FECAL COLIFORM BACTERIA TOTAL MAXIMUM DAILY LOAD EVALUATION FOR BRULE CREEK, UNION COUNTY, SOUTH DAKOTA

South Dakota Department of
Environment and Natural Resources

Protecting South Dakota's Tomorrow ... Today

Prepared by:

Andrew Kopp
South Dakota Department of
Environment and Natural Resources
Water Resources Assistance Program

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Total Maximum Daily Load Summary Table

Brule Creek Fecal Coliform Total Maximum Daily Load	
Entity ID:	SD-BS-R-BRULE_01
Location:	HUC Code: 10170203
Size of Watershed:	67,672 acres
Water Body Type:	River/Stream
303(d) Listing Parameter:	Fecal Coliform Bacteria
Initial Listing Date:	2010 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	Big Sioux River to the confluence of East and West Brule Creek
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards 74:51:01:51
Indicators:	Fecal Coliform Bacteria Counts
Threshold Value:	< 1000 colonies/100 ml geometric mean concentration with maximum single sample concentrations of <2000 colonies/100 ml
High Flow Zone LA:	3.1E+16 (cfu/day)
High Flow Zone WLA:	-
High Flow Zone MOS:	2.8E+12 (cfu/day)
High Flow Zone TMDL:	3.1E+16 (cfu/day)

1.0 Introduction

The intent of this document in to clearly identify the components of the Total Maximum Daily Load (TMDL) submittal to support adequate public participation and facilitate the United States 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 the EPA. This TMDL document addresses the fecal coliform bacteria impairment of Brule Creek from the Big Sioux River to the confluence of East and West Brule Creek, SD-BS-R-BRULE_01.

1.1 Watershed Characteristics

Brule Creek drains 67,672 acres in southeast South Dakota and discharges to the Big Sioux River north of Elk Point, South Dakota (Figure 1). The stream receives runoff from agricultural operations. During the assessment, data was collected indicating the creek experiences periods of degraded water quality as a result of total suspended solids loads. This area includes both upper and lower Brule Creek. The landuse in the watershed consists of 71% row crops, 21% grass, 0.6% open spaces, 1.4% small grains, 4.4% developed (including roads and farmsteads), and 1.7% forested

The impaired reach of Brule Creek lies within Union County. Common soil associations on the uplands in the watershed include Wentworth-Shindler-Worthing, Wakonda-Worthing-Chancellor, Moody-Nora-Alcester, and Cropfton-Nora-Alcester. Graceville-Dempster soil association comprises the stream terraces. The bottomland soil associations include Calco-Kennebec, Kennebec-Fluvaquents-Benclare, Forney-Luton, and Modale-Blyburg-Benclare. Two of these soil associations, Calco-Kennebec and Kennebec-Fluvaquents-Benclare, are used for grazing purposes and make up the majority of the soil associations occurring in the bottomlands (USDA, 1978)

Union County is characterized by hot summer and cold winters. Most of the precipitation (78%) occurs during the growing season and rainfall is normally heaviest late in spring and early in summer. Average annual precipitation is 24.9 inches, of this about 19 inches usually falls in April through September. Snowfall accumulations typically total 23 inches annually (USDA, 1978).

Brule Creek was assessed as an individual portion of the larger Lower Big Sioux River Watershed Assessment, which looked at individual streams such as Brule Creek as well as the entire drainage basin and the cumulative effects of the individual waterbodies.

South Dakota has recently adopted *Escherichia coli* criteria for the protection of the limited contact and immersion recreation uses. However, Brule Creek does not require an *E. coli* TMDL because the parameter is not currently listed as a cause of impairment to this stream. Because the two indicators are closely related, the fecal coliform bacteria TMDL and associated implementation strategy described in this document are expected to address both the fecal coliform bacteria and possible future *E. coli* impairment. If a

TMDL must be established for *E. coli* in the future, a separate TMDL document will be developed for this parameter.

Segment SD-BS-R-BRULE_01 was listed for total suspended solids (TSS) and fecal coliform bacteria in the 2010 Integrated Report (SDDENR, 2010). This TMDL will address the fecal coliform bacteria listing.

