E. coli Bacteria TMDL for Baldhill Creek, Silver Creek, and an Unnamed Tributary to Baldhill Creek in Griggs and Barnes Counties, North Dakota

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Prepared for:
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Prepared by:
Michael J. Hargiss
Environmental Scientist
North Dakota Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

North Dakota Department of Health
Division of Water Quality

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Jack Dalrymple, Governor
Terry Dwelle, M.D., State Health Officer

North Dakota Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

701.328.5210

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Middle Sheyenne River sub-basin (09020203) collectively covers approximately 2,005 square miles, or 1,283,384 acres and is located within seven counties (Barnes, Benson, Eddy, Foster, Griggs, Nelson, Steele, and Stutsman Counties) (Table 1 and Figure 1). For the purposes of this TMDL, the impaired stream segments are located in Griggs and Barnes counties that comprise a watershed area of approximately 488,125 acres. The Baldhill Creek, Silver Creek, and unnamed tributary impaired stream segments lies within the level III Northern Glaciated Plains (46) ecoregion.

Table 1. General Characteristics of Baldhill Creek, Silver Creek, and Unnamed Tributary.

Legal Name	Baldhill Creek, Silver Creek, and unnamed tributary
Stream Classification	Class II and III
Major Drainage Basin	Sheyenne River
8-Digit Hydrologic Unit	09020203
Counties	Griggs and Barnes
Level III Ecoregion	Northern Glaciated Plains (46)
Watershed Area (acres)	488,125

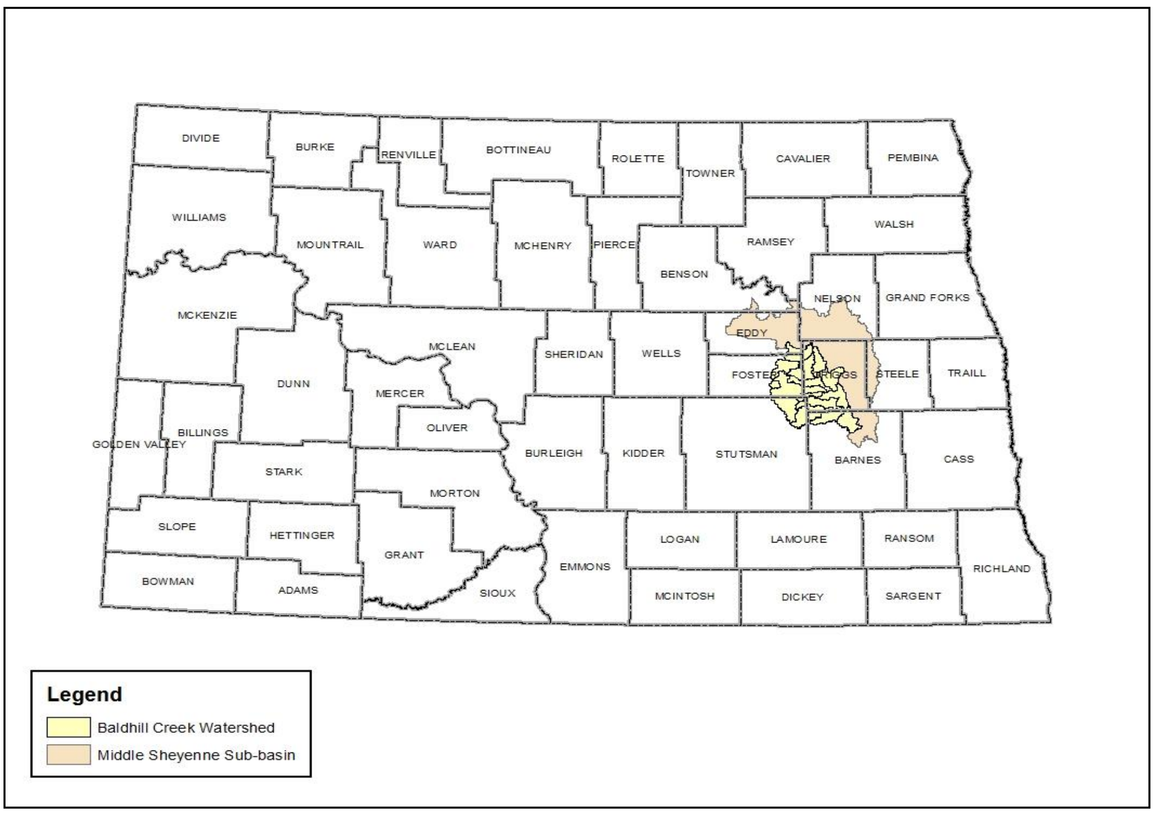

Figure 1. Middle Sheyenne River Sub-basin and Baldhill Creek Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2012 Section 303 (d) List of Impaired Waters Needing TMDLs (NDDoH, 2012), the North Dakota Department of Health has identified a 30.21 mile segment of Baldhill Creek from a tributary watershed (ND-09020203-005-S_00) downstream to Lake Ashtabula as fully supporting but threatened for recreational uses, a 38.51 mile segment of Silver Creek, including Gunderson Creek and all tributaries as not supporting for recreational uses, and an unnamed tributary watershed to Baldhill Creek (ND-09020203-007-S) as not supporting for recreational uses. The impairments are due to Escherichia coli (E. coli) bacteria (Tables 2, 3, 4 and Figure 2).

Table 2. Baldhill Creek Section 303(d) Listing Information for Assessment Unit ID ND-09020203-002-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020203-002-S_00
Waterbody Description	Baldhill Creek from tributary watershed (ND-09020203-005-S_00) downstream to Lake Ashtabula. Located in Griggs and Barnes County.
Size	30.21 miles
Designated Use	Recreation
Use Support	Fully Supporting but Threatened
Impairment	E. coli
TMDL Priority	High

Table 3. Silver Creek Sect E. coli **ion 303(d) Listing Information for Assessment Unit ID ND-09020203-004-S_00 (NDDoH, 2012).**

Assessment Unit ID	ND-09020203-004-S_00
Waterbody Description	Silver Creek, including Gunderson Creek and all tributaries. Located in southern Griggs County.
Size	38.51 miles
Designated Use	Recreation
Use Support	Not Supporting
Impairment	E. coli
TMDL Priority	High

Table 4. Unnamed Tributary to Baldhill Creek Section 303(d) Listing Information for Assessment Unit ID ND-09020203-008-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020203-008-S_00
Waterbody Description	Unnamed tributary water to Baldhill Creek (ND-09020203-007-S). Located in NW Griggs County.
Size	16.07 miles
Designated Use	Recreation
Use Support	Not Supporting
Impairment	E. coli
TMDL Priority	High

