Escherichia coli BACTERIA TOTAL MAXIMUM DAILY LOAD EVALUATIONS FOR THE SOUTH FORK WHETSTONE RIVER GRANT COUNTY, SOUTH DAKOTA

Watershed Protection Program
Division of Resource Conservation and Forestry
South Dakota Department of Agriculture and Natural Resources

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Contents

List of Tables

List of Figures

Appendices

Total Maximum Daily Load Summary Table

South Fork Whetstone River Segment 01 TMDL

Entity ID's:	SD-MN-R-WHETSTONE_S_FORK_01
Location:	HUC Code: 07020001
Size of Watershed:	43,909 acres
Water body Type:	River/Stream
303(d) Listing Parameter:	*E. coli* Bacteria
Initial Listing date:	2012 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	Headwaters to Lake Farley, 21.7 miles
Designated Use of Concern:	Limited Contact Recreation (8)
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards for South Dakota 74:51:01:51.
Indicators:	*E. coli* Bacteria, Colony Forming Units (CFU)
Threshold Value:	≤ 630 *E. coli* CFU/100 ml geometric mean concentration with maximum single sample concentrations of ≤ 1,178 *E. coli* CFU/100 ml
High Flow Zone LA:	1.31E+13 *E. coli* CFU/day
High Flow Zone WLA:	0.00E+0 *E. coli*/ CFU/day
High Flow Zone MOS:	1.45E+12 *E. coli* CFU/day
High Flow Zone TMDL:	1.45E+13 *E. coli* CFU/day

Total Maximum Daily Load Summary Table

<u>South Fork Whetstone River Segment 02 TMDL</u>

Entity ID's:	SD-MN-R-WHETSTONE_S_FORK_02
Location:	HUC Code: 07020001
Size of Watershed:	44,414 acres
Water body Type:	River/Stream
303(d) Listing Parameter:	*E. coli* Bacteria
Initial Listing date:	2012 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	Lake Farley to Mouth of Whetstone River, 9 miles
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards for South Dakota 74:51:01:51.
Indicators:	*E. coli* Bacteria, Colony Forming Units (CFU)
Threshold Value:	≤ 630 *E. coli* CFU/100 ml geometric mean concentration with maximum single sample concentrations of ≤ 1,178 *E. coli* CFU/100 ml
High Flow Zone LA:	1.10E+13 *E. coli* CFU/Day
High Flow Zone WLA:	8.77E+10 *E. coli* CFU/Day
High Flow Zone MOS:	1.24E+12 *E. coli* CFU/Day
High Flow Zone TMDL:	1.24E+13 *E. coli* CFU/Day

Introduction

The intent of this document is to clearly identify the components of the TMDLs submitted to support adequate public participation and facilitate the United States Environmental Protection Agency (EPA) review and approval. These TMDLs were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by EPA. This TMDL document addresses *Escherichia coli* (*E. coli*) bacteria impairments for segments 01 and 02 of the South Fork Whetstone River. The impaired segments are identified as SD-MN-R-Whetstone_S_Fork_01 (upper) and SD-MN-R-Whetstone_S_Fork_02 (lower) in the 303(d) list of impaired waterbodies in South Dakota's 2022 Integrated Report (IR) for Surface Water Quality Assessment. Both segments were initially placed on the 303(d) list during the 2012 IR cycle.

Watershed Characteristics

The South Fork Whetstone River drains the eastern flank of the Choteau des Prairies upland in northeastern South Dakota, primarily Grant County. The South Fork Whetstone flows eastward and converges with the North Fork to form the Whetstone River approximately 6 miles from the South Dakota/ Minnesota border. The Whetstone River, Yellow Bank River, and outflow from Big Stone Lake constitute the headwaters of the Minnesota River.

Two towns reside within the South Fork Whetstone River watershed. Milbank is the larger of the two communities with a population of 3,544 (2020 census). Twin Brooks is a small rural community with an estimated 47 people (2020 census). Figure 1 depicts the location of the South Fork Whetstone watershed with respect to location in South Dakota. Figure 2 depicts, the South Fork Whetstone watershed, the impaired segments, monitoring stations (red) and other key characteristics.

The entire drainage area for the South Fork of the Whetstone River is approximately 88,323 acres. The upper and lower segments of the South Fork watershed encompass approximately 43,909 acres and 44,414 acres, respectively. Land use in the combined watershed is primarily agriculture (Figure 3). The headwaters originate along the Choteau des Prairies escarpment which is dominated by rangeland/pasture and grasslands with several wooded draws. The eastern portion of the watershed is a relatively flat valley dominated by row crops, in particular, corn and soybeans with some small grains and alfalfa (Table 1). Numerous animal feeding areas are located within the watershed, although the trend is toward fewer operations with higher numbers of animals.

Table 1. Percent land use cover in the SF Whetstone River watershed by category.

Land Use	Percent
Row Crops	45.56%
Grassland/Pasture	33.47%
Alfalfa	5.44%
Wetlands	4.72%
Developed Land	4.39%
Small Grains	2.66%
Forest Land	1.68%
Open Water	1.17%
Barren and Idle land	0.91%

Hydrology of the South Fork Whetstone can be variable due to the exceptional high relief along the Coteau des Prairies escarpment. Elevation changes in excess of 1,000 feet take place across the length of the watershed, much of which occurs within the initial third of the river system. The headwaters of most tributary streams begin at elevations over 2,000 feet above mean sea level, dropping to an elevation of roughly 960 feet where the South Fork Whetstone confluences with the Whetstone River near the SD/MN border at Ortonville, MN. This elevation change takes place over as little as 30 miles.

The average annual precipitation in the watershed area is 22 inches, of which 75% typically falls April through September. Tornadoes and severe thunderstorms strike occasionally. These storms are often of local extent and duration, and occasionally produce heavy rainfall events. The average seasonal snowfall is 30 inches per year.

The surficial character of the watershed can be divided into four parts. The southwestern and northeastern edges of the watershed are dominated by poorly drained, depressions. These areas mark the location of ice-marginal deposits left behind during the last ice age. The northeast flank of the Coteau des Prairies is a well-drained area, with substantial relief. Many small tributary streams cross the area from the southwest to the northeast. The central part of the watershed is characterized by moderately well drained, low relief terrain sloping gently toward the northeast. In all three cases, the land surface is underlain by glacial till. Finally, the valleys of the Whetstone Rivers are deeply incised into the land surface. Glacial outwash is found along these valleys. Shallow wells in the saturated sand and gravel (aquifer) are the drinking water source for some private wells. Discharge from the aquifer may also help maintain river levels during dry periods.

Soils within the study area are derived from a variety of parent materials. Uplands soils are relatively fine-grained, and have developed over glacial till, often with a thin loess (wind-blown silt) cover. Coarse-grained soils are found around the valley bottoms of the river and major tributaries and are derived from glacial outwash or alluvial sediments.

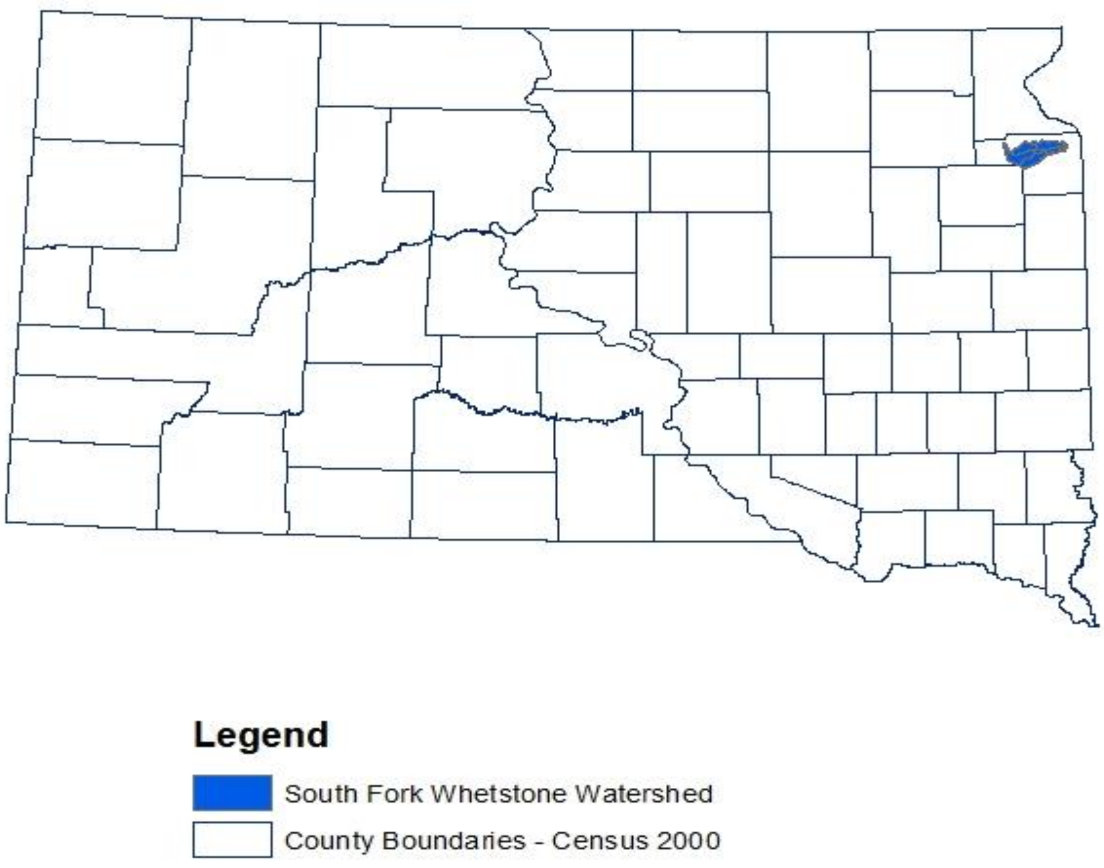

Figure 1. Location of the South Fork Whetstone River watershed in Grant County, South Dakota

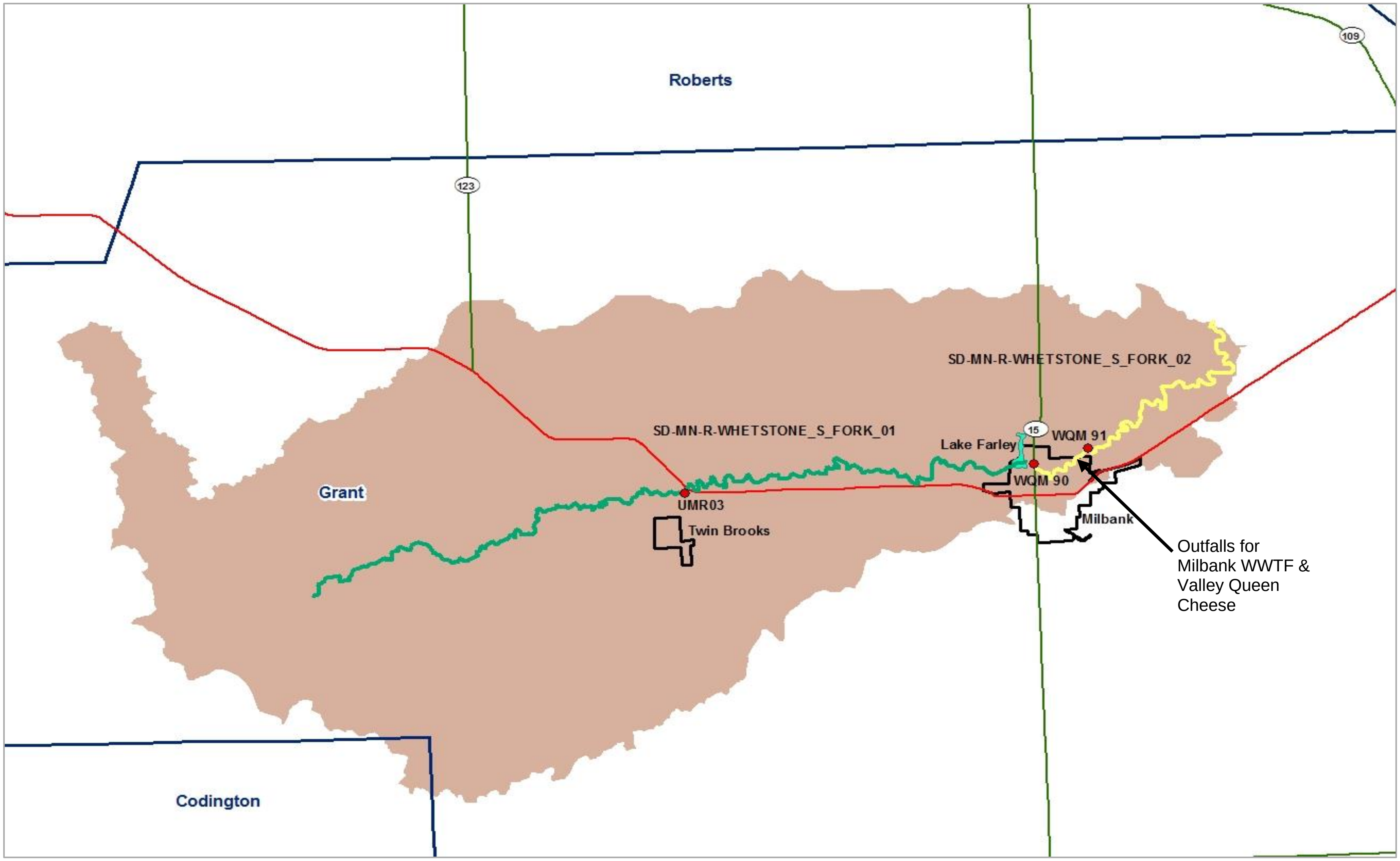

Figure 2. Impaired segments and associated monitoring sites in the SF. Whetstone River watershed.

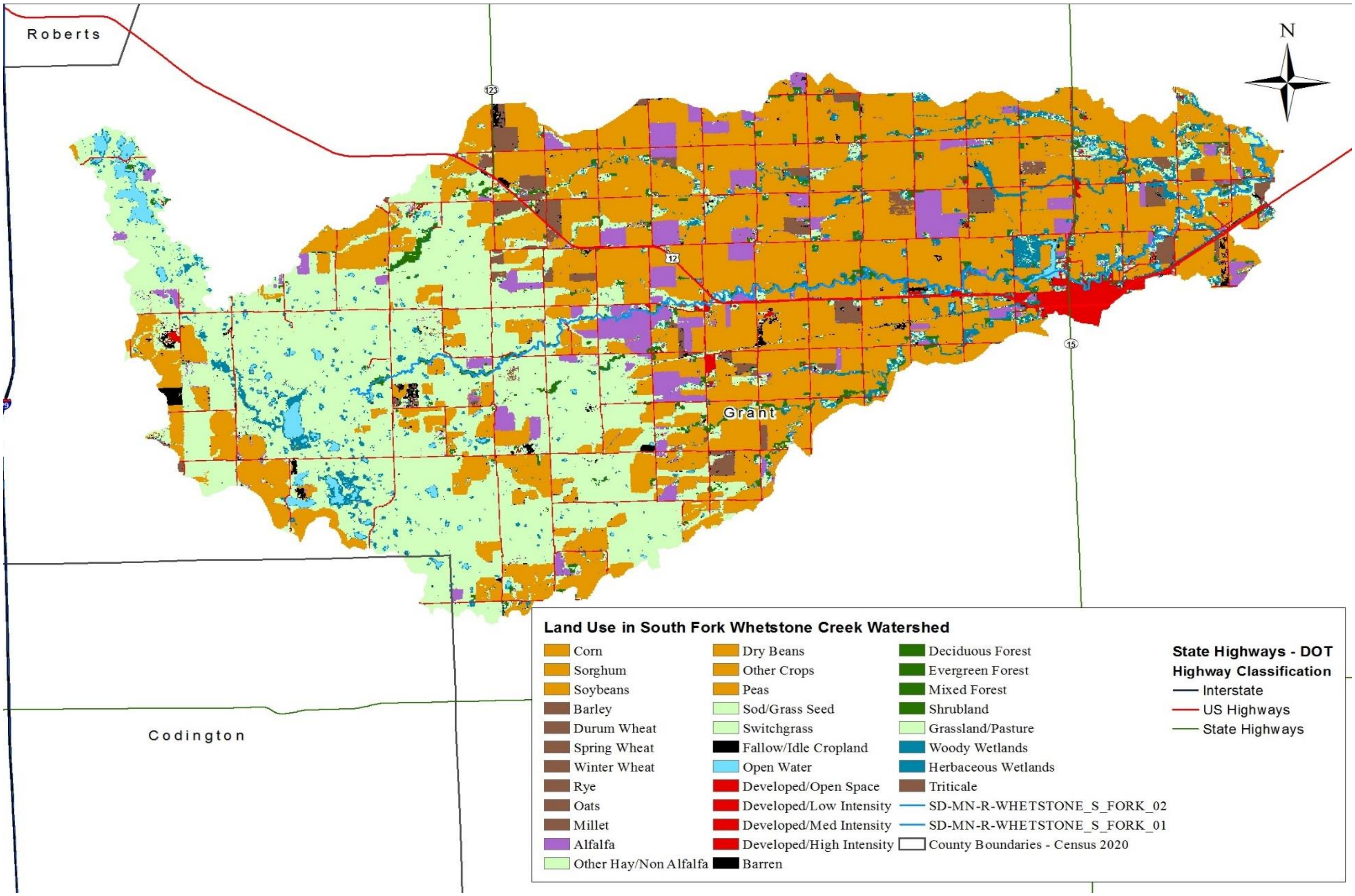

Figure 3. Land use characteristics in the SF Whetstone River watershed.

Water Quality Standards

Water quality standards are comprised of three main components as defined in the Federal Clean Water Act (33 U.S.C. §1251 et seq.) and Administrative Rules of South Dakota (ARSD) Chapter 74:51:01:

- Beneficial Uses – Functions or activities that reflect waterbody management goals
- Criteria – Numeric concentrations or narrative statements that represent the level of water quality required to support beneficial uses
- Antidegradation – Additional policies that protect high quality waters

Beneficial Uses

Waterbodies in South Dakota are assigned beneficial uses. All waters (lakes and streams) are designated the use of fish and wildlife propagation, recreation and stock watering (9). All streams are assigned the use of irrigation (10). Additional beneficial use designations may be assigned by the state based on a use attainability assessment of each waterbody. Water quality standard criteria have been defined in South Dakota state statutes in support of all beneficial uses. The standards consist of suites of numeric criteria that provide physical and chemical benchmarks from which support determinations and impairment decisions can be identified.

The impaired segments of the South Fork Whetstone River have been assigned the following beneficial use designations: warmwater marginal fish life propagation (6), limited contact recreation (8), fish and wildlife propagation, recreation, and stock watering (9), and irrigation (10).

Water Quality Criteria

Tables 2 displays the water quality standard criteria assigned to protect the designated beneficial uses of the South Fork Whetstone River. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

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

Table 2 Designated beneficial uses and associated water quality criteria for the South Fork Whetstone River (SD-MN-R-Whetstone_S_Fork_01 and SD-MN-R-Whetstone_S_Fork_02).

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	Daily criterion mg/L	Warmwater Marginal Fish Life Propagation
	Equal to or less than the result from Equation 2 in Appendix A of Surface Water Quality Standards	Chronic criterion mg/L	
Dissolved Oxygen	≥4.0 Oct-Apr ≥5.0 May-Sept	mg/L	Warmwater Marginal Fish Life Propagation
Total Suspended Solids	≤150 (30-day mean) ≤263 (single sample)	mg/L	Warmwater Marginal Fish Life Propagation
Temperature	≤<90	°F	Warmwater Marginal Fish Life Propagation
Escherichia coli Bacteria (May 1- Sept 30)	≤630 (geometric mean) ≤1,178 (single sample)	count/100 mL	Limited Contact Recreation
Microcystin (May 1-Sept 30)	≤ 8 Not to be exceeded in more than three 10 day assessment periods over the course of the recreation season	µg/L	Limited Contact Recreation
Cylindrospermopsin (May 1-Sept 30)	≤ 15 Not to be exceeded in more than three 10 day assessment periods over the course of the recreation season	µg/L	Limited Contact Recreation
Alkalinity (CaCO3)	≤750 (30-day mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Conductivity	≤2,500 (30-day mean) ≤4,375 (single sample)	µmhos/cm @ 25° C	Irrigation Waters
Nitrogen, nitrate as N	≤50 (30-day mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
pH (standard units)	≥6.0 to ≤9.0	units	Warmwater Marginal Fish Life Propagation
Solids, total dissolved	≤2,500 (30-day mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon	≤10	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Oil and Grease	≤10	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters
Undissociated hydrogen sulfide	≤0.002	mg/L	Warmwater Marginal Fish Life Propagation

E. coli Water Quality Criteria

South Dakota adopted numeric *E. coli* criteria for the protection of the immersion (7) and limited contact recreation uses (8). Immersion recreation waters are to be maintained suitable for activities such as swimming, bathing, water skiing and other similar activities with a high degree of water contact that make bodily exposure and ingestion more likely. Limited contact recreation waters are to be maintained suitable for boating, fishing, and other water-related recreation other than immersion recreation.

