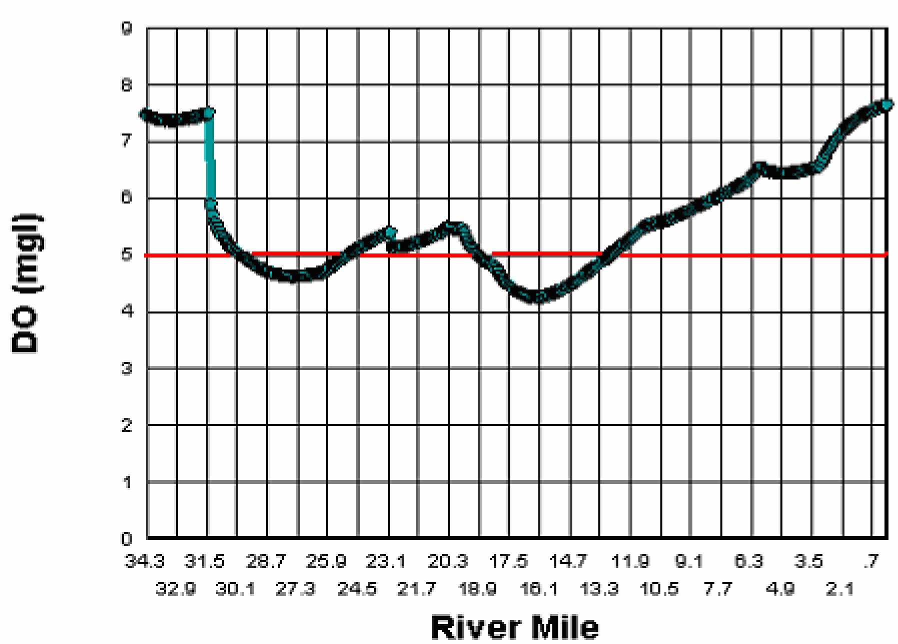


Figure 8. Model Output for DO in Bakers Creek, Regulatory Load Scenario

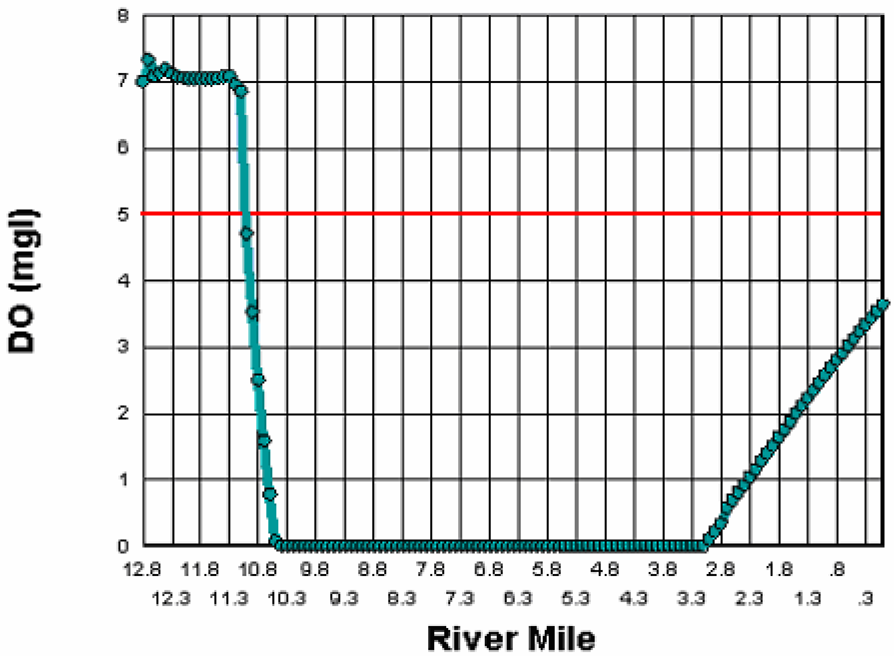


Figure 9. Model Output for DO in Snake Creek, Regulatory Load Scenario

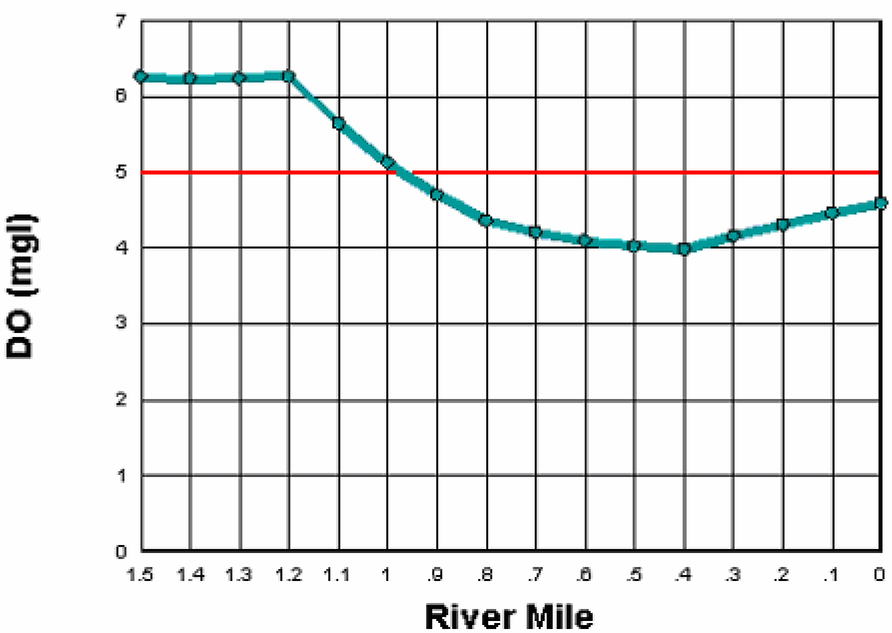