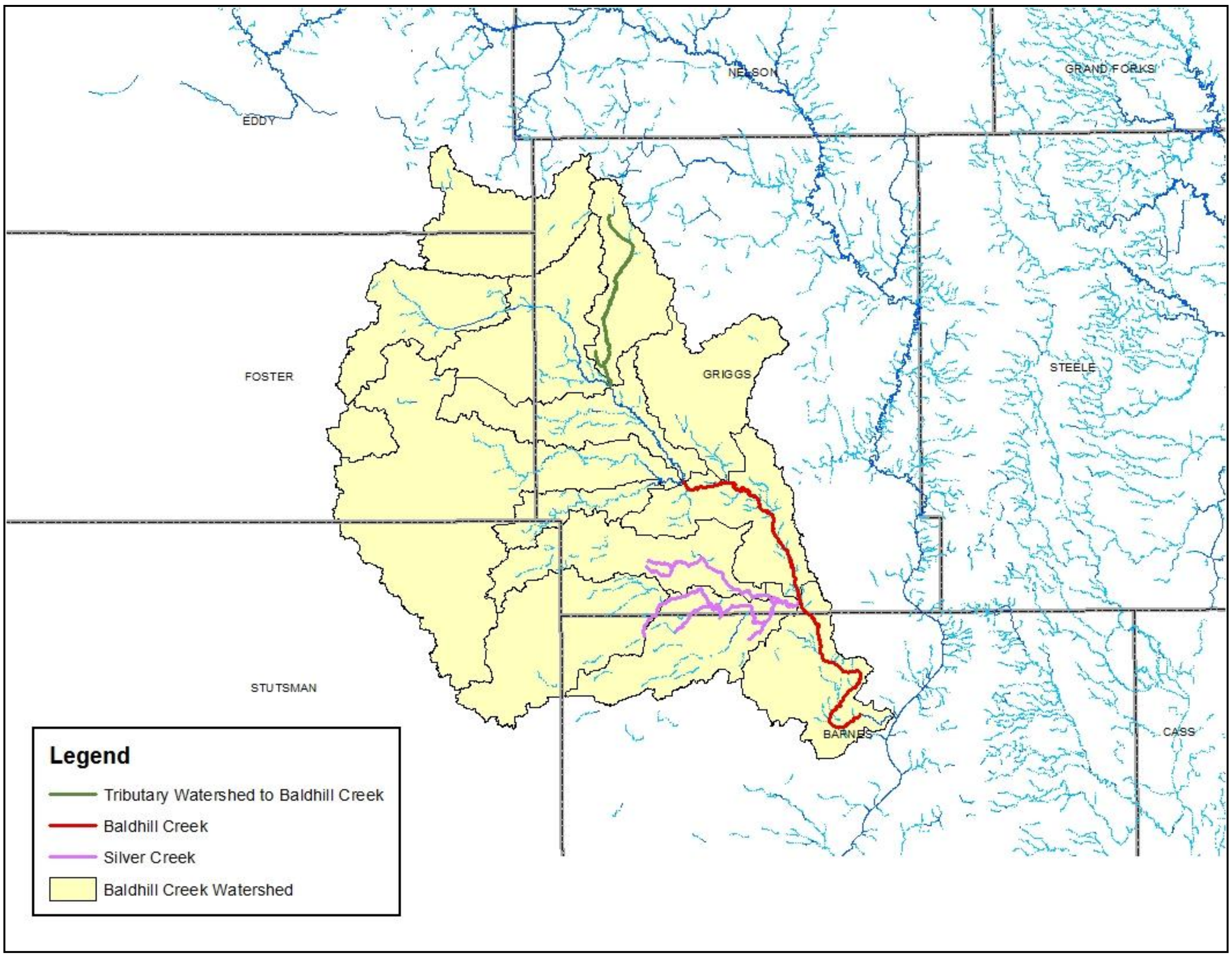

Figure 2. Baldhill Creek, Silver Creek, and Unnamed Tributary TMDL Listed Segments.

1.2 Ecoregions

The Baldhill Creek watershed lies within three level IV ecoregions. These are the End Moraine Complex ecoregion (46f), Drift Plains ecoregion (46i), and Glacial Outwash ecoregion (46j) (Figure 3). The End Moraine Complex ecoregion (46f) is composed of blocks of material scraped off and thrust up by the continental glacier at the south end of the Devils Lake basin. The western part of the ecoregion exhibits similar stagnate moraines similar to the Missouri Coteau while the southern moraines contain slightly higher elevations resulting in wooded lake boundaries and morainal ridges. Land use within the End Moraine Complex ecoregion consists of mixed range and cropland depending on slope and presence of rocky soil.

The Drift Plains ecoregion (46i) was created from the retreating Wisconsinan glaciers which left a subtle rolling topography and thick glacial till. A large number of temporary and seasonal wetlands are found in the Drift Plains. The Drift Plains contain productive soils and level topography which largely favors cultivation practices. Historic grasslands of transitional and mixed grass prairie have been replaced with fields of spring wheat, barley, sunflowers, and alfalfa. The Glacial Outwash ecoregion (46j) is characterized by smoother topography and soils with high permeability and low water holding capacity. Cropland production is poor to fair with most areas being used for irrigated agriculture (USGS, 2006).

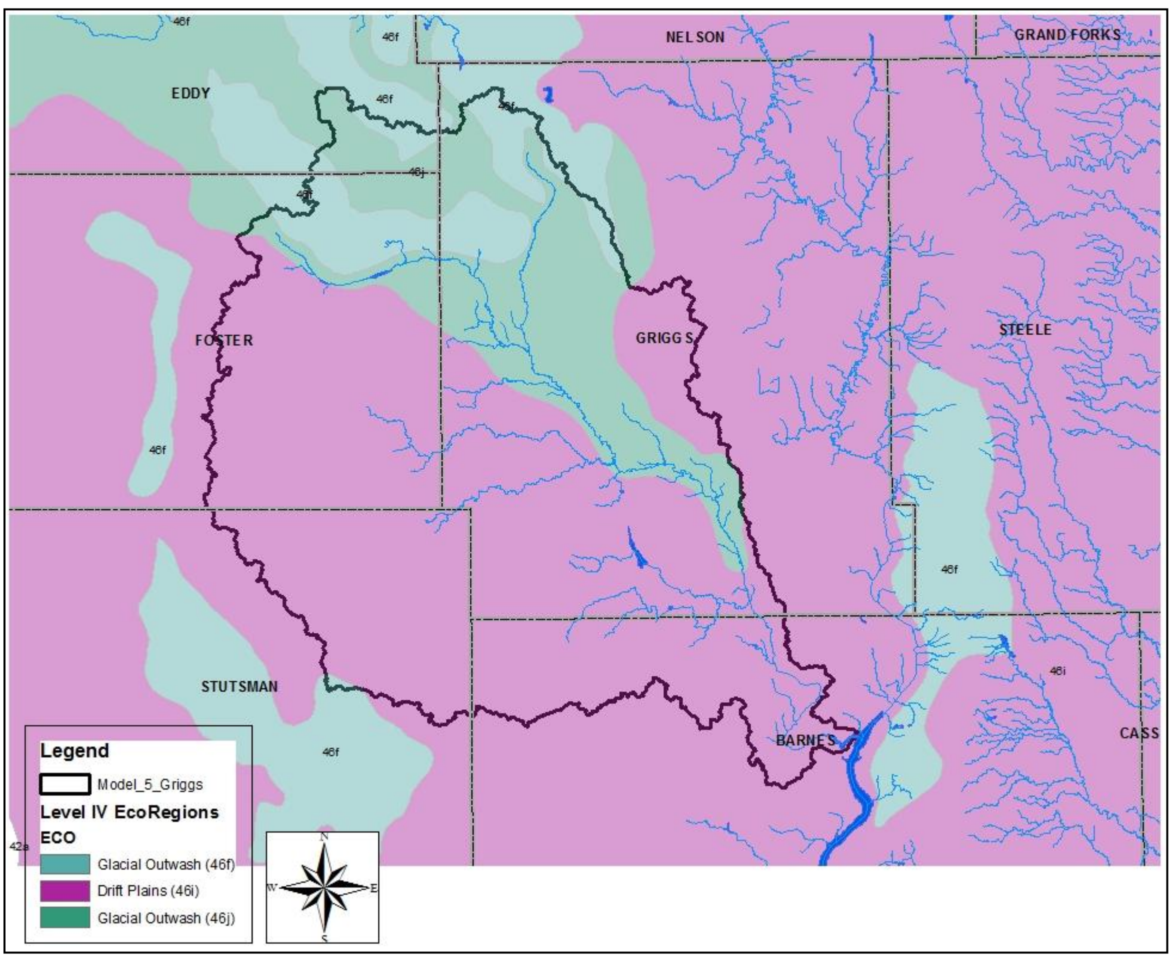

Figure 3. Level IV Ecoregions in the Baldhill Creek Watershed.

1.3 Land Use

According to National Agricultural Statistics Service (NASS) 2007 land cover data, the dominate land use in the Baldhill Creek watershed is agricultural with 68 percent used for cropland, 18 percent grassland/pasture, and the remaining 13 percent a combination of water, wetlands, or developed/open space (Figure 4). The dominant crops grown in the watershed are soybeans, spring wheat, corn, sunflowers, and barley.

