E. coli Bacteria TMDL for Spring Creek in Dunn and Mercer Counties, North Dakota

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List of Figures

List of Tables

Appendices

1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Spring Creek watershed encompasses 375,351 acres in Dunn and Mercer Counties, North Dakota (Table 1 and Figure 1). For the purposes of this TMDL, the watershed of the impaired segments comprise approximately 293,849 acres, which include 175,837 acres in Dunn County and 118,012 acres in Mercer County. Spring Creek originates in the center of Dunn County and flows through the center portion of Mercer County where it confluences with the Knife River. Spring Creek's impaired stream segments lie within the Northwestern Great Plains (43) level III ecoregion.

Table 1. General Characteristics of the Spring Creek Watershed.

Legal Name	Spring Creek
Stream Classification	Class IA
Major Drainage Basin	Missouri River
8-Digit Hydrologic Unit	10130201
Counties	Dunn and Mercer County
Level III Ecoregion	Northwestern Great Plains (43)
Watershed Area (acres)	293,849

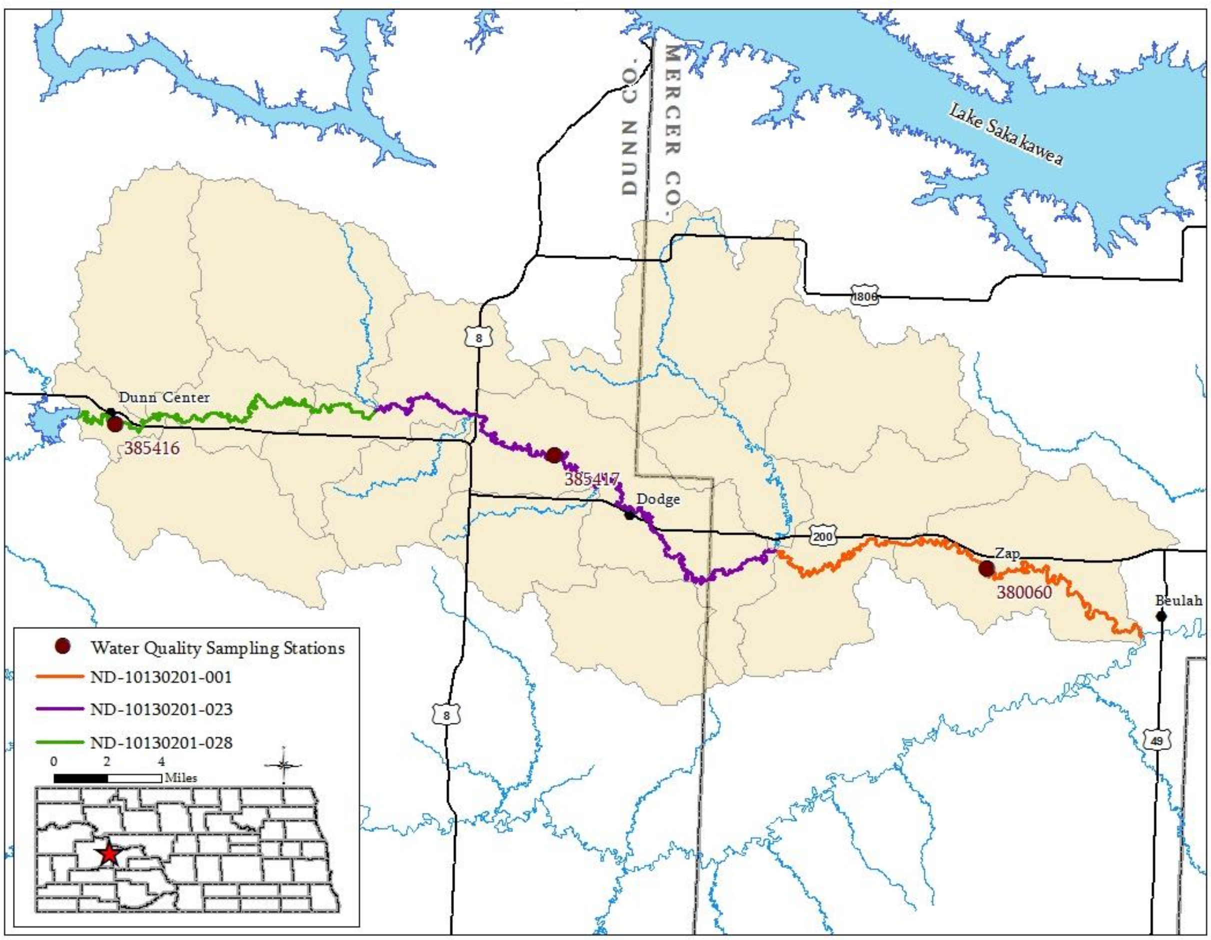


Figure 1. Spring Creek TMDL Listed Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2010 Section 303 (d) List of Impaired Waters Needing TMDLs (NDDoH, 2010), the North Dakota Department of Health (NDDoH) has identified a 23.3 mile segment of Spring Creek from Lake Ilo downstream to its confluence with North Creek (ND-10130201-028-S_00), a 36.36 mile segment of Spring Creek downstream to its confluence with Goodman Creek (ND-10130201-023-S_00), and a 28.56 mile segment of Spring Creek downstream to its confluence with the Knife River (ND-10130201-001-S_00) as fully supporting, but threatened for recreational uses. The impairments are due to E. coli bacteria (Tables 2-4).

Segment ND-10130201-001-S_00 of Spring Creek was originally listed in the 2002 Section 303(d) List for fecal coliform bacteria impairment. Segments ND-10130201-023-S_00 and ND-10130201-028-S_00 of Spring Creek were originally listed in the 1998 Section 303(d) List for fecal coliform bacteria impairment. Currently the State's fecal coliform bacteria water quality standard has been eliminated and replaced with an E. coli bacteria water quality standard. Therefore the TMDL for Spring Creek will be written based on the new E. coli bacteria water quality standard. Please refer to Section 2.2 for more information regarding the bacteria water quality standards change.

Table 2. Spring Creek Section 303(d) Listing Information for Assessment Unit ID ND-10130201-028-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-028-S_00
Waterbody Description	Spring Creek from Lake Ilo downstream to its confluence with North Creek.
Size	23.3 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	E. coli Bacteria
TMDL Priority	High

Table 3. Spring Creek Section 303(d) Listing Information for Assessment Unit ID ND-10130201-023-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-023-S_00
Waterbody Description	Spring Creek from its confluence with North Creek downstream to its confluence with Goodman Creek.
Size	36.36 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	E. coli Bacteria
TMDL Priority	High

Table 4. Spring Creek Section 303(d) Listing Information for Assessment Unit ID ND-10130201-001-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-001-S_00
Waterbody Description	Spring Creek from confluence with Goodman Creek downstream to its confluence with the Knife River.
Size	28.56 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	E. coli Bacteria
TMDL Priority	High

1.2 Ecoregions

The watershed for the Section 303(d) listed segments highlighted in this TMDL lie within the Missouri Plateau (43a) and River Breaks (43c) level IV ecoregions (Figure 2). The Missouri Plateau ecoregion is a semiarid rolling plain of shale, siltstone, and sandstone amongst occasional buttes and badlands. Native grasslands persist in areas of steep or broken topography, but they have been largely replaced by spring wheat and alfalfa over most of the ecoregion. The River Breaks ecoregion form broken terraces and uplands that descend to the Missouri River providing a haven for wildlife. The potential natural vegetation for these ecoregions is mixed-grass prairie (blue grama, western wheatgrass, and buffalograss) with juniper and deciduous trees on northfacing slopes and cottonwoods on the floodplain areas (USGS, 2006).

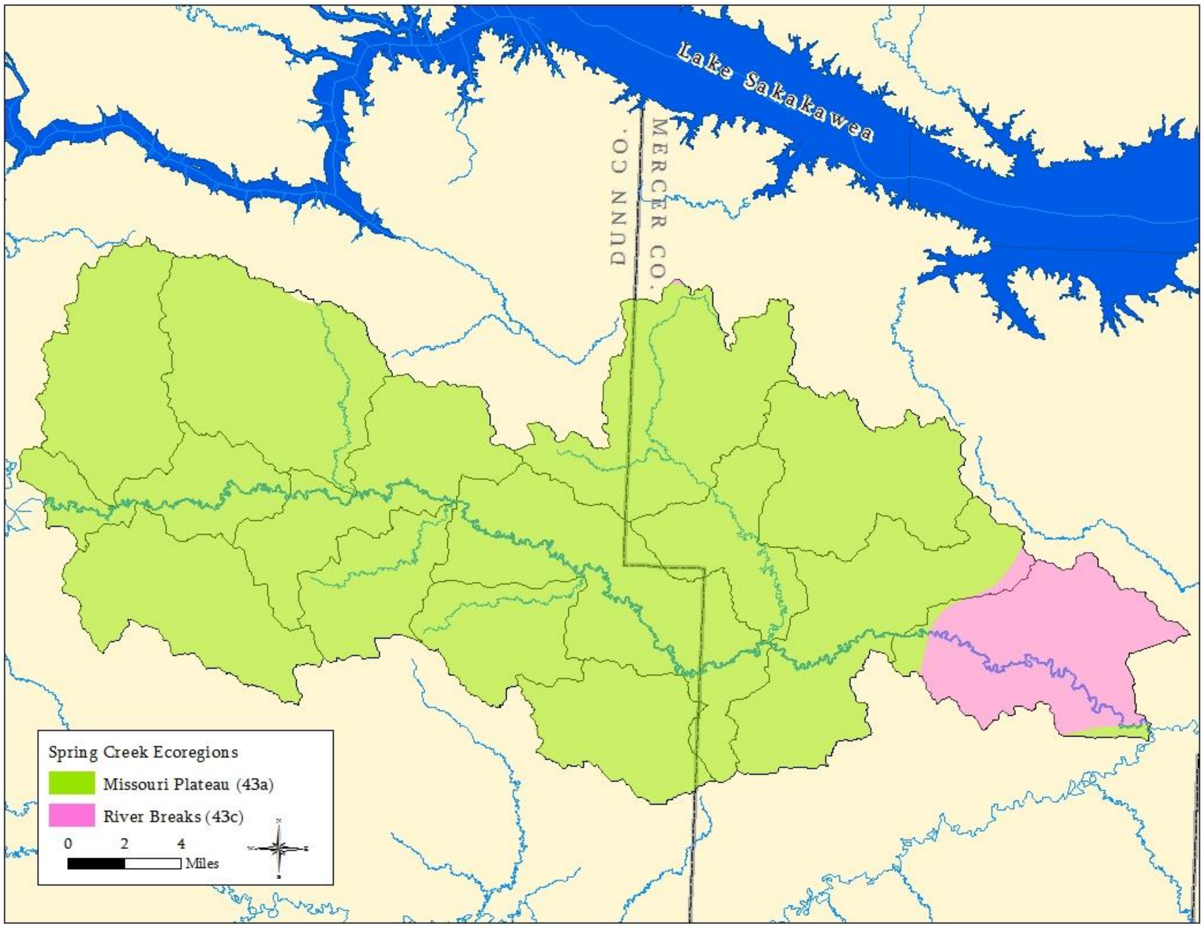


Figure 2. Level IV Ecoregions in the Spring Creek TMDL Listed Watershed.

1.3 Land Use

The dominant land use in the watershed of the Spring Creek TMDL listed segments is grassland. According to the 2010 National Agricultural Statistical Service (NASS) land survey data, approximately 63 percent of the land is grassland, 15 percent is small grain agriculture and 12 percent is pasture, hay and alfalfa. The remaining 10 percent is row crops, developed space, oil seeds, water/wetland, woodlands or fallow. The majority of the crops grown consist of spring wheat, alfalfa, corn, sunflowers, and durum wheat (Figure 3).

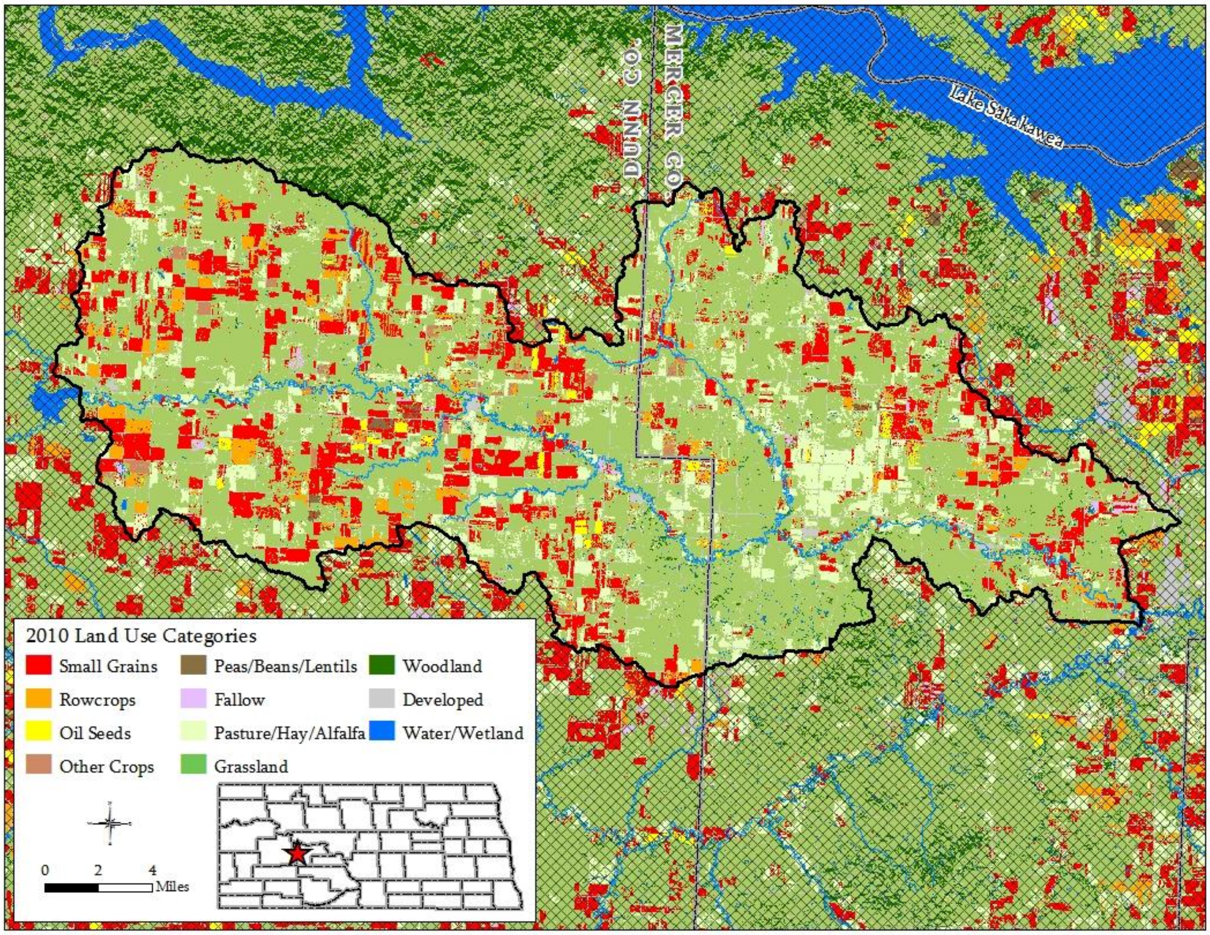


Figure 3. Land Use in the Spring Creek TMDL Listed Watershed (NASS, 2010).