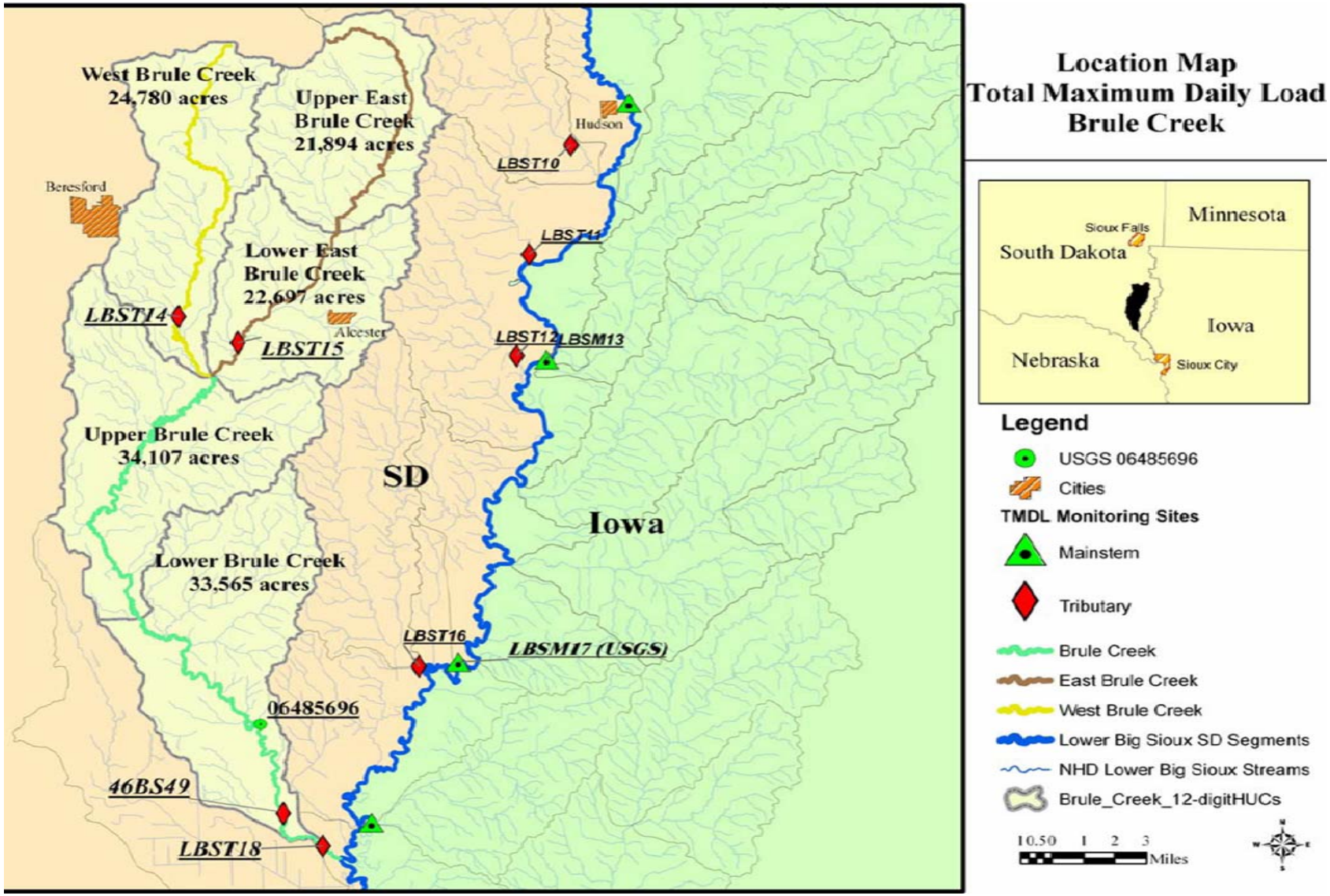

Figure 1. Brule Creek Watershed location in South Dakota

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.

Brule Creek from the Big Sioux River to the confluence of East and West Brule Creek has been assigned the beneficial uses of: warm water marginal 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 Brule Creek is 1000 cfu/100 ml, which is based on the chronic standard for fecal coliform. The fecal coliform criteria for the limited contact recreation beneficial use requires that 1) no sample exceeds 2000 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hour periods must not exceed 1000 cfu/100 ml. These criteria are applicable from May 1 through September 30.

Table 1. State Water Quality Standards for Brule 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/L30 average May 1 to October 31	Warmwater Marginal Fish 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 30	
	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 Marginal Fish Propagation
Total Suspended Solids	≤150 (mean) ≤263 (single sample)	mg/L	Warmwater Marginal Fish Propagation
Temperature	≤32	°C	Warmwater Marginal Fish Propagation
Fecal Coliform Bacteria (May 1 – Sept 30)	≤1,000 (geometric mean) ≤2,000 (single sample)	count/100 ml	Limited Contact Recreation
Escheria coli Bacteria (May 1 – Sept 30)	≤630 (geometric mean) ≤1,178 (single sample)	count/100 ml	Limited Contact Recreation
Alkalinity (CaCO3)	≤750 (mean) ≤1,313 (single sample)	mg/L	Wildlife Propagation and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	µmhos/cm @ 25° C	Irrigation Waters
Nitrogen, Nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Wildlife Propagation and Stock Watering
pH (standard Units	≥6.0 to ≤9.0	units	Warmwater Marginal Fish Propagation
Solids, Total Dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Wildlife Propagation and Stock Watering
Total Pteroleum Hydrocarbon Oil and Grease	≤10 ≤10	mg/L mg/L	Wildlife Propagation and Stock Watering
Sodium Absorption Ratio	≤10	ratio	Irrigation Waters

3.0 Significant Sources

3.1 Nonpoint Sources

Nonpoint sources of fecal coliform bacteria in Brule Creek come primarily from agricultural sources. Data from the 2009 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 (Table 3) was used to estimate relative source contributions of bacteria loads.

3.1.1 Agriculture

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are predominantly hogs and beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. They also can contribute by defecating while grazing on rangelands that get washed off during precipitation events. Table 2 allocates the sources for bacteria production in the watershed into three primary categories. The summary is based on several assumptions. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass.

Table 2. Fecal Source Allocation for Brule Creek.

Source	Percentage
Feedlots	81.2%
Livestock on Grass	18.0%
Wildlife	0.8%

3.1.2 Natural background/wildlife

Wildlife within the watershed is a natural background source of fecal coliform bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Table 3).

Table 3. Brule Creek Potential Nonpoint Sources

Species	#/sq mile	#/acre	FC/Animal/Day	Fecal Coliform	Percent
Dairy Cow	1.52	2.4E-03	4.46E+10	7.18E+12	< 0.01%
Beef	15.22	2.4E-02	3.90E+14	6.28E+17	99.97%
Hog	122.31	1.91E-01	1.08E+10	1.4E+14	0.02%
Sheep	3.11	4.86E-03	1.96E+10	6.45E+12	< 0.01%
Horse	0.43	6.73E-04	5.15E+10	2.34E+12	< 0.01%
All Wildlife	Sum of all Wildlife			1.73326E+12	< 0.01%
Partridge[2]	2.43	3.8E-03	1.40E+08	3.6E+10	
Deer[3]	5.86	9.2E-03	3.47E+08	2.15E+11	
Beaver[3]	2.21	3.5E-03	2.00E+05	4.67E+7	
Raccoon[3]	4.42	6.9E-03	2.50E+08	1.17E+11	
Coyote/Fox[4]	1.83	2.9E-03	1.75E_09	3.39E+11	
Muskrat[1]	3.32	5.2E-03	2.50E+07	8.78E+09	
Opossom[5]	2.29	4.7E-03	2.50E+08	7.9E+10	
Mink[5]	1.66	2.6E-03	2.50E+08	4.39E+10	
Skunk[5]	2.88	4.5E-03	2.50E+08	7.61E+10	
Badger[5]	1.11	1.7E-03	2.50E+08	2.93E+10	
Jackrabbit[5]	1.77	2.8E-03	2.50E+08	4.68E+10	
Cottontail[5]	14.16	2.2E-02	2.50E+08	3.74E+11	
Squirrel[5]	13.94	2.2E-02	2.50E+08	3.68E+11	
1 USEPA 2001					
2 FC/Animal/Day copied from chicken (USEPA 2001) to provide an estimate of background affects of wildlife					
3 Bacteria Indicator Tool worksheet					
4 Best professional judgement based off of dogs					
5 FC/Animal/Day copied from raccoon to provide a more conservative estimate of background affects of wildlife					

3.1.4 Tributary Contributions

West Brule and East Brule Creek flow into Brule Creek. These tributaries drain portions of Union and Lincoln County. Brule Creek is currently listed for fecal coliform and TSS which impact the beneficial uses of limited contact recreation and warmwater marginal fish life propagation. There is one point discharge on East Brule Creek located at Alcester. Percent current contributions of the tributaries and the TMDL percent contributions are listed in Table 4.

Table 4. Percent contribution of fecal coliform loading of East and West Brule Creek to Brule Creek.