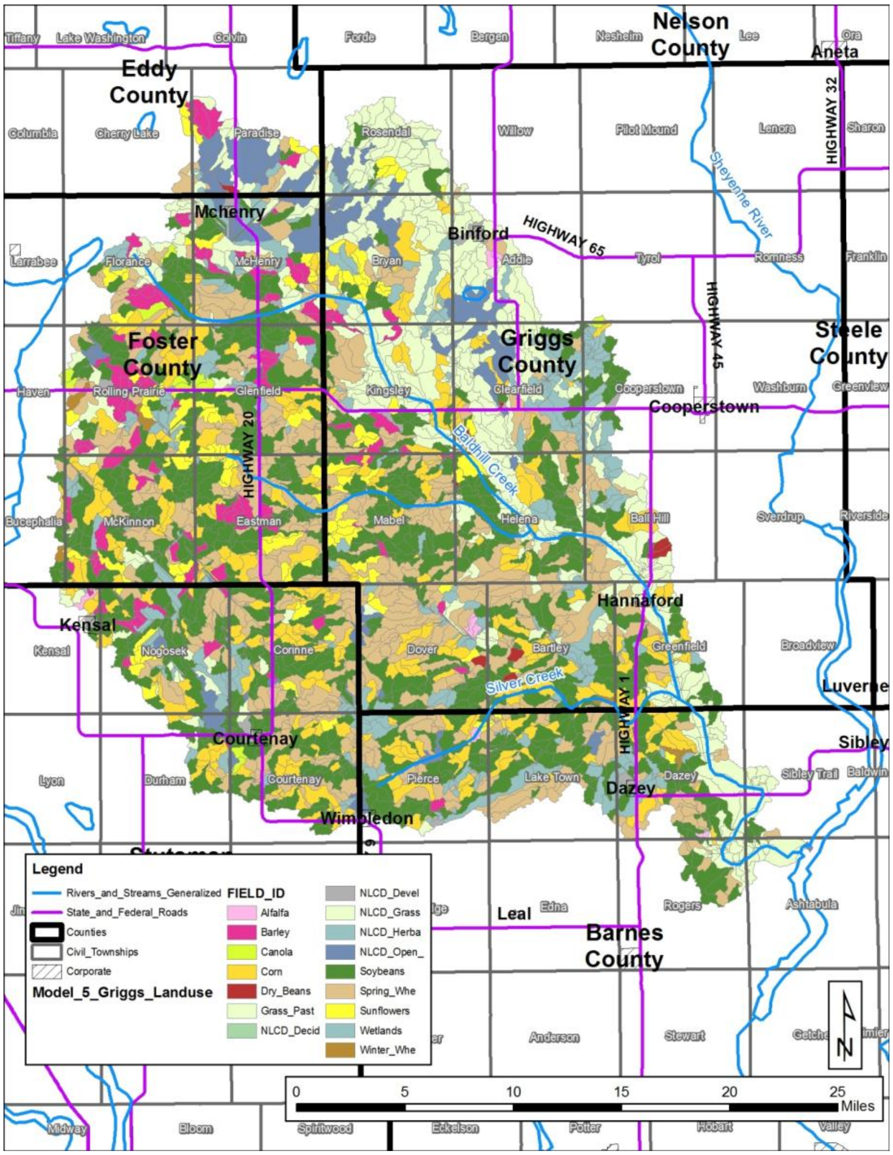

Figure 4. Land Use in the Baldhill Creek Watershed (NASS, 2007).

1.4 Climate and Precipitation

Precipitation data for the Baldhill Creek watershed was obtained from the North Dakota Agricultural Weather Network (NDAWN) station located near Dazey, ND in the southeast corner of the watershed. Figure 5 shows monthly precipitation data averaged for the years of 1993-2008 compared to the precipitation totals for each month during 2009 and 2010. Snowfall data had not been converted into precipitation for the months of January through March and November through December so those months do not appear in Figure 5.

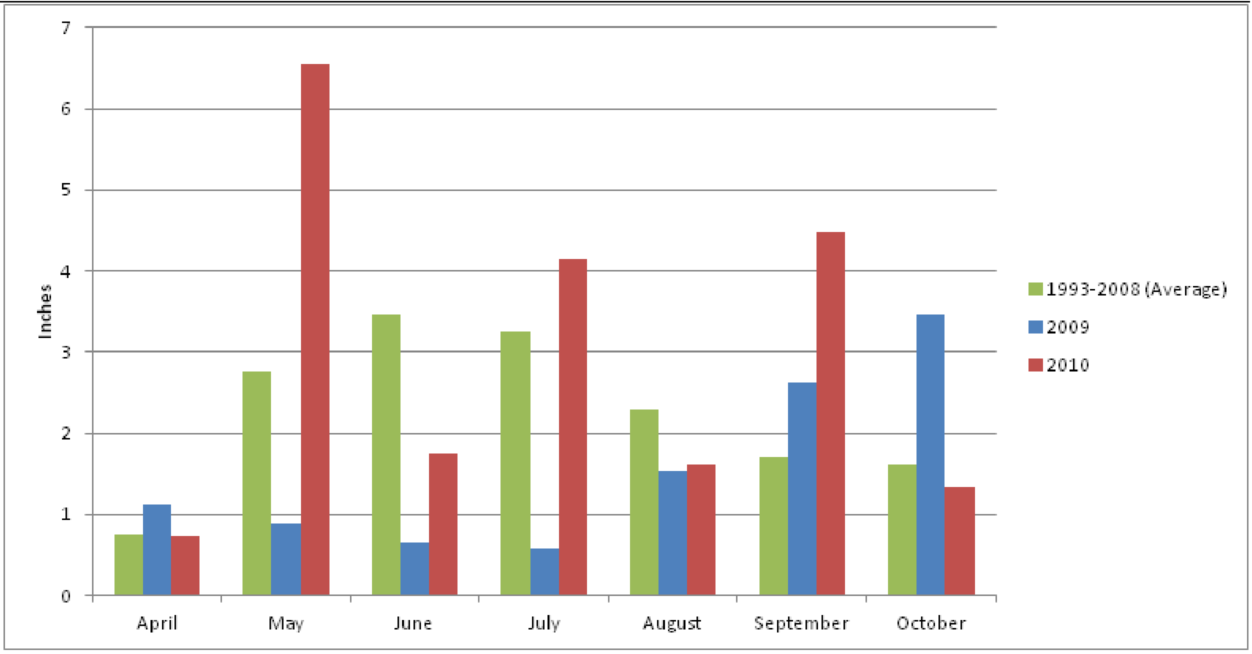

Figure 5. Monthly Precipitation for the NDAWN Weather Station Located Near Dazey, ND.

1.5 Available Data

1.5.1 E. coli Bacteria Data

E. coli bacteria samples were collected at one location within each TMDL listed stream reach (Figure 6). The monitoring site located on Baldhill Creek (ND-09020203-002-S_00), station ID 384126, is located 2.5 miles north and 3.25 miles east of Dazey, ND. Monitoring site 384129, is located on Silver Creek (ND-09020203-004-S_00) 1.5 miles southeast of Walum, ND. Monitoring site 384124, is located on an unnamed tributary to Baldhill Creek (ND-09020203-008-S_00) two miles north of Highway 200.

Sites 384124, 384129, and 384126 were monitored weekly or when flow conditions were present during the recreation season (May-September) of 2009 and 2010. Each monitoring station was sampled by the Griggs County Soil Conservation District.

Table 5 provides a summary of E. coli geometric mean concentrations, the percentage of samples exceeding 409 CFU/100mL for each month and the recreational use assessment by month. The geometric mean E. coli bacteria concentration and the percent of samples over 409 CFU/100ml was calculated for each month (May-September) using those samples collected during each month in 2009 and 2010.

Table 5. Summary of E. coli Bacteria Data for Sites 384124, 384129, and 384126 (Data Collected in 2009 and 2010).