1.4 Climate and Precipitation

North Dakota's climate is characterized by large temperature variation across all time scales, light to moderate irregular precipitation, plentiful sunshine, low humidity, and nearly continuous wind. Its location at the geographic center of North America results in a strong continental climate, which is intensified by the mountains to the west. There are no barriers to the north or south so a combination of cold, dry air masses originating in the far north and warm humid air masses originating in the tropical regions regularly overflow the state. Movement of these air masses and their associated fronts causes near continuous wind and often results in large day to day temperature fluctuations in all seasons. The average last freeze in spring occurs in late May. In the fall, the first 32 degree or lower temperature occurs between September 10th and 25th. However, freezing temperatures have occurred as late as mid-June and as early as mid-August. About 75 percent of the annual precipitation falls during the period of April to September.

The climate of the region varies significantly depending on the season. Climate data for the period of 1994 through 2010 was obtained from the North Dakota Agricultural Network (NDAWN) monitoring station at Hazen, ND, which is located seven miles west of the Spring Creek watershed. The average daily temperature is 42^{o} F, with an average monthly temperature of 69º F in July and 13º F in January (Figure 4). Average annual precipitation is approximately 13 inches for the region, ranging from 7.3 inches in 2004 to 19.2 inches in 2010 (Figure 5).

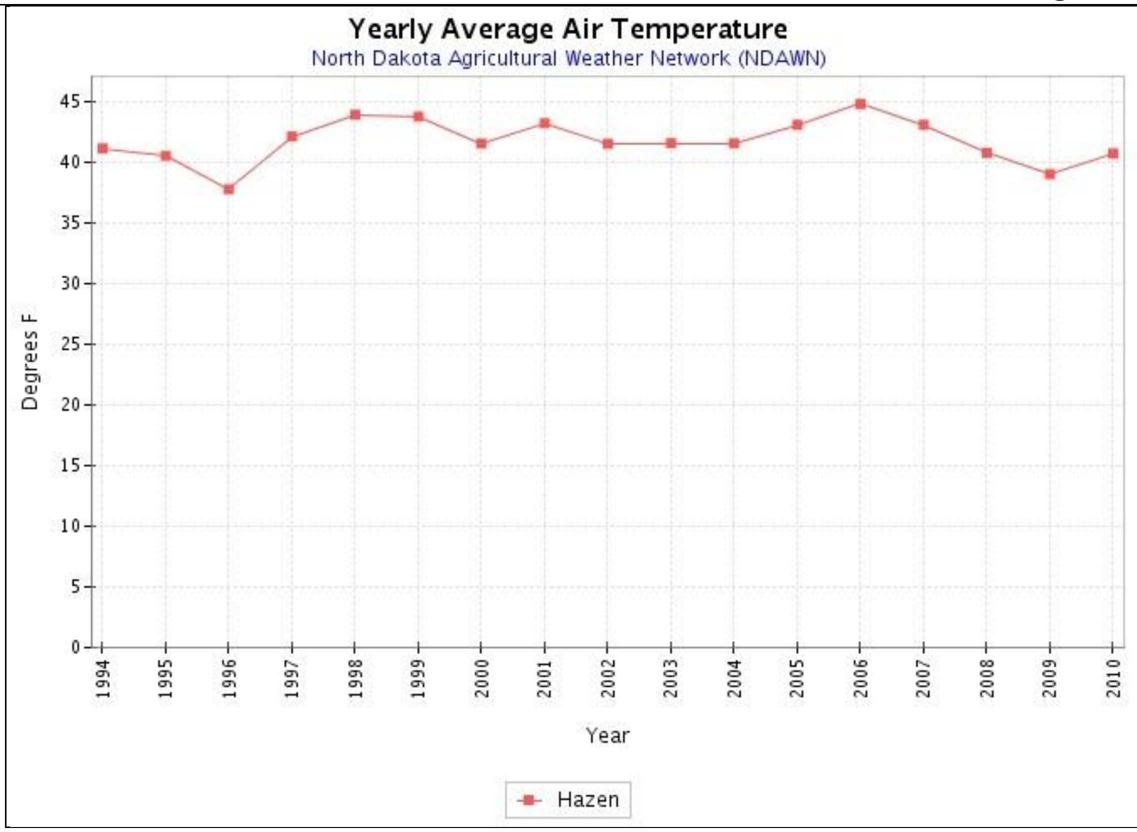


Figure 4. Annual Average Air Temperature at Hazen, North Dakota from 1994-2010. North Dakota Agricultural Weather Network (NDAWN).

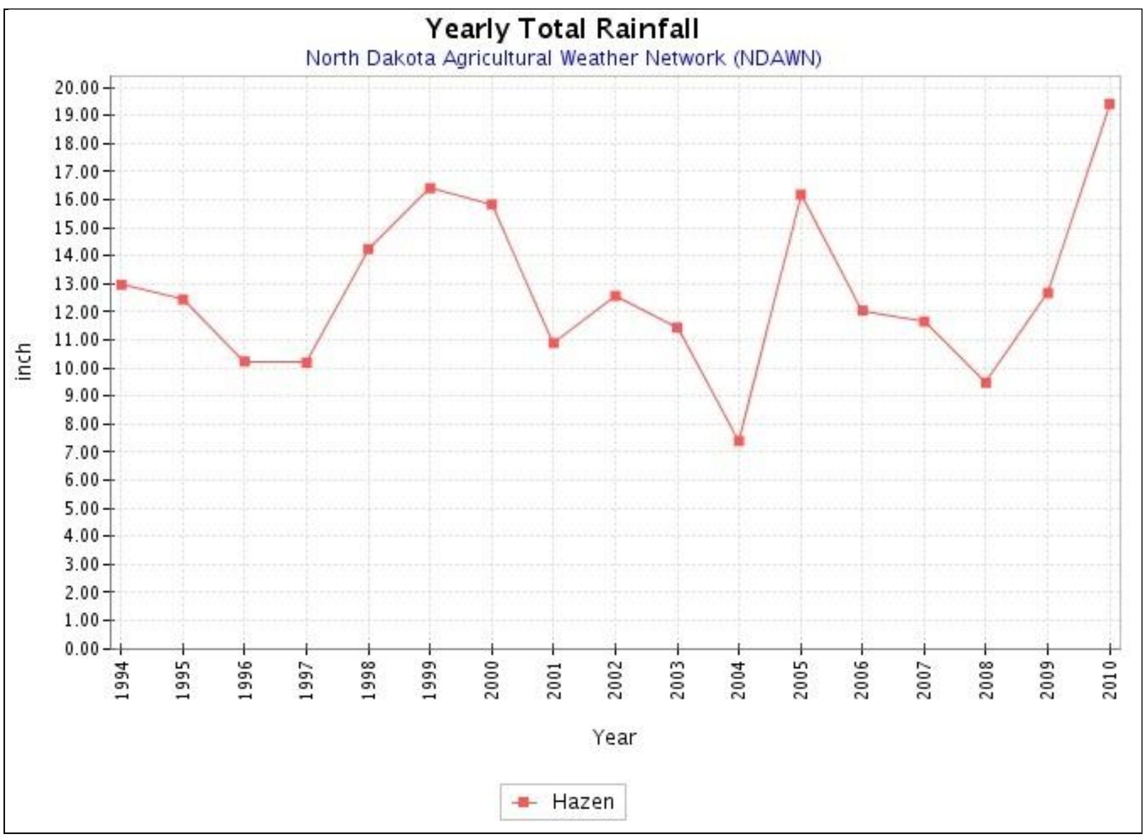


Figure 5. Annual Total Precipitation at Hazen, North Dakota from 1994-2010. North Dakota Agricultural Weather Network (NDAWN).

1.5 Available Data

1.5.1 E. coli Bacteria Data

E. coli bacteria samples were collected at three locations corresponding with each of the three impaired reaches addressed in this TMDL. Monitoring site 380060 is located at Zap, ND and is associated with assessment unit ID ND-10130201-001-S_00; monitoring site 385416 is located one-half mile south of Dunn Center, ND and is associated with assessment unit ID ND-10130201-028-S_00; and monitoring site 385417 is located three miles west and one and one-half miles north of Dodge, ND and is associated with ND-10130201-023-S_00. All sites were sampled weekly or when flow conditions were present during the recreation season (May 1st – September 30th) by the Mercer County Soil Conservation District.

Tables 5-7 provide a summary of E. coli monthly geometric mean concentrations, the percentage of samples exceeding 409 CFU/100mL for each month and the recreational use assessment by month. The monthly geometric mean E. coli bacteria concentration and the percent of samples over 409 CFU/100ml were calculated for each month (May-September) using those samples collected during each month in 2008 and 2009.

Table 5. Summary of E. coli Bacteria Data for Site 380060 Collected in 2008 and 2009.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	10	50	10%	Fully Supporting
June	10	142	30%	Not Supporting
July	9	78	11%	Fully Supporting, but Threatened
August	9	56	0%	Fully Supporting
September	9	70	0%	Fully Supporting

Table 6. Summary of E. coli Bacteria Data for Site 385416 Collected in 2008 and 2009.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	10	38	20%	Fully Supporting, but Threatened
June	10	24	11%	Fully Supporting, but Threatened
July	8	175	25%	Not Supporting
August	8	19	0%	Fully Supporting
September	9	30	0%	Fully Supporting

Table 7. Summary of E. coli Bacteria Data for Site 385417 Collected in 2008 and 2009.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	10	33	0%	Fully Supporting
June	10	79	10%	Fully Supporting
July	9	105	25%	Fully Supporting, but Threatened
August	8	33	0%	Fully Supporting
September	9	35	0%	Fully Supporting

1.5.2 Hydraulic Discharge

The discharge record for the period 1990-2009 was constructed using data obtained from the USGS gauging station 06340000 for TMDL segment ND-10130201-001-S_00. The discharge record for the two upstream TMDL segments, ND-10130201-023-S_00 and ND-10130201-028-S_00, was constructed using the Drainage Area Ratio Method (DARM) (Ries et al., 2000) and the discharge record obtained for USGS gauging station 06340000. USGS gauging station 06340000 is located on Spring Creek at Zap, North Dakota and is collocated with water quality monitoring site 380060 (Figure 1).

2.0 WATER QUALITY STANDARDS

The Clean Water Act requires that Total Maximum Daily Loads (TMDLs) be developed for waters on a state's Section 303(d) list. A TMDL is defined as "the sum of the individual waste load allocations for point sources and load allocations for non point sources and natural background" such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded. The purpose of a TMDL is to identify the pollutant load reductions or other actions that should be taken so that impaired waters will be able to attain water quality standards. TMDLs are required to be developed with seasonal variations and must include a margin of safety that addresses the uncertainty in the analysis. Separate TMDLs are required to address each pollutant or cause of impairment (i.e., E. coli bacteria).

2.1 Narrative North Dakota Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the State. The narrative general water quality standards are listed below (NDDoH, 2011).

- All waters of the State shall be free from substances attributable to municipal, industrial, or other discharges or agricultural practices in concentrations or combinations that are toxic or harmful to humans, animals, plants, or resident aquatic biota.

- No discharge of pollutants, which alone or in combination with other substances shall:

a. Cause a public health hazard or injury to environmental resources;
b. Impair existing or reasonable beneficial uses of the receiving water; or
c. Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set biological goal for all surface waters in the state. The goal states "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites" (NDDoH, 2011).

2.2 Numeric North Dakota Water Quality Standards

Spring Creek is a Class IA stream. The NDDoH definition of a Class IA stream is shown below (NDDoH, 2011).

Class IA- The quality of the waters in this class shall be the same as the quality of class I streams, except that where natural conditions exceed class I criteria for municipal and domestic use, the availability of softening or other treatment methods may be considered in determining whether ambient water quality meets the drinking water requirements of the department.

Effective January 2011, NDDoH revised the State water quality standards. In these latest revisions NDDoH eliminated the fecal coliform bacteria standard, retaining only the E. coli bacteria standard for the protection of recreational uses. This standards change was recommended by the US EPA as E. coli is believed to be a better indicator of recreational use risk (i.e., incidence of gastrointestinal disease).

Table 8 provides a summary of the current numeric E. coli criteria which applies to Class IA streams. The E. coli bacteria standard applies only during the recreation season of May 1 to September 30.

Table 8. North Dakota Bacteria Water Quality Standards for Class IA Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

[1] Expressed as a geometric mean of representative samples collected during any consecutive 30-day period.
[2] No more than ten percent of samples collected during any consecutive 30-day period shall individually exceed the standard.