Through the 1970's and 1980's EPA epidemiological studies identified *E. coli* as a good predictor of gastrointestinal illnesses in fresh waters (USEPA, 1986). *E. coli* is a class of bacteria naturally found in the intestinal tract of humans and warm-blooded animals. The presence and concentration of *E. coli* in surface waters, typically measured in colony forming units (cfu) or counts (#) per 100ml, is used to identify fecal contamination and as an indicator for the likely presence of other pathogenic microorganisms. In 1986 EPA recommended states adopt *E. coli* criteria for immersion recreation based on a rate of 8 illnesses per 1,000 swimmers (USEPA, 1986). While it is generally understood that limited contact recreation is associated with a reduced illnesses risk and different routes of exposure, it is difficult to directly relate an illness rate to these activities from epidemiological studies based on immersion recreation. Therefore, to protect downstream uses and establish effluent limitations for limited contact recreation waters, EPA has suggested numeric criteria five times the immersion recreation values (USEPA, 2002). Because of the reduced risk, the multiplier was considered protective of the limited contact recreation use through the EPA and South Dakota Department of Agriculture and Natural Resources (SD DANR) water quality standards review and approval process.

The South Dakota *E. coli* criteria for the immersion recreation beneficial use requires that 1) no single sample exceed 235 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hr periods must not exceed 126 cfu/100 ml (ARSD 74:51:01:50). The *E. coli* criteria for the limited contact recreation beneficial use requires that 1) no single sample exceed 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 (ARSD 74:51:01:51). As noted, these limited contact criteria are five times the corresponding immersion criteria. *E. coli* criteria apply from May 1 through September 30, which is considered the recreation season. While not explicitly described within the state's water quality standards, geometric mean criteria, including geometric means and 30-day averages, are applied to a calendar month. This method is documented in the listing methodology of South Dakota's most recent (2022) Integrated Report (IR) for Surface Water Quality Assessment and is used in National Pollutant Discharge Elimination Systems (NPDES) Surface Water Discharge permits.

Antidegradation

This TMDL document is consistent with South Dakota antidegradation policies (ARSD 74:51:01:34) because it provides recommendations and establishes pollutant limits at water quality levels necessary to meet criteria and fully support designated beneficial uses.

Numeric TMDL Targets

TMDLs are required to identify a numeric target to measure whether or not the applicable water quality standard is attained. A maximum allowable load, or TMDL, is ultimately calculated by multiplying this target with a flow value and a unit conversion factor. Generally, the pollutant causing the impairment and the parameter expressed as a numeric water quality criterion are the same. In these cases, selecting a TMDL target is as simple as applying the numeric criteria. Occasionally, an impairment is caused by narrative water quality criteria violations or by parameters that cannot be easily expressed as a load. When this occurs, the narrative criteria must be translated into a numeric TMDL target (e.g., nuisance aquatic life translated into a total phosphorus target) or a surrogate target established (e.g., a pH cause addressed through a total nitrogen target) and a demonstration should show how the chosen target is protective of water quality standards.

As seen from Table 2 there are two numeric *E. coli* criteria for TMDL target consideration. When multiple numeric criteria exist for a single parameter, the most stringent criterion is selected as the TMDL target. To judge whether one is more protective of the beneficial use, it is necessary to further elaborate how the criteria were derived.

South Dakota's *E. coli* criteria are based on EPA recommendations originally published in 1986 (USEPA, 1986). EPA issued slightly modified recommendations in 2012 that did not substantially change the underlying analysis or criteria values in South Dakota (USEPA, 2012). As recommended, SDDANR adopted *E. coli* criteria that contain two components: a geometric mean (GM) and a single sample maximum (SSM). The GM was established from epidemiological studies by comparing average summer exposure to an illness rate of 8:1,000. The SSM component was computed using the GM value and the corresponding variance observed in the epidemiological study dataset (i.e., log-standard deviation of 0.4). EPA provided four different SSM values corresponding to the 75th, 82nd, 90th, and 95th percentiles of the expected water quality sampling distribution around the GM to account for different recreational use intensities (Figure 4). South Dakota adopted the most stringent recommendation, the 75th percentile, into state water quality standard regulations as the SSM protective of designated beaches.

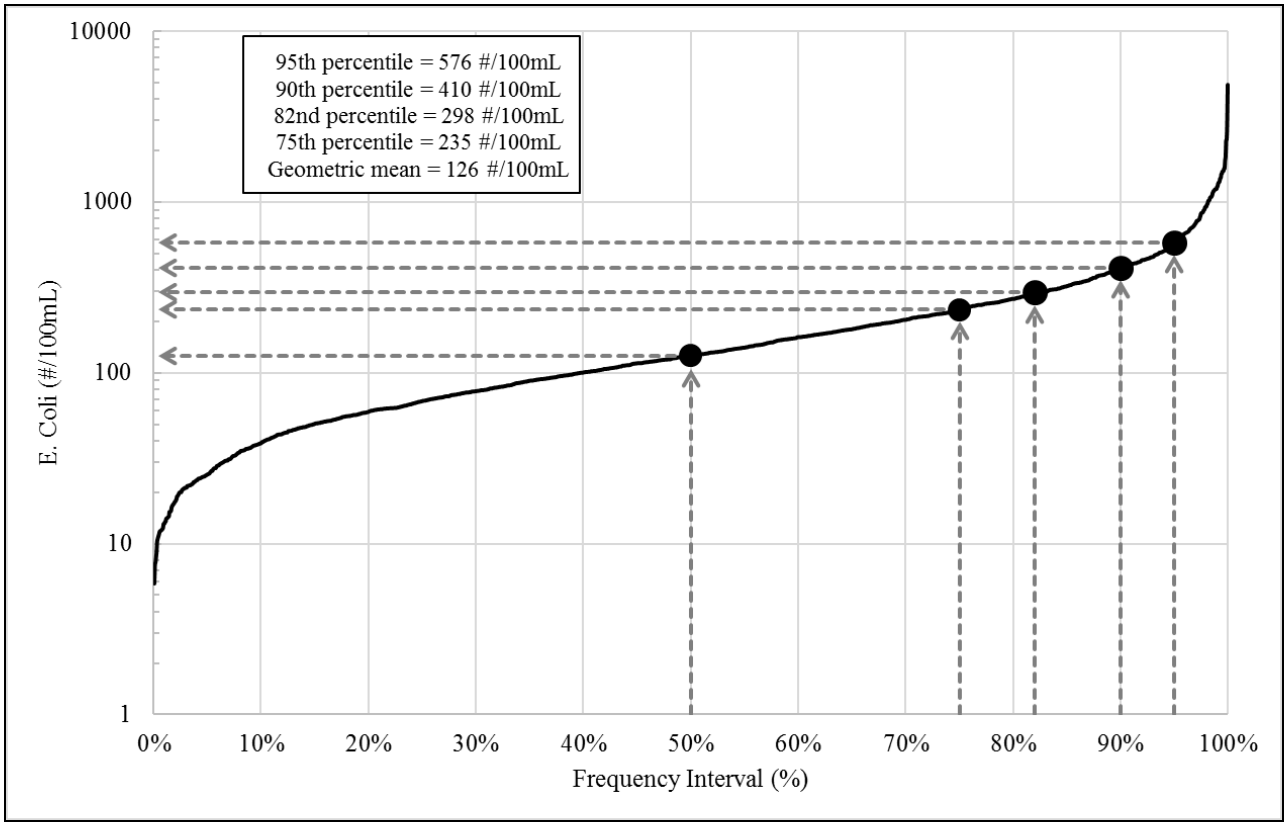

Figure 4. Log-Normal Frequency Distribution Used to Establish South Dakota's Immersion Recreation *E. coli* Criteria of 126 (GM) and 235 (SSM) #/100mL (EPA, 1986).

Dual criteria were established to balance the inherent variability of bacteria data and provide flexibility for handling different sampling routines. Together, the GM and SSM describe a water quality distribution expected to be protective of immersion contact recreation. The GM and SSM are equally protective of the beneficial use because they are based on the same illness rate and differ simply representing different statistical values and sampling timeframes. While this investigation has revealed the GM and SSM *E. coli* criteria to be equally protective of the immersion recreation use, a likewise conclusion can be made for the GM and SSM criteria associated with the limited contact recreation use since those values were simply derived as five times the immersion values.

As described in EPA's *Protocol for Developing Pathogen TMDLs*, the availability of data may dictate which criterion should be used as the TMDL target (EPA, 2001). When a geometric mean of the sampling dataset can be calculated as defined by South Dakota Administrative Rules (i.e., at least five samples separated by a minimum of 24-hours over a 30-day period) and compared to the GM criterion, SDDANR uses the GM criterion as the TMDL target, unless justification for a SSM is otherwise provided. This establishes a smaller overall loading capacity and is considered a conservative approach to setting the TMDL.

When a proper GM cannot be calculated, as in this case for both South Fork Whetstone River segments, SDDANR uses the SSM as the TMDL target. This is permissible because the SSM is equally protective of the beneficial use as discussed above. Although this target selection leads to the establishment of a larger allowable load, in some respects it is more appropriate because timeframes align better (i.e., the SSM is associated with a single day and TMDLs establish daily loads, versus the 30-day GM). Additionally, certain aspects of SDDANR's *E. coli* assessment method, when combined with a SSM TMDL target, result in an expected dataset GM more protective than the GM criterion. SDDANR uses assessment methods to define how to interpret and apply water quality standards to 303(d) impairment decisions. These methods are further discussed in Section 3.4, however for this discussion, it is important to note that SDDANR allows a 10% exceedance frequency of both the SSM and GM. In other words, as long as the *E. coli* dataset meets other age and size requirements, a waterbody is considered impaired (i.e., not meeting water quality standards) when greater than 10% of samples exceed either the SSM or GM. Water quality standards are met if the exceedance frequency is 10% or less.

Returning to the original distribution used to establish South Dakota's Immersion Recreation *E. coli* criteria in Figure 4 remember that SDDANR chose to adopt a SSM concentration based on the most stringent recommendation (75th percentile). According to assessment methods in South Dakota, however, the SSM concentration is treated as a 90th percentile (i.e., 10% exceedance frequency). Step #1 in Figure 5 shows how doing so effectively moves the SSM point to the right. If the original log-normal frequency distribution with a log-standard deviation of 0.4 is subsequently re-fitted to this new 90th percentile point at 235 #/100mL (red dotted line), the corresponding 50th percentile (GM) is 72 #/100mL as shown in Step #2 of Figure 5.

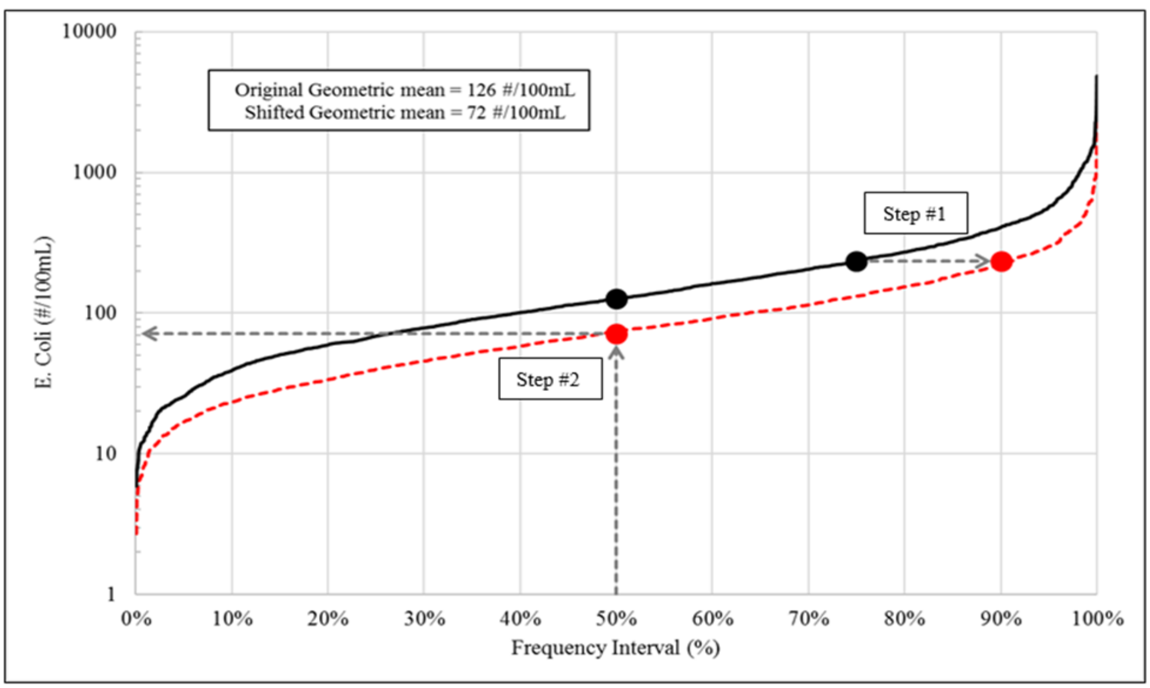

Figure 5. The Effective Impact of South Dakota's *E. coli* Assessment Method on the Criteria's Original Log-Normal Frequency Distribution (Black line = original; red dotted line = shifted)

The GM associated with this shifted distribution is more stringent than the GM of the original distribution (126 #/100mL), thus this demonstrates that attaining a maximum daily SSM target in a TMDL will also achieve the 30-day GM criterion when following South Dakota's assessment method. A similar conclusion was determined by EPA in *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA, 2007) using Michigan criteria as an example. Once again, this outcome holds true for South Dakota's limited contact recreation *E. coli* criteria since they were simply derived as five times the immersion values.

Finally, while the SSM is associated with a single day of sampling and the GM is associated with 30 days of sampling, it is not technically appropriate to refer to them as "acute" and "chronic" criteria. Those terms distinguish timeframes over which harm-to-use impacts develop, not the sampling or averaging timeframe as with the SSM and GM. Acute refers to an effect that comes about rapidly over short periods of time. Chronic refers to an effect that can build up over longer periods, sometimes as long as the lifetime of a subject. In the case of *E. coli*, gastrointestinal illness develops within a matter of hours to days. Both the SSM and GM are derived from this same timeframe and based on the same underlying illness rate, thus treating the SSM as an acute criterion and assuming it to be less stringent is incorrect. EPA recommends states use the GM and SSM together, rather than just the GM or just the SSM, to judge whether water quality is protective of recreational uses. SDDANR follows these guidelines and only relies on one criterion when forced by data availability.

The SSM and GM was used to assess *E. coli* impairment in segments 01 and 02 of the SF. Whetstone. Evaluating impairment with both criteria was possible through a special two-year assessment project which provided a unique opportunity to obtain *E. coli* data at a frequency necessary to calculate monthly GMs. Long-term data availability is expected to be confined primarily to monthly or bi monthly sample frequencies. A decision was made to use the SSM *E. coli* criterion (1,178 cfu/100ml) for waters designated limited contact recreation as the TMDL target for both impaired segments. This decision was based on data availability limitations necessary to evaluate future GM compliance with data acquired from traditional monitoring projects. Using the SSM as the TMDL target is protective of both criteria as described in the rationale above.

Consideration was given to downstream water quality when selecting a TMDL target based on the SF Whetstone's proximity to Minnesota. The SF Whetstone converges with the NF Whetstone to form the Whetstone River. The Whetstone River crosses the Minnesota border approximately 6 miles downstream where it immediately merges with the Minnesota River or the outlet of Big Stone Lake. South Dakota has designated the Whetstone River a limited contact recreation water. Assessment results from the 2022 IR suggest the Whetstone River is fully supporting the limit contact recreation use in accordance with the 303(d) listing methods (SD DANR, 2022). The Whetstone River has historically maintained a full support status in all reporting cycles dating back to the 1998 reporting cycle.

The impaired segment of the SF Whetstone does not contribute bacteria directly to the Minnesota River. As a result, the *E. coli* TMDL target was set consistent with South Dakota's SSM for limited contact recreation waters based on rationale above. The NF Whetstone is a larger contributor of loading to the Whetstone River compared to the SF Whetstone due to the larger drainage area and perennial nature. Assessment results from the 2022 IR suggest the NF Whetstone is fully supporting the limit contact recreation use in accordance with 303(d) listing methods (SD DANR, 2022).

In the event that TMDL development is ever warranted for the Whetstone River the numeric TMDL target will be based on the most stringent criteria required to protect the downstream use. The Minnesota River is a class 2bd water which Minnesota associates with immersion recreation. The *E. coli* criteria for class 2bd waters is a GM of 126 MPN/100mL and SSM of 1,260 MPN/100mL, applicable from April 1 to October 31. In this scenario, an *E. coli* TMDL target of 126 MPN/100mL will be required for the Whetstone River to ensure compliance with Minnesota's most stringent standard. The TMDL target for the SF Whetstone is protective of the SSM for class 2bd waters.

The SF Whetstone *E. coli* TMDL will be re-evaluated when/if the Whetstone River enters impaired status and requires TMDL development. In the interim, it is important to maintain interstate coordination and continued project support for the ongoing watershed scale nonpoint source project (Northeast Glacial Lakes Improvement Project) designed to implement Best Management Practices (BMPs) to reduce bacteria loading in the entire South Dakota portion of the upper Minnesota drainage.

Impairment Assessment Methods

Assessment methods document the decision-making process used to define whether water quality standards are met (SD DANR, 2022). SDDANR evaluates monitoring data following these established procedures to determine if: 1) one or more beneficial uses are not supported, 2) the waterbody is impaired, and 3) it should be placed on the next 303(d) list. Waterbodies impaired by pollutants require TMDLs and these assessment methods are commonly used again in the process sometime after TMDLs have been established and restoration efforts have been implemented. In select cases, attainment is judged instead by comparing current conditions to TMDL loading limits. For example, when certain characteristics of the pollutant (e.g., bioaccumulative) or waterbody (e.g., a reservoir filling with sediment) prioritize loading concerns. Table 3 describes South Dakota's assessment method for *E. coli* and what constitutes a minimum sample size and how an impairment decision is made.

Table 3. 2022 Integrated Report section 303(d) assessment methods.

IR Assessment Methods		
Description	**Minimum Sample Size**	**Impairment Determination Approach**
FOR CONVENTIONAL PARAMETERS (such as dissolved oxygen, TSS, *E. coli* bacteria, pH, water temperature, etc.)	STREAMS: a minimum of 20 samples (collected on separate days) for any one parameter are required within a waterbody reach. A minimum of 10 chronic (calculated) results are required for chronic criteria (30-day averages and geomeans). LAKES: Reference the lake listing methodology starting on page 31 of the 2022 IR.	STREAMS: >10% exceedance for daily maximum criteria (acute) or >10% exceedance for 30-day average criteria OR when overwhelming evidence suggests nonsupport/support LAKES: Reference the lake listing methodology starting on page 31 of the 2022 IR..

The assessment method mentions chronic and acute criteria. Although these terms do not directly relate to *E. coli* criteria for reasons previously discussed, the assessment method is organized together with other conventional parameters in the Integrated Report to show that a consistent approach is applied to many pollutants. In this limited definition, chronic refers to the GM and acute refers to the SSM *E. coli* criteria. Different assessment methods have been established for toxic parameters and mercury in fish tissue. Data collection activities are summarized and monitoring results are evaluated using this assessment method.

Stream water quality data for conventional parameters, such as bacteria, are evaluated based on a 10% exceedance rate of applicable water quality standards. During the 2022 reporting cycle, greater than 10% of the applicable *E. coli* data for segment SD-MN-R-Whetstone_S_Fork_01 and SD-MN-R-Whetstone_S_Fork_02 exceeded the single sample maximum (1,178 CFU/100mL) and/or monthly geometric mean (630 CFU/100mL) standards. Both segments were considered not supporting the designated limited contact recreation use and placed on the 303(d) list of impaired waters, requiring *E. coli* TMDLs. Achieving TMDL goals for both impaired segments will result in compliance of the *E. coli* standards in accordance with South Dakota's 303(d) listing methods.

Significant Sources

Point Sources

There were no point source discharges identified in the watershed of the upper segment of the South Fork Whetstone (SD-MN-R-WHETSTONE_S_Fork_01). As a result, a zero value was assigned to the Waste Load Allocation (WLA) component of the TMDL.

