Pathogen Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River South Dakota

South Dakota Department of Environment and Natural Resources

Protecting South Dakota's Tomorrow ... Today

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Total Maximum Daily Load Summary

East Fork of the Vermillion River - Segments R2 (SD-VM-R-VERMILLION_EAST_FORK_01)

Waterbody Type:	River/Stream
303(d) Listing Parameter:	Pathogens (fecal coliform)
Designated Uses of Concern:	Limited Contact Recreation Waters
Size of Impaired Waterbody:	Segment R2 - Approximately 24.8 km in length Entire length – Approximately 102.7 km in length
Size of Watershed:	Segment R2 - 63,381.7 hectares (ha) Entire Subwatershed Size - 63,381.7 ha
Indicator(s):	Concentration of fecal coliform (colony forming units per 100ml)
Analytical Approach:	Bacteria Source Load Calculator (Ver 3.0) with Load Duration Curve Framework
Location:	Hydrologic Unit Codes (8-digit HUC): 10170102
Goal:	Meet applicable water quality standards for fecal coliform
TMDL Priority Ranking:	Priority 1 (2010 IR)
Target (Water Quality Standards):	Fecal coliform - Maximum daily concentration of ≤ 2,000 CFU/100mL and a geometric mean of ≤ 1,000 based on a minimum of five (5) samples obtained during separate 24-hour periods for any 30-day period and they may not exceed this value in more than 20 percent of the samples examined in this same 30-day period. Both of these criteria apply from May through September.
Reach Number:	Segment R2: SD-VM-R-VERMILLION_EAST_FORK_01

1.0 Objective

The intent of this document is to clearly identify the components of the TMDL, support adequate public participation, and facilitate the US Environmental Protection Agency (US EPA) review. The TMDL was developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by US EPA. This TMDL document addresses the pathogen impairment for one segment of the East Fork of the Vermillion River: Segment R2 (McCook-Lake County Line to the Little Vermillion River) has been assigned a priority category 1 (high-priority) in the 2010 impaired waterbodies list.

2.0 Watershed Characteristics

2.1 General

The project area for Segment R2 of the East Fork of the Vermillion River is shown in Figure 1. The entire East Fork of the Vermillion River drains approximately 346,182.5 total acres (541 miles^2) in southeastern South Dakota (SD). It encompasses two classified segments (R2 and R3) and one unclassified segment which runs north of the McCook/Lake County Line. The immediate watershed for Segment R2 that runs from the McCook/Lake County Line to the Little Vermillion River only includes 24,531 acres. The watershed that drains into the East Fork north of the McCook/Lake County Line and not subject to this TMDL adds an additional 132,083 acres to the drainage area of Segment R2 (total area = 132,083 + 24,531 = 156,614 acres).

Segment R2 of the East Fork is currently classified with the following beneficial uses:

Chapter 74:51:03:01 of the South Dakota Administrative Rules assigns all streams in South Dakota the beneficial uses of:

> *Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters*
> *Beneficial Use Classification 10: Irrigation waters*

Chapter 74:51:03:25 of the South Dakota Administrative Rules assigns the following additional beneficial use classifications to the East Fork of the Vermillion River from the Vermillion River to the McCook-Lake County Line:

> *Beneficial Use Classification 6: Warmwater marginal fish life propagation waters*
> *Beneficial Use Classification 8: Limited contact recreation waters*

Segment R2, as listed in the 2010 Integrated Report (IR), will be the only portion of the East Fork of the Vermillion River covered by this TMDL. This reach (Segment R2) is only 15.4 miles in length running from the Little Vermillion River to the McCook/Lake County Line. Only minor intermittent tributaries, including the Little Vermillion River, merge with the East Fork prior to its confluence with the West Fork where together, the East Fork and the West Fork, form the mainstem of the Vermillion River near Parker, SD (Figure 1).

The East Fork of the Vermillion River watershed is located along the boundary between the James River Lowland and the Prairie Coteau Level IV ecoregions which are both part of the greater Northern Glaciated Plains. A flat to gently rolling landscape composed of glacial drift characterizes the Northern Glaciated Plains ecoregion. This ecoregion is also characterized by dense concentrations of temporary and seasonal wetlands. Native grasses include Eastern wheatgrass, green needlegrass, big bluestem, and blue grama but most areas are extensively tilled to corn and soybeans interspersed with pastureland (Bryce et al., 1996 and Chapman et al., 2001). Wildlife species present in the area include whitetail deer, red fox, beavers, raccoons, ring-necked pheasants, mourning doves, and numerous other species of songbirds, waterfowl, reptiles, and amphibians (SD Game, Fish, and Parks, 2002).

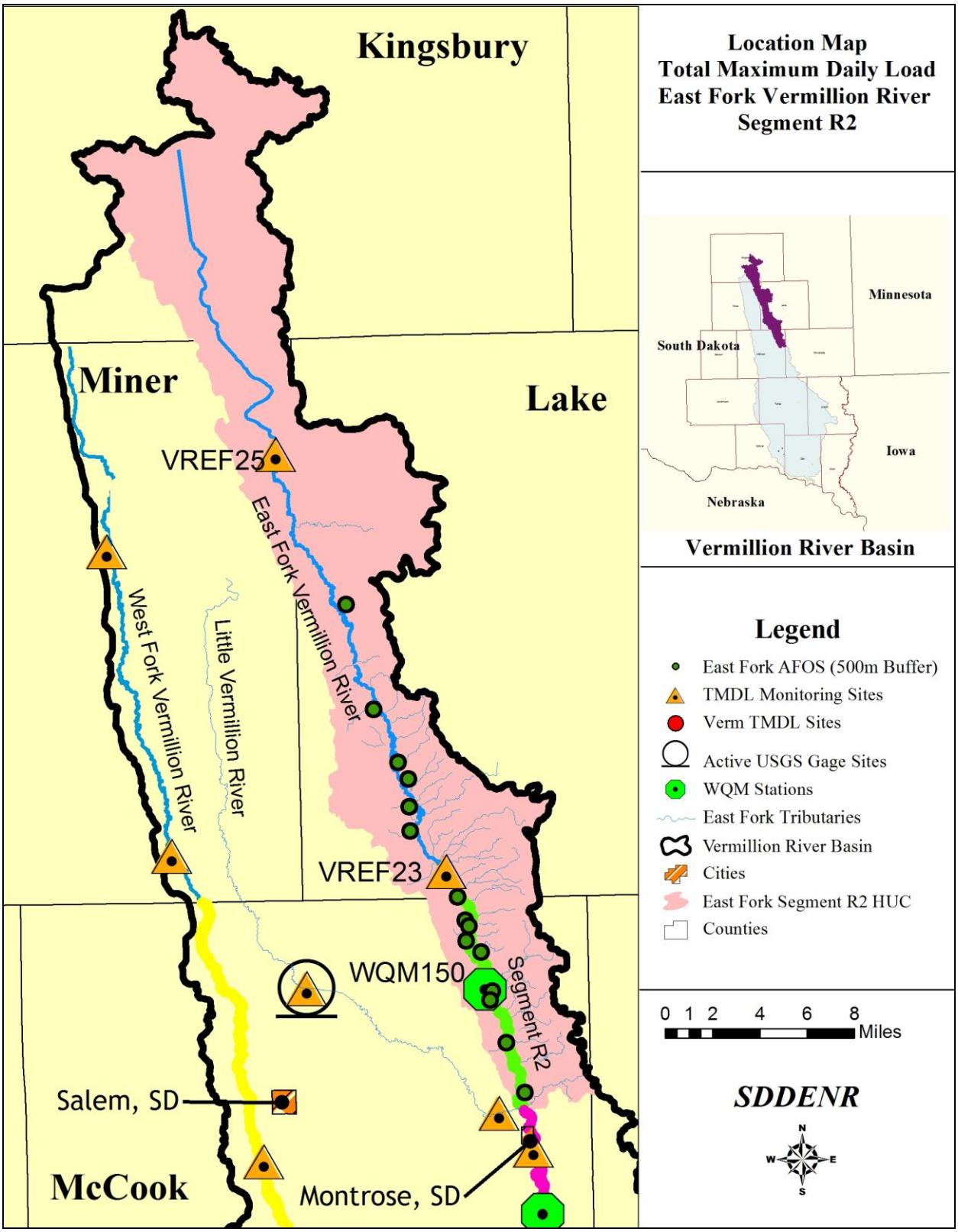

Figure 1. Location of Segment R2, East Fork of the Vermillion River (South Dakota).

Table 1. East and West Fork of the Vermillion River Assessment Reach and Segment Designations.

Segment	MAPID	Length miles	Description	South Dakota Monitoring Stations for Mainstem River	
				Mainstem Sites	Tributary Sites
SD-VM-R-VERMILLION_E_FORK_01	R2	15.4	McCook/Lake County line to Little Vermillion River	VREF23 VREF25 WQM150	

Livestock uses are also a significant landuse type within this watershed. During the animal feeding operation (AFO) inventory conducted during the Vermillion River Basin Watershed Assessment, 15 AFOs were found within 500 meters of the mainstem of the East Fork Vermillion River. Each one of the operations was ranked by the Agricultural Nonpoint Source Computer Model (AGNPS). Thirteen or 87% of the AFOs exhibited an AGNPS rating of 50 or greater.

The impaired reach of the East Fork of the Vermillion River lies within northeastern McCook County (Figure 1). Common soil associations on the uplands include Clarno-Bonilla-Tetonka, Crossplain-Clarno-Tetonka, Clarno-Ethan, Crossplain-Dudley, Hand-Ethan-Clarno, and Wentworth-Egan associations. Associations found within steep areas are limited to Ethan-Betts. Along the terraces, floodplains, and foot slopes Davis-Bon-Lamo and Delmont-Hand-Chaska associations can be found. Soils range from well drained to poorly drained, and level to steep (NRCS, 1980). There is a large mix of uplands, swales, and wetland depressions.

There are no communities within the Segment R2 watershed resulting in no waste load allocation (WLA).

The Vermillion River basin has a subhumid, continental climate characterized by pronounced seasonal differences in temperature, precipitation, and other climatic variables. Temperature varies slightly from the northern to the southern end of the basin. Annual temperatures are slightly cooler at the northern parts of the basin. January is typically the coldest month (13°F in the north and 19°F in the south). July is typically the warmest month (73°F in the north and 75°F in the south). Figure 1 shows that the East Fork of the Vermillion River is located in the northern part of the basin.

The frost free days at the northern end of the basin are typically from May 17th to September 21st, while the southern frost free days are from May 4th to October 5th. The average annual precipitation in the watershed is somewhat variable, both spatially and temporally, ranging from 22 to 26 inches Generally, average annual precipitation decreases as you move north within the study watershed. Average seasonal snowfall for this region is approximately 30 inches.

The average rainfall in the East Fork watershed is approximately 22 inches per year with 64% falling during the May through September (1949-2006). The average annual snowfall is approximately 34 inches but varies widely from year to year. As shown on

Figure 1 and Table 1, there were two TMDL monitoring stations and one WQM station located within the watershed of Segment R2.

Although the East Fork of the Vermillion River is approximately 102 miles in length, the water quality standards only apply from the McCook/Lake County Line to the Little Vermillion River just north of Montrose, SD (Figure 1, Table 1). The data used to determine impairment included two TMDL stations installed as part of the overall Vermillion River Basin Watershed Assessment and one ambient monitoring station: WQM Site 150 (460150). The water quality data for the period 2004-2011 indicated Segment R2 of the East Fork of the Vermillion River was significantly impaired via pathogens and could not support the limited contact recreational use.

Although South Dakota has recently adopted *Escherichia coli* criteria for the protection of the limited contact and immersion recreation uses, the data collected from Segment R2 indicated fecal coliform was the only parameter of concern.

Segment SD-VM-R-VERMILLION_E_FORK_01 (Segment R2) was initially listed in 2002 as partially supporting for the limited contact recreation (pathogens) and warmwater marginal fish life propagation (suspended solids). In 2004, Segment R2 was listed as non-supporting of the warmwater fish life use but insufficient data was available to determine support for the limited contact use. Insufficient information to determine support was also shown for both of these uses in the 2006 IR but the 2008 IR indicated that Segment R2 was under full support. The two latest IR reports (2010 and 2012), show non-support of the limited contact use due to fecal coliform bacteria. This TMDL will address this fecal coliform bacteria impairment for this segment only.

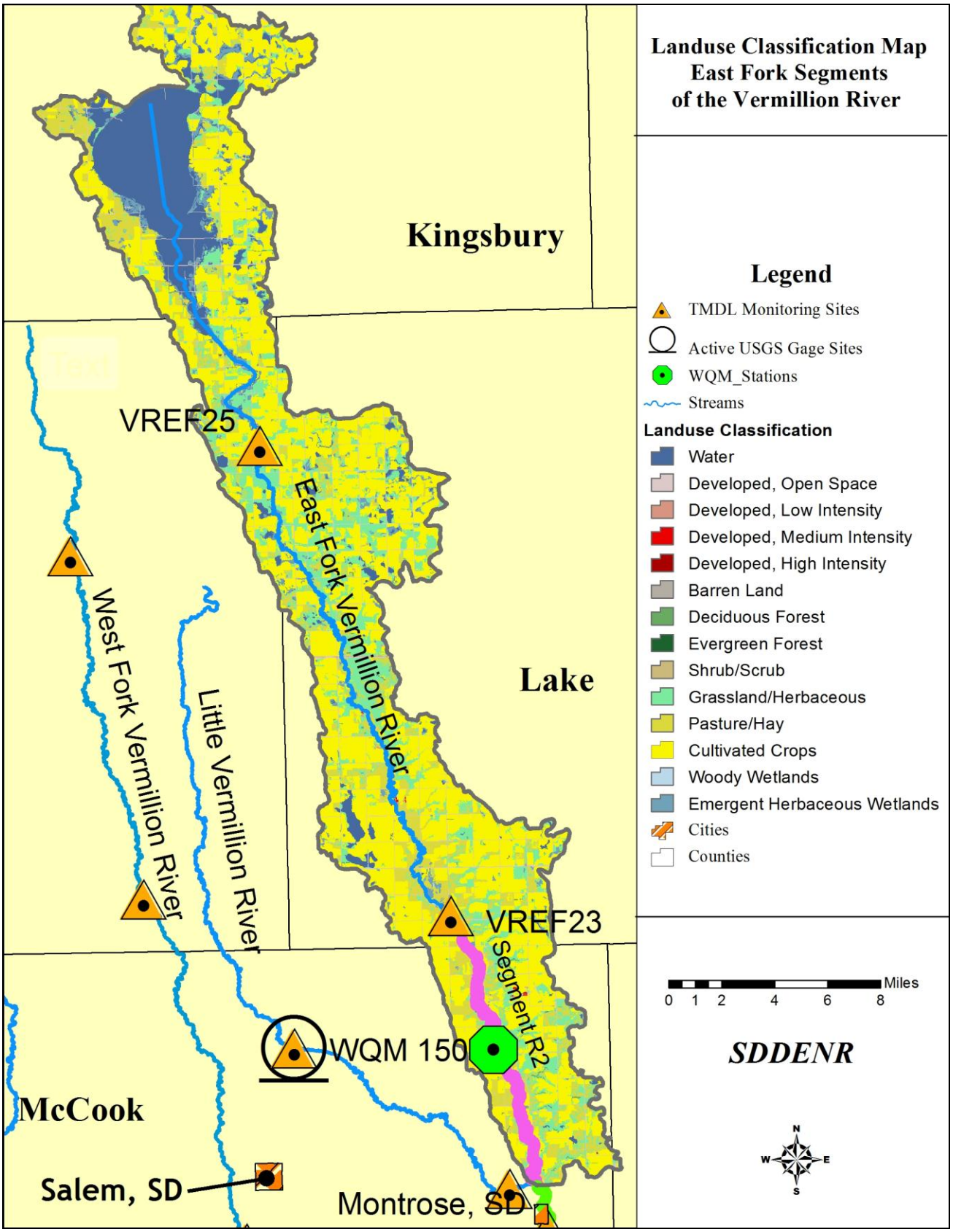

Figure 2. Landuse for the East Fork of the Vermillion River (2001 NLCD).