3.0 TMDL TARGETS

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on state water quality standards, but can also include site specific values when no numeric criteria are specified in the standard. The following TMDL target for Spring Creek is based on the State water quality standard for E. coli bacteria.

3.1 Spring Creek Target Reductions in E. coli Bacteria Concentrations

The three reaches of Spring Creek listed in this TMDL are impaired because of E. coli bacteria. Reaches ND-10130201-028-S_00, ND-10130201-023-S_00 and ND-10130201-

001-S_00 are listed as fully supporting, but threatened for recreational beneficial uses because of E. coli bacteria counts exceeding the North Dakota water quality standard. The North Dakota water quality standard for E. coli bacteria is a geometric mean concentration of 126 CFU/100 mL during the recreation season of May 1 to September 30. Thus, the TMDL target for this report is 126 CFU/100 mL. In addition, no more than ten percent of samples collected for E. coli bacteria should exceed 409 CFU/100 mL.

While the standard is intended to be expressed as the 30-day geometric mean, the target is based on the 126 CFU/100 mL geometric mean standard. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and recreational uses are restored.

4.0 SIGNIFICANT SOURCES

4.1 Point Source Pollution Sources

Within the Spring Creek watershed, there are permitted municipal point sources for the cities of Dunn Center, Dodge and Golden Valley, ND. These facilities are permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program. The city of Dunn Center, ND facility discharges intermittently into Spring Creek, generally for short periods of time. From 1990-2010 the city of Dunn Center discharged 18 times (Appendix D). Each discharge last from 2-9 days and totaled 103.3 million gallons of water. No E. coli bacteria data are available. A wasteload allocation (WLA) is given to the Dunn Center facility as described later in Section 5.4. There have been no discharges in over 20 years for the Dodge (population 125) and Golden Valley (population 189) facilities, and as such, the WLA for these wastewater facilities is zero.

There are no confined animal feeding operations (CAFOs) in the TMDL watershed of Spring Creek. There are three permitted medium (301-999 animal units [Aus]) animal feeding operations (AFOs) in the watershed, however all three AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to Spring Creek. There are several unpermitted AFOs in the watershed, but the exact location and number of these operations is unknown.

4.2 Nonpoint Source Pollution Sources

The data collected during the water quality assessment indicate that the primary nonpoint sources for E. coli bacteria (an indicator of water borne pathogens) in the Spring Creek watershed are as follows:

- Runoff of manure from cropland and pasture if there is knowledge of manure being applied;
- Runoff of manure from animal feeding areas;
- Direct deposit of manure into Spring Creek by livestock; and
- Background levels associated with wildlife

The data collected during the watershed assessment indicate that the primary contributors of E. coli bacteria for the watershed are unpermitted animal feeding areas located in close proximity to Spring Creek and livestock grazing and watering directly in and adjacent to Spring Creek.

With agriculture being the predominant land use, farms and ranches are located throughout the watershed. Livestock production is a dominant agricultural practice in the watershed. The North Dakota Agricultural Statistics Service indicates that out of 53 counties in North Dakota, Dunn County ranked 3rd and Mercer County ranked 18th in livestock production (NASS, 2009).

Wildlife may also contribute to the E. coli bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife are nomadic with fewer numbers concentrated in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

Septic system failure might contribute to the E. coli bacteria in the water quality samples. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g., age, inadequate pumping). Other reasons for failure include improper installation, location and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002).

5.0 TECHNICAL ANALYSIS

In TMDL development, the goal is to define the linkage between the water quality target and the identified source or sources of the pollutant (i.e., E. coli bacteria) to determine the load reduction needed to meet the TMDL target. To determine the cause and effect relationship between the water quality target and the identified source, the “load duration curve” methodology was used.

The loading capacity or total maximum daily load (TMDL) is the amount of a pollutant (e.g. E. coli bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the E. coli bacteria reductions necessary to achieve the water quality standards target for E. coli bacteria of 126 CFU/100 mL with a margin of safety of 10 percent.

5.1 Mean Daily Stream Flow

In west-central North Dakota, rain events are variable, generally occurring during the months of April through August. Rain events can be sporadic and heavy or light, occurring over a short duration. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime. The medium flow regime (moist and dry conditions as depicted in Figures 6-8) is represented by runoff that contributes to the stream over a longer duration. The low flow regime is characteristic of drought or precipitation events of small magnitude and do not contribute to runoff.

The discharge record for TMDL segment ND-10130201-001-S_00 was constructed using data obtained from the USGS gauging station located at Zap, ND (06340000), while the discharge record for the two upstream TMDL segments, ND-10130201-023-S_00 and ND-10130201-028-S_00, was constructed using the Drainage Area Ratio Method (DARM) (Ries et al., 2000) using the discharge record obtained for the downstream USGS gauging station 06340000 as the index station. The DARM assumes that the streamflow at the ungauged site(s) is hydrologically similar (same per unit area) to the stream gauging station used as an index. This assumption is justified since the ungauged sites (385416 and 385417) are located upstream of the index station (06340000) on Spring Creek.

Drainage area for the ungauged sites (385416 and 385417) and index station (06340000) were determined through GIS using digital elevation models (DEMs). Streamflow data for the index station (06340000) was obtained from the USGS Water Science Center website from 1990-2009. The index station (06340000) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged sites to obtain estimated flow statistics for the ungauged sites.

5.2 Flow Duration Curve Analysis

The flow duration curve serves as the foundation for the load duration curve used in the TMDL. Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified time period. A flow duration curve relates flow (expressed as mean daily discharge) to the percent of time those mean daily flow values have been met or exceeded. The use of *"percent of time exceeded"* (i.e., duration) provides a uniform scale ranging from 0 to 100 percent, thus accounting for the full range of stream flows for the period of record. Low flows are exceeded most of the time, while flood flows are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 6). Using this approach, flow duration intervals are expressed as a percentage, with zero corresponding to the highest flows in the record (i.e., flood conditions) and 100 to the lowest flows in the record (i.e., drought). Therefore, as depicted in Figure 6, a flow duration interval of twenty (20) percent, associated with a stream flow of 18 cfs, implies that 20 percent of all observed mean daily discharge values equal or exceed 18 cfs.

Once the flow duration curve is developed for the stream site, flow duration intervals can be defined which can be used as a general indicator of hydrologic condition (i.e. wet vs dry conditions and to what degree). These intervals (or zones) provide additional insight about conditions and patterns associated with the impairment (E. coli bacteria in this case) (USEPA, 2007). As depicted in Figure 6, the flow duration curve was divided into four zones, one representing high flows (0-20 percent), another for moist conditions (20-50 percent), one for dry conditions (50-80 percent) and one for low flows (80-100 percent).

These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot (Figures 6-8). A secondary factor in determining the flow intervals used in the analysis is the number of E. coli bacteria observations available for each flow interval.

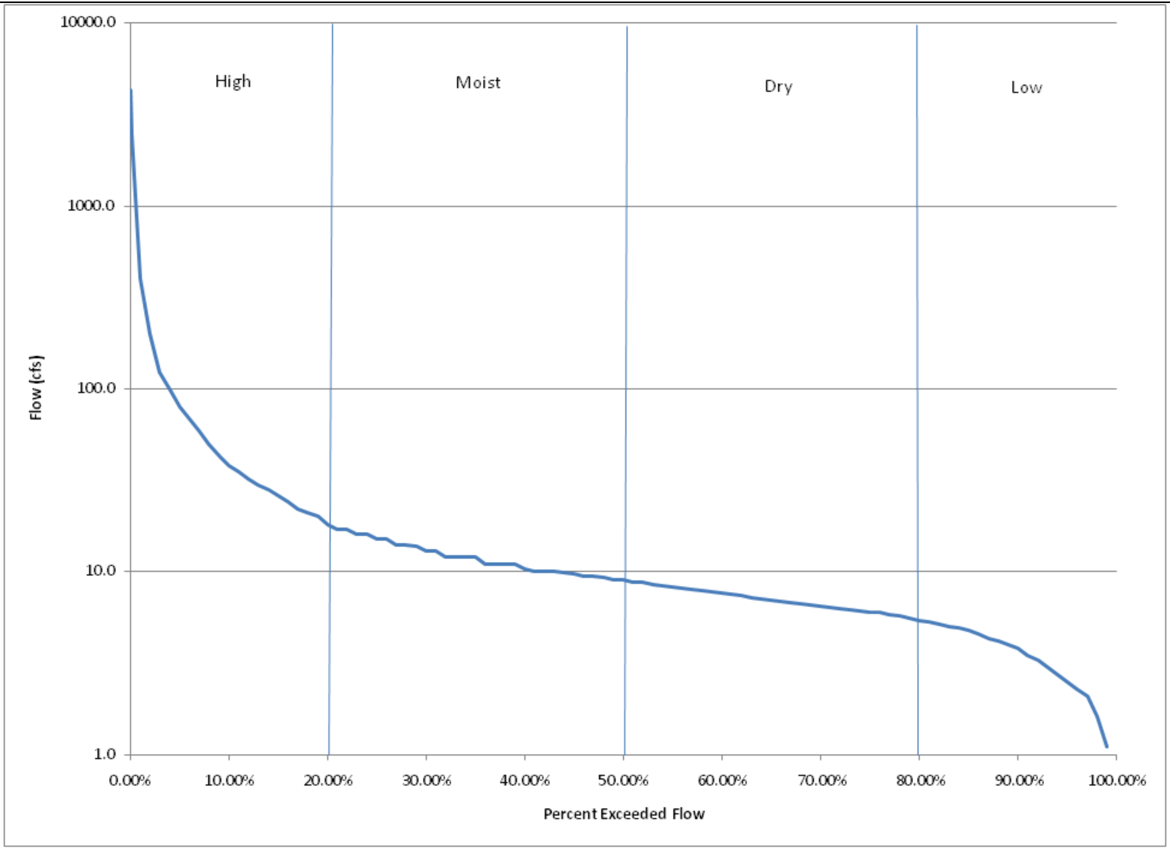


Figure 6. Flow Duration Curve for Spring Creek Monitoring Station 380060.

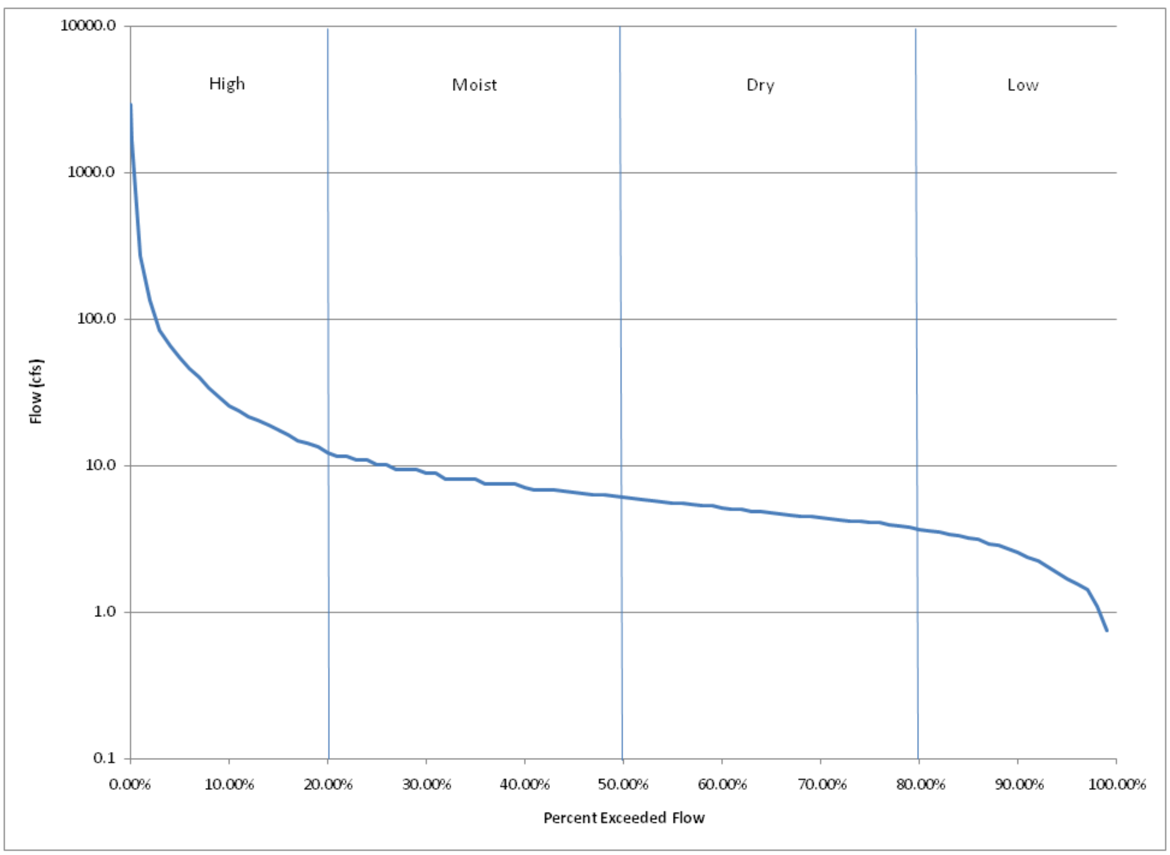


Figure 7. Flow Duration Curve for Spring Creek Monitoring Station 385417.