The City of Milbank and Valley Queen Cheese (VQC) of Milbank contribute continuous point source discharges directly to segment 02 of the South Fork Whetstone (SD-MN-R-WHETSTONE_S_Fork_02). These potential sources of *E. coli* bacteria are documented here to provide a watershed scale account of the systems operational characteristics (discharge permits etc.), potential impact and WLA consideration for TMDL development.

The City of Milbank's water distribution system (i.e., water treatment overflows) could discharge directly to the lower segment of the South Fork Whetstone. Discharge from Milbank's water distribution system is covered by a General Surface Water Discharge Permit https://danr.sd.gov/npdespdf/SDG860025/Milbank%20WTP%20Permit.pdf. The general permit (Permit # SDG860025) does not contain effluent limits for *E. coli* and this source is not expected to impact the TMDL. As a result, a WLA was not assigned to this point source in the TMDL.

Milbank and VQC use mechanical systems as a mechanism to treat wastewater and are regulated by NPDES Surface Water Discharge permits https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/swdpermitting/wwDBSearch.aspx. Continuous discharge from these facilities occurs near the upstream end of the impaired segment approximately 8 river miles from the Whetstone River confluence. Table 4 provides permit numbers and basic system information for the two wastewater discharge facilities.

Table 4. Basic information for the Milbank and Valley Queen Cheese wastewater discharge systems.

Permit Number	Facility Name	System comments	Average Design Flow cfs	Peak Design Flow cfs
SD0020371	Milbank-Town of	Mechanical	1.39	2.78
SD0027987	Valley Queen Cheese	Mechanical	*1.89	*3.09

*Based on DANR approved engineering design for expected upgrade to the facility.

The NPDES permit for Milbank has been administratively continued since 2004. The permit is currently in the renewal process and is reasonably expected to be updated in 2022. Milbank's current permit includes effluent limits for fecal coliform rather than *E. coli*. The revised permit will include *E. coli* effluent limits based on SSM and GM standards for limited contact recreation waters which is consistent with TMDL goals. The *E. coli* TMDL would not add new requirements or implementation expectations to the permit. Because this permitted facility is allowed to discharge *E. coli*, a WLA is required in the TMDL.

The NPDES permit for VQC has been administratively continued since 2021. This permit is also currently in the renewal process and is reasonably expected to be updated in 2022. In 2021, VQC submitted an application with engineering plans and specifications (ISG, Inc.) documenting proposed upgrades to increase production output. DANR approved the application and the system is expected to implement the upgrades in the near future. Information concerning the facilities upgrades will be documented in the updated NPDES permit and Statement of Basis (SOB), when available. The current permit includes *E. coli* effluent limits based on SSM and GM standards for limited contact recreation waters which is consistent with TMDL goals. The updated permit is expected to contain the same *E. coli* effluent limits. The *E. coli* TMDL will not add new requirements or implementation expectations to the permit. Because this permitted facility is allowed to discharge *E. coli*, a WLA is required in the TMDL.

The WLA for Milbank is based on flow characteristics associated with the daily operation of the system and expected *E. coli* effluent limits which will be incorporated into the revised NPDES permit to replace current fecal coliform limits (Table 5). The WLA for Milbank is based on the 80^{th} percentile flow in cubic feet per second (cfs) obtained from Direct Monitoring Reports (DMRs) for the period 2012 to 2020. The 80^{th} percentile flow was multiplied by the expected future permit effluent limit or single sample maximum *E. coli* standard (1,178 CFU/100mL) for limited contact recreation waters times a unit conversion factor (24462688).

The WLA for VQC is based on the average design flow (cfs) provided by ISG, Inc., which accounts for future expected upgrades to the system (Table 5). The average design flow was multiplied by the permit effluent limit or single sample maximum *E. coli* standard (1,178 CFU/100mL) for limited contact recreation waters times a unit conversion factor (24462688).

The normal operation of both facilities would typically result in only a portion of the calculated daily amounts actually being discharged. All discharges are required to meet the single sample maximum and geometric mean water quality standards assigned to limited contact recreation waters in accordance with current and future NPDES permit requirements. The *E. coli* TMDL would not add new requirements or implementation expectations to either permit pending renewal.

Table 5. Waste load allocation for Milbank municipal and Valley Queen Cheese wastewater discharge systems.

Facility Name	Flow (cfs) used for WLA	*E .coli* (CFU/100ml) permit limit	*E .coli* WLA (CFU/day)
Milbank-Town of	1.15	1178	3.31E + 10
Valley Queen Cheese	*1.89	1178	5.46E +10

*Based on DANR approved engineering design for expected upgrade to the facility

Large scale Concentrated Animal Feeding Operations (CAFOs) are considered point sources. All CAFO's are required to maintain compliance with provisions of the SD Water Pollution Control Act (SDCL 34A-2). Provision SDCL 34A-2-36.2 requires each concentrated animal feeding operation, as defined by Title 40 Codified Federal Regulations Part 122.23 dated January1, 2007, to operate under a general or individual water pollution control permit issued pursuant to 34A-2-36. The general permit ensures that all CAFO's in SD have permit coverage regardless if they meet conditions for coverage under a federal NPDES permit. For more information about South Dakota's CAFO requirements and general permits visit: http://DANR.sd.gov/des/fp/cafo.aspx.

As long as CAFOs comply with the general permit requirements ensuring their discharges are unlikely and indirect loading events, the TMDL assumes their *E. coli* contribution is minimal, and unless found otherwise, no additional permit conditions are required by this TMDL. There were no Concentrated Animal Feeding Operations (CAFOs) identified in the collective South Fork Whetstone watershed during TMDL development.

Nonpoint Sources

Nonpoint sources of *E. coli* bacteria in the South Fork Whetstone River watershed were attributed primarily to agricultural (i.e. livestock and wildlife) sources. Due to a lack of literature values for *E. coli* production of many livestock and wildlife species, source loading calculations were based on fecal coliform. This is an acceptable surrogate to source characterization because *E. coli* is a bacterium within the fecal coliform group. Further, fecal coliform source contributions are considered synonymous with *E. coli* based on the close statewide paired bacteria data relationship documented in the bacteria translation TMDL https://danr.sd.gov/Conservation/WatershedProtection/TMDL/docs/TableDocs/tmdl_statewidetranslation_ecoli.pdf.

Data from the National Agricultural Statistic Survey and from the most recent South Dakota Game Fish and Parks County Wildlife Assessment were used to estimate livestock and wildlife densities, respectively (USDA, 2017, Huxoll, 2002). Animal density information was used to estimate relative source contributions of bacteria loads for the South Fork Whetstone River watershed (Table 6). Approximately 99% of the South Fork Whetstone watershed resides in Grant County. Therefore, animal density estimates were based exclusively on the NASS estimates from Grant County. The total numbers of animals in Grant County were divided proportional to the number of acres in the watershed. The same procedure was also used for human and wildlife. Production of bacteria in the South Fork Whetstone River watershed is estimated at 2.76E+09 # /acre/day.

Table 6. South Fork Whetstone Watershed *E. coli* sources.

Species	#/acre watershed	Bacteria/Animal/Day	Bacteria/Acre	Percent
Dairy cow3	4.16E-03	1.01E+11	4.21E+08	15.3%
Beef3	2.12E-02	1.04E+11	2.21E+09	80.0%
Hog3	1.45E-03	1.08E+10	1.56E+07	0.6%
Sheep3	1.24E-03	1.20E+10	1.48E+07	0.5%
Horse3	2.25E-04	4.20E+08	9.47E+04	0.003%
All Wildlife	**Sum of all wildlife**		9.89E+07	3.6%
Human3	3.419E-03	2.00E+09	6.84E+06	0.25%
Turkey (Wild)2	3.72E-04	9.30E+07	3.46E+04	
Goose3	3.25E-04	4.90E+10	1.59E+07	
Deer3	1.25E-03	5.00E+08	6.27E+05	
Beaver3	1.86E-04	2.50E+08	4.65E+04	
Raccoon3	1.86E-03	1.25E+08	2.32E+05	
Coyote/Fox4	3.25E-04	4.09E+09	1.33E+06	
Muskrat2	4.65E-03	1.25E+08	5.81E+05	
Opossom5	3.72E-05	1.25E+08	4.65E+03	
Mink5	2.32E-04	1.25E+08	2.90E+04	
Skunk5	7.44E-04	1.25E+08	9.29E+04	
Badger5	1.58E-04	1.25E+08	1.98E+04	
Jackrabbit5	6.97E-04	1.25E+08	8.71E+04	
Cottontail5	4.18E-03	1.25E+08	5.23E+05	
Squirrel5	4.18E-03	1.25E+08	5.23E+05	

2 USEPA 2001

3 Bacteria Indicator Tool Worksheet

4 Best Professional Judgment based off of Dogs

5 FC/Animal/Day copied from Raccoon to provide a more conservative estimate of background effects of wildlife

Agriculture

Manure from livestock is a potential source of *E. coli* bacteria to the South Fork Whetstone watershed. Livestock in theses basins are predominantly beef and dairy cattle. Livestock can contribute bacteria directly to the stream by defecating while wading in the stream. They can also contribute by defecating while grazing on rangelands that get washed off during precipitation events. Table 7 allocates sources of bacteria production in both watersheds into two 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 7. Bacteria source allocation for the South Fork Whetstone watershed.

	Percentage
Source	**South Fork Whetstone**
Feedlots	33%
Livestock on Grass	67%

The main source of *E. coli* bacteria in the South Fork Whetstone watershed is livestock grazing. Bacteria migration from small feeding areas and upland grazing is most likely occurring during major run-off events. Direct use of the stream by livestock is the most likely source of bacteria at lower flows. Evidence of this is available in the load duration curves which indicate that elevated counts of *E. coli* occur throughout different flow regimes. Beef and dairy cattle were the main sources of bacteria in the South Fork Whetstone watershed (Table 6).

Human

The small rural town of Twin Brooks (population 47) is the only community besides Milbank in the South Fork Whetstone watershed. Twin Brooks does not have a central wastewater treatment facility (no NPDES permit). Twin Brooks residents utilize individual septic systems to contain and treat wastewater. Septic systems are assumed to be the primary human bacteria source for the rural population (approximately 1400) or those not connected to the Milbank WWTF. A majority of the rural population reside on acreages or farmsteads in the watershed. When included in the total load, the rural population produces and estimated 0.25% of all fecal coliform produced in the watershed. Daily human fecal production was estimated at 1.95E+9 (Yagow et al., 2001). Human bacteria production should all be delivered to a septic system, which if functioning correctly, would result in no bacteria entering the river systems. Septic system failure was not identified as a source of concern during the field investigation conducted in the South Fork Whetstone River watershed.

Natural background/wildlife

Wildlife within the watershed is a natural background source of *E. coli* bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Huxoll, 2002). The estimated wildlife contribution of bacteria in the South Fork Whetstone watershed (3.6%) was considered insignificant in comparison to livestock sources.

Technical Analysis

Data Collection Method

E. coli data used to describe impairment and develop load duration curve based TMDLs for the upper (SD–MN-R-Whetstone_S_Fork_01) and lower (SD–MN-R-Whetstone_S_Fork_02) segments of the South Fork Whetstone River was obtained from the following project sources; SD DANR's ambient Water Quality Monitoring (WQM) project, the Upper Minnesota River (UMR) Water Quality Assessment project and East Dakota Water Development Districts (EDWDD) Water Quality Monitoring project. All applicable *E. coli* data acquired from the aforementioned projects was collected from three monitoring stations. The principal monitoring station for the upper segment (01) was UMR3, established during the UMR project conducted from 2010 to 2011. This station was located approximately 6 miles upstream of Lake Farley (Figure 2).

The remaining two monitoring stations were located in the lower segment (02) below Lake Farley. The lower segment monitoring stations were established in 1978 as part of SD DANR's ambient Water Quality Monitoring (WQM) network. Station 460690 (WQM 90) is located on SD Highway 15, approximately 200 meters downstream of the Lake Farley spillway. Station 460691 (WQM 91) is located approximately 1.6 kilometers downstream of WQM 90 on 479th avenue below the outfalls of Milbank and Valley Queen Cheese. Figure 2 depicts segments 01 and 02 of the South Fork Whetstone and the associated monitoring stations.

Flow Analysis

Environmental scientists from SD DANR's Watershed Protection Program installed long-term continuous stream stage recorders at monitoring stations WQM 90 and WQM 91 during the spring of 2010. The recorders measured stream height from a fixed position on the bridge deck to the water surface. The electronic gages were calibrated with fixed wire weight gages and tied to bridge deck elevation at mean sea level. The recorders were programmed to log stream stage at 15 minute intervals. Field personnel from EDWDD measured periodic stream discharge at varying stages of the hydrograph at both stations during the UMR Watershed Assessment project from May 2010 to September 2011.

The hydrologic modeling program Aquarius (version 3.7) was used to generate stream stage-discharge rating curves to quantify daily flow for the period of record (SDDANR, 2009). Rating curve development involved using functions available in Aquarius to create the best fit line between paired stage and discharge points. The ensuing rating curve equation was used to produce flow values for each corresponding stage measurements over the period of record. The modeling function in Aquarius was used to fill gaps in stage data at WQM 91 based on flow records from WQM 90 to create a continuous mean daily flow record for both stations, respectively. The mean daily flow record was calculated for the period 5/5/2010 to 5/26/2016 for WQM 90 and WQM 91, respectively.

The mean daily flow record for WQM 90 and WQM 91 was extended using the flow record from the nearest USGS gage station 05291000 located on the mainstem Whetstone River near Big

Stone City, SD. An initial attempt was made to relate the actual gaged flow data to the long-term USGS flow data using the model function in Aquarius. Unfortunately, the low flows and peak flows did not match well between the two gaged sources rendering the modeled flow data unacceptable for both monitoring stations. The percent difference was calculated between the paired mean daily gaged flow record and the corresponding USGS mean daily flow for the same date. The average percent difference was applied to the USGS data to estimate a flow record for both monitoring stations. The resulting flow frequency curves for both monitoring stations were based on an estimated flow record from 7/12/2001 to 5/26/2016 which corresponded with the period of *E. coli* data availability.

Flow records constructed from WQM 90 and WQM 91 were used to develop load duration curve based TMDLs for segments 01 and 02 of the SF Whetstone, respectively. A long-term gage station was not established directly in segment 01. The flow record from WQ 90 was chosen to represent segment 01 despite its position at the upper end of segment 02. Segment 01 ends at the inlet to Lake Farley and WQM 90 is only 200 meters downstream from the spillway. Station WQM 90 provides the best available flow record to calculate the TMDL for segment 01, despite over estimating flow for this intermittent system. Station WQM 91 was selected to represent segment 02 despite also being located in the upper portion of the segment because of long-term data availability and position in respect to Milbank and VQC discharge outfalls.

Sample Data

E. coli data from UMR3, WQM 90 and WQM91 was used to evaluate the upper (01) and lower (02) segments of the South Fork Whetstone River. A total of 83 *E. coli* samples were available from station UMR3 representing the upper segment. These data were exclusively collected in 2010 and 2011 during the UMR watershed assessment project. A total of 125 and 126 *E. coli* samples were available for the lower segment stations WQM 90 and WQM 91, respectively. The *E. coli* data at WQM 90 and WQM 91 was collected during the period 2001 to 2016 from all monitoring projects. The collective *E. coli* dataset contains samples collected exclusively during the recreation season (May 1 to September 30).

E. coli concentrations obtained from water samples collected during the UMR project were processed by RMB Environmental Laboratories, Inc., in Detroit Lakes, MN. This lab reported *E. coli* concentrations as Most Probable Number (MPN)/100ml. *E. coli* data collected from WQM and EDWDD monitoring efforts was processed by the South Dakota Department of Health, in Pierre, SD. The state health laboratory reports *E. coli* as number/100ml or Colony Forming Units (CFU)/100mL. Both units are considered equivalent and are representative of the number or count of bacteria/100mL. To standardize, all *E. coli* concentrations and TMDLs are expressed in CFUs.

The single sample maximum exceedance rate was evaluated based on South Dakota's *E. coli* standard (≤1178/100ml) for limited contact recreation waters (ARSD chapter 74:51:03). Thirty percent of *E. coli* samples collected at UMR3 in the upper segment exceeded the SSM standard. The SSM exceedance rates for WQM 90 and WQM 91 was 4% and 19%, respectively. The cumulative exceedance rate for the lower segment combining WQM 90 and WQM 91 *E. coli* data was 12%. The upper and lower segments of the South Fork Whetstone River are currently on South Dakota's 303(d) list of impaired waters for exceeding SSM standards in accordance with the listing methodology in South Dakota's 2022 Integrated Report for Surface Water Quality Assessment. All applicable *E. coli* data is available in Appendix A.

The median, quartiles and non-outlier range of *E. coli* concentrations were significantly different (KW ANOVA $p<0.05$) between monitoring stations (Figure 6). The upper segment (UMR3) displayed significantly higher (KW ANOVA $p<0.05$) median, quartiles and non-outlier ranges concentrations in comparison to the lower segment stations. Monitoring station UMR3 was located immediately downstream of a small livestock feeding area that encompassed the entire stream corridor. This localized influence likely contributed to the elevated *E. coli* concentrations. Small livestock operations are prevalent downstream of UMR3. Therefore, *E. coli* concentrations observed at UMR3 are likely representative of the upper segment above Lake Farley. Implementing Best Management Practices (BMPs) to minimize direct livestock access to the stream and riparian corridor is essential to achieve compliance with *E. coli* criteria assigned to protect the limited contact recreation beneficial use.

A significant decrease in *E. coli* concentrations was evident between the upper and lower segments. The reduced *E. coli* concentrations observed at WQM 90 is attributed primarily to Lake Farley (Figure 6). Bacteria concentrations in the lake are diluted and not likely viable for long periods due to extended retention time and resultant exposure to sun light. *E. coli* concentrations increased at WQM 91 approximately one mile downstream. Potential sources of bacteria between WQM 90 and WQM 91 include residential areas, row crop agriculture, livestock pasture and point sources discharges from the City of Milbank and Valley Queen Cheese.

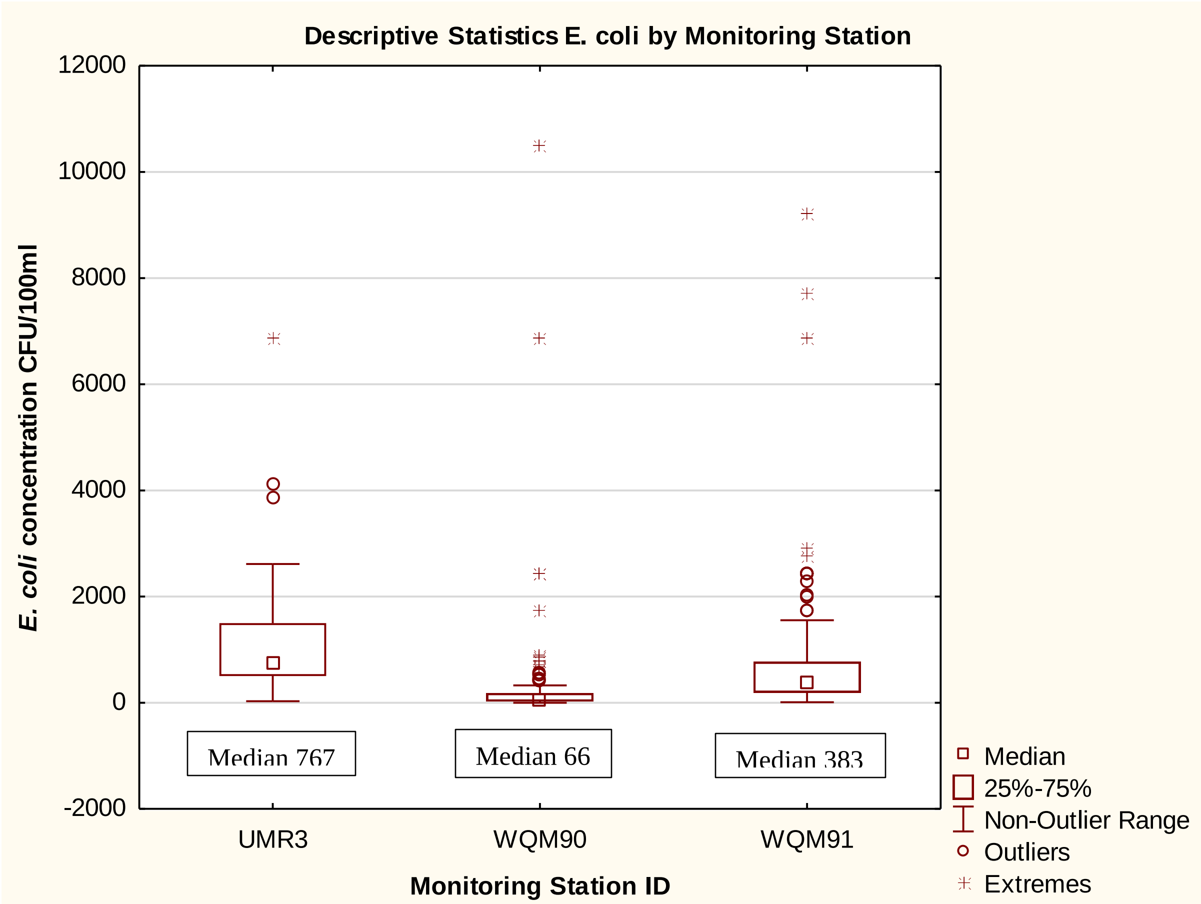

Figure 6. Distribution of *E. coli* between the three South Fork Whetstone sites.

