ESCHERICHIA COLI TOTAL MAXIMUM DAILY LOAD EVALUATION FOR EMANUEL CREEK, BON HOMME COUNTY, SOUTH DAKOTA

South Dakota Department of Environment and Natural Resources

Protecting South Dakota's Tomorrow ... Today

SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

MAY, 2011

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Emanuel Creek Total Maximum Daily Load (TMDL)

Entity ID:	SD-MI-R-EMANUEL-01
Location:	HUC Code: 10170101
Size of Watershed:	120,000 acres
Waterbody Type:	Stream
303(d) Listing Parameter:	*Escherichia coli*
Initial Listing date:	2010 IR
TMDL Priority Ranking:	1
Stream Miles:	16 miles from Lewis and Clark Lake to Section 20, T94N, R60W
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	AnnAGNPS, Bacteria Decay Rates, Aquarius, EDNA
Target:	Meet applicable water quality standards 74:51:01:55
Indicators:	Concentration of *E. coli* Bacteria
Threshold Value	< 630 Colonies/ 100mL mean concentration with maximum single sample concentrations of < 1,178 Colonies/ 100mL
High Flow Zone LA:	3.2E+12 Colonies/ 100mL
High Flow Zone WLA:	0 Colonies/ 100mL
High Flow Zone MOS:	5.4E+11 Colonies/ 100mL
High Flow Zone TMDL	3.7E+12 Colonies/ 100mL

1.0 Introduction

The intent of this document is to clearly identify the components of the TMDL submittal to support adequate public participation and facilitate the US Environmental Protection Agency (EPA) review and approval. The TMDL was developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by EPA. This TMDL document addresses the *E. coli* bacteria impairment of Emanuel Creek from section 20 of Township 94 North, Range 60 West to its confluence with Lewis and Clark Lake, SD-MI-R-EMANUEL_01.

E. coli bacteria are a type of fecal coliform bacteria. In an absence of literature specific to *E. coli*, portions of this report will substitute research knowledge derived from fecal coliforms to support the findings. Concentration comparisons for this watersheds ecoregion suggest that nearly 100% of the measured fecal coliform bacteria were *E. coli*.

The state standards set the acceptable concentrations of *E. coli* lower than that of fecal coliform for a given use. Through the assumption that 100% of the bacteria are *E. coli*, reduction percentages should be higher than those calculated for the fecal coliform TMDL for this waterbody.

1.1 Watershed Characteristics

Emanuel Creek drains 120,000 acres in Southeast South Dakota and discharges to Lewis and Clark Lake in Bon Homme County, South Dakota (Figure 1). The stream receives runoff from agricultural operations. During the Lewis and Clark Watershed Assessment, it was determined that the creek experiences periods of degraded water quality due to fecal coliform bacteria. The land use in the watershed is predominately agricultural consisting of cropland (61%) and grazing (32%), with the remaining portions of the watershed composed of water and wetlands (2%), roads and housing (4%), and forested lands (1%). These percentages are considered representative of both the watershed as a whole as well as the drainage area immediately surrounding the listed segment.

Emanuel Creek was assessed as an individual portion of the larger Lewis and Clark Watershed Assessment which looked at individual streams such as Emanuel Creek as well as the entire drainage basin and the cumulative effects of the individual waterbodies. Feeding area analysis was conducted basin wide, with over 500 individual feeding areas examined. Ninety-seven of these feeding areas were located in the Emanuel Creek drainage.

Segment SD-MI-R-EMANUEL_01 is listed for *E. coli* bacteria. This TMDL will deal specifically with the *E. coli* listing; suspended solids and fecal coliform were addressed in separate TMDL documents.

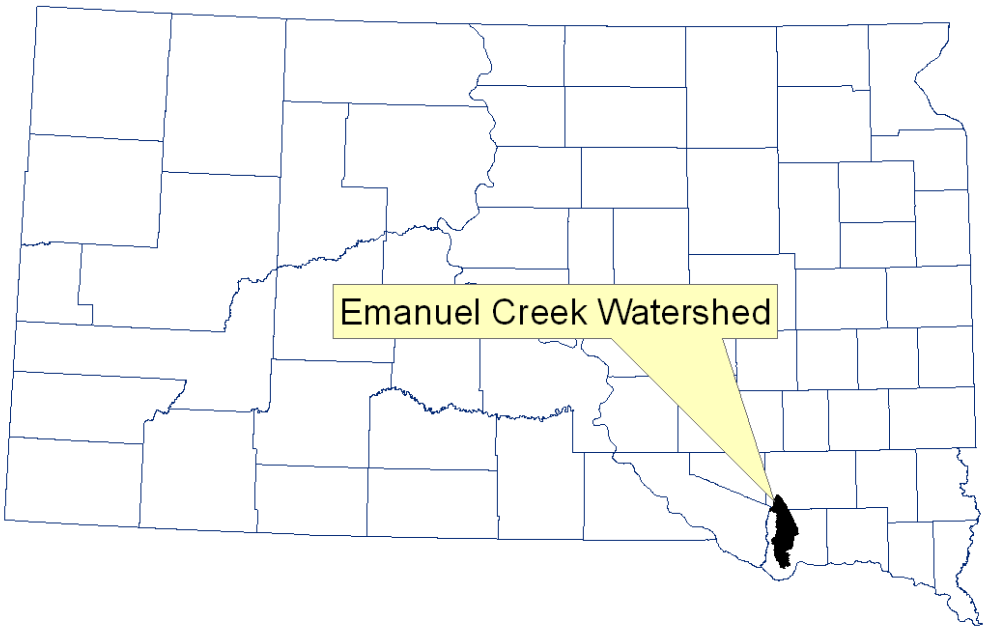

Figure 1. Emanuel Creek Watershed Location in South Dakota

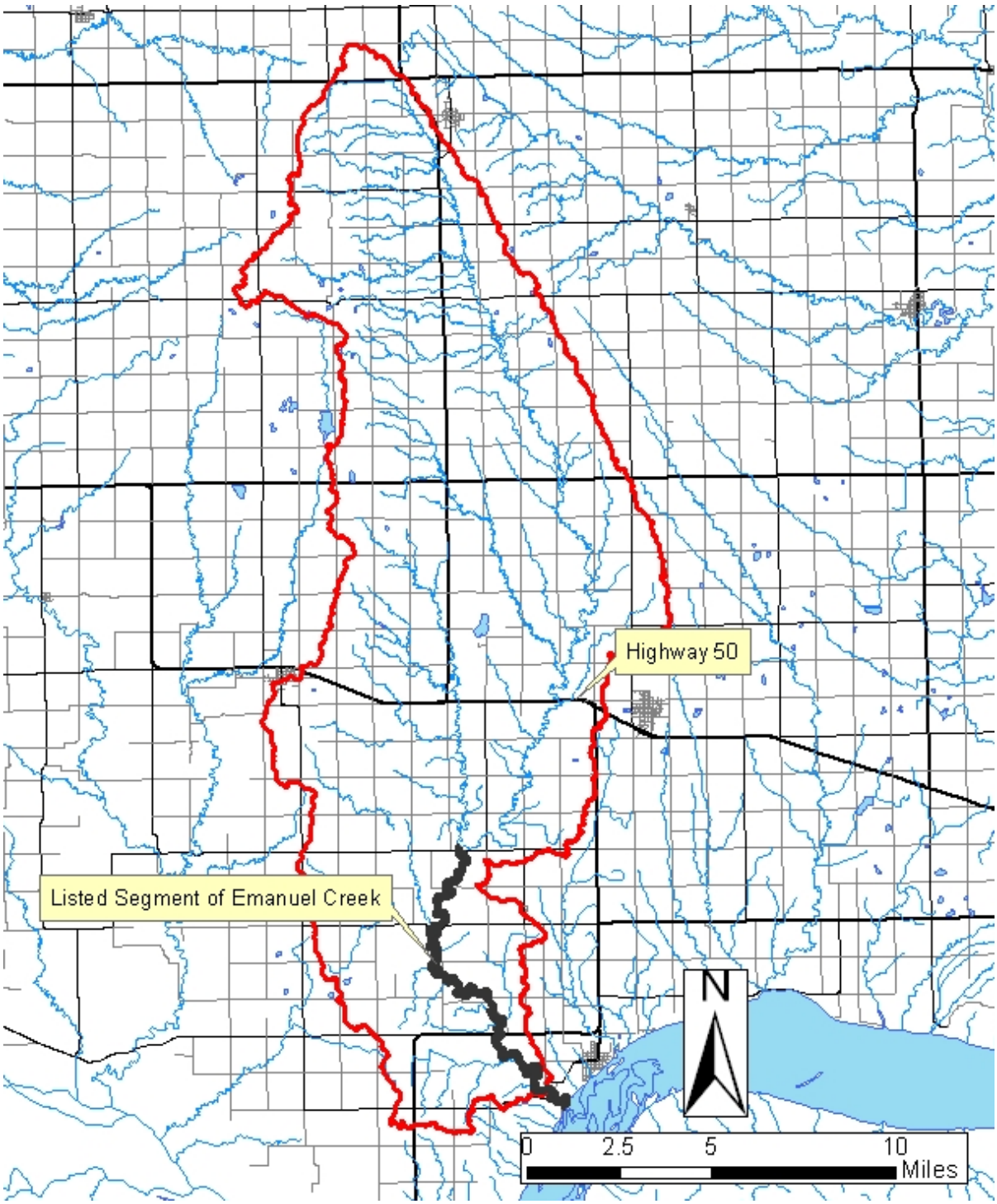

Figure 2. Emanuel Creek Watershed

2.0 Water Quality Standards

Each waterbody within South Dakota is assigned beneficial uses. All waters (both lakes and streams) are designated the use of fish and wildlife propagation, recreation and stock watering. All streams are assigned the use of irrigation. Additional uses may be assigned by the state based on a beneficial use analysis of each waterbody. Water quality standards have been defined in South Dakota state statutes in support of these uses. These standards consist of suites of numeric criteria that provide physical and chemical benchmarks from which management decisions can be developed.