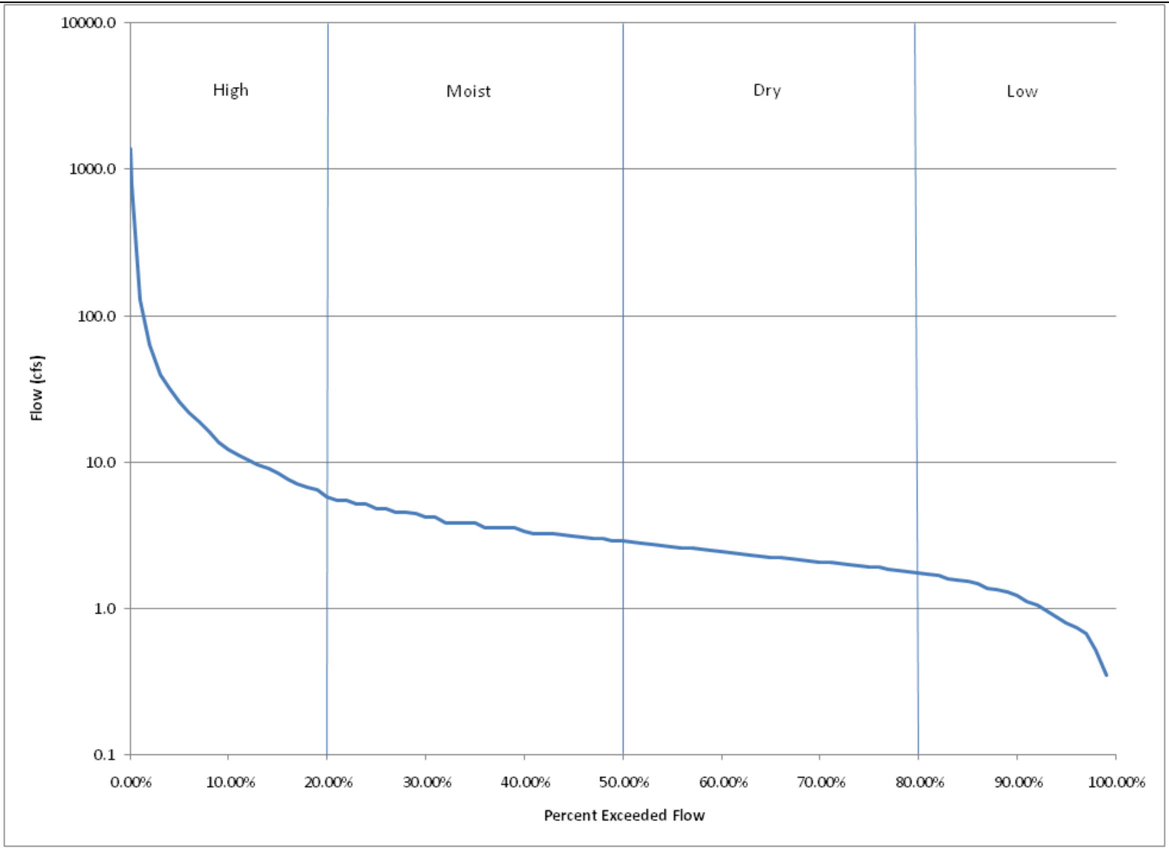


Figure 8. Flow Duration Curve for Spring Creek Monitoring Station 385416.

5.3 Load Duration Analysis

An important factor in determining NPS pollution loads is variability in stream flows and loads associated with high and low flow. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) TMDL listed segments, a load duration curve was developed for Spring Creek. The load duration curves for the three TMDL listed reaches were derived using the E. coli bacteria TMDL target of 126 CFU/100 mL and the flows generated as described in Sections 5.1 and 5.2.

Observed in-stream E. coli bacteria data obtained for monitoring sites 380060, 385417 and 385416 from 2008 and 2009 (Appendix A) were converted to a pollutant load by multiplying E. coli bacteria concentrations by the mean daily flow for the site on the day the sample was collected and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figures 9-11). Points plotted above the 126 CFU/100 mL target curve exceed the State water quality target. Points plotted below the curve are meeting the State water quality target of 126 CFU/100 mL.

For each flow interval or zone with multiple data points above the load duration curve, a regression relationship was developed between the samples which occur above the TMDL target (126 CFU/100 mL) curve and the corresponding percent exceeded flow. The load duration curve for sites 380060, 385417 and 385416 depicting a regression relationship for each flow interval are provided in Figures 9 through 11. As there was only one E. coli bacteria concentration above the TMDL target in the moist and low flow regime for site 380060, dry and low flow regime for site 385417, and moist and dry flow regime for site 385416, the single data point was used to derive the existing load for those flow regimes.

The regression lines for flow regimes with multiple E. coli bacteria concentrations above the TMDL target were then used with the midpoint of the percent exceeded flow for that interval to calculate the existing E. coli bacteria load for that flow interval. For example, in the example provided in Figure 9, the regression relationship between observed E. coli bacteria loading and percent exceeded flow for the high condition and dry condition flow intervals are:

E. coli bacteria load (expressed as 10^7 CFUs/day) = antilog (Intercept + (Slope*Percent Exceeded Flow))

Where the midpoint of the high condition interval from 0 to 20 percent is 10 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (5.96 + (-10.32*0.10))
= 85,210 x 10^7 CFUs/day

Where the midpoint of the dry condition interval from 50 to 80 percent is 65 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (4.02 + (-0.82*0.65))
= 3,089 x 10^7 CFUs/day

The midpoint for the flow intervals is also used to estimate the TMDL target load. In the case of the previous examples, the TMDL target load for the midpoints or 10 and 65 percent exceeded flow derived from the 126 CFU/100 mL TMDL target curves are 11,716 x 10^7 CFUs/day, and 2,158 x 10^7 CFUs/day, respectively.

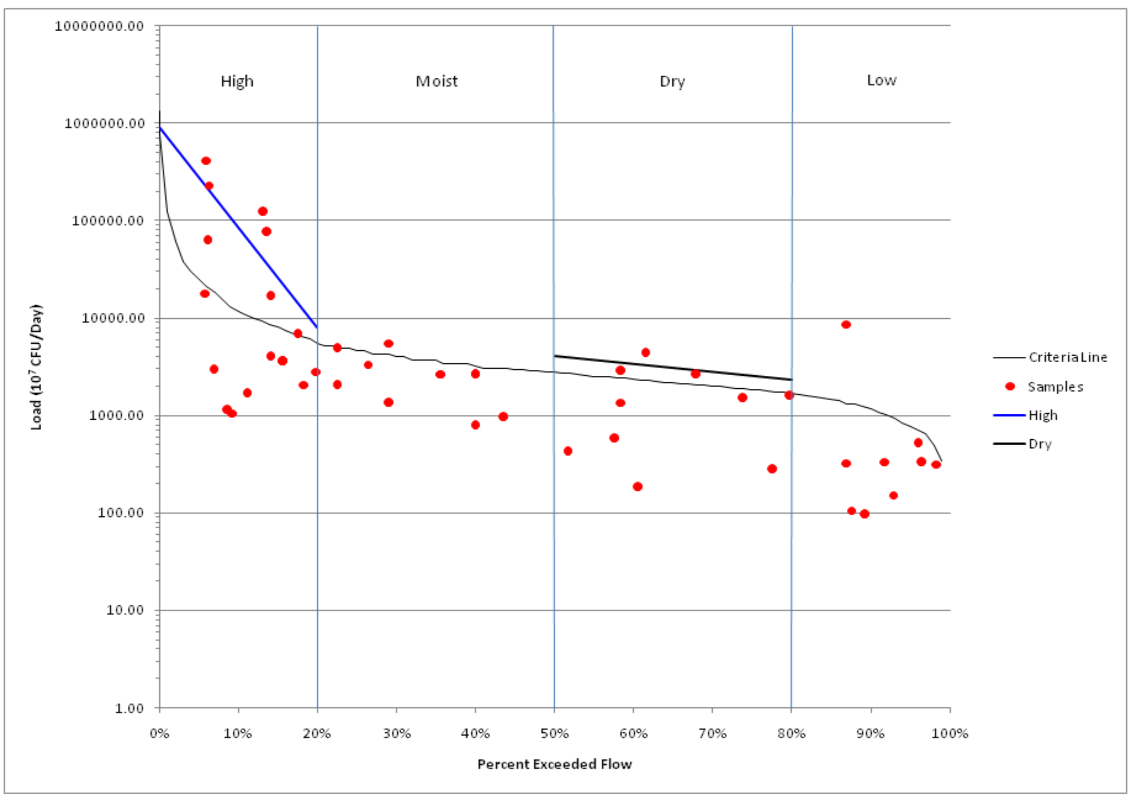


Figure 9. E. coli Bacteria Load Duration Curve for Spring Creek Monitoring Station 380060. The curve reflects flows collected from 1990-2009.

Figure 10. E. coli Bacteria Load Duration Curve for Spring Creek Monitoring Station 385417. The curve reflects flows collected from 1990-2009.

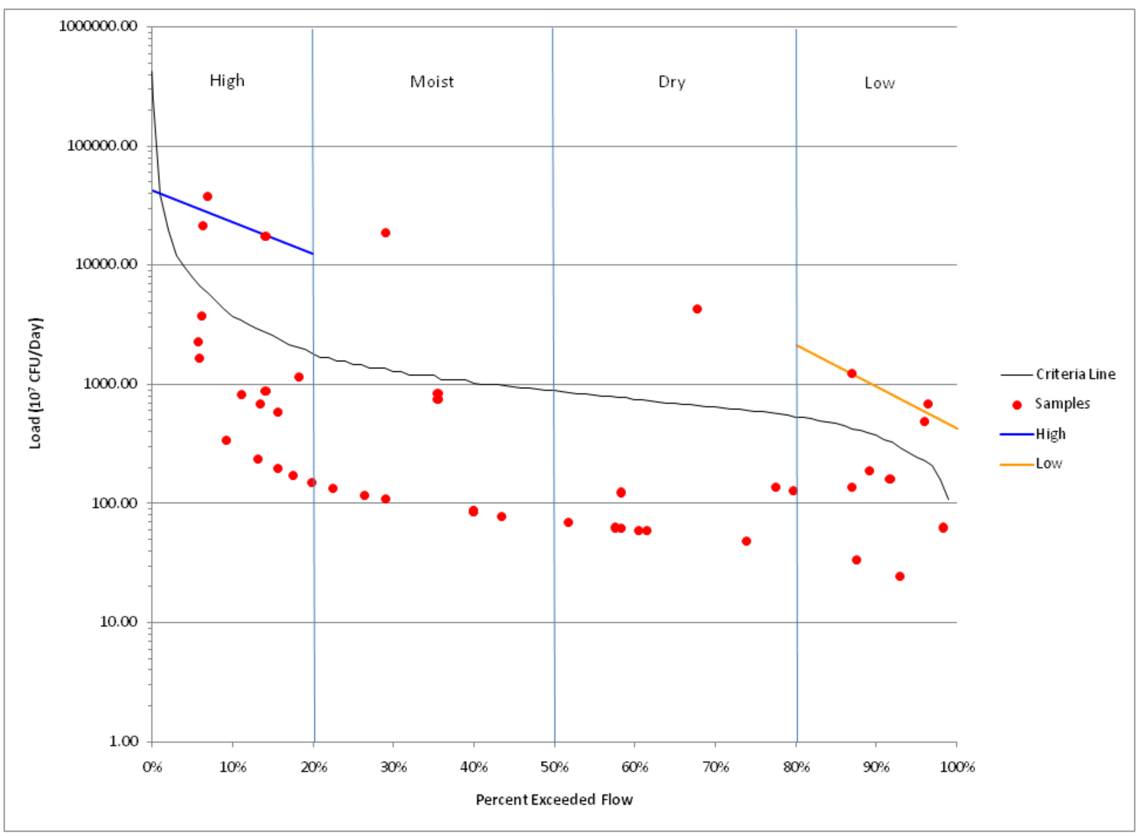


Figure 11. E. coli Bacteria Load Duration Curve for Spring Creek Monitoring Station 385416. The curve reflects flows collected from 1990-2009.

5.4 Waste Load Allocation (WLA) Analysis

According to the NDPDES permit for the city of Dunn Center, ND, the facility is allowed to discharge on an "as needed" basis. The discharge monitoring report (DMR) indicates this wastewater treatment system averages discharges once per year. Based on DMR data, average daily discharge for the years 1990-2010 is 1.56 million gallons per day during the intermittent discharge (Appendix D). Since no E. coli bacteria data are collected for this site, the system is also assigned the water quality standards value of 126 CFU/100mL for this TMDL.

The waste load allocation (WLA) for Dunn Center, ND was determined by taking the median discharge and multiplying by the assumed E. coli bacteria concentration of 126 CFUs/100mL, times appropriate conversion factors.

WLA = 1.56 million gallons/ day * 126 CFUs/100mL

= 1.56 million gallons/day * 3.7854 L/gal*1000mL/L* 126CFUs/100mL

= 74.4 x 10^7 CFUs/day

5.5 Loading Sources

The load reductions needed for Spring Creek E. coli bacteria TMDL can generally be allotted to nonpoint sources. Based on the data available, the general focus of best management practices (BMPs) and load reductions for the listed waterbody should be on unpermitted animal feeding operations and riparian grazing adjacent to or in close proximity to Spring Creek.

Significant sources of E. coli bacteria loading were defined as nonpoint source pollution originating from livestock. One of the more important concerns regarding nonpoint sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, four flow regimes (i.e., high, moist, dry and low conditions) were selected to represent the hydrology of the listed segments on Spring Creek when applicable (Figures 9-11).

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to E. coli bacteria loading. Animals grazing in the riparian area contribute E. coli bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high flow or under moist and dry conditions (Table 9). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and medium impact under moist and dry flows (Table 9). Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for E. coli bacteria contamination.

Table 9. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Nonpoint Sources	Flow Regime		
	High Flow	**Moist Conditions**	**Dry Conditions**
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential importance of nonpoint source area to contribute E. coli bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency (EPA) regulations require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." The margin of safety (MOS) can be either incorporated into conservative assumptions used to develop the TMDL (implicit) or added to a separate component of the TMDL (explicit).

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 126 CFU/100 mL, a ten percent explicit margin of safety was used for this TMDL. The MOS was calculated as ten percent of the TMDL. In other words ten percent of the TMDL is set aside from the load allocation as a MOS. The ten percent MOS was derived by taking the difference between the points on the load duration curve using the 126 CFU/100 mL standard and the curve using the 113 CFU/100 mL.

6.2 Seasonality

Section 303(d)(1)(C) of the Clean Water Act and associated regulations require that a TMDL be established with seasonal variations. The Spring Creek TMDL addresses seasonality because the flow duration curve was developed using 20 years of USGS gauge data encompassing all 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season from May 1 to September 30 and controls will be designed to reduce E. coli bacteria loads during the seasons covered by the standard.

