PROPOSED
December 2005

Fecal Coliform TMDL for Bridge Creek, Elam Creek, and an unnamed tributary to Bridge Creek

North Independent Streams Basin

Alcorn County, Mississippi

Prepared By

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FOREWORD

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired 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 is 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.

Prefixes for fractions and multiples of SI units

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

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.00156	Days	Seconds	86400
Cubic feet	Cu. Meter	0.02832	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805	Gallons	Cu feet	0.13368
Cubic feet	Liters	28.316	Hectares	Acres	2.4711
cfs	Gal/min	448.83	Miles	Meters	1609.34
cfs	MGD	0.64632	Mg/l	ppm	1
Cubic meters	Gallons	264.173	μg/l * cfs	Gm/day	2.45

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TMDL INFORMATION PAGE

Listing Information

Name	ID	County	HUC	Cause	Mon/Eval
Bridge Creek	MS203BE	Alcorn	08010207	Pathogens	Monitored
At Corinth from headwaters to confluence with Tuscumbia River Canal					
Elam Creek	MS204E	Alcorn	08010207	Pathogens	Monitored[1]
Near Corinth from headwaters to confluence with Bridge Creek					
Unnamed tributary to Bridge Creek	MSNI1700R00_030	Alcorn	08010207	Pathogens	Monitored[2]
From headwaters near the intersection of Hwy. 45 and Hwy. 72 to confluence with Bridge Creek					

[1] *Listed as monitored on the 2004 303(d) List, however due to a sampling site discrepancy there is only one set of available data*
[2] *Proposed Listing for 2006, Based on Water Quality Data*

Water Quality Standard

Parameter	Beneficial use	Water Quality Criteria
Pathogens	Secondary Contact	**May - October**: Fecal coliform colony counts not to exceed a geometric mean of 200 per 100ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 400 per 100ml more than 10% of the time. **November – April**: Fecal coliform colony counts shall not exceed a geometric mean of 2000 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 4000 per 100 ml more than 10% of the time.

NPDES Facilities

NPDES ID	Facility Name	Receiving Water
MS0021652	Corinth POTW	Elam Creek

Bridge Creek

Season	WLA (counts per 30 days)	LA (counts per 30 days)	MOS (counts per 30 days)	Total TMDL (counts per 30 days)
Summer	0+00	4.79E+12	5.33E+11	5.33E+12
Winter	0+00	1.40E+13	1.56E+12	1.56E+13

Elam Creek

Season	WLA (counts per 30 days)	LA (counts per 30 days)	MOS (counts per 30 days)	Total TMDL (counts per 30 days)
Summer	1.07E+12	5.02E+11	1.75E+11	1.75E+12
Winter	1.07E+12	3.52E+12	5.10E+11	5.10E+12

UNT to Bridge Creek

Season	WLA (counts per 30 days)	LA (counts per 30 days)	MOS (counts per 30 days)	Total TMDL (counts per 30 days)
Summer	0+00	2.99E+11	3.32E+10	3.32E+11
Winter	0+00	8.65E+11	9.61E+10	9.61E+11

EXECUTIVE SUMMARY

A fecal coliform TMDL has been developed for three water body segments located in the Bridge Creek watershed in Alcorn County, Mississippi. Two of the water body segments, MS203BE and MS204E, are on the Mississippi 2004 Section 303(d) List of Impaired Water Bodies as being impaired due to pathogens. The segments were originally listed for pathogens based on anecdotal information, for segment MS203BE impairment has been verified through recent monitoring. Segment MS204E is also listed as monitored on the 2004 Section 303(d) list, however due to a sampling site discrepancy only one set of data was collected for this water body. The other samples, originally believed to be from Elam Creek were collected on an unnamed tributary (UNT) to Bridge Creek. The three data sets collected at this location all indicated impairment due to pathogens. Therefore, this water body segment, MSNI1700R00_030, is proposed to be added to the next 303(d) list. All monitoring data were assessed based on the 2002 *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. MDEQ selected fecal coliform as an indicator organism for pathogenic bacteria for monitoring and TMDL development.

Bridge Creek, Photo 1, flows in a southwesterly direction from its headwaters near the Tennessee state line to its confluence with the Tuscumbia River Canal in Alcorn County. Elam Creek, Photo 2, flows in a southern direction from its headwaters near Corinth to its confluence with Bridge Creek. The UNT of Bridge Creek flows in a southerly direction from its headwaters near the intersection of Highway 45 and Highway 72 until its confluence with Bridge Creek. The location of three water body segments is shown in Figure 1. This TMDL has been developed for all three segments from their headwaters until their confluence with their receiving water bodies. Due to data limitations, complex dynamic modeling was inappropriate for performing the TMDL allocations for this study, as were load duration curves. Therefore, a mass balance approach was used to develop the TMDL for the three water body segments.

Photo 1. Bridge Creek

Photo 2. Elam Creek

Although fecal coliform loadings from point and nonpoint sources in the watershed were not explicitly represented with a model, a source assessment was conducted for the watershed. Corinth POTW (MS0021652) is the only NPDES permitted facility that discharges to Elam Creek. There are no point sources discharging directly into Bridge Creek or the UNT to Bridge Creek. However, the downstream reaches of Bridge Creek are affected by Corinth POTW. The current winter limits of 2000/4000 for fecal coliform allocated to Corinth POTW exceed the assimilative capacity of Elam Creek. Therefore, this TMDL will recommend that Corinth POTW winter limits for fecal coliform be reduced to the existing summer limits of 200/400 in the next permitting cycle. Monitoring of this facility should continue to ensure that compliance with permit limits is consistently attained. Nonpoint sources of fecal coliform include wildlife, livestock, and urban development. Also considered were the nonpoint sources such as failing septic systems, leaking sewer lines, sewer bypasses, and other direct inputs to the three water bodies.

The seasonal variations in hydrology, climatic conditions, and watershed activities are represented through the use of seasonal average flows and seasonal monitoring. Based on the available data, a determination of the critical period was not viable for Bridge Creek or the UNT to Bridge Creek. The violations to water quality standards in both Bridge Creek and the UNT to Bridge Creek occurred in both the winter and summer seasons. The one set of data available for Elam Creek is not enough to adequately access the conditions of Elam Creek to determine a critical period.

Water quality data indicate violations of both portions of the fecal coliform standard in the two water bodies which have adequate data available. However, it should be noted that the fecal coliform monitoring data collected for use in this TMDL were collected during a time when there were ongoing bypasses from the City of Corinth's sewer collection system. These bypasses in the areas surrounding the UNT to Bridge Creek and Elam Creek have occurred numerous times over the past several years, due to corrosion of the sewer lines caused by circumstances beyond the city's control. The correction of this problem and the repairs to the sewer system are underway. Most of the affected sewer lines have been replaced by the city, which has filed a complaint in U.S. District

Court against the entity suspected of causing the problems. These bypasses are representative of a significant nonpoint source of fecal coliform.

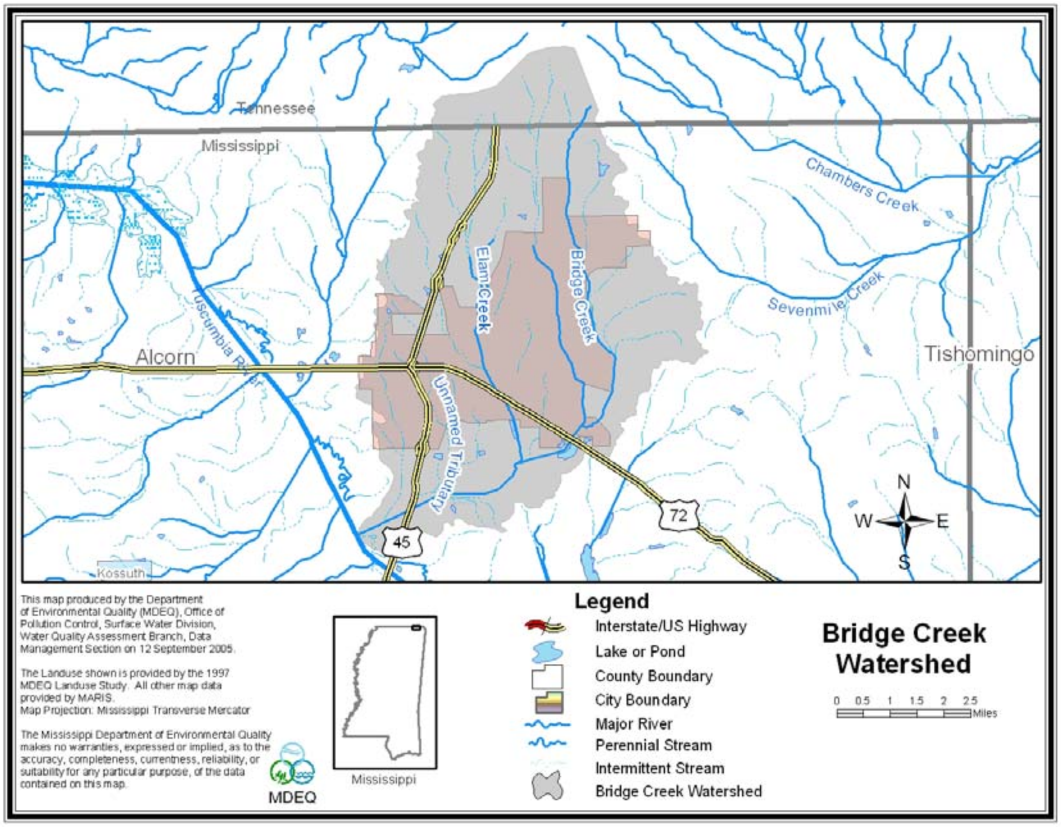
The TMDL for the three water bodies was calculated using a mass balance procedure. In order to account for uncertainty in the mass balance procedure an explicit 10% margin of safety (MOS) was used. The estimated reduction of fecal coliform for each water body segment is shown in Table 1.

