

***ESHERICHIA COLI* TOTAL MAXIMUM DAILY  
LOAD EVALUATION OF THE BELLE FOURCHE  
RIVER SEGMENT 5, MEADE COUNTY, SOUTH  
DAKOTA**

South Dakota Department of  
Environment and Natural Resources



*Protecting South Dakota's Tomorrow ... Today*

**Completed by Jesse Wilkens**

**SOUTH DAKOTA DEPARTMENT OF  
ENVIRONMENT AND NATURAL RESOURCES**

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***E. coli* Total Maximum Daily Load Summary**

<b><i>Entity ID:</i></b>	SD-BF-R-BELLE_FOURCHE_05
<b><i>Location:</i></b>	HUC Code: 1012020214
<b><i>Size of Watershed:</i></b>	557,420 acres
<b><i>Water body Type:</i></b>	River/Stream
<b><i>303(d) Listing Parameter:</i></b>	<i>E. coli</i>
<b><i>Initial Listing date:</i></b>	2010 IR
<b><i>TMDL Priority Ranking:</i></b>	1
<b><i>Listed Stream Miles:</i></b>	51 miles
<b><i>Designated Use of Concern:</i></b>	Immersion Recreation
<b><i>Analytical Approach:</i></b>	Load Duration Curve Framework
<b><i>Target:</i></b>	Meet applicable water quality standards 74:51:01:55
<b><i>Indicators:</i></b>	<i>E. coli</i>
<b><i>Threshold Value:</i></b>	<126 CFU/100mL geometric mean concentration with maximum single sample concentrations of <235 CFU/100mL
<b><i>High Flow Zone LA:</i></b>	3.18E <sup>13</sup> CFU/day
<b><i>High Flow Zone WLA:</i></b>	0 CFU/day
<b><i>High Flow Zone MOS:</i></b>	2.44E <sup>12</sup> CFU/day
<b><i>High Flow Zone TMDL:</i></b>	3.42E <sup>13</sup> CFU/day

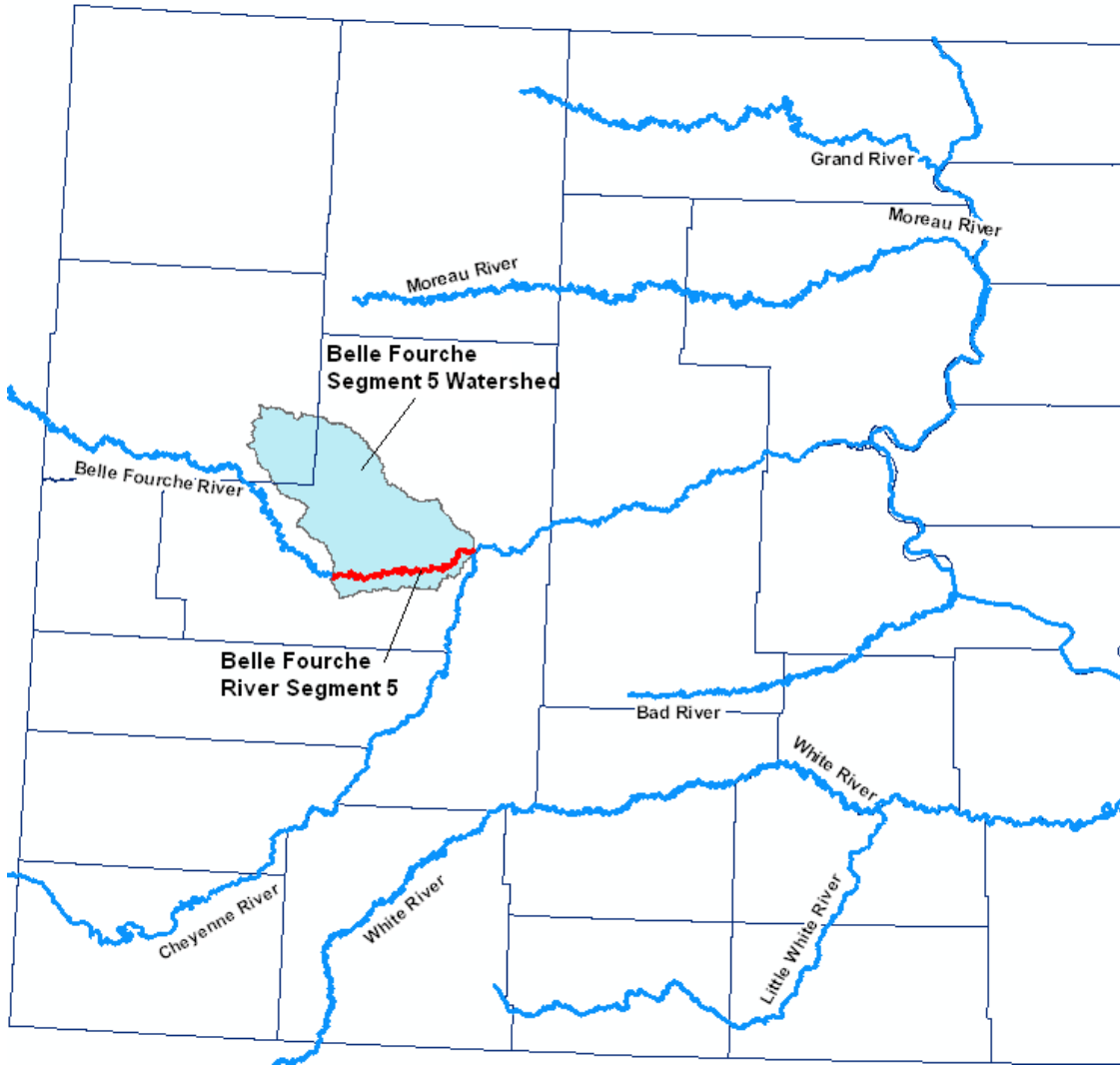
## 1.0 Introduction

The intent of this document is to clearly identify the components of the TMDL submittal to support adequate public participation and facilitate the 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 EPA. This TMDL document addresses the anticipated *E. coli* impairment of the Belle Fourche River, SD-BF-R-BELLE\_FOURCHE\_05. Segment 5 of the Belle Fourche River is listed in the 2010 South Dakota Integrated Report (SDDENR 2010) as impaired in regard to total suspended solids (TSS) and fecal coliform bacteria. A TMDL document for TSS was prepared by SDDENR and approved by EPA in 2005. A TMDL document for fecal coliform bacteria was prepared by SDDENR and presented for public notice at the same time as this document.

Segment 5 of the Belle Fourche River was anticipated to be listed as impaired in regard to *E. coli* based on routine monitoring data collected in 2009 and 2010. South Dakota criteria for determining support status state that if over 20 samples are collected, the waterbody will be listed as impaired if 10% or more of the samples exceed the daily maximum criterion (SDDENR 2010). Of 28 *E. coli* samples collected in this segment, 6 exceeded the single sample standard for a 21% rate of exceedence. Therefore, it is anticipated that this segment will be listed in the next issuance of the Integrated Report.

### 1.1 Watershed Characteristics

The Belle Fourche River is a natural stream that originates in Wyoming, drains parts of Butte, Lawrence and Meade Counties in South Dakota, and flows to the Cheyenne River in Meade County and ultimately to the Missouri River (Figure 1). The Belle Fourche River watershed is approximately 2,100,000 acres (3,300 sq. miles) in size in South Dakota and approximately 2,400,000 acres (3,700 sq. miles) in Wyoming.



**Figure 1. Belle Fourche watershed location in western South Dakota.**

The Belle Fourche River flows across western South Dakota in an easterly direction until it reaches its confluence with the Cheyenne River. Segment 5 of the Belle Fourche River stretches from Alkali Creek to the confluence with the Cheyenne River, a distance of approximately 51 river miles. The area of the watershed that drains to segment 5 of the Belle Fourche encompasses 557,420 acres.

**Table 1. Land use types and percentages in the Belle Fourche River segment 5 watershed.**

Land Use	Percent
Row Crops	0%
Small Grains	1%
Grassland/Pasture/Herbaceous	93%
Open Space	1%
Urban	0%
Wetland	2%
Woodland/Shrubland	1%
Fallow	1%
Water	1%

Table 1 lists the land uses present in the watershed. Land use in the watershed is primarily row crops and areas used for livestock grazing, such as grasslands and herbaceous lands.

Soils in segment 5 of the Belle Fourche River are composed of three primary soil associations. The Nunn-Satanta-Zigweid association is located on high terraces and tablelands. Slopes are smooth and nearly level to gently sloping. These soils are deep, well drained, loamy soils formed in alluvium. Soils in this association are commonly used for crop production with small areas still in native grassland used for livestock grazing (USDA, 1978).

Bottom lands along the Belle Fourche are typically composed of soils in the Lohmiller-Glenberg association. These soils are deep, nearly level, silty, loamy soils formed in alluvium. Surfaces are uneven in areas near the river channel. Runoff is slow. Some areas of this soil association are used for growing crops with irrigation, but the most common use is livestock grazing (USDA, 1978).

Soils located on prominent upland ridges and breaks along the Belle Fourche River and its tributaries are composed of the Samsil-Lismas-Pierre association. These are shallow to moderately deep, well to excessively drained, moderately sloping to steep, clayey soils over shale. These soils are not suited for cultivation because of steep slopes, shallowness, low fertility, and high susceptibility to erosion. Runoff is medium to rapid. These areas are primarily used for livestock grazing (USDA, 1978).

## 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 state's water quality standards, this is the method used in the states 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.

Segment 5 of the Belle Fourche River has been assigned the beneficial uses of: warmwater permanent fish life, irrigation waters, immersion recreation, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 2 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 segment 5 of the Belle Fourche River for *E. coli* is 126 CFU/100mL, which is based on the chronic standard for *E. coli*. The *E. coli* criteria for the immersion contact recreation beneficial use requires that 1) no sample exceeds 235 CFU/100mL 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 126 CFU/100mL. These criteria are applicable from May 1 through September 30.