Figure 10. Model Output for DO in Unnamed Tributary to Bakers Creek, Regulatory Load Scenario

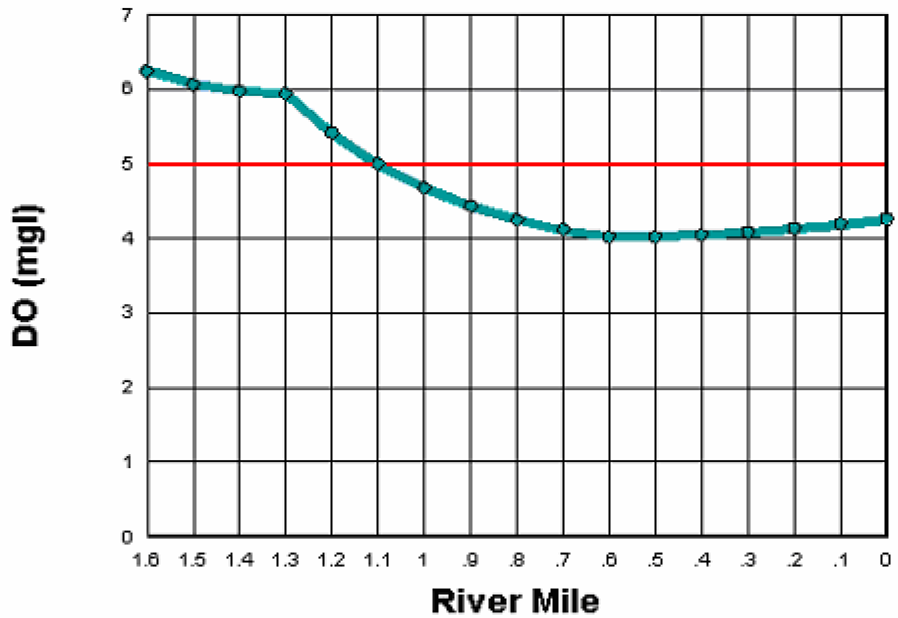


Figure 11. Model Output for in Unnamed Tributary to Little Bakers Creek PL, Regulatory Load Scenario