Chronic standards, including geometric means and 30-day averages, are applied to a calendar month. While not explicitly described within the states water quality standards, this is the method used in the South Dakota Integrated Water Quality Report (IR) as well as in permit development.

Additional "narrative" standards that may apply can be found in the "Administrative Rules of South Dakota: Articles 74:51:01:05; 06; 08; 09, and 12". These contain language that generally prohibits the presence of materials causing pollutants to form, visible pollutants, nuisance aquatic life, and biological integrity.

Emanuel Creek from the Missouri River to section 20 of Township 94 North, Range 60 West has been assigned the beneficial uses of: warm water semipermanent fish life propagation, irrigation waters, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 1 lists the criteria that must be met to support the specified beneficial uses. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

The numeric TMDL target established for Emanuel Creek is based on the current water quality standards. The criteria for the limited contact recreation beneficial use requires that 1) no sample exceeds 1,178 CFU/100 mL and 2) during a 30-day period, the geometric mean of minimum of 5 samples collected during separate 24-hour periods must not exceed 630 CFU/100mL. This criterion is applicable from May 1 through September 30. The numeric TMDL target established for Emanuel Creek is 630 CFU/100mL, which is based on the chronic standard for *E. coli*. This will insure that both standards are fully supported at all times.

Table 1. State Water Quality Standards for Emmanuel Creek.

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L 30 average May 1 to October 31	Warmwater Semipermanent Fish Life Propagation
	Equal to or less than the result from Equation 4 in Appendix A of Surface Water Quality Standards	mg/L 30 average November 1 to April 31	
	Equal to or less than the result from Equation c in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥4.0	mg/L	Warmwater Semipermanent Fish Life Propagation
Total Suspended Solids	≤90 (mean) ≤158 (single sample)	mg/L	Warmwater Semipermanent Fish Life Propagation
Temperature	≤32	°C	Warmwater Semipermanent Fish Life Propagation
Fecal Coliform Bacteria (May 1- Sept 30)	≤1,000 (mean) ≤2,000 (single sample)	count/100 mL	Limited Contact Recreation
Escherichia coli	≤630 (mean) ≤1,178 (single sample)	count/100 mL	Limited Contact Recreation
Alkalinity ($CaCO_3$)	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	□mhos/cm @ 25° C	Irrigation Waters
Nitrogen, nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
pH (standard units)	≥6.5 to ≤9.0	units	Warmwater Semipermanent Fish Life Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10 ≤10	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters

3.0 Significant Sources

3.1 Point Sources

There are no point sources of *E. coli* located within this watershed.

3.2 Nonpoint Sources

3.2.1 Human Sources

There are no municipalities or other point sources that discharge to Emanuel Creek. Septic systems were determined to be an insignificant contributing source to the bacteria loads in the creek based on the following information. Human bacteria production may be estimated at 1.95E+9 (Yagow et al, 2001). The human population of Emanuel Creek from the 2000 census was estimated at 1250 people, or 6.5/ square mile. When included as a total load in the table, human produced fecals account for 6% of all bacteria produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no bacteria entering the stream. At a failure rate of 3% (Durand, 2002), even assuming complete pass through of failing systems and direct delivery to the stream, the contributions from septic systems may be estimated at less than 0.17%, or negligible considering that this is a gross overestimation in the true delivered load.

3.2.2 Agricultural Sources

Table 2 lists most animal sources of bacteria in the Emanuel Creek watershed. *E. coli* data for the listed species was unavailable necessitating that fecal coliform concentrations be used as the surrogate. Wildlife densities were generated by the SD Game Fish and Parks in the 2002 County Wildlife Assessment. Livestock data was gathered from the National Agricultural Statistics publication for 2004. Assuming an equal distribution throughout the watershed, the percentages may be used as the source allocations for each species.

Table 2. Fecal Coliform Sources by Species in Emanuel Creek.

Species	#/mile	#/acre	FC/Animal/Day	FC/Acre	Percent
Dairy cow	24.00	3.8E-02	4.46E+10	1673625000	17.8%
Beef	108.00	1.7E-01	3.90E+10	6581250000	70.0%
Hog	35.00	5.5E-02	1.08E+10	590625000	6.3%
Sheep	4.00	6.3E-03	1.96E+10	122500000	1.3%
Horse	1.00	1.6E-03	5.15E+10	80437500	0.9%
Poultry	100.00	1.6E-01	1.36E+08	21250000	0.2%
All Wildlife	Sum of all Wildlife			325397638	3.5%
Turkey (Wild)[1]	1.57	2.5E-03	1.10E+08	269844	
Goose[2]	0.02	3.1E-05	7.99E+08	24969	
Deer[2]	3.06	4.8E-03	3.47E+08	1659094	
Beaver[2]	2.44	3.8E-03	2.00E+05	763	
Raccoon[2]	5.24	8.2E-03	5.00E+09	40937500	
Coyote/Fox[3]	2.27	3.5E-03	1.75E+09	6207031	
Muskrat[1]	5.24	8.2E-03	2.50E+07	204688	
Opossom[4]	1.92	3.0E-03	5.00E+09	15000000	
Mink[4]	1.48	2.3E-03	5.00E+09	11562500	
Skunk[4]	2.27	3.5E-03	5.00E+09	17734375	
Badger[4]	1.22	1.9E-03	5.00E+09	9531250	
Jackrabbit[4]	1.92	3.0E-03	5.00E+09	15000000	
Cottontail[4]	19.2	3.0E-02	5.00E+09	150000000	
Squirrel[4]	7.33	1.1E-02	5.00E+09	57265625	

1 USEPA 2001

2 Bacteria Indicator Tool Worksheet

3 Best Professional Judgment based off of Dogs

4 FC/Animal/Day copied from Raccon to provide a more conservative estimate of background affects of wildlife

There are an estimated 97 animal feeding operations in the Emanuel Creek watershed, many of which are contributors to the bacteria load, particularly during runoff events. Based on the National Agricultural Statistics report, approximately 40% of the cattle present in the watershed may be found in feedlots. The majority of pigs in the watershed may also be assumed to be in some type of confined feeding area. Table 2 is a summary of Table 3 grouping all sources into three primary categories. Feedlots include any type of livestock confined to un-vegetated areas including wintering operations. Livestock on grass encompass all remaining livestock within the watershed.

Table 3. Fecal Source Allocation for Emanuel Creek.

Source	Percentage
Feedlots	41.7%
Livestock on Grass	54.9%
Wildlife	3.5%

4.0 Technical Analysis

4.1 Data Collection Method

Data on Emanuel Creek was collected during the Lewis and Clark Watershed Assessment. All data was collected from a single sampling point near the mouth of the creek. Analysis completed with modeling programs was done according to the most recent version of the Water Quality Modeling in South Dakota document. The Annualized Agricultural Nonpoint Source Pollution Model (AnnAGNPS) was completed on each of the feeding areas in the watershed, the results of which will be primarily used to direct implementation activities. Fecal decay rates were also used primarily for targeting during the implementation phase. Stream miles and travel times were estimated through the use of AnnAGNPS to support the fecal decay rate equations.

The Aquarius program was used to generate simulated discharge data using the long-term gauge at Choteau Creek (approximately 20 years flow record) to provide a sufficient dataset to develop a load duration curve. Choteau Creek was chosen due to its close proximity, similar basin characteristics, and discharge intensities that were similar to Emanuel Creek when measured on a common date.

Unless otherwise noted, analysis was completed with modeling programs according to the most recent version of the Water Quality Modeling in South Dakota document (SDDENR, 2009).

4.2 Hydrology

Flow frequencies were generated by modeling measured flows on Emanuel Creek against flow data collected on Choteau Creek. The Aquarius empirical modeling tool was used to generate a long term flow frequency for Emanuel Creek based on the long term data available on Choteau Creek. Mean daily flow generated through EDNA was estimated at 0.88 cubic meters/ second. This estimate was used to verify that the Aquarius modeled flow data was reasonable.

4.3 Sample Data

An absence of literature pertaining specifically to *E. coli* concentrations resulted in a need to augment the data set with fecal coliform data. *E. coli* are a type of fecal coliform, as such; fecal coliform data make an acceptable surrogate. A variety of literature values are available suggesting that *E. coli* constitute in excess of 60% of fecal coliform found in the environment. A large number (411) of paired *E. coli* and fecal coliform samples were available in Ecoregion 42.

Utilizing the log function (Figure 3), data were transformed to a normal distribution from which a linear trend could be calculated. The resulting function suggests that for ecoregion 42, a nearly 1:1 ratio of fecal coliform to *E. coli* exists. The relatively strong coefficient of determination allows for the reasonable substitution of fecal coliform data in an absence of sufficient *E. coli* data.