Table 1. Estimated Fecal Coliform Reductions

Name	ID	Summer % Reduction	Winter % Reduction
Bridge Creek	MS203BE	95%	90%
Elam Creek	MS204E	*NA**	*NA**
Unnamed tributary to Bridge Creek	MSNI1700R00_030	89%	91%

***** *Insufficient Data to Estimate a Percent Reduction*

Figure 1. Location of the Bridge, Elam, and UNT Watershed



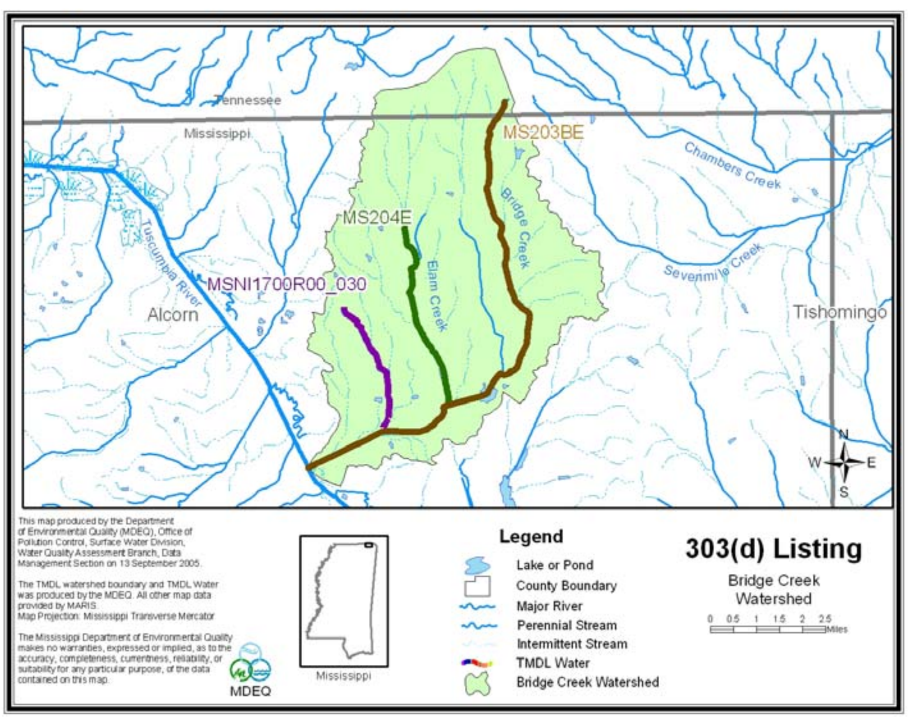
INTRODUCTION

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. The pollutant of concern for this TMDL is pathogens as indicated by fecal coliform. Fecal coliform bacteria are used as indicator organisms because they are readily identifiable and indicate the possible presence of other pathogenic organisms in the water body. The TMDL process can be used to establish water quality based controls to reduce pollution from nonpoint sources, maintain permit requirements for point sources, and restore and maintain the quality of water resources.

A TMDL has been developed for the 303(d) listed segment MS203BE, Bridge Creek and segment MS204E, Elam Creek. Segment MSNI1700R00_030, an unnamed tributary (UNT) to Bridge Creek, is an additional water body segment that is proposed to be added to the next 303(d) list based on recent fecal coliform monitoring data. Bridge Creek is an 11.7 mile segment that flows in a southwestern direction from its headwaters near the Tennessee state line until its confluence with the Tuscumbia River Canal. Elam Creek is a 4.2 mile segment that flows in a southern direction from its headwaters near Corinth to its confluence with Bridge Creek. The UNT to Bridge Creek is a 3.1mile segment that flows in a southerly direction from its headwaters near the intersection of Highway 45 and Highway 72 in Corinth until its confluence with Bridge Creek. The 303(d) segments for the three water bodies are shown in Figure 2.

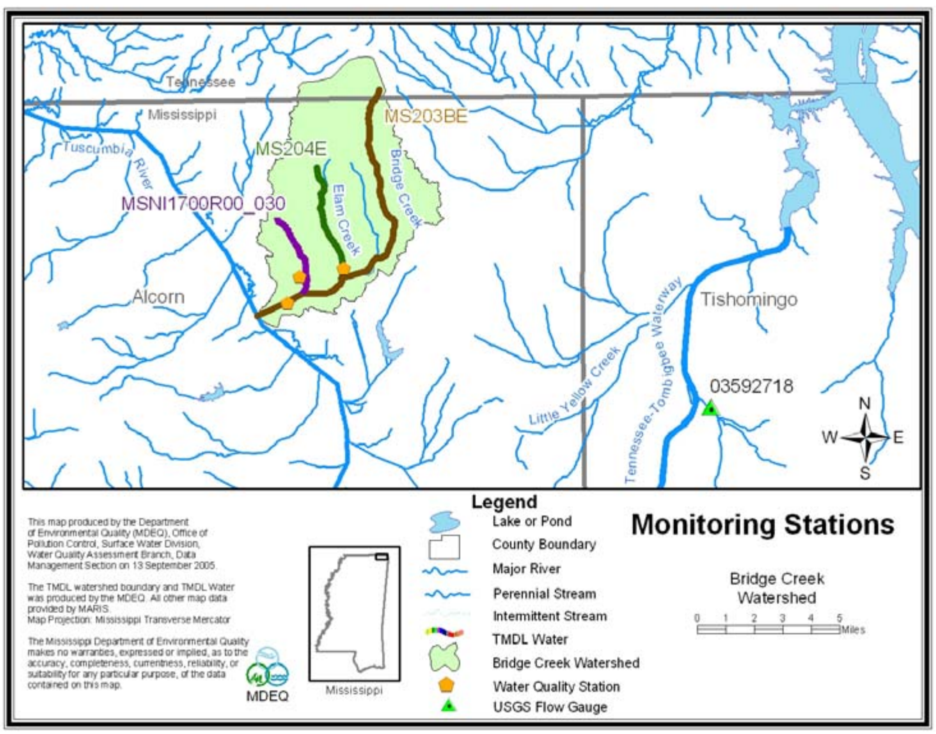
Figure 2. Bridge, Elam, and UNT Watershed Segments



Segments MS203BE and MS204E were originally listed in 1992 based on anecdotal information, but are listed as monitored on the Mississippi 2004 Section 303(d) List of Impaired Water Bodies for biological impairment and pathogens. However, due to a sampling site discrepancy only one set of data were collected for segment MS204E, Elam Creek. The other samples, believed to be from Elam Creek were collected on the UNT to Bridge Creek. The three data sets collected at this location all indicated impairment due to pathogens. The data which were recently collected for Segment MS203BE confirmed impairment for the segment. All available data are listed in Section 2.2.

This TMDL was developed using a mass balance method. This method is an applicable method for TMDL development when water quality data are collected in a manner consistent with water quality standards, that is at least 5 samples collected within a 30 day period. The mass balance method requires water quality data and flow data. The mass balance method can also be applied in situations such as Elam Creek in which insufficient water quality data are available. However, no percent reductions can be specified due to the lack of available data. The water body segments along with the location of the water quality stations and flow gage are shown in Figure 3. The TMDL for segments MS203BE and MSNI1700R00_030 were developed using the mass balance method with water quality data from the fecal coliform sampling stations. The flow for all three water body segments was determined based on the flow measured at USGS gage 03592718 on Little Yellow Creek near Burnsville, MS.

Figure 3. Water Body Segments with Water Quality Stations and Flow Gage



All three water body segments are in Hydrologic Unit Code (HUC) 08010207 in northeast Mississippi. The watershed is approximately 23,688 acres. The impaired segments flow through the urban area of Corinth, which encompasses the majority of the land area within the entire watershed.

1.2 Applicable Water Body Segments Use

The water use classification for the three water body segments, as established by the State of Mississippi in the 2002 *Water Quality Criteria for Intrastate, Interstate and Coastal Waters*, is Fish and Wildlife Support. The designated beneficial uses for the water body segments are Secondary Contact and Aquatic Life Support. Secondary Contact is defined as incidental contact with the water during activities such as wading, fishing, and boating, that are not likely to result in full body immersion.

1.3 Applicable Water Body Segments Standard

The water quality standard applicable to the water body based on the identified use and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (2002). The standard for fecal coliform is different for summer and winter for a secondary contact use, where summer is defined as the months of May through October and winter is defined as the months of November through April. For the summer months the fecal coliform colony counts shall not exceed a geometric mean of 200 per 100 ml, based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 400 per 100 ml more than 10% of the time. For the winter months, the fecal coliform colony counts shall not exceed a geometric mean of 2000 colonies per 100 ml, based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 4000 per 100 ml more than 10% of the time.

TMDL ENDPOINT AND WATER QUALITY ASSESSMENT

2.1 Selection of a TMDL Endpoint and Critical Condition

One of the major components of a TMDL is the establishment of instream numeric endpoints, which are used to evaluate the attainment of acceptable water quality. Instream numeric endpoints, therefore, represent the water quality goals that are to be achieved by implementing the load and waste load reductions specified in the TMDL. The endpoints allow for a comparison between observed instream conditions and conditions that are expected to restore designated uses. The fecal coliform standard allows for a statistical review of any fecal coliform data set. There are two tests, the geometric mean test and the 10% test, that the data set must pass to show acceptable water quality.

The geometric mean test states that for the summer the fecal coliform colony count shall not exceed a geometric mean of 200 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples and for the winter the fecal coliform colony count shall not exceed a geometric mean of 2000 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples. The 10% test states that for the summer the samples examined during a 30-day period shall not exceed a count of 400 per 100 ml more than 10% of the time and for the winter the samples examined during a 30-day period shall not exceed a count of 4000 per 100 ml more than 10% of the time.

2.1.1 Discussion of the Geometric Mean Test

The level of fecal coliform found in a natural water body varies greatly depending on several independent factors such as temperature, flow, or distance from the source. This variability is accentuated by the standard laboratory analysis method used to measure fecal coliform levels in the water. The membrane filtration (MF) method uses a direct count of bacteria colonies on a nutrient medium to estimate the fecal level. The fecal coliform colony count per 100 ml is determined using an equation that incorporates the dilution and volume to the sample filtered.

The geometric mean test is used to dampen the impact of the large numbers when there are smaller numbers in the data set. The geometric mean is calculated by multiplying all of the data values together and taking the root of that number based on the number of samples in the data set.

$$G = \sqrt[n]{s1 * s2 * s3 * s4 * s5 * sn}$$

The water quality standard requires a minimum of 5 samples be used to determine the geometric mean. MDEQ routinely gathers 6 samples within a 30-day period in case there is a problem with one of the samples. It is conceivable that there would be more samples available in an intensive survey, but typically each data set will contain 6 samples therefore, n would equal 6. For the data set to indicate no impairment, the result must be less than or equal to 200 in the summer and 2000 in the winter.