Site		Flow Zones				
		0-10%	10-40%	40-60%	60-90%	90-100%
LBST14	Current Loading	2.97E+15	1.22E+13	1.11E+09	1.15E+12	-
	Current Percent Contribution	1.06E-02	8.13E-02	5.05E-05	2.21E+01	-
	TMDL Loading	1.12E+14	2.02E+12	2.22E+11	1.68E+11	2.20E+10
	TMDL Percent Contribution	3.61E-01	6.52E-01	1.01E+00	3.50E+00	5.64E+00
LBST15	Current Loading	5.88E+17	2.27E+15	1.16E+14	1.24E+13	-
	Current Percent Contribution	2.10E+00	1.51E+01	5.27E+00	2.38E+02	-
	TMDL Loading	2.00E+08	1979980	191943.5	66844.12	15490.89
	TMDL Percent Contribution	6.45E-07	6.39E-07	8.72E-07	1.39E-06	3.97E-06
LBST18	Current Loading	2.80E+19	1.50E+16	2.20E+15	5.20E+12	1.90E+12
	TMDL Loading	3.10E+16	3.10E+14	2.20E+13	4.80E+12	3.90E+11

4.0 Technical Analysis

4.1 Data Collection Method

Data on Brule Creek was collected during the Lower Big Sioux River Watershed Assessment from sampling points located throughout upper and lower Brule Creek. These include LBST18, 46bs49, 46bsa10, 460166, 460167, and 460168. Average daily flows were tied to fecal coliform samples and this data was used to develop the load duration curve (LBST18).

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 Flow Analysis

This TMDL was developed using the Load Duration Curve (LDC) approach that results in a flow-variable target that considers the entire flow regime. The LDC is a dynamic expression of the allowable load for any given flow.

Continuous flow data was collected at LBST18 from 2002 to 2004. Additionally USGS flow data exists for LBST from 1982 to 1994. Average daily flow data and fecal coliform samples dating from 2002 to 2004 and 2010 were used to create a load duration curve. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones representing high flows (0-10 percent), moist conditions (10-40 percent), mid-range flows (40-60 percent), dry conditions (60-90 percent),and low flows (90-100 percent) (USEPA, 2006).

4.3 Sample Data

Sample data from the assessment project were utilized to evaluate the stream. A total of 45 samples were available for the LDC analysis (Figure 2). Comparing flow and concentration resulted in a very weak relationship that was inadequate for use in predicting daily loads. Twenty four of the 45 samples were above the chronic standard while twenty of those exceeded the acute standard (Table 5).

Table 5. Brule Creek fecal coliform bacteria sample data (italicized samples in light grey exceeded the chronic standard and bolded italicized samples in dark grey cells exceeded the acute standard)

Date	Fecal Coliform Bacteria (cfu/100ml)	Average Daily Flow	Flow Zone
05/02/2002	100	66.4	Moist Conditions
05/29/2002	***140000***	***28***	***Mid-range Conditions***
06/20/2002	*2000*	*21.4*	*Mid-range Conditions*
07/02/2002	*1500*	*12.4*	*Dry Conditions*
07/10/2002	***93000***	***59.1***	***Moist Conditions***
07/17/2002	480	10.8	Dry Conditions
08/20/2002	***8600***	***15.7***	***Mid-range Conditions***
08/20/2002	***8600***	***15.7***	***Mid-range Conditions***
08/22/2002	***3700000***	***270.2***	***High Flows***
08/22/2002	***3700000***	***270.2***	***High Flows***
09/23/2002	210	9.8	Dry Conditions
09/23/2002	130	9.8	Dry Conditions
05/01/2003	***22000***	***73.7***	***Moist Conditions***
05/13/2003	*1500*	*114.6*	*Moist Conditions*
05/20/2003	*1100*	69.4	*Moist Conditions*
06/11/2003	***2300***	***37.6***	***Moist Conditions***
06/19/2003	300	32.8	Moist Conditions
06/24/2003	***30000***	***55.8***	***Moist Conditions***
06/26/2003	***18000***	***309.3***	***High Flows***
07/09/2003	***14000***	***269.4***	***High Flows***
07/22/2003	410	38.9	Moist Conditions
08/18/2003	150	11.3	Dry Conditions
08/20/2003	170	12.1	Dry Conditions
09/02/2003	330	8.7	Dry Conditions
09/02/2003	300	8.7	Dry Conditions
09/10/2003	***5800***	***31.1***	***Moist Conditions***
09/10/2003	***6000***	***31.1***	***Moist Conditions***
09/11/2003	**380000**	**127.6**	***Moist Conditions***
09/24/2003	750	13.3	Dry Conditions
05/10/2004	***140000***	***193.8***	***High Flows***
05/25/2004	***53000***	***333.8***	***High Flows***
06/02/2004	***4900***	***0.2***	***Low Flows***
06/02/2004	***3900***	***0.2***	***Low Flows***
06/16/2004	**2700**	**73.4**	***Moist Conditions***
06/29/2004	1000	58.5	Moist Conditions

Table 5. Continued

Date	Fecal Coliform Bacteria (cfu/100ml)	Average Daily Flow	Flow Zone
08/17/2004	290	24.4	Mid-range Conditions
08/17/2004	110	24.4	Mid-range Conditions
05/25/2010	460	84.7	Moist Conditions
05/25/2010	***3700***	***84.7***	***Moist Conditions***
05/25/2010	20	84.7	Moist Conditions
05/25/2010	430	84.7	Moist Conditions
08/23/2010	210	89.8	Moist Conditions
08/23/2010	130	89.8	Moist Conditions
08/24/2010	840	88.6	Moist Conditions
08/24/2010	260	88.6	Moist Conditions