The UMR assessment project provided a unique opportunity to obtain sufficient monthly *E. coli* samples to calculate a GM. This provided the ability to characterize impairment using both SSM and GM standards for limited contact recreation. The GM exceedance rate for the upper and lower segments of the South Fork Whetstone River was evaluated based on South Dakota's GM *E. coli* standard ($\leq$ 630/100ml) for limited contact recreation waters applicable May 1 to September 30 (ARSD chapter 74:51:03). Monthly GMs were calculated from *E. coli* data collected at UMR3, WQM 90 and WQM 91, exclusively during the UMR Watershed Assessment Project conducted in 2010 and 2011. The number of *E. coli* samples collected during separate 24-hour periods for the applicable 30-day calendar months ranged from eight to ten samples for all three stations, respectively. The GM *E. coli* standard was exceeded eight of nine months at UMR3 while no exceedances were observed at WQM90 and only one exceedance was observed at WQM 91 (Table 8).

Table 8. Monthly geometric mean *E. coli* concentrations for the South Fork Whetstone River.

	South Fork Whetstone-Segment 01 (CFU/100ml)	South Fork Whetstone-Segment 02 (CFU/100ml)	
Month/Year	**UMR03**	**WQM 90**	**WQM 91**
Jun-10	661	72	523
Jul-10	1248	64	515
Aug-10	740	242	557
Sep-10	765	86	475
May-11	314	32	250
Jun-11	765	134	521
Jul-11	1014	200	956
Aug-11	1315	30	589
Sep-11	1096	100	367

E. coli impairment is more pronounced in the upper segment (segment 01) in comparison to the lower segment (segment 02) of the South Fork Whetstone. Again, UMR3 is located just downstream of a small livestock feeding area that encompasses the entire stream corridor. The high violation rate of the SSM and GM standard indicates livestock presence throughout the growing season. The monthly GMs are significantly reduced at WQM90 in the lower segment primarily due to the influence of Lake Farley. The monthly GMs increase at WQM91, a mere one mile downstream, likely due to local influences. The lower segment was not considered impaired by the GM standard when originally placed on the 303(d) list during the 2012 IR cycle. Current water quality monitoring projects encompassing segments 01 and 02 of the SF Whetstone do not conduct *E. coli* sampling at a frequency necessary to calculate monthly GMs. As a result, the SSM *E. coli* criteria (1,178 CFU/100ml) assigned to protect the designated limited contact recreation use was selected as the TMDL target for both impaired segments. The SSM based TMDL is also considered protective of the GM criteria based on information provided in the Numeric TMDL Target section.

South Fork Whetstone Segment 01 TMDL and Allocations

A load duration curve framework provides the essential components for TMDL development. The flow frequency curve component is a measure of the frequency of occurrence of all daily mean flows in the record expressed as a percentage. Zero percent corresponds to the highest stream flow in the record and 100% to the lowest (EPA, 2007). The flow frequency curve serves as the foundation for development of a load duration curve. A load duration curve is developed by multiplying daily stream flow by the numeric water quality target and a conversion factor for the pollutant of concern. Hence, the load duration curve serves as the TMDL.

A load duration curve was generated for segment 01 of the South Fork Whetstone to facilitate TMDL development. The load duration curve was based on the flow frequency (WQM 90) and the single sample maximum water quality criteria (1,178 CFU/100 ml) assigned to protect the designated limited contact recreation use for segment 01 of the South Fork Whetstone. The applicable *E. coli* data available from monitoring station UMR3 was plotted over the load duration curve to represent the current or actual loadings at individual flows along the flow frequency curve (Figure 7).

The load duration curve generated for the South Fork Whetstone Segment 01 was separated into five flow zones (Figure 7). Flow zones were defined according to the flow regime structure and distribution of the actual *E. coli* concentrations following guidance recommended by EPA (USEPA 2007). Five distinct flow zones were established to facilitate interpretation of the hydrologic condition and patterns associated with the impairment. The zones were segmented by high flows (0-10 percent), moist conditions (10-40 percent), mid-range flows (40-60 percent), dry conditions (60-90 percent) and low flows (90-100 percent).

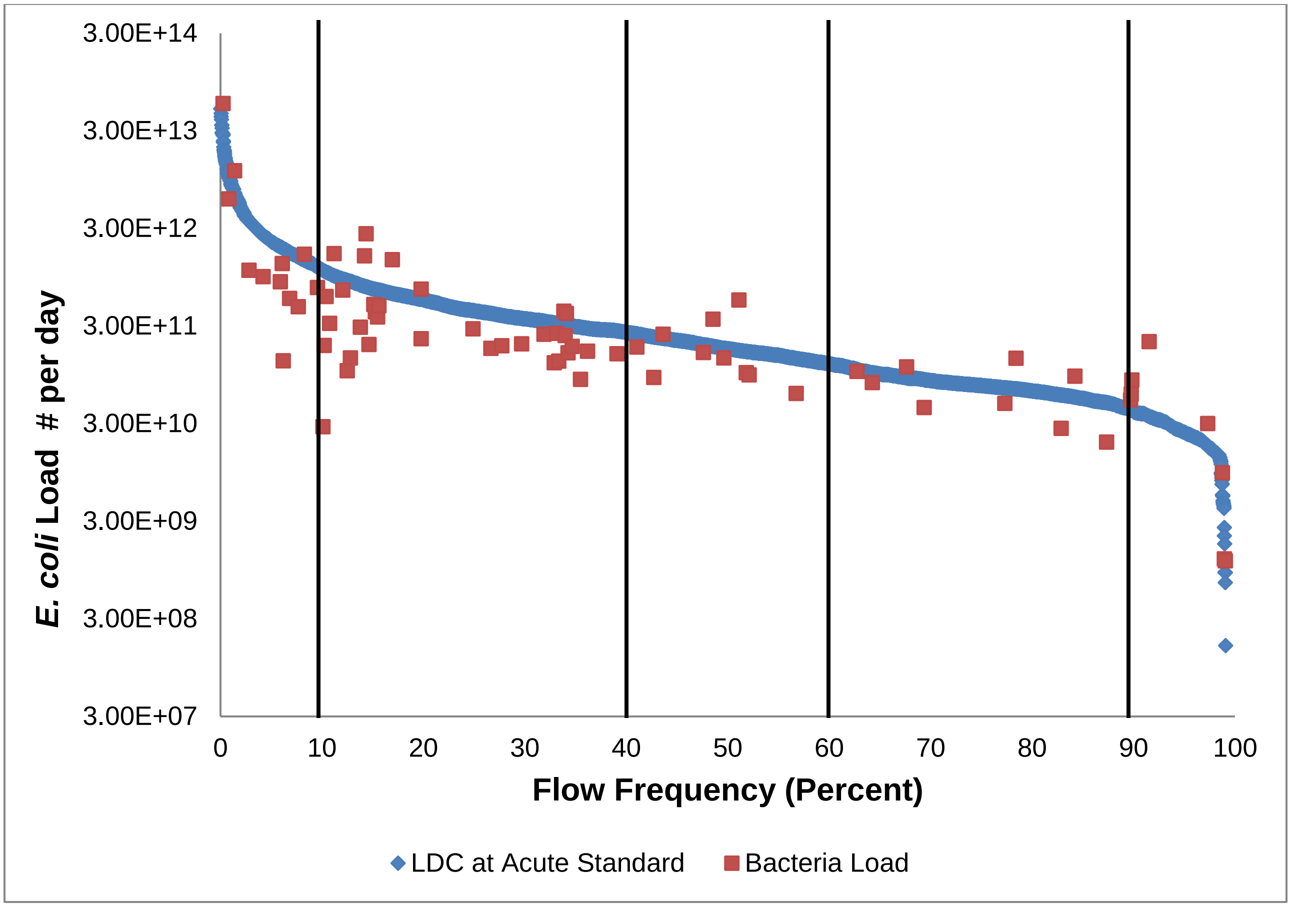

Figure 7. Load Duration Curve for the South Fork Whetstone Segment 01.

All TMDL components including numeric calculations for each flow zone associated with the South Fork Whetstone segment 01 are presented in Table 9. The load capacity or TMDL was calculated by multiplying the 95th percentile flow and SSM *E. coli* criterion for each flow zone. The current loads for all flow zones were calculated by multiplying the 95th percentile flow and concentration. Reduction calculations were based on reducing the current load to the TMDL to assure compliance with SSM criterion (1,178 CFU/100ml) for limited contact recreation waters. In addition to the daily load, the geometric mean criteria must be attained on a longer (i.e., monthly) basis. There are no point sources discharges contributing to the upper segment. Therefore, the WLA was set to zero for all flow zones. All reductions are required from nonpoint sources (LA). A description for the margin of safety (MOS) used for the TMDL is provided in a subsequent section.

Table 9. *E. coli* TMDL and flow zone allocations for the South Fork Whetstone Segment 01.

TMDL Component	South Fork Whetstone Segment 01 Flow Zones Expressed as (CFU/day)				
	High Flows	Moist Conditions	Mid-range Flows	Dry Conditions	Low Flows
	>39.5 cfs	<39.5 to 9.0 cfs	<9.0 to 4.3 cfs	<4.3 to 1.4 cfs	<1.4 cfs
LA	**1.31E+13**	**8.61E+11**	**2.25E+11**	**1.04E+11**	**3.44E+10**
10% Explicit MOS	**1.45E+12**	**9.57E+10**	**2.50E+10**	**1.15E+10**	**3.82E+09**
WLA	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
TMDL @ 1178 CFU/100mL	**1.45E+13**	**9.57E+11**	**2.50E+11**	**1.15E+11**	**3.82E+10**
Current Load	**2.72E+13**	**2.01E+12**	**6.65E+11**	**2.37E+11**	**1.29E+11**
Load Reduction	**47%**	**52%**	**62%**	**51%**	**70%**

High Flows (<10% flow frequency)

The high flow zone represents flows in the upper range that account for 10% or less of the flow frequency. The flow rate for this zone was variable ranging from 1755.4 cfs to 39.5 cfs. Flows represented in this zone occur on an infrequent basis and are characteristic of significant run-off events typically during spring and early summer. High flows are commonly the product of spring snowmelt events but may be generated by intense rain events. Bacteria sources across the watershed have the potential to be conveyed to the stream channel during high flow conditions. The 95^{th} percentile *E. coli* concentration and flow was calculated at 2,209 CFU/100ml and 429.3 cfs, respectively. An *E. coli* load reduction of 47% is required in the high flow zone to achieve compliance with the single sample maximum criterion for limited contact recreation waters.

Moist Conditions (10% to 40% flow frequency)

Moist conditions represent the portion of the flow regime that occur following moderate storm events. Flows in this zone vary from 39.5 cfs to 9 cfs. The flows in this zone occur in early to mid-summer near the peak of the recreation season providing for optimal recreational opportunity. Sources of bacteria may be expected to be closer to the channel and somewhat easier to mitigate than those impacting high flows. The 95^{th} percentile *E coli* concentration and flow was calculated at 2,478 CFU/100ml and 33.2 cfs, respectively. An *E. coli* load reduction of 52% is required in the moist condition flow zone to achieve compliance with the single sample maximum criterion for limited contact recreation waters.

Mid-range Flows (40% to 60% flow frequency)

Mid-range flow conditions represent flow rates between 9 cfs and 4.3 cfs. This portion of the flow regime likely occurs in mid to late summer. Run-off from storm events is likely minimized by mature vegetative growth present during the peak of the growing season. Flows in this zone may also represent conditions that occur in the fall during recovery periods of dryness. Mid-range flows represent the transition from run-off based flow to base flows. Bacteria sources in this flow zone likely originated near the channel or within the riparian zone. The 95th percentile *E. coli* concentration and flow was calculated at 3,138 CFU/100ml and 8.6 cfs, respectively. An *E. coli* load reduction of 62% is required in the mid-range flow zone to achieve compliance with the single sample maximum criterion for limited contact recreation waters.

Dry Conditions (60% to 90% flow frequency)

Dry conditions represent flow rates between 4.3 cfs and 1.4 cfs. Dry condition flows are best characterized as base flow conditions influenced by ground water sources. Bacteria sources likely originate in the stream channel during dry flow conditions. The 95th percentile *E. coli* concentration and flow was calculated at 2,420 CFU/100ml and 4 cfs, respectively. An *E. coli* load reduction of 51% is required in the dry condition flow zone to achieve compliance with the single sample maximum criterion for limited contact recreation waters.

Low Flows (90% to 100% flow frequency)

The Low flow zone represents minimal to no flow conditions of less than 1.4 cfs. Recreation uses and associated criteria are applicable to all flow conditions. However, lower flows result in reduced recreational opportunities. Bacteria sources likely originate in the stream channel during low flow conditions. The 95th percentile *E. coli* concentration and flow was calculated at 3,976 CFU/100ml and 1.3 cfs, respectively. An *E. coli* load reduction of 70% is required to achieve compliance with the single sample maximum criterion for limited contact recreation waters.

South Fork Whetstone Segment 02 TMDL and Allocations

Two load duration curves were generated for segment 02 of the South Fork Whetstone to illustrate the influence of the WLA's on the TMDL development process. Both load duration curves incorporate the flow frequency occurrence (WQM91) at the single sample maximum *E. coli* criteria (1,178 cfu/100ml) for limited contact recreation waters. The load capacity or TMDL was calculated by multiplying the 95th percentile flow and SSM *E. coli* criterion for each flow zone. To be conservative, *E. coli* data from WQM 90 was not used in the load duration curve or TMDL calculations due to the influence of Lake Farley. All applicable *E. coli* data from monitoring station WQM91 was plotted over the load duration curves to represent the current loadings at individual flows along the flow frequency curve (Figures 8-9). The current loads for all flow zones were calculated by multiplying the 95th percentile flow and concentration. The *E. coli* data from WQM91 is considered representative of the lower segment and accounts for the waste loads from the City of Milbank and Valley Queen Cheese (VQC).

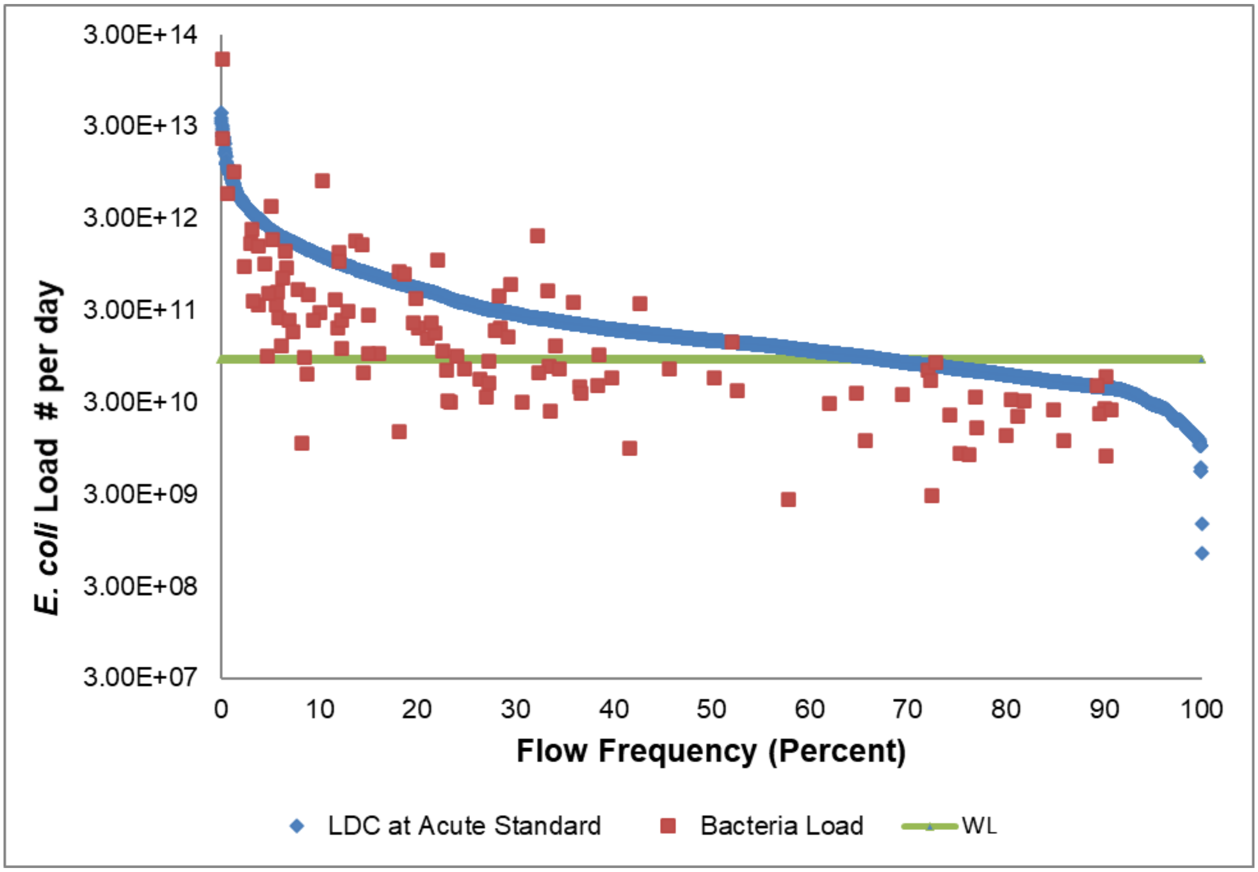

Figure 8. Load Duration Curve for the South Fork Whetstone Segment 02 based on actual flow regime.

The cumulative WLAs for the City of Milbank and VQC (8.77E+10) was plotted against the load duration curve (Figure 8). The cumulative WLA from both facilities exceeds the daily load from 65% to 100% of the flow frequency occurrence. The corresponding daily average flows ranged from 3.28 cfs to 0.0 cfs. Daily flows from both facilities are variable and not expected to exceed the cumulative flow rate associated with the WLAs on a consistent basis.

The load duration curve guidance indicates that modifications may need to be made to the flow zone structure, in particular, the low flow zone to account for effluent driven conditions from continuous wastewater discharges (USEPA, 2007). An adjustment to the average daily flows at the lower end of the flow frequency occurrence was necessary to account for the continuous waste loads of both facilities for TMDL development. The estimated daily flow values were replaced with 3.28 cfs in 65% to 100% of the flow frequency occurrence to account for the cumulative flow rate. A new load duration curve was generated to accommodate the WLAs and facilitate TMDL development (Figure 9).