2.1.2 Discussion of the 10% Test

The 10% test looks at the data set as representing the 30 days for 100% of the time. The data points are sorted from the lowest to the highest and each value then represents a point on the curve from 0% to 100% or from day 1 to day 30. The lowest value becomes the 1st data point and the highest data point becomes the nth data point. The water quality standard requires that 90% of the time, the counts of fecal coliform in the stream be less than or equal to 400 counts per 100 ml in the summer and 4000 counts per 100 ml in the winter.

By calculating a concentration of fecal coliform for every percentile point based on the data set, it is possible to determine a curve that represents the percentile ranking of the data set. Once the 90th percentile of the data set has been determined, it may be compared to the standard of 400 counts per 100 ml. If the 90th percentile of the data is greater than 400, then the stream will be considered impaired. This can be used not only to assess actual water quality data, but also computer generated daily average model results. Actual water quality data will typically have 5 or 6 values in the data set, and computer generated model results would have 30 daily values.

2.1.3 Discussion of Combining the Tests

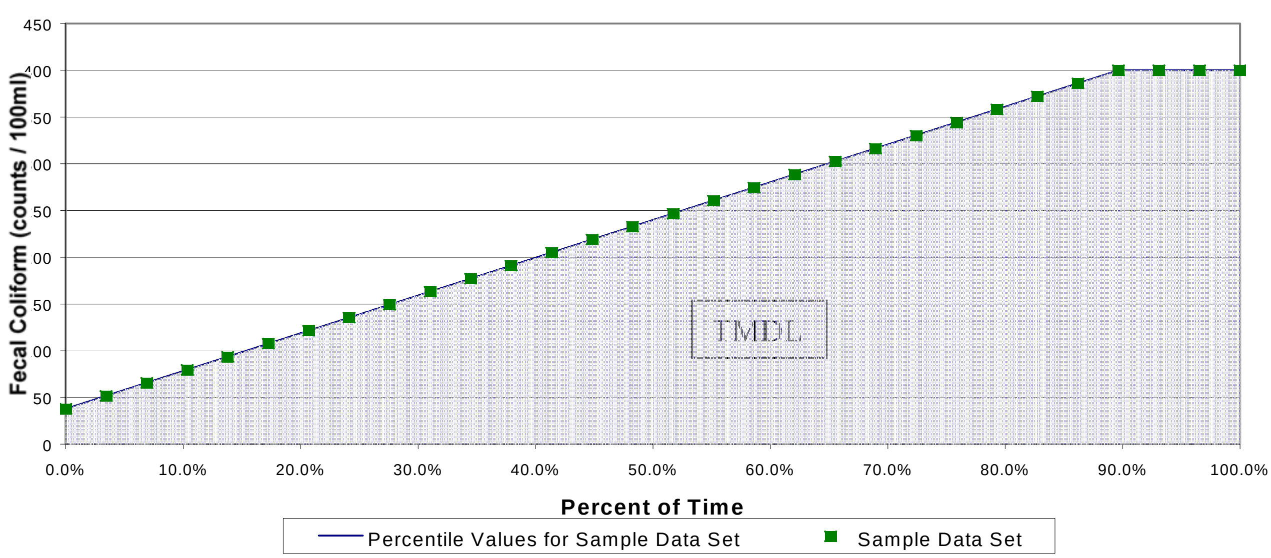
MDEQ determined a theoretical maximum allowable load data set that meets both portions of the water quality standard and is indicative of possible water quality conditions. This theoretical maximum allowable load data set is shown in Table 2. The theoretical maximum allowable load data set was constructed to represent the maximum amount of fecal coliform per day that will still meet both portions of the water quality standard. The theoretical maximum allowable load data set was then plotted, generating a theoretical maximum allowable load data set curve. This curve can be seen in Figure 4. The integral of the theoretical maximum allowable load data set curve is used for mass balance TMDL calculations. By multiplying the integral of the theoretical maximum allowable load data set curve by the flow in a given water body, the mass balance TMDL is calculated.

When actual data are collected from a water body, and the data are plotted in a similar way, an existing load can be calculated based on the integral of the existing load curve and the flow in the water body. This existing load can be compared to the TMDL calculated using the theoretical maximum allowable load data set curve to determine the percent reduction of fecal coliform necessary for the water body to meet both portions of the water quality standard, the geometric mean test and the 10% test.

Table 2. Theoretical Maximum Allowable Load Data Set

Fecal Coliform (counts/100ml)	Percentile Ranking
37.82	0.0%
51.75	3.4%
65.68	6.9%
79.61	10.3%
93.54	13.8%
107.47	17.2%
121.4	20.7%
135.33	24.1%
149.26	27.6%
163.19	31.0%
177.12	34.5%
191.05	37.9%
204.98	41.4%
218.91	44.8%
232.84	48.3%
246.77	51.7%
260.7	55.2%
274.63	58.6%
288.56	62.1%
302.49	65.5%
316.42	69.0%
330.35	72.4%
344.28	75.9%
358.21	79.3%
372.14	82.8%
386.07	86.2%
400	89.7%
400	93.1%
400	96.6%
400	100.0%

Figure 4. Theoretical Maximum Allowable Load Data Set Curve



2.1.4 Discussion of the Targeted Endpoint

While the endpoint of a TMDL calculation is similar to a standard for a pollutant, the endpoint is not the standard. For a mass balance TMDL, the endpoint selected is both portions of the standard, that is the geometric mean test and the 10% test. Meeting the geometric mean test and applying the 10% test to the data sets applies both parts of the standard to an actual data set or when considering a computer generated data set. It is therefore appropriate to select both portions of the standard as the targeted endpoint for the mass balance TMDL.

2.1.5 Discussion of the Critical Condition for Fecal Coliform

Critical conditions for waters impaired by nonpoint sources generally occur during periods of wet-weather and high surface runoff. But, critical conditions for point source dominated systems generally occur during periods of low-flow, low-dilution conditions. Therefore, a careful examination of the data is needed to determine the critical 30-day period to be used for the TMDL. Based on the available data a determination of the critical period was not viable for segments MS203BE and MSNI1700R00_030. Violations to water quality standards in both water bodies occurred in both the winter and summer seasons. Because of the limited amount of available data for segment MS204E, Elam Creek, the critical period was unable to be determined.

2.2 Discussion of Instream Water Quality

Monitoring was performed in a manner consistent with the water quality standards. At least 5 samples were collected in each 30-day period, at stations 8 in segment MS203BE during two summer seasons and two winter seasons in 2001, 2002, and 2003. Only one set of data was collected at Station 9 for segment MS204E during the summer season of 2003. For segment MSNI1700R00_030, there were at least five samples collected in each 30-day period for the winters of 2001 and 2003 and the summer of 2002.

2.2.1 Inventory of Available Water Quality Monitoring Data

The data collected at station 8 on Bridge Creek is provided in Tables 3 through 6 and the data collected at station 9 on Elam Creek is provided in Tables 7. The data which was inadvertently collected on the UNT to Bridge Creek is shown in Tables 8 through 10.

Bridge Creek

Table 3. Fecal Coliform Data reported in Bridge Creek, Station 8

Winter 2001

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
12/4/01 9:55	6000	3147.4	Yes, geometric mean is greater than 2000	6000.0	Yes, 90th percentile is greater than 4000
12/6/01 9:10	780				
12/11/01 9:25	2200				
12/21/01 9:25	5000				
12/26/01 8:55	6000				

Table 4. Fecal Coliform Data reported in Bridge Creek, Station 8
Summer 2002

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
5/8/02 10:00	6000	4890.8	Yes, geometric mean is greater than 200	6000.0	Yes, 90th percentile is greater than 400
5/14/02 9:45	3200				
5/17/02 9:45	3300				
5/21/02 9:25	6000				
5/23/02 9:55	6000				
6/4/02 9:25	6000				

Table 5. Fecal Coliform Data reported in Bridge Creek, Station 8
Winter 2003

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
3/13/03 8:30	1300	2065.6	Yes, geometric mean is greater than 2000	6000.0	Yes, 90th percentile is greater than 4000
3/21/03 9:15	4100				
3/25/03 8:55	440				
4/1/03 8:55	920				
4/3/03 8:50	6000				
4/10/03 9:05	6000				

Table 6. Fecal Coliform Data reported in Bridge Creek, Station 8
Summer 2003

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
9/8/03 10:45	560	695.6	Yes, geometric mean is greater than 200	3530.0	Yes, 90th percentile is greater than 400
9/10/03 12:00	640				
9/12/03 10:00	540				
9/16/03 11:45	1060				
9/18/03 10:00	92				
9/24/03 11:45	6000				

Elam Creek

Table 7. Fecal Coliform Data reported in Elam Creek, Station 9
Summer 2003

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
9/8/03 11:00	3000	245.9	Yes, geometric mean is greater than 200	1930.0	Yes, 90th percentile is greater than 400
9/10/03 11:30	170				
9/12/03 10:30	860				
9/16/03 11:30	42				
9/18/03 10:30	120				
9/24/03 11:15	100				

UNT to Bridge Creek

Table 8. Fecal Coliform Data reported in UNT to Bridge Creek
Winter 2001

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
12/4/01 10:15	6000	4446.8	Yes, geometric mean is greater than 2000	6000.0	Yes, 90th percentile is greater than 4000
12/6/01 9:25	3500				
12/11/01 9:35	2300				
12/21/01 9:30	6000				
12/26/01 9:10	6000				

Table 9. Fecal Coliform Data reported in UNT to Bridge Creek
Summer 2002

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
5/8/02 10:10	1000	1563.4	Yes, geometric mean is greater than 200	6000.0	Yes, 90th percentile is greater than 400
5/14/02 9:55	920				
5/17/02 9:55	6000				
5/21/02 9:35	1160				
5/23/02 10:05	380				
6/4/02 9:30	6000				

Table 10. Fecal Coliform Data reported in UNT to Bridge Creek
Winter 2003

Date and Time	Fecal Coliform (counts/100ml)	Geometric Mean	Geometric Mean Test Violation	90th Percentile	10% Test Violation
3/13/03 8:39	280	449.5	No, geometric mean is less than 2000	3170.0	No, 90th percentile is less than 4000
3/21/03 9:25	340				
3/25/03 9:00	175				
4/1/03 9:00	6000				
4/3/03 9:00	300				
4/10/03 9:15	275				

2.2.2 Analysis of Instream Water Quality Monitoring Data

For segment MS203BE, Bridge Creek, the data collected at station 8 during the summer and winter monitoring periods of 2001, 2002, and 2003 indicate a violation of the geometric mean portion of the standard and the percent of time in exceedence. For segment MS204E, Elam Creek, the data collected at station 9 during the summer of 2003 indicated a violation of the geometric mean portion of the standard and the percent of time in exceedence. For segment MSNI1700R00_030, the UNT to Bridge Creek the data collected during the winter of 2001 and the summer of 2002 indicated a violation of the geometric mean portion of the standard and the percent of time in exceedence.