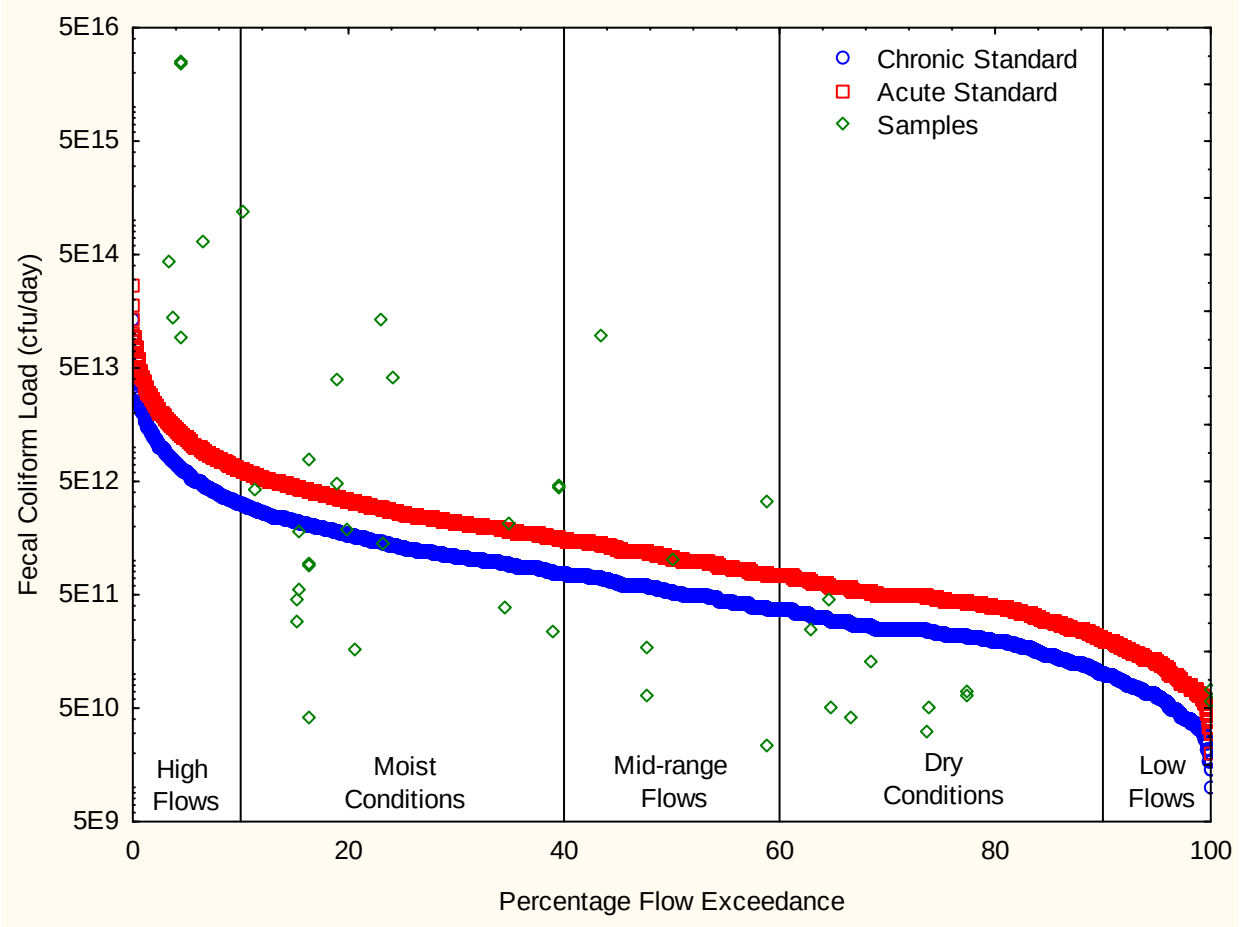

Figure 2. Brule Creek Fecal Coliform Bacteria Load Duration Curve

5.0 TMDL and Allocations

5.0.1 High Flows (<10% exceedance)

The high flow zone is composed of the highest 10% of flows that occurred in Brule Creek. The 10th percentile equates to a flow of about 142 cfs, which is higher than the one-year high flow event of 54 cfs.

There were six samples representing this zone and this all above both the acute and chronic standard. The 95% concentration of all samples in the zone was used to calculate the current load from which reductions were calculated. A load reduction of 99.9% will be needed to fully support designated beneficial uses to the chronic water quality standard. Table 6 depicts an example of a TMDL for a flow of 1119 cfs (95% flow in this zone) within the high flow zone regime. Higher and lower flows within this zone may acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

The concentration of 2000 cfu/100ml represents the acute standard and may make an appropriate goal for this flow zone because flows in excess of 129 cfs typically only last for short periods of time (peak runoff events).

While the 2000 cfu/100ml goal may have made an acceptable goal, the chronic threshold of 1000 cfu/100ml was chosen for the TMDL. Chronic violations are not likely in this flow zone, but by using the 1000 cfu/100ml threshold assurance is provided that the water quality standard will not be exceeded.

Table 6. High Flow Condition Total Maximum Daily Load

	Flow Zone (expressed as CFU/day)	
	High Flows	
	>129 cfs	
LA	3.1E+16	Remaining load after deducting WLA and MOS from TMDL
MOS	2.8E+12	
TMDL @1000 cfu/100 ml	3.1E+16	Standard multiplied by 95th % flow for zone
Current Load	2.8E+19	95th Percentile of observed fecal coliform bacteria load for each zone multiplied by 95% flow for zone
Load Reduction	99.9%	Reduction required to reduce the current load to the load at the standard

5.0.2 Moist Conditions (10% to 40% exceedance)

Moist condition flows are characterized by above average moisture conditions in the watershed. Flows in this regime are generated by precipitation and snowmelt events. The moist condition flows extend from approximately 129 cfs down to 31 cfs. Table 7 depicts an example of a TMDL for a flow of about 113 cfs (95% flow in this zone) within the moist condition regime. Higher and lower flows within this zone may acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Nine of 22 samples collected within this zone were above both the chronic threshold of 1000 cfu/100ml and the acute threshold of 2000 cfu/100 ml. Two of the 22 samples collected within this zone were above the chronic threshold of 1000 cfu/100 ml but not above the acute threshold. Flows within this zone may be expected to persist for several weeks on a regular basis. As a result of insufficient data to accurately assess the chronic standard, reductions will be based on the chronic threshold of 1000 cfu/100 ml. By utilizing 1000 cfu/100ml as the reduction target for a single sample maximum, it insures that both the chronic and acute standards are fully supported. A load reduction of 98% will be needed to fully support designated beneficial uses to the chronic water quality standard.