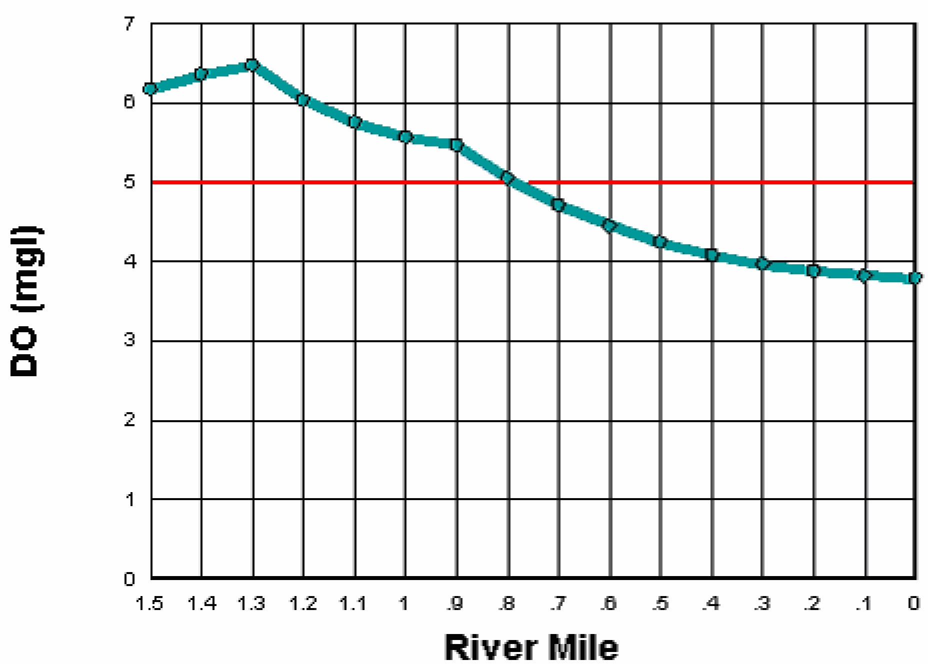


Figure 12. Model Output for DO in Unnamed Tributary to Little Bakers Creek WV, Regulatory Load Scenario

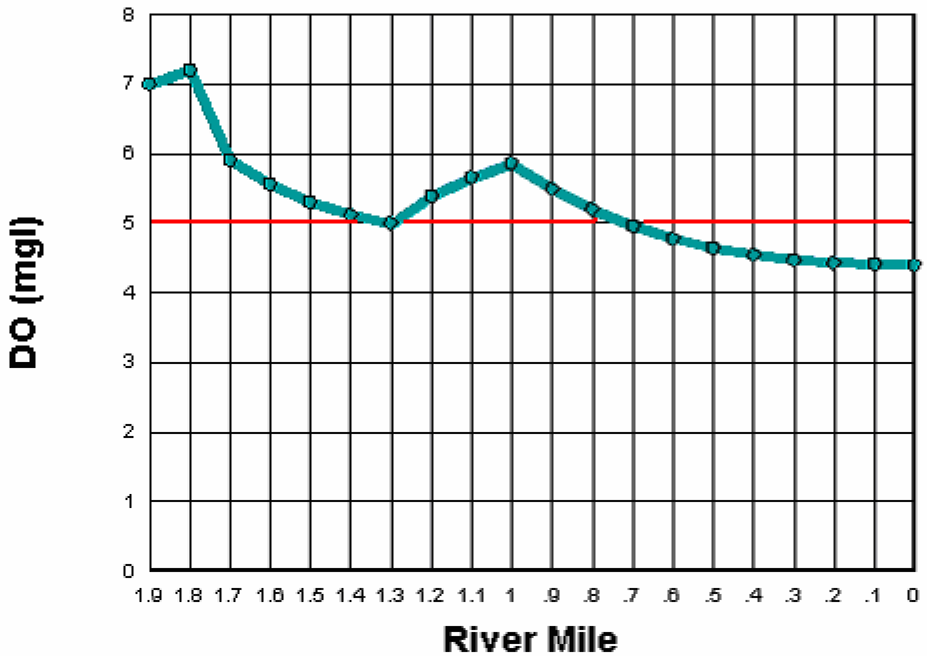


Figure 13. Model Output for DO in Unnamed Tributary to Snake Creek, Regulatory Load Scenario

3.5.2 Maximum Load Scenario

The graph of the regulatory load scenario output shows that the predicted DO does fall below the DO standard of 5.0 mg/l in Bakers Creek, Little Bakers Creek, Snake Creek, Unnamed Tributaries to Bakers Creek, Unnamed Tributaries to Little Bakers Creek, and Unnamed Tributary to Snake Creek during critical conditions. Thus, reductions of the loads of TBODu are necessary. Calculating the maximum allowable loads of TBODu involved decreasing the model input loads in the model until the modeled DO was above 5.0 mg/l. The non-point source loads in this model were already set at background conditions based on MDEQ regulations so no non-point source reductions were necessary. Thus, the permitted limits were decreased until the modeled DO remained at or above 5.0 mg/L. The decreased loads were then used to develop the allowable maximum daily load for this report. The maximum load scenario model results are shown in Figures 14, 15, 16, 17, 18, and 19.