Land use/land cover, livestock, wildlife, septic tanks and sewerage systems are a determinant in identifying and quantifying sources of pathogens within a watershed. Table 2 shows the significant percentages of 11-land use categories taken from the 2001 National Land Cover Data set (NLCD, 2001) for the East and West Forks of the Vermillion River in southeastern SD.

Table 2. Landuse for the East and West Forks of the Vermillion River.

NLCD (2001 National Land Cover Data Set**)**	**East Fork**	**West Fork**
11-Open Water	**7.3%**	**0.8%**
21-Developed, Open Space	**4.0%**	**4.7%**
22-Developed, Low Intensity	**0.2%**	**0.6%**
23-Developed, Medium Intensity	**0.0%**	**0.2%**
24-Developed High Intensity	**0.0%**	**0.0%**
31-Barren Land, Rock, Sand, Clay	**0.0%**	**0.0%**
41-Deciduous Forest	**0.4%**	**0.3%**
71-Grassland, Herbaceous	**11.6%**	**2.9%**
81-Pasture, Hay	**17.3%**	**21.7%**
82-Cultivated Crops	**56.5%**	**67.3%**
90-Woody Wetlands	**0.0%**	**0.0%**
95-Emergent Herbaceous Wetlands	**2.6%**	**1.4%**
Total	**100.0%**	**100.0%**

3.0 Problem Identification

Pathogen sources are overland runoff from nearby croplands and feedlots, inflow from tributaries, and septic tanks. Wastewater treatment facilities (WWTF) are not currently located in the watershed.

The East Fork of the Vermillion River was first listed as impaired due to exceedence of fecal coliform criteria in the 2002 Integrated Report. Water quality data collected from the Section 106 ambient monitoring stations was used to determine support status. The initial listing spawned the development of the watershed assessment project which began in 2004. This project collected data at more than thirty sites for approximately two years ending in 2006. Data from the watershed assessment and one established WQM station (WQM150) were used to determine support status of the beneficial uses. Methodology used to determine support status is described in South Dakota's Integrated Report, which is submitted to EPA biennially (SDDENR 2012). In brief:

"For Streams: >10% violation rate (3 or more exceedances between 10 and 19 samples) for daily maximum criteria. >10% violation rate (2 or more exceedances between 2 and 19 samples) for 30-day average criteria."

"To ensure a sufficient number of samples were available for each stream segment (usually a minimum of 20) the period of record considered for this report was from October 1, 2006, to September 30, 2011, (5 years) for streams."

Since 1995, the USGS has operated a gaging station on the East Fork of the Vermillion (USGS Gage# 06478600). In 2009, SDDENR staff installed gaging equipment on WQM Site 154 and 150 on the East Fork of the Vermillion River located upstream of the gaging station (Figure 1). The USGS gage data was regressed against the WQM sites to develop a long term discharge record. Intensive water quality monitoring was conducted at Sites VREF23 and VREF25 beginning in 2005 and was collected through 2006. This information was coupled with Section 106 ambient monitoring data collected from Site WQM150 through 2011 (Table 6). Water quality monitoring over this period showed that approximately 18% of the fecal coliform samples exceeded the daily maximum standard for Segment R2. Samples were collected to infrequently to determine compliance with the geometric mean standard which requires the collection of five samples during separate 24-hour periods for any 30-day period (Table 4). Across all sites, maximum concentrations ranged from 2,000 colony-forming units per 100 mL (CFU/100mL) up to >300,000 CFU/100mL (too numerous to count). Table 3 summarizes the sampling results for Segment R2. All samples and their corresponding flows can be found in Appendix A.

Figure 3 show fecal coliform concentrations categorized by flow. Five flowzones are shown: High, Moist, Mid-Range, Low, and Dry. Violations of the pathogen criterion occurred across the three lower flow conditions. Although the most significant violations were sampled during storm events (>50% stormflow), there were persistent violations found within low and dry conditions flow zones (Figure 3). Mid-Range flowzone violations are indicative of streambank erosion in both the mainstem and tributaries along with sheet and rill erosion from farm field and feedlot runoff during moist conditions (Cleland, 2003). Lower flow violations can be attributed to bacteria delivered from tributaries from smaller storm events, cattle standing in the stream, and septic tank inputs.

Five flowzones were used for the East Fork of the Vermillion River because of the natural breaks with the flow distribution and the limited number of samples collected in the dry zone (90-100%).

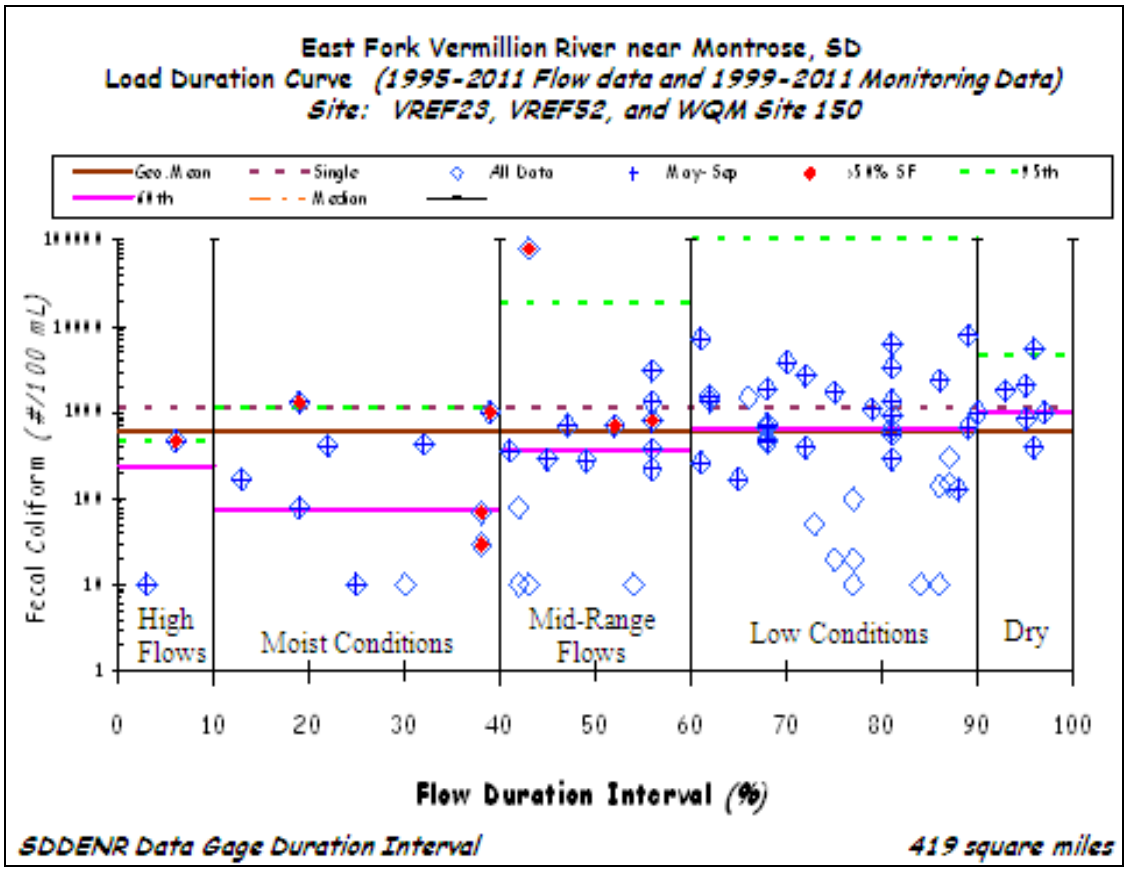

Figure 3. Site VREF23, VREF25, and WQM150 fecal coliform concentrations for each of the five flowzones.

Table 3. Summary Table of Sampling Results for Segment R2.

Statistic	Station			All Data
	VREF23	**VREF25**	**WQM150**	
Count of Fecal Coliform (CFU/100mL)	18	17	45	80
Average of Fecal Coliform (CFU/100mL)	14,239	24,740	1,122	9,092
Min of Fecal Coliform (CFU/100mL)	10	10	10	10
Max of Fecal Coliform (CFU/100mL)	130,000	330,000	7,200	330,000
Max of Flow Rank* (Higher Flows)	6%	25%	3%	3%
Min of Flow Rank* (Lower Flows)	89%	89%	97%	97%
# of Samples > 1,000 CFU/100mL (Chronic)	5	7	14	26
# of Samples > 2,000 CFU/100mL (Daily Max)	4	3	7	14
Date of First Sample	4/18/2005	3/31/2005	7/21/2004	
Date of Last Sample	9/19/2006	6/14/2006	8/8/2011	
Baseflow Sampling	Yes	Yes	No	
Event Base Sampling	Yes	Yes	No	
Monthly Sampling	Yes	Yes	Yes	
* Percent flow rank indicates what percent of the time the flow meets or exceeds shown percentage.				

4.0 Description of Applicable Water Quality Standards & Numeric Water Quality Targets

4.1 South Dakota Water Quality Standards

Each waterbody within SD are assigned designated or beneficial uses. All waters (both lakes and streams) within SD are designated with the use of fish and wildlife propagation, recreation, and stock watering. All streams are assigned the use of irrigation. Additional uses are assigned by the state based on a beneficial use analysis of each waterbody. Water quality standards have been defined in SD state statutes in support of these uses. These standards consist of suites of 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 water quality standards, this is the method used in the South Dakota Integrated Water Quality Report (IR) as well as in permit development.

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

The East Fork of the Vermillion River from the McCook/Lake County Line to the confluence with the Little Vermillion River has been assigned the beneficial uses of: warm water marginal fish life propagation, irrigation waters, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 4 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.

4.2 Water Quality Targets

Of all the assessed parameters for which surface water quality criteria are established (Tables 4), fecal coliform exceeded criteria for the limited contact recreation beneficial use. This TMDL will address the limited contact recreation pathogen impairment.

The fecal coliform criteria for the limited contact recreation beneficial use requires that 1) no sample exceeds 2,000 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hour periods must not exceed 1,000 cfu/100 ml. These criteria are applicable from May 1 through September 30.The numeric TMDL targets established for the East Fork are 1,000 cfu/100 ml for the fecal coliform impairment. This target is based on the chronic threshold.

The *E. coli* criteria for the limited contact recreation beneficial use requires that 1) no sample exceeds 1,178 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hour periods must not exceed 630 cfu/100 ml. These criteria are applicable from May 1 through September 30 as well. Impairment for the E. coli criteria was not exhibited, however.

Table 4. South Dakota surface water quality standards for the East Fork of the Vermillion River, McCook, Miner, and Turner Counties, South Dakota.

Parameter	Criteria	Unit of Measure	Special Conditions
Total alkalinity as calcium carbonate	≤ 750	mg/L	30-day average
	≤ 1313	mg/L	daily maximum
Chlorides (warmwater marginal)	≤ 100	mg/L	30-day average
	≤ 175	mg/L	daily maximum
Dissolved oxygen (warmwater marginal)	≥ 5.0	mg/L	Daily minimum May 1-Sept. 30
	≥ 4.0	mg/L	Daily minimum Oct 1-April 30
Total ammonia nitrogen as N (warmwater marginal)	Equal to or less than the result from Equation 3 in Appendix A	mg/L	30-day average May 1 - October 31
	Equal to or less than the result from Equation 4 in Appendix A	mg/L	30-day average November 1 – April 30
	Equal to or less than the result from Equation 2 in Appendix A	mg/L	daily maximum
Fecal coliform and *E. coli* (May 1 – September 30) (limited contact recreation)	≤ 1,000 (*E. coli* ≤ 630)	cfu/100 mL	geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period
	≤ 2,000 (*E. coli* ≤ 1,178)	cfu/100 mL	in any one sample
Conductivity at 25°C	≤ 2,500	micromhos/cm	30-day average
	≤ 4,375	micromhos/cm	daily maximum
pH (warmwater marginal)	≥ 6.0 and ≤ 9.0	standard units	see § 74:51:01:07
Nitrates as N	≤ 88	mg/L	daily maximum
	≤ 50	mg/L	30-day average
Total dissolved solids	≤ 2,500	mg/L	30-day average
	≤ 4,375	mg/L	daily maximum
Total Suspended Solids (warmwater marginal)	≤ 150	mg/L	30-day average
	≤ 263	mg/L	daily maximum
Temperature (warmwater marginal)	≤ 90	°F	see § 74:51:01:31
Undisassociated hydrogen sulfide	≤ 0.002	mg/L	
Total petroleum hydrocarbon	≤ 10	mg/L	see § 74:51:01:10
Oil and grease	≤ 10	mg/L	see § 74:51:01:10
Sodium adsorption ratio	≤ 10		see definition

During this study, each site shown in Table 5 exhibited several samples exceeding the fecal coliform daily maximum criterion (2,000 cfu/100 ml). Fecal coliform impairment is a persistent problem shown along multiple reaches in the Vermillion River Basin. Table 5 shows significant differences in violations rates between flowzones. Although there is typically a significant relationship between high flows (storm events) and high bacteria concentrations this is not always true. For Segment R2, all violations occurred within the three lower flow zones.

The numeric TMDL target established herein for Segment R2 limited contact recreation use is based on the chronic threshold taken from South Dakota's 30-day geometric mean for fecal coliform criterion. The chronic threshold represents the numeric target of the chronic standard whereas the chronic standard represents the geometric mean of a minimum of five samples collected within a 30-day period. The numeric target of 1,000 cfu/100mL established for Segment R2 took into consideration all current water quality standards and will ensure that both the chronic and acute standards are met.