**Table 2. South Dakota water quality standards for segment 5 of the Belle Fourche River.**

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L 30 average March 1 to October 31	Warmwater Permanent Fish Life Propagation
	Equal to or less than the result from Equation 4 in Appendix A of Surface Water Quality Standards	mg/L 30 average November 1 to February 29	
	Equal to or less than the result from Equation c in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥5.0	mg/L	Warmwater Permanent Fish Life Propagation
Total Suspended Solids	≤90 (mean)	mg/L	Warmwater Permanent Fish Life Propagation
	≤158 (single sample)		
Temperature	≤26.6	°C	Warmwater Permanent Fish Life Propagation
Fecal Coliform Bacteria (May 1- Sept 30)	≤200 (geometric mean)	count/100 mL	Immersion Contact Recreation
	≤400 (single sample)		
<i>Escherichia coli</i> Bacteria (May 1- Sept 30)	≤126 (geometric mean)	count/100 mL	Immersion Contact Recreation
	≤235 (single sample)		
Alkalinity (CaCO <sub>3</sub> )	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, 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	Fish and Wildlife Propagation, Recreation, and Stock Watering
pH (standard units)	≥6.5 to ≤9.0	units	Warmwater Permanent Fish Life Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10 ≤10	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters

## 3.0 Significant Sources

### 3.1 Point Sources

There are no point sources in the segment 5 Belle Fourche River watershed.

### 3.2 Non-Point Sources

Nonpoint sources of *E. coli* in segment 5 of the Belle Fourche River come primarily from agricultural sources. Data from the 2010 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 and is summarized in Table 3. *E. coli* loads for each type of animal were estimated from fecal coliform values using the method described in section 4.3 of this report. Total daily production for the segment 5 basin for *E. coli* is  $3.71E^{13}$  CFU/100mL.

**Table 3. Belle Fourche River segment 5 *E. coli* non-point source loadings.**

Species	Number	<i>E. coli</i> /Animal/Day	<i>E. coli</i> /day	<i>E. coli</i> /acre/day	Percent
Dairy Cow	44	1.23E+09	5.39E+10	9.68E+04	0.15%
Beef	29839	1.10E+09	3.27E+13	5.86E+07	88.14%
Hog	3	3.71E+08	1.11E+09	2.00E+03	0.00%
Sheep	3168	6.13E+08	1.94E+12	3.49E+06	5.24%
Horse	993	1.38E+09	1.37E+12	2.47E+06	3.71%
Human <sup>1</sup>	79	8.79E+07	6.94E+09	1.25E+04	0.02%
<b>All Wildlife</b>			1.01E+12	1.82E+06	2.74%
Turkey (Wild) <sup>2</sup>	1517	7.80E+06	1.18E+10	2.12E+04	0.03%
Goose <sup>3</sup>	348	4.15E+07	1.44E+10	2.59E+04	0.04%
Deer <sup>2</sup>	3180	2.05E+07	6.53E+10	1.17E+05	0.18%
Beaver <sup>2</sup>	263	3.84E+04	1.01E+07	1.81E+01	0.00%
Raccoon <sup>2</sup>	1717	1.94E+08	3.33E+11	5.98E+05	0.90%
Coyote/Fox <sup>3</sup>	1843	8.02E+07	1.48E+11	2.65E+05	0.40%
Muskrat <sup>1</sup>	422	2.24E+06	9.46E+08	1.70E+03	0.00%
Opossum <sup>4</sup>	0	5.63E+07	0.00E+00	0.00E+00	0.00%
Mink <sup>4</sup>	110	5.63E+07	6.20E+09	1.11E+04	0.02%
Skunk <sup>4</sup>	1329	5.63E+07	7.49E+10	1.34E+05	0.20%
Badger <sup>4</sup>	282	5.63E+07	1.59E+10	2.85E+04	0.04%
Jackrabbit <sup>4</sup>	3289	5.63E+07	1.85E+11	3.32E+05	0.50%
Cottontail <sup>4</sup>	2154	5.63E+07	1.21E+11	2.18E+05	0.33%
Squirrel <sup>4</sup>	667	5.63E+07	3.76E+10	6.74E+04	0.10%
<sup>1</sup> Yaggow et. al. 2001					
<sup>2</sup> USEPA 2001					
<sup>3</sup> Bacteria Indicator Tool Worksheet					
<sup>4</sup> Best Professional Judgment based off of Dogs					

### 3.2.1 Natural Background Sources

Wildlife within the watershed is a natural background source of *E. coli*. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks. Best estimates suggest wildlife account for approximately 3% of the bacteria produced in the watershed.

### 3.2.2 Human Sources

A total of 79 people reside in the Belle Fourche River segment 5 watershed (Census, 2000). Septic systems are assumed to be the primary human source for the rest of the population in the watershed. Table 3 includes all human produced *E. coli*. When included as a total load in the table, the population produced *E. coli* accounting for approximately 0.01% of the total loading in the watershed. These bacteria should all be

delivered to a septic system, which if functioning correctly would result in an insignificant amount of bacteria entering the river

### 3.2.3 Agricultural Sources

Manure from livestock is a potential source of *E. coli* to the river. Livestock in the basin are predominantly beef cattle. Livestock can contribute *E. coli* directly by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands or in feeding areas, which is then washed off during precipitation events. Table 4 allocates the sources of bacteria production in the watershed into three primary categories. The summary is based on several assumptions. Feedlots 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 4. Bacteria source allocation for segment 5 of the Belle Fourche River watershed.**

Source	Percentage
Feeding Areas	0.7%
Livestock on Grass	97.5%
Wildlife	1.7%

Grazing areas account for nearly all of the *E. coli* loadings to segment 5 of the Belle Fourche River. Grazing areas should be addressed as part of future implementation efforts.

## 4.0 Technical Analysis

### 4.1 Data Collection Method

To develop the *E. coli* TMDL, data from segment 5 of the Belle Fourche River were collected from SDDENR ambient water quality monitoring site WQM 460676 from 1976 until 2010. Flow data was collected at USGS gauging site 6438000, located near Elm Springs, SD. Flow data from 1976 until 2010 was used to match the period of record from which water quality samples were collected. Site locations are displayed in Figure 2.

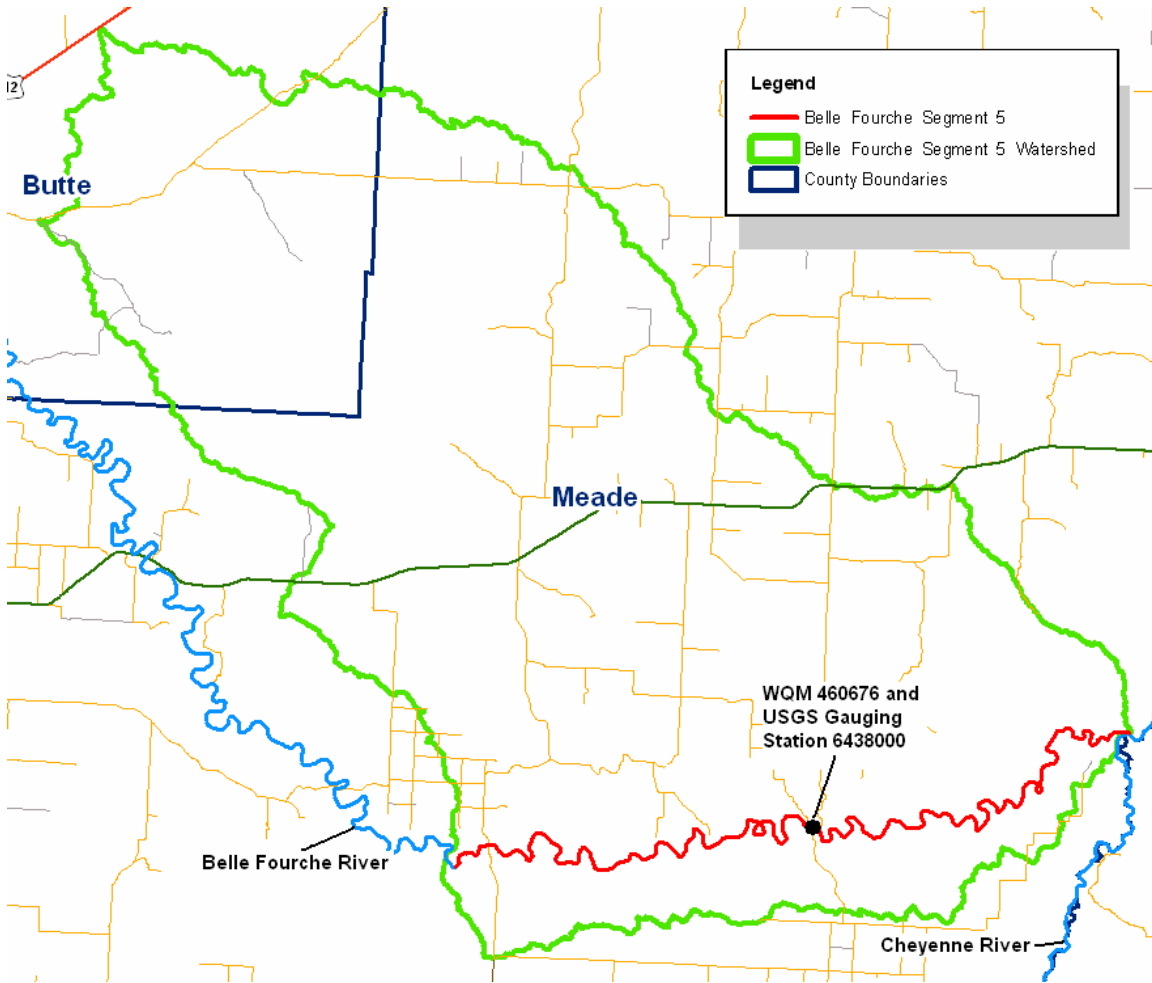


Figure 2. Belle Fourche River segment 5 watershed map including site locations.

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

The USGS gauging station 6438000 is located at approximately the midpoint of segment 5. Flows at this station are representative of the entire segment. Flow data from 1976 to 2010 was used to develop the TMDL. The hydrograph for the period of record is found in Figure 3.