384124					
Recreational Season	**May**	**June**	**July**	**August**	**September**
Number of Samples	7	10	5	0	0
Geometric Mean	16	84	125	N/A	N/A
% Exceeded 409 CFU/100 mL	0%	10%	40%	N/A	N/A
Recreational Use Assessment	FS	FS	FSBT	INSFD	INSFD
384129					
Recreational Season	**May**	**June**	**July**	**August**	**September**
Number of Samples	8	10	8	9	4
Geometric Mean	16	93	193	149	108
% Exceeded 409 CFU/100 mL	0%	10%	38%	22%	25%
Recreational Use Assessment	FS	FS	NS	NS	FSBT
384126					
Recreational Season	**May**	**June**	**July**	**August**	**September**
Number of Samples	8	10	8	10	8
Geometric Mean	22	105	68	44	43
% Exceeded 409 CFU/100 mL	13%	0%	0%	10%	13%
Recreational Use Assessment	FSBT	FS	FS	FS	FSBT

FS – Fully Supporting; FSBT- Fully Supporting but Threatened; NS – Not Supporting; INSFD – Insufficient Data

Analysis of E. coli data collected at site 384124 in 2009 and 2010 demonstrated that the months of May and June were fully supporting recreation use. Based on the geometric mean and percent exceeded calculations for the month of July, recreation use was fully supporting, but threatened (Table 5 and Appendix A). Recreational use could not be assessed for the months of August and September due to an insufficient amount of samples taken in 2009 and 2010.

The recreational use support assessment for site 384129 concluded that during the months of July and August recreation use was not supporting and during May and June recreation use was fully supporting (Table 5 and Appendix A). Recreation use could not be assessed for the month of September due to an insufficient amount of samples taken in 2009 and 2010.

Based on the E. coli data collected in 2009 and 2010 for site 384126, recreation use for May and September was assessed as fully supporting, but threatened (Table 5 and Appendix A). For the months of June, July, and August, recreation use was assessed as fully supporting.

1.5.2 Hydraulic Discharge

Daily stream discharge values were collected at one stream location within the Baldhill Creek watershed. This location was at the United States Geological Survey (USGS) gage station located on Baldhill Creek near Dazey, ND (05057200). The USGS station has operated continuously since 1957 and is collocated with the North Dakota Department of Health (NDDoH) monitoring location 384126.

A discharge record was constructed for Silver Creek (ND-09020203-004-S_00) and unnamed tributary to Baldhill Creek (ND-09020203-008-S_00) using the Drainage Area Ratio Method (Ries et al., 2000) and the historical discharge measurements collected by the USGS at gage station (05057200) from 1990-2010 (Figure 6).

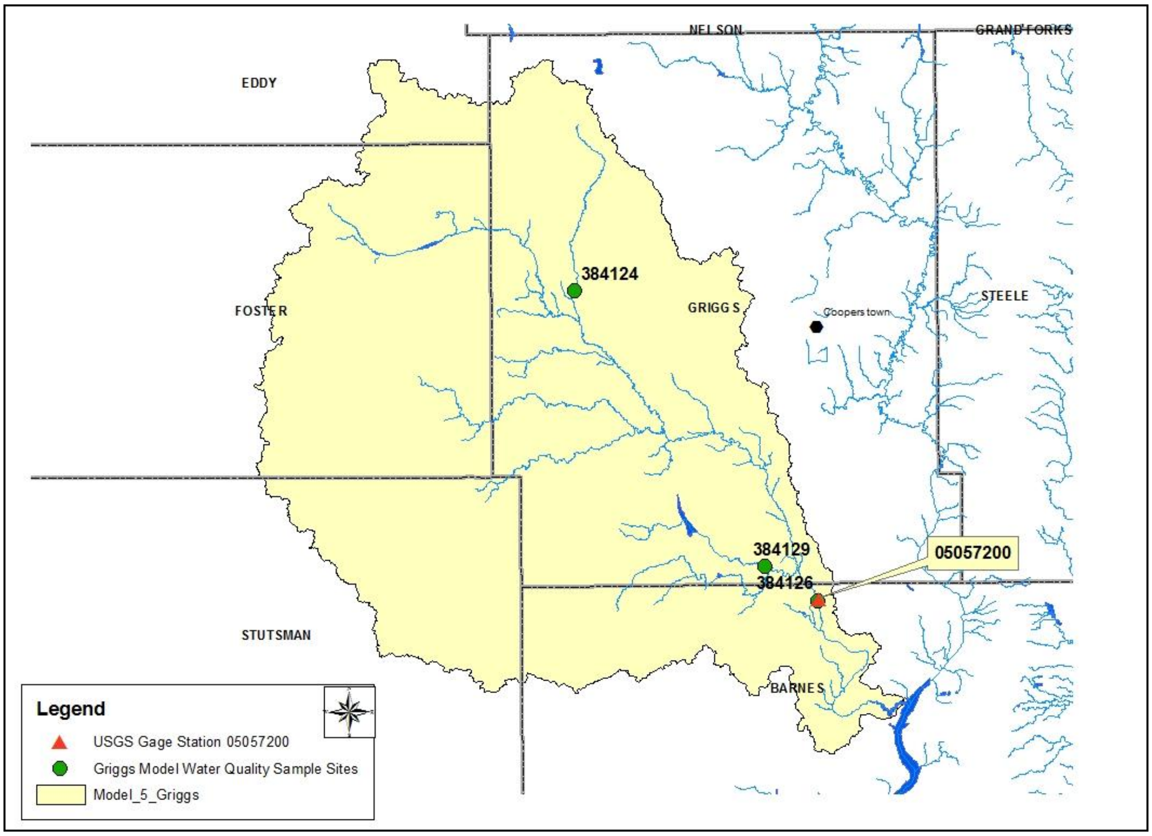

Figure 6. E. coli Bacteria Sample Sites and USGS Gage Station 05057200 on Baldhill Creek.

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 wasteload 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, which in this case is 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

Baldhill Creek (ND-09020203-002-S_00) is a Class II stream. The NDDoH definition of a Class II stream is shown below (NDDoH, 2011).

Class II- The quality of the waters in this class shall be the same as the quality of class I streams, except that additional treatment may be required to meet the drinking water requirements of the department. Streams in this classification may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, irrigation, bathing, or swimming.

Silver Creek (ND-09020203-004-S_00) and unnamed tributary to Baldhill Creek (ND-09020203-008-S_00) are Class III streams. The NDDoH definition of a Class III stream is shown below (NDDoH, 2011).

Class III- The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Table 6 provides a summary of the current numeric E. coli criteria which applies to Class II and III streams. The E. coli bacteria standard applies only during the recreation season from May 1 to September 30.

Table 6. North Dakota Bacteria Water Quality Standards for Class II and III 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 10 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 Baldhill Creek, Silver Creek, and unnamed tributary to Baldhill Creek is based on the NDDoH water quality standard for E. coli bacteria.

3.1 Baldhill Creek, Silver Creek, and Unnamed Tributary to Baldhill Creek Target Reductions in E. coli Bacteria Concentrations

Baldhill Creek, Silver Creek, and unnamed tributary to Baldhill Creek are impaired because of E. coli bacteria. Baldhill Creek, Silver Creek, and unnamed tributary are classified as not supporting to fully supporting, but threatenedfor recreation uses due to 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 from 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 a 30-day geometric mean, for purposes of these TMDLs, the target is based on an E. coli concentration of 126 CFU/100 mL expressed as a daily average based on individual grab samples. 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 Baldhill Creek watershed, there is a municipal point source located in Hannaford, ND located on segment ND-09020203-002-S. This facility (North Dakota Pollutant Discharge Elimination System (NDPDES) permit No. NDG221482) is permitted through the NDPDES Program. The Hannaford facility discharges intermittently into Baldhill Creek, generally for short periods of time. A review of the city of Hannaford's Discharge Monitoring Reports (DMRs) showed E. coli results from a grab sample indicating a concentration of 20 CFU/100mL in the one cell lagoon. The DMR data also show that each wastewater discharge lasted 3 to 8 days and totaled 10 million gallons of water. While the DMR review reported a 20 CFU/100 mL E.coli bacteria concentration from the lagoon, the E. coli bacteria water quality standard of 126 CFU/100 mL will be used in the waste load allocation (WLA) for TMDL segment ND-09020203-002-S.