Table 7. Moist Condition Total Maximum Daily Load

	Flow Zone (expressed as CFU/day)	
	Moist Conditions 129 - 31 cfs	
LA	3.1E+14	Remaining load after deducting WLA and MOS from TMDL
MOS	5.4E+11	
TMDL @1000 cfu/100 ml	3.1E+14	Standard multiplied by 95th % flow for zone
Current Load	1.5E+16	95th Percentile of observed fecal coliform bacteria load for each zone multiplied by 95% flow for zone
Load Reduction	98%	Reduction required to reduce the current load to the load at the standard

5.0.3 Midrange Flows (40% to 60% exceedance)

The midrange flows extend from approximately 31 cfs down to 15 cfs. Of the six samples collected from this flow regime, three exceeded the chronic standard and acute thresholds. One sample violates the chronic standard. A load reduction of 99% will be needed to fully support designated beneficial uses to the chronic water quality standard. Table 8 depicts an example of a TMDL for a flow of 30 cfs (95% flow in this zone) within the midrange flow zone regime. Higher and lower flows within this zone may

acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Table 8. Midrange Condition Total Maximum Daily Load

	Flow Zone (expressed as CFU/day)	
	Midrange Conditions 31 – 15 cfs	
LA	2.2E+13	Remaining load after deducting WLA and MOS from TMDL
MOS	1.7E+11	
TMDL @1000 cfu/100 ml	2.2E+13	Standard multiplied by 95th % flow for zone
Current Load	2.2E+15	95th Percentile of observed fecal coliform bacteria load for each zone multiplied by 95% flow for zone
Load Reduction	99%	Reduction required to reduce the current load to the load at the standard

5.0.4 Dry Conditions (60% to 90% exceedance)

The dry condition flows extend from approximately 15 cfs down to 4.1 cfs. One of nine samples collected within this flow zone violated the chronic threshold of 1000 cfu/100ml. A load reduction of 7.6% will be needed to fully support designated beneficial uses to the chronic water quality standard. Table 9 depicts an example of a TMDL for a flow of 14 cfs (95% flow in this zone) within the dry condition regime. Higher and lower flows within this zone may acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Table 9. Dry Condition Total Maximum Daily Load

	Flow Zone (expressed as CFU/day)	
	Dry Conditions 15 – 4.1 cfs	
LA	4.7E+12	Remaining load after deducting WLA and MOS from TMDL
MOS	1.3E+11	
TMDL @1000 cfu/100 ml	4.8E+12	Standard multiplied by 95th % flow for zone
Current Load	5.2E+12	95th Percentile of observed fecal coliform bacteria load for each zone multiplied by 95% flow for zone
Load Reduction	7.6%	Reduction required to reduce the current load to the load at the standard

5.0.5 Low Flows (90% to 100% exceedance)

The low flows encompass the lowest ten percent of the flow regime. These flows are characterized by discharges of 4.1 cfs or less. Two samples were collected for this flow regime and both exceeded the chronic and acute thresholds. A load reduction of 79.4% will be needed to fully support designated beneficial uses to the chronic water quality standard. Table 10 depicts an example of a TMDL for a flow of 4 cfs (95% flow in this zone). Higher and lower flows within this zone may acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Table 10. Low Flow Total Maximum Daily Load

	Flow Zone (expressed as CFU/day)	
	Low Flows < 4.1 cfs	
LA	3.4E+11	Remaining load after deducting MOS from TMDL
MOS	5.1E+10	
TMDL @ 1000 cfu/100 ml	3.9E+11	Standard multiplied by 95th% flow for zone
Current Load	1.9E+12	95th Percentile of observed fecal coliform bacteria load for each zone multiplied by 95% flow for zone
Load Reduction	79%	Reduction required to reduce the current load to the load at the standard

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. A 99.9% reduction in fecal coliform bacteria from anthropogenic sources (livestock) is required in the high flow zone to fully attain the current chronic water quality standards. A 98% reduction in fecal coliform bacteria is required in the moist flow zone to fully attain current chronic water quality standards. A 99% reduction in fecal coliform bacteria is required in the midrange flow zone to fully attain current chronic water quality standards. A 7.6% reduction in fecal coliform bacteria is required in the dry conditions zone to fully attain current chronic water quality standards. A 79% reduction in fecal coliform bacteria is required in the low flow zone to fully attain current chronic water quality standards. Reducing the highest samples below the chronic standard provides assurance that both acute and chronic standards will be met.

6.0 Margin of Safety (MOS) and Seasonality

6.1 Margin of Safety

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 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.

6.2 Seasonality

The impairments to Brule Creek are most severe during summer (Figure 3). During this time period the creek is most likely to experience higher temperatures (encouraging livestock use of the stream) and peak recreational use of the waters. Typically, livestock are allowed to graze along the streams during the summer months. Combined with the peak in bacteria sources, high-intensity rainstorm events are common during the summer and produce a significant amount of fecal coliform loading due to bacterial wash-off from the watershed.

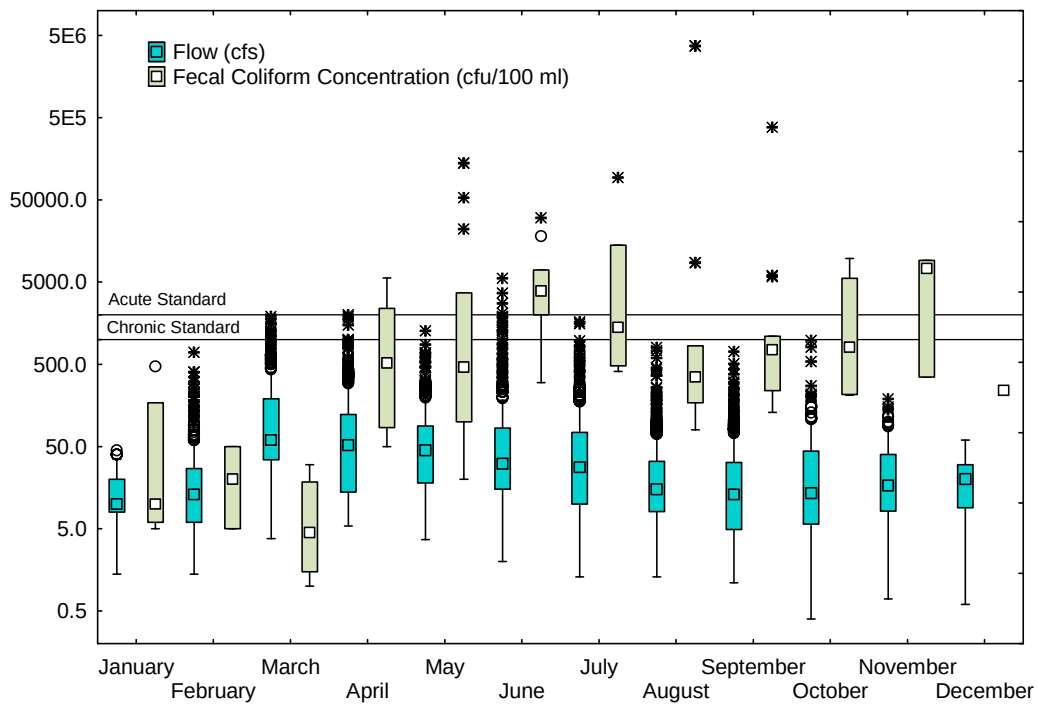

Figure 3. Monthly fecal coliform concentration and flow.