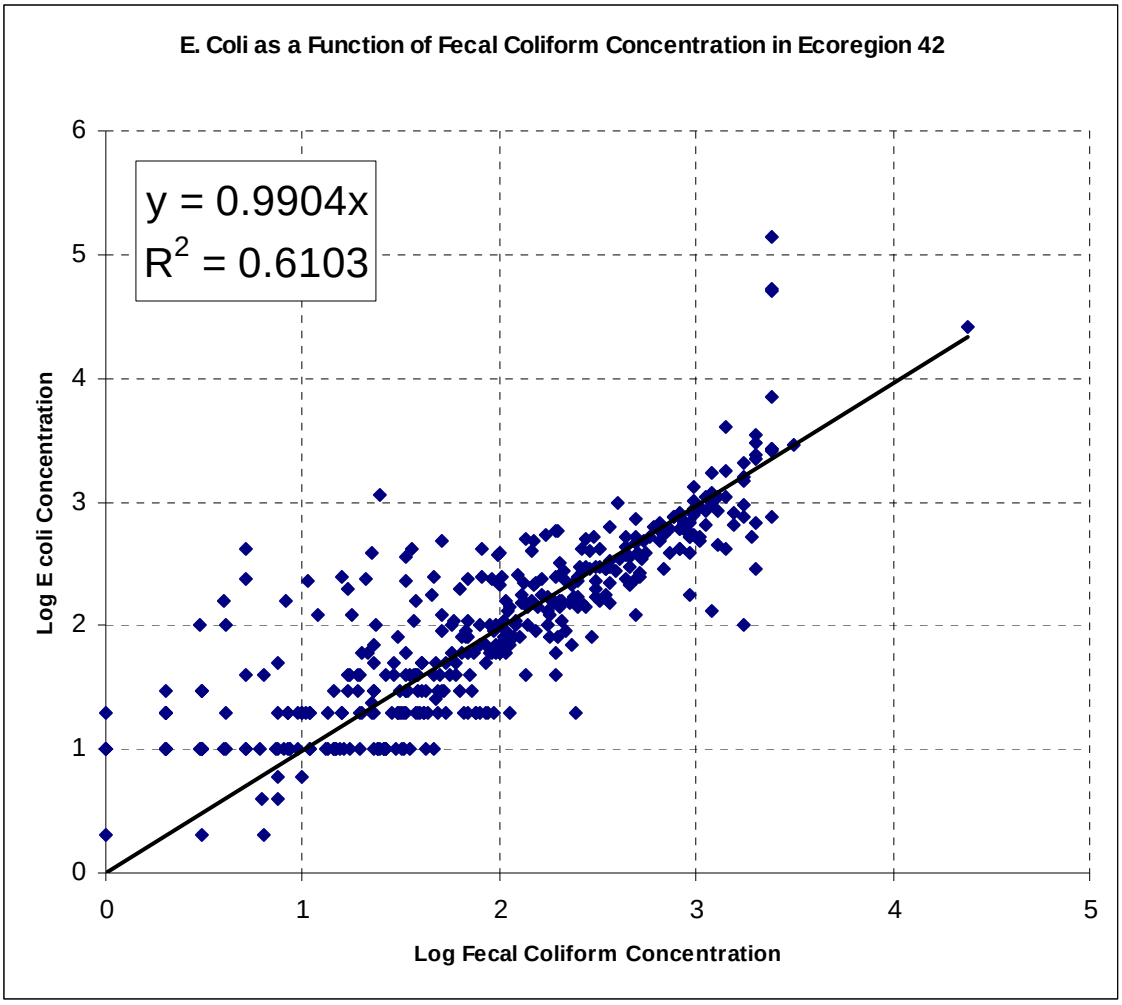

Figure 3. E. coli as a Function of Fecal Coliform Concentrations in Ecoregion 42.

Analytical results from bacteria sampling exceeded the acute standard on six of the 23 samples for fecal coliform and eight of the 22 samples for *E. coli*. The violations appear to be primarily storm event driven with the highest counts occurring at or above 20 cfs; however counts that were elevated, but not in excess of the standard were routinely measured during base-flow conditions, suggesting improvements to riparian condition may also provide some benefits to the health of the stream.

Table 4 represents the samples collected from Emanuel Creek. Flow data was not available, nor reasonably calculated for five of the samples. Based on flow data in neighboring drainages, it is likely that the August sample in 2004 and the June samples in 2005 are event based samples (>20 cfs). All four of these samples were above the chronic standard (1000 colonies/ 100 mL geometric mean) and three of those were above the acute standard (2000 colonies/ 100 mL grab sample.

The highest sample was collected on June 21, 2005, for which no discharge data is available. At 100,000 colonies/ 100mL, it would require a 98% reduction to achieve the acute standard of 2,000 colonies/ 100mL. To account for a margin of safety, a 99% reduction to the chronic fecal coliform standard of 1,000 colonies/ 100mL is incorporated. Assuming a similar proportion of this were E. coli which should be reduced to a concentration of 630, a reduction of slightly greater than 99% is required.

Table 4. Discharge, Fecal Coliform, and *E. coli* Samples for Emanuel Creek.

Sample Date	Discharge	Fecal Count	*E. coli*	Sample Date	Discharge	Fecal Count	*E. coli*
05/07/2003	1.86	380	501	08/21/2003	2.28	490	50.5
05/14/2003	20.38	670	921	08/27/2003	2.5	410	80.5
05/22/2003	14.785	250	249	09/10/2003	19.35	52000	2420
05/27/2003	10.84	420	260	09/10/2003	19.35	51000	2420
06/04/2003	11.5	830	980	05/17/2004		950	1730
06/19/2003	8.57	600	727	08/24/2004		8600	>2420
06/23/2003	5.7	840	1120	08/25/2004	36.98	4100	1410
07/08/2003	28.47	600	866	06/06/2005		2900	>2420
07/24/2003	7.57	420	5.1	06/13/2005		1100	1414
07/31/2003	3.71	1300	980	06/21/2005		100000	>2420
08/06/2003	2.55	250	46.7	07/07/2005	19.38	240	
08/12/2003	3.03	390	22.7				

5.0 TMDL and Allocations

The fecal load duration curve located in Figure 4 represents the 3 distinct flow regimes exhibited by Emanuel Creek. The highest flow regime was selected based on the following criteria. The flow rate of 15 cfs corresponds to approximately the annual or one year return flow and the sample data suggests that flows in excess of this are most likely to exceed the standard. Flow volumes in this regime may be considered entirely storm event runoff in origin. Sources of bacteria contamination are more likely to be located outside of the stream corridor. An exact flow for the highest concentration data

point (100,000 colonies/ 100mL) was not available, but it was estimated that this sample was collected from a flow close to bankfull, which was calculated to be 66 cfs.

The middle flow regime extends from 15 cfs down to 3 cfs or from the 15th percentile down to the 48th percentile. The lower limit of 3 cfs was selected because flows below this are composed entirely of groundwater. Samples collected from the middle flow regime did not exceed the acute criteria and only one sample was above the chronic standard. Sources of bacteria can be expected to be in direct contact with the stream or immediately adjacent to the stream corridor. The highest concentration collected from within this flow regime was 1300 colonies/ 100 mL.

The lower flow regime consists of flows that are less than 3 cfs. These flows are composed entirely of groundwater discharge and exhibited the lowest concentrations of fecal coliform bacteria. Sources of bacteria would be expected to be in direct contact with the stream. The maximum concentration collected in this regime was 490 colonies/ 100 mL.

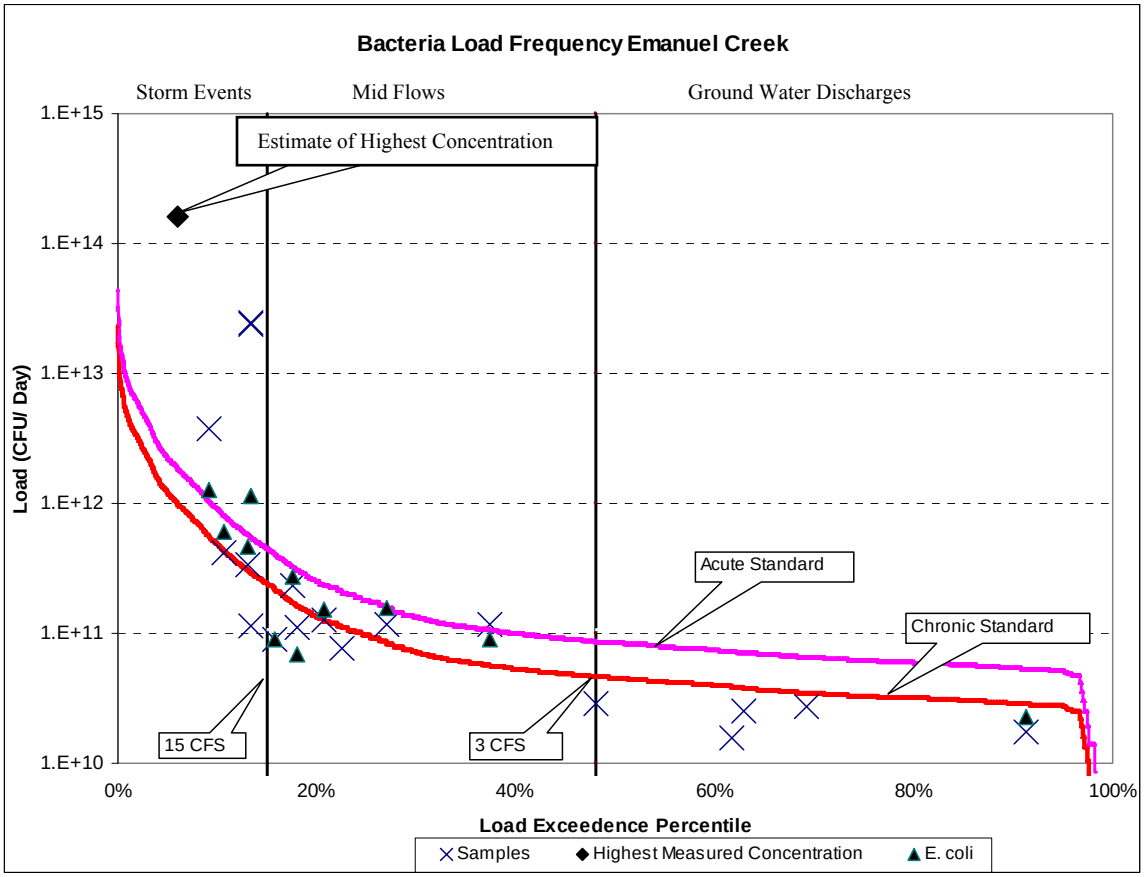

Figure 4. Bacteria Load Duration Curve for Emanuel Creek

Table 5. TMDL Summary for *E. coli* on Emanuel Creek

TMDL Component	Flow Zone (expressed as CFU/day)		
	High	Middle	Low
	>15 cfs	3-15 cfs	<3 cfs
LA	3.2E+12	1.6E+11	1.2E+10
WLA	0	0	0
MOS	5.4E+11	2.2E+10	3.2E+10
TMDL @ 630 CFU/ 100 mL	3.7E+12	1.8E+11	4.5E+10
Current Load*	3.1E+14	3.7E+11	3.6E+10
Load Reduction	99%	52%	0%
**Current Load is the highest concentration * 90th percentile flow in each regime*			

5.1 Load Allocations (LAs)

Approximately 93% of the landuse in the watershed is agricultural. The majority of the TMDL load has been allocated to these nonpoint source loads in the following load allocations. In the high flow regime, a 99% reduction in bacteria from anthropogenic sources (confined livestock, and those on pasture) is necessary to reach the target of an *E. coli* concentration of less than 630 colonies/ 100 mL.