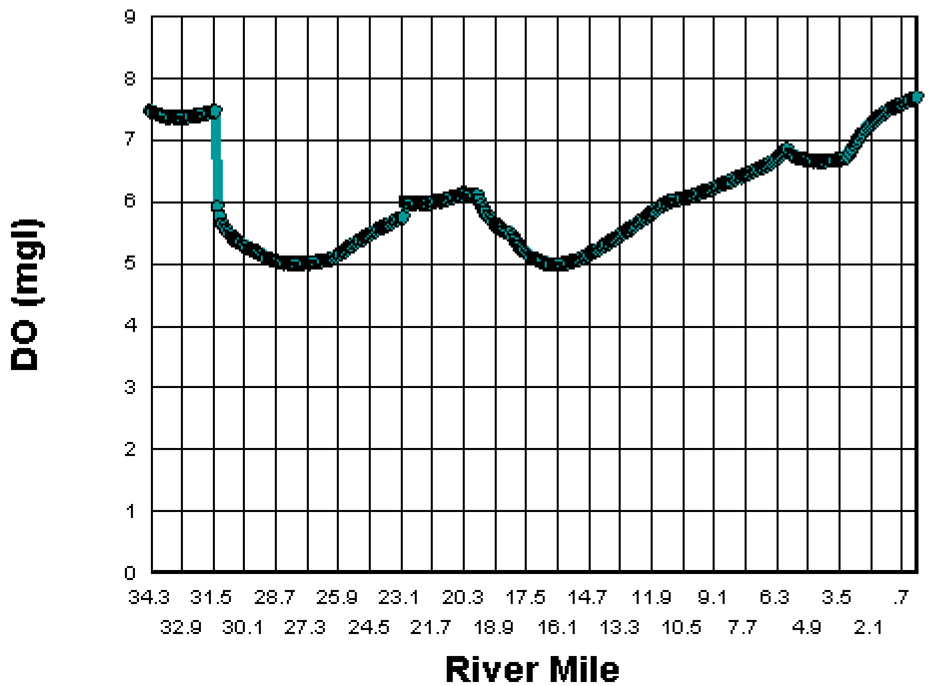


Figure 14. Model Output for DO in Bakers Creek, Maximum Load Scenario

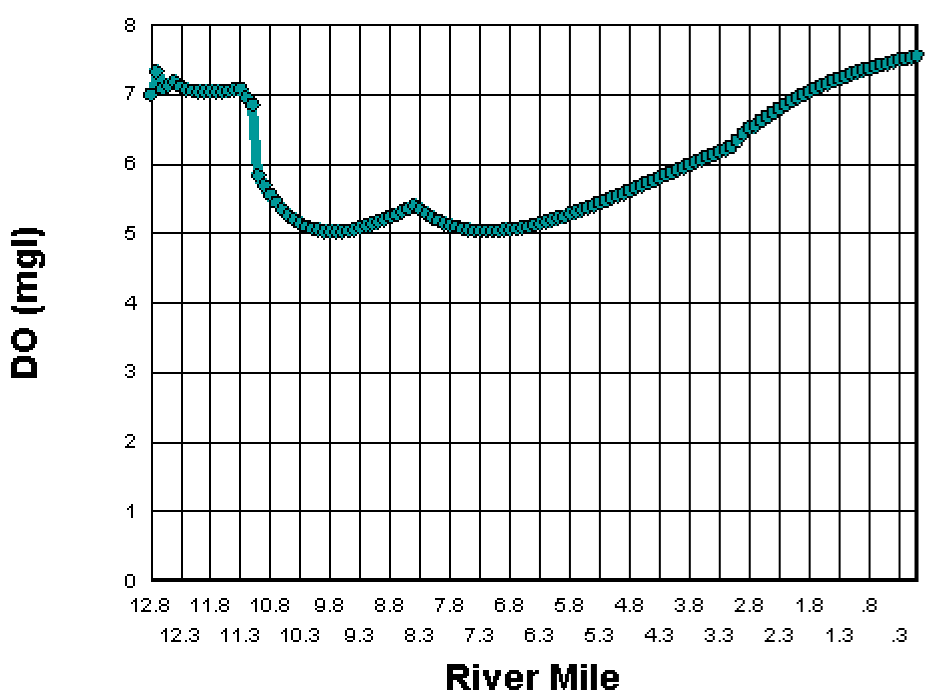


Figure 15. Model Output for DO in Snake Creek, Maximum Load Scenario

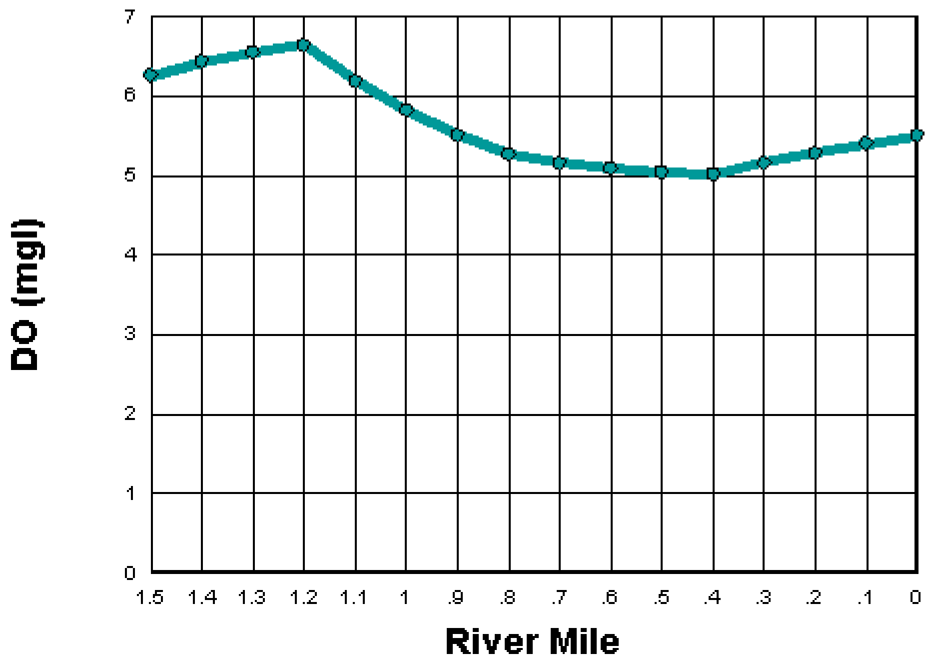