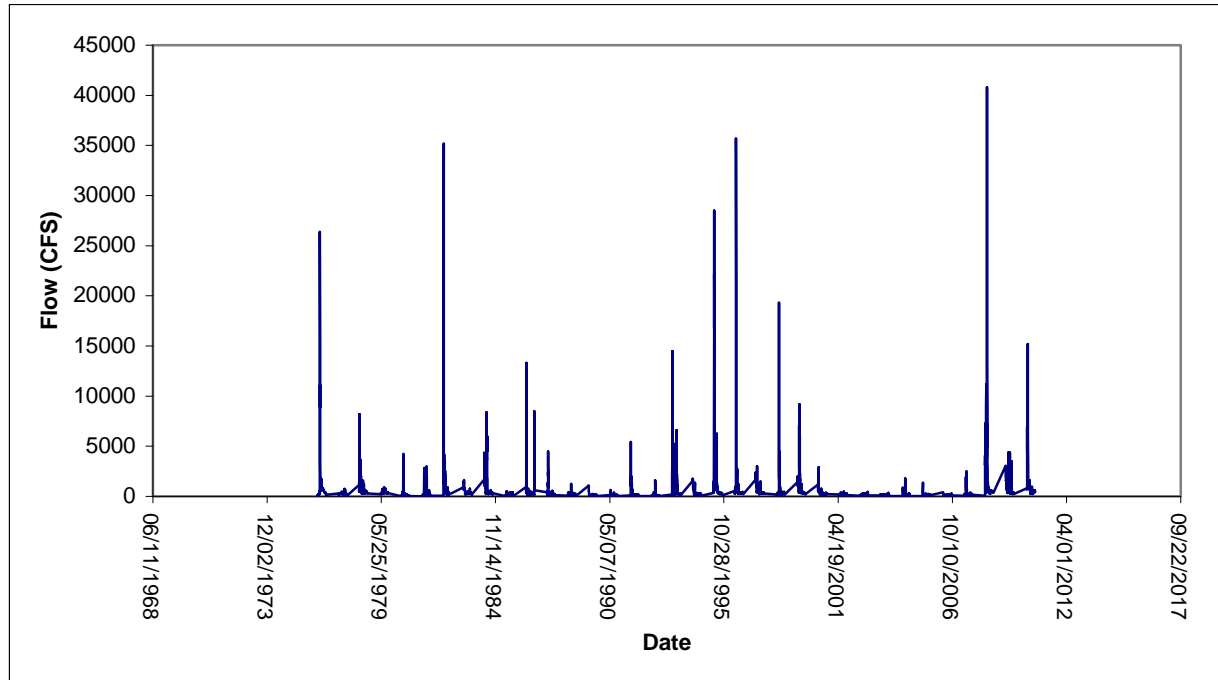


Figure 3. Daily streamflow for the Belle Fourche River at USGS site 6438000.

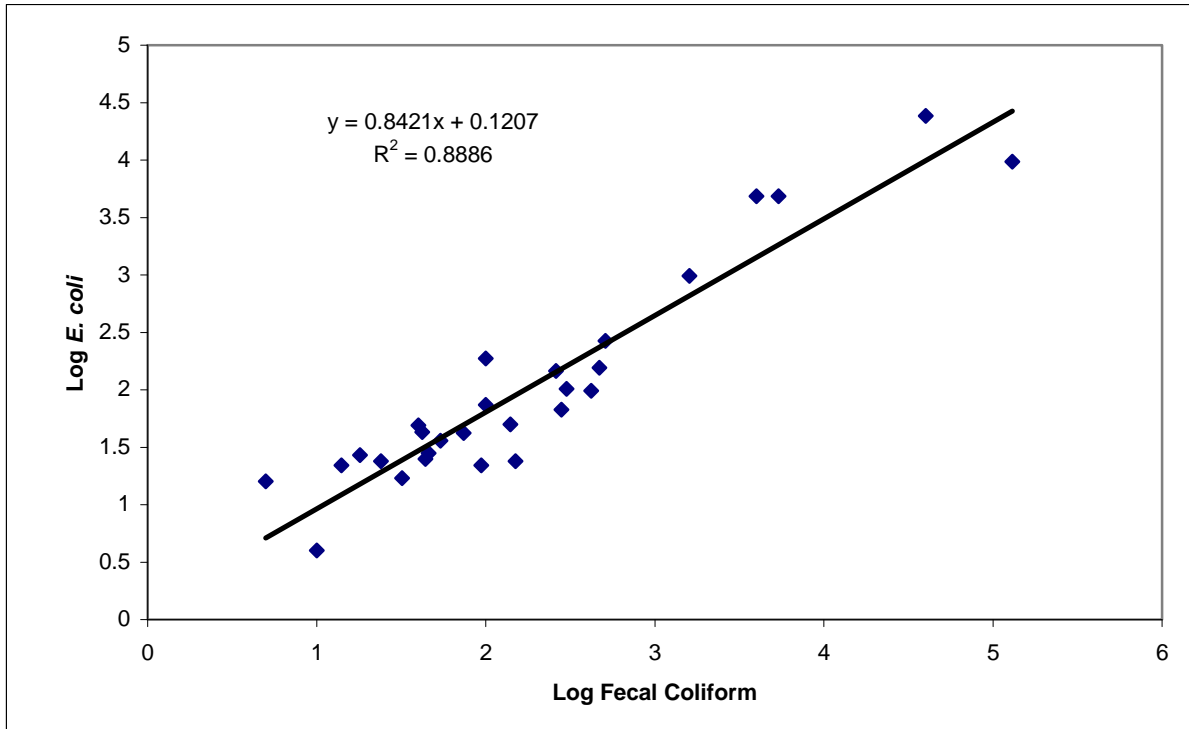
### 4.3 Sample Data

A total of 28 *E. coli* samples were collected at DENR ambient monitoring station WQM 460676 in 2009 and 2010. Of those 28 samples, 6 exceeded the single sample standard for a 21% rate of exceedence. To create a more robust dataset, fecal coliform bacteria data were used to estimate *E. coli* concentrations. A total of 107 fecal coliform samples were collected at WQM 460676 between the years of 1976 and 2010 during the months of May through September. Of those 107 samples, 28 were taken simultaneously with *E. coli* samples. The relationship of these 28 paired samples was used to estimate *E. coli* concentrations. The resulting dataset of 107 *E. coli* samples was used to develop the *E. coli* TMDL.

**Table 5. Paired *E. coli* and fecal coliform concentration data from WQM 460676.**

Date	<i>E. coli</i> (CFU/100mL)	Fecal Coliform (CFU/100mL)
05/05/2009	16	5
06/16/2009	4839.2	4000
07/14/2009	9678.4	130000
08/11/2009	4840	5400
09/15/2009	42	74
05/03/2010	28	46
05/26/2010	24196	40000
06/04/2010	146	260
06/09/2010	102	300
06/21/2010	67	280
06/22/2010	98	420
06/30/2010	156	470
07/01/2010	187	100
07/06/2010	50	140
07/13/2010	17	32
07/22/2010	267	510
08/06/2010	980	1600
08/10/2010	36	54
08/11/2010	24	24
08/18/2010	43	42
09/02/2010	24	150
09/08/2010	25	44
09/13/2010	4	10
09/14/2010	22	14
09/16/2010	74	100
09/21/2010	49	40
09/24/2010	22	94
09/27/2010	27	18

Fecal coliform and *E. coli* data were collected simultaneously at WQM site 460676 in 2009 and 2010 during the months from May to September (Table 5). Because *E. coli* is a fecal coliform bacterium and both indicators originate from common sources in somewhat consistent proportions, fecal coliform data can be used as a surrogate for *E. coli* data.



**Figure 4. Linear relationship of log transformed fecal coliform and *E. coli* data from WQM 460676.**

Fecal and *E. coli* concentrations from paired samples were transformed logarithmically and plotted. Fecal coliform concentration was plotted on the X-axis and *E. coli* concentration on the Y-axis. Applying a best fit line to these data sets yields a useful relationship with an  $r^2$  value of 0.8886. The equation of this relationship can be used to estimate *E. coli* concentrations in segment 5 of the Belle Fourche River.

$$\text{Log of } E. coli \text{ concentration} = 0.8421(\text{log of fecal concentration}) + .1207$$

The antilog of the resulting value is then calculated, yielding the estimated *E. coli* concentration.

**Table 6. Estimated *E. coli* concentrations derived from fecal coliform concentrations.**

Date	Fecal Coliform (CFU/100mL)	Estimated <i>E. coli</i> (CFU/100mL)	Date	Fecal Coliform (CFU/100mL)	Estimated <i>E. coli</i> (CFU/100mL)
09/29/1976	13	11	09/18/2003	34	26
05/23/1977	280	152	05/13/2004	100	64
06/29/1977	90	58	06/15/2004	150	90
07/26/1977	120	74	07/15/2004	98	63
08/23/1977	600	289	08/25/2004	30	23
09/26/1977	52400	12441	09/16/2004	44	32
05/01/1978	7000	2284	06/23/2005	620	297
06/06/1978	170	100	07/20/2005	100	64
07/10/1978	1500	624	08/18/2005	54	38
08/08/1978	10	9	09/22/2005	58	40
09/06/1978	43	31	05/23/2006	66	45
05/08/1979	5	5	06/22/2006	130	80
06/06/1979	110	69	07/27/2006	70	47
07/05/1979	80	53	08/17/2006	44	32
08/07/1979	370	192	09/25/2006	160	95
09/17/1979	80	53	05/08/2007	320	170
05/07/1980	28	22	06/12/2007	140	85
06/03/1980	200	114	07/10/2007	88	57
07/02/1980	8000	2556	08/14/2007	84	55
08/06/1980	22	18	09/11/2007	46	33
09/10/1980	62	43	05/13/2008	300	161
05/14/1981	13	11	06/24/2008	130	80
06/22/1981	43	31	07/08/2008	72	48
07/08/1981	340	179	08/13/2008	150	90
05/06/1982	36	27	09/10/2008	6	6
06/16/1982	1150	499	05/22/2001	49	35
07/15/1982	50	36	06/14/2001	46	33
08/19/1982	300	161	07/10/2001	870	395
09/09/1982	60	42	08/28/2001	33	25
07/14/1988	20	16	09/25/2001	18	15
05/20/1999	620	297	05/20/2002	5	5
06/21/1999	140	85	06/19/2002	320	170
07/19/1999	200	114	07/22/2002	200	114
08/11/1999	5	5	08/19/2002	15	13
09/23/1999	60	42	09/19/2002	100	64
05/24/2000	100	64	05/15/2003	12	11
06/29/2000	120	74	06/11/2003	160	95
07/20/2000	85	56	07/14/2003	10	9
08/22/2000	50	36	08/25/2003	250	138
09/28/2000	280	152			