The middle flow regime, a reduction of 52% is required to meet the TMDL goal. This is significantly greater than the 23% reduction required to meet the fecal coliform TMDL for this waterbody. The additional reductions were generated by assuming that 100% of fecal coliforms were *E. coli* and reducing that concentration to the lower *E. coli* standard of 630 CFU/ 100 mL. Reducing the highest samples below the chronic standard provides assurance that both standards will be met.

5.2 Wasteload Allocations (WLAs)

There are no point sources of pollutants in this watershed. Therefore, the "wasteload allocation" component of these TMDLs is considered a zero value. The TMDLs are considered wholly included within the "load allocation" component.

6.0 Margin of Safety (MOS) and Seasonality

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc). An explicit MOS was calculated as the difference between the loading capacity at the mid-point of each of the three flow zones and the loading capacity at the minimum flow in each zone. A substantial MOS is provided

using this method, because the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point.

Because the allocations are a direct function of flow, accounting for potential flow variability is an appropriate way to address the MOS. As new information becomes available and the TMDL is revisited, this unallocated capacity may be attributed to nonpoint sources and added to the load allocation, or the unallocated capacity may be attributed to point sources and become part of the waste load allocation.

Different seasons of the year can yield differences in water quality due to changes in precipitation and agricultural practices. The fecal coliform standard only applies to streams from May 1 through September 30, which is the season that the TMDL addresses.

7.0 Public Participation

The project was presented at many meetings during the assessment period. With Randall Resource, Conservation, and Development Associated, Inc, (RC&D) as the leading sponsor, the project was not limited by state boundaries. The project had many partners from both South Dakota as well as Nebraska: Many of the organizations listed below saw several updated presentations as the project progressed. In addition to the many meetings that were attended, a website was also developed and maintained throughout the project.

South Dakota Conservation Districts: Aurora, Bennett, Bon Homme, Charles Mix, Clearfield-Keya Paha, Douglas, Gregory, Hutchinson, Todd, Yankton

Nebraska Natural Resource Districts:
Lewis and Clark, Lower Niobrara, Middle Niobrara, Upper Elkhorn

Government: National Park Service, Nebraska DEQ, NRCS, SD DENR, SD Department of Agriculture, SD GF&P, USACOE, USGS

Organizations: Bon Homme - Yankton Rural Water, Cedar-Knox Rural Water, Cities of Yankton and Springfield, Knox Co. Commission, Lewis and Clark SD-NE Preservation Association, Rosebud Cattlemen's Association, Spring/Bull Creek Watershed District, So. Central Water Development District, Village of Niobrara, Yankton and Rosebud Sioux Tribes

R.C.&D's
Badlands, Lower James, Northeast Nebraska, North Central Nebraska, South Central SD

Industry: Natural Resource Solutions, Brooking South Dakota

The findings from these public meetings and comments have been taken into consideration in development of the Emanuel Creek Fecal TMDL.

8.0 Monitoring Strategy

It is critical that monitoring of the fecal coliform counts be conducted during the implementation of best management practices at both the start and end of the listed segment. This data will provide information on the effectiveness of the BMPs.

The Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or come to light during the implementation of the TMDL and a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment of the load and waste load allocation will only be made following an opportunity for public participation. New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information and land use information. The Department will propose adjustments only in the event that any adjusted LA or WLA will not result in a change to the loading capacity; the adjusted TMDL, including its WLAs and LAs, will be set at a level necessary to implement the applicable water quality standards; and any adjusted WLA will be supported by a demonstration that load allocations are practicable. The Department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

9.0 Restoration Strategy

Implementation activities for the Emanuel Creek watershed were incorporated within the Lewis and Clark Implementation Project which covers all of the subwatersheds that drain to Lewis and Clark Lake on the Missouri River.

Available data makes it impossible to allocate specific loads to particular portions of the watershed. It is likely that the load may be significantly reduced through the mitigation of sources closest to the listed segment of Emanuel Creek. This segment may be found in Figure 2 and restoration activities should make all sources within 1 mile of the listed segment their first priority. Second priority should target all sources south of Highway 50, which is 18 km upstream of the listed segment. Sources north of Highway 50 should be considered on a case by case basis.

10.0 Literature Cited

Durand, B., Liss, L.A., Giles, C. and Haas, G. (2002). *Bacteria TMDL for the Shawsheen river basin*. Report MA83-01-2002-24.
www.mass.gov/dep/water/resources/shawshee.pdf

SDDENR (South Dakota Department of Environment and Natural Resources). 2009. Water Quality Modeling in South Dakota, May, 2009 Revision; Pierre, SD.

USEPA, 2001; Protocol for Developing Pathogen TMDLs EPA 841-R-00-002. Office of Water (4503F), United States Environmental Protection Agency, Washington DC. 132 pp.

Yagow, G., Dillaha, T., Mostaghimi, S., Brannan, K., Heatwole, C. and Wolfe, M.L. (2001). *TMDL modeling of fecal coliform bacteria with HSPF*. ASAE meeting paper No.01-2066. St. Joseph, Mich.

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Total Maximum Daily Load Evaluation for Emanuel Creek, Bon Homme County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**May 18, 2011**
Review Date:	**June 21, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice Draft**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final review only):

- ☐ Approve
- ☐ Partial Approval
- ☐ Disapprove
- ☐ Insufficient Information

Approval Notes to Administrator:

This document provides a standard format for EPA Region 8 to provide comments to state TMDL programs on TMDL documents submitted to EPA for either formal or informal review. All TMDL documents are evaluated against the minimum submission requirements and TMDL elements identified in the following 8 sections:

1. Problem Description
   - 1.1. TMDL Document Submittal Letter
   - 1.2. Identification of the Waterbody, Impairments, and Study Boundaries
   - 1.3. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
   - 4.1. Data Set Description
   - 4.2. Waste Load Allocations (WLA)
   - 4.3. Load Allocations (LA)
   - 4.4. Margin of Safety (MOS)
   - 4.5. Seasonality and variations in assimilative capacity
5. Public Participation
6. Monitoring Strategy
7. Restoration Strategy
8. Daily Loading Expression

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while

maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant**.** A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's minimum submission requirements relative to that section, a brief summary of the EPA reviewer's findings, and the reviewer's comments and/or suggestions. Use of the verb "must" in the minimum submission requirements denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable.

This review template is intended to ensure compliance with the Clean Water Act and that the reviewed documents are technically sound and the conclusions are technically defensible.

1. Problem Description

A TMDL document needs to provide a clear explanation of the problem it is intended to address. Included in that description should be a definitive portrayal of the physical boundaries to which the TMDL applies, as well as a clear description of the impairments that the TMDL intends to address and the associated pollutant(s) causing those impairments. While the existence of one or more impairment and stressor may be known, it is important that a comprehensive evaluation of the water quality be conducted prior to development of the TMDL to ensure that all water quality problems and associated stressors are identified. Typically, this step is conducted prior to the 303(d) listing of a waterbody through the monitoring and assessment program. The designated uses and water quality criteria for the waterbody should be examined against available data to provide an evaluation of the water quality relative to all applicable water quality standards. If, as part of this exercise, additional WQS problems are discovered and additional stressor pollutants are identified, consideration should be given to concurrently evaluating TMDLs for those additional pollutants. If it is determined that insufficient data is available to make such an evaluation, this should be noted in the TMDL document.

1.1 TMDL Document Submittal Letter

When a TMDL document is submitted to EPA requesting formal comments or a final review and approval, the submittal package should include a letter identifying the document being submitted and the purpose of the submission.

Minimum Submission Requirements.

☒ A TMDL submittal letter should be included with each TMDL document submitted to EPA requesting a formal review.

☒ The submittal letter should specify whether the TMDL document is being submitted for initial review and comments, public review and comments, or final review and approval.

☐ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute**.** The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek E. coli TMDL was submitted to EPA for review via an email from Cheryl Saunders, SD DENR on May 18, 2011. The email included the draft TMDL document and a request to review and comment on the TMDL.

COMMENTS: None

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied. Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

☒ The TMDL document should clearly identify the pollutant and waterbody segment(s) for which the TMDL is being established. If the TMDL document is submitted to fulfill a TMDL development requirement for a waterbody on the state's current EPA approved 303(d) list, the TMDL document submittal should clearly identify the waterbody and associated impairment(s) as they appear on the State's/Tribe's current EPA approved 303(d) list, including a full waterbody description, assessment unit/waterbody ID, and the priority ranking of the waterbody. This information is necessary to ensure that the administrative record and the national TMDL tracking database properly link the TMDL document to the 303(d) listed waterbody and impairment(s).

☒ One or more maps should be included in the TMDL document showing the general location of the waterbody and, to the maximum extent practical, any other features necessary and/or relevant to the understanding of the TMDL analysis, including but not limited to: watershed boundaries, locations of major pollutant sources, major tributaries included in the analysis, location of sampling points, location of discharge gauges, land use patterns, and the location of nearby waterbodies used to provide surrogate information or reference conditions. Clear and concise descriptions of all key features and their relationship to the waterbody and water quality data should be provided for all key and/or relevant features not represented on the map.