A graphical representation of the data for the three water body segments can be seen below in Figures 5 through 11. For the summer periods a line has been added to the graphs representing 400 counts/100 ml and showing that this occurs less than 90% of the time, meaning that the counts of fecal coliform in the stream are greater than 400 more than 10% of the time. For the winter periods a line has been added to the graphs representing 4000 counts/100 ml and showing that this occurs less than 90% of the time, meaning that the counts of fecal coliform in the stream are greater than 4000 more than 10% of the time. The critical period for this TMDL was not able to be determined, due to the fact that violations of both portions of the standard occurred in both the summer and winter seasons in segments MS203BE and MSNI1700R00_030. Although the one set of data collected in segment MS204E shows violations of both portions of the water quality standard, there is not enough data available to fully access the conditions of this water body or to determine a critical period.

Bridge Creek

Figure 5. 10% Test Curve for Station 8, Winter 2001

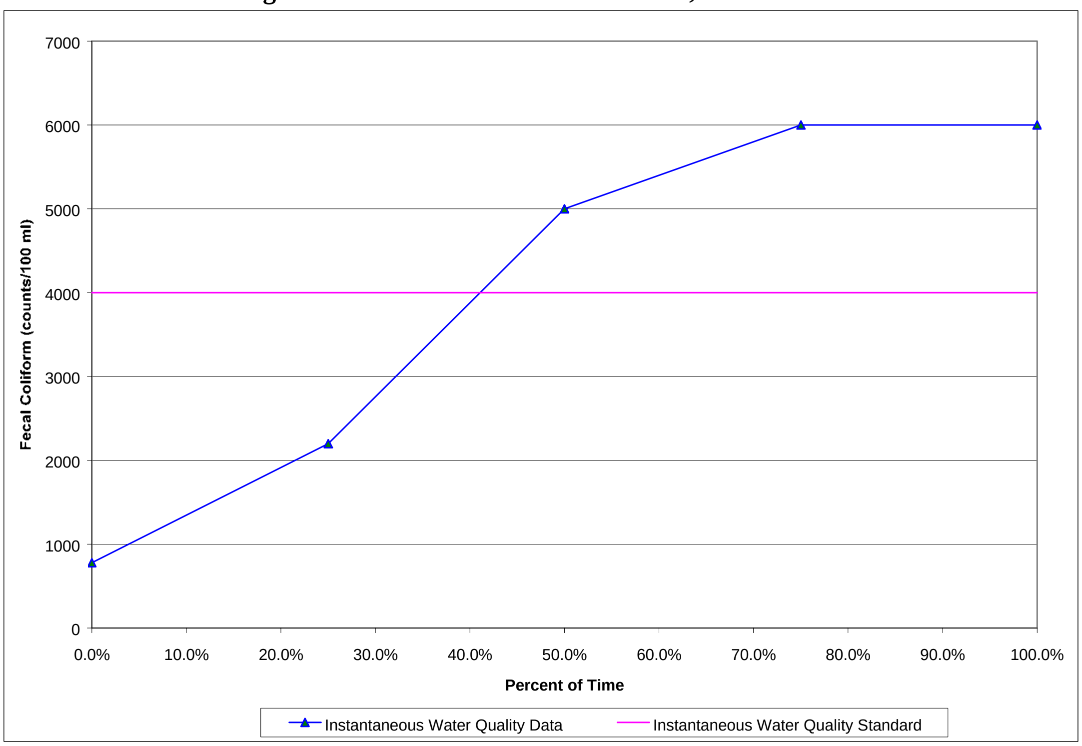


Figure 6. 10% Test Curve for Station 8, Summer 2002