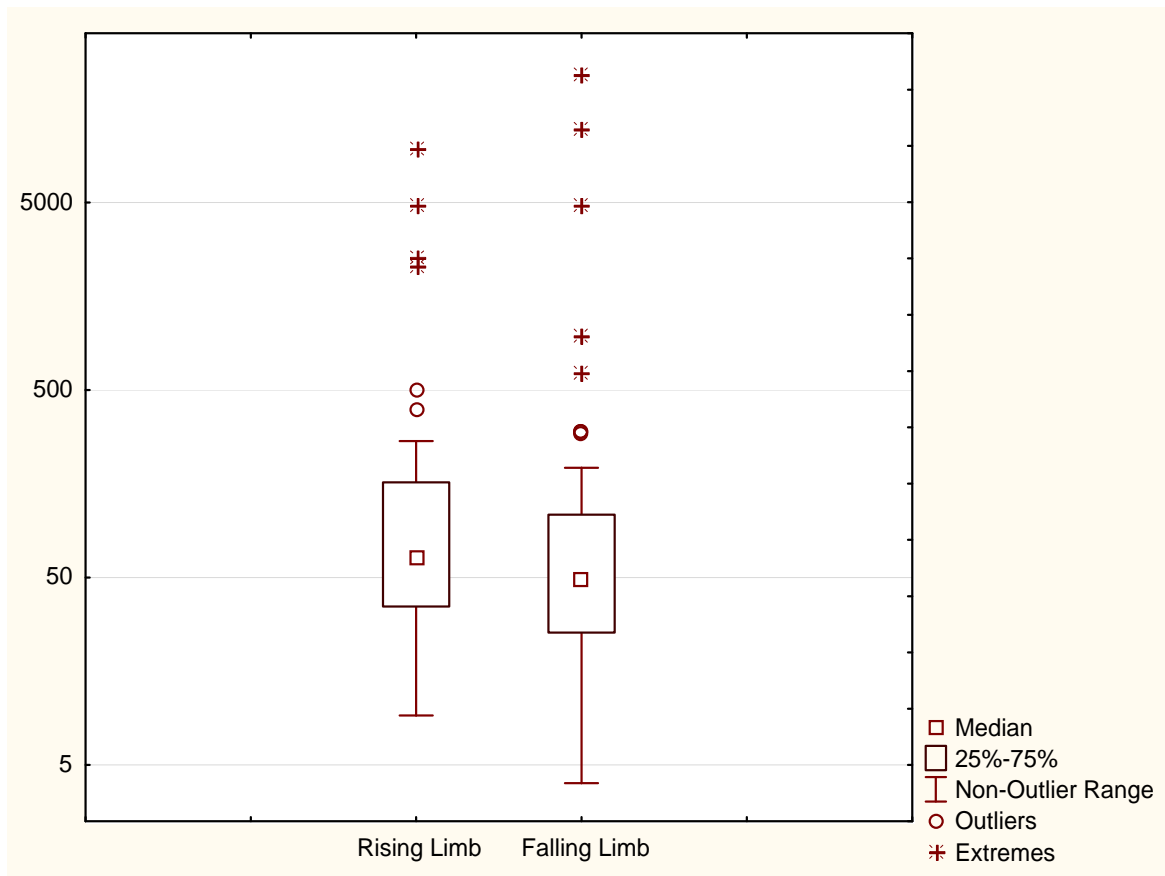
Of the 107 samples, 38 exceeded the chronic standard of 126 CFU/100mL and 22 samples exceeded the single sample standard of 235 CFU/100mL. Samples were



collected during the recreation season between the months of May and September, which is when the majority of immersion recreation takes place.

**Table 7. *E. coli* dataset used to develop Belle Fourche River segment 5 TMDL.**

Date	<i>E. coli</i> (CFU/100mL)	Date	<i>E. coli</i> (CFU/100mL)	Date	<i>E. coli</i> (CFU/100mL)
09/29/1976	11	08/14/2007	55	05/24/2000	64
05/23/1977	<b>152</b>	09/11/2007	33	06/29/2000	74
06/29/1977	58	05/13/2008	<b>161</b>	07/20/2000	56
07/26/1977	74	06/24/2008	80	08/22/2000	36
08/23/1977	<b>289</b>	07/08/2008	48	09/28/2000	<b>152</b>
09/26/1977	<b>12441</b>	08/13/2008	90	05/22/2001	35
05/01/1978	<b>2284</b>	09/10/2008	6	06/14/2001	33
06/06/1978	100	05/05/2009	16	07/10/2001	<b>395</b>
07/10/1978	<b>624</b>	06/16/2009	<b>4839</b>	08/28/2001	25
08/08/1978	9	07/14/2009	<b>9678</b>	09/25/2001	15
09/06/1978	31	08/11/2009	<b>4840</b>	05/20/2002	5
05/08/1979	5	09/15/2009	42	06/19/2002	<b>170</b>
06/06/1979	69	05/03/2010	28	07/22/2002	114
07/05/1979	53	05/26/2010	<b>24196</b>	08/19/2002	13
08/07/1979	<b>192</b>	06/04/2010	<b>146</b>	09/19/2002	64
09/17/1979	53	06/09/2010	102	05/15/2003	11
05/07/1980	22	06/21/2010	67	06/11/2003	95
06/03/1980	114	06/22/2010	98	07/14/2003	9
07/02/1980	<b>2556</b>	06/30/2010	<b>156</b>	08/25/2003	<b>138</b>
08/06/1980	18	07/01/2010	<b>187</b>	09/18/2003	26
09/10/1980	43	07/06/2010	50	05/13/2004	64
05/14/1981	11	07/13/2010	17	06/15/2004	90
06/22/1981	31	07/22/2010	<b>267</b>	07/15/2004	63
07/08/1981	<b>179</b>	08/06/2010	<b>980</b>	08/25/2004	23
05/06/1982	27	08/10/2010	36	09/16/2004	32
06/16/1982	<b>499</b>	08/11/2010	24	06/23/2005	<b>297</b>
07/15/1982	36	08/18/2010	43	07/20/2005	64
08/19/1982	<b>161</b>	09/02/2010	24	08/18/2005	38
09/09/1982	42	09/08/2010	25	09/22/2005	40
07/14/1988	16	09/13/2010	4	05/23/2006	45
05/20/1999	<b>297</b>	09/14/2010	22	06/22/2006	80
06/21/1999	85	09/16/2010	74	07/27/2006	47
07/19/1999	114	09/21/2010	49	08/17/2006	32
08/11/1999	5	09/24/2010	22	09/25/2006	95
09/23/1999	42	09/27/2010	27	05/08/2007	<b>170</b>
07/10/2007	57			06/12/2007	85
Samples exceeding the chronic standard in bold text					



**Figure 5. Box and whisker plot of *E. coli* samples collected on the rising and falling limbs of the hydrograph.**

A comparison of samples collected on the rising limb of the hydrograph and samples collected on the falling limb of the hydrograph (Figure 5) yielded insight into potential sources of *E. coli* in segment 5 of the Belle Fourche River. High bacteria concentrations on the rising limb typically indicate that bacteria sources are located some distance from the river and are washed from the land into the water during precipitation events. High concentrations in the falling limb typically indicate that bacteria sources are in close proximity to the stream, and perhaps in the stream itself, such as livestock animals defecating directly into the water.

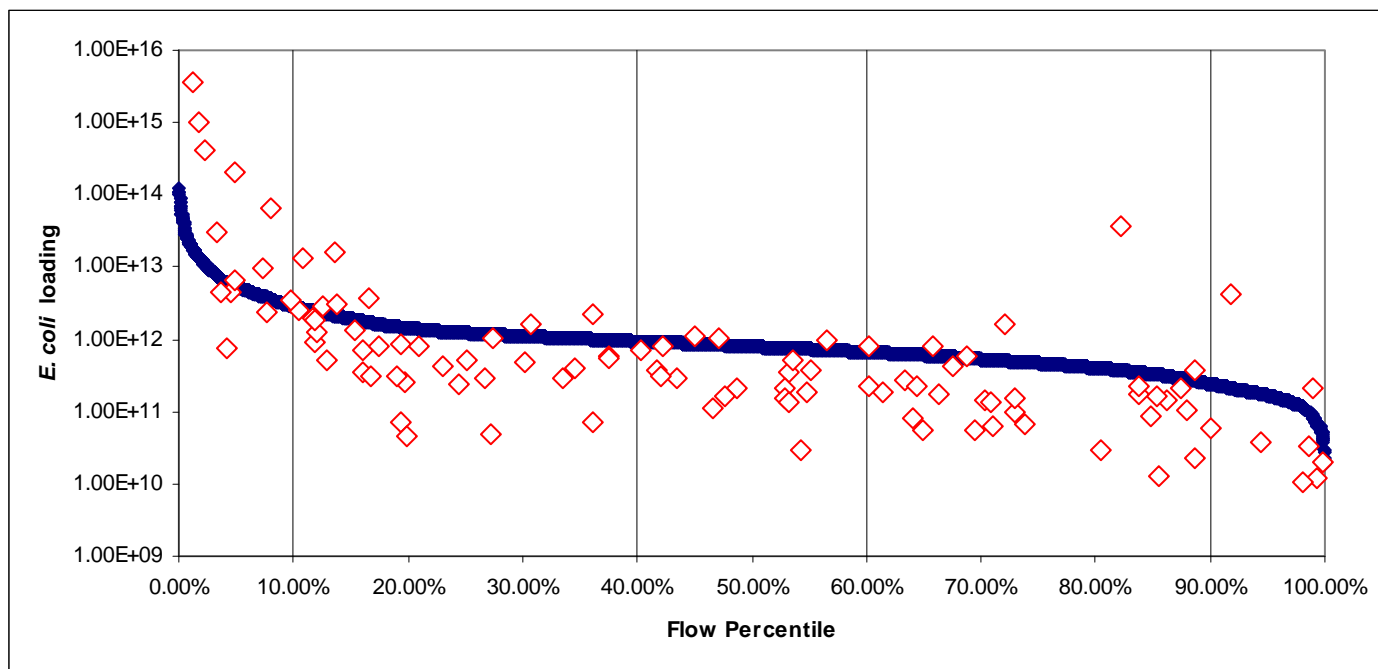
**Table 8. Statistics of samples collected on the rising and falling limbs of the hydrograph.**

	Samples	Mean	Median	Minimum	Maximum
Rising Limb	39	580.22	63.81	9	9678
Falling Limb	68	698.47	49.20	4	24196

The statistics of samples on the rising and falling limbs are not markedly different, indicating that bacteria sources are somewhat evenly distributed in the watershed. The mean concentration of samples collected on the falling limb is higher than the mean concentration of samples collected on the rising limb, while the median concentration of samples collected on the falling limb is lower than the median concentration of samples

collected on the falling limb. Outliers and extreme concentrations result in the higher average value for samples collected on the falling limb. It should be noted that while mean concentrations for both limbs of the hydrograph exceed both the single sample and chronic standards, median concentrations from the rising and falling limbs are both well below the single sample and chronic standards.