☐ If information is available, the waterbody segment to which the TMDL applies should be identified/geo-referenced using the National Hydrography Dataset (NHD). If the boundaries of the TMDL do not correspond to the Waterbody ID(s) (WBID), Entity_ID information or reach code (RCH_Code) information should be provided. If NHD data is not available for the waterbody, an alternative geographical referencing system that unambiguously identifies the physical boundaries to which the TMDL applies may be substituted.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Emanuel Creek is a stream located in Bon Homme, South Dakota and is part of the larger Missouri River watershed in the Lewis and Clark Lake sub-basin (HUC 10170101). The listed river segment contains a small portion of the watershed drainage area of approximately 120,000 acres in south eastern South Dakota, and includes approximately 16.1 miles of the stream from S20, T94N, R60W to its mouth (i.e., to the confluence with Lewis and Clark Lake; SD-MI-R-EMANUEL_01). It is listed as a high priority for TMDL development.

The designated uses for Emanuel Creek include warmwater semipermanent fish life propagation waters, limited-contract recreation waters, irrigation, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for E. coli and fecal coliform which are impairing the recreational use and for total suspended solids (TSS) which is impairing the aquatic life use. EPA approved Emanuel Creek TMDLs for fecal coliform and TSS in September 2009.

COMMENTS: None.

1.3 Water Quality Standards

TMDL documents should provide a complete description of the water quality standards for the waterbodies addressed, including a listing of the designated uses and an indication of whether the uses are being met, not being met, or not assessed. If a designated use was not assessed as part of the TMDL analysis (or not otherwise recently assessed), the documents should provide a reason for the lack of assessment (e.g., sufficient data was not available at this time to assess whether or not this designated use was being met).

Water quality criteria (WQC) are established as a component of water quality standard at levels considered necessary to protect the designated uses assigned to that waterbody. WQC identify quantifiable targets and/or qualitative water quality goals which, if attained and maintained, are intended to ensure that the designated uses for the waterbody are protected. TMDLs result in maintaining and attaining water quality standards by determining the appropriate maximum pollutant loading rate to meet water quality criteria, either directly, or through a surrogate measurable target. The TMDL document should include a description of all applicable water quality criteria for the impaired designated uses and address whether or not the criteria are being attained, not attained, or not evaluated as part of the analysis. If the criteria were not evaluated as part of the analysis, a reason should be cited (e.g., insufficient data were available to determine if this water quality criterion is being attained).

Minimum Submission Requirements:

☒ The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)).

Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.

☒ The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.

☐ If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both

acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek segment addressed by this TMDL is impaired based on E. coli concentrations for limited contact recreation. South Dakota has applicable numeric standards for E. coli that may be applied to this stream segment. The E. coli numeric standards being implemented in this TMDL are: a single sample maximum value of ≤ 1178 cfu/100 mL, and a 30-day geometric mean of ≤ 630 cfu/ 100 mL. Discussion of additional applicable water quality standards for Emanuel Creek can be found on pages 5 - 6 of the TMDL document.

COMMENTS: None.

2. Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddeness, stream morphology, up-slope conditions and a measure of biota).

Minimum Submission Requirements:

☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained.

Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.

☐ When a numeric TMDL target is established to ensure the attainment of a narrative water quality criterion, the numeric target, the methodology used to determine the numeric target, and the link between the pollutant of concern and the narrative water quality criterion should all be described in the TMDL document. Any additional information supporting the numeric target and linkage should also be included in the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The water quality target for this TMDL is based on the numeric water quality standards for E. coli to achieve the limited contact recreation beneficial use for Emanuel Creek. The target for the Emanuel Creek segment included in the TMDL document is the E. coli standard expressed as the 30-day geometric mean of 630 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each significant source (or source category) should be identified and quantified to the maximum practical extent. This may be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach may be appropriate. The approach should be clearly defined in the document.

Minimum Submission Requirements:

☒ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.

☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.

☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.

☒ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (61%), grassland / rangeland (32%) and water/wetlands, developed or forest land (7%).

There are no point sources that discharge to the impaired segment of Emanuel Creek.

Nonpoint sources of E. coli bacteria in Emanuel Creek come primarily from agricultural sources. Data from the 2004 National Agricultural Statistic Survey (NASS) and from the 2002 South Dakota Game Fish and Parks county wildlife assessment were utilized for livestock and wildlife densities, respectively. Animal density information was used to estimate relative source contributions of bacteria loads as summarized in Table 2 of the TMDL document.

Livestock in the basin are predominantly beef cattle. Livestock can contribute E. coli bacteria directly to the stream by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands, which then get washed off during precipitation events. Table 3, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. Feedlots include any type of livestock confined to un-vegetated areas including wintering operations. Livestock on grass encompass all remaining livestock within the watershed.

Table 3. Fecal Source Allocation for Emanuel Creek.

Source	Percentage
Feedlots	41.7%
Livestock on Grass	54.9%
Wildlife	3.5%

There are an estimated 97 animal feeding operations in the Emanuel Creek watershed, many of which are contributors to the bacteria load, particularly during runoff events. Based on the National Agricultural Statistics report, approximately 40% of the cattle present in the watershed may be found in feedlots. The majority of pigs in the watershed may also be assumed to be in some type of confined feeding area.

There are no municipalities or other point sources that discharge to Emanuel Creek. Septic systems were determined to be an insignificant contributing source to the bacteria loads in the creek based on the following information. Human bacteria production may be estimated at 1.95E+09. The human population of Emanuel Creek from the 2000 census was estimated at 1250 people, or 6.5 per square mile. When included as a total load in the table, human produced fecals account for 6 percent of all bacteria produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no bacteria entering the stream. At a failure rate of 3 percent, even assuming complete pass through of failing systems and direct delivery to the stream, the contributions from septic systems may be estimated at less than 0.17 percent, or negligible considering that this likely an overestimation of the actual delivered load.

COMMENTS: None.

4. TMDL Technical Analysis

TMDL determinations should be supported by a robust data set and an appropriate level of technical analysis**.** This applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader.

A TMDL analysis determines the maximum pollutant loading rate that may be allowed to a waterbody without violating water quality standards. The TMDL analysis should demonstrate an understanding of the relationship between the rate of pollutant loading into the waterbody and the resultant water quality impacts. This stressor → response relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and load allocations needs to be clearly articulated and supported by an appropriate level of technical analysis. Every effort should be made to be as detailed as possible, and to base all conclusions on the best available scientific principles.

The pollutant loading allocation is at the heart of the TMDL analysis. TMDLs apportion responsibility for taking actions by allocating the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways, such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or division of responsibility.

The pollutant loading allocation that will result in achievement of the water quality target is expressed in the form of the standard TMDL equation:

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = The portion of the Load Capacity allocated to the Margin of safety.

Minimum Submission Requirements:

☒ A TMDL must identify the loading capacity of a waterbody for the applicable pollutant, taking into consideration temporal variations in that capacity. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

☒ The TMDL document should describe the methodology and technical analysis used to establish and quantify the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

☒ It is necessary for EPA staff to be aware of any assumptions used in the technical analysis to understand and evaluate the methodology used to derive the TMDL value and associated loading allocations. Therefore, the TMDL document should contain a description of any important assumptions (including the basis for those assumptions) made in developing the TMDL, including but not limited to:

(1) the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
(2) the distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) a presentation of relevant information affecting the characterization of the pollutant of concern and its allocation to sources such as population characteristics, wildlife resources, industrial activities etc…;
(4) present and future growth trends, if taken into consideration in determining the TMDL and preparing the TMDL document (e.g., the TMDL could include the design capacity of an existing or planned wastewater treatment facility);
(5) an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

☒ The TMDL document should contain documentation supporting the TMDL analysis, including an inventory of the data set used, a description of the methodology used to analyze the data, a discussion of strengths and weaknesses in the analytical process, and the results from any water quality modeling used. This information is necessary for EPA to review the loading capacity determination, and the associated load, wasteload, and margin of safety allocations.

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

☐ Where both nonpoint sources and NPDES permitted point sources are included in the TMDL loading allocation, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document must include a demonstration that nonpoint source loading reductions needed to implement the load allocations are actually practicable [40 CFR 130.2(i) and 122.44(d)].

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Emanuel Creek TMDL describes how the E. coli loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data for Emanuel Creek was collected during the Lewis and Clark watershed assessment from a single sampling point near the mouth of the creek. The Aquarius program was used to generate simulated discharge data using the long-term gauge at Choteau Creek (approximately 20 years flow record) to provide a sufficient data set to develop a load duration curve. Choteau Creek was chosen due to its close proximity, similar basin characteristics, and discharge intensities that were similar to Emanuel Creek when measured on a common date.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 3 distinct flow regimes – high flow ($\geq$ 15 cfs), midrange flow (between 15 cfs and 3 cfs) and dry flow (< 3 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 4 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at the 90th percentile of the observed E. coli bacteria load for each flow regime:

high flow = 3.7E+12 CFU/day; midrange flow = 1.8E+11 CFU/day; and dry flow = 4.5E+10 CFU/day.

COMMENTS: None.

4.1 Data Set Description

TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis. An inventory of the data used for the TMDL analysis should be provided to document, for the record, the data used in decision making. This also provides the reader with the opportunity to independently review the data. The TMDL analysis should make use of all readily available data for the waterbody under analysis unless the TMDL writer determines that the data are not relevant or appropriate. For relevant data that were known but rejected, an explanation of why the data were not utilized should be provided (e.g., samples exceeded holding times, data collected prior to a specific date were not considered timely, etc…).

Minimum Submission Requirements:

☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.

☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data for Emanuel Creek was collected during the Lewis and Clark watershed assessment from a single sampling point located near the mouth of the creek.

An absence of literature pertaining specifically to E. coli concentrations resulted in a need to augment the data set with fecal coliform data. E. coli are a type of fecal coliform, as such; fecal coliform data make an acceptable surrogate. A variety of literature values are available suggesting that E. coli constitute in excess of 60 percent of fecal coliform found in the environment. A large number of paired E. coli and fecal coliform samples were available in ecoregion 42. Data were transformed to a normal distribution from which a linear trend could be calculated. The resulting function suggests that for ecoregion 42, a nearly 1:1 ratio of fecal coliform to E. coli exists. The relatively strong coefficient of determination allows for the reasonable substitution of fecal coliform data in an absence of sufficient E. coli data.