Figure 16. Model Output for DO in Unnamed Tributary to Bakers Creek BE, Maximum Load Scenario

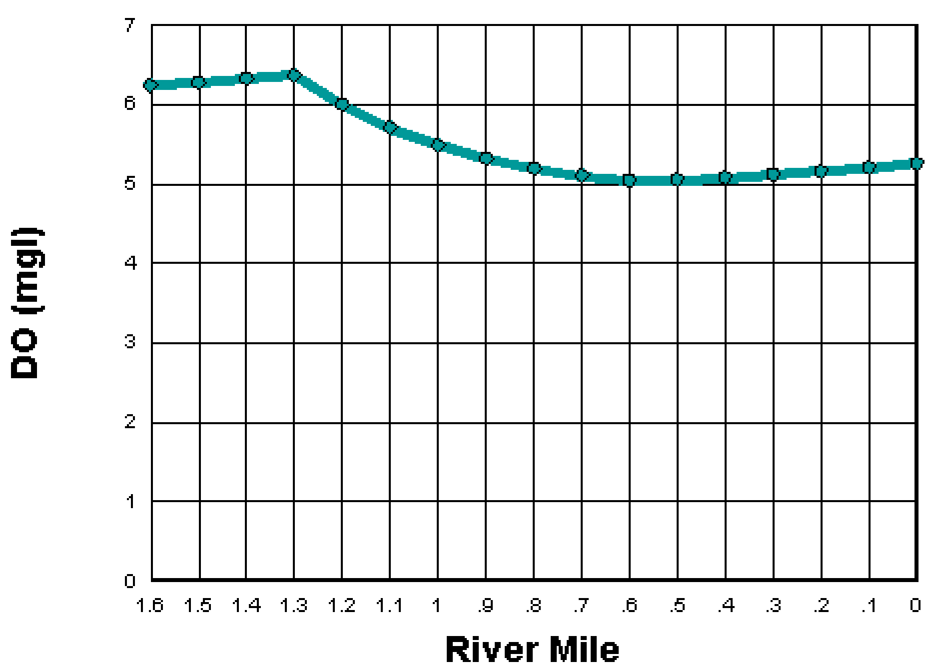


Figure 17. Model Output for DO in Unnamed Tributary to Bakers Creek PL, Maximum Load Scenario