7.0 Public Participation

Efforts were taken to gain public education, review, and comment during the development of the TMDL involved:

1. Various public meetings were held during the Lower Big Sioux River assessment phase.

2. A webpage was developed and used during the course of the assessment.
3. Presentations were given to local groups on findings of the assessment.
4. 30-day public notice (PN) period for public review and comment in the Sioux City Journal, Yankton Daily Press and Dakotan, and the Sioux Falls Argus Leader..

8.0 Monitoring Strategy

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

Currently there is an implementation project targeting areas outlined by the Lower Big Sioux Pathogen TMDL. Project goals for improving fecal coliform bacteria impairment include: reduced access to streams for livestock, increased sources of alternative watering sources for livestock, and animal waste management systems.

10.0 Literature Cited

Huxoll, Cory. 2002. South Dakota Game Fish and Parks; South Dakota Game Report No. 2003-11; 2002 Annual Report County Wildlife Assessments with a summary of the 1991-2002 Assessments.

SDDENR (South Dakota Department of Environment and Natural Resources). 2010. The 2010 South Dakota Integrated Report for Surface Water Quality Assessment Pierre, SD.

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SDDENR (South Dakota Department of Environment and Natural Resources). 2011. Fecal Coliform Bacteria Total Maximum Daily Load Evaluation for East Brule Creek, Union County, South Dakota

USDA (United States Department of Agriculture). 1978. Soil Survey of Union County, South Dakota.

USEPA (U.S. Environmental Protection Agency). 2006. An Approach for Using Load Duration Curves in Developing TMDLs. U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Washington, DC.

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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.01-2006. St. Joseph, Mich.

Appendix A

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria Total Maximum Daily Load Evaluation for Brule Creek, Union County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**March 24, 2011**
Review Date:	**April 6, 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 Brule Creek fecal coliform TMDL was submitted to EPA for review via an email from Cheryl Saunders, SD DENR on March 24, 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: Brule Creek is a stream located in Union County, South Dakota and is part of the larger Big Sioux River watershed in the Lower Big Sioux sub-basin (HUC 10170203). The listed

segment has a drainage area of approximately 67,672 acres in south eastern South Dakota, and includes approximately 37 miles of stream from the confluence of East and West Brule Creek to the confluence with the Big Sioux River (SD-BS-R-BRULE_01). It is listed as a high priority for TMDL development.

The designated uses for Brule Creek include warmwater marginal 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 fecal coliform and total suspended solids which are impairing the recreational use. The TMDL document and this review, only address the fecal coliform impairment. The TSS impairment will be addressed in a separate document.

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, <u>all TMDL documents must be written to meet the existing water quality standards</u> 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: Brule Creek is listed as impaired based on fecal coliform concentrations for limited contact recreation. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream. The fecal coliform numeric standards being implemented in this TMDL are: a single sample maximum value of ≤ 2000 cfu/100 mL, and a 30-day geometric mean of ≤ 1000 cfu/ 100 mL. Discussion of additional applicable water quality standards for Brule Creek can be found on pages 6 and 7 of the TMDL.

South Dakota has adopted Escherichia coli criteria for the protection of the limited contact and immersion recreation uses. However, Brule Creek does not require an E. coli TMDL because the parameter is not currently listed as a cause of impairment to this stream segment. Because the two indicators are closely related, the fecal coliform bacteria TMDL and associated implementation strategy described in the TMDL document are expected to address both the fecal coliform bacteria and possible future E. coli impairments. If a TMDL must be established for E. coli in the future, a separate TMDL document will be developed for this parameter.

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 fecal coliform to achieve the limited contact recreation beneficial use for Brule Creek. The target for Brule Creek included in the TMDL document is the fecal coliform standard expressed as the 30-day geometric mean of 1000 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 row crops and small grains (72%), grassland / rangeland (21%), developed (4%), and water/wetlands or forest land (3%).

Alcester, South Dakota (permit number SD0021695) is the only municipality within the watershed that has a permitted waste water treatment facility. The city of Alcester's wastewater treatment facility discharges continuously to an unnamed tributary which flows approximately 1.5 miles before entering East Brule Creek, then flows an additional 4 miles before entering the listed segment of Brule Creek. A wasteload allocation is included in the TMDL for the discharge from this facility.

Nonpoint sources of fecal coliform bacteria in Brule Creek come primarily from agricultural sources. Data from the 2009 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 5 of the TMDL document.

Livestock in the basin are predominantly beef cattle and hogs. Livestock can contribute fecal coliform 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 4, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass. The main source of fecal coliform bacteria is likely overland runoff from livestock feedlots or livestock grazing in pastures.

Table 4. Fecal Source Allocation for Brule Creek.

Source	Percentage
Feedlots	81.2%
Livestock on Grass	18.0%
Wildlife	0.8%

The City of Alcester's wastewater treatment plant is the only point source is located in the Brule Creek watershed. This system accounts for about 885 people in the watershed and septic systems are assumed to be the primary human source for the rest of the population in the watershed.

Human fecal production may be estimated at 1.95E+9. When computed as a total load, the remaining population produced fecals accounting for about 1.4% of all fecal coliforms produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliforms entering the Creek.

COMMENTS: The TMDL for ***East*** Brule Creek includes the same WLA for Alcester's WWTP discharge as the TMDL for Brule Creek. Given that: 1) this load is fully accounted for in the TMDL for the upper reach (i.e., East Brule Creek); 2) there are no expected load reductions from this source; 3) there will be measureable pathogen decay by the time it reaches the start of the impaired segment of Brule Creek, and significantly more by the time it reaches LBST 18; and 4) any future changes in the WLA will require revising both TMDL documents, it seems unnecessary to include a WLA for Alcester's discharge in the Brule Creek TMDL. However, we have no objection to leaving the WLA in this TMDL if SD DENR feels strongly that the discharge is likely to impact the impaired segment of Brule Creek. Our recommendation is to remove the WLA for Alcester from the Brule Creek TMDL, or include an explanation of why it wouldn't be adequately controlled by the East Brule Creek TMDL or an explanation of how it is expected to present a significant load to Brule Creek.

Remedy: The WLA for Alcester was removed from the document.