Analytical results from bacteria sampling exceeded the acute standard for 6 of the 23 samples for fecal coliform and 8 of the 22 samples for E. coli. The violations appear to be primarily storm event driven with the highest counts occurring at or above 20 cfs; however counts that were elevated, but not in excess of the standard were routinely measured during base-flow conditions, suggesting improvements to riparian condition may also provide some benefits to the health of the stream.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

Waste Load Allocations represent point source pollutant loads to the waterbody. Point source loads are typically better understood and more easily monitored and quantified than nonpoint source loads. Whenever practical, each point source should be given a separate waste load allocation. All NPDES permitted dischargers that discharge the pollutant under analysis directly to the waterbody should be identified and given separate waste load allocations. The finalized WLAs are required to be incorporated into future NPDES permit renewals.

Minimum Submission Requirements:

☒ EPA regulations require that a TMDL include WLAs for all significant and/or NPDES permitted point sources of the pollutant. TMDLs must identify the portion of the loading capacity allocated to individual existing and/or future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit. If no allocations are to be made to point sources, then the TMDL should include a value of zero for the WLA.

☒ All NPDES permitted dischargers given WLA as part of the TMDL should be identified in the TMDL, including the specific NPDES permit numbers, their geographical locations, and their associated waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: There are no point sources that discharge to the impaired segment of Emanuel Creek. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:

☒ EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.

☒ Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Watershed Characteristics section of the TMDL explains that the landuse in the watershed is predominately agricultural consisting of cropland (61%), grassland / rangeland (32%) and water/wetlands, developed or forest land (7%). Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Table 5 includes the load allocations at each of the flow regimes – 3.26E+12 CFU/day at high flows; 1.6E+11 CFU/day at midrange flows; and 1.2E+10 CFU/day during dry conditions.

COMMENTS: None.

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL. The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

☒ TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

- ☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.
- ☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the five flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Table 5 of the TMDL.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary based on seasonal considerations. Therefore, it is appropriate that the TMDL analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

☒ The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variability as a factor. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in E. coli loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months.

COMMENTS: None.

5. Public Participation

EPA regulations require that the establishment of TMDLs be conducted in a process open to the public, and that the public be afforded an opportunity to participate. To meaningfully participate in the TMDL process it is necessary that stakeholders, including members of the general public, be able to understand the problem and the proposed solution. TMDL documents should include language that explains the issues to the general public in understandable terms, as well as

provides additional detailed technical information for the scientific community. Notifications or solicitations for comments regarding the TMDL should be made available to the general public, widely circulated, and clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for approval, a copy of the comments received by the state and the state responses to those comments should be included with the document.

Minimum Submission Requirements:

☒ The TMDL must include a description of the public participation process used during the development of the TMDL (40 C.F.R. §130.7(c)(1)(ii)).

☐ TMDLs submitted to EPA for review and approval should include a summary of significant comments and the State's/Tribe's responses to those comments.

Recommendation:

☒ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Public Participation section of the TMDL document describes the public participation process that has occurred during the development of the TMDL. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization.

COMMENTS: None.

6. Monitoring Strategy

TMDLs may have significant uncertainty associated with the selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL document to articulate the means by which the TMDL will be evaluated in the field, and to provide for future supplemental data that will address any uncertainties that may exist when the document is prepared.

Minimum Submission Requirements:

☒ When a TMDL involves both NPDES permitted point source(s) and nonpoint source(s) allocations, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring.

☐ Under certain circumstances, a phased TMDL approach may be utilized when limited existing data are relied upon to develop a TMDL, and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but

may be necessary to support a rationale for approving the TMDL.
http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs. The Monitoring Strategy section acknowledges that monitoring is a critical component of the implementation phase, but does not provide any details on when or where monitoring will be conducted.

COMMENTS: None.

7. Restoration Strategy

The overall purpose of the TMDL analysis is to determine what actions are necessary to ensure that the pollutant load in a waterbody does not result in water quality impairment. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document. During the TMDL analytical process, information is often gained that may serve to point restoration efforts in the right direction and help ensure that resources are spent in the most efficient manner possible. For example, watershed models used to analyze the linkage between the pollutant loading rates and resultant water quality impacts might also be used to conduct "what if" scenarios to help direct BMP installations to locations that provide the greatest pollutant reductions. Once a TMDL has been written and approved, it is often the responsibility of other water quality programs to see that it is implemented. The level of quality and detail provided in the restoration strategy will greatly influence the future success in achieving the needed pollutant load reductions.

Minimum Submission Requirements:

☒ EPA is not required to and does not approve TMDL implementation plans. However, in cases where a WLA is dependent upon the achievement of a LA, "reasonable assurance" is required to demonstrate the necessary LA called for in the document is practicable). A discussion of the BMPs (or other load reduction measures) that are to be relied upon to achieve the LA(s), and programs and funding sources that will be relied upon to implement the load reductions called for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Restoration Strategy section of the TMDL document mentions that implementation activities for Emanuel Creek were incorporated into the Lewis and Clark Implementation Project. It is recommended that sources located within 1 mile of the listed segment be the first priority for implementation.

COMMENTS: None.

8. Daily Loading Expression

The goal of a TMDL analysis is to determine what actions are necessary to attain and maintain WQS. The appropriate averaging period that corresponds to this goal will vary depending on the pollutant and the nature of the waterbody under analysis. When selecting an appropriate averaging period for a TMDL analysis, primary concern should be given to the nature of the pollutant in question and the achievement of the underlying WQS. However, recent federal appeals court decisions have pointed out that the title TMDL implies a "daily" loading rate. While the most appropriate averaging period to be used for developing a TMDL analysis may vary according to the pollutant, a daily loading rate can provide a more practical indication of whether or not the overall needed load reductions are being achieved. When limited monitoring resources are available, a daily loading target that takes into account the natural variability of the system can serve as a useful indicator for whether or not the overall load reductions are likely to be met. Therefore, a daily expression of the required pollutant loading rate is a required element in all TMDLs, in addition to any other load averaging periods that may have been used to conduct the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

☒ The document should include an expression of the TMDL in terms of a daily load. However, the TMDL may also be expressed in temporal terms other than daily (e.g., an annual or monthly load). If the document expresses the TMDL in additional "non-daily" terms the document should explain why it is appropriate or advantageous to express the TMDL in the additional unit of measurement chosen.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek E. coli TMDL includes daily loads expressed as cfu/day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
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http://www.epa.gov/region08

Ref: 8EPR-EP

AUG 10 2011

Steven M. Pirner
Secretary
South Dakota Department of Environment & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Re: TMDL Approvals
Emanuel Creek, E. coli;
SD-MI-R-EMANUEL_01

Dear Mr. Pirner:

We have completed our review of the total maximum daily loads (TMDLs) as submitted by your office for the waterbodies listed in the enclosure to this letter. In accordance with the Clean Water Act (33 U.S.C. 1251 *et. seq.*), we approve all aspects of the TMDL(s) referenced above as developed for the water quality limited waterbodies as described in Section 303(d)(1). Based on our review, we feel the separate elements of the TMDL(s) listed in the enclosed table adequately address the pollutants of concern as given in the table, taking into consideration seasonal variation and a margin of safety.

Thank you for submitting these TMDLs for our review and approval. If you have any questions, the most knowledgeable person on my staff is Vern Berry and he may be reached at 303-312-6234.

Sincerely,

Carol L. Campbell

Carol L. Campbell
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

ENCLOSURE 1: APPROVED TMDLs

Escherichia Coli Total Maximum Daily Load Evaluation for Emanuel Creek, Bon Homme County, South Dakota (SD DENR, May 2011)

Submitted: 6/28/2011

1	Pollutant TMDLs completed.
1	Causes addressed from the 2010 303(d) list.
0	Determinations that no pollutant TMDL needed.

Segment: Emanuel Creek

303(d) ID: SD-MI-R-EMANUEL_01

Parameter/Pollutant (303(d) list cause): E. COLI - 227

Water Quality Targets: <= 630 cfu/100mL

Allocation*	Value	Units	Permits
WLA	0	CFU/DAY	
LA	1.6E+11	CFU/DAY	
TMDL	1.8E+11		
MOS	2.2E+10	CFU/DAY	

Notes: The loads shown represent the loads during the midrange flow regime as defined by the load duration curve for Emanuel Creek (see Figure 4 of the TMDL). The midrange flows are when significant differences occur between the existing loads and the target loads, and represent the flow regime that is most likely to be targeted for BMP implementation.

* LA = Load Allocation, WLA = Wasteload Allocation, MOS = Margin of Safety, TMDL = sum(WLAs) + sum(LAs) + MOS

ENCLOSURE 2

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Total Maximum Daily Load Evaluation for Emanuel Creek, Bon Homme County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**June 28, 2011**
Review Date:	**August 4, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Final**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final review only):

- ☒ Approve
- ☐ Partial Approval
- ☐ Disapprove
- ☐ Insufficient Information

Approval Notes to Administrator:

This document provides a standard format for EPA Region 8 to provide comments to state TMDL programs on TMDL documents submitted to EPA for either formal or informal review. All TMDL documents are evaluated against the minimum submission requirements and TMDL elements identified in the following 8 sections:

1. Problem Description
   - 1.1. .TMDL Document Submittal Letter
   - 1.2. Identification of the Waterbody, Impairments, and Study Boundaries
   - 1.3. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
   - 4.1. Data Set Description
   - 4.2. Waste Load Allocations (WLA)
   - 4.3. Load Allocations (LA)
   - 4.4. Margin of Safety (MOS)
   - 4.5. Seasonality and variations in assimilative capacity
5. Public Participation
6. Monitoring Strategy
7. Restoration Strategy
8. Daily Loading Expression

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant

loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant. A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's minimum submission requirements relative to that section, a brief summary of the EPA reviewer's findings, and the reviewer's comments and/or suggestions. Use of the verb "must" in the minimum submission requirements denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable.