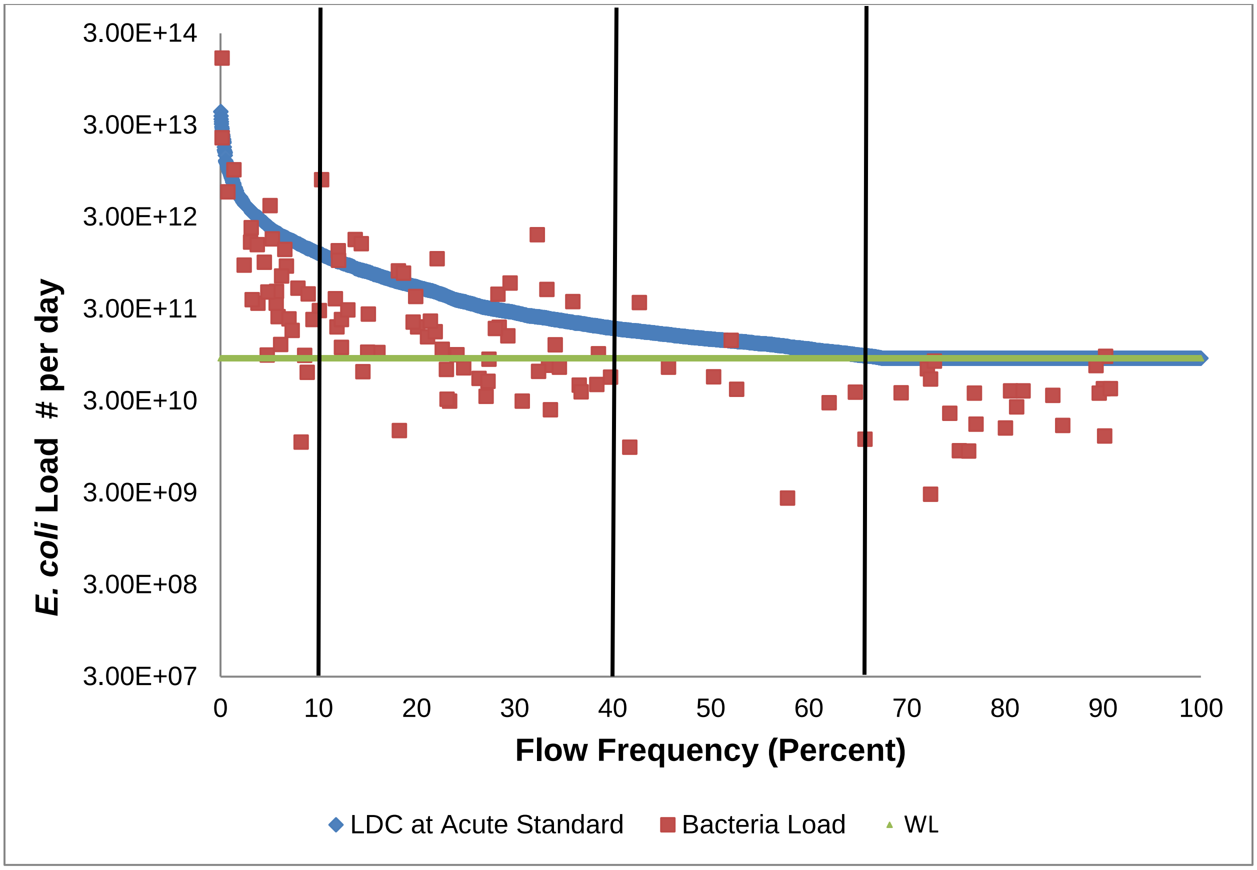

Figure 9. Load Duration Curve for the South Fork Whetstone Segment 02 based on adjusted flow regime.

The load duration curve generated for segment 02 of the South Fork Whetstone was separated into four separate flow zones (Figure 9). Flow zones were defined according to flow regime structure and distribution of the observed data following guidance recommended by EPA (USEPA, 2007). Four distinct flow zones were established to facilitate interpretation of the hydrologic conditions and patterns associated with the impairment. The flow zones were segmented by high flows (0-10 percent), moderate flows (10-40 percent), dry condition flows (40-65 percent), and low flows (65-100 percent).

E. coli data is relatively dense and well distributed across the high and moderate flow zones, while more sparsely distributed across the remaining flow zones. The low flow zone constitutes the cumulative flow (≤ 3.28 cfs) associated with the WLAs from the City of Milbank and Valley Queen Cheese. Discharge from both facilities is variable and expected to be below the cumulative rate associated with the WLAs on a consistent basis. As a result, there is general capacity for load allocation from nonpoint sources assuming effluent flows comply with permit effluent limits.

All TMDL components including numeric calculations for each flow zone associated with segment 02 of the South Fork Whetstone are presented in Table 10. The load capacity or TMDL was calculated by multiplying the 95th percentile flow and SSM *E. coli* criterion for each flow zone. The current loads for all flow zones were calculated by multiplying the 95th percentile flow and concentration. Reduction calculations were based on reducing the current load to the single sample maximum *E. coli* standard (1,178 CFU/100ml) to assure compliance with the single sample maximum criterion for limited contact recreation waters. In addition to the daily load, the geometric mean criteria must be attained on a longer (i.e., monthly) basis. The WLAs for the City of Milbank and Valley Queen Cheese were included in each flow zone as a constant. All reductions are required from nonpoint sources (LA). A description for the margin of safety (MOS) used for the TMDL is provided in a subsequent section.

Table 10. *E. coli* TMDL and flow zone allocations for the South Fork Whetstone Segment 02.

TMDL Component	South Fork Whetstone Segment 02 Flow Zones Expressed as (CFU/day)			
	High Flows	Moderate flows	Dry Conditions	Low Flows
	> 42.1 cfs	<42.1 to 6.44 cfs	<6.44 to 3.28 cfs	≤ 3.28 cfs
LA	1.10E+13	8.44E+11	7.31E+10	0
WLA-City of Milbank	3.31E+10	3.31E+10	3.31E+10	3.31E+10
WLA-Valley Queen	5.46E+10	5.46E+10	5.46E+10	5.46E+10
10% Explicit MOS (Low Zone Implicit)	1.24E+12	1.04E+11	1.79E+10	Implicit
TMDL @ 1178 CFU/100mL	1.24E+13	1.04E+12	1.79E+11	9.45E+10
Current Load	2.00E+13	2.23E+12	2.93E+11	1.04E+11
Load Reduction	38%	54%	39%	9%

High Flow Conditions (<10% flow frequency)

The high flow zone represents high flow conditions in segment 02 of the South Fork Whetstone. The flows in this zone are variable ranging from 1,462.8 cfs to 42.1 cfs. Flows represented in this zone occur on an infrequent basis and are characteristic of significant run-off events typically during spring and early summer. High flows are commonly the product of spring snowmelt events but may be generated by intense rain events. Bacteria sources across the watershed have the potential to be conveyed to the stream channel during high flow conditions. The 95^{th} percentile flow and bacteria concentration was calculated at 429 cfs and 1,904 CFU/100ml, respectively. An *E. coli* load reduction of 38% is required to achieve compliance with the single sample maximum criterion.

Moderate Flow Conditions (10% to 40% flow frequency)

Moderate conditions represent the portion of the flow regime that occurs following moderate storm events. Flows in this zone vary from 42.1 cfs to 6.4 cfs. The flows in this zone occur in early to mid-summer near the peak of the recreation season providing for optimal recreational opportunity. Sources of bacteria may be expected to be closer to the channel and somewhat easier to mitigate than those impacting the high flows. The 95^{th} percentile flow and bacteria concentration was calculated at 35.9 cfs and 2,537 CFU/100ml, respectively. An *E. coli* load reduction of 54% is required to achieve compliance with the single sample maximum threshold.

Dry Conditions (40% to 65% flow frequency)

Dry conditions represent flow rates between 6.4 cfs and 3.28 cfs. Dry condition flows are best characterized as base flow conditions influenced by ground water sources. Bacteria sources likely originate in the stream channel during dry flow conditions. The 95^{th} percentile flow and bacteria concentration was calculated at 6.2 cfs and 1,933 CFU/100ml, respectively. An *E. coli* load reduction of 39% is required to achieve compliance with the single sample maximum criterion. Reducing bacteria sources within the stream channel is warranted to assure compliance with single sample maximum criterion for the dry flow condition.

Low Flows (65% to 100% flow frequency)

Flow characteristics for the South Fork Whetstone suggest that it is an intermittent system. During the UMR assessment project it was common for the spill way on Lake Farley to be dry by middle to late summer despite the wet cycle experienced in 2010 and 2011. This is not well depicted in the flow frequency curves likely due to shortfalls in the method used to produce the flow record. Nonetheless, zero flows were present at 99% of the flow frequency curve at WQM90, while only two zero flows were present from 99.9% to 100% of the flow frequency at WQM91. All indications are that the system is effluent driven at low flows. As a result, the low flow zone was adjusted in the load duration curve to give the entire load to the WLAs for the City of Milbank and Valley Queen Cheese.

The 95^{th} percentile flow and *E. coli* concentration for the low flow zone was calculated at 3.28 cfs and 1,293 CFU/100ml, respectively. An *E. coli* load reduction of 9% is required to achieve compliance with the single sample maximum criterion. The load reduction can be attributed solely to nonpoint sources (LA), when waste loads from both facilities comply with permit effluent limits. Bacteria originating from nonpoint sources in the low flow zone likely originate in the stream channel. Mitigation efforts directed towards nonpoint sources are expected to result in reductions in the low flow zone to achieve compliance with single sample maximum criterion.

Load Allocations (LAs)

The majority of bacteria production in the South Fork Whetstone watershed (96.4%) originates from livestock sources. Human and wildlife bacteria production in both watersheds was considered negligible. The majority of the bacteria produced by livestock can be attributed to beef and dairy cattle. Approximately 70% of the livestock in both watersheds were estimated to be on grass or rangeland/pasture. Approximately 30% of the livestock were estimated to be in feedlots. Restoration efforts focused on grazing management and manure management in feedlots will likely yield the greatest bacteria reduction benefits.

Bacteria load reductions were based on 1,178 CFU/100ml the single sample maximum to assure compliance with daily maximum criterion. Segment 01 of the South Fork Whetstone requires reductions in all flow zones exclusively from nonpoint source load allocation. A 47% reduction in *E. coli* bacteria is required from nonpoint sources in the high flow zone. A 52% reduction in *E. coli* bacteria is required in the moist conditions flow zone. A 62% reduction in *E. coli* bacteria is required in the mid-range flow zone. A 51% and 70% reduction in *E. coli* bacteria is required in the dry and low flow zones, respectively. To achieve the specified reductions, primary focus should be placed on reducing bacteria inputs from livestock grazing and feeding areas.

Segment 02 of the South Fork Whetstone requires a 38% reduction in *E. coli* bacteria from nonpoint sources in the high flow zone. A 54% reduction in *E. coli* bacteria is required in the moderate flow zone. A 39% and 9% reduction in *E. coli* bacteria is required in the dry and low flow zones, respectively. To achieve the specified reductions, primary focus should be placed on nonpoint source load allocation by reducing bacteria inputs from livestock grazing and feeding areas.

Waste Load Allocations (WLAs)

There are no point source discharges that contribute directly to the upper segment of the South Fork Whetstone (SD-MN-R-Whetstone_S_Fork_01). As a result, the WLA was set to zero in all flow zones. There are two point source discharges that may contribute *E. coli* to the lower segment of the South Fork Whetstone (SD-MN-R-Whetstone_S_Fork_02). Wastewater from both systems is regulated by NPDES surface water discharge permits. Both facilities are permitted to discharge *E. coli* bacteria and have been assigned a WLA in the TMDL.

SD DANR issued the City of Milbank a NPDES wastewater discharge permit April 1, 2004 (Permit # SD0020371). This permit has been administratively continued to date. The current permit includes fecal coliform effluent limits and associated monitoring requirements to determine compliance with SSM and GM standards. SD DANR is in the process of updating the permit to include *E. coli* effluent limits and associated monitoring requirements. The new permit is expected to be issued sometime in 2022. SD DANR issued Valley Queen Cheese a NPDES discharge permit effective April 1, 2012 (Permit # 0027987). This permit has also been administratively continued to date with expected renewal by the end of 2022. The permit requires *E. coli* monitoring to determine compliance with SSM and GM standards. An *E. coli*

WLA was provided for both facilities in the TMDL. The *E. coli* TMDL would not add new requirements or implementation expectations to either permit pending renewal in 2022. The normal operation of both systems would typically result in only a small portion of the calculated daily amounts actually being discharged.

The WLAs established in this TMDL are not intended to add load limits to NPDES permits. Permits will be deemed consistent with the assumptions and requirements of the WLAs by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target where applicable. The renewed Milbank and VQC NPDES permits will include a daily maximum (1,178 CFU/100 ml) and a 30-day GM (630 CFU/100 ml) *E. coli* effluent limit. If the effluent flow increases, then the Milbank and VQC WLAs also increase proportional to the increase in discharge while the concentration limit is maintained. As long as wastewater discharges from both facilities do not exceed peak design flows and *E. coli* effluent limits, any variable flow rates from these facilities is not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if either facility increases peak flow capacity (expansion) or a new waste load(s) is added to the stream segment and there is insufficient remaining WLA to assign to the new source.

Margin of Safety (MOS) and Seasonality

Margin of Safety

A margin of safety (MOS) is a required component of TMDL development. The MOS accounts for uncertainty (i.e., pollutant loads from tributary streams, effectiveness of controls, etc.) in the TMDL development process. A margin of safety may be provided by; (1) using implicit assumptions in the calculation of the loading capacity of the waterbody and; (2) by establishing explicit allocations that in total are lower than the defined loading capacity. An explicit approach was used within the load duration curve framework to establish a MOS for both impaired segments of the South Fork Whetstone with the exception of the low flow zone for segment 02.

A 10% explicit MOS was calculated from the TMDL and allocated as a reserved load to account for uncertainty. The remaining assimilative capacity was attributed to nonpoint sources (LA) or point sources (WLA). The Load Duration Curve Guidance recognizes that different situations can occur in the low flow zone making it difficult to use a consistent MOS approach across the different flow zones (USEPA, 2007). The guidance supports the use of an implicit MOS in the low flow zone to account for effluent driven conditions from continuous wastewater discharges. The following conservative assumptions are intended to implicitly describe the MOS used in the low flow zone for the South Fork Whetstone Segment 02 TMDL to account for uncertainty:

- The TMDL loading does not account for *E. coli* die-off or the attenuation rate.
- Load reductions are based on the 95^{th} percentile of *E. coli* concentrations from the monitoring dataset which overestimates the actual reduction needed in many situations.
- The TMDL assessment project was conducted during a wet cycle and a majority of the *E. coli* samples were collected immediately following major runoff events (i.e. worst case).

- The WLAs for Milbank and VQC are considered conservative based on the facilities actual and expected flow (i.e., 80th percentile and average design flow, respectively). This condition provides an extra MOS for reductions from nonpoint sources at low flow conditions, despite a zero load allocation in the TMDL.

Seasonality

Seasonality is an important factor when considering patterns associated with bacteria contamination. Bacteria samples used in the TMDL analysis were collected from May to September to cover seasonal differences and satisfy the criterion associated with the standards for limited contact recreation waters. Seasonal variation is also a component of the load duration curve framework through the establishment of individual flow zones and associated TMDL load allocations. Daily bacteria loads exceed the single sample maximum TMDL threshold consistently throughout the flow regimes of both the impaired segments of the South Fork Whetstone. The implications of this pattern suggest bacteria contamination in both systems is continual. Bacteria conveyance in the spring and early summer is likely to occur watershed wide during high and moderate range flows. Bacteria contamination is more likely to be localized to the riparian zone and direct stream channels in the summer and fall during dry and low flow conditions. Focusing restoration efforts to account for these seasonal patterns is warranted to achieve TMDL goals.

Critical Conditions

Remediation efforts focused on reducing *E. coli* loading in the SF. Whetstone watershed should account for critical conditions. *E. coli* concentrations and loading are greatest at high to moderate flows resulting from snow-melt and heavy precipitation events encountered in the spring and early summer. Implementing watershed-scale best management practices designed to reduce manure transport potential during high to moderate flow conditions is essential to meet reduction goals. *E. coli* concentrations also exceed water quality criteria at dry to low flow conditions when livestock have direct access to the stream. Implementing practices to reduce livestock access to the stream corridor and channel during this critical condition is also necessary to meet reduction goals.

Public Participation

STATE AGENCIES

The South Dakota Department of Agriculture and Natural Resources (SDDANR) formed a partnership with the Minnesota Pollution Control Agency (MPCA) to provide technical support for project activities and coordination of the Upper Minnesota River Watershed Water Quality Assessment (i.e. UMR project). SD DANR also provided financial support for the UMR project and was the primary agency involved in the completion of this TMDL document. Bacteria data collected during the UMR project was supplemented with bacteria data available from SD DANR's ambient water quality monitoring stations in the South Fork Whetstone watershed.

FEDERAL AGENCIES

The Environmental Protection Agency (EPA) provided a significant portion of the funding for the UMR project. Long-term daily stream flow data was obtained from United States Geologic

Survey (USGS) gauge sites. This data was used in conjunction with flow data collected during the UMR project to construct long-term flow frequency curves for the impaired segments.

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

East Dakota Water Development District (EDWDD) was the primary South Dakota local sponsor for the UMR project. The district provided significant funding, field support and administrative processing during the UMR project. Two local watershed districts in Minnesota also provided support for the UMR project. The Upper Minnesota River Watershed District provided in-kind services and technical support to the local project coordinator responsible for sample collection. The Lac qui Parle-Yellow Bank River Watershed District also provided field support, funding and other in-kind services.

Public interest in the UMR project was a result of communications between EDWDD, local South Dakota conservation districts (Grant and Roberts), local Minnesota watershed districts, Citizens for Big Stone Lake and other stakeholder groups concerned with water quality in the South Fork Whetstone watersheds. Public involvement was encouraged through several multi-media networks during the UMR project.

A 30-day public comment period was issued for the draft TMDL document. Several entities were notified in South Dakota and Minnesota and a public notice letter was published in local newspapers (Watertown Public Opinion, Grant County Review-Milbank) within close proximity to the South Fork Whetstone watershed. The draft TMDL document and ability to comment was made available on DANRs One-Stop Public Notice Page at: https://danr.sd.gov/public/default.aspx. The public comment period began April 28, 2022 and ended May 30, 2022. No comments were received during the public comment period.

Adaptive Management and Monitoring Strategy

The Department (or EPA) may adjust the load and/or waste load allocations in this TMDL to account for new information or circumstances that are developed or come to light during the implementation of the TMDL and a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment of the load and waste load allocation will only be made following an opportunity for public participation. New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information and land use information. The Department will propose adjustments only in the event that any adjusted LA or WLA will not result in a change to the loading capacity; the adjusted TMDL, including its WLAs and LAs, will be set at a level necessary to implement the applicable water quality standards and any adjusted WLA will be supported by a demonstration that load allocations are practicable. The Department will follow EPA guidance for revising or withdrawing TMDLs in accordance with considerations documented in EPA's 2012 draft memo before taking action (http://www.epa.gov/sites/production/files/2015-10/documents/draft-tmdl_32212.pdf).

Long-term water quality monitoring will continue at sites WQM 90 and WQM 91 in segment 02 through DANR's Ambient Water Quality Monitoring Program. The current monitoring schedule

is limited to quarterly sampling. East Dakota Water Development District collects *E. coli* samples bi monthly during the recreation season at both of the aforementioned sites as part of the district's routine monitoring efforts. Sampling is expected to continue indefinitely depending on resource availability. Monitoring in Segment 02 will also be conducted as part of DANRs Rotating Basin (RB) Project. Details about the RB project will be available on DANRs Watershed Protection Program web site in 2022
https://danr.sd.gov/Conservation/WatershedProtection/default.aspx
Watershed Protection Program staff continue to maintain long-term stream gages at WQM 90 and WQM 91 as part of the statewide stream flow monitoring network.
https://danr.sd.gov/Conservation/WatershedProtection/Projects/StreamflowMonitoringNetwork.aspx. Data collected as part of these monitoring efforts will be used to determine beneficial use support in accordance with 303(d) listing methods, evaluate TMDL effectiveness following BMP implementation and to make potential future adjustments to the TMDLs, if necessary.

The NE Glacial Lakes Implementation project provides another potential avenue for future monitoring. In addition, future monitoring or assessment plans implemented by DANR and partners should include segment 01. Bacteria monitoring should be conducted at station UMR3 to maintain consistency with data used for TMDL development.

Reasonable Assurance

South Fork Whetstone segment 02 (SD –MN-R-Whetstone_S_Fork_02) receives *E. coli* loadings from both point and non-point sources. When a TMDL is developed for impaired waters that receive pollutant loadings from both point and nonpoint sources and the WLA is based on an assumption that nonpoint source load reductions will occur, the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions. Reasonable assurance ensures that a TMDL's WLA and load allocations are properly calibrated to meet the applicable water quality standards.

Reasonable assurance of the TMDL established for segment 02 of the South Fork Whetstone will require a comprehensive approach that addresses:

- Wastewater discharges under NPDES permits.
- Non-point source pollution.
- Existing and potential future sources, and
- Regulatory and voluntary approaches.

There is reasonable assurance that the goals of the TMDL established for segment 02 of the South Fork Whetstone can be met with proper planning between state and local regulatory agencies, stakeholders, BMP implementation, and access to adequate financial resources. The waste load allocations used in the TMDL were obtained from regulations defined in the NPDES permits administratively assigned to the City of Milbank and Valley Queen Cheese waste water treatment facilities (WWTF).

Point Sources

The City of Milbank and Valley Queen Cheese WWTFs are located in the upper portion of segment 02 of the South Fork Whetstone. It is imperative that these facilities operate in compliance with their NPDES permits and WLA's set forth in the TMDL. Below are some recommendations for both facilities to consider ensuring high operational effectiveness of wastewater treatment.

City of Milbank WWTF

- Continue scheduled sewer repair.
- Continue upgrading treatment system as new technologies become available.
- Implement *E. coli* monitoring to assure compliance with water quality standards.

Valley Queen Cheese WWTF

- Continue scheduled sewer repair as needed.
- Continue upgrading treatment system as new technologies become available.
- Continue to monitor *E. coli* to assure compliance with water quality standards.