7.0 TMDL

Table 10 provides an outline of the critical elements of the bacteria TMDL for the three TMDL listed segments. TMDLs for Spring Creek (ND-10130201-001-S_00, ND-10130201-023-S_00 and ND-10130201-028-S_00) are summarized in Tables 11 through 13, respectively. The TMDLs provide a summary of average daily loads by flow regime necessary to meet the water quality target (i.e. TMDL). The TMDL for each segment and flow regime provide an estimate of the existing daily load, an estimate of the average daily loads necessary to meet the water quality target (i.e. TMDL load). The TMDL load includes a load allocation from known nonpoint sources and a 10 percent margin of safety.

It should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

Table 10. TMDL Summary for Spring Creek.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutants	E. coli Bacteria	See Section 2.1
E. coli TMDL Target	126 CFU/100 mL	Based on the current state water quality standard for E. coli bacteria.
Significant Sources	Nonpoint Sources	No contributing Point Sources in Subwatershed
Margin of Safety (MOS)	Explicit	10%

The TMDL can be described by the following equation:

TMDL = LC = WLA + LA + MOS

where

LC = loading capacity, or the greatest loading a waterbody can receive without violating water quality standards;

WLA = wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;

LA = load allocation, or the portion of the TMDL allocated to existing or future non-point sources;

MOS = margin of safety, or an accounting of the uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of the loading capacity.

Table 11. E. coli Bacteria TMDL (10^7 CFU/day) for Spring Creek Waterbody ND-10130201-001-S_00 as Represented by Site 380060.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	85,210	5,481	3,089	8,613
TMDL	11,716	3,700[1]	2,158	1,172[1]
WLA	0	0	0	0
LA	10,544	3,330	1,942	1,055
MOS	1,172	370	216	117

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 12. E. coli Bacteria TMDL (10^7 CFU/day) for Spring Creek Waterbody ND-10130201-023-S_00 as Represented by Site 385417.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	21,874	8,736	1,745	5,851
TMDL	7,959	2,513	1,466[1]	796[1]
WLA	0	0	0	0
LA	7,163	2,262	1,319	716
MOS	796	251	147	80

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 13. E. coli Bacteria TMDL (10^7 CFU/day) for Spring Creek Waterbody ND-10130201-028-S_00 as Represented by Site 385416.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	23,095	18,676	4,269	956
TMDL	3,757	1,186[1]	692[1]	376
WLA	74.4	74.4	74.4	74.4
LA	3,307	993	548	264
MOS	376	119	69.2	37.6

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

8.0 ALLOCATION

The point source in the watershed is given a small wasteload allocation based on its historic and future projected discharges, population size, and State water quality standards. The remaining E. coli load allocation for this TMDL is allocated to nonpoint sources in the watershed. The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, or waste management).

Nonpoint source pollution is a contributor to elevated total E. coli bacteria levels in the Spring Creek watershed. The E. coli bacteria samples and load duration curve analysis of the impaired reaches identified moist and low flow regimes for ND-10130201-001-S, dry and low flow regimes for ND-10130201-023-S and moist and dry flow regimes for ND-10130201-028-S as the time of E. coli bacteria exceedences for the 126 CFU/100 mL target. To reduce NPS pollution for the high, moderate, and low flow regimes, specific BMPs are described in Section 8.1 that will mitigate the effects of E. coli bacteria loading to the impaired reaches.

To achieve the TMDL targets identified in the report, it will require the wide spread support and voluntary participation of landowners and residents in the watershed. The TMDLs described in this report are a plan to improve water quality by implementing BMPs through non-regulatory approaches. BMPs are methods, measures, or practices that are determined to be a reasonable and cost effective means for a land owner to meet nonpoint source pollution control needs," (USEPA, 2001). This TMDL plan is put forth as a recommendation for what needs to be accomplished for the Spring Creek watershed to restore and maintain its recreational uses. Water quality monitoring should continue in order to measure BMP effectiveness and determine through adaptive management if loading allocation recommendations need to be adjusted.

Controlling nonpoint sources is an immense undertaking requiring extensive financial and technical support. Provided that technical/financial assistance is available to stakeholders, these BMPs have the potential to significantly reduce E.coli bacteria loading to Spring Creek. The following sections describe in detail those BMPs that will reduce E. coli bacteria levels in the Spring Creek watershed.

8.1 Livestock Management Recommendations

Livestock management BMPs are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock, erosion from poorly managed grazing, land and riparian areas can be a significant source of E. coli bacteria loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody because of livestock. These specific BMPs are known to reduce nonpoint source pollution from livestock.

<u>Livestock exclusion from riparian areas</u>- This practice is established to remove livestock from grazing riparian areas and watering in the stream. Livestock exclusion is accomplished through fencing. A reduction in stream bank erosion can be expected by minimizing or eliminating hoof trampling. A stable stream bank will support vegetation that will hold banks in place and serve a secondary function as a filter from nonpoint source runoff. Added vegetation will create aquatic habitat and shading for macroinvertebrates and fish. Direct deposit of fecal matter into the stream and stream banks will be eliminated as a result of livestock exclusion by fencing.

<u>Water well and tank development</u>- Fencing animals from stream access requires and alternative water source. Installing water wells and tanks satisfies this need. Installing water tanks provides a quality water source and keeps animals from wading and defecating in streams. This will reduce the probability of pathogenic infections to livestock and the public.

<u>Prescribed grazing</u>- This practice is used to increase ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resource Conservation Service (NRCS) recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil

water for plant growth and better manure distribution and increased rate of decomposition, (NRCS, 1998). In a study by Tiedemann et al. (1998), as presented by USEPA (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 14) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month, with water developments and fencing, bacteria levels were reduced significantly.

Table 14. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Grazing Strategy		Geometric Mean Bacteria Count
Strategy A:	Ungrazed	40/L
Strategy B:	Grazing without management for livestock distribution; 20.3 ac/AUM.	150/L
Strategy C:	Grazing with management for livestock distribution: fencing and water developments; 19.0 ac/AUM	90/L
Strategy D:	Intensive grazing management, including practices to attain uniform livestock distribution and improve forage production with cultural practices such as seeding, fertilizing, and forest thinning; 6.9 ac/AUM	950/L

Waste management system- Waste management systems can be effective in controlling up to 90 percent of bacteria loading originating from confined animal feeding areas (Table 15). A waste management system is made up of various components designed to control nonpoint source pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water from the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application of manure is designed to be adaptive to environmental, soil and plant conditions to minimize the probability of contamination of surface water.

Table 15. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

Practice[b] Category	Runoff[c] Volume	Total[d] Phosphorus (%)	Total[d] Nitrogen (%)	Sediment (%)	Fecal Bacteria (%)
Animal Waste System[e]	-	90	80	60	85
Diversion System[f]	-	70	45	NA	NA
Filter Strips[g]	-	85	NA	60	55
Terrace System	-	85	55	80	NA
Containment Structures[h]	-	60	65	70	90

NA = Not Available.
a Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.
b Each category includes several specific types of practices.
c - = reduction; + = increase; 0 = no change in surface runoff.
d Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N and nitrate-N.
e Includes methods for collecting, storing and disposing of runoff and process-generated wastewater.
f Specific practices include diversion of uncontaminated water from confinement facilities.
g Includes all practices that reduce contaminant losses using vegetative control measures.
h Includes such practices as waste storage ponds, waste storage structures and waste treatment lagoons.

8.2 Other Recommendations

Vegetative filter strip- Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, E. coli bacteria to streams. The effectiveness of filter strips and other BMPs in removing E. coli bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993), suggest that vegetative filter strips are capable of removing up to 55 percent of bacteria loading to rivers and streams (Table 15). The ability of the filter strip to remove contaminants is dependent on field slope, filter strip slope, erosion rate, amount and particulate size distribution of sediment delivered to the filter strip, density and height of vegetation, and runoff volume associated with erosion producing events (NRCS, 2001).

Septic System – Septic systems provide an economically feasible way of disposing of household wastes where other means of waste treatment are unavailable (e.g., public or private treatment facilities). The basis for most septic systems involves the treatment and distribution of household wastes through a series of steps involving the following:

1. A sewer line connecting the house to a septic tank
2. A septic tank that allows solids to settle out of the effluent
3. A distribution system that dispenses the effluent to a leach field
4. A leaching system that allows the effluent to enter the soil

Septic system failure occurs when one or more components of the septic system do not work properly and untreated waste or wastewater leaves the system. Wastes may pond in the leach field and ultimately run off directly into nearby streams or percolate into groundwater. Untreated septic system waste is a potential source of nutrients (nitrogen and phosphorus), organic matter, suspended solids, and fecal bacteria. Land application of septic system sludge, although unlikely, may also be a source of contamination.

Septic system failure can occur for several reasons, although the most common reason is improper maintenance (e.g., age, inadequate pumping). Other reasons for failure include improper installation, location and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002).

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDL for Spring Creek and a request for comment was mailed to participating agencies, partners, and to those who request a copy. Those included in the mailing of a hard copy were as follows:

- Mercer County Soil Conservation District;
- Dunn County Soil Conservation District;
- Mercer County Water Resource Board;
- Dunn County Water Resource Board;
- Natural Resource Conservation Service (State Office); and
- U.S. Environmental Protection Agency, Region VIII.

In addition to mailing copies of this TMDL for Spring Creek to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at http://www.ndhealth.gov./WQ/SW/Z2 TMDL/TMDLs Under PublicComment/B Under Public Commment.html . A 30 day public notice soliciting comment and participation was also published in the Dunn County Herald and the Hazen Star.

Comments were only received from US EPA Region 8, which were provided as part of their normal public notice review (Appendix E). The NDDoH's response to these comments are provided in Appendix F.

10.0 MONITORING

As stated previously, it should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

To insure that the BMPs and technical assistance that are implemented as part of the Section 319 Spring Creek watershed project are successful in reducing E. coli bacteria loading to levels prescribed in this TMDL, water quality monitoring will be conducted in accordance with an approved Quality Assurance Project Plan (QAPP). A QAPP will be developed in the fall of 2011 as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s).

11.0 TMDL IMPLEMENTATION STRATEGY

In response to the Spring Creek Watershed Assessment and in anticipation of this completed TMDL, local sponsors successfully applied for and received Section 319 funding for the Spring Creek Watershed Project. Beginning in 2012, local sponsors will provide technical assistance and implement BMPs designed to reduce E. coli bacteria loadings and help restore the beneficial uses of Spring Creek (i.e., recreation). As the watershed restoration project progresses, water quality data will be collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing E. coli bacteria loadings. As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

12.0 REFERENCES

Cleland. 2003. *TMDL Development from the "Bottom Up" – Part III: Duration Curves and Wet Weather Assessment*. America's Clean Water Foundation, Washington, D.C.

NASS. 2009. *North Dakota Agricultural Statistics Service*. Available at http://www.nass.usda.gov/Statistics_by_State/North_Dakota/index.asp.

NDAWN. 2010. Hazen, North Dakota Weather Station. North Dakota Agriculture Weather Network. North Dakota State University, Fargo, North Dakota. Available at http://ndawn.ndsu.nodak.edu/index.html

NDDoH. 2008. Quality Assurance Project Plan for the Spring Creek Watershed Assessment Project Mercer County in North Dakota. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2010. *North Dakota 2010 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads.* North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2011. *Standards of Quality for Waters of the State.* Chapter 33-16-02 of the North Dakota Century Code. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NRCS. 1998. *Natural Resources Conservation Service Practice Specification* 528. USDA-Natural Resources Conservation Service, North Dakota. Available at http://efotg.nrcs.usda.gov

NRCS. 2001. *Natural Resources Conservation Service Practice Specification 393* – Filter Strip (Acres) [Online]. USDA – Natural Resources Conservation Service, North Dakota. Available at http://www.nd.nrcs.usda.gov/resources/section4/standards/Section4.html.

Pennsylvania State University. 1992. Nonpoint Source Database. Pennsylvania State University, Department of Agricultural and Biological Engineering, University Park, PA.

Ries, K. G., III and P.J. Friesz.2000. *Methods for Estimating Low-Flow Statistics for Massachusetts Streams.* U.S. Geological Survey Water Resources Investigations Report 00-4135. U.S. Geological Survey, Reston, VA.

Tiedemann, A.R., D.A. Higgins, T.M. Quigley, H.R. Sanderson, and C. C. Bohn.1988. *Bacterial Water Quality Responses to Four Grazing Strategies – Comparison with Oregon Standards*.

USEPA. 1993. Guidance Specifying Management Measures for Sources of NonpointPollution in Coastal Waters. EPA 840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

USEPA. 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

USEPA. 2002. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008. U. S. Environmental Protection Agency. Office of Water, Office of Research and Development.

USEPA. 2007. An Approach for Using Load Duration Curves in the Development of TMDLs. EPA-841-B-07-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. Available at http://www.epa.gov/owow/tmdl/techsupp.html

USGS. 2006. *Ecoregions of North Dakota*. United States Geological Survey. Available at http://www.npwrc.usgs.gov/resource/habitat/ndsdeco/nodak.html.