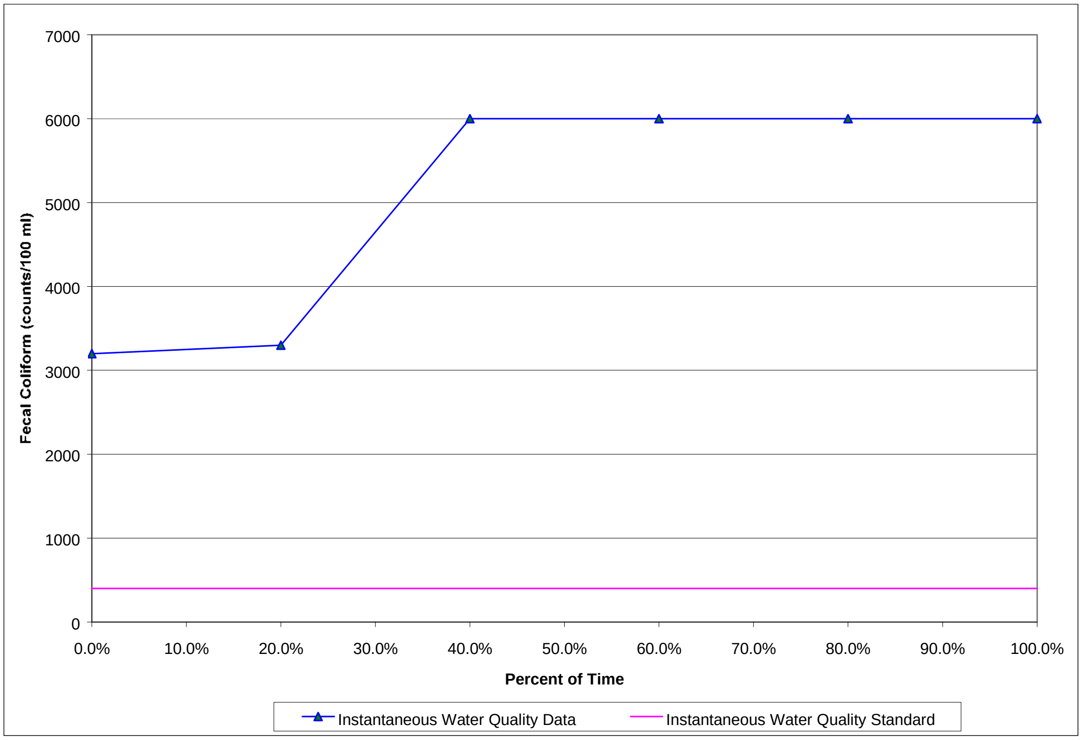


Figure 7. 10% Test Curve for Station 8, Winter 2003

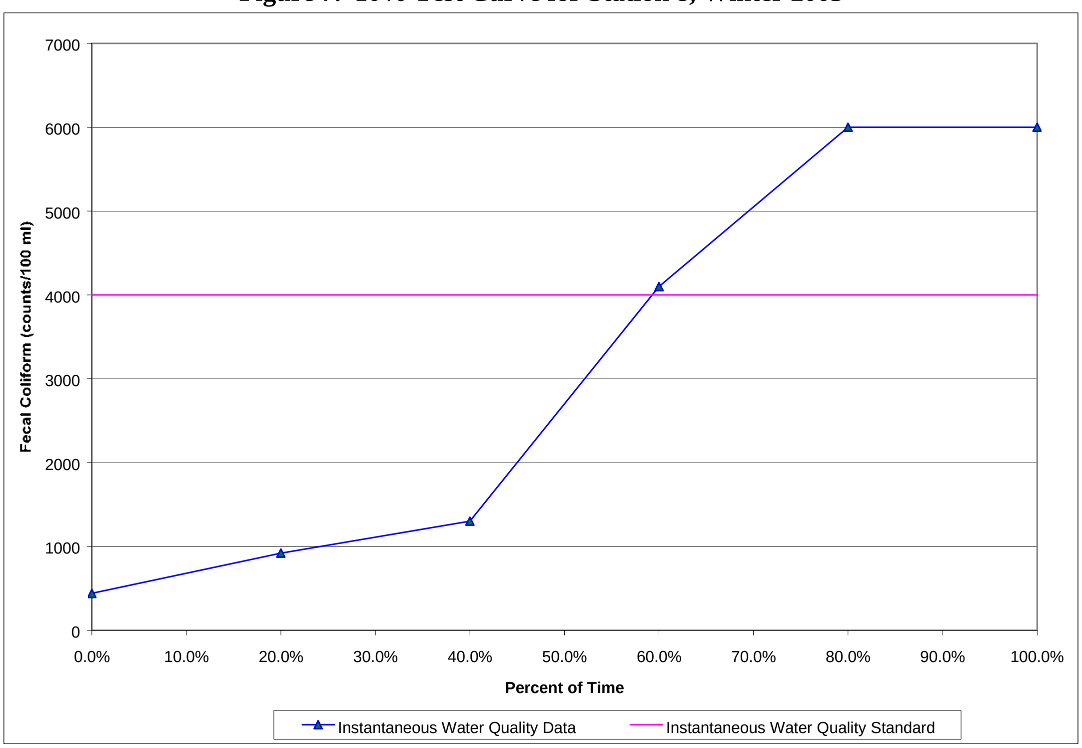
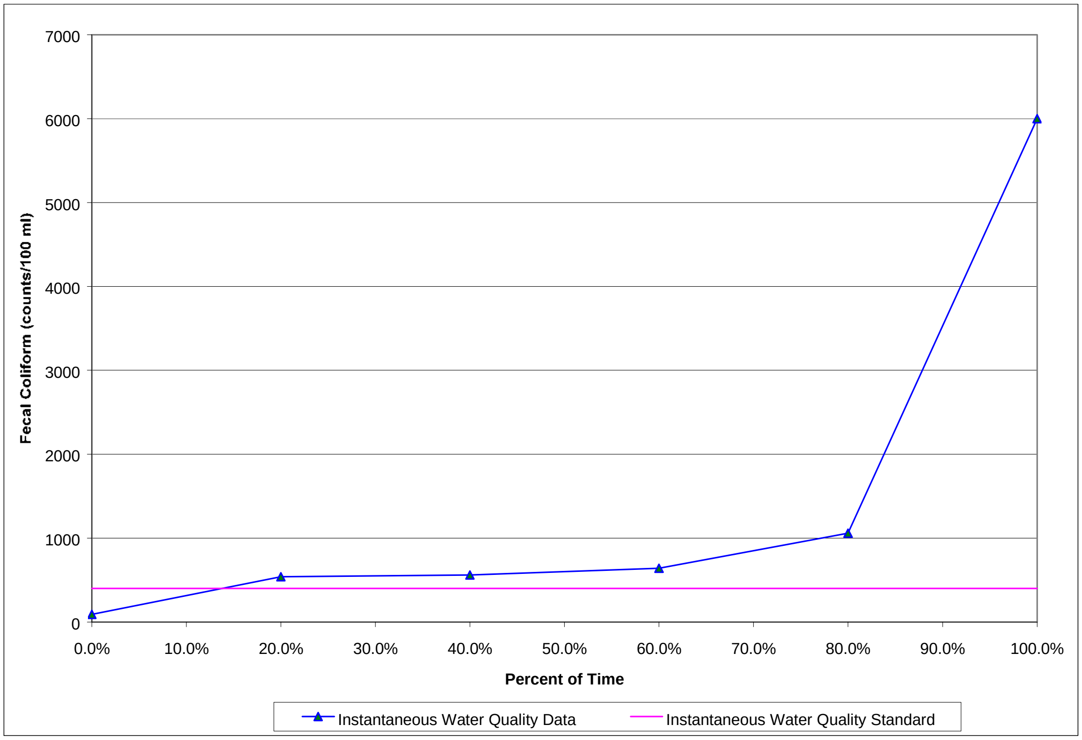
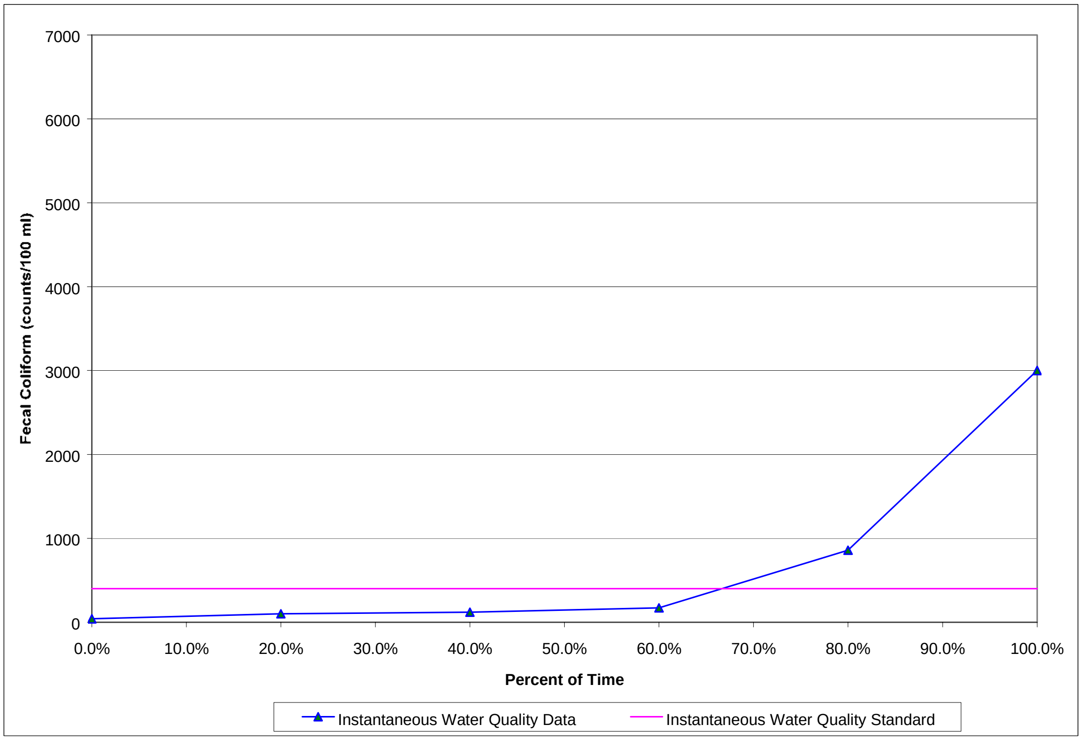


Figure 8. 10% Test Curve for Station 8, Summer 2003



Elam Creek

Figure 9. 10% Test Curve for Station 9, Summer 2003



UNT to Bridge Creek

Figure 10. 10% Test Curve for UNT, Winter 2001

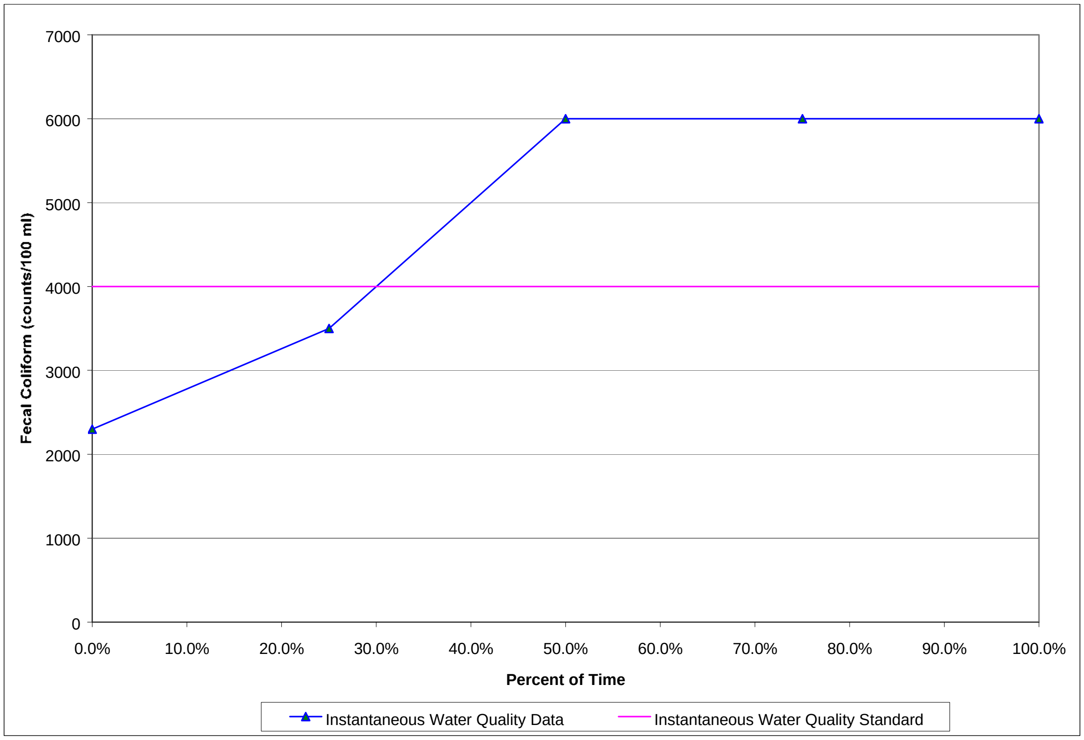
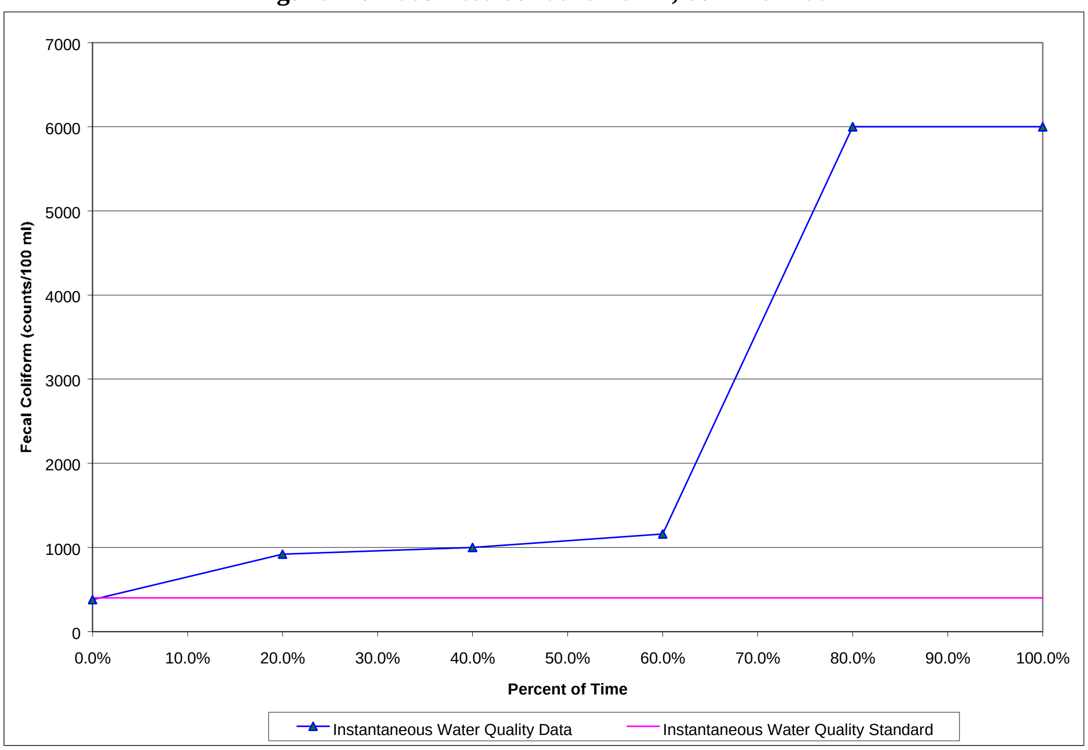


Figure 11. 10% Test Curve for UNT, Summer 2002



SOURCE ASSESSMENT

The TMDL evaluation summarized in this report examined all known potential fecal coliform sources in the watershed. In evaluation of the sources, loads were characterized by the best available information, monitoring data, literature values, and local management activities. This section documents the available information and interpretation for the analysis.

3.1 Assessment of Point Sources

Point sources of fecal coliform bacteria have their greatest potential impact on water quality during periods of low flow. Thus, a careful evaluation of point sources that discharge fecal coliform bacteria was necessary in order to quantify the degree of impairment present during the low flow, critical condition period.