Non-point Source

There are several entities that provide watershed stewardship and have vested interest in the South Fork Whetstone watershed. These include the City of Milbank, Grant County Conservation District, South Dakota GFP, Natural Resource Conservation Service, East Dakota Water Development District and the Northeast Glacial Lakes Watershed Implementation Project.

Two projects are currently engaged in the South Fork Whetstone watershed that focus on bacteria monitoring and implementation efforts to reduce bacteria loading from nonpoint sources. These projects provide reasonable assurance that bacteria loading from non-point sources in the South Fork Whetstone will be reduced through activities outlined in the Restoration Strategy section below.

Restoration Strategy

The TMDLs for the impaired segments of the South Fork Whetstone correspond exclusively to the 303(d) listed segments identified in South Dakota's 2022 Integrated Report for Surface Water Quality Assessment. During the planning process for the Upper Minnesota River Watershed Water Quality Assessment project (UMR project) monitoring sites were established to determine potential impairment of beneficial uses in South Dakota and to allow quantification of loadings for use in TMDL development.

A significant portion of the South Fork Whetstone was not monitored as part of the TMDL assessment. Implementation efforts are directed to the entire South Fork Whetstone watershed with priority given to the sub-watersheds of the impaired segments. South Dakota received EPA 319 funding to incorporate the South Fork Whetstone watershed into the Northeast Glacial Lakes Implementation Project boundary. The project coordinator targeted grazing management in the first phase of the multiple phase project. The coordinator has established relationships with federal, state and local entities as well as stakeholders in the watershed to increase project awareness and seek additional sources of funding to assure long-term project success. Bacteria data from monitoring efforts and a digital feedlot layer will be used as tools to identify potential target areas. The long-term goal of this implementation effort is to achieve the TMDL reductions derived in this document on both impaired segments and ultimately reduce bacteria inputs to the South Fork Whetstone drainages to protect the upstream and downstream uses.

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Appendix A

E. coli data used in the impairment analysis and TMDL analysis for Segment 01 and 02 of the South Fork Whetstone River

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli #/100mL*	Flow (cfs)
UMR	UMR3	05/19/2010	SD-MN-SF_Whetsone_01	204.6	38.1
UMR	UMR3	05/24/2010	SD-MN-SF_Whetsone_01	435.2	27.4
UMR	UMR3	05/26/2010	SD-MN-SF_Whetsone_01	307.6	25.8
UMR	UMR3	06/01/2010	SD-MN-SF_Whetsone_01	727	10.4
UMR	UMR3	06/02/2010	SD-MN-SF_Whetsone_01	686.7	9.3
UMR	UMR3	06/07/2010	SD-MN-SF_Whetsone_01	866.4	8.7
UMR	UMR3	06/09/2010	SD-MN-SF_Whetsone_01	344.8	10.2
UMR	UMR3	06/14/2010	SD-MN-SF_Whetsone_01	727	41.8
UMR	UMR3	06/16/2010	SD-MN-SF_Whetsone_01	365.4	53.0
UMR	UMR3	06/21/2010	SD-MN-SF_Whetsone_01	517.2	14.0
UMR	UMR3	06/23/2010	SD-MN-SF_Whetsone_01	866.4	11.7
UMR	UMR3	06/28/2010	SD-MN-SF_Whetsone_01	920.8	10.7
UMR	UMR3	06/30/2010	SD-MN-SF_Whetsone_01	980.4	6.7
UMR	UMR3	07/06/2010	SD-MN-SF_Whetsone_01	452	8.1
UMR	UMR3	07/07/2010	SD-MN-SF_Whetsone_01	1299.7	7.8
UMR	UMR3	07/12/2010	SD-MN-SF_Whetsone_01	1553.1	10.6
UMR	UMR3	07/14/2010	SD-MN-SF_Whetsone_01	2239.8	6.5
UMR	UMR3	07/19/2010	SD-MN-SF_Whetsone_01	1986.3	0.6
UMR	UMR3	07/21/2010	SD-MN-SF_Whetsone_01	>2419.6	1.4
UMR	UMR3	07/26/2010	SD-MN-SF_Whetsone_01	648.8	0.0
UMR	UMR3	07/28/2010	SD-MN-SF_Whetsone_01	922.2	0.0
UMR	UMR3	08/02/2010	SD-MN-SF_Whetsone_01	1246	0.0
UMR	UMR3	08/04/2010	SD-MN-SF_Whetsone_01	504	0.0
UMR	UMR3	08/09/2010	SD-MN-SF_Whetsone_01	816.4	0.0
UMR	UMR3	08/11/2010	SD-MN-SF_Whetsone_01	104.3	0.0
UMR	UMR3	08/16/2010	SD-MN-SF_Whetsone_01	488	0.0
UMR	UMR3	08/18/2010	SD-MN-SF_Whetsone_01	770.1	0.0
UMR	UMR3	08/23/2010	SD-MN-SF_Whetsone_01	2419.6	0.0
UMR	UMR3	08/25/2010	SD-MN-SF_Whetsone_01	687.6	0.1
UMR	UMR3	08/30/2010	SD-MN-SF_Whetsone_01	1986.3	0.2
UMR	UMR3	09/01/2010	SD-MN-SF_Whetsone_01	1553.1	0.0
UMR	UMR3	09/08/2010	SD-MN-SF_Whetsone_01	517.2	4.8
UMR	UMR3	09/09/2010	SD-MN-SF_Whetsone_01	1119.9	3.8
UMR	UMR3	09/14/2010	SD-MN-SF_Whetsone_01	686.7	5.7
UMR	UMR3	09/15/2010	SD-MN-SF_Whetsone_01	1616	10.8
UMR	UMR3	09/21/2010	SD-MN-SF_Whetsone_01	648.8	12.5
UMR	UMR3	09/23/2010	SD-MN-SF_Whetsone_01	461.1	11.2
UMR	UMR3	09/28/2010	SD-MN-SF_Whetsone_01	488.4	11.0
UMR	UMR3	09/30/2010	SD-MN-SF_Whetsone_01	616.7	10.6
UMR	UMR3	05/02/2011	SD-MN-SF_Whetsone_01	29.2	39.0
UMR	UMR3	05/04/2011	SD-MN-SF_Whetsone_01	193.5	29.8
UMR	UMR3	05/09/2011	SD-MN-SF_Whetsone_01	816.4	25.0
UMR	UMR3	05/11/2011	SD-MN-SF_Whetsone_01	83.6	64.8
UMR	UMR3	05/16/2011	SD-MN-SF_Whetsone_01	139.6	30.6
UMR	UMR3	05/18/2011	SD-MN-SF_Whetsone_01	> 2419.6	26.7
UMR	UMR3	05/23/2011	SD-MN-SF_Whetsone_01	1986.3	34.0
UMR	UMR3	05/25/2011	SD-MN-SF_Whetsone_01	365.4	125.6
UMR	UMR3	06/01/2011	SD-MN-SF_Whetsone_01	1986.3	240.8
UMR	UMR3	06/02/2011	SD-MN-SF_Whetsone_01	686.7	360.0
UMR	UMR3	06/06/2011	SD-MN-SF_Whetsone_01	365.4	35.9
UMR	UMR3	06/08/2011	SD-MN-SF_Whetsone_01	813	24.3
UMR	UMR3	06/13/2011	SD-MN-SF_Whetsone_01	767	15.0

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli #/100mL*	Flow (cfs)
UMR	UMR3	06/15/2011	SD-MN-SF_Whetsone_01	465	19.6
UMR	UMR3	06/28/2011	SD-MN-SF_Whetsone_01	520	67.3
UMR	UMR3	06/29/2011	SD-MN-SF_Whetsone_01	395	59.5
UMR	UMR3	07/05/2011	SD-MN-SF_Whetsone_01	1500	19.6
UMR	UMR3	07/07/2011	SD-MN-SF_Whetsone_01	620	24.5
UMR	UMR3	07/12/2011	SD-MN-SF_Whetsone_01	663	37.3
UMR	UMR3	07/13/2011	SD-MN-SF_Whetsone_01	441	89.2
UMR	UMR3	07/19/2011	SD-MN-SF_Whetsone_01	909	31.5
UMR	UMR3	07/20/2011	SD-MN-SF_Whetsone_01	4106	26.3
UMR	UMR3	07/25/2011	SD-MN-SF_Whetsone_01	813	65.8
UMR	UMR3	07/27/2011	SD-MN-SF_Whetsone_01	1354	49.3
UMR	UMR3	08/01/2011	SD-MN-SF_Whetsone_01	695	24.8
UMR	UMR3	08/04/2011	SD-MN-SF_Whetsone_01	2613	22.5
UMR	UMR3	08/08/2011	SD-MN-SF_Whetsone_01	576	13.4
UMR	UMR3	08/10/2011	SD-MN-SF_Whetsone_01	683	9.9
UMR	UMR3	08/15/2011	SD-MN-SF_Whetsone_01	934	6.2
UMR	UMR3	08/17/2011	SD-MN-SF_Whetsone_01	3873	5.9
UMR	UMR3	08/22/2011	SD-MN-SF_Whetsone_01	933	3.5
UMR	UMR3	08/24/2011	SD-MN-SF_Whetsone_01	712	5.7
UMR	UMR3	08/29/2011	SD-MN-SF_Whetsone_01	6867	1.2
UMR	UMR3	09/01/2011	SD-MN-SF_Whetsone_01	538	2.0
UMR	UMR3	09/06/2011	SD-MN-SF_Whetsone_01	464	1.7
UMR	UMR3	09/07/2011	SD-MN-SF_Whetsone_01	816	2.4
UMR	UMR3	09/12/2011	SD-MN-SF_Whetsone_01	> 2419.6	2.4
UMR	UMR3	09/14/2011	SD-MN-SF_Whetsone_01	613	2.9
UMR	UMR3	09/19/2011	SD-MN-SF_Whetsone_01	1935	2.0
UMR	UMR3	09/20/2011	SD-MN-SF_Whetsone_01	1515	3.1
UMR	UMR3	09/27/2011	SD-MN-SF_Whetsone_01	1500	1.4
UMR	UMR3	09/28/2011	SD-MN-SF_Whetsone_01	1720	1.4

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli* #/100mL	Flow (cfs)
DANR WQM	WQM90	07/12/2001	SD-MN-SF_Whetsone_02	53.6	9.936
DANR WQM	WQM90	07/14/2004	SD-MN-SF_Whetsone_02	48.7	3.3948
DANR WQM	WQM90	07/14/2005	SD-MN-SF_Whetsone_02	228	7.4796
DANR WQM	WQM90	07/13/2006	SD-MN-SF_Whetsone_02	167	3.9744
DANR WQM	WQM90	07/12/2007	SD-MN-SF_Whetsone_02	19.7	8.556
DANR WQM	WQM90	05/07/2009	SD-MN-SF_Whetsone_02	5.2	24.5364
DANR WQM	WQM90	05/11/2010	SD-MN-SF_Whetsone_02	31.8	40.2
UMR	WQM90	05/19/2010	SD-MN-SF_Whetsone_02	14.5	38.1
UMR	WQM90	05/24/2010	SD-MN-SF_Whetsone_02	22.3	27.4
UMR	WQM90	05/26/2010	SD-MN-SF_Whetsone_02	95.9	25.8
UMR	WQM90	06/01/2010	SD-MN-SF_Whetsone_02	56.5	10.4
UMR	WQM90	06/02/2010	SD-MN-SF_Whetsone_02	27.5	9.3
UMR	WQM90	06/07/2010	SD-MN-SF_Whetsone_02	118.7	8.7
UMR	WQM90	06/09/2010	SD-MN-SF_Whetsone_02	85.7	10.2
UMR	WQM90	06/14/2010	SD-MN-SF_Whetsone_02	206	41.8
UMR	WQM90	06/16/2010	SD-MN-SF_Whetsone_02	75.9	53.0
UMR	WQM90	06/21/2010	SD-MN-SF_Whetsone_02	81.6	14.0
UMR	WQM90	06/23/2010	SD-MN-SF_Whetsone_02	83.6	11.7
UMR	WQM90	06/28/2010	SD-MN-SF_Whetsone_02	44.3	10.7
UMR	WQM90	06/30/2010	SD-MN-SF_Whetsone_02	52.8	6.7
UMR	WQM90	07/06/2010	SD-MN-SF_Whetsone_02	34.2	8.1
UMR	WQM90	07/07/2010	SD-MN-SF_Whetsone_02	121.2	7.8
UMR	WQM90	07/12/2010	SD-MN-SF_Whetsone_02	37.3	10.6
UMR	WQM90	07/14/2010	SD-MN-SF_Whetsone_02	21.3	6.5
UMR	WQM90	07/19/2010	SD-MN-SF_Whetsone_02	59.4	0.6
UMR	WQM90	07/21/2010	SD-MN-SF_Whetsone_02	178.5	1.4
UMR	WQM90	07/26/2010	SD-MN-SF_Whetsone_02	101.9	0.0
UMR	WQM90	07/28/2010	SD-MN-SF_Whetsone_02	82	0.0
UMR	WQM90	08/02/2010	SD-MN-SF_Whetsone_02	260.3	0.0
UMR	WQM90	08/04/2010	SD-MN-SF_Whetsone_02	794	0.0
UMR	WQM90	08/09/2010	SD-MN-SF_Whetsone_02	547.5	0.0
UMR	WQM90	08/11/2010	SD-MN-SF_Whetsone_02	238.2	0.0
UMR	WQM90	08/16/2010	SD-MN-SF_Whetsone_02	128	0.0
UMR	WQM90	08/18/2010	SD-MN-SF_Whetsone_02	866.4	0.0
UMR	WQM90	08/23/2010	SD-MN-SF_Whetsone_02	172.2	0.0
UMR	WQM90	08/25/2010	SD-MN-SF_Whetsone_02	71.4	0.1
UMR	WQM90	08/30/2010	SD-MN-SF_Whetsone_02	77.1	0.2
UMR	WQM90	09/01/2010	SD-MN-SF_Whetsone_02	298.7	0.0
UMR	WQM90	09/08/2010	SD-MN-SF_Whetsone_02	90.6	4.8
UMR	WQM90	09/09/2010	SD-MN-SF_Whetsone_02	66.3	3.8

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli* #/100mL	Flow (cfs)
UMR	WQM90	09/21/2010	SD-MN-SF_Whetsone_02	52.1	12.5
UMR	WQM90	09/23/2010	SD-MN-SF_Whetsone_02	58.8	11.2
UMR	WQM90	09/28/2010	SD-MN-SF_Whetsone_02	11	11.0
UMR	WQM90	09/30/2010	SD-MN-SF_Whetsone_02	19.7	10.6
UMR	WQM90	05/02/2011	SD-MN-SF_Whetsone_02	5.2	39.0
UMR	WQM90	05/04/2011	SD-MN-SF_Whetsone_02	3.1	29.8
UMR	WQM90	05/09/2011	SD-MN-SF_Whetsone_02	31.3	25.0
UMR	WQM90	05/11/2011	SD-MN-SF_Whetsone_02	83.6	64.8
UMR	WQM90	05/16/2011	SD-MN-SF_Whetsone_02	13.9	30.6
DANR WQM	WQM90	05/17/2011	SD-MN-SF_Whetsone_02	10.9	26.7
UMR	WQM90	05/18/2011	SD-MN-SF_Whetsone_02	15.8	34.0
UMR	WQM90	05/23/2011	SD-MN-SF_Whetsone_02	275.5	125.6
UMR	WQM90	05/25/2011	SD-MN-SF_Whetsone_02	410.6	240.8
UMR	WQM90	06/01/2011	SD-MN-SF_Whetsone_02	1732.9	360.0
UMR	WQM90	06/02/2011	SD-MN-SF_Whetsone_02	579.4	35.9
UMR	WQM90	06/06/2011	SD-MN-SF_Whetsone_02	69.7	24.3
UMR	WQM90	06/08/2011	SD-MN-SF_Whetsone_02	50.4	15.0
UMR	WQM90	06/13/2011	SD-MN-SF_Whetsone_02	115.3	19.6
UMR	WQM90	06/15/2011	SD-MN-SF_Whetsone_02	25.6	11.1
UMR	WQM90	06/20/2011	SD-MN-SF_Whetsone_02	16.1	941.6
UMR	WQM90	06/23/2011	SD-MN-SF_Whetsone_02	> 2419.6	67.3
UMR	WQM90	06/28/2011	SD-MN-SF_Whetsone_02	74	59.5
UMR	WQM90	06/29/2011	SD-MN-SF_Whetsone_02	63	19.6
UMR	WQM90	07/05/2011	SD-MN-SF_Whetsone_02	52	24.5
UMR	WQM90	07/07/2011	SD-MN-SF_Whetsone_02	6867	37.3
UMR	WQM90	07/12/2011	SD-MN-SF_Whetsone_02	250	89.2
UMR	WQM90	07/13/2011	SD-MN-SF_Whetsone_02	175	31.5
UMR	WQM90	07/19/2011	SD-MN-SF_Whetsone_02	63	26.3
UMR	WQM90	07/20/2011	SD-MN-SF_Whetsone_02	98	65.8
UMR	WQM90	07/25/2011	SD-MN-SF_Whetsone_02	107	49.3
UMR	WQM90	07/27/2011	SD-MN-SF_Whetsone_02	249	24.8
UMR	WQM90	08/01/2011	SD-MN-SF_Whetsone_02	31	22.5
UMR	WQM90	08/04/2011	SD-MN-SF_Whetsone_02	41	13.4
UMR	WQM90	08/08/2011	SD-MN-SF_Whetsone_02	10	9.9
UMR	WQM90	08/10/2011	SD-MN-SF_Whetsone_02	20	6.2
DANR WQM	WQM90	08/11/2011	SD-MN-SF_Whetsone_02	25	5.9
UMR	WQM90	08/15/2011	SD-MN-SF_Whetsone_02	10	3.5
UMR	WQM90	08/17/2011	SD-MN-SF_Whetsone_02	10	5.7
UMR	WQM90	08/22/2011	SD-MN-SF_Whetsone_02	75	1.2
UMR	WQM90	09/06/2011	SD-MN-SF_Whetsone_02	41	2.4

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli* #/100mL	Flow (cfs)
UMR	WQM90	09/07/2011	SD-MN-SF_Whetsone_02	30	2.9
UMR	WQM90	09/12/2011	SD-MN-SF_Whetsone_02	137.4	2.0
UMR	WQM90	09/14/2011	SD-MN-SF_Whetsone_02	648.8	3.1
UMR	WQM90	09/19/2011	SD-MN-SF_Whetsone_02	165.8	1.4
UMR	WQM90	09/20/2011	SD-MN-SF_Whetsone_02	> 2419.6	1.4
UMR	WQM90	09/27/2011	SD-MN-SF_Whetsone_02	30	1.4
UMR	WQM90	09/28/2011	SD-MN-SF_Whetsone_02	75	1.4
DANR WQM	WQM90	05/10/2012	SD-MN-SF_Whetsone_02	48.8	27.8
DANR WQM	WQM90	05/09/2013	SD-MN-SF_Whetsone_02	<1	28.7
DANR WQM	WQM90	08/08/2013	SD-MN-SF_Whetsone_02	28.6	4.7
DANR WQM	WQM90	05/13/2014	SD-MN-SF_Whetsone_02	727	43.8
EDWDD	WQM90	05/20/2014	SD-MN-SF_Whetsone_02	8.5	20.4
EDWDD	WQM90	06/03/2014	SD-MN-SF_Whetsone_02	907	824.1
EDWDD	WQM90	06/18/2014	SD-MN-SF_Whetsone_02	689	86.8
EDWDD	WQM90	07/01/2014	SD-MN-SF_Whetsone_02	305	42.8
EDWDD	WQM90	07/15/2014	SD-MN-SF_Whetsone_02	8.2	15.6
EDWDD	WQM90	07/29/2014	SD-MN-SF_Whetsone_02	7.3	9.7
DANR WQM	WQM90	08/07/2014	SD-MN-SF_Whetsone_02	8.4	5.8
EDWDD	WQM90	08/12/2014	SD-MN-SF_Whetsone_02	461	129.6
EDWDD	WQM90	08/26/2014	SD-MN-SF_Whetsone_02	32	27.4
EDWDD	WQM90	09/09/2014	SD-MN-SF_Whetsone_02	27.5	11.3
EDWDD	WQM90	05/05/2015	SD-MN-SF_Whetsone_02	24.9	10.9
DANR WQM	WQM90	05/07/2015	SD-MN-SF_Whetsone_02	179	9.8
EDWDD	WQM90	05/19/2015	SD-MN-SF_Whetsone_02	63	25.2
EDWDD	WQM90	06/02/2015	SD-MN-SF_Whetsone_02	37	17.1
EDWDD	WQM90	06/16/2015	SD-MN-SF_Whetsone_02	435	5.3
EDWDD	WQM90	06/30/2015	SD-MN-SF_Whetsone_02	161	11.1
EDWDD	WQM90	07/14/2015	SD-MN-SF_Whetsone_02	120	5.7
EDWDD	WQM90	07/28/2015	SD-MN-SF_Whetsone_02	275	3.2
EDWDD	WQM90	08/25/2015	SD-MN-SF_Whetsone_02	20	19.5
EDWDD	WQM90	09/09/2015	SD-MN-SF_Whetsone_02	21.3	3.6
DANR WQM	WQM90	05/12/2016	SD-MN-SF_Whetsone_02	10	18.0
EDWDD	WQM90	05/24/2016	SD-MN-SF_Whetsone_02	256	9.4
EDWDD	WQM90	06/07/2016	SD-MN-SF_Whetsone_02	328	NA
EDWDD	WQM90	06/21/2016	SD-MN-SF_Whetsone_02	10500	NA
EDWDD	WQM90	07/19/2016	SD-MN-SF_Whetsone_02	<10	NA
EDWDD	WQM90	08/17/2016	SD-MN-SF_Whetsone_02	93.5	NA
EDWDD	WQM90	08/31/2016	SD-MN-SF_Whetsone_02	20	NA
EDWDD	WQM90	09/14/2016	SD-MN-SF_Whetsone_02	20	NA
EDWDD	WQM90	09/27/2016	SD-MN-SF_Whetsone_02	31	NA