This analysis suggests that sources of bacterial contamination are widespread throughout the watershed. The presence of extreme concentrations on the falling limb indicates that stock animals have access to the water and contribute *E. coli* directly to the river. The presence of extreme concentrations in the rising limb indicates that bacterial sources exist some distance from the watershed. The most likely contributor is grazing areas, including areas in close proximity and also those some distance from the watershed.



**Figure 6.** *E. coli* load duration curve for segment 5 of the Belle Fourche river.

The load duration curve in Figure 6 represents the 107 samples collected within segment 5 of the Belle Fourche River. The blue line represents the chronic standard of 126 CFU/100mL. TMDL reductions will be based on the chronic standard to ensure the TMDL meets all applicable water quality standards.

A total of 9 samples exceeded the chronic standard in the high flow zone, 7 in the moist flow zone, 3 in the moderate flow zone, 5 in the dry flow zone, and 2 in the low flow zone. These numbers indicate that bacterial contamination occurs over a wide range of flow conditions, but the most severe contamination occurs during high flows in the high and moist flow zones, and during very low flows.

## 5.0 TMDL and Allocations

Table 9. *E. coli* TMDL information for segment 5 of the Belle Fourche River.

TMDL Component	Flow Zone				
	High	Moist	Moderate	Dry	Low
LA	3.18E+13	2.20E+12	7.98E+11	4.16E+11	8.66E+10
WLA	0	0	0	0	0
MOS	2.44E+12	2.90E+11	1.23E+11	2.31E+11	1.48E+11
TMDL @ 126 CFU/100mL	3.42E+13	2.49E+12	9.22E+11	6.47E+11	2.34E+11
Current Load	2.63E+15	5.70E+12	1.18E+12	9.19E+11	1.15E+12
Load Reduction	98.70%	56.33%	21.71%	29.54%	79.68%
Flow Range (CFS)	>916	303-916	217-303	78-217	<78

### 5.0.1 Flow Zone 1 (<10% flow frequency exceedence)

Flow zone 1 represents the high flows in the Belle Fourche River. The lower limit of this zone is the 10<sup>th</sup> percentile, which corresponds to a flow rate of 916 CFS. Flows in this zone are typically short in duration, only lasting for a few days. Flows in this zone were most commonly the product of spring snowmelt events but may be generated by large rain events.

Table 9 depicts the components of the TMDL for this flow zone. Data in this zone will be used as the overall TMDL load for the segment. The current load is based on the 95<sup>th</sup> percentile flow in this flow zone and the 95<sup>th</sup> percentile *E. coli* concentration in this flow zone. The current load suggests a 99% reduction in loading is necessary to attain the standard.

The high flow zone is the most difficult zone in which to attain reductions. Elevated concentrations may be the result of upstream influences as well as contributions from numerous sources dispersed throughout the watershed. Animal grazing areas located some distance from the stream are a probable source of contamination within this flow zone, but manure spread on fields may also contribute. Reductions from sources contributing to other flow zones will also likely help reduce concentrations within this flow zone.

### 5.0.2 Flow Zone 2 (10% to 40% flow frequency exceedence)

Flow zone 2 consists of flows that occur under moist conditions. For the Belle Fourche River, zone 2 consists of the flows ranging from 303 to 916 CFS. These flows are associated with runoff events. Water velocities during these conditions are significantly slower than during high flows, reducing the distance *E. coli* bacteria may travel before dying off.

Table 9 depicts the components of the TMDL for this flow zone. The current load is based on the 95<sup>th</sup> percentile flow in this flow zone and the 95<sup>th</sup> percentile *E. coli* concentration in this flow zone. The current load suggests a 56% reduction in loadings will be necessary to attain the standard in this flow zone.

Potential sources of impairment in this flow zone include pastures and crop land with manure spread on it. Due to the reduced transport velocities, impairments within this zone are less likely to be the result of loadings from upstream segments.

Targeting impairments to this flow zone may also help provide reductions for the high flow zone. Addressing grazing areas not in close proximity to the river should be an implementation priority to attain full support of the water quality standards for this flow zone.

### **5.0.3 Flow Zone 3 (40% to 60% flow frequency exceedence)**

Flow zone 3 consists of mid-range flows. For the Belle Fourche River, these flows range from 217 to 303 CFS. These flows may be associated with small runoff events or occur at the trailing end of a runoff event. Table 9 depicts the components of the TMDL for this flow zone. The current load is based on the 95<sup>th</sup> percentile flow in this flow zone and the 95<sup>th</sup> percentile *E. coli* concentration in this flow zone. A 22% reduction is necessary to attain the standard in this flow zone.

Potential sources of bacteria in this flow zone include areas within a short distance from the stream corridor or in the stream itself, such as cattle defecating directly into the stream. Grazing areas in close proximity to the stream may also contribute to loadings in this flow zone during small runoff events.

Targeting impairments in this zone can be accomplished by addressing potential areas contributing to bacterial contamination within a short distance of the stream corridor.

### **5.0.4 Flow Zone 4 (60% to 90% flow frequency exceedence)**

Flow zone 4 consists of flows that occur during dry conditions. For the Belle Fourche River, these flows range from 78 to 217 CFS. These flows are indicative of drought conditions. Table 9 depicts the components of the TMDL for this flow zone. The current load is based on the 95<sup>th</sup> percentile flow in this flow zone and the 95<sup>th</sup> percentile *E. coli* concentration in this flow zone. The current load suggests a 30% reduction in loading is necessary to attain the standard.

Sources of bacteria in this flow zone deliver *E. coli* directly to the stream. Potential contributing sources are livestock grazing areas with direct access to the river or a perennial stream that flows into the river.

Targeting impairments in this flow zone can be accomplished by addressing potential areas of bacterial contamination that allow stock animals direct access to the river or a tributary.

### **5.0.5 Flow Zone 5 (90% to 100% flow frequency exceedence)**

Flow zone 5 consists of the lowest flows recorded on the river. They are representative of severe drought conditions both locally and regionally. Flows in this zone range from the lowest measured to 78 CFS.

Table 9 depicts the components of the TMDL for this flow zone. The current load is based on the 95<sup>th</sup> percentile flow in this flow zone and the 95<sup>th</sup> percentile *E. coli* concentration in this flow zone. An 80% reduction is necessary to attain the standard in this flow zone.

Impairments in this flow zone are in direct contact with the waterway and are located in close proximity. Low flows also have low velocities, which allows for bacterial die off rates to take effect without the load traveling a significant distance. The most likely source of bacteria in this flow zone is livestock defecating directly into the stream. Implementation efforts for this flow zone should focus on areas where livestock have direct access to the Belle Fourche River or perennial streams that flow into the river.

### **5.1 Load Allocations (LAs)**

Approximately 85% of land use in the watershed is agricultural or used for livestock grazing. 97.2% of the TMDL load has been allocated to these non-point source loads. An additional 2.7% was attributed to wildlife as natural background sources. A very small amount of *E. coli*, less than 0.02%, was attributed to human sources. A 99% reduction in *E. coli* from anthropogenic sources (livestock) is required in the high flow zone to fully attain the current water quality standards. The moist flow zone requires a 56% reduction in fecal coliform bacteria. The moderate flow zone requires a 22% reduction, the dry flow zone a 30% reduction, and the low flow zone a 80% reduction to fully attain the current water quality standards. Reducing the 95<sup>th</sup> percentile samples in each impaired flow zone below the chronic standard provides assurance that both acute and chronic standards will be met.

### **5.2 Waste Load Allocations (WLAs)**

No point sources are located in the Belle Fourche River segment 5 watershed, therefore the WLA was assigned a value of zero.

## **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**

Seasonality is important when considering bacteria contamination. Sample data was collected between the months of May and September. Peak use is typically late in the season after temperatures increase. Monthly evaluations of the data showed no trend of a particular month generating higher or lower concentrations. The lack of a pattern further suggests numerous sources dispersed throughout the basin.

## **7.0 Public Participation**

### STATE AGENCIES

South Dakota Department of the Environment and Natural Resources (SD DENR) was the primary state agency involved in the completion of this assessment. SD DENR provided technical support and equipment throughout the course of the project. This TMDL was made available for public notice in the Rapid City Journal, Black Hills Pioneer, and the Belle Fourche Post.

### FEDERAL AGENCIES

Environmental Protection Agency (EPA) provided the primary source of funds for the completion of the assessment on the Belle Fourche River

### LOCAL GOVERNMENT, INDUSTRY, ENVIRONMENTAL, AND OTHER GROUPS AND PUBLIC AT LARGE

During the summer sampling seasons, project personnel frequently met with landowners in the field. These meetings were most often facilitated through the landowners stopping to ask questions while data collection was occurring. Although informal in nature, these meetings provide an important medium for obtaining local landowner views and opinions.

## **8.0 Monitoring Strategy**

The Department may adjust the load and/or waste load 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.

Monitoring will continue throughout the Belle Fourche River watershed. WQM site 460676 will be monitored monthly as part of the ambient water monitoring program. The results from this monitoring cycle can be used to supplement the modeling to judge project effectiveness or TMDL adjustments.

## 9.0 Restoration Strategy

The Belle Fourche River Implementation Project is currently underway in segment 5 of the Belle Fourche River. Best management practices (BMPs) should focus on grazing areas and cropland where manure is applied. Emphasis should be placed on bacterial sources throughout the watershed, as data shows contributing areas exist throughout the watershed. This includes areas where stock animals have direct access to the stream and also areas of bacterial contribution some distance from the river that contribute during flow events.

## 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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- US Census Bureau. 2000. *U.S. Summary: 2000, Census US Profile*
- USDA (United States Department of Agriculture). 1978 Soil Survey of Meade County, South Dakota.
- USDA (United States Department of Agriculture); National Agricultural Statistics Service. 2010. *South Dakota Agriculture 2010*, June 2010. Sioux Falls, SD.
- 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.