The effluent from the only point source, Corinth POTW was characterized based on all available monitoring data including permit limits, discharge monitoring reports, and information on treatment type. The receiving water body and the flow for Corinth POTW are shown in Table 11.

Table 11. Inventory of Point Source Dischargers

NPDES ID	Facility Name	Receiving Water	Design Flow (MGD)
MS0021652	Corinth POTW	Elam Creek	4.7

3.2 Assessment of Nonpoint Sources

There are many potential nonpoint sources of fecal coliform bacteria in the watershed, including:

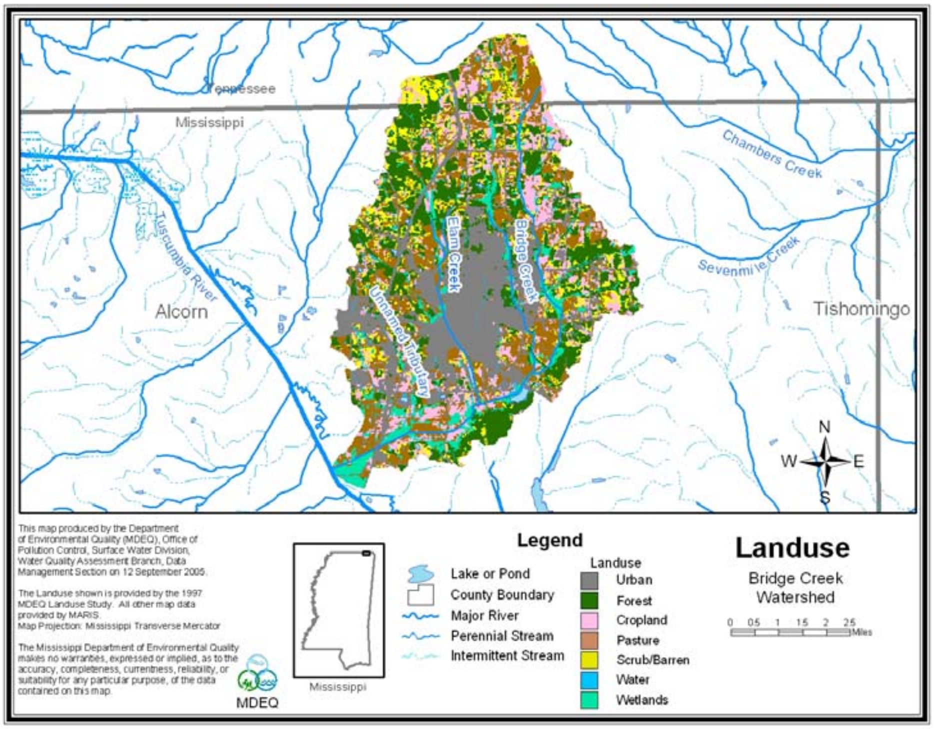
- Failing septic systems
- Wildlife
- Grazing animals
- Urban development
- Sewer Bypasses
- Other Direct Inputs

The 23,688 acre drainage area, of Bridge Creek, Elam Creek, and the UNT to Bridge Creek contains many different landuse types, including urban, forest, cropland, pasture, scrub/barren, water, and wetlands. The area directly surrounding the three impaired segments is predominantly urban. The landuse distribution for the watershed is provided in Table 12 and displayed in Figure 12. The landuse information for the watershed is based on the Multi-Resolution Land Characterization (MRLC), 2001. Data used for MRLC comes from the 2001 National Land Cover Data set (NLCD). The landuse categories were grouped into the land uses of urban, forest, cropland, pasture, scrub/barren, water, and wetlands.

Table 12. Landuse Distribution

	Urban	Forest	Cropland	Pasture	Scrub/Barren	Wetland	Water	Total
Area (acres)	6,323	5,340	3,169	4,753	2,236	1,665	202	23,688
% Area	27%	23%	13%	20%	9%	7%	1%	100%

Figure 12. Landuse Distribution Map



To refine the information concerning nonpoint sources of fecal coliform bacteria, MDEQ contacted the Natural Resources Conservation Service. The NRCS gave MDEQ information on area practices which may impact the nonpoint source loading of fecal coliform. The 2002 Census of Agriculture produced by the National Agriculture Statistics Service was used to estimate agricultural animal populations in the watershed.

3.2.1 Failing Septic Systems

Septic systems have a potential to deliver fecal coliform bacteria loads to surface waters due to malfunctions, failures, and direct pipe discharges. Properly operating septic systems treat wastewater and dispose of the water through a series of underground field lines. The water is applied through these lines into a rock substrate, thence into underground absorption. The systems can fail when the field lines are broken, or when the underground substrate is clogged or flooded. A failing septic system's discharge can reach the surface, where it becomes available for wash-off into the stream. Another potential problem is a direct bypass from the system to a stream. In an effort to keep the water off the land, pipes are occasionally placed from the septic tank or the field lines directly to the creek.

Another consideration is the use of individual onsite wastewater treatment plants. These treatment systems are in wide use in Mississippi. They can adequately treat wastewater when properly maintained. However, these systems may not receive the maintenance needed for proper, long-term operation. These systems require some sort of disinfection to properly operate. When this expense is ignored, the water does not receive adequate disinfection prior to release. The watershed contains several facilities that operate onsite wastewater treatment plants. These facilities are permitted with no discharge to surrounding areas, but they may be a significant nonpoint source of fecal coliform during rainfall events.

All septic systems may have an impact on nonpoint source fecal coliform impairment in the North Independent Streams Basin. The best management practices needed to reduce this pollutant load need to prioritize eliminating septic tank failures and improving maintenance and proper use of individual onsite treatment systems.

Some counties in Mississippi manage the problem of onsite treatment systems through the use of a wastewater ordinance. A wastewater ordinance requires that the wastewater treatment and disposal system used be certified as sufficient. It also ensures that electricity, water, or natural gas will not be made available without written approval from the county Health Department or the Mississippi Department of Environmental Quality that the wastewater treatment and disposal system used is sufficient. Currently, Alcorn County does not have a wastewater ordinance. The lack of a wastewater ordinance could allow some of the rural areas not connected to the City of Corinth's sewer system to have only modest wastewater treatment, if any treatment, before discharge.

3.2.2 Wildlife

Wildlife present in the watershed contributes to fecal coliform bacteria on the land surface which is then available for wash-off and delivery to receiving water bodies. Some form of wildlife may be present on all landuses within the watershed. Also, wildlife is present throughout the year.

3.2.3 Beef and Dairy Cattle

Grazing cattle deposit manure on pastureland where it is available for wash-off and delivery to receiving water bodies. Beef cattle have access to pastureland for grazing all of the time. For dairy cattle, the dry cattle and heifers have access to pastureland for grazing all of the time. Manure produced by grazing beef and dairy cows is directly deposited onto pastureland and is available for wash off.

Small dairy farms confine the lactating cattle for a limited time during the day for milking and feeding. The manure collected during confinement is applied to the available pastureland in the watershed. Application rates of dairy cow manure to pastureland vary monthly according to management practices currently used in this area.

Alcorn County has a small number of cattle farms, in which most of the farms have less than 200 head of cattle. In 2002, there were only three farms with greater than 200 head of cattle. These cattle are primarily beef cattle, heifers, steers, and bulls. There are very few dairy cattle within the watershed and they are also all on small farms.

3.2.4 Urban Development

Urban areas include land classified as urban and barren. The urban area of Corinth is located adjacent to the impaired segments. Fecal coliform contributions from the city of Corinth may come from storm water runoff, failing sewer collection lines, sewer bypasses, and runoff contributions from improper disposal of materials such as pet waste and litter.

3.2.5 Sewer Bypasses

In the past several years, there have been multiple bypasses of the city of Corinth's sewer collection system in the areas of Elam Creek and the UNT to Bridge Creek due to corrosion of the sewer lines caused by circumstances beyond the city's control. The correction of this problem and the repairs to the sewer system are underway. The city has filed a complaint in U.S. District Court against the entity suspected of causing the problems. These bypasses may represent a significant nonpoint source of fecal coliform.

3.2.6 Other Direct Inputs

Other direct inputs of fecal coliform bacteria to water bodies in the watershed include illicit discharges, human recreation, and access of both domestic and wild animals to the stream.

MASS BALANCE PROCEDURE

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. 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.

4.1 Modeling Framework Selection

A mass balance approach was used to calculate the TMDL for segments MS203BE, MS204E, and MSNI1700R00_030. This method of analysis was selected because data limitations precluded the use of more complex methods. Therefore, the mass balance approach is suitable for this TMDL.

4.2 Calculation of Allowable Load

The mass balance approach utilizes the conservation of mass principle. Loads can be calculated by multiplying the fecal coliform concentration in the water body for a 30-day period by the flow. The principle of the conservation of mass allows for the addition and subtraction of those loads to determine the appropriate numbers necessary for the TMDL. The loads can be calculated using the following relationship:

Load (counts/30days) = [**Concentration for 30 days** (30 days*counts/ 100 ml)] * [**Flow** (cfs)] * (Conversion Factor)

where (Conversion Factor) = [(28316.8 ml/1 ft^3)*(1 (100 ml)/100 (1 ml))*(60 s/1 min)* (60 min/1 hour)*(24 hour/1 day)*(30 days/1 (30 days)/30 days]
= 2.45 E+07 ((100 ml * s)/(ft^3 *30 days*30days))

For the calculation of the TMDL, the concentration for 30 days used was the integral of the theoretical maximum allowable load curve. This value is 7129.4 (30days*counts/100 ml). USGS flow gage 03592718 was used to estimate the flow for all three segments. The average summer discharge at the flow gage was calculated by averaging the USGS monthly mean stream flows for the summer period (May through October) for the period of record of the gage. The average winter discharge at the flow gage was calculated accordingly. The average summer flow for the three water body segments was then estimated based on the average summer discharge at this station (03592718) which is on Little Yellow Creek near Burnsville, MS. To estimate the flow for each water body segment MDEQ utilized a drainage area ratio. The average summer discharge for Bridge Creek was determined to be 30.5 cfs, the average summer discharge for Elam Creek was determined to be 10.0 cfs, and the average summer discharge for the UNT to Bridge Creek was determined to be 1.9 cfs. This method was also used to calculate the average winter discharge for the three water body segments. For Bridge Creek the average winter discharge was determined to be 89.2 cfs, for Elam Creek the average winter discharge was determined to be 29.2 cfs, and for the UNT to Bridge Creek the average winter discharge was determined to be 5.5 cfs.