There are four known animal feeding operations (AFOs) in the contributing watershed of Baldhill Creek, Silver Creek and unnamed tributary. The four AFOs in the Baldhill Creek watershed include one small (0-300 animal units (AUs)) AFO and three medium (301-999 AUs) AFOs which have a permit to operate. All four AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to Baldhill Creek, Silver Creek, or unnamed tributary.

4.2 Nonpoint Source Pollution Sources

The TMDL listed segments of Baldhill Creek, Silver Creek, and unnamed tributary are experiencing E. coli bacteria pollution from nonpoint sources in the watersheds. Livestock grazing and watering in close proximity to these streams is common.

This area of North Dakota typically experience short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Due to the close proximity of livestock grazing and watering to the stream, it is likely that livestock contribute to the E. coli bacteria pollution in the TMDL listed stream segments.

These assessments are supported by the load duration curve analysis (Section 5.3) which shows exceedences of the E. coli bacteria standard occurring during moist and dry flow regimes.

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 concentrating 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 (EPA, 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 (i.e., 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 an explicit margin of safety of 10 percent.

5.1 Mean Daily Stream Flow

Daily stream discharge values were collected at one stream location within the Baldhill Creek watershed. This location was at the USGS gage station located on Baldhill Creek near Dazey, ND (05057200). The USGS station has operated continuously since 1957 and is collocated with the NDDoH monitoring location 384126. For the purposes of this assessment, the last twenty years (1990-2010) of historical discharge records will be used to describe the hydrology of the Baldhill Creek watershed. This block of time should account for wet and dry cycles through the hydrological history of USGS gage station 05057200. From 1990 to 1992, the annual mean discharge of Baldhill Creek near Dazey, ND was very low most likely due to drought conditions in the late 1980's. Then in 1993-2001 the mean annual discharge fluctuated from average to above average flows most likely due to a wet cycle, then begins to drop significantly in 2002 thru 2008 (Figure 7). In 2009 and 2010, the discharge was 2.9 and 1.5 times higher than the average annual discharge of 1990-2010 which was calculated at 50 cfs. This can be attributed to record snowfalls and above average spring rains that were present all across North Dakota.

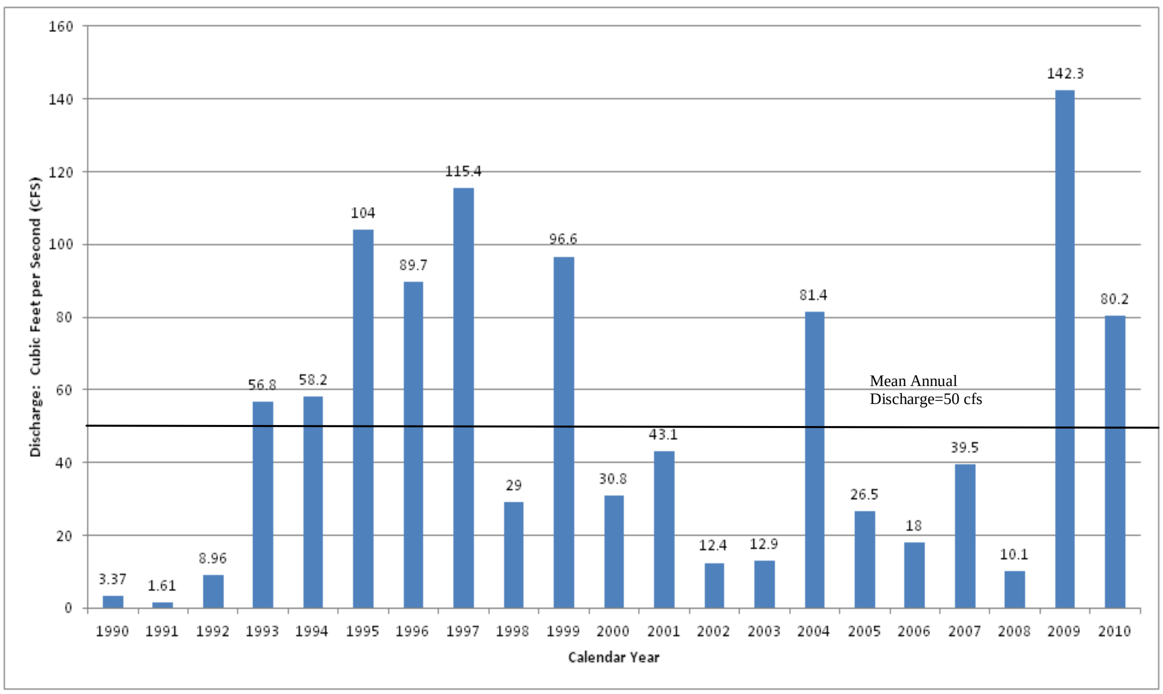

Figure 7. Mean Annual Discharge at the USGS Gage Station 05057200 on Baldhill Creek near Dazey, ND.

In northeastern North Dakota, rain events are variable generally occurring during the months of April through October (Figure 5). 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 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.

Flows for the ungaged water quality monitoring sites 384124 and 384129 were determined by utilizing the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000). The Drainage-Area Ratio Method assumes that the streamflow at the ungaged site is hydrologically similar (same per unit area) to the stream gaging station used as an index. This assumption is justified since the ungaged sites 384124 and 384129 are located within the same watershed and located upstream of the index station, USGS gaging station 05057200.

Drainage area and landuse for the ungaged sites 384124 and 384129 and index station 05057200 were determined through GIS using digital elevation models (DEMs). Streamflow data for the index station 05057200 were obtained from the USGS Water Science Center website. The index station 05057200 daily streamflow data were then divided by the drainage area for the site to determine daily streamflows per unit area at the index station. Those values were then multiplied by the drainage area for the ungaged sites to obtain estimated daily flow for the ungaged 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 (1990-2010). Low flows are exceeded most of the time, while flood flows are exceeded infrequently (EPA, 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 8). 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 8, a flow duration interval of 25 percent, associated with a stream flow of 31 cfs, implies that 25 percent of all observed mean daily discharge values equal or exceed 31 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 8, the flow duration curve for site 384126, representing TMDL segment ND-09020203-002-S, was divided into four zones, one representing high flows (0-10 percent), another for moist conditions (10-45 percent), one for dry conditions (45-92 percent) and one for low flows (92-98 percent). Based on the flow duration curve analysis, no flow occurred two percent of the time (98 to 100 percent).

Similarly, as depicted in Figure 9, the flow duration curve for water quality site 384129, representing TMDL segment ND-09020203-004-S, was also divided into four zones, one representing high flows (0-5 percent), another for moist conditions (5-42 percent), dry conditions (42-89 percent), and one for low flows (89-98 percent). Based on the flow duration curve analysis, no flow (or zero flow) was met or exceeded 98-100 percent.

Likewise, as depicted in Figure 10, the flow duration curve for water quality site 384124, representing TMDL segment ND-09020203-008-S, was also divided into four zones, one representing high flows (0-10 percent), another for moist conditions (10-40 percent), dry conditions (40-83 percent), and one for low flows (83-98 percent). Based on the flow duration curve analysis, no flow (or zero flow) was met or exceeded 98-100 percent.

These flows 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 8 - 10). 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.