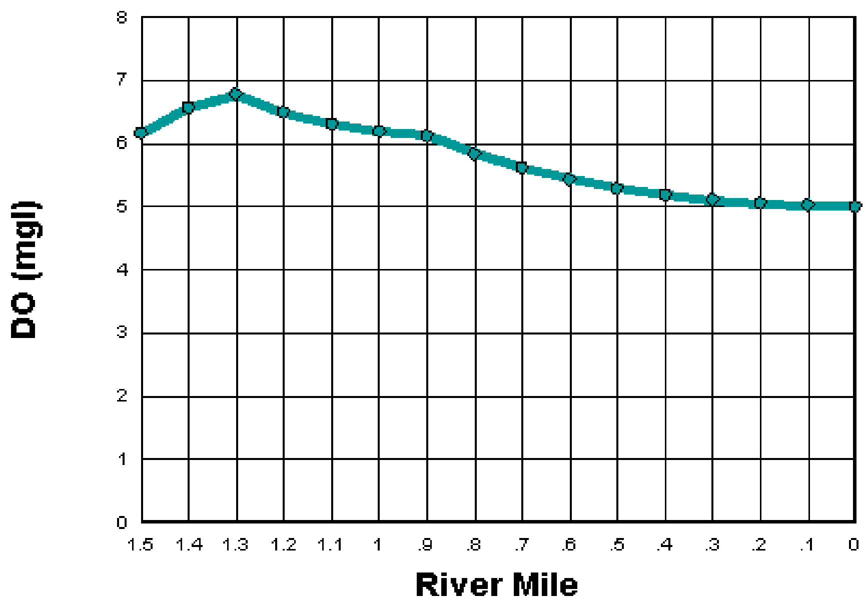


Figure 18. Model Output for DO in Unnamed Tributary to Little Bakers Creek WV, Maximum Load Scenario

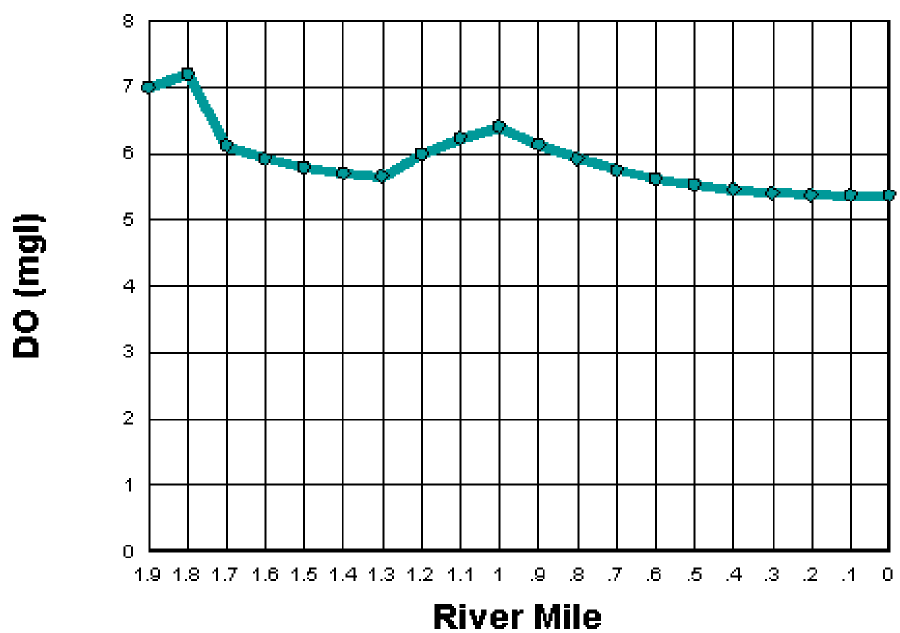


Figure 19. Model Output for DO in Unnamed Tributary to Snake Creek, Maximum Load Scenario

ALLOCATION

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

4.1 Wasteload Allocation

There are 16 point sources in the Fourteen Mile Creek Watershed. Four of these were too small to have any effect on the model and were omitted. The critical 7Q10 flow for Fourteen Mile Creek is 0.2 cfs. The NPDES permitted facilities included in the wasteload allocation for The Fourteen Mile Creek Watershed are given in Tables 15-18. Table 15 gives the wasteload allocation for TBODu. Table 16 gives the proposed permit limits for CBOD5. Table 17 gives the WLA for TN from the point sources. Table 18 gives the WLA for TP.