Table 5. Exceedance Rate of the fecal coliform Daily Maximum Criterion for three sites on Segment SD-VM-R-VERMILLION_E_FORK_01 of the East Fork of the Vermillion River (2,000 cfu/100ml).

			High	Moist	Mid	Low	Dry
Segment R2	VREF23,VREF25, and WQM150	Samples per Zone	2	12	17	42	7
		Exceedances per Zone	0	0	2	10	2
		%Violation	0%	0%	12%	24%	29%

5.0 Data Collection Method

5.1 Water Quality Data and Discharge Information

Stream discharge information collected from 34 sites was used to develop stage/discharge curves for each monitoring site. Both targeted TMDL sites and ambient (monthly) monitoring data were used to assess impairments and develop trend information. Table 6 shows sites used and numbers of samples collected during the project period. Those sites used for the East Fork of the Vermillion River are Sites VREF23, VREF25, and WQM150.

The design of the assessment project was used to identify beneficial use impairments and estimate the sediment and nutrient loadings within the Vermillion River and major individual tributaries in the watershed through hydrologic, chemical and biological monitoring. The information was not only used to develop a TMDL for the Vermillion River but also locate critical areas in the watershed to be targeted for implementation.

A continuous stage record for the project period, with the exception of winter months after freeze up was maintained for each site. Discrete discharge measurements were taken on a regular schedule and during storm surges. Discharge measurements were taken with a hand-held current velocity meter under wadeable conditions or from a bridge crane during high flows using methods outlined by the U.S. Geological Survey (USGS). Discharge measurements and water level data were used to

calculate a stage/discharge table for all stream systems. USGS Gage No. 06478600 has been recording daily discharge information on the East Fork the Vermillion River since 1995 and this was used to develop a long-term flow record for monitoring sites located upstream. Both WQM sites had approximately two years worth of discharge data (2009-2011) that could be related back to the long-term USGS gage.

Samples were collected during spring runoff, storm events, and monthly base flows. Locations of sites monitoring tributaries and the Vermillion River mainstem can be found in Figure 1 and Table 6. Intensive sampling was conducted on a temporal basis over the course of two years (Jan'05 – Dec'06). Five ambient stations were also used to conduct long-term (1968 to Present) trend analysis (TSS or fecal coliform vs. time). The East Fork of the Vermillion River has a two long-term WQM station. Samples were collected during the spring snowmelt runoff, and baseflow conditions for spring (March 1 to May 31), summer (June 1 to September 15), and fall (September 16 to November 15). Baseflow was defined as no significant increase in flow.

Storm event samples for each season were collected at or as near as possible to the peak discharge. During the project personnel from the Vermillion Basin Water Development collected all samples and periodically aided by SDDENR. Autosamplers were used to collect at some of the more remote locations. The autosamplers were programmed to collect composite samples over the course of a storm event.

All sampling and discharge data collection conducted during this project were done with methods in accordance with the South Dakota *Standard Operating Procedures for Field Samplers* developed by the Water Resource Assistance Program and approved by USEPA Region VIII. All samples collected in SD, including the mainstem, were sent to the State Health Laboratory in Pierre, SD for analysis.

Table 6. Site and sample description, and sample numbers collected as part of the East Fork Vermillion River Pathogen TMDL (2004-2006).

Site ID	Description	USGS Gage	Year	Samples	Blanks	Dups	Storm
Blank			2005-06		56		
VR01	Vermillion River at Vermillion, SD		2005-06	5		3	16
VR03	Vermillion River North of Vermillion, SD	6479010	2005-06	7		1	15
VR05	Vermillion River near Hub City, SD		2005-06	10			13
VR06	Vermillion River (Colfax Corner)		2005-06	9		1	14
VR08	Vermillion River at Centerville, SD		2005-06	9		1	13
VR13	Vermillion River near Hurley, SD		2005-06	9		2	16
VREF14	East Fork Vermillion River East of Parker, SD	6478600	2005-06	7		3	18
VREF17	East Lake Vermillion Outlet		2005-06	9			11
VREF19	East Fork Vermillion River near Montrose, SD		2005-06	8		3	17
VREF23	East Fork Vermillion River South of Winfred, SD		2005-06	7		1	12
VREF25	East Fork Vermillion River Outlet from Lake Thompson		2005-06	7		1	10
VREFT18	East Fork Vermillion River Unnamed Tributary		2005-06	3		3	15
VREFT21	Little Vermillion River Outlet near Montrose, SD		2005-06	9		3	16
VREFT29	Little Vermillion River near Salem, SD	6478540	2005-06	1			2
VRELV27	East Lake Vermillion South End		2005-06	43			
VRELV28	East Lake Vermillion North End		2005-06	27		5	
VRSL26	Silver Lake		2005-06	27		4	
VRT02	Yankton Clay Ditch		2005-06	2		1	7
VRT04	Clay Creek Ditch		2005-06	6		3	16
VRT07	Frog Creek		2005-06	9		1	11
VRT09	Turkey Ridge Creek		2005-06	9		2	14
VRT10	Long Creek		2005-06	8		4	13
VRT11	Hurley Creek		2005-06	4		1	12
VRT12	Camp Creek		2005-06	7			10
VRWF15	WestFork Vermillion River near Marion, SD	6478690	2005-06	9		1	14
VRWF20	West Fork Vermillion River near Salem, SD		2005-06	8		2	13
VRWF22	West Fork Vermillion River near Canova, SD		2005-06	8			10
VRWF24	West Fork Vermillion River near Howard, SD		2005-06	6		2	11
WQM150	East Fork Vermillion River North of Montrose, SD		2005-06	43			
WQM154	East Fork Vermillion River South of Montrose, SD		2005-06	43			
WQM4	Vermillion River near Wakonda, SD		2005-06	53			
WQM5	Vermillion River near Vermillion, SD		2005-06	54			
WQM61	Vermillion River near Parker, SD		2005-06	53			
VRT30	Spirit Mound Creek		2006			3	7
VRT31	Baptist Creek		2006	4		2	5
VRT32	Ash Creek		2006	6		1	5
VRT33	Clay Creek		2006	6		2	5
VRT34	Turkey Creek		2006	8			3
VSS-1	City of Vermillion, 48" Storm Sewer		2006				6
VSS-2	City of Vermillion, 36" Storm Sewer East		2006			1	6
VSS-3	City of Vermillion, 36" Storm Sewer West		2006				5
VSS-4	City of Vermillion, 60" Concrete Storm Sewer East		2006				1

6.0 Source Assessment and Allocation

6.1 Point Sources

There are no documented point sources within this 156,614 acre subwatershed (SDDENR, Surface Water Quality Program).

6.2 Nonpoint Sources

Nonpoint sources of fecal coliform bacteria from the East Fork of the Vermillion River come primarily from agricultural sources. County wide livestock data, from the 2007 and 2009 National Agricultural Statistic Survey (NASS), and wildlife data, from the 2002 South Dakota Game Fish and Parks county wildlife assessment, were used to derive density estimates for livestock and wildlife densities, respectively.

Statistically derived livestock estimates (beef cattle, hogs, etc.) from the NASS 2007 Agricultural Census was used for each county involved in the Segment R2 watershed (Appendix B). Livestock animals per acre for each county were then multiplied by the acres from each county within the watershed. Table 9 shows the acres of Segment R2 watershed that are located within each county. The animals listed in Table 9 (wildlife and livestock) are the largest animals and most densely populated within the involved counties (Kingsbury, Lake, McCook, Miner, Minnehaha). The density estimates were then multiplied by the acres of Segment R2 watershed found within each county, which is also found in Table 9.

The animal density information was used to estimate relative source contributions of bacteria loads. For example, based on the 2007 density estimates there were 425 dairy cows in the watershed resulting in an estimated 3.17E+13 cfus per day (425 cows X 7.45E+10 cfus). Daily outputs from each animal type were taken from the reference worksheet found on the Bacterial Indicator Tool (BIT). The EPA BIT tool is a spreadsheet that estimates the bacteria contribution from multiple sources.

Human inputs were determined through several GIS county wide feature datasets provided by the SD Dept. of Transportation (SDDOT). The dataset was used primarily for assessing county roads and structures along roads, such as rural residences (both occupied and unoccupied), were documented. The number of occupied residences for the acres of watershed within each county were used to estimate how many septic tanks were located in the watershed in each county. It was assumed on average that each residence contained two people. It was assumed that 25% of these septic tanks were failing. The daily human output of 1.88E+11 fecal coliform per human was taken from the BIT Tool Reference worksheet which lists the USGS as the source of the human output estimate (EPA BIT tool). The total estimate of 2.31E+13 fecal coliform from humans was used in Table 7 and Table 8.

Table 7. Human Input Estimates

County	Occupied
Lake	114
Miner	25
Kingsbury	82
McCook	25
Total Occupied Residences	246
# per household	2
Total Population	492
25% Failure Rate for Septic Tank	0.25
USGS Human Daily Estimate	1.88E+11
Total Human Contribution	**2.31E+13**

6.2.1 Agriculture

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are predominantly hogs and beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. They also can contribute by defecating while grazing on rangelands that get washed off during precipitation events. Table 8 allocates the sources for bacteria production in the watershed into four primary categories. The summary is based on several assumptions. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass.

Table 8. Fecal Coliform Allocations for the East Fork of the Vermillion River.

Source	Percentage
Feedlots	75.5%
Livestock on Grass	14.8%
Wildlife	6.0%
Septic Tanks	3.7%

6.2.2 Human

There were no identified point sources within the watershed for Segment R2. Failing onsite septic systems are assumed to be the primary human source. Human fecal production may be estimated at 1.88E+11 (Bacterial Indicator Tool Reference Worksheet - USGS estimate). When included as a total load in the table, the remaining population accounted for about 3.7% of all fecal coliforms produced in the watershed assuming a 25% failure rate for the onsite wastewater systems.

6.2.3 Natural background/wildlife

Wildlife within the watershed is a natural background source of fecal coliform bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Table 9).

Table 9. East Fork of the Vermillion River Potential Nonpoint Sources and Percent Contribution (animal density is individuals per acre).

			Animal Density Estimate per County (NASS, 2007)						
Animal Type	Fecal Coliform (#/animal/day)	Animal Type Used for Fecal Output Estimate (BIT)	HUTCHINSON	KINGSBURY	LAKE	MCCOOK	MINER	MINNEHAHA	TURNER
CATTLE ON GRASS	4.57E+09	Cow	0.1016	0.1089	0.0788	0.0961	0.0938	0.0923	0.0676
CATTLE, COWS, MILK - INVENTORY	7.45E+10	Dairy Cow	0.0056	0.0011	0.0024	0.0077	0.0019	0.0099	0.0163
CATTLE, ON FEED - INVENTORY	7.27E+10	Beef Cow	0.0232	0.0425	0.0230	0.0175	0.0129	0.0405	0.0403
CHICKENS, BROILERS - INVENTORY	1.81E+08	Broilers	0.0000	0.0004	0.0000	0.0027	0.0003	0.0012	0.0001
EQUINE, HORSES & PONIES - INVENTORY	2.59E+10	Horse	0.0009	0.0011	0.0019	0.0018	0.0010	0.0044	0.0019
HOGS - INVENTORY	1.02E+10	Hog	0.2251	0.0162	0.1207	0.1658	0.0364	0.1178	0.1554
SHEEP, INCL LAMBS - INVENTORY	1.66E+10	Sheep	0.0057	0.0101	0.0057	0.0111	0.0108	0.0107	0.0333
TURKEYS - INVENTORY	1.04E+08	Turkey (Wild)	0.5522	0.1140	0.0000	0.0000	0.0001	0.0000	0.0001
Badger	1.25E+08	Raccoon	0.0013	0.0029	0.0008	0.0019	0.0009	0.0010	0.0014
Beaver	2.50E+08	Beaver	0.0023	0.0006	0.0025	0.0015	0.0014	0.0035	0.0028
Cottontail Rabbit	1.25E+08	Raccoon	0.0134	0.0384	0.0334	0.0177	0.0495	0.0345	0.0127
Coyote	4.09E+09	Dog	0.0017	0.0014	0.0006	0.0010	0.0021	0.0008	0.0013
Fox	1.25E+08	Raccoon	0.0018	0.0019	0.0035	0.0030	0.0009	0.0031	0.0018
Jackrabbit	1.25E+08	Raccoon	0.0033	0.0086	0.0022	0.0052	0.0220	0.0021	0.0009
Mink	2.50E+07	Muskrat	0.0013	0.0054	0.0083	0.0045	0.0047	0.0031	0.0019
Muskrat	2.50E+07	Muskrat	0.0024	0.0144	0.0139	0.0136	0.0149	0.0207	0.0020
Nest Canada Geese	4.90E+10	Goose	0.0011	0.0009	0.0083	0.0020	0.0019	0.0071	0.0013
Opossum	1.25E+08	Raccoon	0.0023	0.0038	0.0036	0.0033	0.0033	0.0048	0.0030
Partridge	1.37E+08	Layers	0.0017	0.0115	0.0056	0.0041	0.0033	0.0021	0.0006
Raccoon	1.25E+08	Raccoon	0.0057	0.0115	0.0170	0.0061	0.0138	0.0067	0.0058
Skunk	1.25E+08	Raccoon	0.0029	0.0157	0.0061	0.0060	0.0110	0.0058	0.0035
Squirrel	1.25E+08	Raccoon	0.0023	0.0067	0.0278	0.0218	0.0206	0.0307	0.0203
Turkey	1.04E+08	Turkey (Wild)	0.0009	0.0000	0.0000	0.0000	0.0000	0.0012	0.0006
Whitetail Deer	5.00E+08	Deer	0.0027	0.0073	0.0083	0.0082	0.0083	0.0056	0.0043
		Acres in Segment R2 Watershed	**-**	**49,189**	**68,029**	**23,348**	**15,948**	**106**	**-**

Source	Total Contribution	Percent Contribution
Cattle on Grass	6.39E+13	10.3%
Beef Cattle on Feed	2.97E+14	48.1%
Dairy Cow	3.17E+13	5.1%
Chickens, Turkeys, Goats	5.50E+11	0.1%
Hogs	1.37E+14	22.2%
Sheep	2.11E+13	3.4%
Horses	6.14E+12	1.0%
All Wildlife	3.68E+13	6.0%
Septic Tanks	2.31E+13	3.7%
Total	6.18E+14	100%

6.2.4 Tributary Contributions

The East Fork of the Vermillion River has several smaller unnamed tributaries which drain very intermittently. These tributaries drain portions of Kingsbury, Lake, Miner, and McCook (Figure 1). The significance of these smaller intermittent streams on the East Fork of the Vermillion was not determined. Most loadings occur along the length of the East Fork and drain directly to it.