This review template is intended to ensure compliance with the Clean Water Act and that the reviewed documents are technically sound and the conclusions are technically defensible.

1. Problem Description

A TMDL document needs to provide a clear explanation of the problem it is intended to address. Included in that description should be a definitive portrayal of the physical boundaries to which the TMDL applies, as well as a clear description of the impairments that the TMDL intends to address and the associated pollutant(s) causing those impairments. While the existence of one or more impairment and stressor may be known, it is important that a comprehensive evaluation of the water quality be conducted prior to development of the TMDL to ensure that all water quality problems and associated stressors are identified. Typically, this step is conducted prior to the 303(d) listing of a waterbody through the monitoring and assessment program. The designated uses and water quality criteria for the waterbody should be examined against available data to provide an evaluation of the water quality relative to all applicable water quality standards. If, as part of this exercise, additional WQS problems are discovered and additional stressor pollutants are identified, consideration should be given to concurrently evaluating TMDLs for those additional pollutants. If it is determined that insufficient data is available to make such an evaluation, this should be noted in the TMDL document.

1.1 TMDL Document Submittal Letter

When a TMDL document is submitted to EPA requesting formal comments or a final review and approval, the submittal package should include a letter identifying the document being submitted and the purpose of the submission.

Minimum Submission Requirements.

☒ A TMDL submittal letter should be included with each TMDL document submitted to EPA requesting a formal review.

☒ The submittal letter should specify whether the TMDL document is being submitted for initial review and comments, public review and comments, or final review and approval.

☒ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek E. coli TMDL was submitted to EPA for review and approval via an email from Cheryl Saunders, SD DENR on June 28, 2011. The email included the final TMDL document and a letter requesting approval of the TMDL.

COMMENTS: None

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied. Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

☒ The TMDL document should clearly identify the pollutant and waterbody segment(s) for which the TMDL is being established. If the TMDL document is submitted to fulfill a TMDL development requirement for a waterbody on the state's current EPA approved 303(d) list, the TMDL document submittal should clearly identify the waterbody and associated impairment(s) as they appear on the State's/Tribe's current EPA approved 303(d) list, including a full waterbody description, assessment unit/waterbody ID, and the priority ranking of the waterbody. This information is necessary to ensure that the administrative record and the national TMDL tracking database properly link the TMDL document to the 303(d) listed waterbody and impairment(s).

☒ One or more maps should be included in the TMDL document showing the general location of the waterbody and, to the maximum extent practical, any other features necessary and/or relevant to the understanding of the TMDL analysis, including but not limited to: watershed boundaries, locations of major pollutant sources, major tributaries included in the analysis, location of sampling points, location of discharge gauges, land use patterns, and the location of nearby waterbodies used to provide surrogate information or reference conditions. Clear and concise descriptions of all key features and their relationship to the waterbody and water quality data should be provided for all key and/or relevant features not represented on the map.

☐ If information is available, the waterbody segment to which the TMDL applies should be identified/geo-referenced using the National Hydrography Dataset (NHD). If the boundaries of the TMDL do not correspond to the Waterbody ID(s) (WBID), Entity_ID information or reach code (RCH_Code) information should be provided. If NHD data is not available for the waterbody, an alternative geographical referencing system that unambiguously identifies the physical boundaries to which the TMDL applies may be substituted.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Emanuel Creek is a stream located in Bon Homme, South Dakota and is part of the larger Missouri River watershed in the Lewis and Clark Lake sub-basin (HUC 10170101). The listed river segment contains a small portion of the watershed drainage area of approximately 120,000 acres in south eastern South Dakota, and includes approximately 16.1 miles of the stream from S20, T94N, R60W to its mouth (i.e., to the confluence with Lewis and Clark Lake; SD-MI-R-EMANUEL_01). It is listed as a high priority for TMDL development.

The designated uses for Emanuel Creek include warmwater semipermanent fish life propagation waters, limited-contract recreation waters, irrigation, fish and wildlife propagation, recreation, and stock

watering. The segment was listed on the 2010 303(d) list for E. coli and fecal coliform which are impairing the recreational use and for total suspended solids (TSS) which is impairing the aquatic life use. EPA approved Emanuel Creek TMDLs for fecal coliform and TSS in September 2009.

COMMENTS: None.

1.3 Water Quality Standards

TMDL documents should provide a complete description of the water quality standards for the waterbodies addressed, including a listing of the designated uses and an indication of whether the uses are being met, not being met, or not assessed. If a designated use was not assessed as part of the TMDL analysis (or not otherwise recently assessed), the documents should provide a reason for the lack of assessment (e.g., sufficient data was not available at this time to assess whether or not this designated use was being met).

Water quality criteria (WQC) are established as a component of water quality standard at levels considered necessary to protect the designated uses assigned to that waterbody. WQC identify quantifiable targets and/or qualitative water quality goals which, if attained and maintained, are intended to ensure that the designated uses for the waterbody are protected. TMDLs result in maintaining and attaining water quality standards by determining the appropriate maximum pollutant loading rate to meet water quality criteria, either directly, or through a surrogate measurable target. The TMDL document should include a description of all applicable water quality criteria for the impaired designated uses and address whether or not the criteria are being attained, not attained, or not evaluated as part of the analysis. If the criteria were not evaluated as part of the analysis, a reason should be cited (e.g., insufficient data were available to determine if this water quality criterion is being attained).

Minimum Submission Requirements:

☒ The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)).

Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.

☒ The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.

☐ If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Emanuel Creek is listed as impaired based on E. coli concentrations that are impairing the limited contact recreation beneficial uses. South Dakota has numeric standards for E. coli that are applicable to this stream segment. The E. coli numeric standards being implemented in this TMDL are: a single sample maximum value of ≤ 1178 cfu/100 mL, and a 30-day geometric mean of ≤ 630 cfu/ 100 mL. Discussion of additional applicable water quality standards for Emanuel Creek can be found on pages 5 - 6 of the TMDL document.

COMMENTS: None.

2. Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddeness, stream morphology, up-slope conditions and a measure of biota).

Minimum Submission Requirements:

☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained.

Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.

☐ When a numeric TMDL target is established to ensure the attainment of a narrative water quality criterion, the numeric target, the methodology used to determine the numeric target, and the link between the pollutant of concern and the narrative water quality criterion should all be described in the TMDL document. Any additional information supporting the numeric target and linkage should also be included in the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The water quality target for this TMDL is based on the numeric water quality standards for E. coli established to protect the limited contact recreation beneficial uses for Emanuel Creek. The target for the Emanuel Creek segment included in the TMDL document is the E. coli standard expressed as the 30-day geometric mean of 630 cfu/100 mL during the recreation season from May 1 to September 30.

While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each significant source (or source category) should be identified and quantified to the maximum practical extent. This may be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach may be appropriate. The approach should be clearly defined in the document.

Minimum Submission Requirements:

☒ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.

☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.

☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.

☒ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (61%), grassland / rangeland (32%) and water/wetlands, developed or forest land (7%).

There are no point sources that discharge to the impaired segment of Emanuel Creek.

Nonpoint sources of E. coli bacteria in Emanuel Creek come primarily from agricultural sources. Data from the 2004 National Agricultural Statistic Survey (NASS) and from the 2002 South Dakota Game Fish

and Parks county wildlife assessment were utilized for livestock and wildlife densities, respectively. Animal density information was used to estimate relative source contributions of bacteria loads as summarized in Table 2 of the TMDL document.

Livestock in the basin are predominantly beef cattle. Livestock can contribute E. coli bacteria directly to the stream by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands, which then get washed off during precipitation events. Table 3, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. Feedlots include any type of livestock confined to un-vegetated areas including wintering operations. Livestock on grass encompass all remaining livestock within the watershed.

Table 3. Fecal Source Allocation for Emanuel Creek.

Source	Percentage
Feedlots	41.7%
Livestock on Grass	54.9%
Wildlife	3.5%

There are an estimated 97 animal feeding operations in the Emanuel Creek watershed, many of which are contributors to the bacteria load, particularly during runoff events. Based on the National Agricultural Statistics report, approximately 40% of the cattle present in the watershed may be found in feedlots. The majority of pigs in the watershed may also be assumed to be in some type of confined feeding area.

There are no municipalities or other point sources that discharge to Emanuel Creek. Septic systems were determined to be an insignificant contributing source to the bacteria loads in the creek based on the following information. Human bacteria production may be estimated at 1.95E+09. The human population of Emanuel Creek from the 2000 census was estimated at 1250 people, or 6.5 per square mile. When included as a total load in the table, human produced fecals account for 6 percent of all bacteria produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no bacteria entering the stream. At a failure rate of 3 percent, even assuming complete pass through of failing systems and direct delivery to the stream, the contributions from septic systems may be estimated at less than 0.17 percent, or negligible considering that this likely an overestimation of the actual delivered load.

COMMENTS: None.

4. TMDL Technical Analysis

TMDL determinations should be supported by a robust data set and an appropriate level of technical analysis. This applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader.

A TMDL analysis determines the maximum pollutant loading rate that may be allowed to a waterbody without violating water quality standards. The TMDL analysis should demonstrate an understanding of the relationship between the rate of pollutant loading into the waterbody and the resultant water quality impacts. This stressor → response relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and load allocations needs to be clearly articulated and supported by an

appropriate level of technical analysis. Every effort should be made to be as detailed as possible, and to base all conclusions on the best available scientific principles.

The pollutant loading allocation is at the heart of the TMDL analysis. TMDLs apportion responsibility for taking actions by allocating the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways, such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or division of responsibility.

The pollutant loading allocation that will result in achievement of the water quality target is expressed in the form of the standard TMDL equation:

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = The portion of the Load Capacity allocated to the Margin of safety.