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 Brule Creek TMDL describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data on Brule Creek was collected during the Lower Big Sioux River watershed assessment from sampling points located throughout upper and lower Brule Creek. These include LBST18, 46bs49, 46bsa10, 460166, 460167, and 460168. LBST18 has flows tied to fecal coliform samples and this data was used to develop the load duration curve. Continuous flow data was collected at LBST18 from 2002 to 2004. Additionally USGS flow data exists for LBST 18 from 1982 to 1994. Flow data and flow-linked fecal coliform samples dating from 2002 to 2004 and 2010 was used to create a load duration curve.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow ($\geq$ 129 cfs), moist flow (between 129 cfs and 31 cfs), midrange flow (between 31 cfs and 15 cfs), dry flow (between 15 cfs and 4.1 cfs), and low flow (< 4.1 cfs). The result is a flow-variable TMDL target across the flow regimes shown in Figure 2 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 95th percentile of the observed fecal coliform bacteria load for each flow regime: high flow = 3.06E+16 CFU/day; moist flow = 3.11E+14 CFU/day; midrange flow = 2.20E+13 CFU/day; dry flow = 4.79E+12 CFU/day; and low flow = x.xxE+xx CFU/day.

COMMENTS: Section 4.2 of the TMDL document mentions using 5 flow zones in the load duration curve. It would be helpful to show the vertical zone lines for each zone on the LDC in Figure 2. Also, the LDC tables in Section 5 do not include a table or subsection for the low flow zone (90 – 100% exceedance). Also, it's generally not necessary to include 5 significant figures when expressing loads in scientific notation as was done in Tables 8-11. The TMDL should be revised to addresses these issues.

Remedy: A subsection and table for the low flow zone was added. A low flow zone was not included in the original report due to errors caused by using instantaneous flows. Using average daily flows resolved the issue and allowed for inclusion of the low flow zone. In addition, the number of significant figures in loads expressed with scientific notation (Tables 8-11) were decreased.

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 Brule Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data on Brule Creek was collected during the Lower Big Sioux River watershed assessment from points located throughout upper and lower Brule Creek. Sample data from the assessment project were utilized to evaluate the stream. A total of 45 samples were available for the LDC analysis. Twenty four of the 45 samples were above the chronic standard while twenty of those exceeded the acute standard. LBST18 has flows tied to fecal coliform samples and this data was used to develop the load duration curve

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: Alcester, South Dakota (permit number SD0021695) is the only municipality within the watershed that has a permitted waste water treatment facility. The city of Alcester's wastewater treatment facility discharges continuously to an unnamed tributary which flows approximately 1.5 miles before entering East Brule Creek, then flows an additional 4 miles before entering the listed segment of Brule Creek. The facility was upgraded in 2003, following numerous violations of ammonia, BOD5, TSS, total residual chlorine, and fecal coliform bacteria. Table 3 includes the information used by SDDENR to calculate a maximum allowable discharge from each of these facilities. The maximum waste load for the system in aggregate is 1.14E+10 cfu/day.

Table 3. Waste Load Allocation for Facilities in the East Brule Creek Drainage

Facility Name	Flow (cfs) used in WLA	30-day Geometric Mean Fecal Coliform Bacteria (cfu/100ml) permit limit	Fecal Coliform WLA (cfu/day)
City of Alcester	0.46	1000	1.14E+10

COMMENTS: See comments above regarding duplication of the East Brule Creek WLA in the Brule Creek TMDL.

Remedy: The East Brule Creek WLA was removed from Brule Creek TMDL.

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 as predominately agricultural consisting of row crops and small grains (72%), grassland / rangeland (21%), developed (4%), and water/wetlands or forest land (3%). Nonpoint sources of fecal coliform bacteria in Brule Creek come primarily from agricultural sources. Livestock in the basin are predominantly beef cattle and hogs. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 8 - 11 include the load allocations at each of the flow regimes – 3.06E+16 CFU/day at high flows; 3.10E+14 CFU/day during moist flows; 2.18E+13 CFU/day at midrange flows; 4.66E+12 CFU/day at dry flows, and x.xxE+xx during low flow 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).

- ☐ <u>If the MOS is implicit</u>, 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.
- ☒ <u>If the MOS is explicit</u>, 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.
- ☐ <u>If</u>, rather than an explicit or implicit MOS, the <u>TMDL relies upon a phased approach</u> 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 Brule 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 Tables 8 - 11 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 fecal coliform 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: The Monitoring Strategy section mentions that the Lower Big Sioux River implementation project is currently assessing project effectiveness with models such as AnnAGNPS. Also, there are five monitoring sites on Brule Creek and WQM sites on the Big Sioux River upstream and downstream of the Brule Creek confluence. These sites are being monitored for various water quality parameters. The results from this monitoring can be used to supplement the modeling to judge project effectiveness or to be used for TMDL adjustments.

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 an implementation project underway that is targeting areas outlined by the Lower Big Sioux Pathogen TMDL. Project goals for improving fecal coliform bacteria impairment include: reduced access to streams for livestock, increased sources of alternative watering sources for livestock, rotational grazing, riparian management, and seventy-five animal waste management systems.

The city of Alcester discharges in the upper reach of the watershed and the discharge permit for fecal coliform bacteria is limited to 1,000 colonies/100 ml for five samples per 30-day period and 2,000 colonies/100 ml for a single sample.

If the above BMPs are implemented in the watershed and considering that the discharge permit for Alcester is designed to meet the current chronic and acute fecal coliform standards, there is likelihood that the TMDL can be attained.

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 Brule Creek fecal coliform 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
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

RECEIVED
JUN 7 2011
DEPT. OF ENVIRONMENT AND NATURAL RESOURCES, SECRETARY'S OFFICE

Ref: 8EPR-EP

JUN 2 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
Brule Creek; Fecal Coliform; SD-BS-R-BRULE_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 TMDLs 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 TMDLs 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
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

Printed on Recycled Paper

ENCLOSURE 1: APPROVED TMDLs

Fecal Coliform Bacteria Total Daily Maximum Daily Load Evaluation for Brule Creek, Union County, South Dakota (SD DENR, March 2011)

Submitted: 4/21/2011

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

Segment: Brule Creek from the confluence of East and West Brule Creek to the confluence with Big Sioux River

303(d) ID: SD-BS-R-BRULE_01

Parameter/Pollutant (303(d) list cause): FECAL COLIFORM - 259

Water Quality Targets: <= 1000 cfu/100 mL geometric mean concentration; <= 2000 cfu/100 mL single sample maximum

Allocation*	Value	Units	Permits
WLA	0	CFU/DAY	
TMDL	3.1E+14	CFU/DAY	
LA	3.1E+14	CFU/DAY	
MOS	5.4E+11	CFU/DAY	

Notes: The loads shown represent the loads during the moist flow regime as defined by the load duration curve for Brule Creek (see Figure 2 of the TMDL). The moist range 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:	**Fecal Coliform Bacteria Total Maximum Daily Load Evaluation for Brule Creek, Union County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**April 21, 2011**
Review Date:	**May 27, 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 Brule Creek fecal coliform TMDL was submitted to EPA for review and approval via an email from Cheryl Saunders, SD DENR on April 21, 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: Brule Creek is a stream located in Union County, South Dakota and is part of the larger Big Sioux River watershed in the Lower Big Sioux sub-basin (HUC 10170203). The listed segment has a drainage area of approximately 67,672 acres in south eastern South Dakota, and includes approximately 37 miles of stream from the confluence of East and West Brule Creek to the confluence with the Big Sioux River (SD-BS-R-BRULE_01). It is listed as a high priority for TMDL development.