7.0 Linkage Analyses

7.1 Load Duration Curve Analysis

This fecal coliform TMDL was developed using a Load Duration Curve (LDC) approach resulting in a flow-variable target that considers the entire flow regime. In the East Fork of the Vermillion River, Figures 3 and 4 (pg. 14) show violations occurring within the three lowest flowzones. The LDC approach was deemed an appropriate method for identifying possible sources of bacteria based on the flow zone.

The LDC is a dynamic expression of the allowable load for any given day. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into four flow zones representing high flows (0–10 percent), moist conditions (10-40 percent), mid-range flows (40–60 percent), low conditions (60–90 percent), and dry conditions (90-100 percent) according to EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA, 2006). The ranges for these five zones were based on 16 years of flow data (1995-2011), five years of sampling data collected from Vermillion River as part of the watershed assessment, and the Section 106 ambient monitoring program.

For the East Fork of the Vermillion River instantaneous loads were calculated by multiplying the fecal coliform concentrations collected from SD DENR TMDL Sites VREF23, VREF25 and WQM Site 150 by relating the daily average flow from WQM150 (2009-2011) to the daily average flow from USGS Gage No. 06478600 for the same period. Flow was then predicted using the long-term record from the USGS gage, and a units conversion factor.

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, pathogen samples collected from the East Fork of the Vermillion River exceed the daily maximum and geometric mean criterion within the lower three zones (Figure 4). Loads exceeding the criteria in the high flow zones imply storm runoff from animal feeding operations or storm sewer runoff. Loads shown in the low flow zone typically indicate a point source load or livestock defecating in the stream.

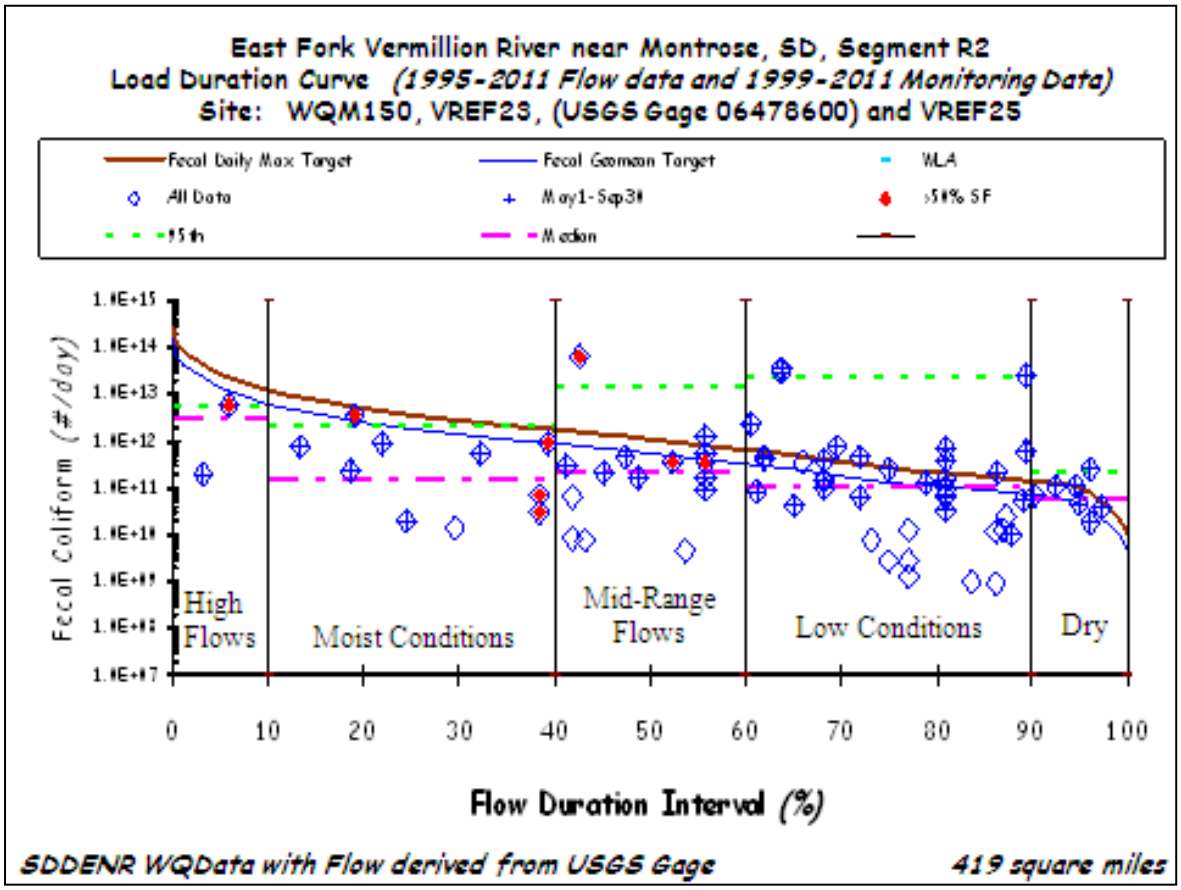

Figure 4. Segment R2 - Load duration curve representing allowable daily fecal coliform loads based on the geometric mean and daily maximum criteria (≤1,000 cfu/100ml and ≤2,000 cfu/100ml, respectively). Plot showing median and 95th percentiles, and daily loads for each flow zone. The geometric mean (1,000 cfu/100ml) was used to determine the loading capacity for the Segment R2 and the TMDL. Observed concentrations are also displayed.

8.0 TMDL and Allocations

8.1 TMDL Load Duration Curve

The LDC (Figure 4 and Table 10) represents the dynamic expression of the Fecal Coliform TMDL for Segment R2, resulting in a unique maximum daily load that corresponds to a measured average daily flow. To aid in the implementation of the TMDL and estimation of needed fecal coliform load reductions, Table 10 presents a combination of allocations for each of five flow zones. Methods used to calculate the TMDL components are discussed below. This TMDL is in effect from year round and is based on daily flow and the chronic threshold from the water quality standard (geometric mean).

8.1.1 Extreme or High Flows (0-10%)

The extreme flow zone is composed of the highest exceeding 246 cfs or greater than 10%. Although a total of 80 samples were used in the development of the LDC, there were only two samples collected in this zone and none exceeded the fecal coliform standard. Using the 95th percentile flow

with the chronic standard (1,000 cfu/100 ml) from this zone to calculate the TMDL goal is appropriate and provides assurance that the water quality criteria will not be exceeded.

8.1.2 Moist Conditions (10-40%)

The sixteen year discharge record indicated that the 10-40% flows ranged between 246 cfs and 37 cfs. Out of the 80 samples collected from this segment 12 came from this zone with zero violations. The 95th percentile flow from this zone was 213.76 cfs which was used to set the TMDL goal for this zone (Table 10).

8.1.3 Mid-Range Flows (40-60%)

Mid-Range flows ranged from 37 cfs to 14 cfs. Seventeen samples were collected in this flow zone and two samples exceeded the water quality standard. Both of these violations were classified as storm event samples collected from the higher end of the flowzone. The flows from this zone are expected to persist longer throughout the year and may be low enough within the river where livestock are able to enter the side channels (Table 10).

The violation rate from this zone (12%) requires a 94% percent reduction in order to achieve the full support of the limited contact beneficial use (Table 10). The reduction is based on the 1,000 cfu/100ml geometric mean. This insures that both the chronic and acute standards will be met.

8.1.4 Low Flows (60-90%)

Low flows ranged from 14 cfs to 3 cfs. The flows typically occur during late summer and can persist through late fall. Forty-two samples were collected from this zone with 10 violations. The 95th percentile flow of 12.4 cfs coupled with the violations show that a 99% reduction in fecal coliform loadings is necessary for this zone (Table 10).

8.1.5 Dry Flows (60-90%)

Dry flows were estimated to be less than three cfs. These flows typically occur during late fall and during the winter when precipitation is limited. Seven samples were collected from this zone and two exceeded the water quality standard (29% violation rate). The 95th percentile flow (2.74 cfs) and concentration (4,550 cfu/100 ml) indicates that a 68% reduction in fecal coliform loadings is required for this zone (Table 10).

Table 10. Segment R2 – Fecal Coliform Total Maximum Daily Load (TMDL) allocations by flow zone (Site WQM150).

Parameter of Concern	Flow Zone (expressed as colony forming units/day)				
Fecal Coliform	**Extreme Flows (0-10%)**	**High-Range (10-40%)**	**Mid-Range Flows (40-60%)**	**Low Flows (60-90%)**	**Dry Conditions (90-100%)**
Flow Range (cfs)	**>246**	**<246 to >37**	**<37 to >14**	**<14 to >3**	**<3**
Median Flow Per Zone	565.24	74.33	23.27	5.49	2.04
95%tile Flow Per Zone	2269.22	213.76	35.78	12.37	2.74
Load Allocation	5.00E+13	4.71E+12	7.88E+11	2.72E+11	6.04E+10
WLA - N/A*	0.00	0.00	0.00	0.00	0.00
MOS (10% Explicit)	6E+12	5E+11	9E+10	3E+10	7E+09
TMDL	**5.55E+13**	**5.23E+12**	**8.75E+11**	**3.03E+11**	**6.71E+10**
*WLA - This segment contains no point sources					
	Existing Condition per Zone (expressed as colony forming units/day)				
95th Percentile Load per Zone	5.65E+12	2.17E+12	1.41E+13	2.38E+13	2.06E+11
Load Reduction	**-883.3%**	**-140.7%**	**93.8%**	**98.7%**	**67.5%**
95th Percentile Concentration Per Zone	457	1,135	18,480	104,900	4,550
Number of Values	2	12	17	42	7
Number of Values exceeding 2,000 CFUs/100ml	0	0	2	10	2
Current Load or Existing Condition is the 95th Percentile of the observed Fecal coliform Loads for each flow zone.					

8.2 Allocations – East Fork of the Vermillion River, Segment R2

8.2.1 Load Allocation (LA)

To develop the bacterial load allocation (LA), the loading capacity (LC) was first determined. The LC for Segment R2 (McCook/Lake County line to Little Vermillion River) was calculated by multiplying the geometric mean (1,000 cfu/100 ml) fecal coliform threshold by the daily average flow. Site WQM 150 is the most downstream site within this segment. Including WQM 150 there were three mainstem sites located within this segment (Figure 4).

The geometric mean criterion (1,000 cfu/100 ml) was used for the calculation of the LC, rather than the daily maximum criterion (2,000 cfu/100 ml) because the chronic threshold is considered more protective. The geometric mean, as defined in ARSD § 74:51:01:01, is the arithmetic mean of a minimum of five separate grab or composite samples taken on separate 24-hour periods in a 30-day period. The 30-day average fecal coliform criteria (ARSD § 74:51:01:48) applies at all times but compliance can only be determined when a minimum of five samples are obtained during separate 24-hour periods for any 30-day period. In many instances, only one or two samples were collected during any 30-day period, so the chronic threshold was applied to each flowzone in Figure 4. Although the daily maximum criteria are exceeded, to be conservative it was decided to use the chronic threshold to develop the loading capacity of the stream to ensure that the most stringent water quality standards are met. Additional data would be needed to accurately assess compliance with the geometric mean criterion. The loading capacities and reductions derived from the available data are estimates (i.e., the calculated loading capacities and reductions may be higher or lower if/when a more extensive data set is collected to fully assess compliance with the chronic standard). For each of the five flow zones, the 95th percentile of the range of LCs within a zone was set as the flow zone goal. Setting the flow zone goal at the 95th percentile within each flowzone protects the

limited contact recreation beneficial use and will also incorporate the natural variability of the system (Figure 4).

All of the LC were allocated to nonpoint sources as a load allocation (LA) because of the absence of any point source facilities within the watershed. A fraction of the LC was also reserved as a margin of safety (MOS) to account for uncertainty in the calculations of these load allocations. The method used to calculate the MOS is discussed below. The LA was determined by subtracting the WLA and MOS from the LC. Thus, the TMDL (and LC) is the sum of WLA, LA, and MOS.

8.2.2 Waste Load Allocation (WLA)

There are no facilities or NPDES Permit holders in the subwatershed of this segment of the East Fork of the Vermillion River. The WLA is constant across all flow conditions and ensures that water quality standards will be attained.

8.3 Margin of Safety (MOS) – All Segments

In accordance with the regulations, a margin of safety was established to account for uncertainty in the data analyses. A margin of safety may be provided (1) by using conservative assumptions in the calculation of the loading capacity of the waterbody and (2) by establishing allocations that in total are lower than the defined loading capacity. In the case of Segment R2 of the East Fork of the Vermillion River analysis, the latter approach was used to establish a safety margin.

An 10% explicit MOS was calculated within the duration curve framework to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). This 10% explicit MOS was calculated from the TMDL within each flowzone and reserved as unallocated assimilative capacity. The remaining assimilative capacity was attributed nonpoint sources (LA) or point sources (WLA).

As new information becomes available and the TMDL is revisited, this unallocated capacity may be attributed to nonpoint sources and added to the load allocation, or the unallocated capacity may be attributed to point sources and become part of the waste load allocation.

9.0 Seasonal Variation

Discharge in the East Fork of the Vermillion River (USGS gage# 06478600, near Parker, SD) displayed seasonal variation for the period of record (10/1/95 to 9/30/11). Highest stream flows typically occur during spring with highest monthly average stream flow reported in April (336.5 cfs). The lowest observed stream flows occur during the winter months with the lowest monthly average stream flow reported in January (26.2 cfs). Fecal coliform concentrations also displayed seasonal variation relative to flow with most exceedances occurring with the lower three flow zones. During the lower flows livestock have access to the stream allowing them to cool during warmer temperatures of the summer. By using the LDC approach to develop the TMDL allocations, seasonal variability in fecal coliform loads is taken into account.

Although the TMDL displays seasonality through flow, it is effective throughout the entire year.

10.0 Critical Conditions

Critical conditions occur within the basin during the spring and summer storm events as well as low flow during the summer and fall. Typically, during severe thunderstorms the largest concentrations are highest in the basin during the summer months. However, the higher concentrations for Segment R2 occur at lower flows when livestock have access to the streams. These two flow regimes have been targeted for implementation.

11.0 Monitoring Strategy

During and after the implementation of management practices, monitoring will be necessary to assure attainment of the TMDL. Stream water quality monitoring will be accomplished through SD DENR's ambient water quality monitoring stations found within the river basin especially for the segment addressed in this report: Segment R2 – WQM Site 150 near Montrose, SD. This station, along with four other WQM stations within the basin, is sampled on a monthly basis.

Additional monitoring and evaluation efforts will be targeted toward the effectiveness of implemented BMPs. Sample sites will be based on BMP site selection and parameters will be based on a product-specific basis.

The Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances identified during the implementation of the TMDL. If a review of the new information or circumstances indicates that an adjustment to the LA and WLA is appropriate than the TMDL will be updated following SDDENR programmatic steps including public participation. 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 and will reflect the water quality standards found in the ARSD. The Department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

12.0 Public Participation

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

1. Monthly meetings were held during the assessment phase (2004-2006) through the Vermillion Basin Water Development District (VBWDD) which was the local sponsor for the TMDL project. Meetings minutes are available upon request.
2. A webpage was developed and used during the course of the assessment.
3. Presentations to local groups on the findings of the assessment.
4. 30-day public notice (PN) period for public review and comment.

The findings from these public meetings, the webpage, and 30-day PN comments have been taken into consideration in development of the previous Vermillion River Basin TMDLs as well as this TMDL targeting Segment R2.

13.0 Implementation

Currently, there is an implementation project targeting areas of sediment and bacterial sources within the Vermillion River Basin. During the next Section 319 funding round an increase in funding will be requested for additional BMPs targeting more areas of streambank erosion, animal waste management systems, and grazing management.

Several types of BMPs have been considered in the development of a water quality management implementation plan for the impaired segments of the Vermillion River Basin. The results shown in the Load Duration Curves indicate significant reductions are required in the lower three flow zones. Because of the rural area and the lack of point sources (WWTF) most of the implementation measures should focus on the following:

- Livestock access to streams should be reduced, and livestock should be provided sources of water away from streams.
- Unstable stream banks should be protected by enhancing the riparian vegetation that provides erosion control and filters runoff of pollutants into the stream.
- Filter strips should be installed along the stream bordering cropland and pastureland.
- Animal confinement facilities should implement proper animal waste management systems.
- An assessment of progress will be part of every Section 319 implementation segment, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.

Funds to implement watershed water quality improvements can be obtained through SD DENR. SD DENR administers three major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. They include: Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, and the Section 319 Nonpoint Source program.

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15.0 APPENDIX A: Water Quality Data

Station	Segment	Date	Time	Flow *(cfs)*	Flow Rank	Fecal Coliform (CFU/100mL)
VREF23	R2	4/18/2005	2:30:00 PM	33.91	41.80%	10
VREF23	R2	5/10/2005	1:45:00 PM	12.37	61.90%	1,400
VREF23	R2	5/19/2005	4:45:00 PM	35.29	41.30%	360
VREF23	R2	6/16/2005	2:45:00 PM	505.23	5.80%	480
VREF23	R2	6/29/2005	3:45:00 PM	17.66	55.70%	380
VREF23	R2	7/20/2005	10:00:00 AM	4.53	81.00%	3,400
VREF23	R2	9/9/2005	1:00:00 PM	3.09	89.30%	8,000
VREF23	R2	9/23/2005	12:00:00 PM	8.53	68.20%	500
VREF23	R2	1/31/2006	2:15:00 PM	31.86	43.20%	10
VREF23	R2	3/2/2006	5:00:00 PM	3.62	86.20%	10
VREF23	R2	3/16/2006	12:30:00 PM	5.49	77.00%	10
VREF23	R2	3/30/2006	2:30:00 PM	40.21	38.40%	70
VREF23	R2	4/26/2006	1:45:00 PM	58.68	29.60%	10
VREF23	R2	5/5/2006	2:00:00 PM	76.74	24.50%	10
VREF23	R2	5/30/2006	7:15:00 PM	8.53	68.20%	740
VREF23	R2	6/14/2006	2:45:00 PM	4.53	81.00%	920
VREF23	R2	9/19/2006	3:15:00 PM	11.24	63.70%	110,000
VREF23	R2	9/19/2006	3:30:00 PM	11.24	63.70%	130,000
VREF25		3/31/2005	2:15:00 PM	19.50	53.70%	10
VREF25		4/13/2005	11:30:00 AM	33.23	42.60%	80,000
VREF25		4/18/2005	1:45:00 PM	33.91	41.80%	80
VREF25		5/10/2005	1:15:00 PM	12.37	61.90%	1,600
VREF25		5/12/2005	5:45:00 PM	20.74	52.30%	700
VREF25		6/29/2005	2:30:00 PM	17.66	55.70%	3,100
VREF25		6/29/2005	2:45:00 PM	17.66	55.70%	1,300
VREF25		9/23/2005	11:15:00 AM	8.53	68.20%	460
VREF25		1/31/2006	1:00:00 PM	31.86	43.20%	10
VREF25		3/2/2006	2:45:00 PM	3.62	86.20%	10
VREF25		3/16/2006	11:30:00 AM	5.49	77.00%	10
VREF25		3/30/2006	1:15:00 PM	40.21	38.40%	30
VREF25		4/26/2006	2:45:00 PM	58.68	29.60%	10
VREF25		5/5/2006	12:45:00 PM	76.74	24.50%	10
VREF25		5/30/2006	6:00:00 PM	8.53	68.20%	1,900
VREF25		6/14/2006	1:45:00 PM	4.53	81.00%	1,350
WQM150	R2	7/21/2004		8.53	68.20%	690
WQM150	R2	7/20/2005		4.53	81.00%	6,200
WQM150	R2	5/1/2006	1:15:00 PM	90.65	21.90%	410
WQM150	R2	5/8/2006	2:15:00 PM	51.88	32.30%	430
WQM150	R2	5/15/2006	3:15:00 PM	29.16	45.10%	290
WQM150	R2	5/18/2006	2:15:00 PM	25.21	48.70%	280
WQM150	R2	5/22/2006	6:30:00 PM	12.94	61.20%	270

Station	Segment	Date	Time	Flow *(cfs)*	Flow Rank	Fecal Coliform (CFU/100mL)
WQM150	R2	6/1/2006	2:30:00 PM	6.98	72.00%	390
WQM150	R2	6/12/2006	3:45:00 PM	4.53	81.00%	640
WQM150	R2	6/15/2006	11:30:00 AM	4.53	81.00%	290
WQM150	R2	6/22/2006	1:45:00 PM	4.53	81.00%	570
WQM150	R2	6/28/2006	3:30:00 PM	3.26	87.80%	130
WQM150	R2	7/5/2006	6:30:00 PM	2.83	90.20%	990
WQM150	R2	7/12/2006	5:00:00 PM	2.16	94.60%	2,100
WQM150	R2	7/17/2006	6:30:00 PM	1.80	96.10%	5,600
WQM150	R2	7/19/2006	3:00:00 PM	1.80	96.10%	400
WQM150	R2	7/24/2006		1.53	97.30%	1,000
WQM150	R2	8/3/2006	5:30:00 PM	17.66	55.70%	800
WQM150	R2	8/11/2006	2:00:00 PM	5.98	75.00%	1,700
WQM150	R2	8/16/2006	5:30:00 PM	6.98	72.00%	2,700
WQM150	R2	8/23/2006	5:45:00 PM	3.18	89.00%	680
WQM150	R2	8/29/2006	1:15:00 PM	2.12	94.90%	860
WQM150	R2	9/8/2006	12:00:00 PM	8.01	69.50%	3,900
WQM150	R2	9/12/2006	4:15:00 PM	5.01	78.90%	1,100
WQM150	R2	9/14/2006	12:00:00 PM	3.57	86.40%	2,400
WQM150	R2	9/21/2006	3:15:00 PM	13.51	60.50%	7,200
WQM150	R2	9/28/2006	4:00:00 PM	38.79	39.30%	1,000
WQM150	R2	10/5/2006	4:45:00 PM	9.60	66.00%	1,500
WQM150	R2	10/13/2006	1:45:00 PM	5.98	75.00%	20
WQM150	R2	10/25/2006	3:15:00 PM	3.44	86.90%	150
WQM150	R2	10/31/2006	1:45:00 PM	6.47	73.20%	50
WQM150	R2	11/6/2006	4:00:00 PM	3.39	87.30%	300
WQM150	R2	11/8/2006	2:45:00 PM	3.62	86.20%	140
WQM150	R2	11/14/2006	3:45:00 PM	4.07	83.70%	10
WQM150	R2	11/16/2006	1:45:00 PM	5.49	77.00%	20
WQM150	R2	11/28/2006	3:45:00 PM	5.49	77.00%	100
WQM150	R2	7/23/2007		2.53	92.50%	1,800
WQM150	R2	7/2/2008		26.51	47.40%	720
WQM150	R2	7/2/2008	10:30:00 AM	26.51	47.40%	720
WQM150	R2	5/21/2009	11:40:00 AM	10.14	65.10%	170
WQM150	R2	8/19/2009	11:15:00 AM	17.66	55.70%	220
WQM150	R2	5/12/2010	11:50:00 AM	115.33	19.00%	1,300
WQM150	R2	8/18/2010	11:30:00 AM	118.82	18.60%	80
WQM150	R2	5/17/2011	10:50:00 AM	792.09	3.20%	10
WQM150	R2	8/8/2011	11:40:00 AM	184.77	13.40%	170

16.0 APPENDIX B: County Livestock Data

NASS Progam	Year	Domain	Domain Category	County	Total County Acres	Livestock Data Item	Total Animal Number	# per acre
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CATTLE, COWS - INVENTORY	27,889	0.050
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CATTLE, COWS, BEEF - INVENTORY	27,271	0.049
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CATTLE, COWS, MILK - INVENTORY	618	0.001
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CATTLE, INCL CALVES - INVENTORY	84,267	0.153
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CATTLE, ON FEED - INVENTORY	23,468	0.042
CENSUS				KINGSBURY	552,500	cattle on grass	60,181	0.109
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	CHICKENS, BROILERS - INVENTORY	225	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	EQUINE, HORSES & PONIES - INVENTORY	621	0.001
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	HOGS - INVENTORY	8,932	0.016
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	SHEEP, INCL LAMBS - INVENTORY	5,591	0.010
CENSUS	2007	TOTAL	NOT SPECIFIED	KINGSBURY	552,500	TURKEYS - INVENTORY	63,005	0.114
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CATTLE, COWS - INVENTORY	18,620	0.050
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CATTLE, COWS, BEEF - INVENTORY	15,791	0.043
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CATTLE, COWS, MILK - INVENTORY	2,829	0.008
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CATTLE, INCL CALVES - INVENTORY	44,776	0.121
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CATTLE, ON FEED - INVENTORY	6,478	0.018
CENSUS				MCCOOK	369,238	cattle on grass	35,469	0.096
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	CHICKENS, BROILERS - INVENTORY	1,000	0.003
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	EQUINE, HORSES & PONIES - INVENTORY	680	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	HOGS - INVENTORY	61,228	0.166
CENSUS	2007	TOTAL	NOT SPECIFIED	MCCOOK	369,238	SHEEP, INCL LAMBS - INVENTORY	4,115	0.011
CENSUS				MCCOOK	369,238	TURKEYS - INVENTORY	0	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CATTLE, COWS - INVENTORY	19,101	0.052
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CATTLE, COWS, BEEF - INVENTORY	18,396	0.050
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CATTLE, COWS, MILK - INVENTORY	705	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CATTLE, INCL CALVES - INVENTORY	39,776	0.109
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CATTLE, ON FEED - INVENTORY	4,734	0.013
CENSUS				MINER	365,887	cattle on grass	34,337	0.094
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	CHICKENS, BROILERS - INVENTORY	105	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	EQUINE, HORSES & PONIES - INVENTORY	384	0.001
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	HOGS - INVENTORY	13,335	0.036
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	SHEEP, INCL LAMBS - INVENTORY	3,953	0.011

NASS Progam	Year	Domain	Domain Category	County	Total County Acres	Livestock Data Item	Total Animal Number	# per acre
CENSUS	2007	TOTAL	NOT SPECIFIED	MINER	365,887	TURKEYS - INVENTORY	36	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE, COWS - INVENTORY	15,911	0.043
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE, COWS, BEEF - INVENTORY	15,017	0.041
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE, COWS, MILK - INVENTORY	894	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE, INCL CALVES - INVENTORY	38,370	0.104
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE, ON FEED - INVENTORY	8,471	0.023
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CATTLE ON GRASS	29005	0.079
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	CHICKENS, BROILERS - INVENTORY	10	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	EQUINE, HORSES & PONIES - INVENTORY	684	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	HOGS - INVENTORY	44,414	0.121
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	SHEEP, INCL LAMBS - INVENTORY	2,115	0.006
CENSUS	2007	TOTAL	NOT SPECIFIED	LAKE	367,942	TURKEYS - INVENTORY	10	0.000

17.0 APPENDIX C: Public Comments

EPA REGION 8 TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River South Dakota**
Submitted by:	**South Dakota Department of Environment and Natural Resources Water Resources Assistance Program**
Date Received:	**May 17, 2012**
Review Date:	**September 7, 2012**
Reviewer:	**Bonnie Lavelle**
Rough Draft / Public Notice / Final Draft?	**Public Notice Draft Version**
Notes:	**Formal Review**

Reviewers Final Recommendation(s) to EPA Administrator (used for final draft 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
   a. … TMDL Document Submittal Letter
   b. Identification of the Waterbody, Impairments, and Study Boundaries
   c. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
   a. Data Set Description
   b. Waste Load Allocations (WLA)
   c. Load Allocations (LA)
   d. Margin of Safety (MOS)
   e. 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

17.1.1

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 ☐ N/A

Summary:

This draft TMDL document, "Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River South Dakota" was transmitted to EPA via email on May 17, 2012 requesting a formal review. This is a public notice draft document. South Dakota Department of Environment and Natural Resources (SD DENR) provided a 30-day period for public review and comment on this document.

Comments:

No comments.

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:

Physical setting and Listing History*:*
Section 1.0, "Objective", and Section 2.0, "Watershed Characteristics" (page 2) describe the physical setting.

The East Fork of the Vermillion River is located southeast South Dakota in the northern part of the Vermillion River basin. Reach SD-VM-R-VERMILLION_EAST_FORK_01 (Segment R2) runs from the McCook-Lake County Line to the confluence with the Little Vermillion River, a length of 15.4 miles. The size of the drainage area for Segment R2 is 156,614 acres. This includes the 132,083 acres that drain into the East Fork north of the McCook/Lake County Line- a portion that is not impaired and is therefore not subject to this TMDL. The watershed that drains the immediate area of segment R2 is 24,531 acres.

The predominant land use in the East Fork of the Vermillion River drainage area is cultivated crops (56.5%). Other land uses include pasture (17.3%) and grassland (11.6%). The remaining surface area is covered by open water (7.3%), emergent herbaceous wetlands (2.6%), open space (4%), low density development (0.2%) and deciduous forest (0.4%). 15 Animal Feeding Operations (AFOs) are located within 500 meters of the East Fork of the Vermillion River. 13 of the AFOs exhibited a rating of 50 or greater using the AGNPS Feedlot Rating Module. According to the Project Summary Sheet for the Vermillion River Basin Watershed Project Segment II, AFOs with a rating of 50 or greater will be subject to further evaluation. The higher rated facilities will be targeted for installation of an animal waste management system to reduce fecal coliform impacts to the Vermillion River.