**EPA REGION VIII TMDL REVIEW**

## TMDL Document Info:

<b>Document Name:</b>	<b>Escherichia Coli Total Maximum Daily Load Evaluation of the Belle Fourche River, Segment 5, Meade County, South Dakota</b>
<b>Submitted by:</b>	<b>Rich Hanson, SD DENR</b>
<b>Date Received:</b>	<b>August 3, 2011</b>
<b>Review Date:</b>	<b>September 12, 2011</b>
<b>Reviewer:</b>	<b>Vern Berry, EPA</b>
<b>Rough Draft / Public Notice / Final?</b>	<b>Public Notice Draft</b>
<b>Notes:</b>	

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 Belle Fourche River, Segment 5, *E. coli* TMDL was submitted to EPA for review via an email from Rich Hanson, SD DENR on August 3, 2011. The email included the draft TMDL document for review and comment.

**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:** The Belle Fourche River is a natural stream that originates in Wyoming and drains parts of Butte, Lawrence and Meade Counties in South Dakota. The Belle Fourche River is part of the larger Cheyenne River basin in the Lower Belle Fourche sub-basin (HUC 10120202). The impaired segment of the Belle Fourche River begins at the confluence with Alkali Creek and ends at the confluence with the Cheyenne River (51 miles; SD-BF-R-BELLE\_FOURCHE\_05), and is listed as a high priority for TMDL development.

This segment is identified on the 2010 South Dakota 303(d) waterbody list as impaired due to elevated *E. coli* and total suspended solids (TSS) concentrations. The TSS impairment was addressed in a separate TMDL document developed by SD DENR and approved by EPA in February 2005.

The designated uses for Segment 5 of the Belle Fourche River include: warmwater permanent fish life propagation waters, immersion recreation waters, limited-contact recreation waters, irrigation waters, fish and wildlife propagation, recreation, and stock watering.

**COMMENTS:** The TMDL document does not include a description of the listed segment (i.e., from x to y). We recommend including the description of the segment as it appears on the 2010 IR. However, despite what is shown on page 4, this segment of the Belle Fourche River was not listed for *E. coli* on the 2010 IR. Because no previous *E. coli* impairment determination has been made for Segment 5 of the Belle Fourche River, the TMDL document needs to include a detailed explanation of why the TMDL is being written. This explanation needs to include an analysis of the *E. coli* data and the impairment determination.

The 2010 IR includes an impairment listing in this segment for TSS. This TMDL document should include a sentence that refers to the separate TSS TMDL written by SD DENR to address the impairment and the approval by EPA in February 2005 [see: [http://iaspub.epa.gov/waters10/attains\\_impaired\\_waters.tmdl\\_report?p\\_tmdl\\_id=11387&p\\_tribe=&p\\_report\\_type=](http://iaspub.epa.gov/waters10/attains_impaired_waters.tmdl_report?p_tmdl_id=11387&p_tribe=&p_report_type=)]. We also recommend including reference to the separate TMDL that was developed for fecal coliform in this segment.

We found 1 reference to Beaver Creek in this document on page 2, List of Figures. This should be corrected.

*DENR Response: A description of the listed segment was included in section 1.1. An explanation of the anticipated E. coli listing and reasoning for completing a TMDL was included in section 1.0. Language that makes note of the TSS impairment listing and TMDL approval by EPA was included in section 1.0. Language that makes note of the fecal coliform TMDL that was submitted to EPA at the same time as this document was also included. Any referenced to Beaver Creek were removed and corrected.*

### 1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

- The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).
- The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)).

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

- The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.
- If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** The Belle Fourche River, Segment 5, is likely to be impaired based on *E. coli* concentrations that are impacting the immersion contact recreation beneficial uses. South Dakota has numeric standards for *E. coli* that are applicable to this stream segment. The *E. coli* standards being implemented in this TMDL are: a daily maximum value of 235 cfu/100mL in any one sample, and a maximum geometric mean of 126 cfu/100mL during a 30-day period. The standards for *E. coli* are applicable from May 1 to September 30. Discussion of additional applicable water quality standards for the Belle Fourche River, Segment 5, can be found on pages 7 – 9 of the TMDL document.

**COMMENTS:** None.

## 2. Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddness, 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 targets for this TMDL are based on the numeric water quality standards for *E. coli* established to protect the immersion contact recreation beneficial uses for the Belle Fourche River, Segment 5. The *E. coli* targets are: daily maximum of  $\leq 235$  cfu/100mL in any one sample, and maximum geometric mean of  $\leq 126$  cfu/100mL during a 30-day period. The *E. coli* standards are applicable 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 uses in the watershed as predominately agriculture in the form of cropland (48.5 percent) and rangeland (36.1 percent) with a small amount of other uses. The specific landuse breakdown for the watershed is included in Table 1 of the TMDL document.

There are no point sources that discharge to Segment 5 of the Belle Fourche River. Therefore, the wasteload allocation for this TMDL is zero.

Nonpoint sources of *E. coli* bacteria in Segment 5 of the Belle Fourche River come primarily from agricultural sources. Data from the 2010 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 and are presented in Table 3 of the TMDL document. *E.*

coli loads for each type of animal were estimated from fecal coliform values using the method described in section 4.3 of the TMDL document.

Manure from livestock is a potential source of *E. coli* to the stream. Livestock in the basin are mainly beef cattle with sheep being the next abundant animals in the study area. Other livestock in the basin include dairy cattle, hogs, horses and chickens. Numbers of animals on private land were estimated through personal communication with landowners and agricultural statistics in the watershed.

A total of 79 people reside within the watershed of the Belle Fourche River, Segment 5. Septic systems are assumed to be the primary human source for the rest of the population in the watershed. When included as a total load it's estimated that this population produced *E. coli* bacteria of approximately 0.01% of the total loading in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no *E. coli* bacteria entering the river.

Wildlife within the watershed is a natural source of *E. coli* bacteria in the study area. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish and Parks. Best estimates suggest wildlife account for approximately 2% of the bacteria produced in the watershed.

Based on review of available information and communication with local land owners, the primary nonpoint sources of *E. coli* within the impaired reach of the Belle Fourche River include agricultural runoff and wildlife. Table 4, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. The main source of *E. coli* bacteria is likely overland runoff from livestock grazing in pastures.

**Table 4. Bacteria source allocation for segment 5 of the Belle Fourche River watershed.**

Source	Percentage
Feeding Areas	0.7%
Livestock on Grass	97.5%
Wildlife	1.7%

**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., stream 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 TMDL technical analysis for Segment 5 of the Belle Fourche River describes how the *E. coli* loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

A total of 28 *E. coli* samples were collected at DENR ambient monitoring station WQM 76 in 2009 and 2010. To create a more robust dataset, fecal coliform bacteria data were used to estimate *E. coli* concentrations. A total of 107 fecal coliform samples were collected at WQM 76 between the years of 1976 and 2010 during the months of May through September. Of those 107 samples, 28 were taken simultaneously with *E. coli* samples. The relationship of these 28 paired samples was used to estimate *E. coli* concentrations. The resulting dataset of 107 *E. coli* samples was used to develop the *E. coli* TMDL. Belle Fourche River flow data were available from U.S. Geological Survey (USGS) Station 6438000, located near Elm Springs, SD. Flow data from 1976 until 2010 was used to match the period of record from which water quality samples were collected.

The TMDLs were developed using the Load Duration Curve (LDC) approach, resulting in a flow-variable target that considers the entire flow regime within the recreational season (May 1st – September 30th). The LDC is a dynamic expression of the allowable load for any given day within the recreation season. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones: high flows (0–10%), moist conditions (10–40%), mid-range flows (40–60%), dry conditions (60–90%), and low flows (90–100%) according to EPA’s LDC guidance.

Instantaneous bacteria loads were calculated by multiplying the estimated *E. coli* sample concentrations from ambient water quality site WQM 76, the USGS daily average flow and a unit conversion factor. The LDC shown in Figure 6 of the TMDL document represents a dynamic expression of the TMDL for Segment 5 of the Belle Fourche River that is based on the 30-day geometric mean *E. coli* criteria, resulting in unique loads that correspond to measured average daily flows.

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown. Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, the 95th percentile of *E. coli* samples collected from Segment 5 of the Belle Fourche River exceed the geometric mean criterion primarily in the high and moist flow zones. Loads exceeding the criteria in the low flow zone typically indicate point source load contributions, while those further left on the plot generally reflect potential nonpoint source contributions.

**COMMENTS:** The flow ranges explained in the text of sections 5.0.1 – 5.0.5 do not match the flow ranges specified in Table 9. The text and table values need to be checked for consistency and revised as necessary.

**DENR Response:** *The flow ranges explained in the text of sections 5.0.1 – 5.0.5 were corrected to match the flow ranges in Table 9.*

#### 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 Belle Fourche River, Segment 5, TMDL data description and summary are included text and tables throughout the document. A total of 28 *E. coli* samples were collected at DENR ambient monitoring station WQM 76 in 2009 and 2010. To create a more robust dataset, fecal coliform bacteria data were used to estimate *E. coli* concentrations. A total of 107 fecal coliform samples were collected at WQM 76 between the years of 1976 and 2010 during the months of May through September. Of those 107 samples, 28 were taken simultaneously with *E. coli* samples. The relationship of these 28 paired samples was used to estimate *E. coli* concentrations. The resulting dataset of 107 *E. coli* samples was used to develop the *E. coli* TMDL. This dataset was used to develop the TMDL for Segment 5 of the Belle Fourche River. The data set also includes approximately 25 years of flow data collected at USGS gauging site 6438000, located near Elm Springs, SD.

**COMMENTS:** None.

#### 4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** There are no point sources that discharge to Segment 5 of the Belle Fourche River. Therefore, the WLA for this TMDL is zero.

**COMMENTS:** None.

#### 4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The

background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:

- EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.
- Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** Nonpoint sources of *E. coli* bacteria in Segment 5 of the Belle Fourche River come primarily from agricultural sources. Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. To develop the *E. coli* bacteria load allocation (LA), the loading capacity (LC) was first determined. The LC for the Belle Fourche River was calculated by multiplying the daily maximum *E. coli* bacteria criterion by the daily average flow measured at the USGS gauging station 6438000 on the Belle Fourche River and a conversion factor. The more stringent geometric mean criterion (126 cfu/100ml) was used rather than the daily maximum criterion (235 cfu/100ml). Table 9 in the TMDL document includes the load allocations at each of the flow regimes – 3.18E+13 cfu/day at high flows; 2.20E+12 cfu/day during moist flows; 7.98E+11 cfu/day at midrange flows; 4.16E+11 cfu/day at dry flows and 8.66E+10 cfu/100mL at low flow conditions. The resulting LAs were allocated to the various nonpoint sources identified in the watershed.