Table 15. WLA Loads for TBODu

NPDES	Facility	Permitted Discharge (MGD)	CBODu (lbs/day)	NBODu (lbs/day)	TBODu (lbs/day)
MS0051772	Raymond POTW	0.15	16.93	11.46	28.39
MS0021032	Bolton POTW	0.21	113.25	16.05	129.3
MS0054992	Clinton POTW Southside	3.5	538.43	267.46	805.89
MS0036382	Edwards POTW Southeast	0.33	124.16	25.22	149.38
MS0036277	Gulf States Canners Inc.	0.098	12.25	7.49	19.74
MS0043745	Pine Lakes Village	0.021	3.42	1.60	5.02
MS0031453	West View Subdivision	0.032	6.02	2.45	8.47
MS0054984	Bolton Edwards School	0.0192	3.13	1.47	4.6
MS0031186	United Pentecostal	0.015	5.64	1.15	6.79
MS0022250	Country Oaks MHP	0.01	1.88	0.76	2.64
MS0025852	Raymond POTW East	0.6	37.6	45.85	83.45
MS0030015	Central Hinds Academy	0.014	2.63	1.07	3.7
		Total	**865.34**	**382.03**	**1247.37**

Table 16. Proposed Permit Limits for BOD5 and Amonia

NPDES	Facility	Permitted Discharge (MGD)	Current BOD5 Limit (mg/l)	Proposed Amonia Limit (mg/l)	Proposed CBOD5 Limit (mg/l)	CBOD5 % Reduction
MS0051772	Raymond POTW	0.15	10	2	10	--
MS0021032	Bolton POTW	0.21	45	2	45	--
MS0054992	Clinton POTW Southside	3.5	10	--	8	20.0
MS0036382	Edwards POTW Southeast	0.33	30	2	30	--
MS0036277	Gulf States Canners Inc.	0.098	6.5	2	6.5	--
MS0043745	Pine Lakes Village	0.021	30	2	20	33.3
MS0031453	West View Subdivision	0.032	30	2	20	33.3
MS0054984	Bolton Edwards School	0.0192	30	2	20	33.3
MS0031186	United Pentecostal	0.015	30	2	30	--
MS0022250	Country Oaks MHP	0.01	30	2	30	--
MS0025852	Raymond POTW East	0.6	40	1	8	80.0
MS0030015	Central Hinds Academy	0.014	30	3	20	33.3

Table 17. TN Wasteload Allocation

Facility Name	TN concentration estimate (mg/l)	Permitted Discharge (MGD)	TN Load estimate (lbs/day)	TN Load allocated (lbs/day)	Percent Reduction
Raymond POTW	13.6	0.15	17.01	17.01	0
Bolton POTW	11.5	0.21	20.14	20.14	0
Clinton POTW Southside	13.6	3.5	396.98	396.98	0
Edwards POTW Southeast	11.5	0.33	31.65	31.65	0
Gulf States Canners Inc.	11.5	0.098	9.40	9.40	0
Pine Lakes Village	11.5	0.021	2.01	2.01	0
West View Subdivision	11.5	0.032	3.07	3.07	0
Bolton Edwards School	11.5	0.0192	1.84	1.84	0
United Pentecostal	11.5	0.015	1.44	1.44	0
Country Oaks MHP	13.6	0.01	1.13	1.13	0
Raymond POTW East	11.5	0.6	57.55	57.55	0
Central Hinds Academy	11.5	0.014	1.34	1.34	0
Total		**5.00**	**543.56**	**543.56**	**0**

Table 18. TP Wasteload Allocation

Facility Name	TP concentration estimate (mg/l)	Permitted Discharge (MGD)	TP Load estimate (lbs/day)	TP Load allocated (lbs/day)	Percent Reduction
Raymond POTW	5.8	0.15	7.26	4.57	37
Bolton POTW	5.2	0.21	9.11	5.74	37
Clinton POTW Southside	5.8	3.5	169.30	103.41	37
Edwards POTW Southeast	5.2	0.33	14.31	9.02	37
Gulf States Canners Inc.	5.2	0.098	4.25	4.25	0
Pine Lakes Village	5.2	0.021	0.91	0.91	0
West View Subdivision	5.2	0.032	1.39	1.39	0
Bolton Edwards School	5.2	0.0192	0.83	0.83	0
United Pentecostal	5.2	0.015	0.65	0.65	0
Country Oaks MHP	5.8	0.01	0.48	0.48	0
Raymond POTW East	5.2	0.6	26.02	16.39	37
Central Hinds Academy	5.2	0.014	0.61	0.61	0
Total		**5.00**	**235.12**	**148.25**	**37**

It is noted that due to the lack of nutrient water quality criteria these TMDL allocations are estimates based on literature assumptions and projected targets. The State of Mississippi is in the process of developing numeric nutrient criteria in accordance with an EPA agreed to work plan for nutrient criteria development.