Section 4.1, "South Dakota Water Quality Standards" (page 12) provides a complete description of the beneficial uses assigned to reach SD-VM-R-VERMILLION_EAST_FORK_01. Table 4, "South Dakota surface water quality standards for the East Fork of the Vermillion River, McCook, Miner, and Turner Counties, South Dakota" (page 13) provides a summary of the water quality criteria that must be met to support the designated uses of the reach.

Beneficial Uses Assigned to the Reach:

Chapter 74:51:03:01 of the South Dakota Administrative Rules assigns all streams in South Dakota the beneficial uses of:

Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters
Beneficial Use Classification 10: Irrigation waters

Chapter 74:51:03:25 of the South Dakota Administrative Rules assigns the following additional beneficial use classifications to the East Fork of the Vermillion River from the Vermillion River to the McCook-Lake County Line:

Beneficial Use Classification 6: Warm water marginal fish life propagation waters
Beneficial Use Classification 8: Limited contact recreation waters

The Hydrologic Unit Code for this Reach is10170102.

***Impairment Status**:*

The "Total Maximum Daily Load Summary" on page 1 of the document describes the impairment status.

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment identifies reach number SD-VM-R-VERMILLION_EAST_FORK_01 (Segment R2) as not supporting limited contact recreation use due to elevated levels of fecal coliform. The following information is from the 2010 303(d) list:

Stream Segment	*Source of Water Quality Data*	*Beneficial Use Not Supported*	*Cause*	*Source*	*TMDL Priority*
SD-VM-R-VERMILLION_EAST_FORK_01	*DENR*	*Limited Contact Recreation*	*Fecal Coliform*	*Not Specified*	*1*

All other designated uses for this segment are supported.

Chapter 74:51:01:51 of the South Dakota Administrative Rules establishes the numeric criteria that are protective of limited contact recreation waters. For fecal coliform, the criteria are:

- *<2,000 colony forming units per 100 milliliters (cfu/100mL) in any one sample; and*
- *<1000 cfu/100mL as the geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and they may not exceed this value in more than 20 percent of the samples examined in this same 30-day period.*
- *These criteria apply only during the period May 1- September 30.*

A watershed assessment of the Vermillion River Basin was performed during the period 2004 -2007. Water quality data collected from three locations along the East Fork of the Vermillion River were used to determine that reach SD-VM-R-VERMILLION_EAST_FORK_01is impaired due to elevated concentrations of fecal coliform. The three sampling locations were:

- *Sampling location WQM 150 (460150). This station was established by the South Dakota Department of Environment and Natural Resources (DENR) as part of its long term surface water quality monitoring program. Water samples are collected from this location monthly. Those samples collected during the period May through September are analyzed for E. coli and fecal coliform. The description on page 6 of the TMDL document states that sample results from the period 2004-2011 were considered in the determination of impairment.*
- *Sample location VREF23. This station was established for the watershed assessment project for the Vermillion River Basin. Samples were collected during 2005-2006. Station VREF23 is located on the East Fork of the Vermillion River, south of Winfred. According to the Project Summary Sheet for the Vermillion River Basin Watershed Assessment, samples were collected monthly for nine months during the two-year watershed assessment project period. Additionally, four spring runoff samples and 4 storm event samples were collected each year. Samples were analyzed for E, Coli and fecal coliform. Flow was measured at the time of sample collection.*
- *Sample location VREF25. This station was also established for the watershed assessment project for the Vermillion River Basin. Samples were collected during 2005-2006. Station VREF25 is located on the East Fork of the Vermillion River at the outlet to Lake Thompson. According to the Project Summary Sheet for the Vermillion River Basin Watershed Assessment samples were collected monthly*

for nine months during the two-year watershed assessment project period. Additionally, four spring runoff samples and 4 storm event samples were collected each year. Samples were analyzed for E, Coli and fecal coliform. Flow was measured at the time of sample collection.

Comments:

No comments.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, <u>all TMDL documents must be written to meet the existing water quality standards</u> for that waterbody (CWA §303(d) (1) (C)). *Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.*

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

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

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

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

Summary:

Section 4.1, "South Dakota Water Quality Standards" (page 12) provides a complete description of the beneficial uses assigned to reach SD-VM-R-VERMILLION_EAST_FORK_01.

Table 4, " South Dakota surface water quality standards for the East Fork of the Vermillion River, McCook, Miner, and Turner Counties, South Dakota" (page 13) provides a summary of the water quality criteria that must be met to support the designated uses of the reach.

Section 4.2, "Water Quality Targets" (page 12) clearly states that the numeric water quality target established for reach SD-VM-R-VERMILLION_EAST_FORK_01 is a fecal coliform concentration of 1,000 cfu /100mL. This is the chronic water quality criterion protective of limited contact recreation use and is intended to be compared to the geometric mean of a minimum of 5 samples collected during separate 24-hour periods during a 30 day period for the purpose of determining compliance with the water quality standard.

For this TMDL, the fecal coliform load is determined that will result in achieving this target. The allowable loading and necessary load reductions are determined based on each single sample achieving the chronic water quality criterion. This provides certainty that the acute water quality criterion of 2,000 cfu/100mL will be also be achieved, i.e., if individual sample results achieve the water quality criterion, then the geometric mean of individual sample results is expected to achieve the water quality criterion.

A TMDL is not developed with a water quality target based on the acute criterion.

Comments:

No comments.

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, embeddedness, 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:

Section 4.2, "Water Quality Targets" (page 11) clearly states that the numeric water quality target established for reach SD-VM-R-VERMILLION_EAST_FORK_01 is a fecal coliform concentration of 1,000 cfu /100mL. This is the chronic water quality criterion protective of limited contact recreation use and is intended to be compared to the geometric mean of a minimum of 5 samples collected during separate 24-hour periods during a 30 day period. For this TMDL, the fecal coliform load will be determined that will result in achieving this target. The allowable loading and necessary load reductions will be determined based on each single sample achieving the chronic water quality criterion. This provides certainty that the acute water quality criterion of 2,000 cfu/100mL will also be achieved.

A TMDL is not developed with a water quality target based on the acute criterion.

Comments:
No comments.

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:

There are no point sources within the sub watershed. Nonpoint sources of fecal coliform bacteria are primarily agricultural sources but include human sources and wildlife sources. Table 8, "Fecal Coliform Allocations for the East Fork of the Vermillion River" (page 18) provides an estimate of the percent

contribution of fecal coliform from each of four primary categories: feedlots, livestock on grass, wildlife, and septic tanks.

The agricultural source is manure from livestock, predominantly hogs and beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. Livestock also defecate while grazing on rangelands. This can contribute fecal coliform to streams indirectly by runoff during precipitation events. The percent contribution of fecal coliform from agricultural sources is estimated to be 75.5% from feedlots and 14.8% from livestock on grass.

The human source is assumed to be failing onsite septic systems and is estimated to contribute 3.7% of the fecal coliform loading.

Wildlife, an additional source of fecal coliform within the watershed, is considered to be a natural background source, contributing 6% of the loading.

There are several smaller unnamed tributaries which intermittently drain portions of Kingsbury, Lake, Miner, and McCook counties. The significance of these smaller intermittent streams on the East Fork of the Vermillion was not determined. It is assumed that most of the loading occurs along the length of the East Fork and drains directly to it.

Comments:
No comments.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

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

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

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

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

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

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)).

TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

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

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

Summary:

The TMDL was developed using a Load Duration Curve (LDC) approach resulting in a flow-variable target that considers the entire flow regime. The allowable load is based on a water quality target that is the chronic fecal coliform concentration protective of limited contact recreation use, <1000 cfu/100mL.

The LDC is a dynamic expression of the allowable load for any given flow. The flow intervals were grouped into five flow zones representing high flows (exceeded only 0–10 percent of the time), moist conditions (exceeded 10-40 percent of the time), mid-range flows (exceeded 40–60 percent of the time), low flow conditions (exceeded 60–90 percent of the time), and dry conditions (exceeded 90-100 percent of the time). Five flow zones were designated using data from 16 years of flow data (1995-2011). Point estimates of loading were plotted on the LDC. These were generated from five years of sampling data collected from Vermillion River as part of the watershed assessment and the SD DENR ambient water quality monitoring program.

Section 7.1, "Load Duration Curve Analyses" (page 20) describes that fecal coliform concentrations measured in samples collected from monitoring locations VREF23, VREF25 and WQM Site 150 were combined with daily average flow estimates for the dates when samples were collected to determine the instantaneous loads over the entire flow regime. The flow estimates were determined using the daily average flow measurements from SD DENR monitoring location WQM150 collected during the period (2009-2011) compared to the daily average flow from USGS Gage No. 06478600 for the same period. Flow was then predicted using the long-term record from the USGS gage, and a unit conversion factor. These data are not provided in the document but are available upon request from the SDDENR.

The instantaneous loads were plotted on the LDC. Instantaneous loads that plot above the LDC indicate that load reductions are needed to attain the water quality standard. Instantaneous loads that plot below the LDC are in compliance.

Figure 4 (page 21) presents the LDC. In the mid range, low, and dry flow zones, the measured loading exceeded the allowable loading (based on a water quality target of <1000 cfu/100mL) during some sampling events. Loads in the low flow zone typically indicate a point source load or livestock defecating in the stream or inputs from failing septic tanks.

The LDC presents a dynamic expression of the fecal coliform TMDL for segment R2 and provides a unique maximum daily load that corresponds to a measured average daily flow. This TMDL is based on daily flow and the chronic (geometric mean) water quality standard.

The resulting TMDL, based on the 95th percentile flow for each of the five flow zones is:

- *Extreme flow zone (flows exceeding 246 cfs): TMDL is 5.55E+13 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): TMDL is 5.23E+12 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): TMDL is 8.75E+11cfu/day*
- *Low flow zone (flows range from 3 cfs to14 cfs): TMDL is 3.03E+11 cfu/day*
- *Dry flow zone (flows less than 3 cfs): TMDL is 6.71E+10 cfu/day*

Comments
No comments.

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:

Sampling Locations
As part of the Vermillion River Basin Watershed Assessment Project, stream monitoring locations VREF23 and VREF25 were established on reach SD-VM-R-VERMILLION_EAST_FORK_01. According to the Project Summary sheet for the assessment project, water samples were collected from these locations from 2005-2006. Baseflow sampling consisted of monthly sample collection for 9 months each year. In addition to the baseflow samples, 4 spring runoff samples (2 samples collected during the first week of runoff and one sample per week thereafter) and 4 storm event samples were also collected each year. Stage and flow measurements were taken during each sample event. In addition to these two locations, SD DENR has performed long term water quality monitoring at station WQM150, also located within reach SD-VM-R-VERMILLION_EAST_FORK_01. Samples are collected from WQM150 monthly under the Statewide Surface Water Quality Monitoring Program. Sample results from all 3 sites during the period 2005-2006 were used in this TMDL.

Fecal Coliform Concentrations
Table 6, " Site and Sample Description, and Sample Numbers Collected as Part of the East Fork Vermillion River Pathogen TMDL (2004-2006)" summarizes the number of samples, blanks, duplicates and storm event samples collected during 2005-2006 for all sites included in the Vermillion River Basin Watershed Assessment Project. This includes the 3 monitoring locations within the reach. Table 6 indicates that during 2005-2006, 19 samples were collected from VREF23, 17 samples were collected from VREF25 and 43 samples were collected from WQM150. No fecal coliform concentrations are

provided in Table 5. However, Figure 3, "Sites VREF23, VREF25, and WQM150 fecal coliform concentrations for each of the five flow zones" displays the results in graphical form for all 3 stations combined. Figure 3 does not relate the measured concentrations to individual monitoring locations. However, this information is provided in Appendix A, Water Quality Data.

The following table provides a summary of the number of samples collected per flow zone and the number of sample results greater than the fecal coliform daily maximum water quality criterion for limited contact recreation use (2000 cfu/100mL) during 2005-2006 monitoring of sites VREF23, VREF25, and WQM150.

Flow zone	*High*	*Moist*	*Mid-Range*	*Low*	*Dry*
Samples per zone	*2*	*12*	*17*	*42*	*7*
Exceedances per zone of daily maximum criterion	*0*	*0*	*2*	*10*	*2*
% Exceedances	*0%*	*0%*	*12%*	*24%*	*29%*

Summary of 2005-2006 Fecal Coliform Sample Results from Monitoring Locations VREF23, VREF25, and WQM150:

Water quality monitoring during 2005-2006 showed that approximately 18% of the fecal coliform samples exceeded the daily maximum standard for segment R2. Concentrations of fecal coliform greater than the daily maximum water quality criterion were most frequently measured during low and dry flow conditions, indicating that the most likely sources are livestock with direct access to the stream and/or failing septic systems.

Discharge measurements and water level data were used to calculate a stage/discharge table for all stream systems in the Vermillion River watershed project. USGS Gage No. 06478600 has been recording daily discharge information on the East Fork of the Vermillion River since 1995 and this was used to develop a long-term flow record for monitoring sites located upstream. There are approximately two years of discharge data from Site WQM150 (2009-2011). This data was related back to the USGS gage.

Comments:
No Comments.

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 ☒ Not applicable

Summary:
There are no point source dischargers in the drainage area of the impaired segment therefore no WLAs are necessary.

Comments:

No comments.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

The TMDL for each of the five flow zones was allocated to nonpoint sources as a load allocation (LA) because of the absence of any point source facilities within the watershed. A fraction of the TMDL was also allocated to a margin of safety (MOS) to account for uncertainty in the calculations of these load allocations. An explicit 10% of the TMDL was calculated and reserved as the MOS. The LA for each of the five flow zones was determined by subtracting the WLA (0, since there are no point sources) and the MOS from the TMDL. Thus, the TMDL is the sum of WLA, LA, and MOS.

The LA for each flow zone is as follows:

- *Extreme flow zone (flows exceeding 246 cfs): LA is 5.00E+13 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): LA is 4.71E+12 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): LA is 7.88E+11 cfu/day*
- *Low flow zone (flows range from 3 cfs to 14 cfs): LA is 2.72E+11 cfu/day*
- *Dry flow zone (flows are less than 3 cfs): LA is 6.04E+10 cfu/day*

Comments:

No comments.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.

☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

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

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

Summary:

The document identifies 2 specific sources of uncertainty in the development of the TMDL: the loading of fecal coliform from tributary streams (no sampling data are available to characterize the loads from some tributaries and there is uncertainty in the quantification of actual loading by using sampling results), and the effectiveness of controls. Another source of uncertainty in developing the TMDL is the uncertainty in the flow data used to develop the LDC. A USGS gaging station downstream of the reach has been collecting daily flow data since 1995. In 2009, SDDENR installed stream gaging equipment on WQM150. The data from the USGS gage was used to extrapolate the stream gage data from WQM150 to

develop a long term discharge record for the reach. There is some uncertainty in using the stage-discharge curve from a location downstream of the reach.

To account for the several sources of uncertainty in the TMDL analysis, the TMDL includes an explicit MOS of 10%. This 10% explicit MOS was calculated from the TMDL within each flow zone and reserved as unallocated assimilative capacity. The remaining assimilative capacity was attributed nonpoint sources (LA) or point sources (WLA).

The magnitude of the MOS for each flow zone is as follows:

- *Extreme flow zone (flows exceeding 246 cfs): MOS is 6E+12 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): MOS is 5E+11 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): MOS is 9E+10 cfu/day*
- *Low flow zone (flows range from 3 cfs to 14 cfs): MOS is 3E+10 cfu/day*
- *Dry flow zone (flows are less than 3 cfs): MOS is 7E+9 cfu/day*

The document states that as new information becomes available and the TMDL is revisited, this unallocated capacity may be attributed to nonpoint sources and added to the load allocation, or the unallocated capacity may be attributed to point sources and become part of the waste load allocation.

Comments:
No comments.

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:

Although no hydrograph is included in the document, Section 9.0, "Seasonal Variation" (page 24) states that discharge in the East Fork of the Vermillion River, measured at USGS gage # 06478600 near Parker, SD, displayed seasonal variation for the period of record (10/1/95 to 9/30/11). The highest stream flows typically occur during spring. The highest observed monthly average stream flows occurred in April (336.5 cfs). The lowest observed stream flows occur during the winter months. The lowest observed monthly average stream flow occurred in January (26.2 cfs).

Data provided in Appendix A indicate that fecal coliform concentrations vary seasonally, relative to flow. The highest frequency of exceedances of the daily maximum fecal coliform criteria was detected when discharges were in the lower three flow zones.

Critical conditions occur within the basin during the spring and summer storm events as well as during low flow conditions in the summer and fall. Typically, the largest concentrations are highest in the basin during severe thunderstorms in the summer months. Additionally, the higher concentrations of fecal coliform in the reach occur at lower flows in the summer when livestock have access to the streams. These two flow regimes are considered critical conditions and have been targeted for implementation of control projects to achieve the TMDL.

The LDC approach was used to develop the TMDL. LA and MOS were determined for each of five flow zones. In this way, the seasonal variability in fecal coliform loads and critical conditions are taken into account.

***Comments**:*

No comments.

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:

During development of the TMDL, SDDENR conducted the following activities to educate and involve the public and to provide opportunities for public review and comment:

1. *Various public meetings were held during the assessment phase.*
2. *A webpage was developed and used during the course of the assessment.*
3. *Presentations to local groups on the findings of the assessment.*
4. *A 30-day period for public review and comment on the draft TMDL will be provided. A Public Notice for the TMDL will be published in the Sioux Falls Argus Leader, Montrose Herald, and Madison Daily Leader.*

Comments:
Please include a summary of significant public comments received and SD DENR responses to those comments in the final TMDL document for EPA approval.

SDDENR Response:
SDDENR did not receive any public comments for this TMDL document.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

Summary:

During implementation of best management practices that target sources of fecal coliform, surface water quality monitoring will be performed at station WQM150, located within segment SD-VM-R-VERMILLION_EAST_FORK_01, near Montrose, SD. Station WQM150 was established by SDDENR as part of its statewide ambient water quality monitoring program and surface water samples will continue to be collected monthly at this location. Other sampling locations will be established based on the selection of locations for the implementation projects. The parameters to be monitored will be based on the specific best management practice projects and parameters will be selected to evaluate progress towards attaining the TMDL. Once the TMDL is attained, monitoring is expected to continue with the objective of demonstrating that the TMDL continues to be achieved. Data may also be used in models chosen to evaluate the effectiveness of best management practices.

Comments:
No comments.

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:

Since there are no point sources discharging to segment SD-VM-R-VERMILLION_EAST_FORK_01, the TMDL does not include a WLA. Therefore, the requirement to demonstrate reasonable assurance that the LA is practicable is not applicable to this TMDL.

*Analyses in this TMDL document indicate that significant load reductions are required in the lower three flow zones to achieve the TMDL for segment SD-VM-R-VERMILLION_EAST_FORK_*01. *Because of the rural area and the lack of point sources in the sub watershed, most of the implementation measures are expected to focus on the following:*

- *Livestock access to streams should be reduced, and livestock should be provided sources of water away from streams.*
- *Unstable stream banks should be protected by enhancing the riparian vegetation that provides erosion control and filters runoff of pollutants into the stream.*
- *Filter strips should be installed along the stream bordering cropland and pastureland.*
- *Animal confinement facilities should implement proper animal waste management systems.*
- *An assessment of progress will be part of every Section 319 implementation segment, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.*

Section 13.0, "Implementation" (page 26), describes that currently there is an implementation project targeting areas of sediment and bacterial sources within the Vermillion River Basin. SDDENR has applied for an increase in funding in 2012 to implement additional BMPs over the next several years.

Funds to implement watershed water quality improvements can be obtained through SD DENR. SD DENR administers three major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. They include: Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, and the Section 319 Nonpoint Source program.

Comments:
No comments.

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 fecal coliform TMDL for segment SD-VM-R-VERMILLION_EAST_FORK_01of the East Fork of the Vermillion River is expressed as cfu/day for all flow zones.

Comments:
No comments.

18.0 Placeholder for EPA Approval letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

SEP 26 2012

Ref: 8EPR-EP

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

Re: TMDL Approval
East Fork Vermillion River, Segment R2, Fecal Coliform
SD-VM-R-VERMILLION_EAST_FORK_01

Dear Mr. Pirner:

We have completed our review of the total maximum daily load as submitted by your office for the waterbody 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 referenced above as developed for the water quality limited waterbody as described in Section 303(d)(1). Based on our review, we feel the separate elements of the TMDL as listed in the enclosed table adequately address the pollutant of concern as given in the table, taking into consideration seasonal variation and a margin of safety.

Thank you for submitting the TMDL for our review and approval. If you have any questions, the most knowledgeable person on my staff is Bonnie Lavelle and she may be reached at 303-312-6579.

Sincerely,

Howard M. Cantor, for
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

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ENCLOSURE 1: APPROVED TMDLs

Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River, South Dakota (SD DENR, Jan 2012)

Submitted: 9/13/2012

1	Pollutant TMDLs completed.
1	Causes addressed from the 2012 303(d) list.
0	Determinations that no pollutant TMDL needed.

Segment: East Fork Vermillion River from McCook/Lake County line to its confluence with Little Vermillion River

303(d) ID: SD-VM-R-VERMILLION E FORK 01

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

Water Quality Targets: <1000 cfu/100mL geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period; < 2000 cfu/100 mL in any one sample

Allocation*	Value	Units	State Permits	Permits
WLA	0.00	CFU/DAY		
LA	7.88E+11	CFU/DAY		
TMDL	8.75E+11	CFU/DAY		
MOS	9E+10	CFU/DAY		

Notes:

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

ENCLOSURE 2

EPA REGION 8 TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River South Dakota**
Submitted by:	**South Dakota Department of Environment and Natural Resources Water Resources Assistance Program**
Date Received:	**September 13, 2012**
Review Date:	**September 18, 2012**
Reviewer:	**Bonnie Lavelle**
Rough Draft / Public Notice / Final Draft?	**Final**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final draft 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 ☐ N/A

Summary:

This final TMDL document, "Pathogen Total Maximum Daily Load (TMDL) for One Segment of the East Fork of the Vermillion River South Dakota" was transmitted to EPA via email on September 13, 2012 requesting final review and approval.

Comments: *No comments.*

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:

Physical setting and Listing History:
Section 1.0, "Objective", and Section 2.0, "Watershed Characteristics" (page 2) describe the physical setting.

The East Fork of the Vermillion River is located southeast South Dakota in the northern part of the Vermillion River basin. Reach SD-VM-R-VERMILLION_EAST_FORK_01 (Segment R2) runs from the McCook-Lake County Line to the confluence with the Little Vermillion River, a length of 15.4 miles. The size of the drainage area for Segment R2 is 156,614 acres. This includes the 132,083 acres that drain into the East Fork north of the McCook/Lake County Line- a portion that is not impaired and is therefore not subject to this TMDL. The watershed that drains the immediate area of segment R2 is 24,531 acres.

The predominant land use in the East Fork of the Vermillion River drainage area is cultivated crops (56.5%). Other land uses include pasture (17.3%) and grassland (11.6%). The remaining surface area is covered by open water (7.3%), emergent herbaceous wetlands (2.6%), open space (4%), low density development (0.2%) and deciduous forest (0.4%). 15 Animal Feeding Operations (AFOs) are located within 500 meters of the East Fork of the Vermillion River. 13 of the AFOs exhibited a rating of 50 or greater using the AGNPS Feedlot Rating Module. According to the Project Summary Sheet for the Vermillion River Basin Watershed Project Segment II, AFOs with a rating of 50 or greater will be subject to further evaluation. The higher rated facilities will be targeted for installation of an animal waste management system to reduce fecal coliform impacts to the Vermillion River.

Section 4.1, "South Dakota Water Quality Standards" (page 12) provides a complete description of the beneficial uses assigned to reach SD-VM-R-VERMILLION_EAST_FORK_01. Table 4, "South Dakota surface water quality standards for the East Fork of the Vermillion River, McCook, Miner, and Turner Counties, South Dakota" (page 13) provides a summary of the water quality criteria that must be met to support the designated uses of the reach.

Beneficial Uses Assigned to the Reach:

Chapter 74:51:03:01 of the South Dakota Administrative Rules assigns all streams in South Dakota the beneficial uses of:

Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters
Beneficial Use Classification 10: Irrigation waters

Chapter 74:51:03:25 of the South Dakota Administrative Rules assigns the following additional beneficial use classifications to the East Fork of the Vermillion River from the Vermillion River to the McCook-Lake County Line:

Beneficial Use Classification 6: Warm water marginal fish life propagation waters
Beneficial Use Classification 8: Limited contact recreation waters

The Hydrologic Unit Code for this Reach is10170102.

***Impairment Status**:*

The "Total Maximum Daily Load Summary" on page 1 of the document describes the impairment status.

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment identifies reach number SD-VM-R-VERMILLION_EAST_FORK_01 (Segment R2) as not supporting limited contact recreation use due to elevated levels of fecal coliform. The following information is from the 2010 303(d) list:

Stream Segment	*Source of Water Quality Data*	*Beneficial Use Not Supported*	*Cause*	*Source*	*TMDL Priority*
SD-VM-R-VERMILLION_EAST_FORK_01	*DENR*	*Limited Contact Recreation*	*Fecal Coliform*	*Not Specified*	*1*

All other designated uses for this segment are supported.

Chapter 74:51:01:51 of the South Dakota Administrative Rules establishes the numeric criteria that are protective of limited contact recreation waters. For fecal coliform, the criteria are:

- *<2,000 colony forming units per 100 milliliters (cfu/100mL) in any one sample; and*
- *<1000 cfu/100mL as the geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and they may not exceed this value in more than 20 percent of the samples examined in this same 30-day period.*
- *These criteria apply only during the period May 1- September 30.*

A watershed assessment of the Vermillion River Basin was performed during the period 2004 -2007. Water quality data collected from three locations along the East Fork of the Vermillion River were used to determine that reach SD-VM-R-VERMILLION_EAST_FORK_01is impaired due to elevated concentrations of fecal coliform. The three sampling locations were:

- *Sampling location WQM 150 (460150). This station was established by the South Dakota Department of Environment and Natural Resources (DENR) as part of its long term surface water*

quality monitoring program. Water samples are collected from this location monthly. Those samples collected during the period May through September are analyzed for E. coli and fecal coliform. The description on page 6 of the TMDL document states that sample results from the period 2004-2011 were considered in the determination of impairment.

- *Sample location VREF23. This station was established for the watershed assessment project for the Vermillion River Basin. Samples were collected during 2005-2006. Station VREF23 is located on the East Fork of the Vermillion River, south of Winfred. According to the Project Summary Sheet for the Vermillion River Basin Watershed Assessment, samples were collected monthly for nine months during the two-year watershed assessment project period. Additionally, four spring runoff samples and 4 storm event samples were collected each year. Samples were analyzed for E, Coli and fecal coliform. Flow was measured at the time of sample collection.*
- *Sample location VREF25. This station was also established for the watershed assessment project for the Vermillion River Basin. Samples were collected during 2005-2006. Station VREF25 is located on the East Fork of the Vermillion River at the outlet to Lake Thompson. According to the Project Summary Sheet for the Vermillion River Basin Watershed Assessment samples were collected monthly for nine months during the two-year watershed assessment project period. Additionally, four spring runoff samples and 4 storm event samples were collected each year. Samples were analyzed for E, Coli and fecal coliform. Flow was measured at the time of sample collection.*

Comments: *No comments.*

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:

Section 4.1, "South Dakota Water Quality Standards" (page 12) provides a complete description of the beneficial uses assigned to reach SD-VM-R-VERMILLION_EAST_FORK_01.

Table 4, " South Dakota surface water quality standards for the East Fork of the Vermillion River, McCook, Miner, and Turner Counties, South Dakota" (page 13) provides a summary of the water quality criteria that must be met to support the designated uses of the reach.

Section 4.2, "Water Quality Targets" (page 12) clearly states that the numeric water quality target established for reach SD-VM-R-VERMILLION_EAST_FORK_01 is a fecal coliform concentration of 1,000 cfu /100mL. This is the chronic water quality criterion protective of limited contact recreation use and is intended to be compared to the geometric mean of a minimum of 5 samples collected during separate 24-hour periods during a 30 day period for the purpose of determining compliance with the water quality standard.

For this TMDL, the fecal coliform load is determined that will result in achieving this target. The allowable loading and necessary load reductions are determined based on each single sample achieving the chronic water quality criterion. This provides certainty that the acute water quality criterion of 2,000 cfu/100mL will be also be achieved, i.e., if individual sample results achieve the water quality criterion, then the geometric mean of individual sample results is expected to achieve the water quality criterion.

A TMDL is not developed with a water quality target based on the acute criterion.

Comments: *No comments.*

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, embeddedness, 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:

Section 4.2, "Water Quality Targets" (page 11) clearly states that the numeric water quality target established for reach SD-VM-R-VERMILLION_EAST_FORK_01 is a fecal coliform concentration of 1,000 cfu /100mL. This is the chronic water quality criterion protective of limited contact recreation use and is intended to be compared to the geometric mean of a minimum of 5 samples collected during separate 24-hour periods during a 30 day period. For this TMDL, the fecal coliform load will be determined that will result in achieving this target. The allowable loading and necessary load reductions will be determined based on each single sample achieving the chronic water quality criterion. This provides certainty that the acute water quality criterion of 2,000 cfu/100mL will also be achieved.