Appendix A
E. coli Bacteria Data Collected for Sites 380060, 385416 and 385417 (2008 and 2009)

380060	May		June		July		August		September	
	5/4/2008	10	6/2/2008	70	7/8/2008	60	8/4/2008	90	9/2/2008	90
	5/12/2008	20	6/9/2008	90	7/15/2008	80	8/12/2008	100	9/9/2008	30
	5/19/2008	100	6/16/2008	160	7/22/2008	150	8/18/2008	10	9/15/2008	40
	5/20/2008	120	6/23/2008	20	7/28/2008	800	8/25/2008	20	9/22/2008	30
	5/27/2008	160	6/30/2008	10	7/29/2008	240	8/4/2009	130	9/29/2008	380
	5/4/2009	10	6/1/2009	60	7/6/2009	50	8/12/2009	250	9/8/2009	90
	5/6/2009	10	6/9/2009	1100	7/15/2009	20	8/18/2009	60	9/16/2009	120
	5/11/2009	20	6/16/2009	1700	7/21/2009	40	8/25/2009	60	9/22/2009	100
	5/26/2009	1400	6/22/2009	2400	7/28/2009	40	8/31/2009	40	9/30/2009	30
	5/27/2009	100	6/29/2009	60						
Geomean		50.48343826		141.6721836		77.5493872		56.09622656		70.44513195
% Exceeded 409 CFU/100 mL		10		30		11		0		0
Recreational Use Assessment	FS		NS		FST		FS		FS	
Number of Samples		10		10		9		9		9

FS-Fully Supporting, FST-Fully Supporting, but Threatened and NS-Not Supporting

385416	May		June		July		August		September	
	5/4/2008	10	6/2/2008	10	7/8/2008	380	8/4/2008	90	9/2/2008	260
	5/12/2008	10	6/9/2008	10	7/15/2008	50	8/12/2008	10	9/9/2008	40
	5/19/2008	10	6/16/2008	10	7/22/2008	20	8/18/2008	60	9/15/2008	60
	5/20/2008	30	6/23/2008	30	7/28/2008	360	8/25/2008	10	9/22/2008	10
	5/27/2008	800	6/30/2008	10	7/29/2008	10	8/4/2009	10	9/29/2008	70
	5/6/2009	10	6/1/2009	30	7/15/2009	800	8/12/2009	40	9/8/2009	80
	5/11/2009	30	6/9/2009	30	7/21/2009	70	8/18/2009	10	9/16/2009	10
	5/26/2009	410	6/16/2009	10	7/28/2009	1700	8/25/2009	10	9/22/2009	10
	5/27/2009	40	6/22/2009	30			8/31/2009	10	9/30/2009	10
			6/29/2009	800						
Geomean		37.54194439		24.05234921		175.1384228		18.9127734		29.98572207
% Exceeded 409 CFU/100 mL		20		11		25		0		0
Recreational Use Assessment	FST		FST		NS		FS		FS	
Number of Samples		9		10		8		8		10

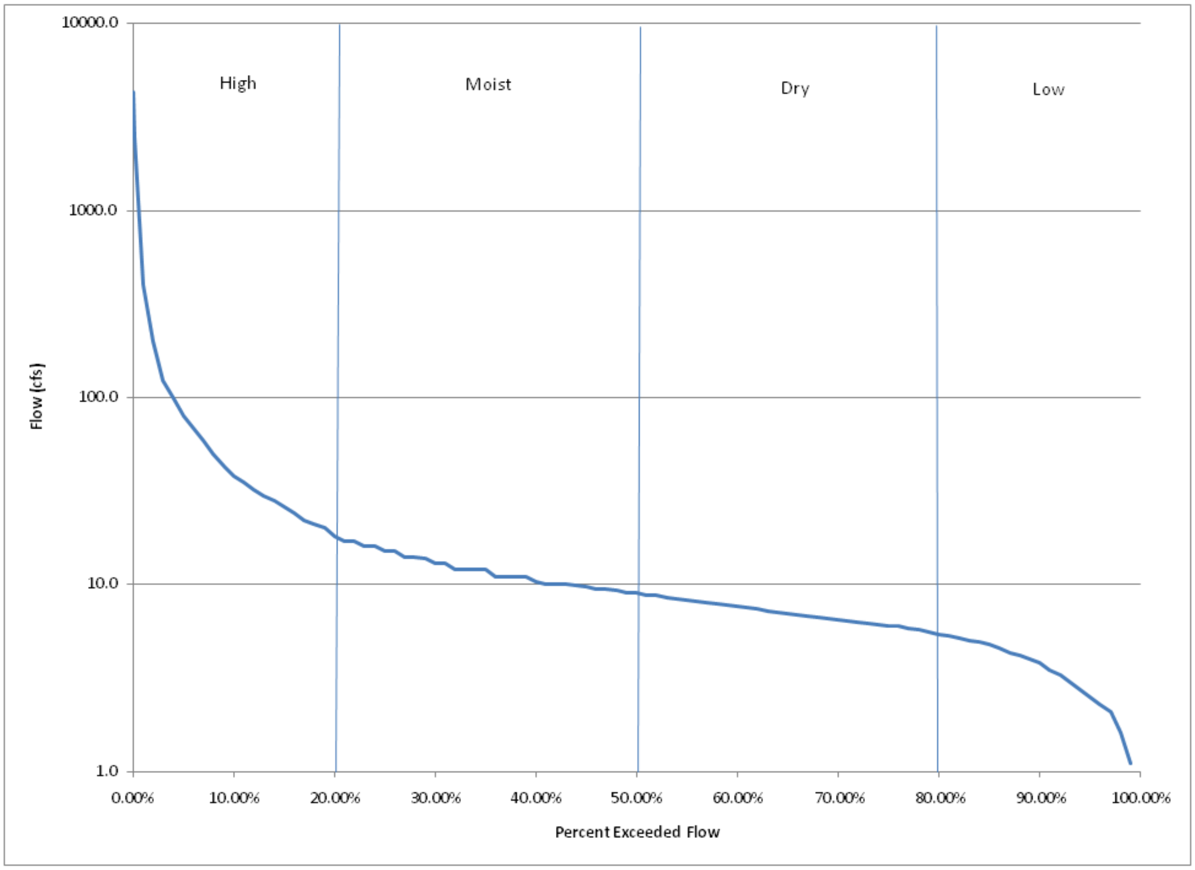
FS-Fully Supporting, FST-Fully Supporting, but Threatened and NS-Not Supporting

385417	May		June		July		August		September	
	5/4/2008	10	6/2/2008	70	7/8/2008	70	8/4/2008	20	9/2/2008	50
	5/12/2008	70	6/9/2008	40	7/15/2008	100	8/18/2008	50	9/9/2008	40
	5/19/2008	10	6/16/2008	10	7/22/2008	70	8/25/2008	10	9/15/2008	10
	5/20/2008	10	6/23/2008	20	7/28/2008	800	8/4/2009	210	9/22/2008	360
	5/27/2008	10	6/30/2008	50	7/29/2008	140	8/12/2009	80	9/29/2008	10
	5/4/2009	10	6/1/2009	390	7/6/2009	800	8/18/2009	30	9/8/2009	380
	5/6/2009	50	6/9/2009	1100	7/15/2009	60	8/25/2009	10	9/16/2009	10
	5/11/2009	90	6/16/2009	100	7/21/2009	20	8/31/2009	60	9/22/2009	30
	5/26/2009	380	6/22/2009	160	7/28/2009	40			9/30/2009	10
	5/27/2009	140	6/29/2009	50						
Geomean		33.29831203		79.11713116		105.1920245		32.71333683		34.90168191
% Exceeded 409 CFU/100 mL		0		10		25		0		0
Recreational Use Assessment	FS		FS		FST		FS		FS	
Number of Samples		10		10		9		8		9

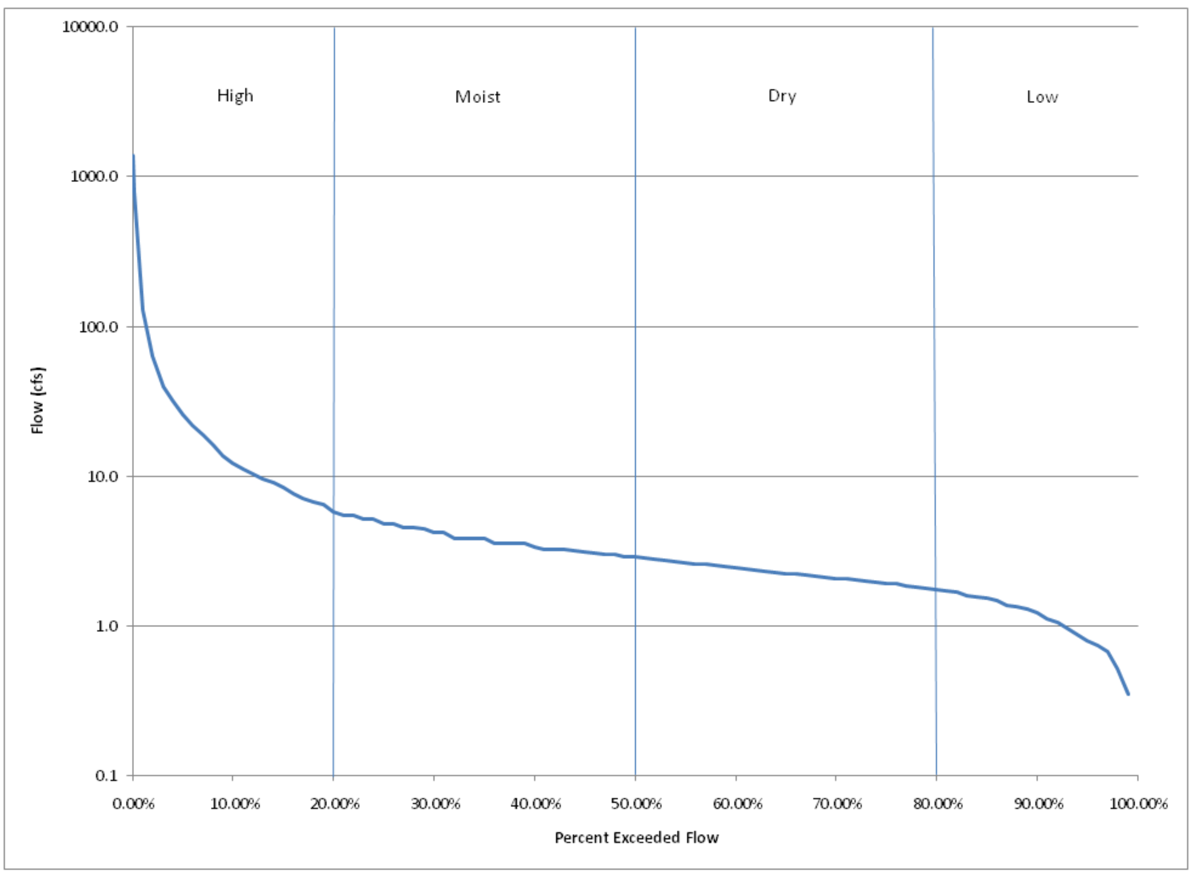
FS-Fully Supporting, FST-Fully Supporting, but Threatened and NS-Not Supporting

Appendix B
Flow Duration Curves for
Sites 380060, 385416 and 385417

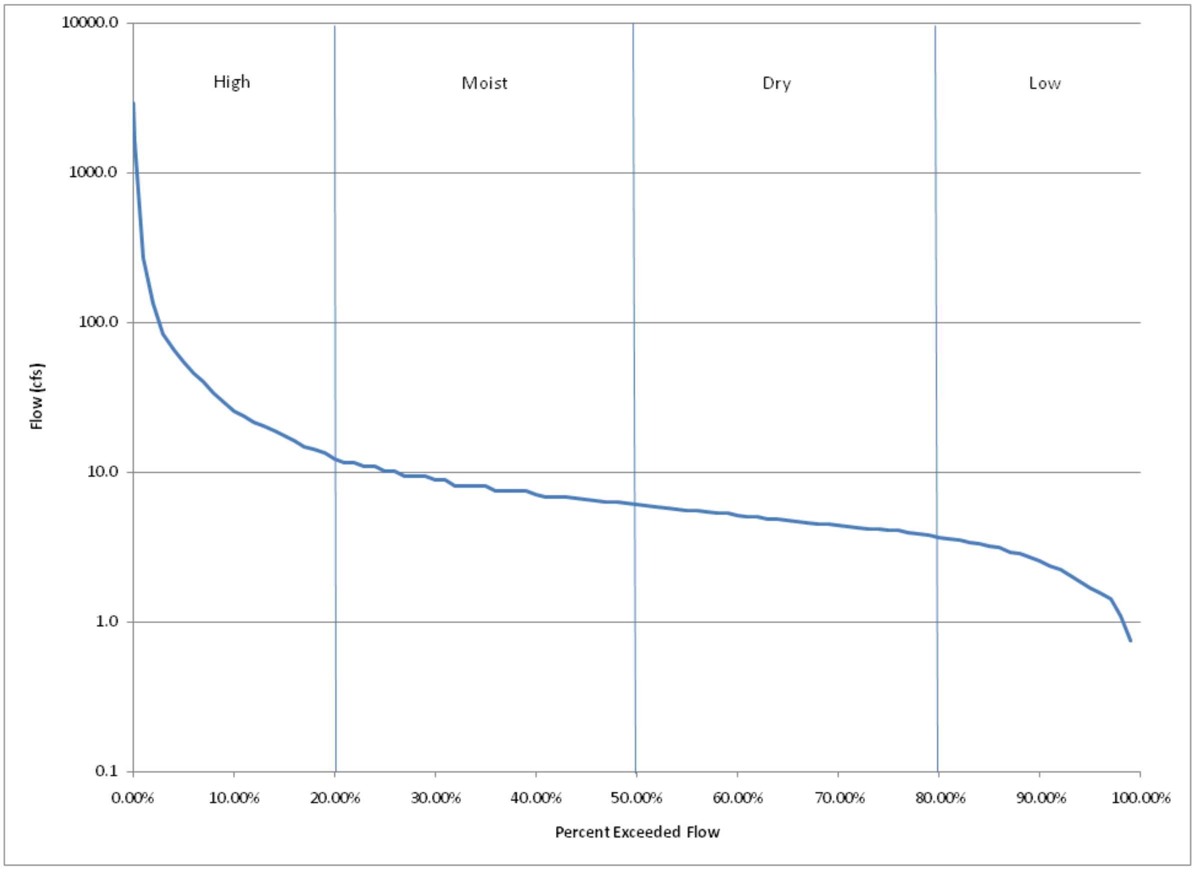
Site 380060



Site 385416



Site 385417



High
Moist
Dry
Low
10000.0
1000.0
100.0
10.0
1.0
0.1
Flow (cfs)
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
70.00%
80.00%
90.00%
100.00%
Percent Exceeded Flow