Avg Seasonal Discharge (cfs)={[**03592718 Avg Seasonal Discharge** (cfs)]/[**03592718 Drainage Area** (acres)]}*[**Water Body Drainage Area** (acres)]

MS203BE Avg Summer Discharge (cfs)= {[22 (cfs)]/[15808 (acres)]}*[21852 (acres)]
= 30.5 cfs

MS204E Avg Summer Discharge (cfs) = {[22 (cfs)]/[15808 (acres)]}*[7168 (acres)]
= 10.0 cfs

MSNI1700R00_030 Avg Summer Discharge (cfs) = {[22 (cfs)]/[15808 (acres)]}*[1357 (acres)]
= 1.9 cfs

4.3 Calculation of Existing Load

For the calculation of the existing load, the daily stream flow was multiplied by the fecal coliform concentration for the dates the water quality samples were taken to get a daily load. An existing daily load curve was then developed for the daily loads. The integral of this daily load curve over 30 days was then multiplied by the conversion factor to get the existing load in counts/30 days. The existing loads for Bridge Creek are shown in tables 13 through 16 and the existing loads for the UNT to Bridge Creek are shown in tables 18 through 20. The existing load for the one data set available for Elam Creek is shown in table 17. The most critical conditions for Bridge Creek occurred during the winter of 2001 and the summer of 2002. For UNT to Bridge Creek, the most critical periods were also the winter of 2001 and the summer of 2002. The existing loads for the most critical periods were used to calculate the necessary percent reductions that are shown in Table 24. Due to the lack of available data the critical period or a percent reduction could not be determined for Elam Creek.

Bridge Creek

Table 13. Existing Load in Bridge Creek, Station 8

Winter 2001

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
12/4/01 9:55	6000	44.2	6.50E+12	1.57E+14
12/6/01 9:10	780	37.3	7.13E+11	
12/11/01 9:25	2200	59.4	3.20E+12	
12/21/01 9:25	5000	55.2	6.76E+12	
12/26/01 8:55	6000	55.2	8.11E+12	

Table 14. Existing Load in Bridge Creek, Station 8
Summer 2002

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
5/8/02 10:00	6000	35.9	5.28E+12	1.04E+14
5/14/02 9:45	3200	48.3	3.79E+12	
5/17/02 9:45	3300	49.7	4.02E+12	
5/21/02 9:25	6000	23.5	3.45E+12	
5/23/02 9:55	6000	19.3	2.84E+12	
6/4/02 9:25	6000	9.2	1.35E+12	

Table 15. Existing Load in Bridge Creek, Station 8
Winter 2003

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
3/13/03 8:30	1300	59.4	1.89E+12	1.42E+14
3/21/03 9:15	4100	82.8	8.32E+12	
3/25/03 8:55	440	46.9	5.06E+11	
4/1/03 8:55	920	51.1	1.15E+12	
4/3/03 8:50	6000	44.2	6.50E+12	
4/10/03 9:05	6000	75.9	1.12E+13	

Table 16. Existing Load in Bridge Creek, Station 8
Summer 2003

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
9/8/03 10:45	560	8.4	1.15E+11	1.50E+13
9/10/03 12:00	640	7.3	1.14E+11	
9/12/03 10:00	540	6.4	8.47E+10	
9/16/03 11:45	1060	5.5	1.43E+11	
9/18/03 10:00	92	3.9	8.79E+09	
9/24/03 11:45	6000	27.6	4.06E+12	

Elam Creek

Table 17. Existing Load in Elam Creek, Station 9
Summer 2003

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
9/8/03 11:00	3000	2.8	2.06E+11	1.12E+12
9/10/03 11:30	170	2.4	1.04E+10	
9/12/03 10:30	860	2.1	4.42E+10	
9/16/03 11:30	42	1.8	1.96E+09	
9/18/03 10:30	120	1.3	3.82E+09	
9/24/03 11:15	100	9.0	2.28E+10	

UNT to Bridge Creek

Table 18. Existing Load in the UNT to Bridge Creek
Winter 2001

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
12/4/2001	6000	2.7	1.65E+04	1.10E+13
12/6/2001	3500	2.3	8.11E+03	
12/11/2001	2300	3.7	8.49E+03	
12/21/2001	6000	3.4	2.06E+04	
12/26/2001	6000	3.4	2.06E+04	

Table 19. Existing Load in the UNT to Bridge Creek
Summer 2002

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
5/8/02 10:10	1000	2.2	2.23E+03	2.89E+12
5/14/02 9:55	920	3.0	2.76E+03	
5/17/02 9:55	6000	3.1	1.85E+04	
5/21/02 9:35	1160	1.5	1.69E+03	
5/23/02 10:05	380	1.2	4.57E+02	
6/4/02 9:30	6000	0.6	3.45E+03	

Table 20. Existing Load in the UNT to Bridge Creek
Winter 2003

Date and Time	Fecal Coliform (counts/100ml)	Flow (cfs)	Existing Load (counts/day)	Existing Load (counts/30days)
3/13/03 8:39	280	3.7	1.03E+03	2.16E+12
3/21/03 9:25	340	5.2	1.75E+03	
3/25/03 9:00	175	2.9	5.11E+02	
4/1/03 9:00	6000	3.2	1.91E+04	
4/3/03 9:00	300	2.7	8.24E+02	
4/10/03 9:15	275	4.7	1.30E+03	

ALLOCATION

The allocation for this TMDL includes a wasteload allocation (WLA) for point sources, a load allocation (LA) for nonpoint sources, and a margin of safety (MOS).

5.1 Wasteload Allocations

The wasteload allocation is based on the existing point sources in the watershed. The point source in segment MS204E, Elam Creek, and its allocated load is shown in Table 21. Table 21 also shows the permit limits of Corinth POTW (MS0021652). The first value is the average fecal coliform concentration that the facility may discharge and the second is the maximum fecal coliform concentration that the facility may discharge. While the allocated loads included in the TMDL calculation are based upon the permit limit of the average allowable concentration, the maximum portion of the permit is still allowable and does not indicate any permit modification is necessary. The Corinth POTW is recommended for permit modification to include stricter winter fecal coliform limits of 200/400, which will give them the same limit year round. The current winter limits of 2000/4000 exceed the assimilative capacity of Elam Creek. This TMDL was developed using the new limits.

Table 21. Wasteload Allocations for Segment MS204E

NPDES ID	Summer Permit Limit Average/Maximum (counts/100ml)	Recommended Winter Permit Limit Average/Maximum (counts/100ml)	Average Summer Allocated Load (counts/30days)	Average Winter Allocated Load (counts/30days)	Permit Modification Necessary
MS0021652	200/400	200/400	1.07E+12	1.07E+12	Yes

5.2 Load Allocations

The load allocation for the three water body segments is calculated using the water quality criteria and the estimated critical flow. The load allocation is assumed to represent nonpoint sources as described in section 3.2. In calculating the LA component, the total TMDL for the water body is reduced by a 10% MOS. For this TMDL, the summer load is based on a fecal coliform concentration for 30 days determined by the integral of the theoretical maximum allowable load curve and the average summer flow. The resulting winter LA was estimated using the average winter flow and the integral of the theoretical maximum allowable load curve. The resulting load allocations are shown below in Table 22.

Table 22. Load Allocations

Name	ID	Summer LA (counts per 30 days)	Winter LA (counts per 30 days)
Bridge Creek	MS203BE	4.79E+12	1.40E+13
Elam Creek	MS204E	5.02E+11	3.52E+12
UNT to Bridge Creek	MSNI1700R00_030	2.99E+11	8.65E+11

Load Allocation = **0.9***$\mathbf{7129.4}$(30 days*counts/100ml)* **Flow**(cfs) * **2.45E+07**[(100ml*s)/(ft^3 *30 days*30 days)] **- WLA**

5.3 Incorporation of a Margin of Safety (MOS)

The two types of MOS development are to implicitly incorporate the MOS using conservative assumptions or to explicitly specify a portion of the total TMDL as the MOS. An explicit 10% margin of safety was used for this TMDL. The margin of safety is calculated below for the three water body segments using the average seasonal flows and theoretical maximum allowable load data set curve. The results of the calculations are shown in Table 23.

Table 23. Margin of Safety

Name	ID	Summer MOS (counts per 30 days)	Winter MOS (counts per 30 days)
Bridge Creek	MS203BE	5.33E+11	1.56E+12
Elam Creek	MS204E	1.75E+11	5.10E+11
UNT to Bridge Creek	MSNI1700R00_030	3.32E+10	9.61E+10

MOS = **0.1*****7129.4**(30 days*counts/100ml)* **Flow**(cfs) * **2.45E+07**[(100ml*s)/(ft^3*30 days*30 days)]

5.4 Calculation of the TMDL

The TMDL for the three water body segments is calculated based on the following equation:

TMDL = WLA + LA + MOS

where WLA is the Waste Load Allocation, LA is the Load Allocation, and MOS is the Margin of Safety.

WLA = NPDES Permitted Facilities

LA = Surface Runoff + Other Direct Inputs

MOS = 10% explicit

The summer TMDL for the three segments was calculated based on the average summer flow of the watershed, and a fecal coliform concentration for 30 days determined by the integral of the theoretical maximum allowable load data set curve. The winter TMDL was calculated based on the average winter flow of the watershed, and a fecal coliform concentration for 30 days determined by the integral of the theoretical maximum allowable load data set curve. The necessary percent reductions are shown below in Table 24.