**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 an 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 Belle Fourche River, Segment 5, TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Table 9 of the TMDL.

**COMMENTS:** None.

#### 4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

Recommendation:

Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** By using the load duration curve approach to develop the TMDL allocations seasonal variability in *E. coli* loads are taken into account. Highest stream 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](http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf)

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** The impaired segment of Belle Fourche River will continue to be monitored through SD DENR's ambient water quality monitoring stations in the Belle Fourche River watershed. WQM site 76 will be monitored monthly as part of the ambient water monitoring program. The results from this monitoring cycle can be used to supplement the modeling to judge project effectiveness or TMDL adjustments. The Belle Fourche River Implementation Project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL. During the recreation season bacterial monitoring should be increased to collect at least 5 samples per month to assess the geometric mean criterion. Additional monitoring and evaluation efforts should be targeted toward designed BMPs to document the effectiveness of implemented BMPs. Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

**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 says that a variety of BMPs could be considered in the development of a water-quality management implementation plan for the impaired segment of the Belle Fourche River watershed. The Belle Fourche River Implementation Project is currently underway in Segment 5 of the Belle Fourche River. Best management practices (BMPs) should focus on grazing areas and cropland where manure is applied.

**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 Belle Fourche River, Segment 5, *E. coli* TMDL includes daily loads expressed as colonies forming units (cfu) per day. The daily TMDL loads are included in TMDL Section of the document.

**COMMENTS:** None.

***Comments from the Belle Fourche River Watershed  
Partnership and Responses from South Dakota  
Department of the Environment and Natural Resources***

**Page 3, Comment 1:** Comment refers to an error in the table of contents referring to Beaver Creek.

***DENR Response:*** The error was corrected to “Belle Fourche River segment 5”

**Page 7, Comment 1:** BFRWP commented: “Land use does not appear correct for this watershed. Very little row crop and should be predominantly range.”

***DENR Response:*** The numbers were not correct and land use in the watershed has been reassessed to properly reflect the actual uses in the watershed.

**Page 10, Comment 1:** In reference to the following sentence in section 3.2.1 Natural Background Sources: “Best estimates suggest wildlife account for approximately 2% of the bacteria produced in the watershed.” BFRWP commented: “Closer to 3%”

***DENR Response:*** The sentence was changed to: “Best estimates suggest wildlife account for approximately 3% of the bacteria produced in the watershed.”

**Page 11, Comment 1:** In reference to the following sentence in section 3.2.2 Human Sources: “These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliform bacteria entering the river.” BFRWP commented, “Septic impacts are variable dependent on age, type of system, and proximity to the stream.

***DENR Response:*** Because human sources account for 0.02% of the total potential *E. coli* load in the watershed, contributions from septic tanks are insignificant. The sentence was corrected to more accurately state this condition. The sentence now reads, “These bacteria should all be delivered to a septic system, which if functioning correctly would result in an insignificant amount of bacteria entering the river.”

**Page 19, Comment 1:** In reference to the following sentence in section 4.3 Sample Data: “The presence of extreme concentrations on the falling limb indicates that stock animals have access to the water and contribute *E. coli* directly to the river.” BFRWP commented, “as well as wildlife”

***DENR Response:*** Data shows that contributions from wildlife are not of great concern in this watershed. Wildlife account for 2.7% of the potential *E. coli* loading in the watershed and are not a significant source of bacteria. Stock animals are the predominant source of bacteria, accounting for 97.2% of the potential *E. coli* loading in the watershed.

**Page 19, Comment 2:** In reference to the following sentence in section 4.3 Sample Data: “Possibilities include grazing areas and cropland where manure has been applied.” The words “cropland where manure” were highlighted as the point of concern. BFRWP commented, “Cropland is limited in the watershed, but acres are concentrated around streams so could be a concern.”

***DENR Response:*** Based on the correction to the land use data in Table 1 that shows cropland makes up a very small portion of the watershed, the sentence was changed to: “The most likely contributor is grazing areas, including areas in close proximity and also those some distance from the watershed.”

**Page 19, Comment 3:** In reference to the following sentence in section 4.3 Sample Data: “These numbers indicate that bacterial contamination occurs over a wide range of flow conditions, but the most severe contamination occurs during high flows in the high and moist flow zones, and during very low flows.” The words “low flows” were highlighted as the point of concern. BFRWP commented, “This indicates a direct source which could include direct defecation by wildlife/livestock or septic systems. What is the proximity of septic systems to sampling location.”

***DENR Response:*** The nearest possible septic system is located 6 miles upstream of the sampling site. At low flows, bacteria do not travel as great of a distance before dying off because of slower stream flow velocities. It is unlikely that this residence is causing impairment at the sampling site at low flows. As discussed throughout the report, contamination at low flows is likely caused by livestock in riparian areas and the stream itself.

**Page 21, Comment 1:** In reference to the following sentence in section 5.0.3 Flow Zone 3: “Grazing areas and crop land with manure spread on it in close proximity to the stream may also contribute to loadings in this flow zone during small runoff events.” The words “crop land with manure spread” were highlighted as the point of concern. BFRWP commented, “Not sure how prevalent this is as cropland is limited.”

***DENR Response:*** The sentence was changed to reflect the corrected land use data and reads as follows: “Grazing areas in close proximity to the stream may also contribute to loadings in this flow zone during small runoff events.”

**Page 21, Comment 2:** In reference to the following sentence in section 5.0.4: “Targeting impairments in this flow zone can be accomplished by addressing potential areas of bacterial contamination that allow stock animals direct access to the river or a tributary.” The phrase “stock animals” was highlighted as a point of concern. BFRWP commented: “Wildlife and septic systems close to streams could also potentially be a source.”

***DENR Response:*** Because this sentence refers to targeting impairments, and wildlife is considered a natural background source, it is not an appropriate implementation practice to reduce wildlife numbers in close proximity to the stream. Furthermore, wildlife

account for a small percentage of potential bacteria sources in the watershed relative to agricultural sources.

While septic systems may contribute a small amount of bacteria to the river, potential bacteria loadings from human sources account for only 0.02% of the *E. coli* in the watershed. These bacteria are all delivered to septic systems which would result in even less bacteria being delivered to the stream. Human sources are insignificant compared to stock animals, which account for 97.2% of potential *E. coli* loading in the watershed. Furthermore, the vast majority of stock animals are located in grazing areas (97.5%). Some grazing areas allow livestock access to the river and its tributaries, and in this flow zone it is likely that bacteria sources are located in close proximity to the stream, or in the stream itself such as stock animals defecating directly into the water. It is not recommended that septic systems be targeted for implementation as it would result in an inefficient use of resources. Much greater reductions in bacteria loading would likely result from targeting grazing areas where stock animals have access to the stream.

**Page 22, Comment 1:**

In reference to the following sentences in section 5.0.5: “The most likely source of bacteria in this flow zone is livestock defecating directly into the stream. Implementation efforts for this flow zone should focus on areas where livestock have direct access to the Belle Fourche River or perennial streams that flow into the river.” BFRWP commented: “Could also potentially be attributed to wildlife or septic.”

***DENR Response:*** Wildlife and septic systems are not the most likely sources of fecal coliform bacteria in the watershed, as evidenced by the source allocations outlined in this report. Livestock, the most likely source of fecal coliform bacteria in this flow zone and all other flow zones, account for 97.2% of the potential *E. coli* loading in this watershed. Sources of bacteria in this flow zone are in direct contact with the stream or in very close proximity, such as stock animals defecating directly into the water while wading. It is not recommended that septic systems be targeted for implementation as it would result in an inefficient use of resources. Much greater reductions in bacteria loading would likely result from targeting grazing areas where stock animals have access to the stream.

**Page 22, Comment 2:** In reference to the following sentence in section 5.1 Load Allocations: “All of the TMDL load has been allocated to these non-point source loads.” BFRWP commented: “A portion should also go to wildlife and septic.”

***DENR Response:*** The sentence was changed to read as follows: “97.2% of the TMDL load has been allocated to these non-point source loads. An additional 2.7% was attributed to wildlife as natural background sources. A very small amount of *E. coli*, less than 0.02%, was attributed to human sources.”

**Page 24, Comment 1:** In reference to the following sentence in section 8.0 Monitoring Strategy: “The Belle Fourche River Implementation Project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL.” BFRWP commented: “These models are not currently being used in the implementation project.”

A HSPF model was developed for hydrology and sediment during TMDL development for sediment on this stream segment.”

***DENR Response:*** This sentence was removed from the document.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8

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RECEIVED

OCT 24 2011

DEPT. OF ENVIRONMENT AND  
NATURAL RESOURCES,  
SECRETARY'S OFFICE

Ref: 8EPR-EP

OCT 17 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  
*Belle Fourche River, Segment 5, E. coli;*  
*SD-BF-R-BELLE\_FOURCHE\_05*

Dear Mr. Pirner:

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

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

Sincerely,

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

Enclosures



ENCLOSURE 1: APPROVED TMDLs

**Esherichia Coli Total Maximum Daily Load Evaluation of the Belle Fourche River Segment 5, Meade County, South Dakota (SD DENR, June 2011)**

Submitted: 9/29/2011

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

Segment: Belle Fourche River from Alkali Creek to the mouth (confluence with Cheyenne River)

303(d) ID: SD-BF-R-BELLE FOURCHE 05

Parameter/Pollutant (303(d) list cause):	E. COLI - 227		Water Quality <= 126 cfu/100mL		Permits
	Allocation*	Value	Units	Targets:	
	WLA	0	CFU/DAY		
	LA	2.2E+12	CFU/DAY		
	TMDL	2.49E+12	CFU/DAY		
	MOS	2.9E+11	CFU/DAY		

**Notes:** The loads shown represent the loads during the moist flow regime as defined by the load duration curve for the Belle Fourche River, Segment 5 (see Figure 6 of the TMDL). The moist 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



EPA REGION VIII TMDL REVIEW

TMDL Document Info:

<b>Document Name:</b>	<b>Escherichia Coli Total Maximum Daily Load Evaluation of the Belle Fourche River, Segment 5, Meade County, South Dakota</b>
<b>Submitted by:</b>	<b>Rich Hanson, SD DENR</b>
<b>Date Received:</b>	<b>September 29, 2011</b>
<b>Review Date:</b>	<b>October 4, 2011</b>
<b>Reviewer:</b>	<b>Vern Berry, EPA</b>
<b>Rough Draft / Public Notice / Final?</b>	<b>Final</b>
<b>Notes:</b>	

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

- Approve
- Partial Approval
- Disapprove
- Insufficient Information

**Approval Notes to Administrator: Based on the review presented below, I recommend approval of the TMDLs submitted in this document.**

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 Belle Fourche River, Segment 5, E. coli TMDL was submitted to EPA for review and approval via an email from Rich Hanson, SD DENR on September 29, 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:** The Belle Fourche River is a natural stream that originates in Wyoming and drains parts of Butte, Lawrence and Meade Counties in South Dakota. The Belle Fourche River is part of the larger Cheyenne River basin in the Lower Belle Fourche sub-basin (HUC 10120202). The impaired segment of the Belle Fourche River begins at the confluence with Alkali Creek and ends at the confluence with the Cheyenne River (51 miles; SD-BF-R-BELLE\_FOURCHE\_05). This segment drains approximately 557,420 acres of land.