A TMDL is not developed with a water quality target based on the acute criterion.

Comments: *No comments.*

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:

There are no point sources within the sub watershed. Nonpoint sources of fecal coliform bacteria are primarily agricultural sources but include human sources and wildlife sources. Table 8, "Fecal Coliform Allocations for the East Fork of the Vermillion River" (page 18) provides an estimate of the percent contribution of fecal coliform from each of four primary categories: feedlots, livestock on grass, wildlife, and septic tanks.

The agricultural source is manure from livestock, predominantly hogs and beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. Livestock also defecate while grazing on rangelands. This can contribute fecal coliform to streams indirectly by runoff during precipitation events. The percent contribution of fecal coliform from agricultural sources is estimated to be 75.5% from feedlots and 14.8% from livestock on grass.

The human source is assumed to be failing onsite septic systems and is estimated to contribute 3.7% of the fecal coliform loading.

Wildlife, an additional source of fecal coliform within the watershed, is considered to be a natural background source, contributing 6% of the loading.

There are several smaller unnamed tributaries which intermittently drain portions of Kingsbury, Lake, Miner, and McCook counties. The significance of these smaller intermittent streams on the East Fork of the Vermillion was not determined. It is assumed that most of the loading occurs along the length of the East Fork and drains directly to it.

Comments: *No comments.*

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL =		Total Pollutant Loading Capacity of the waterbody
LAs	=	Pollutant Load Allocations
WLAs	=	Pollutant Wasteload Allocations
MOS	=	The portion of the Load Capacity allocated to the Margin of safety.

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

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

Summary:

The TMDL was developed using a Load Duration Curve (LDC) approach resulting in a flow-variable target that considers the entire flow regime. The allowable load is based on a water quality target that is the chronic fecal coliform concentration protective of limited contact recreation use, <1000 cfu/100mL.

The LDC is a dynamic expression of the allowable load for any given flow. The flow intervals were grouped into five flow zones representing high flows (exceeded only 0–10 percent of the time), moist conditions (exceeded 10-40 percent of the time), mid-range flows (exceeded 40–60 percent of the time), low flow conditions (exceeded 60–90 percent of the time), and dry conditions (exceeded 90-100 percent of the time). Five flow zones were designated using data from 16 years of flow data (1995-2011). Point estimates of loading were plotted on the LDC. These were generated from five years of sampling data collected from Vermillion River as part of the watershed assessment and the SD DENR ambient water quality monitoring program.

Section 7.1, "Load Duration Curve Analyses" (page 20) describes that fecal coliform concentrations measured in samples collected from monitoring locations VREF23, VREF25 and WQM Site 150 were combined with daily average flow estimates for the dates when samples were collected to determine the instantaneous loads over the entire flow regime. The flow estimates were determined using the daily average flow measurements from SD DENR monitoring location WQM150 collected during the period (2009-2011) compared to the daily average flow from USGS Gage No. 06478600 for the same period. Flow was then predicted using the long-term record from the USGS gage, and a unit conversion factor. These data are not provided in the document but are available upon request from the SDDENR.

The instantaneous loads were plotted on the LDC. Instantaneous loads that plot above the LDC indicate that load reductions are needed to attain the water quality standard. Instantaneous loads that plot below the LDC are in compliance.

Figure 4 (page 21) presents the LDC. In the mid range, low, and dry flow zones, the measured loading exceeded the allowable loading (based on a water quality target of <1000 cfu/100mL) during some sampling events. Loads in the low flow zone typically indicate a point source load or livestock defecating in the stream or inputs from failing septic tanks.

The LDC presents a dynamic expression of the fecal coliform TMDL for segment R2 and provides a unique maximum daily load that corresponds to a measured average daily flow. This TMDL is based on daily flow and the chronic (geometric mean) water quality standard.

The resulting TMDL, based on the 95th percentile flow for each of the five flow zones is:

- *Extreme flow zone (flows exceeding 246 cfs): TMDL is 5.55E+13 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): TMDL is 5.23E+12 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): TMDL is 8.75E+11cfu/day*
- *Low flow zone (flows range from 3 cfs to14 cfs): TMDL is 3.03E+11 cfu/day*
- *Dry flow zone (flows less than 3 cfs): TMDL is 6.71E+10 cfu/day*

Comments: *No comments.*

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:

Sampling Locations
As part of the Vermillion River Basin Watershed Assessment Project, stream monitoring locations VREF23 and VREF25 were established on reach SD-VM-R-VERMILLION_EAST_FORK_01. According to the Project Summary sheet for the assessment project, water samples were collected from these locations from 2005-2006. Baseflow sampling consisted of monthly sample collection for 9 months each year. In addition to the baseflow samples, 4 spring runoff samples (2 samples collected during the first week of runoff and one sample per week thereafter) and 4 storm event samples were also collected each year. Stage and flow measurements were taken during each sample event. In addition to these two locations, SD DENR has performed long term water quality monitoring at station WQM150, also located within reach SD-VM-R-VERMILLION_EAST_FORK_01. Samples are collected from WQM150 monthly under the Statewide Surface Water Quality Monitoring Program. Sample results from all 3 sites during the period 2005-2006 were used in this TMDL.

Fecal Coliform Concentrations
Table 6, " Site and Sample Description, and Sample Numbers Collected as Part of the East Fork Vermillion River Pathogen TMDL (2004-2006)" summarizes the number of samples, blanks, duplicates and storm event samples collected during 2005-2006 for all sites included in the Vermillion River Basin Watershed Assessment Project. This includes the 3 monitoring locations within the reach. Table 6 indicates that during 2005-2006, 19 samples were collected from VREF23, 17 samples were collected from VREF25 and 43 samples were collected from WQM150. No fecal coliform concentrations are provided in Table 5. However, Figure 3, "Sites VREF23, VREF25, and WQM150 fecal coliform concentrations for each of the five flow zones" displays the results in graphical form for all 3 stations

combined. Figure 3 does not relate the measured concentrations to individual monitoring locations. However, this information is provided in Appendix A, Water Quality Data.

The following table provides a summary of the number of samples collected per flow zone and the number of sample results greater than the fecal coliform daily maximum water quality criterion for limited contact recreation use (2000 cfu/100mL) during 2005-2006 monitoring of sites VREF23, VREF25, and WQM150.

Summary of 2005-2006 Fecal Coliform Sample Results from Monitoring Locations VREF23, VREF25, and WQM150:

Flow zone	*High*	*Moist*	*Mid-Range*	*Low*	*Dry*
Samples per zone	*2*	*12*	*17*	*42*	*7*
Exceedances per zone of daily maximum criterion	*0*	*0*	*2*	*10*	*2*
% Exceedances	*0%*	*0%*	*12%*	*24%*	*29%*

Water quality monitoring during 2005-2006 showed that approximately 18% of the fecal coliform samples exceeded the daily maximum standard for segment R2. Concentrations of fecal coliform greater than the daily maximum water quality criterion were most frequently measured during low and dry flow conditions, indicating that the most likely sources are livestock with direct access to the stream and/or failing septic systems.

Discharge measurements and water level data were used to calculate a stage/discharge table for all stream systems in the Vermillion River watershed project. USGS Gage No. 06478600 has been recording daily discharge information on the East Fork of the Vermillion River since 1995 and this was used to develop a long-term flow record for monitoring sites located upstream. There are approximately two years of discharge data from Site WQM150 (2009-2011). This data was related back to the USGS gage.

Comments: *No Comments.*

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 ☒ Not applicable

Summary:
There are no point source dischargers in the drainage area of the impaired segment therefore no WLAs are necessary.

Comments:
No comments.

4.3 Load Allocations (LA):

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

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

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

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

Summary:

The TMDL for each of the five flow zones was allocated to nonpoint sources as a load allocation (LA) because of the absence of any point source facilities within the watershed. A fraction of the TMDL was also allocated to a margin of safety (MOS) to account for uncertainty in the calculations of these load allocations. An explicit 10% of the TMDL was calculated and reserved as the MOS. The LA for each of the five flow zones was determined by subtracting the WLA (0, since there are no point sources) and the MOS from the TMDL. Thus, the TMDL is the sum of WLA, LA, and MOS.

The LA for each flow zone is as follows:

- *Extreme flow zone (flows exceeding 246 cfs): LA is 5.00E+13 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): LA is 4.71E+12 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): LA is 7.88E+11 cfu/day*

- *Low flow zone (flows range from 3 cfs to 14 cfs): LA is 2.72E+11 cfu/day*
- *Dry flow zone (flows are less than 3 cfs): LA is 6.04E+10 cfu/day*

Comments: *No comments.*

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.

☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

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

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

Summary:

The document identifies 2 specific sources of uncertainty in the development of the TMDL: the loading of fecal coliform from tributary streams (no sampling data are available to characterize the loads from some tributaries and there is uncertainty in the quantification of actual loading by using sampling results), and the effectiveness of controls. Another source of uncertainty in developing the TMDL is the uncertainty in the flow data used to develop the LDC. A USGS gaging station downstream of the reach

has been collecting daily flow data since 1995. In 2009, SDDENR installed stream gaging equipment on WQM150. The data from the USGS gage was used to extrapolate the stream gage data from WQM150 to develop a long term discharge record for the reach. There is some uncertainty in using the stage-discharge curve from a location downstream of the reach.

To account for the several sources of uncertainty in the TMDL analysis, the TMDL includes an explicit MOS of 10%. This 10% explicit MOS was calculated from the TMDL within each flow zone and reserved as unallocated assimilative capacity. The remaining assimilative capacity was attributed nonpoint sources (LA) or point sources (WLA).

The magnitude of the MOS for each flow zone is as follows:

- *Extreme flow zone (flows exceeding 246 cfs): MOS is 6E+12 cfu/day*
- *High-Range flow zone (flows range from 37 cfs to 246 cfs): MOS is 5E+11 cfu/day*
- *Mid-Range flow zone (flows range from 14 cfs to 37 cfs): MOS is 9E+10 cfu/day*
- *Low flow zone (flows range from 3 cfs to 14 cfs): MOS is 3E+10 cfu/day*
- *Dry flow zone (flows are less than 3 cfs): MOS is 7E+9 cfu/day*

The document states that as new information becomes available and the TMDL is revisited, this unallocated capacity may be attributed to nonpoint sources and added to the load allocation, or the unallocated capacity may be attributed to point sources and become part of the waste load allocation.

***Comments**: No comments.*

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**:*

Although no hydrograph is included in the document, Section 9.0, "Seasonal Variation" (page 24) states that discharge in the East Fork of the Vermillion River, measured at USGS gage # 06478600 near Parker, SD, displayed seasonal variation for the period of record (10/1/95 to 9/30/11). The highest stream flows typically occur during spring. The highest observed monthly average stream flows occurred in April (336.5 cfs). The lowest observed stream flows occur during the winter months. The lowest observed monthly average stream flow occurred in January (26.2 cfs).

Data provided in Appendix A indicate that fecal coliform concentrations vary seasonally, relative to flow. The highest frequency of exceedances of the daily maximum fecal coliform criteria was detected when discharges were in the lower three flow zones.

Critical conditions occur within the basin during the spring and summer storm events as well as during low flow conditions in the summer and fall. Typically, the largest concentrations are highest in the basin during severe thunderstorms in the summer months. Additionally, the higher concentrations of fecal coliform in the reach occur at lower flows in the summer when livestock have access to the streams. These two flow regimes are considered critical conditions and have been targeted for implementation of control projects to achieve the TMDL.

The LDC approach was used to develop the TMDL. LA and MOS were determined for each of five flow zones. In this way, the seasonal variability in fecal coliform loads and critical conditions are taken into account.

***Comments**: No comments.*

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**:*

During development of the TMDL, SDDENR conducted the following activities to educate and involve the public and to provide opportunities for public review and comment:

1. *Various public meetings were held during the assessment phase.*
2. *A webpage was developed and used during the course of the assessment.*
3. *Presentations to local groups on the findings of the assessment.*
4. *A 30-day period for public review and comment on the draft TMDL will be provided. A Public Notice for the TMDL will be published in the Sioux Falls Argus Leader, Montrose Herald, and Madison Daily Leader. SD DENR did not receive any public comments on this TMDL.*

***Comments**: No comments.*

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

Summary:

During implementation of best management practices that target sources of fecal coliform, surface water quality monitoring will be performed at station WQM150, located within segment SD-VM-R-VERMILLION_EAST_FORK_01, near Montrose, SD. Station WQM150 was established by SDDENR as part of its statewide ambient water quality monitoring program and surface water samples will continue to be collected monthly at this location. Other sampling locations will be established based on the selection of locations for the implementation projects. The parameters to be monitored will be based on the specific best management practice projects and parameters will be selected to evaluate progress towards attaining the TMDL. Once the TMDL is attained, monitoring is expected to continue with the objective of demonstrating that the TMDL continues to be achieved. Data may also be used in models chosen to evaluate the effectiveness of best management practices.

Comments: *No comments.*

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:

Since there are no point sources discharging to segment SD-VM-R-VERMILLION_EAST_FORK_01, the TMDL does not include a WLA. Therefore, the requirement to demonstrate reasonable assurance that the LA is practicable is not applicable to this TMDL.

*Analyses in this TMDL document indicate that significant load reductions are required in the lower three flow zones to achieve the TMDL for segment SD-VM-R-VERMILLION_EAST_FORK_*01. *Because of the rural area and the lack of point sources in the sub watershed, most of the implementation measures are expected to focus on the following:*

- *Livestock access to streams should be reduced, and livestock should be provided sources of water away from streams.*
- *Unstable stream banks should be protected by enhancing the riparian vegetation that provides erosion control and filters runoff of pollutants into the stream.*
- *Filter strips should be installed along the stream bordering cropland and pastureland.*
- *Animal confinement facilities should implement proper animal waste management systems.*
- *An assessment of progress will be part of every Section 319 implementation segment, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.*

Section 13.0, "Implementation" (page 26), describes that currently there is an implementation project targeting areas of sediment and bacterial sources within the Vermillion River Basin. SDDENR has applied for an increase in funding in 2012 to implement additional BMPs over the next several years.

Funds to implement watershed water quality improvements can be obtained through SD DENR. SD DENR administers three major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. They include: Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, and the Section 319 Nonpoint Source program.

Comments: *No comments.*

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 fecal coliform TMDL for segment SD-VM-R-VERMILLION_EAST_FORK_01of the East Fork of the Vermillion River is expressed as cfu/day for all flow zones.

Comments: *No comments.*