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli* #/100mL	Flow (cfs)
DANR WQM	WQM91	07/12/2001	SD-MN-SF_Whetsone_02	2420	8.2800
DANR WQM	WQM91	05/07/2009	SD-MN-SF_Whetsone_02	28.5	20.4470
DANR WQM	WQM91	08/13/2009	SD-MN-SF_Whetsone_02	26.4	4.0710
DANR WQM	WQM91	05/11/2010	SD-MN-SF_Whetsone_02	579	62.0863
UMR	WQM91	05/19/2010	SD-MN-SF_Whetsone_02	77.6	49.4180
UMR	WQM91	05/24/2010	SD-MN-SF_Whetsone_02	228.2	34.4349
UMR	WQM91	05/26/2010	SD-MN-SF_Whetsone_02	142.1	33.0695
UMR	WQM91	06/01/2010	SD-MN-SF_Whetsone_02	435.2	18.0643
UMR	WQM91	06/02/2010	SD-MN-SF_Whetsone_02	365.4	16.8090
UMR	WQM91	06/07/2010	SD-MN-SF_Whetsone_02	435.2	16.0406
UMR	WQM91	06/09/2010	SD-MN-SF_Whetsone_02	478.6	18.5247
UMR	WQM91	06/14/2010	SD-MN-SF_Whetsone_02	387	53.4336
UMR	WQM91	06/16/2010	SD-MN-SF_Whetsone_02	198.9	71.5469
UMR	WQM91	06/21/2010	SD-MN-SF_Whetsone_02	1553.1	20.5724
UMR	WQM91	06/23/2010	SD-MN-SF_Whetsone_02	920.8	18.2436
UMR	WQM91	06/28/2010	SD-MN-SF_Whetsone_02	547.5	16.5309
UMR	WQM91	06/30/2010	SD-MN-SF_Whetsone_02	770.1	10.1404
UMR	WQM91	07/06/2010	SD-MN-SF_Whetsone_02	328.2	10.6084
UMR	WQM91	07/07/2010	SD-MN-SF_Whetsone_02	1732.9	10.2300
UMR	WQM91	07/12/2010	SD-MN-SF_Whetsone_02	296.6	15.0720
UMR	WQM91	07/14/2010	SD-MN-SF_Whetsone_02	133.3	9.1507
UMR	WQM91	07/19/2010	SD-MN-SF_Whetsone_02	461.1	3.3210
UMR	WQM91	07/21/2010	SD-MN-SF_Whetsone_02	1203.3	4.6730
UMR	WQM91	07/26/2010	SD-MN-SF_Whetsone_02	613.1	2.9056
UMR	WQM91	07/28/2010	SD-MN-SF_Whetsone_02	648.8	2.9056
UMR	WQM91	08/02/2010	SD-MN-SF_Whetsone_02	210.5	2.9056
UMR	WQM91	08/04/2010	SD-MN-SF_Whetsone_02	686.7	2.9056
UMR	WQM91	08/09/2010	SD-MN-SF_Whetsone_02	1540.2	2.9056
UMR	WQM91	08/11/2010	SD-MN-SF_Whetsone_02	613.1	2.9056
DANR WQM	WQM91	08/12/2010	SD-MN-SF_Whetsone_02	688	2.9056
UMR	WQM91	08/18/2010	SD-MN-SF_Whetsone_02	1226.2	2.9056
UMR	WQM91	08/25/2010	SD-MN-SF_Whetsone_02	365.4	2.9056
UMR	WQM91	08/30/2010	SD-MN-SF_Whetsone_02	272.3	2.9056
UMR	WQM91	09/01/2010	SD-MN-SF_Whetsone_02	365.4	8.2252
UMR	WQM91	09/08/2010	SD-MN-SF_Whetsone_02	191.8	11.2510
UMR	WQM91	09/09/2010	SD-MN-SF_Whetsone_02	1986.3	7.4429
UMR	WQM91	09/14/2010	SD-MN-SF_Whetsone_02	272.3	6.8142
UMR	WQM91	09/15/2010	SD-MN-SF_Whetsone_02	344.8	6.4727
UMR	WQM91	09/21/2010	SD-MN-SF_Whetsone_02	224.7	12.5533
UMR	WQM91	09/23/2010	SD-MN-SF_Whetsone_02	> 2419.6	9.7357

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli* #/100mL	Flow (cfs)
UMR	WQM91	05/04/2011	SD-MN-SF_Whetsone_02	145.5	69.4269
UMR	WQM91	05/09/2011	SD-MN-SF_Whetsone_02	426	65.7146
UMR	WQM91	05/11/2011	SD-MN-SF_Whetsone_02	253	145.7705
UMR	WQM91	05/16/2011	SD-MN-SF_Whetsone_02	269	71.2023
DANR WQM	WQM91	05/17/2011	SD-MN-SF_Whetsone_02	75.9	66.6830
UMR	WQM91	05/18/2011	SD-MN-SF_Whetsone_02	161	59.7427
UMR	WQM91	05/23/2011	SD-MN-SF_Whetsone_02	933	76.5286
UMR	WQM91	05/25/2011	SD-MN-SF_Whetsone_02	529	124.1425
UMR	WQM91	06/01/2011	SD-MN-SF_Whetsone_02	1732	231.9721
UMR	WQM91	06/02/2011	SD-MN-SF_Whetsone_02	638	362.5067
UMR	WQM91	06/06/2011	SD-MN-SF_Whetsone_02	123.6	57.9374
UMR	WQM91	06/08/2011	SD-MN-SF_Whetsone_02	282	41.8098
UMR	WQM91	06/13/2011	SD-MN-SF_Whetsone_02	> 2419.6	28.8901
UMR	WQM91	06/15/2011	SD-MN-SF_Whetsone_02	450	35.2382
UMR	WQM91	06/20/2011	SD-MN-SF_Whetsone_02	171	24.2097
UMR	WQM91	06/23/2011	SD-MN-SF_Whetsone_02	6867	961.4160
UMR	WQM91	06/28/2011	SD-MN-SF_Whetsone_02	135	105.1819
UMR	WQM91	06/29/2011	SD-MN-SF_Whetsone_02	223	83.9934
UMR	WQM91	07/05/2011	SD-MN-SF_Whetsone_02	2282	27.5782
UMR	WQM91	07/07/2011	SD-MN-SF_Whetsone_02	285	33.0988
UMR	WQM91	07/12/2011	SD-MN-SF_Whetsone_02	379	47.2913
UMR	WQM91	07/13/2011	SD-MN-SF_Whetsone_02	134	115.7490
UMR	WQM91	07/19/2011	SD-MN-SF_Whetsone_02	7701	40.7114
UMR	WQM91	07/20/2011	SD-MN-SF_Whetsone_02	1553	34.0859
UMR	WQM91	07/25/2011	SD-MN-SF_Whetsone_02	2046	80.0998
UMR	WQM91	07/27/2011	SD-MN-SF_Whetsone_02	862	63.1412
UMR	WQM91	08/01/2011	SD-MN-SF_Whetsone_02	1223	34.0793
UMR	WQM91	08/04/2011	SD-MN-SF_Whetsone_02	383	31.3144
UMR	WQM91	08/08/2011	SD-MN-SF_Whetsone_02	1515	19.9535
UMR	WQM91	08/10/2011	SD-MN-SF_Whetsone_02	2755	15.7254
DANR WQM	WQM91	08/11/2011	SD-MN-SF_Whetsone_02	87.5	13.9324
UMR	WQM91	08/15/2011	SD-MN-SF_Whetsone_02	301	8.5264
UMR	WQM91	08/17/2011	SD-MN-SF_Whetsone_02	121	8.1292
UMR	WQM91	08/22/2011	SD-MN-SF_Whetsone_02	355	4.6363
UMR	WQM91	08/24/2011	SD-MN-SF_Whetsone_02	637	9.8283
UMR	WQM91	08/29/2011	SD-MN-SF_Whetsone_02	529	2.9056
UMR	WQM91	09/01/2011	SD-MN-SF_Whetsone_02	146	3.2246
UMR	WQM91	09/06/2011	SD-MN-SF_Whetsone_02	282	2.9056
UMR	WQM91	09/07/2011	SD-MN-SF_Whetsone_02	145	2.9056
UMR	WQM91	09/12/2011	SD-MN-SF_Whetsone_02	143.9	2.9056

Project	Station ID	Sample Date	Assessment Unit ID	*E. coli #/100 mL*	Flow (cfs)
UMR	WQM91	09/20/2011	SD-MN-SF_Whetsone_02	579.4	2.9056
UMR	WQM91	09/27/2011	SD-MN-SF_Whetsone_02	1046.2	2.9056
UMR	WQM91	09/28/2011	SD-MN-SF_Whetsone_02	816.4	2.9056
DANR WQM	WQM91	05/10/2012	SD-MN-SF_Whetsone_02	157	26.4294
DANR WQM	WQM91	08/09/2012	SD-MN-SF_Whetsone_02	256	2.9056
DANR WQM	WQM91	05/09/2013	SD-MN-SF_Whetsone_02	8.5	51.5632
DANR WQM	WQM91	08/08/2013	SD-MN-SF_Whetsone_02	45.6	2.9056
DANR WQM	WQM91	05/13/2014	SD-MN-SF_Whetsone_02	435	91.2075
EDWDD	WQM91	05/20/2014	SD-MN-SF_Whetsone_02	52.9	47.6528
EDWDD	WQM91	06/03/2014	SD-MN-SF_Whetsone_02	985	912.6939
EDWDD	WQM91	06/18/2014	SD-MN-SF_Whetsone_02	585	105.4382
EDWDD	WQM91	07/01/2014	SD-MN-SF_Whetsone_02	211	44.8500
EDWDD	WQM91	07/15/2014	SD-MN-SF_Whetsone_02	89.4	14.3290
EDWDD	WQM91	07/29/2014	SD-MN-SF_Whetsone_02	188	10.6490
DANR WQM	WQM91	08/07/2014	SD-MN-SF_Whetsone_02	249	7.3140
EDWDD	WQM91	08/12/2014	SD-MN-SF_Whetsone_02	770	122.5900
EDWDD	WQM91	08/26/2014	SD-MN-SF_Whetsone_02	93.4	27.3700
EDWDD	WQM91	09/09/2014	SD-MN-SF_Whetsone_02	727	10.3500
EDWDD	WQM91	05/05/2015	SD-MN-SF_Whetsone_02	63.1	6.1180
DANR WQM	WQM91	05/07/2015	SD-MN-SF_Whetsone_02	2420	5.9570
EDWDD	WQM91	05/19/2015	SD-MN-SF_Whetsone_02	413	26.2200
EDWDD	WQM91	06/02/2015	SD-MN-SF_Whetsone_02	299	13.0410
EDWDD	WQM91	06/16/2015	SD-MN-SF_Whetsone_02	520	5.4740
EDWDD	WQM91	06/30/2015	SD-MN-SF_Whetsone_02	591	6.7850
EDWDD	WQM91	07/14/2015	SD-MN-SF_Whetsone_02	629	7.9810
EDWDD	WQM91	07/28/2015	SD-MN-SF_Whetsone_02	9210	8.5560
EDWDD	WQM91	08/11/2015	SD-MN-SF_Whetsone_02	461	4.8760
EDWDD	WQM91	08/25/2015	SD-MN-SF_Whetsone_02	128	10.7870
EDWDD	WQM91	09/09/2015	SD-MN-SF_Whetsone_02	328	3.5880
EDWDD	WQM91	09/22/2015	SD-MN-SF_Whetsone_02	1300	2.9056
DANR WQM	WQM91	05/12/2016	SD-MN-SF_Whetsone_02	187	14.4900
EDWDD	WQM91	05/24/2016	SD-MN-SF_Whetsone_02	213	7.2450
EDWDD	WQM91	06/07/2016	SD-MN-SF_Whetsone_02	53.7	NA
EDWDD	WQM91	06/21/2016	SD-MN-SF_Whetsone_02	228	NA
EDWDD	WQM91	07/05/2016	SD-MN-SF_Whetsone_02	794	NA
EDWDD	WQM91	07/19/2016	SD-MN-SF_Whetsone_02	156	NA
EDWDD	WQM91	08/02/2016	SD-MN-SF_Whetsone_02	743	NA
DANR WQM	WQM91	08/11/2016	SD-MN-SF_Whetsone_02	2910	NA
EDWDD	WQM91	08/17/2016	SD-MN-SF_Whetsone_02	2420	NA
EDWDD	WQM91	08/31/2016	SD-MN-SF_Whetsone_02	209	NA

Project	Station ID	Sample Date	Assessment Unit ID	E. coli #/100mL	Flow (cfs)
EDWDD	WQM91	09/27/2016	SD-MN-SF_Whetsone_02	1200	NA

UMR=Upper Minnesota River Watershed Assessment Project

DANR WQM=DANR Ambient Surface Water Quality Monitoring Project

EDWDD=East Dakota Water Development District-Water Quality Monitoring Project.

NA=Not Available

Impairment Analysis Data= All data in Appendix A.

TMDL Development Data= All UMR3 *E. coli* data used in the TMDL analysis for Segment 01. All *E. coli* data from WQM 91 except those concentrations without a paired flow value were used in the TMDL analysis for Segment 02. WQM 90 *E. coli* data not used in the TMDL analysis for Segment 02 only for impairment analysis.

Appendix B

EPA Approval Letter and Decision Document

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

June 8, 2022

Ref: 8WD-CWS

SENT VIA EMAIL

Hunter Roberts, Secretary
South Dakota Department of Agriculture and Natural Resources
Hunter.Roberts@state.sd.us

Re: Approval of *Escherichia coli* Bacteria Total Maximum Daily Load Evaluations for the South Fork Whetstone River, Grant County, South Dakota

Dear Mr. Roberts,

The U.S. Environmental Protection Agency (EPA) has completed review of the total maximum daily loads (TMDLs) submitted by your office on May 31, 2022. In accordance with the Clean Water Act (33 U.S.C. §1251 *et. seq*.) and the EPA's implementing regulations at 40 C.F.R. Part 130, the EPA hereby approves South Dakota's TMDL for segment 1 and 2 of the South Fork Whetstone River. The EPA has determined that the separate elements of the TMDLs listed in the enclosure adequately address the pollutant of concern, are designed to attain and maintain applicable water quality standards, consider seasonal variation and include a margin of safety. The EPA's rationale for this action is contained in the enclosure.

Thank you for submitting these TMDLs for our review and approval. If you have any questions, please contact Amy King on my staff at (303) 312-6708.

Sincerely,

Judy Bloom, Manager
Clean Water Branch

Enclosure:
EPA Decision Rationale – South Fork Whetstone Segments 1 and 2 *E. coli* TMDLs

Cc: Barry McLaury, Watershed Protection Program Administrator, South Dakota DANR
Paul Lorenzen, Environmental Scientist Manager – TMDL Team Leader, South Dakota DANR

EPA TOTAL MAXIMUM DAILY LOAD (TMDL) DECISION RATIONALE

TMDL: *Escherichia coli* Bacteria Total Maximum Daily Load Evaluations for the South Fork Whetstone River, Grant County, South Dakota

ATTAINS TMDL ID: R8-SD-2022-02

LOCATION: Grant and Codington counties, South Dakota

IMPAIRMENTS/POLLUTANTS: The TMDL submittal addresses two river segments both with a recreation use that is impaired due to elevated levels of *Escherichia coli* (*E. coli*) bacteria.

Waterbody/Pollutant Addressed in this TMDL Action

Assessment Unit ID	Waterbody Description	Pollutant Addressed
SD-MN-R-WHETSTONE_S_FORK_01	South Fork Whetstone River (Headwaters to Lake Farley)	*E. coli*
SD-MN-R-WHETSTONE_S_FORK_02	South Fork Whetstone River (Lake Farley to mouth)	*E. coli*

BACKGROUND: The South Dakota Department of Agriculture and Natural Resources (DANR) submitted to EPA the final *E. coli* TMDLs for segments 01 and 02 of the South Fork Whetstone River with a letter requesting review and approval dated May 31, 2022. EPA previously reviewed and provided staff comments on draft versions of the report but did not submit comments during the subsequent public comment period (April 28, 2022 to May 30, 2022).

The submittal included:

- Letter requesting EPA's review and approval of the TMDL
- Final TMDL report
- Data appendices

APPROVAL RECOMMENDATIONS: Based on the review presented below, the reviewer recommends approval of the final South Fork Whetstone River segments 01 and 02 *E. coli* TMDLs. All the required elements of an approvable TMDL have been met.

TMDL Approval Summary	
Number of TMDLs Approved:	2
Number of Causes Addressed by TMDLs:	2

REVIEWER: Amy King, EPA

The following review summary explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with Section 303(d) of the Clean Water Act (CWA), and EPA's implementing regulations in 40 C.F.R. Part 130.

EPA REVIEW OF THE SOUTH FORK WHETSTONE RIVER SEGMENTS 01 AND 02 *E. COLI* TMDLS

This TMDL review document includes EPA's guidelines that summarize the currently effective statutory and regulatory requirements relating to TMDLs (CWA Section 303(d) and 40 C.F.R. Part 130). These TMDL review guidelines are not themselves regulations. Any differences between these guidelines and EPA's regulations should be resolved in favor of the regulations themselves. The italicized sections of this document describe the information generally necessary for EPA to determine if a TMDL submittal fulfills the legal requirements for approval. The sections in regular type reflect EPA's analysis of the state's compliance with these requirements. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal must clearly identify (40 C.F.R. §130.7(c)(1)):

- *the waterbody as it appears on the State's/Tribe's 303(d) list;*
- *the pollutant for which the TMDL is being established; and*
- *the priority ranking of the waterbody.*

The TMDL submittal must include (40 C.F.R. §130.7(c)(1); 40 C.F.R. §130.2):

- *an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading (e.g., lbs. per day);*
- *facility names and NPDES permit numbers for point sources within the watershed; and*
- *a description of the natural background sources, and the magnitude and location of the sources, where it is possible to separate natural background from nonpoint sources.*

This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

- *the spatial extent of the watershed in which the impaired waterbody is located;*
- *the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);*
- *population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;*
- *present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and*
- *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.*

Segments 01 and 02 of South Fork Whetstone River are located in northeastern South Dakota and are part of the larger Minnesota River Basin. Segment 01 extends from its headwaters 21.7 miles to Lake Farley and is identified as SD-MN-R-WHETSTONE_S_FORK_01. Downstream, segment 02 extends for 9 miles from Lake Farley to the mouth of the Whetstone River and is identified as SD-MN-R-WHETSTONE_S_FORK_02. The entire drainage area is 88,323 acres in HUC 07020001, divided almost evenly between the segment 01 and 02 drainages. Nearly 99 percent of the drainage is located in

Grant County. Figure 1 displays the general location of the South Fork Whetstone watershed within the state. Figure 2 shows the impaired segments, with segment 01 illustrated in green and segment 02 in yellow, water quality and flow monitoring locations, permit outfalls, and the nearby towns of Milbank and Twin Brooks. Figure 2 incorrectly shows segment 01 encompassing Lake Farley. The correct segment description defines the river's spatial extent extending from its headwaters to the lake. South Dakota's geospatial files will be updated during the 2024 list cycle to correctly display segment 01 ending at the head of the lake. This submittal does not include a TMDL or address an impairment in Lake Farley.