This segment is identified on the 2010 South Dakota 303(d) waterbody list as impaired due to elevated fecal coliform and total suspended solids (TSS) concentrations. The TSS impairment was addressed in a separate TMDL document developed by SD DENR and approved by EPA in February 2005. A TMDL document for fecal

coliform bacteria was prepared by SD DENR and presented for public notice at the same time as this E. coli TMDL document.

It is anticipated that the 2012 303(d) list will include Segment 5 of the Belle Fourche River as impaired for E. coli based on routine monitoring data collected in 2009 and 2010. The South Dakota assessment methodology for pathogens says that if over 20 samples are collected, the waterbody will be listed as impaired if 10% or more of the samples exceed the daily maximum criterion. Of 28 E. coli samples collected in this segment, 6 exceeded the single sample standard for a 21 percent rate of exceedence.

The designated uses for Segment 5 of the Belle Fourche River include: warmwater permanent fish life propagation waters, immersion recreation waters, limited-contact recreation waters, irrigation waters, fish and wildlife propagation, recreation, and stock watering.

**COMMENTS:** None.

### 1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

- The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).
- The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)).

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

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

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

Recommendation:

- Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** The Belle Fourche River, Segment 5, is currently impaired for E. coli based on concentrations that are impacting the immersion contact recreation beneficial uses. South Dakota has numeric standards for E. coli that are applicable to this stream segment. The E. coli standards being implemented in this TMDL are: a daily maximum value of 235 cfu/100mL in any one sample, and a maximum geometric mean of 126 cfu/100mL during a 30-day period. The standards for E. coli are applicable from May 1 to September 30. Discussion of additional applicable water quality standards for the Belle Fourche River, Segment 5, can be found on pages 7 – 9 of the TMDL document.

**COMMENTS:** None.

## 2. Water Quality Targets

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

Minimum Submission Requirements:

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

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

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

Recommendation:

- Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** The water quality targets for this TMDL are based on the numeric water quality standards for *E. coli* established to protect the immersion contact recreation beneficial uses for the Belle Fourche River, Segment 5. The *E. coli* targets are: daily maximum of  $\leq 235$  cfu/100mL in any one sample, and maximum geometric mean of  $\leq 126$  cfu/100mL during a 30-day period. The *E. coli* standards are applicable 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 uses in the watershed as predominately agriculture in the form of pasture/rangeland (93 percent), water/wetlands (3 percent), small grains (1 percent) and the remainder is a mixture of fallow, woodland, roads and homesteads. The specific landuse breakdown for the watershed is included in Table 1 of the TMDL document.

There are no point sources that discharge to Segment 5 of the Belle Fourche River. Therefore, the wasteload allocation for this TMDL is zero.

Nonpoint sources of E. coli bacteria in Segment 5 of the Belle Fourche River come primarily from agricultural sources. Data from the 2010 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 and are presented in Table 3 of the TMDL document. E. coli loads for each type of animal were estimated from fecal coliform values using the method described in section 4.3 of the TMDL document.

Manure from livestock is a potential source of E. coli to the stream. Livestock in the basin are mainly beef cattle with sheep being the next abundant animals in the study area. Other livestock in the basin include dairy cattle, hogs, horses and chickens. Numbers of animals on private land were estimated through personal communication with landowners and agricultural statistics in the watershed.

A total of 79 people reside within the watershed of the Belle Fourche River, Segment 5. Septic systems are assumed to be the primary human source for the rest of the population in the watershed. When included as a total load it's estimated that this population produced E. coli bacteria of approximately 0.01% of the total loading in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no E. coli bacteria entering the river.

Wildlife within the watershed is a natural source of E. coli bacteria in the study area. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish and Parks. Best estimates suggest wildlife account for approximately 3% of the bacteria produced in the watershed.

Based on review of available information and communication with local land owners, the primary nonpoint sources of E. coli within the impaired reach of the Belle Fourche River include agricultural runoff and wildlife. Table 4, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. The main source of E. coli bacteria is likely overland runoff from livestock grazing in pastures.

**Table 4. Bacteria source allocation for segment 5 of the Belle Fourche River watershed.**

Source	Percentage
Feeding Areas	0.7%
Livestock on Grass	97.5%
Wildlife	1.7%

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., stream 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 TMDL technical analysis for Segment 5 of the Belle Fourche River describes how the E. coli loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

A total of 28 E. coli samples were collected at DENR ambient monitoring station WQM 76 in 2009 and 2010. To create a more robust dataset, fecal coliform bacteria data were used to estimate E. coli concentrations. A total of 107 fecal coliform samples were collected at WQM 76 between the years of 1976 and 2010 during the months of May through September. Of those 107 samples, 28 were taken simultaneously with E. coli samples. The relationship of these 28 paired samples was used to estimate E. coli concentrations. The resulting dataset of 107 E. coli samples was used to develop the E. coli TMDL. Belle Fourche River flow data were available from U.S. Geological Survey (USGS) Station 6438000, located near Elm Springs, SD. Flow data from 1976 until 2010 was used to match the period of record from which water quality samples were collected.

The TMDLs were developed using the Load Duration Curve (LDC) approach, resulting in a flow-variable target that considers the entire flow regime within the recreational season (May 1st – September 30th). The LDC is a dynamic expression of the allowable load for any given day within the recreation season. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones: high flows (0–10%), moist conditions (10–40%), mid-range flows (40–60%), dry conditions (60–90%), and low flows (90–100%) according to EPA’s LDC guidance.

Instantaneous bacteria loads were calculated by multiplying the estimated E. coli sample concentrations from ambient water quality site WQM 76, the USGS daily average flow and a unit conversion factor. The LDC shown in Figure 6 of the TMDL document represents a dynamic expression of the TMDL for Segment 5 of the Belle Fourche River that is based on the 30-day geometric mean E. coli criteria, resulting in unique loads that correspond to measured average daily flows.

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown. Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, the 95th percentile of E. coli samples collected from Segment 5 of the Belle Fourche River exceed the geometric mean criterion primarily in the high and moist flow zones. Loads exceeding

the criteria in the low flow zone typically indicate point source load contributions, while those further left on the plot generally reflect potential nonpoint source contributions.

**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 Belle Fourche River, Segment 5, TMDL data description and summary are included text and tables throughout the document. A total of 28 E. coli samples were collected at DENR ambient monitoring station WQM 76 in 2009 and 2010. To create a more robust dataset, fecal coliform bacteria data were used to estimate E. coli concentrations. A total of 107 fecal coliform samples were collected at WQM 76 between the years of 1976 and 2010 during the months of May through September. Of those 107 samples, 28 were taken simultaneously with E. coli samples. The relationship of these 28 paired samples was used to estimate E. coli concentrations. The resulting dataset of 107 E. coli samples was used to develop the TMDL for Segment 5 of the Belle Fourche River. The data set also includes approximately 25 years of flow data collected at USGS gauging site 6438000, located near Elm Springs, SD.

**COMMENTS:** None.

#### 4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** There are no point sources that discharge to Segment 5 of the Belle Fourche River. Therefore, the WLA for this TMDL is zero.

**COMMENTS:** None.

### 4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

- EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.
- Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** Nonpoint sources of E. coli bacteria in Segment 5 of the Belle Fourche River come primarily from agricultural sources. Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. To develop the E. coli bacteria load allocation (LA), the loading capacity (LC) was first determined. The LC for the Belle Fourche River was calculated by multiplying the daily maximum E. coli bacteria criterion by the daily average flow measured at the USGS gauging station 6438000 on the Belle Fourche River and a conversion factor. The more stringent geometric mean criterion (126 cfu/100ml) was used rather than the daily maximum criterion (235 cfu/100ml). Table 9 in the TMDL document includes the load allocations at each of the flow regimes – 3.18E+13 cfu/day at

high flows; 2.20E+12 cfu/day during moist flows; 7.98E+11 cfu/day at midrange flows; 4.16E+11 cfu/day at dry flows and 8.66E+10 cfu/100mL at low flow conditions. The resulting LAs were allocated to the various nonpoint sources identified in the watershed.

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 an 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 Belle Fourche River, Segment 5, TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Table 9 of the TMDL.

COMMENTS: None.

#### 4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

Recommendation:

- Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** By using the load duration curve approach to develop the TMDL allocations seasonal variability in E. coli loads are taken into account. Highest stream 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](http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf)

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** The impaired segment of Belle Fourche River will continue to be monitored through SD DENR's ambient water quality monitoring stations in the Belle Fourche River watershed. WQM site 76 will be monitored monthly as part of the ambient water monitoring program. The results from this monitoring cycle can be used to supplement the modeling to judge project effectiveness or TMDL adjustments. During the recreation season bacterial monitoring should be increased to collect at least 5 samples per month to assess the geometric mean criterion. Additional monitoring and evaluation efforts should be targeted toward designed BMPs to document the effectiveness of implemented BMPs. Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

**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 says that a variety of BMPs could be considered in the development of a water-quality management implementation plan for the impaired segment of the Belle Fourche River watershed. The Belle Fourche River Implementation Project is currently underway in Segment 5 of the Belle Fourche River. Best management practices (BMPs) should focus on grazing areas and cropland where manure is applied.

**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 Belle Fourche River, Segment 5, E. coli TMDL includes daily loads expressed as colonies forming units (cfu) per day. The daily TMDL loads are included in TMDL Section of the document.

**COMMENTS:** None.