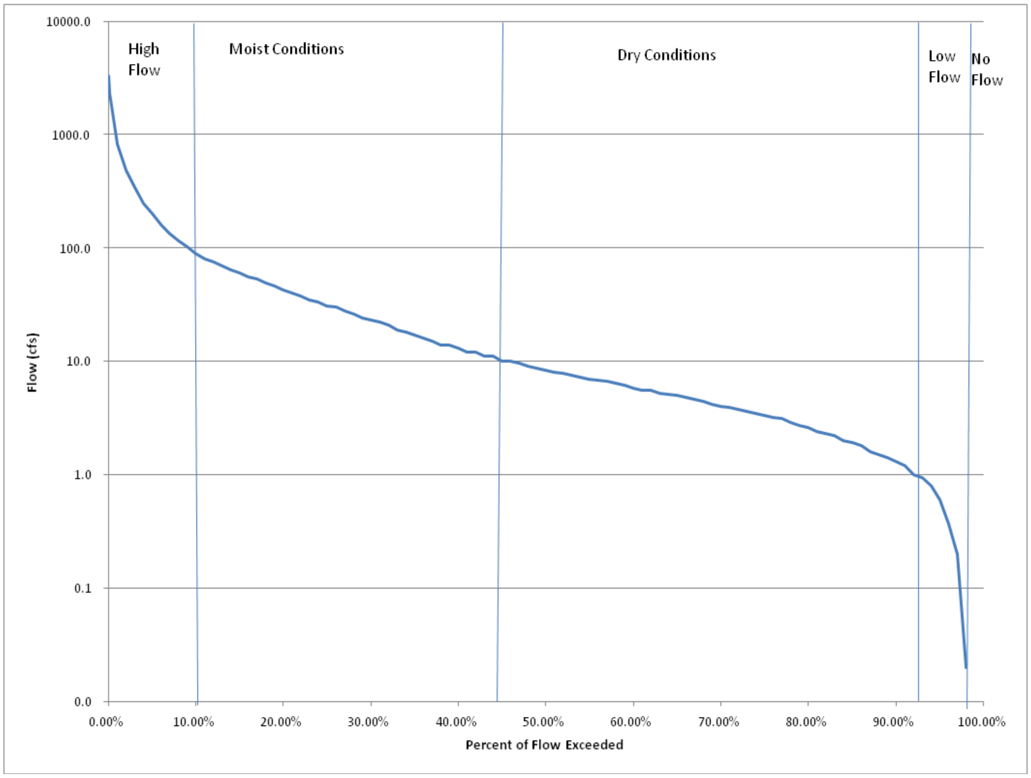

Figure 8. Flow Duration Curve for Baldhill Creek Monitoring Station 384126 Located near Dazey, North Dakota.

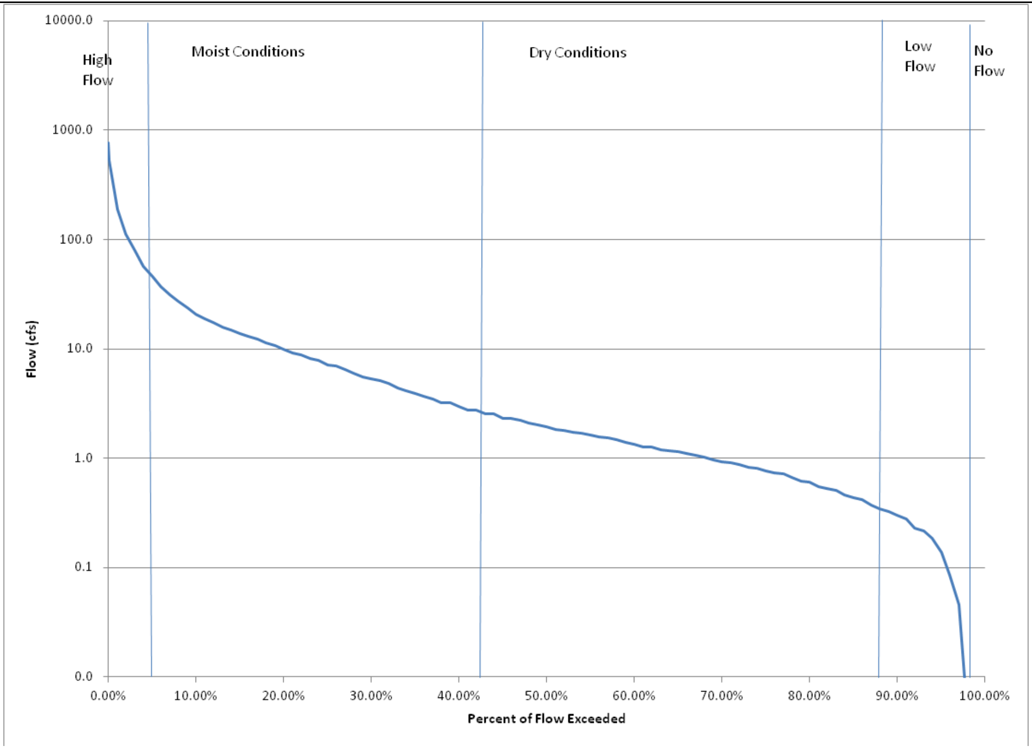

Figure 9. Flow Duration Curve for the Silver Creek Monitoring Station 384129 Located near Walum, North Dakota.

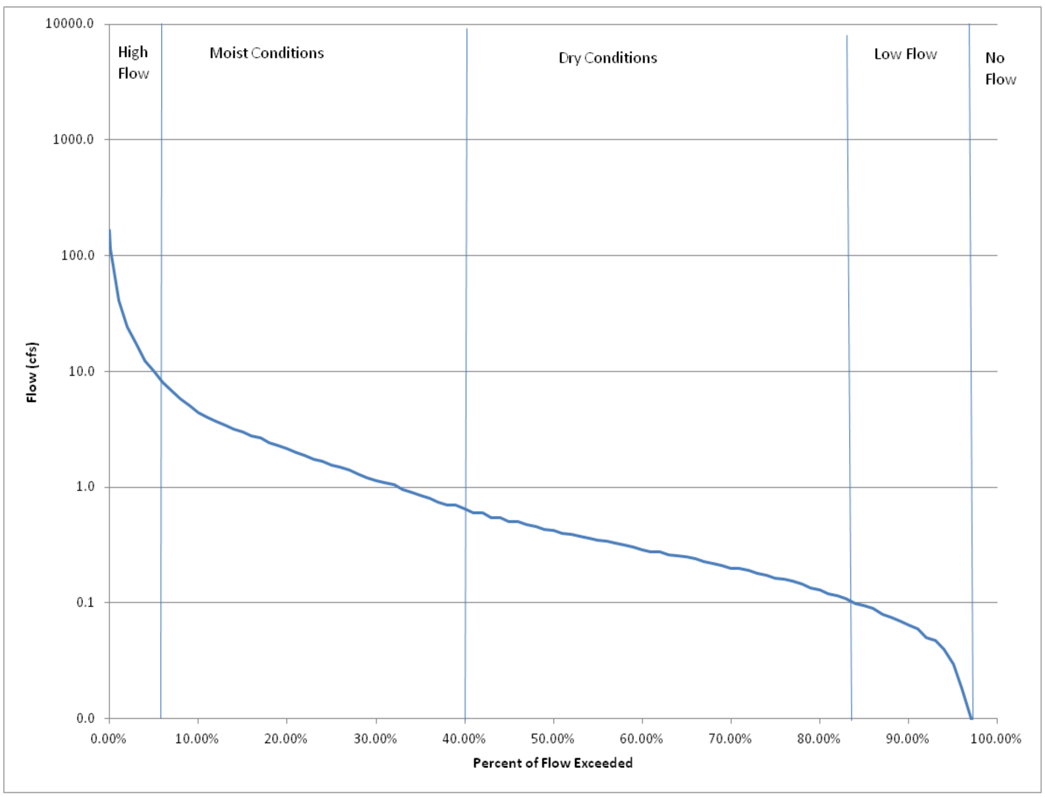

Figure 10. Flow Duration Curve for the Unnamed Tributary Monitoring Station 384124 Located north of Highway 200 in Griggs County, North Dakota.

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 the Baldhill Creek, Silver Creek, and unnamed tributary. 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 mean daily flows and flow duration curves generated as described in Sections 5.1 and 5.2.