Table 24. Estimated Fecal Coliform Reductions

Name	ID	Summer % Reduction	Winter % Reduction
Bridge Creek	MS203BE	95%	90%
Elam Creek	MS204E	*NA**	*NA**
UNT to Bridge Creek	MSNI1700R00_030	*89%*	*91%*

**Insufficient Data to Estimate a Percent Reduction*

Bridge Creek

Summer

TMDL = 7129.4(30 days*counts/100ml)* 30.5(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 5.33E+12 (counts for 30 days)

Winter

TMDL = 7129.4(30 days*counts/100ml)* 89.2(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 1.56E+13 (counts for 30 days)

Table 25. TMDL Summary for Bridge Creek – MS203BE (counts/30 days)

	Summer	Winter
WLA	0+00	0+00
LA	4.79E+12	1.40E+13
MOS	5.33E+11	1.56E+12
TMDL = WLA + LA +MOS	**5.33E+12**	**1.56E+13**

Elam Creek

Summer

TMDL = 7129.4(30 days*counts/100ml)* 10.0(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 1.75E+12 (counts for 30 days)

Winter

TMDL = 7129.4(30 days*counts/100ml)* 29.2(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 5.10E+12 (counts for 30 days)

Table 26. TMDL Summary for Elam Creek – MS204E (counts/30 days)

	Summer	Winter
WLA	1.07E+12	1.07E+12
LA	5.02E+11	3.52E+12
MOS	1.75E+11	5.10E+11
TMDL = WLA + LA +MOS	**1.75E+12**	**5.10E+12**

UNT to Bridge Creek

Summer

TMDL = 7129.4(30 days*counts/100ml)* 1.9(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 3.32E+11 (counts for 30 days)

Winter

TMDL = 7129.4(30 days*counts/100ml)* 5.5(cfs) * 2.45E+07[(100ml*s)/(ft^3*30 days*30 days)]
TMDL = 9.61E+11 (counts for 30 days)

Table 27. TMDL Summary for UNT to Bridge Creek – MSNI1700R00_030 (counts/30 days)

	Summer	Winter
WLA	0+00	0+00
LA	2.99E+11	8.65E+11
MOS	3.32E+10	9.61E+10
TMDL = WLA + LA +MOS	**3.32E+11**	**9.61E+11**

5.5 Seasonality

For many streams in the state, fecal coliform limits vary according to the seasons. All three water bodies are designated for the use of secondary contact. For this use, the fecal coliform standard is seasonal.

MDEQ used the average summer flow for calculating the summer TMDL and the average winter flow for calculating the winter TMDL; therefore, the season differences are incorporated in the seasonal average flow values.

5.6 Reasonable Assurance

This component of TMDL development does not apply to this TMDL Report. There is no WLA reduction request based on promised LA components and reductions. This TMDL will recommend that all point sources discharge treated and disinfected effluent that will be below the 200 colony counts per 100ml target at the end of their discharge pipe.

CONCLUSION

The TMDL will not impact future NPDES Permits as long as the effluent is disinfected to meet water quality standards for fecal coliform. The TMDL recommends the Corinth POTW meet fecal coliform limits of 200/400 for both the summer and winter seasons.

In the past several years, there have been multiple bypasses of the city of Corinth's sewer collection system in the area surrounding Elam Creek and the UNT to Bridge Creek due to corrosion of the sewer lines caused by circumstances beyond the city's control. Since, these bypasses were occurring during the time that the fecal coliform monitoring data were collected for Bridge Creek, Elam Creek, and the UNT to Bridge Creek; they are believed to represent a significant nonpoint source of fecal coliform. The correction of this problem and the repairs to the sewer system are underway. Most of the affected sewer lines have been replaced by the city, which has filed a complaint in U.S. District Court against the entity suspected of causing the problems.

Education projects that teach best management practices should be used as a tool for reducing other nonpoint source contributions. These projects may be funded by CWA Section 319 Nonpoint Source (NPS) Grants.

MDEQ will continue to evaluate the city of Corinth's collection system for bypasses through the Environmental Compliance and Enforcement Division (ECED). Also, additional fecal coliform monitoring data for all three water bodies may be collected during the next monitoring phase in the North Independent Streams Basin to confirm restoration of the stream after the necessary repairs to the sewer system are complete.

6.1 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 year long cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the North Independent Streams Basin, all three water body segments may receive additional monitoring to identify any change in water quality. MDEQ produced guidance for future Section 319 project funding will encourage NPS restoration projects that attempt to address TMDL related issues within Section 303(d)/TMDL watersheds in Mississippi.

6.2 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.

All comments should be directed 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.

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.

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 natural body of water to receive wastewaters or toxic materials without deleterious effects and without damage to aquatic life or humans who use the water.

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.

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 waterbody have their greatest potential for adverse effects.

Daily discharge: the discharge of a pollutant measured during a 24-hour period that reasonably represents the 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 discharge is calculated as the average measurement of the pollutant over the day.

Designated Uses: (1) those uses specified in the water quality standards for each water body or segments whether or not they are being attained. (2) those water uses identified in state water quality standards which must be achieved and maintained as required under the Clean Water Act. Uses can include public water supply, recreation, etc.

Discharge monitoring report (DMR): the EPA uniform national form, including any subsequent additions, revisions, or modifications for the reporting of self-monitoring results by permittees.

Effluent: wastewater – treated or untreated – that flows out of a treatment plant or industrial outfall. Generally refers to wastes discharged into surface waters.

Effluent limitation: (1) any restriction established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean, including schedules of compliance. (2) restrictions established by a State or EPA on quantities, rates, and concentrations in wastewater discharges.

Effluent standard: any effluent standard or limitation, which may include a prohibition of any discharge, established or proposed to be established for any toxic pollutant under section 307(a) of the Act.

Fecal Coliform Bacteria: (1) those organisms associated with the intestines of warm-blooded animals that are commonly used to indicate the presence of fecal material and the potential presence of organisms capable of causing human disease. (2) bacteria found in the intestinal tracts of mammals. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

Geometric mean: the *n*th root of the production of n factors. A 30-day geometric mean is the 30^{th} root of the product of 30 numbers.

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 nonpoint source pollution from the land surface to the receiving stream.

Load allocation (LA): the portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.

Loading: the introduction of waste into a waste management unit but not necessarily to complete capacity.

Mass Balance: a concept based on a fundamental law of physical science (conservation of mass) which says that matter can not be created or destroyed. It is used to calculate all input and output streams of a given substance in a system.

Model: a quantitative or mathematical representation or computer simulation which attempts to describe the characteristics or relationships of physical events.

National pollutant discharge elimination system (NPDES): the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under section 307, 402, 318, and 405 of the Clean Water Act.

Nonpoint Source: the pollution sources which generally are not controlled by establishing effluent limitations under section 301, 302, and 402 of the Clean Water Act. Nonpoint source pollutants are not traceable to a discrete identifiable origin, but generally result from land runoff, precipitation, drainage, or seepage.

Outfall: the point where an effluent is discharges into receiving waters

Point Source: a stationery location or fixed facility from which pollutants are discharges or emitted. Also, any single identifiable source of pollution, e.g., a pipe, ditch, ship, ore pit, factory smokestack.

Pollution: generally, the presence of matter or energy whose nature, location or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, and radiological integrity of water.

Publicly Owned Treatment Works (POTW): the treatment works treating domestic sewage that is owned by a municipality or State.

Regression: a relationship of y and x in a function of y = f(x), where: y is the expected value of an independent random variable x. The parameters in the function f(x) are determined by the method of least squares. When f(x) is a linear function of x, the term linear regression is used.

Regression Coefficient: a quantity that describes the slope and intercept of a regression line.

Scientific Notation (Exponential Notation): mathematical method in which very large numbers or very small numbers are expressed in a more concise form. The notation is based on powers of ten. Numbers in scientific notation are expressed as the following: *4.16 x 10^(+b)* and *4.16 x 10^(-b) [same as 4.16E4 or4.16E-4]*. In this case, *b* is always a positive, real number. The *10^(+b)* tells us that the decimal point is *b* places to the right of where it is shown. The *10^(-b)* tells us that the decimal point is *b* places to the left of where it is shown.
For example: $2.7X10^{4}$ = 2.7E+4 =27000 and $2.7X10^{-4}$ = 2.7E-4=0.00027.

Sigma (Σ): shorthand way to express taking the sum of a series of numbers. For example, the sum or total of three amounts 24, 123, 16, ($\mathbf{d_l}$, $\mathbf{d_2}$, $\mathbf{d_3}$) respectively could be shown as:

$$\sum_{i=1}^{3} d_i = d_1+d_2+d_3 = 24 + 123 + 16 = 163$$

Total Maximum Daily Load or TMDL: (1) the calculated maximum permissible pollutant loading introduced to a water body such that any additional loading will produce a violation of water quality standards. (2) the sum of the individual waste load allocations and load allocations. A margin of safety is included with the two types of allocations so that any additional loading, regardless of source, would not produce a violation of water quality standards.

Waste: (1) useless, unwanted or discarded material resulting form (agricultural, commercial, community and industrial) activities. Wastes include solids, liquids, and gases. (2) any liquid resulting from industrial, commercial, mining, or agricultural operations, or from community activities that is discarded or is being accumulated, stored, or physically, chemically, or biologically treated prior to being discarded or recycled.

Wasteload allocation (WLA): (1) the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation. (2) the portion of a receiving water's total maximum daily load that is allocated to one of its existing or future point source of pollution. (3) the maximum load of pollutants each discharger of waste is allowed to release into a particular waterway. Discharge limits are usually required for each specific water quality criterion being, or expected to be, violated. The portion of a stream's total assimilative capacity assigned to an individual discharge.

Water Quality Standards: State-adopted and EPA-approved regulations mandated by the Clean Water Act and specified in 40 CFR 131 that describe the designated uses of a water body, the numeric and narrative water quality criteria designed to protect those uses, and an antidegredation statement to protect existing levels of water quality. Standards are designed to safeguard the public health and welfare, enhance the quality of water and serve the purposes of the Clean Water Act.

Water quality criteria: numeric water quality values and narrative statements which are derived to protect designated uses. Numeric criteria are scientifically-derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. Ambient waters that meet applicable water quality criteria are considered to support their designated 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: (1) the land area that drains (contributes runoff) into a stream. (2) the land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

ABBREVIATIONS

BMP ....Best Management Practice

CWA ....Clean Water Act

DMR ....Discharge Monitoring Report

EPA ....Environmental Protection Agency

GIS ....Geographic Information System

HUC ....Hydrologic Unit Code

LA ....Load Allocation

MDEQ ....Mississippi Department of Environmental Quality

MOS ....Margin of Safety

MRLC……………………………………………………….Multi-Resolution Land Characterization

NLCD………………………………………………………..………….National Land Cover Data

NRCS ....National Resource Conservation Service

NPDES ....National Pollution Discharge Elimination System

UNT ....Unnamed Tributary

USGS ....United States Geological Survey

WLA ....Waste Load Allocation

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