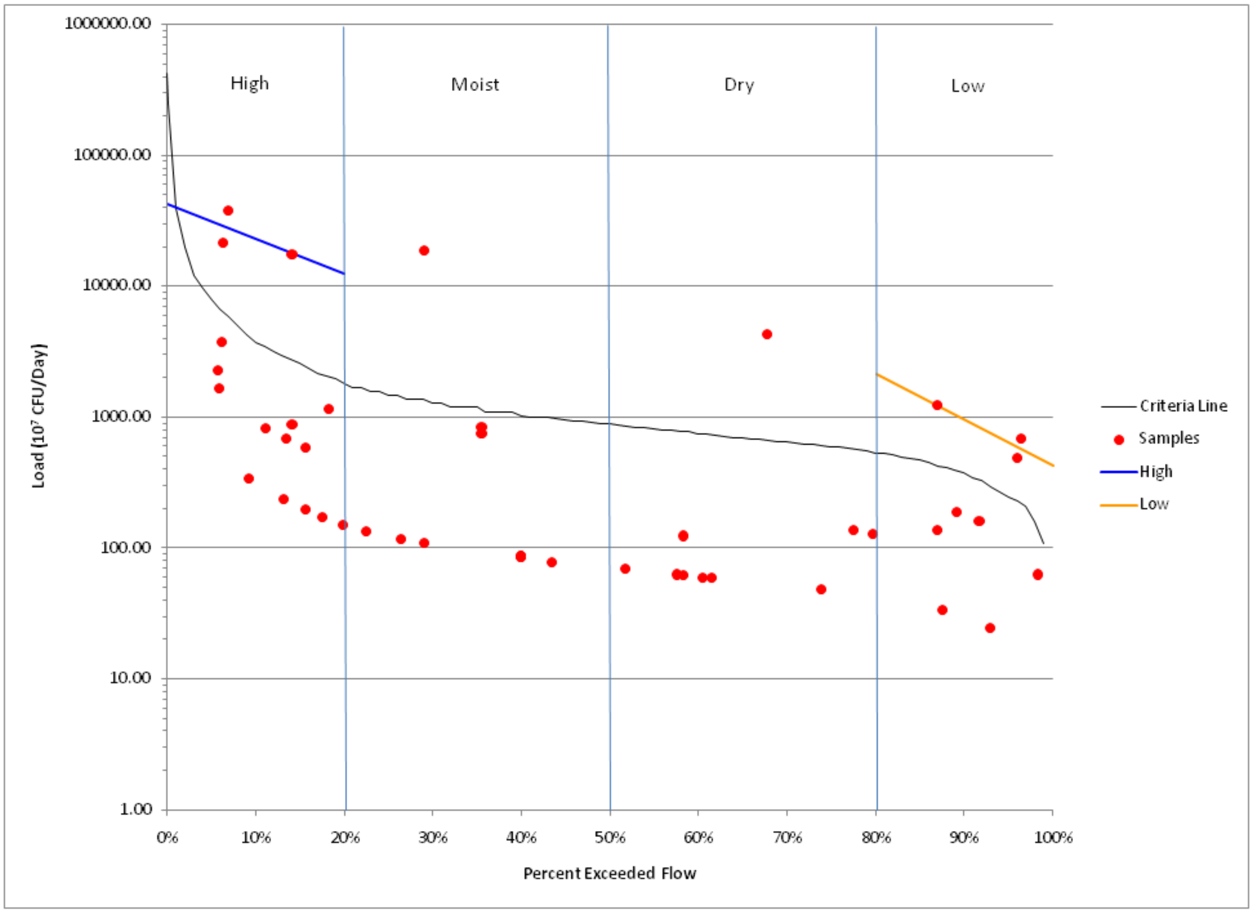
Appendix C
Load Duration Curve, Estimated Loads, TMDL Targets, and Percentage of Reduction Required for Sites 380060, 385416 and 385417

380060 Spring Creek near Zap, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	10.00%	85210.41	11715.75	73.00	6220359.86	855249.86	86.25%
Dry	57.55%	3089.33	2158.16	109.14			
			Total	182	6220360	855250	86.25%

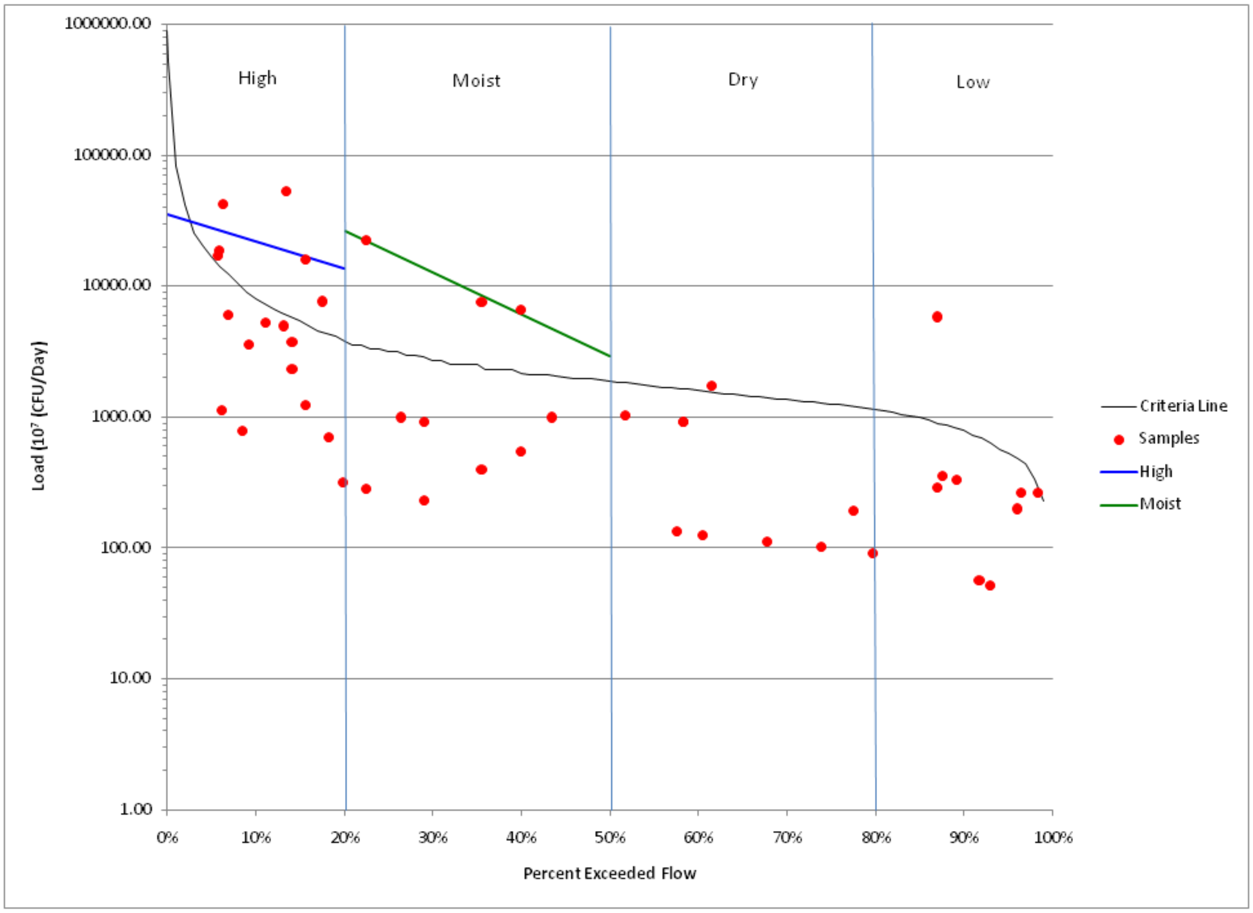
385416 Spring Creek near Dodge, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	10.00%	23094.60	3757.09	73.00	1685905.66	274267.87	83.73%
Low	90.05%	956.11	375.71	72.64			
			Total	146	1685906	274268	83.73%



385417 Spring Creek near Dunn Center, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	10.00%	21874.45	7958.66	73.00	1596834.76	580981.98	63.62%
Moist	35.05%	8736.02	2513.26	109.14	953405.04	274284.65	71.23%
			Total	182	2550240	855267	66.46%



Appendix D
North Dakota Department of Health NDPDES DMR Data Report for Dunn Center, North Dakota

Permit #	Facility Name	Start	End	Days	Total Discharged	Units	Discharge /Day
ND0020594	Dunn Center City Of	4/18/1990	4/21/1990	4	6.6	MGAL	1.65
ND0020595	Dunn Center City Of	5/6/1991	5/9/1991	4	6.6	MGAL	1.65
ND0020596	Dunn Center City Of	5/14/1992	5/17/1992	4	6.6	MGAL	1.65
ND0020597	Dunn Center City Of	5/24/1993	5/26/1993	3	6.66	MGAL	2.22
ND0020598	Dunn Center City Of	11/10/1993	11/11/1993	2	1.66	MGAL	0.83
ND0020599	Dunn Center City Of	5/19/1994	5/24/1994	6	6.66	MGAL	1.11
ND0020600	Dunn Center City Of	5/26/1995	5/29/1995	4	6.66	MGAL	1.67
ND0020601	Dunn Center City Of	5/13/1997	5/17/1997	5	6.66	MGAL	1.33
ND0020602	Dunn Center City Of	11/1/1998	4/30/1999	3	4.16	MGAL	1.39
ND0020603	Dunn Center City Of	5/16/1999	5/20/1999	4	6.66	MGAL	1.67
ND0020604	Dunn Center City Of	9/30/1999	10/2/1999	2	5.83	MGAL	2.92
ND0020605	Dunn Center City Of	5/18/2000	5/20/2000	3	6.664	MGAL	2.22
ND0020606	Dunn Center City Of	5/8/2001	5/12/2001	5	6.66	MGAL	1.33
ND0020607	Dunn Center City Of	11/1/2001	11/2/2001	2	1.661	MGAL	0.83
ND0020608	Dunn Center City Of	5/20/2002	5/22/2002	3	5	MGAL	1.67
ND0020609	Dunn Center City Of	11/2/2002	11/4/2002	2	5	MGAL	2.50
ND0020610	Dunn Center City Of	9/15/2004	9/17/2004	2	3.4	MGAL	1.70
ND0020611	Dunn Center City Of	11/8/2005	11/13/2005	6	4.9	MGAL	0.82
ND0020612	Dunn Center City Of	9/19/2010	9/27/2010	9	4.998	MGAL	0.56

Average/Day (MGAL):	1.56

Appendix E
US EPA Region 8 Public Notice Review and Comments

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**E. coli Bacteria TMDL for Spring Creek in Dunn and Mercer Counties, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**August 5, 2011**
Review Date:	**September 6, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice**
Notes:	

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

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

Approval Notes to Administrator:

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

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

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant**.** A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

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

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

1. Problem Description

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

1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

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

SUMMARY: The public notice draft Spring Creek E. coli TMDLs were submitted to EPA for review via an email from Mike Ell, NDDoH on August 5, 2011. The email included the draft TMDL document and a request to review and comment on the TMDL document.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Spring Creek watershed is a 375,351 acre watershed located in Dunn and Mercer Counties, in west central North Dakota. Spring Creek flows from central Dunn County to eastern Mercer County where it confluences with the Knife River near Beulah, ND. The listed Spring Creek segments are: 1) Spring Creek from Lake Ilo downstream to its confluence with North Creek (23.3 miles; ND-10130201-028-S_00); 2) Spring Creek from its confluence with North Creek downstream to its confluence with Goodman Creek (36.36 miles; ND-10130201-023-S_00); and 3) Spring Creek from its confluence with Goodman Creek downstream to its confluence with the Knife River (28.56 miles; ND-10130201-001-S_00). The Spring Creek watershed is part of the larger Missouri River basin in the Knife sub-basin (HUC 10130201). These segments are listed as impaired for E. coli bacteria and are a high priority for TMDL development.

The designated uses for the Spring Creek segments are based on the Class IA stream classification in the ND water quality standards (NDCC 33-15-02.1-09).

COMMENTS: The map in Figure 1 does not show where each of the three segments begin or end, nor does it include labels which would help delineate the start/end of each segment (e.g., where Spring Creek confluences with North Creek and Goodman Creek). We recommend that the Figure 1 map be revised to show each of the three listed segments using different colored lines and/or include labels for the key tributary segments that confluence with Spring Creek where the segments start/end.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

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

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

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

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

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

SUMMARY: The Spring Creek segments addressed by the TMDL document are impaired based on E. coli concentrations impacting the recreational uses. All three segments are Class IA streams. The quality of the waters in Class I streams shall be suitable for the propagation or protection, or both, of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be suitable for irrigation, stock watering, and wildlife without injurious effects. The quality of water in Class IA streams is similar for aquatic life and recreational uses except additional treatment may be necessary for drinking water uses. Numeric criteria for E. coli in North Dakota, Class IA streams have been established and are presented in the excerpted Table 8 shown below. Discussion of additional applicable water quality standards for the Spring Creek and its tributaries can be found on pages 8 – 9 of the TMDL.

Table 8. North Dakota Bacteria Water Quality Standards for Class IA Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

[1] Expressed as a geometric mean of representative samples collected during any consecutive 30-day period
[2] No more than ten percent of samples collected during any consecutive 30-day period shall individually exceed the standard.

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The water quality target for these TMDLs is based on the numeric water quality standards for E. coli bacteria based on the recreational beneficial use for the Spring Creek segments. The E. coli target for the Spring Creek segments are the E. coli concentration of 126 cfu/100 mL during the recreation season from May 1 to September 30. While the standard was intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both of the previous acute (single sample value) and chronic (geometric mean of 5 samples) standard.

Effective January 2011, the Department revised the state water quality standards. In these latest revisions the Department eliminated the fecal coliform bacteria standard, retaining only the E. coli bacteria standard for the protection of recreational uses. This standards change was recommended by the US EPA as E. coli is believe to be a better indicator of recreational use risk (i.e., incidence of gastrointestinal disease).