Minimum Submission Requirements:

☒ A TMDL must identify the loading capacity of a waterbody for the applicable pollutant, taking into consideration temporal variations in that capacity. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

☒ The TMDL document should describe the methodology and technical analysis used to establish and quantify the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

☒ It is necessary for EPA staff to be aware of any assumptions used in the technical analysis to understand and evaluate the methodology used to derive the TMDL value and associated loading allocations. Therefore, the TMDL document should contain a description of any important assumptions (including the basis for those assumptions) made in developing the TMDL, including but not limited to:

(1) the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
(2) the distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) a presentation of relevant information affecting the characterization of the pollutant of concern and its allocation to sources such as population characteristics, wildlife resources, industrial activities etc…;
(4) present and future growth trends, if taken into consideration in determining the TMDL and preparing the TMDL document (e.g., the TMDL could include the design capacity of an existing or planned wastewater treatment facility);
(5) an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

☒ The TMDL document should contain documentation supporting the TMDL analysis, including an inventory of the data set used, a description of the methodology used to analyze the data, a discussion of strengths and weaknesses in the analytical process, and the results from any water quality modeling used. This information is necessary for EPA to review the loading capacity determination, and the associated load, wasteload, and margin of safety allocations.

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

☐ Where both nonpoint sources and NPDES permitted point sources are included in the TMDL loading allocation, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document must include a demonstration that nonpoint source loading reductions needed to implement the load allocations are actually practicable [40 CFR 130.2(i) and 122.44(d)].

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Emanuel Creek TMDL describes how the E. coli loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data for Emanuel Creek was collected during the Lewis and Clark watershed assessment from a single sampling point near the mouth of the creek. The Aquarius program was used to generate simulated discharge data using the long-term gauge at Choteau Creek (approximately 20 years flow record) to provide a sufficient data set to develop a load duration curve. Choteau Creek was chosen due to its close proximity, similar basin characteristics, and discharge intensities that were similar to Emanuel Creek when measured on a common date.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 3 distinct flow regimes – high flow ($\geq$ 15 cfs), midrange flow (between 15 cfs and 3 cfs) and dry flow (< 3 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 4 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at the 90th percentile of the observed E. coli bacteria load for each flow regime: high flow = 3.7E+12 cfu/day; midrange flow = 1.8E+11 cfu/day; and dry flow = 4.5E+10 cfu/day.

COMMENTS: None.

4.1 Data Set Description

TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis. An inventory of the data used for the TMDL analysis should be provided to document, for the record, the data used in decision making. This also provides the reader with the opportunity to independently review the data. The TMDL analysis should make use of all readily available data for the waterbody under analysis unless the TMDL writer determines that the data are not relevant or appropriate. For relevant data that were known but rejected,

an explanation of why the data were not utilized should be provided (e.g., samples exceeded holding times, data collected prior to a specific date were not considered timely, etc...).

Minimum Submission Requirements:

☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.

☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data for Emanuel Creek was collected during the Lewis and Clark watershed assessment from a single sampling point located near the mouth of the creek.

An absence of literature pertaining specifically to E. coli concentrations resulted in a need to augment the data set with fecal coliform data. E. coli are a type of fecal coliform, as such; fecal coliform data make an acceptable surrogate. A variety of literature values are available suggesting that E. coli constitute in excess of 60 percent of fecal coliform found in the environment. A large number of paired E. coli and fecal coliform samples were available in ecoregion 42. Data were transformed to a normal distribution from which a linear trend could be calculated. The resulting function suggests that for ecoregion 42, a nearly 1:1 ratio of fecal coliform to E. coli exists. The relatively strong coefficient of determination allows for the reasonable substitution of fecal coliform data in an absence of sufficient E. coli data.

Analytical results from bacteria sampling exceeded the acute standard for 6 of the 23 samples for fecal coliform and 8 of the 22 samples for E. coli. The violations appear to be primarily storm event driven with the highest counts occurring at or above 20 cfs; however counts that were elevated, but not in excess of the standard were routinely measured during base-flow conditions, suggesting improvements to riparian condition may also provide some benefits to the health of the stream.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

Waste Load Allocations represent point source pollutant loads to the waterbody. Point source loads are typically better understood and more easily monitored and quantified than nonpoint source loads. Whenever practical, each point source should be given a separate waste load allocation. All NPDES permitted dischargers that discharge the pollutant under analysis directly to the waterbody should be identified and given separate waste load allocations. The finalized WLAs are required to be incorporated into future NPDES permit renewals.

Minimum Submission Requirements:

☒ EPA regulations require that a TMDL include WLAs for all significant and/or NPDES permitted point sources of the pollutant. TMDLs must identify the portion of the loading capacity allocated to individual existing and/or future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than

one discharger, e.g., if the source is contained within a general permit. If no allocations are to be made to point sources, then the TMDL should include a value of zero for the WLA.

☒ All NPDES permitted dischargers given WLA as part of the TMDL should be identified in the TMDL, including the specific NPDES permit numbers, their geographical locations, and their associated waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: There are no point sources that discharge to the impaired segment of Emanuel Creek. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:

☒ EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.

☒ Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Watershed Characteristics section of the TMDL explains that the landuse in the watershed is predominately agricultural consisting of cropland (61%), grassland / rangeland (32%) and water/wetlands, developed or forest land (7%). Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Table 5 includes the load allocations at each of the flow regimes – 3.26E+12 cfu/day at high flows; 1.6E+11 cfu/day at midrange flows; and 1.2E+10 cfu/day during dry conditions.

COMMENTS: None.

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL. The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

☒ TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

- ☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.
- ☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.
- ☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Table 5 of the TMDL.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary based on seasonal considerations. Therefore, it is appropriate that the TMDL

analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

☒ The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variability as a factor. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in E. coli loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months.

COMMENTS: None.

5. Public Participation

EPA regulations require that the establishment of TMDLs be conducted in a process open to the public, and that the public be afforded an opportunity to participate. To meaningfully participate in the TMDL process it is necessary that stakeholders, including members of the general public, be able to understand the problem and the proposed solution. TMDL documents should include language that explains the issues to the general public in understandable terms, as well as provides additional detailed technical information for the scientific community. Notifications or solicitations for comments regarding the TMDL should be made available to the general public, widely circulated, and clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for approval, a copy of the comments received by the state and the state responses to those comments should be included with the document.

Minimum Submission Requirements:
☒ The TMDL must include a description of the public participation process used during the development of the TMDL (40 C.F.R. §130.7(c)(1)(ii)).

☒ TMDLs submitted to EPA for review and approval should include a summary of significant comments and the State's/Tribe's responses to those comments.

Recommendation:
☒ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Public Participation section of the TMDL document describes the public participation process that has occurred during the development of the TMDL. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization.

COMMENTS: None.

6. Monitoring Strategy

TMDLs may have significant uncertainty associated with the selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL document to articulate the means by which the TMDL will be evaluated in the field, and to provide for future supplemental data that will address any uncertainties that may exist when the document is prepared.

Minimum Submission Requirements:

☒ When a TMDL involves both NPDES permitted point source(s) and nonpoint source(s) allocations, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring.

☐ Under certain circumstances, a phased TMDL approach may be utilized when limited existing data are relied upon to develop a TMDL, and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but may be necessary to support a rationale for approving the TMDL. http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs. The Monitoring Strategy section acknowledges that monitoring is a critical component of the implementation phase, but does not provide any details on when or where monitoring will be conducted.

COMMENTS: None.

7. Restoration Strategy

The overall purpose of the TMDL analysis is to determine what actions are necessary to ensure that the pollutant load in a waterbody does not result in water quality impairment. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document. During the TMDL analytical process, information is often gained that may serve to point restoration efforts in the right direction and help ensure that resources are spent in the most efficient manner possible. For example, watershed models used to analyze the linkage between the pollutant loading rates and resultant water quality impacts might also be used to conduct "what if" scenarios to help direct BMP installations to locations that provide the greatest pollutant reductions. Once a TMDL has been written and approved, it is often the responsibility of other water quality programs to see that it is implemented. The level of quality and detail provided in the restoration strategy will greatly influence the future success in achieving the needed pollutant load reductions.

Minimum Submission Requirements:

☒ EPA is not required to and does not approve TMDL implementation plans. However, in cases where a WLA is dependent upon the achievement of a LA, "reasonable assurance" is required to demonstrate the necessary LA called for in the document is practicable). A discussion of the BMPs (or other load reduction measures) that are to be relied upon to achieve the LA(s), and programs and funding sources that will be relied upon to implement the load reductions called for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Restoration Strategy section of the TMDL document mentions that implementation activities for Emanuel Creek were incorporated into the Lewis and Clark Implementation Project. It is recommended that sources located within 1 mile of the listed segment be the first priority for implementation.

COMMENTS: None.

8. Daily Loading Expression

The goal of a TMDL analysis is to determine what actions are necessary to attain and maintain WQS. The appropriate averaging period that corresponds to this goal will vary depending on the pollutant and the nature of the waterbody under analysis. When selecting an appropriate averaging period for a TMDL analysis, primary concern should be given to the nature of the pollutant in question and the achievement of the underlying WQS. However, recent federal appeals court decisions have pointed out that the title TMDL implies a "daily" loading rate. While the most appropriate averaging period to be used for developing a TMDL analysis may vary according to the pollutant, a daily loading rate can provide a more practical indication of whether or not the overall needed load reductions are being achieved. When limited monitoring resources are available, a daily loading target that takes into account the natural variability of the system can serve as a useful indicator for whether or not the overall load reductions are likely to be met. Therefore, a daily expression of the required pollutant loading rate is a required element in all TMDLs, in addition to any other load averaging periods that may have been used to conduct the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

☒ The document should include an expression of the TMDL in terms of a daily load. However, the TMDL may also be expressed in temporal terms other than daily (e.g., an annual or monthly load). If the document expresses the TMDL in additional "non-daily" terms the document should explain why it is appropriate or advantageous to express the TMDL in the additional unit of measurement chosen.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Emanuel Creek E. coli TMDL includes daily loads expressed as cfu/day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.