4.1.1 Wasteload Allocation Stormwater

There is a phase II MS4 in this TMDL watershed. MDEQ has established a method to estimate the stormwater waste load allocation (WLAsw). The WLAsw = LA * % Urban Area in MS4 in watershed *70%. The intent of the stormwater NPDES permit is not to treat the water after collection, but to reduce the exposure of stormwater runoff to pollutants by implementing various controls. Stormwater NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment. (GA, 2009)

4.2 Load Allocation

The load allocation for the TBODu TMDL is shown in Table 19.

Based on initial estimates in Sections 2.4 and 2.5, most of the TN load and a significant portion of the TP load in this watershed come from non-point sources. Therefore, best management practices (BMPs) should be encouraged in the watershed to reduce potential nutrient loads from non-point sources The watershed should be considered a priority for riparian buffer zone restoration and any nutrient reduction BMPs. For land disturbing activities related to silviculture, construction, and agriculture, it is recommended that practices, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), be followed, respectively. Table 20 shows the load allocation for TN and TP.

Table 19. Load Allocation for TBODu

Water Body	CBODu (lbs/day)	NBODu (lbs/day)	TBODu (lbs/day)
Fourteen Mile Creek Watershed	3.34	0.76	4.09

Table 20. Load Allocation for TN and TP

Nutrient	Allocated Nutrient Non-point Source Load (lbs/day)
TN	1473.59
TP	148.5

4.3 Incorporation of a Margin of Safety

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

4.4 Calculation of the TMDL

Equation 2 was used to calculate the TMDL for TP and TN. The target concentration was used with the average flow for the watershed to determine the nutrient TMDLs. The STREAM model was used to calculate the TBODu TMDL. The allocations for TN, TP, and TBODu are given in Tables 21 and 22. These allocations are established to attain the applicable water quality standards. The LA was further reduced by calculating the WLAsw. The sum of the WLA, WLAsw, LA, and MOS equal the TMDL.

Table 21. TMDL for TBODu in Fourteen Mile Creek Watershed

	WLA (lbs/day)	WLAsw (lbs/day)	LA (lbs/day)	MOS (lbs/day)	TMDL (lbs/day)
CBODu	865.34	0.20	3.34	Implicit	868.88
NBODu	382.03	0.04	0.76	Implicit	382.83
TBODu	**1247.37**	**0.24**	**4.09**		**1251.7**

Table 22. TMDL for TN and TP in Fourteen Mile Creek Watershed

	WLA (lbs/day)	WLAsw (lbs/day)	LA (lbs/day)	MOS (lbs/day)	TMDL (lbs/day)
TN	611.62	87.7	1385.9	Implicit	2085.2
TP	148.25	8.7	139.8	Implicit	296.75

4.5 Seasonality and Critical Condition

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

CONCLUSION

Nutrients were addressed through an estimate of a preliminary total phosphorous target concentration and a preliminary total nitrogen target concentration. Based on the estimated existing and target total nitrogen concentrations, this TMDL does not recommend a reduction of the nitrogen loads entering this stream to meet the preliminary target of 1.12 mg/l. Based on the estimated existing and target total phosphorous concentrations, this TMDL recommends a reduction of the phosphorous loads entering this stream to meet the preliminary target of 0.16 mg/l. Because the estimated current TP point source load is 79% of the TMDL load, this TMDL recommends establishing reduced TP limits for the five largest NPDES permitted facilities. This TMDL also recommends quarterly monitoring of nutrients (TP and TN) for the twelve NPDES facilities included in this report. Nine of the twelve facilities will also require changes to their existing permits to establish limits for ammonia nitrogen (NH_3-N). Six of the Twelve NPDES permitted facilities included in this report require permit reductions for CBOD5 in order to maintain a DO concentration at or above 5 mg/l.

It is recommended that the Fourteen Mile Creek Watershed be considered as a priority watershed for riparian buffer zone restoration and any nutrient reduction BMPs. The implementation of these BMP activities should reduce the nutrient load entering the creek. This will provide improved water quality for the support of aquatic life in the water bodies and will result in the attainment of the applicable water quality standards.

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 Big Black 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 or Greg Jackson, 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.

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