Both segments were first identified as impaired by *E. coli* and placed on South Dakota's 303(d) list in 2012 and remained as impairments on subsequent list cycles. They were assigned a high priority (i.e., 1) for TMDL development on the most recent EPA-approved 303(d) list in 2022. This priority ranking information is contained on pages 1 and 2, which summarize TMDL components for each segment. No other known impairments exist for these segments, nor have any previous TMDLs been developed for the South Fork Whetstone River.

Watershed Characteristics (p. 3-4), Figure 3, and Table 1 summarize the land use distribution draining into the impaired segments, which is predominantly row crops (45.56%) and grassland/pasture (33.47%) with portions of alfalfa (5.44%), wetlands (4.72%), and developed land (4.39%). The headwaters to the west originate in the Choteau des Prairies and contain the majority of grassland/pasture. Moving east, the watershed becomes relatively flat and dominated by row crops (corn and soybeans), along with alfalfa. The developed area of the town of Milbank is to the east along the southern edge of the watershed, near Lake Farley and the origin of segment 02.

Nonpoint Sources (p. 19-21) characterizes the nonpoint sources into categories of agriculture, human (i.e., septic systems), and natural background/wildlife. DANR quantified *E. coli* production from these sources using population estimates, geographic information system (GIS) analysis, and the Bacterial Indicator Tool (EPA, 2000) with information provided by U.S. Department of Agriculture, South Dakota Game Fish and Parks, and local municipalities (Table 6).

Point Sources (p. 17-19) describe the permitted point sources by facility name, permit number, and discharge characteristics. The City of Milbank operates a wastewater treatment facility (WWTF; SD0020371) that discharges *E. coli* directly to South Fork Whetstone River segment 02. This permit is currently in the renewal process (anticipated completion in 2022) and the updated permit will include effluent limits for *E. coli* rather than fecal coliform. The updated permit limits will be consistent with the single sample maximum and geometric mean criteria for the limited contact recreation use. The most recent inspection report (2021) notes no fecal or total coliform exceedances since the prior 2020 inspection. The City of Milbank also operates a water distribution system (SDG860025); however, this facility does not have effluent limits for *E. coli* and is not expected to be a source of bacteria.

The Valley Queen Cheese (VQC) WWTF (SD0027987) also discharges directly to segment 02. This permit is also in the renewal process (anticipated completion in 2022) and VQC proposed upgrades to increase the capacity of the facility. Effluent limits are currently consistent with the limited recreation water quality criteria and are expected to remain unchanged in the updated permit. All measurements from July 2019 to August 2021 were below effluent limits. The capacity of this facility is expected to increase, so this TMDL submittal incorporates the average design flow for the updated facility. DANR also notes numerous animal feeding areas are located within the watershed, although none are permitted Concentrated Animal Feeding Operations (CAFOs).

Assessment: EPA concludes that DANR adequately identified the impaired waterbodies, the pollutant of concern, the priority ranking, the identification, location and magnitude of the pollutant sources, and the important assumptions and information used to develop the TMDLs.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal 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 antidegradation policy (40 C.F.R. §130.7(c)(1)); and*
- *a numeric water quality target for each TMDL. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal (40 C.F.R. §130.2(i)).*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

Water Quality Standards (p. 8-10) describes the water quality standards applicable to the impaired segments with citations to relevant South Dakota regulations. SD-MN-R-WHETSTONE_S_FORK_01 and SD-MN-R-WHETSTONE_S_FORK_02 are designated the following beneficial uses:

- warmwater marginal fish life propagation,
- limited contact recreation,
- fish and wildlife propagation, recreation, and stock watering,
- irrigation waters.

All numeric criteria applicable to these uses are presented in Table 2. DANR determined that *E. coli* is preventing the river's limited contact recreation use from being fully supported. Numeric *E. coli* criteria established to protect this recreation use are comprised of a 30-day mean criterion (≤ 630 colony forming units per 100 milliliters [CFU/100mL]) and a single sample maximum criterion (≤ 1,178 CFU/100mL) (Table 2 and E. coli *Water Quality Criteria*, p. 10). These criteria are seasonally applicable from May 1 to September 30.

The numeric *E. coli* criteria for limited contact recreation waters are applied directly as water quality targets for these TMDLs (*Numeric TMDL Targets*, p. 11-15). DANR expects that meeting the numeric *E. coli* criteria will lead to conditions necessary to support any relevant narrative criteria. A special two-year assessment project was performed, which provided an opportunity to calculate monthly geometric means; however, long-term data collection is expected to include monthly or bi-monthly sample frequencies. The data from this special study indicate exceedance of the geometric mean criterion. Exceedance of the single sample maximum criterion was observed in both the special study and the longer-term sampling data. The TMDL numeric target applicable to both segments is based on the single sample maximum criterion (1,178 CFU/100mL) as future monitoring is not expected to have sufficient frequency to assess compliance with the geometric mean criterion. DANR demonstrates in *Numeric*

TMDL Targets (p. 11-15) that attaining the single sample maximum target will also achieve the geometric mean criterion.

The TMDLs are consistent with South Dakota antidegradation policies because they provide recommendations and establish pollutant limits at water quality levels necessary to meet criteria and fully support existing beneficial uses.

Assessment: EPA concludes that DANR adequately described the applicable water quality standards and numeric water quality target for these TMDLs.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

The TMDL submittal must include the loading capacity for each waterbody and pollutant of concern. 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 TMDL submittal must:

- *describe the method used to establish 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;*
- *contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling; and*
- *include a description and summary of the water quality data used for the TMDL analysis.*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation (40 C.F.R. §130.2).

The full water quality dataset should be made available as an appendix to the TMDL or as a separate electronic file. Other datasets used (e.g., land use, flow), if not included within the TMDL submittal, should be referenced by source and year. The TMDL analysis should make use of all readily available data for the waterbody unless the TMDL writer determines that the data are not relevant or appropriate.

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). Most TMDLs should be expressed as daily loads (USEPA. 2006a). If the TMDL is expressed in terms other than a daily load (e.g., annual load), the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen.

The TMDL submittal must describe the critical conditions and related physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions (e.g., stream flow, temperature, loads) in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. TMDLs should define the applicable critical conditions and describe the approach used to estimate both point and nonpoint source loads under such critical conditions.

DANR relied on the load duration curve approach to define the *E. coli* loading capacities for South Fork Whetstone River segments 01 and 02. A load duration curve is a graphic representation of pollutant loads across various flows. The approach correlates water quality conditions to stream flow and provides insight into the variability of source contributions. EPA has published guidance on the use of duration curves for TMDL development (USEPA, 2007) and the practice is well established.

Using this approach, DANR set the TMDLs equivalent to the loading capacity, which is the sum of the load allocations, wasteload allocations, and margin of safety (MOS is 10% of the total loading capacity), and expressed the TMDLs in CFUs per day at different flow zones (i.e., high, moist, mid-range, dry, and low for segment 01 and high, moderate, dry, and flow for segment 02). The TMDLs are not expressed as a load or mass, but instead as a number of organisms per day due to the nature of the pollutant. This approach is consistent with EPA guidance and the flexibility offered in 40 CFR §130.3(i) to express TMDLs in other appropriate, non-mass-based measures (USEPA, 2001).

The load duration curve for segments 01 and 02 are shown visually in Figures 7 and 9, respectively. The number of flow zones differs by segment because point source discharges in segment 02 result in effluent driven conditions impacting the minimum flow (illustrated by the load duration curve in Figure 8). Figures 7 and 9 demonstrate the load duration curves, representing the loading capacity, calculated with the numeric TMDL target and estimated flow compared to instantaneous loads calculated from the monitoring dataset. The monitoring data used to develop the load duration curves and calculate existing loads are summarized in the *Technical Analysis* section (p. 22-26) and provided fully in Appendix A. Tables 9 and 10 summarize the 95th percentile existing loads and loading capacity by flow regime for South Fork Whetstone River segments 01 and 02, respectively. DANR described conditions associated with each flow regime in sub-sections below each of these tables.

DANR demonstrated the cause-and-effect relationship between sources and the water quality target at various flow conditions by supplementing the pattern of observed exceedances in each flow zone with known characteristics of various source categories as investigated and described in *Significant Sources* (p. 17-21). Loading sources were characterized and quantified using multiple approaches. Two National Pollutant Discharge Elimination System (NPDES) permitted facilities were identified as sources to segment 02 and their contributions were estimated using effluent limits and flows from discharge monitoring reports for the Millbank WWTF and the VQC WWTF average facility design condition (*Point Sources*, p. 17-19; Table 5). DANR estimated relative nonpoint source contributions, including agricultural livestock, wildlife (natural background), and human sources, using bacteria production rates from the Bacterial Indicator Tool (EPA, 2000; Table 6). Livestock grazing was identified as the main source of bacteria loading in the watershed (p. 21).

While the loading capacity is defined for multiple stream flow conditions, DANR described the critical conditions when bacteria loading to South Fork Whetstone River segments 01 and 02 are greatest as periods of high to moderate flows (*Critical Conditions*, p. 37; Figures 7 and 9). These flow conditions are typically associated with snowmelt and heavy precipitation in the spring and early summer. However, high *E. coli* concentrations have been observed throughout the recreation period and reduction goals and allocations are provided for each flow regime to meet water quality standards from May 1 through September 30.

Assessment: EPA concludes that the loading capacity was calculated using an acceptable approach, used a water quality target consistent with water quality criteria, and has been appropriately set at a level necessary to attain and maintain the applicable water quality standards. The pollutant loads have been expressed as daily limits. The critical conditions were described and factored into the calculations and were based on a reasonable approach to establish the relationship between the target and pollutant sources.

4. Load Allocation

The TMDL submittal must include load allocations (LAs). EPA regulations define LAs as the portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution and to natural background sources. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, separate LAs should be provided for natural background and for nonpoint sources.

In the rare instance that a TMDL concludes that there are no nonpoint sources or natural background for a pollutant, the load allocation must be expressed as zero and the TMDL should include a discussion of the reasoning behind this decision.

As described in *Load Allocations* (p. 35), DANR established a single LA as the allowable load remaining after accounting for the WLA and explicit MOS (i.e., LA = TMDL – WLA – MOS). Tables 9 and 10 present the LA across the TMDL's different flow regimes in CFUs per day for segments 01 and 02, respectively. This composite LA represents all nonpoint source contributions, both human and natural, as one allocation, however, individual nonpoint source categories, including agriculture, human, and wildlife, were characterized in greater depth in *Nonpoint Sources* (p. 19-21) and *Sample Data* (p. 23-26).

Assessment: EPA concludes that the LAs provided in the TMDLs are reasonable and will result in attainment of the water quality standards.

5. Wasteload Allocations

The TMDL submittal must include wasteload allocations (WLAs). EPA regulations define WLAs as the portion of a receiving water's loading capacity that is allocated to existing and future point sources (40 C.F.R. §130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and natural background will result in attainment of the applicable water quality standards, and all point sources have no measurable contribution.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. In some cases, WLAs may cover more than one discharger (e.g., if the source is contained within a general permit).

For segment 01 of the South Fork Whetstone River, DANR established a WLA equal to zero (Table 9). There are no identified point source facilities that discharge to this segment.

Wasteload allocations are established for two NPDES-regulated WWTFs discharging to segment 02, City of Milbank (SD0020371) and Valley Queen Cheese (SD0027987). These WLAs are identified in Table 10 and discussed in the *Waste Load Allocations* (p. 35-36) and *Point Sources* (p. 17-19) sections. WLAs for both facilities are given in CFUs per day and are set at a constant load throughout all four flow regimes (Table 10). The WLA allocation analysis is detailed *Point Sources* (p. 17-19). The City of Milbank WWTF WLA was calculated using the 80th percentile of observed flows while the Valley Queen Cheese WWTF WLA used the average design flow associated with the forthcoming system upgrades. Both WLAs incorporated the water quality standard value of 1,178 CFU/100mL as the allowable *E. coli* concentration, which is also equal to the permit effluent limit. DANR notes that all discharges are required to meet the limited contact recreation single sample maximum and geometric mean water quality criteria (*Waste Load Allocations*, p. 35-36).

Concentrated Animal Feeding Operations (CAFOs) were mentioned in *Point Sources* (p. 17-19), but no CAFOs were identified in the collective South Fork Whetstone watershed. Therefore, CAFOs were not assigned an allocation within the document and, thus, are given a WLA of zero. The City of Milbank water distribution system (SDG860025) also discharges in the watershed, but it is not a contributing source of *E. coli* and no wasteload allocation was established for this facility.

Assessment: EPA concludes that the WLAs provided in the TMDLs are reasonable, will result in the attainment of the water quality standards and will not cause localized impairments. The TMDLs account for all point sources contributing loads to impaired segments, upstream segments, and tributaries in the watershed.

6. Margin of Safety

*The TMDL submittal must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load allocations, wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). The MOS may be **implicit** or **explicit**.* *If the MOS is **implicit**, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is **explicit**, the loading set aside for the MOS must be identified.*

The TMDLs for the South Fork Whetstone River segments 01 and 02 include an explicit MOS derived as 10% of the loading capacity (*Margin of Safety*, p. 36-37). The explicit MOS is included as a separate allocation in Tables 9 and 10 for segments 01 and 02, respectively, and vary by flow regime. In addition, an implicit MOS is included for segment 02 to account for uncertainty with the effluent driven conditions in that segment. These conservative assumptions are described in *Margin of Safety* (p. 36-37).

Assessment: EPA concludes that the TMDLs incorporate an adequate margin of safety.

7. Seasonal Variation

The TMDL submittal must be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

The variability of measured stream flows and monitored *E. coli* concentrations are summarized in the *Seasonality* section (p. 37). The load duration curve method used to establish the TMDLs incorporates variations in stream flow, which in turn, is influenced by other climatic and human factors that change throughout the year. To account for these variations, DANR developed the TMDLs at different flow zones as listed in Tables 9 and 10 for segments 01 and 02, respectively. In addition to these flow and water quality patterns, the limited recreation water quality criteria have a seasonal component as they apply during the recreation season (May through September).

DANR noted that bacteria concentrations exceed the TMDL targets throughout the different flow regimes of both impaired segments, suggesting that bacteria contamination is continual. The greatest *E. coli* loads are observed during the high and moist or moderate flow zones and are associated with watershed-wide spring snowmelt or intense rainfall events. DANR also notes that bacteria contamination during dry and low flow conditions are likely to be more localized in the riparian zone and direct stream channels. Restoration efforts should account for seasonal patterns to achieve TMDL goals.

Assessment: EPA concludes that seasonal variations were adequately described and considered to ensure the TMDL allocations will be protective of the applicable water quality standards throughout any given year.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by both point and nonpoint sources, EPA guidance (USEPA. 1991) and court decisions say that the TMDL must provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement the applicable water quality standards (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

EPA guidance (USEPA. 1997) also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

The TMDL for segment 02 of the South Fork Whetstone River is developed for an assessment unit impaired by both point and nonpoint sources, thus reasonable assurances must be provided (see *Reasonable Assurance*, p. 39-40). Reasonable assurance justifications are provided for both point and nonpoint sources.

For point sources, the WLAs established for the City of Milbank and Valley Queen Cheese WWTFs are based on an *E. coli* effluent concentration at the TMDL target and facility discharge rates more conservative than using a design capacity flow. Achieving these WLAs, which will be implemented through the NPDES permitting process, is critical to implementation success. DANR provided recommendations to ensure high operational effectiveness including continue with scheduled sewer repair, upgrading treatment systems with new technologies, and monitoring *E. coli* to assess compliance.

Nonregulatory, voluntary-based reasonable assurances are provided for the LAs where the submittal discusses DANR's monitoring strategy to gage TMDL effectiveness in the future (*Adaptive Management and Monitoring Strategy*; p. 38-39) and the core aspects of a TMDL implementation strategy (*Restoration Strategy*; p. 40-41). These assurances include the watershed stewardship and interest from the City of Milbank, Grant County Conservation District, South Dakota Game, Fish, and Parks, Natural Resources Conservation Service, East Dakota Water Development District, and the Northeast Glacial Lakes Watershed Implementation Project. DANR notes that two projects are underway in the watershed focusing on bacteria monitoring and nonpoint source bacteria load reduction. In particular, projects implemented by the Northeast Glacial Lakes Watershed Implementation Project will initially focus on grazing management, which is a primary source of bacteria loading in the watershed, followed by additional phases of implementation (*Restoration Strategy*; p. 40-41). These voluntary-based reasonable assurances also apply to South Fork Whetstone River segment 01, the nonpoint source-only impaired segment contained in this submittal.

Assessment: EPA considered the reasonable assurances contained in the TMDL submittal and concludes that they are adequate to meet the load reductions. Nonpoint source load reductions are expected to occur through the implementation of best management practices ongoing and planned to begin in the future. Point sources with NPDES permits require that effluent limits are consistent with assumptions and requirements of WLAs for the discharges in the TMDL.

9. Monitoring Plan

The TMDL submittal should include a monitoring plan for all:

- *Phased TMDLs; and*
- *TMDLs with both WLA(s) and LA(s) where reasonable assurances are provided.*

Under certain circumstances, a phased TMDL should be developed when there is significant uncertainty associated with the selection of appropriate numeric targets, estimates of source loadings, assimilative capacity, allocations or when limited existing data are relied upon to develop a TMDL. EPA guidance (USEPA. 2006b) recommends that a phased TMDL submittal, or a separate document (e.g., implementation plan), include a monitoring plan, an explanation of how the supplemental data will be used to address any uncertainties that may exist when the phased TMDL is prepared and a scheduled timeframe for revision of the TMDL.

For TMDLs that need to provide reasonable assurances, the monitoring plan should describe the additional data to be collected to determine if the load reductions included in the TMDL are occurring and leading to attainment of water quality standards.

EPA guidance (USEPA. 1991) recommends post-implementation monitoring for all TMDLs to determine the success of the implementation efforts. Monitoring plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

In *Adaptive Management and Monitoring Strategy* (p. 38-39), DANR commits to supporting future water quality monitoring activities and stream flow recording at sites WQM 90 and WQM 91 in segment 02 to judge progress towards achieving the goals outlined in the TMDL. Future sampling may include station(s) in segment 01. This submittal is not considered a phased TMDL, however, DANR maintains the ability to modify the TMDLs and allocations as new data become available using an adaptive management approach in accordance with the TMDL revision process previously recommended by EPA.

Assessment: Monitoring plans are not a required element of EPA's TMDL review and decision-making process. The TMDLs submitted by DANR includes a commitment to monitor progress toward attainment of water quality standards. EPA is taking no action on the monitoring strategy included in the TMDL submittal.

10. Implementation

EPA policy (USEPA. 1997) encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

EPA encourages States/Tribes to include restoration recommendations (e.g., framework) in all TMDLs for stakeholder and public use to guide future implementation planning. This could include identification of a range of potential management measures and practices that might be feasible for addressing the main loading sources in the watershed (see USEPA. 2008b, Chapter 10). Implementation plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

In *Restoration Strategy* (p. 40-41), DANR describes how EPA 319 funding was used to incorporate the South Fork Whetstone watershed into the Northeast Glacial Lakes Implementation Project. Phase 1 of this project will target grazing management to reduce bacteria loading. Bacteria data and a digital feedlot layer will be used to identify potential target areas for implementation. Implementation goals include achieving the TMDL reductions on the impaired segments and ultimately reducing watershed bacteria inputs to protect both upstream and downstream uses.

Assessment: Although not a required element of the TMDL approval, DANR discussed how information derived from the TMDL analysis process can be used to support implementation of the TMDLs. EPA is taking no action on the implementation portion of the TMDL submittal.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. §25.3 and §130.7(c)(1)(ii)).

The final TMDL submittal must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments (40 C.F.R. §25.3 and §25.8). Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

The *Public Participation* section (p. 37-38) explains the public engagement process DANR followed during development of the TMDL. A draft TMDL report was released for public comment from April 28, 2022 to May 30, 2022. The opportunity for public review and comment was posted on DANR's website and announced in two area newspapers: the Watertown Public Opinion and the Grant County Review-Milbank. The public notice letter and draft TMDL document were also provided to the Minnesota Pollution Control Agency and East Dakota Water Development District. No public comments were submitted.

Assessment: EPA has reviewed DANR's public participation process and concludes that DANR involved the public during the development of the TMDLs and provided adequate opportunities for the public to comment on the draft report.

12. Submittal Letter

The final TMDL submittal must 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 (40 C.F.R. §130.7(d)(1)). The final submittal letter should contain such identifying information as the waterbody name, location, assessment unit number and the pollutant(s) of concern.

A transmittal letter with the appropriate information was included with the final TMDL report submission from DANR, dated May 31, 2022 and signed by Paul Lorenzen, Environmental Scientist Manager – TMDL Team Leader, Water Protection Program.

Assessment: EPA concludes that the state's submittal package clearly and unambiguously requested EPA to act on the TMDLs in accordance with the Clean Water Act and the submittal contained all necessary supporting information.

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