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

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

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

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

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

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

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2010 National Agricultural Statistics Service (NASS) data. The dominant land use in the Spring Creek watershed is grassland and cropland. According to the 2010 NASS land survey data, approximately 63 percent of the landuse in the watershed was grassland, 15 percent was small grain cropland, 12 percent was pasture, hay and alfalfa, and the remaining 10 percent was a mixture of row crops, wetlands, water, woods, and urban. The majority of the crops grown consisted of spring wheat, alfalfa, corn, sunflowers and durum wheat.

Within the Spring Creek watershed, there are three permitted municipal point sources for the cities of Dunn Center, Dodge and Golden Valley, North Dakota. The city of Dunn Center's wastewater facility discharges intermittently into Spring Creek, generally for short periods of time. A wasteload allocation was derived for the Dunn Center facility as described in Section 5.4 of the TMDL document. There have been no discharges in over 20 years for the Dodge (population 125) and Golden Valley (population 189) wastewater facilities. Therefore, the WLA for these wastewater facilities is zero.

There are no confined animal feeding operations (CAFOs) in the TMDL watershed of Spring Creek. There are three permitted medium (301-999 animal units) animal feeding operations (AFOs) in the watershed, however all three AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to Spring Creek. There are several unpermitted AFOs in the watershed, but the exact location and number of these operations is unknown.

The data collected during the water quality assessment indicate that the primary nonpoint sources for E. coli bacteria in the Spring Creek watershed are as follows:

- Runoff of manure from cropland and pastureland;
- Runoff of manure from unpermitted animal feeding areas;
- Direct deposit of manure into Spring Creek by grazing livestock; and
- Background levels associated with wildlife.

The data collected during the watershed assessment indicate that the primary contributors of E. coli bacteria for the watershed are unpermitted animal feeding areas located in close proximity to Spring Creek and livestock grazing and watering directly in and adjacent to Spring Creek.

Dwellings located within the majority of the watershed utilize septic systems. Septic system failure might contribute to the E. coli bacteria in Spring Creek. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing.

Wildlife may also contribute to the E. coli bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife is nomadic with fewer numbers concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

COMMENTS: None.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

Recommendation:

☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

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

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) listed waterbodies, LDCs were developed for each of the tributary segments at monitoring sites 380060, 385416 and 385417. All sites were sampled weekly or when flow conditions were present during the recreation season. The LDCs were derived using the 126 cfu/100 mL TMDL target (i.e., state water quality standard), the daily flow records, and the observed E. coli data collected from each site (see Figure 1 of the TMDL document).

Flows for the watershed were determined by utilizing the Drainage-Area Ratio Method developed by the USGS. The Drainage-Area Ratio Method assumes that the streamflow at the ungauged sites is hydrologically similar (same per unit area) to the stream gauging station used as an index. This assumption is justified for Spring Creek because the ungauged sites (385416 and 385417) are nested on the same reach as the index station (06340000). The drainage area for the ungauged sites (385416 and 385417) and index station (06340000) were determined through GIS using digital elevation models (DEMs). Streamflow data for the index station (06340000) was obtained from the USGS Water Science Center website from 1990-2009. The index station (06340000) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged sites to obtain estimated flow statistics for the ungauged sites. This flow data was used to develop LDCs for each of the impaired segments of Spring Creek.

The load duration curves were divided into the following four flow zones: high flows (0-20 percent), moist conditions (20-50 percent), dry conditions (50-80 percent), and low flows (80-100 percent). These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot. A secondary factor in determining the flow intervals used in the analysis is the number of E. coli observations available for each flow interval. E. coli load duration curves for all three impaired segments are provided in Figures 9 - 11 of the TMDL document.

The load duration curves plot the allowable E. coli load (using the 126 cfu/100 mL standard) across the four flow regimes. Single grab sample E. coli concentrations were converted to loads by multiplying by flow and a conversion factor to produce cfu/day values. Each value was plotted individually on the load duration curves. Values falling above the curves indicate exceedances of the TMDL at that flow value while values falling below the curves indicate attainment of the TMDLs at that flow.

To estimate the required percent reductions in loading needed to achieve the TMDL, a linear regression line through the E. coli load data above the TMDL curve in each flow regime was plotted. The required percent reductions needed under the four regimes were determined using the linear regression line.

The LDCs represent flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the Spring Creek segments covered by the TMDL document, the LDCs are dynamic expressions of the allowable load for any given daily flow. Loading capacities were derived from this approach for the three impaired segments at each flow regime. Tables 11 - 13 show the loading capacity load (i.e., TMDL load) for each listed tributary segment of Spring Creek.

COMMENTS: Section 1.5.2, Hydraulic Discharge, says that a discharge record was constructed for "…the listed segments using the Drainage Area Ratio Method…" However, the description of stream flow in Section 5.1 seems to imply that the Drainage Area Ration Method (DARM) was only use for the two upper segments because the USGS index station (06340000) is located in the lower segment. We recommend adding a clear sentence to one or both sections that says that the flow curve for Segment 001 (monitoring station 380060) was constructed using data from the USGS gage site, and the flow curves for Segments 023 and 028 (monitoring stations 385417, 385416 respectively) were constructed using the DARM.

We realize that a regression line cannot be drawn for those flow zones that have only one data point above the curve. However, in the absence of additional data points above the curve in those zones, the single data point should be used to derive the existing load for that zone. That would enable all of the blank "Existing Load" boxes in Tables 11 – 13 to be completed.

Table 13 should include the calculated WLA for the moist and dry flow zones unless the permit for Dunn Center will not allow discharges to occur during the moist and dry flow regimes. Also, we don't understand why all of the loads shown in Table 13 for Segment 028 are the same for both the "moist" and "dry" flow zones. If the TMDL load is represented as point at the midpoint of the curve in each flow zone, then the values should be different for each zone unless the curve is flat. The loading values in the moist and dry flow zones should be checked with the curve data and revised as necessary.

4.1 Data Set Description

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

Minimum Submission Requirements:

- ☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.
- ☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

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

SUMMARY: The TMDL data description and summary tables for Spring Creek, Segments 001, 023 and 028 are included in the Available Data section, in tables throughout the document and in the tables in Appendix A. Recent water quality monitoring was conducted from May 2008 to September 2009 at sites 380060, 385416 and 385417. The data set also includes approximately 20 years of flow records from USGS gauging site 06340000 located on Spring Creek at Zap, North Dakota. The flow data and water quality data, along with the TMDL targets, were used to develop the E. coli load duration curves for the impaired segments of Spring Creek.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: Within the Spring Creek watershed, there are three permitted municipal point sources for the cities of Dunn Center, Dodge and Golden Valley, North Dakota. The city of Dunn Center's wastewater facility (permit number ND0020594) discharges intermittently into Spring Creek, generally for short periods of time. From 1990-2010 the city of Dunn Center's wastewater facility discharged 18 times. Each discharge lasted from 2-9 days and totaled 103.3 million gallons of water. No E. coli bacteria data are available from these discharges. A wasteload allocation was derived for the Dunn Center facility based on the E. coli standard of 126 cfu/100mL and estimates of the average discharge volume from the facility. There have been no discharges in over 20 years for the Dodge (population 125) and Golden Valley (population 189) wastewater facilities. Therefore, the WLA for these wastewater facilities is zero.

There are no confined animal feeding operations (CAFOs) in the TMDL watershed of Spring Creek. There are three permitted medium (301-999 animal units) animal feeding operations (AFOs) in the watershed, however all three AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to Spring Creek. There are several unpermitted AFOs in the watershed, but the exact location and number of these operations is unknown.

COMMENTS: As mentioned in the comments above, the WLA for Segment 028, Table 13, should be included in all four flow zones unless the existing or future permit for Dunn Center will not allow discharges to occur during the moist and dry flows as defined by the curve. Also, as part of the implementation of this TMDL the permit for Dunn Center will need to be revised to reflect the WLA specified.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2010 National Agricultural Statistics Service (NASS) data. The dominant land use in the Spring Creek watershed is grassland and cropland. According to the 2010 NASS land survey data, approximately 63 percent of the landuse in the watershed was grassland, 15 percent was small grain cropland, 12 percent was pasture, hay and alfalfa, and the remaining 10 percent was a mixture of row crops, wetlands, water, woods, and urban. The majority of the crops grown consist of spring wheat, alfalfa, corn, sunflowers and durum wheat. The TMDL listed segments of Spring Creek are experiencing E. coli bacteria pollution from nonpoint sources in the watershed. Agriculture is the predominant land use and livestock production is a dominant agricultural practice in the watershed. There only point source discharges intermittently and is unlikely to impact the 303(d) impaired segments in the watershed. Therefore the majority of the E. coli bacteria loads for these TMDLs were allocated to nonpoint sources in the watersheds.

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to E. coli and E. coli bacteria loading. Animals grazing in the riparian area contribute bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, medium and low flows. In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and under moist conditions at moderate flows. Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for bacterial contamination.

Source specific data are limited so an aggregate LA is assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table.

Table 9. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Nonpoint Sources	Flow Regime		
	High Flow	Moist Conditions	Dry Conditions
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential importance of nonpoint source area to contribute E. coli bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

COMMENTS: None.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Spring Creek TMDLs for Segments 001, 023 and 028 include explicit MOSs for the listed segments derived by calculating 10 percent of the loading capacity. The explicit MOSs for the Spring Creek segments are included in Tables 11 - 13 of the TMDL document.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

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

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in E. coli loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the TMDLs are seasonal since the E. coli criteria are in effect from May 1 to September 30, therefore the TMDLs are only applicable during that period.

COMMENTS: None.

5. Public Participation

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

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

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

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

SUMMARY: The TMDL document includes a summary of the public participation process that has occurred. It describes the opportunities the public had to be involved in the TMDL development process. Copies of the draft TMDL document were mailed to stakeholders in the watershed during public comment. Also, the draft TMDL document was posted on NDoDH’s Water Quality Division website, and a public notice for comment was published in local newspapers.

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: To insure that the BMPs and technical assistance that are implemented as part of the Section 319 Spring Creek watershed project are successful in reducing E. coli bacteria loading to levels prescribed in this TMDL, water quality monitoring will be conducted in accordance with an approved Quality Assurance Project Plan (QAPP). A QAPP will be developed in the fall of 2011 as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s).

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

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

SUMMARY: The Allocation section (Section 8.0) of the TMDL document includes a list of BMPs that are recommended to meet the TMDL loads. In response to the Spring Creek Watershed Assessment and in anticipation of this completed
TMDL, local sponsors successfully applied for and received Section 319 funding for the Spring Creek Watershed Project. Beginning in 2012, local sponsors will provide technical assistance and implement BMPs designed to reduce E. coli bacteria loadings and help restore the beneficial uses of Spring Creek (i.e., recreation). As the watershed restoration project progresses, water quality data will be collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing E. coli bacteria loadings. As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

COMMENTS: None.

8. Daily Loading Expression

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

Minimum Submission Requirements:

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

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

SUMMARY: The Spring Creek E. coli TMDL document includes daily loads expressed as colonies per day for the three impaired segments. The daily TMDL loads are included in TMDL section (Section 7.0) of the document.

COMMENTS: None.

Appendix F
NDDoH's Response to Comments Received from US EPA Region 8

US EPA Comment: The map in Figure 1 does not show where each of the three segments begin or end, nor does it include labels which would help delineate the start/end of each segment (e.g., where Spring Creek confluences with North Creek and Goodman Creek). We recommend that the Figure 1 map be revised to show each of the three listed segments using different colored lines and/or include labels for the key tributary segments that confluence with Spring Creek where the segments start/end.

NDDoH Response: The map in Figure 1 has been modified to show the three stream segments.

US EPA Comment: Section 1.5.2, Hydraulic Discharge, says that a discharge record was constructed for "…the listed segments using the Drainage Area Ratio Method…" However, the description of stream flow in Section 5.1 seems to imply that the Drainage Area Ration Method (DARM) was only use for the two upper segments because the USGS index station (06340000) is located in the lower segment. We recommend adding a clear sentence to one or both sections that says that the flow curve for Segment 001 (monitoring station 380060) was constructed using data from the USGS gage site, and the flow curves for Segments 023 and 028 (monitoring stations 385417, 385416 respectively) were constructed using the DARM.

We realize that a regression line cannot be drawn for those flow zones that have only one data point above the curve. However, in the absence of additional data points above the curve in those zones, the single data point should be used to derive the existing load for that zone. That would enable all of the blank "Existing Load" boxes in Tables 11 – 13 to be completed.

Table 13 should include the calculated WLA for the moist and dry flow zones unless the permit for Dunn Center will not allow discharges to occur during the moist and dry flow regimes. Also, we don't understand why all of the loads shown in Table 13 for Segment 028 are the same for both the "moist" and "dry" flow zones. If the TMDL load is represented as point at the midpoint of the curve in each flow zone, then the values should be different for each zone unless the curve is flat. The loading values in the moist and dry flow zones should be checked with the curve data and revised as necessary.

NDDoH Response: Wording in Sections 1.5.2 and 5.1 was revised to make it clear that the flow record for TMDL segment ND-10130201-001-S_00 was obtained from USGS gauging station 06030000 and that the flow record for segments ND-1030201-023-S_00 and ND-10130201-028-S_00 was constructed using the Drainage Area Ratio Method.

Existing E. coli loads were provided in Tables 11-13 for those flow regimes with only one data point above the load duration curve.

The TMDL provided in Table 13 was corrected to include a WLA for all four flow regimes. Also, corrections were made to the TMDL, LA and margin of safety values in Table 13.

US EPA Comment: As mentioned in the comments above, the WLA for Segment 028, Table 13, should be included in all four flow zones unless the existing or future permit for Dunn Center will not allow discharges to occur during the moist and dry flows as defined by the curve. Also, as part of the implementation of this TMDL the permit for Dunn Center will need to be revised to reflect the WLA specified.

NDDoH Response: As mention in the above response to comments, a WLA was provided for all four flow regimes for TMDL segment ND-10130201-028-S_0 . In addition, effluent limits based on this WLA will be added to the NDPDES permit for Dunn Center, ND when their permit is re-issued in March 2013.