Observed in-stream E. coli bacteria data obtained from monitoring sites 384124, 384126, and 384129 in 2009 and 2010 (Appendix A) were converted to a pollutant load by multiplying E. coli bacteria concentrations by the mean daily flow and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figures 11 - 13). 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, 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 384126, 384129 and 384124 depicting a regression relationship for each flow interval are provided in Figures 11 - 13.

The regression lines for the moist condition and dry condition flow regime flows for site 384126 and 384129 and moist condition flow regime flows for site 384124 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 11, the regression relationship between observed E. coli bacteria loading and percent exceeded flow for the moist 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 moist condition interval from 10 to 45 percent is 27.5 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (5.26 + (-3.91*0.275))
= 15,366 x 10^7 CFUs/day

Where the midpoint of the dry condition interval from 45 to 92 percent is 68.5 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (5.67 + (-3.29*0.685))
= 2,592 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 of 27.5, and 68.5 percent exceeded flow derived from the 126 CFU/100 mL TMDL target curves are 8,324 x 10^7 CFUs/day and 1,326 x 10^7 CFUs/day, respectively.

Since there was only one E. coli bacteria concentration result above the TMDL target in the high flow regime for site 384126 (Figure 11), a regression relationship could not be derived for this flow regime. Therefore, the existing load was estimated based on the E. coli concentration for this one sample and its corresponding daily flow.

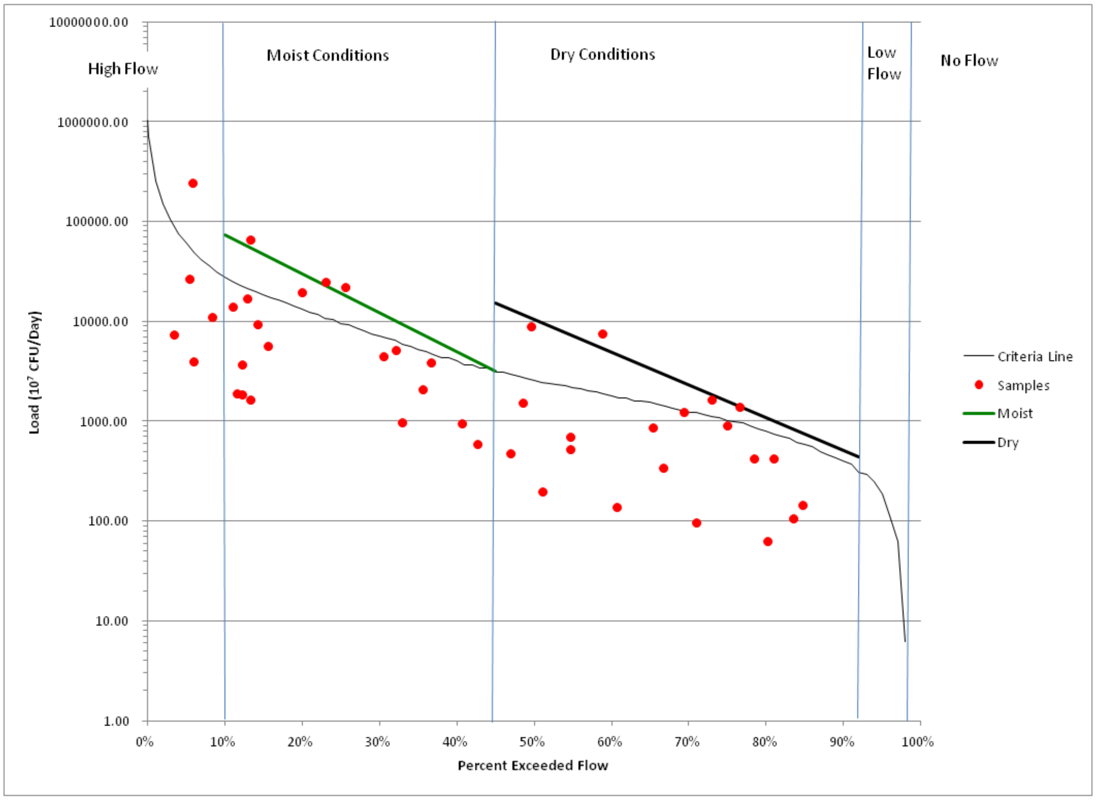

Figure 11. E. coli Bacteria Load Duration Curve for Baldhill Creek Monitoring Station 384126 (The curve reflects flows from 1990-2010).

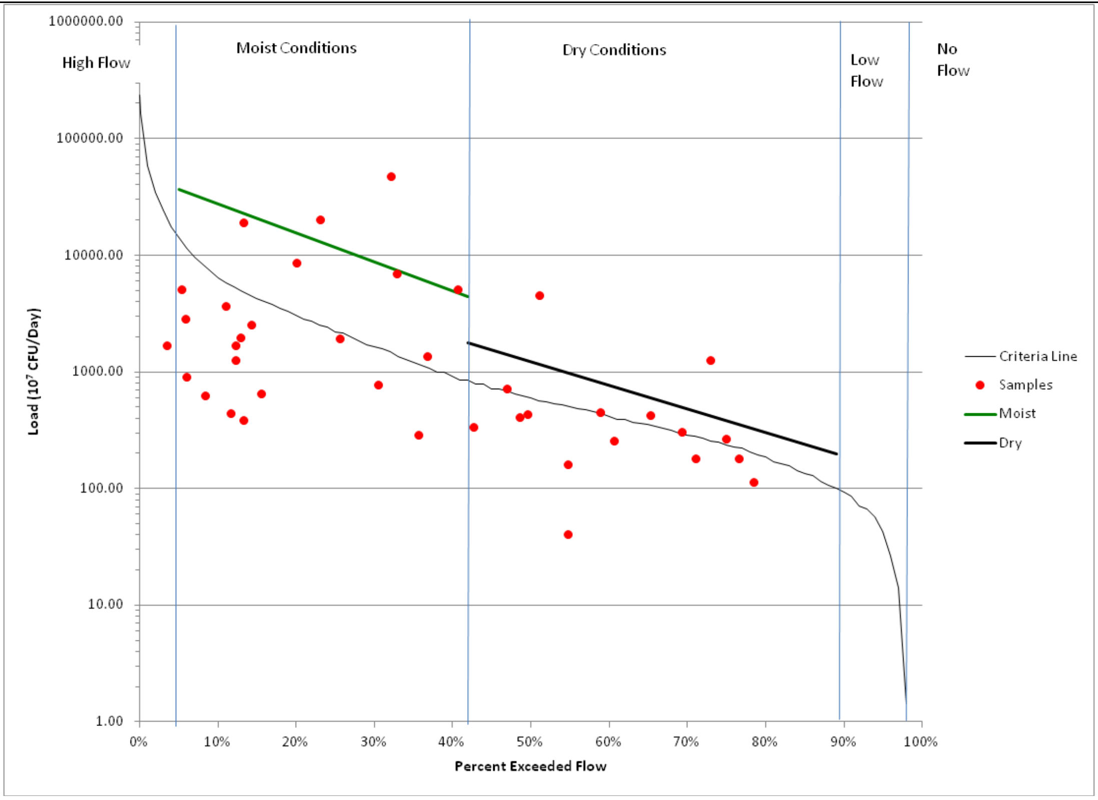

Figure 12. E. coli Bacteria Load Duration Curve for Silver Creek Monitoring Station 384129 (The curve reflects flows from 1990-2010).