The designated uses for Brule Creek include warmwater marginal fish life propagation waters, limited-contact recreation waters, irrigation, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for fecal coliform and total suspended solids which are impairing the recreational use. The TMDL document and this review, only address the fecal coliform impairment. The TSS impairment will be addressed in a separate document.

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, <u>all TMDL documents must be written to meet the existing water quality standards</u> 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: Brule Creek is listed as impaired based on fecal coliform concentrations for limited contact recreation. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream. The fecal coliform numeric standards being implemented in this TMDL are: a single sample

maximum value of ≤ 2000 cfu/100 mL, and a 30-day geometric mean of ≤ 1000 cfu/ 100 mL. Discussion of additional applicable water quality standards for Brule Creek can be found on pages 6 and 7 of the TMDL.

South Dakota has adopted Escherichia coli criteria for the protection of the limited contact and immersion recreation uses. However, Brule Creek does not require an E. coli TMDL because the parameter is not currently listed as a cause of impairment to this stream segment. Because the two indicators are closely related, the fecal coliform bacteria TMDL and associated implementation strategy described in the TMDL document are expected to address both the fecal coliform bacteria and possible future E. coli impairments. If a TMDL must be established for E. coli in the future, a separate TMDL document will be developed for this parameter.

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 fecal coliform to achieve the limited contact recreation beneficial use for Brule Creek. The target for Brule Creek included in the TMDL document is the fecal coliform standard expressed as the 30-day geometric mean of 1000 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 row crops and small grains (72%), grassland / rangeland (21%), developed (4%), and water/wetlands or forest land (3%).

Nonpoint sources of fecal coliform bacteria in Brule Creek come primarily from agricultural sources. Data from the 2009 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 3 of the TMDL document.

Livestock in the basin are predominantly beef cattle and hogs. Livestock can contribute fecal coliform 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 2, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass. The main source of fecal coliform bacteria is likely overland runoff from livestock feedlots or livestock grazing in pastures.

Table 2. Fecal Source Allocation for Brule Creek.

Source	Percentage
Feedlots	81.2%
Livestock on Grass	18.0%
Wildlife	0.8%

The City of Alcester's wastewater treatment plant is the only point source is located in the Brule Creek watershed. The wasteload allocation for Alcester's discharge is fully accounted for and included in the East Brule Creek TMDL, which is upstream of the impaired segment of Brule Creek. This system accounts for about 885 people in the watershed and septic systems are assumed to be the primary human source for the rest of the population in the watershed. Human fecal production may be estimated at 1.95E+9. When computed as a total load, the remaining population produced fecals accounting for about 1.4% of all fecal coliforms produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliforms entering the Creek.

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 Brule Creek TMDL describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data on Brule Creek was collected during the Lower Big Sioux River watershed assessment from sampling points located throughout upper and lower Brule Creek. These include LBST18, 46bs49, 46bsa10, 460166, 460167, and 460168. LBST18 has flows tied to fecal coliform samples and this data was used to develop the load duration curve. Continuous flow data was collected at LBST18 from 2002 to 2004. Additionally USGS flow data exists for LBST 18 from 1982 to 1994. Flow data and flow-linked fecal coliform samples dating from 2002 to 2004 and 2010 was used to create a load duration curve.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow (≥ 129 cfs), moist flow (between 129 cfs and 31 cfs), midrange flow (between 31 cfs and 15 cfs), dry flow (between 15 cfs and 4.1 cfs), and low flow (< 4.1 cfs). The result is a flow-variable TMDL target across the flow regimes shown in Figure 2 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 95th percentile of the observed fecal coliform bacteria load for each flow regime: high flow = 3.1E+16 CFU/day; moist flow = 3.1E+14 CFU/day; midrange flow = 2.2E+13 CFU/day; dry flow = 4.8E+12 CFU/day; and low flow = 3.9E+11 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 Brule Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data on Brule Creek was collected during the Lower Big Sioux River watershed assessment from points located throughout upper and lower Brule Creek. Sample data from the

assessment project were utilized to evaluate the stream. A total of 45 samples were available for the LDC analysis. Twenty four of the 45 samples were above the chronic standard while twenty of those exceeded the acute standard. LBST18 has flows tied to fecal coliform samples and this data was used to develop the load duration curve

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: Alcester, South Dakota (permit number SD0021695) is the only municipality within the watershed that has a permitted waste water treatment facility. The city of Alcester's wastewater treatment facility discharges continuously to an unnamed tributary which flows approximately 1.5 miles before entering East Brule Creek, then flows an additional 4 miles before entering the listed segment of Brule Creek. The fecal coliform wasteload allocation from Alcester's discharge is fully accounted for in the TMDL for East Brule Creek so the WLA for Brule Creek 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 as predominately agricultural consisting of row crops and small grains (72%), grassland / rangeland (21%), developed (4%), and water/wetlands or forest land (3%). Nonpoint sources of fecal coliform bacteria in Brule Creek come primarily from agricultural sources. Livestock in the basin are predominantly beef cattle and hogs. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 6 - 10 include the load allocations at each of the flow regimes – 3.1E+16 CFU/day at high flows; 3.1E+14 CFU/day during moist flows; 2.2E+13 CFU/day at midrange flows; 4.7E+12 CFU/day at dry flows, and 3.4E+11 during low flow 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 Brule 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 Tables 6 - 10 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 fecal coliform 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: The Monitoring Strategy section mentions that the Lower Big Sioux River implementation project is currently assessing project effectiveness with models such as AnnAGNPS. Also, there are five monitoring sites on Brule Creek and WQM sites on the Big Sioux River upstream and downstream of the

Brule Creek confluence. These sites are being monitored for various water quality parameters. The results from this monitoring can be used to supplement the modeling to judge project effectiveness or to be used for TMDL adjustments.

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 an implementation project underway that is targeting areas outlined by the Lower Big Sioux Pathogen TMDL. Project goals for improving fecal coliform bacteria impairment include: reduced access to streams for livestock, increased sources of alternative watering sources for livestock, rotational grazing, riparian management, and seventy-five animal waste management systems.

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 Brule Creek fecal coliform 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.