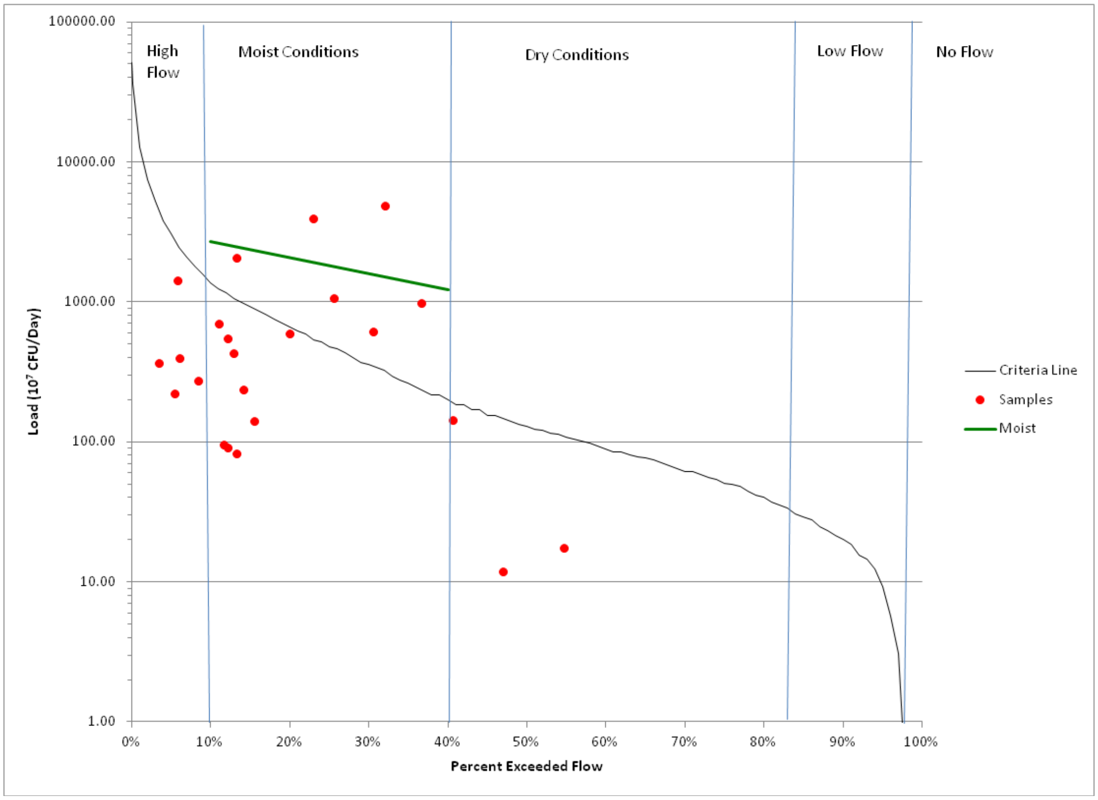

Figure 13. E. coli Bacteria Load Duration Curve for the Unnamed Tributary Monitoring Station 384124 (The curve reflects flows from 1990-2010).

5.4 Waste Load Allocation (WLA) Analysis

Based on a review of the NDPDES Discharge Monitoring Repots (DMRs) for the city of Hannaford, the city has discharge five times from 1994-2011. The average total volume of wastewater discharged each time was 10.0 million gallons and the average discharge period was 5 days (range 3-8 days). While the grab sample results for the city of Hannaford's wastewater facility reported an E. coli bacteria concentration of 20 CFU/100 mL, the water quality standard for E. coli bacteria will be used to estimate the WLA for the TMDL. Based on these assumptions a daily load of 954 x 10^7 CFUs/day is estimated for the WLA used for TMDL segment ND-09020203-002-S. The following is the formula used to calculate the WLA:

$$WLA = \frac{\text{10 million gallons/discharge x 126 CFU/100 mL}}{\text{5 days/discharge}}$$

$$= \frac{\text{10 million gallons/discharge x 3.7854 liters/gallon x 1000 mL/1-Liter x 126 CFU/100 mL}}{\text{5 days/discharge}}$$

$$= 953.92 \times 10^7 \text{ CFUs/day}$$

In 2011 the city of Hannaford was reviewed by the NDPDES program and a grab sample indicated an E.coli bacteria concentration of 20 CFU/100 mL in the one cell lagoon. Each discharge lasted 3 to 8 days and totaled 10 million gallons of water. Since the NDPDES review reported a 20 CFU/100 mL E.coli bacteria concentration lower than the permitted discharge limit, reasonable assurance is not needed for this TMDL.

5.5 Loading Sources

The majority of load reductions can generally be allotted to nonpoint sources, however to account of uncertainty due to periodic discharges from the city of Hannaford's wastewater treatment facility, a waste load allocation (WLA) has been included for the impaired segment ND-09020203-002-S.

The most significant sources of E. coli bacteria loading were defined as nonpoint source pollution originating from livestock. Based on the data available, the general focus of BMPs and load reductions for the listed waterbodies should be on riparian grazing adjacent to or in close proximity to Baldhill Creek, Silver Creek, and unnamed tributary. 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). Three flow regimes (i.e., high, moist, and dry) were used for site 384126 and two flow regimes (i.e., moist and dry) were used for site 384129 because samples indicated exceedences of the water quality standard during periods of moderate flows (Figures 8 and 9). Additionally, one flow regime (i.e., moist conditions) was selected to represent the hydrology of the listed segment of the unnamed tributary (Figure 10). This flow regime was used for site 384124 because samples indicated exceedences of the water quality standard during periods of moderate flow.

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 7). 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 conditions impact at moderate flows (Table 7). 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 7. 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.

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 Baldhill Creek, Silver Creek, and unnamed tributary TMDL addresses seasonality because the flow duration curve was developed using 20 years of USGS gage 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 8 provides an outline of the critical elements of the bacteria TMDL for the three TMDL listed segments. TMDLs for Baldhill Creek (ND-09020203-002-S_00), Silver Creek (ND-09020203-004-S_00), and unnamed tributary (ND-09020203-008-S_00) are summarized in Tables 9 through 11, 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 8. TMDL Summary for Baldhill Creek, Silver Creek, and Unnamed Tributary.

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%

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 9. E. coli Bacteria TMDL (10^7 CFU/day) for Baldhill Creek Assessment Unit ID ND-09020203-002-S_00 as Represented by Site 384126.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	245,179	15,365	2,591	
TMDL	49,329	8,324	1,325	185[1]
WLA	954	954	954	No Reduction Necessary
LA	43,442	6,538	239	
MOS	4,933	832	132	

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

Table 10. E. coli Bacteria TMDL (10^7 CFU/day) for Silver Creek Assessment Unit ID ND-090200203-004-S_00 as Represented by Site 384129.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load		12,762	595	
TMDL	2,403[1]	2,420	348	67[1]
WLA	No Reduction Necessary	0	0	No Reduction Necessary
LA		2,178	313	
MOS		242	35	

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

Table 11. E. coli Bacteria TMDL (10^7 CFU/day) for the Unnamed Tributary in the Baldhill Creek Watershed Assessment Unit ID ND-09020203-008-S_00 as Represented by Site 384124.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load		1,806		
TMDL	3,080[1]	477	79[1]	20[1]
WLA	No Reduction Necessary	0	No Reduction Necessary	No Reduction Necessary
LA		429		
MOS		48		

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

8.0 ALLOCATION

There is a NDPDES permitted municipal wastewater treatment facility located in Hannaford, ND which discharges to segment ND-09020203-002-S, therefore a portion, (954 x 10^7 CFU/day) of the E. coli bacteria load for this TMDL has been allocated to this point source. The remaining load has been allocated to nonpoint sources in the watershed. For segments ND-09020203-004-S and ND-09020203-008_S_00, the entire E. coli bacteria load has been allocated to nonpoint sources located in the watersheds. The 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). 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 immediate watershed as well as those located upstream. The TMDLs described in this report are a plan to improve water quality by implementing “best management practices” (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 Baldhill Creek, Silver Creek, and unnamed tributary watersheds 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.

Nonpoint source pollution is the largest contributor to elevated E. coli bacteria concentrations in the Baldhill Creek watershed. The E. coli samples and load duration curve analysis of the impaired reaches identified the high, moist condition and dry condition flow regimes for ND-09020203-002-S_00, moist and dry condition flow regimes for ND-09020203-004-S_00 and a moist condition flow regime for ND-09020203-008-S_00 as the time of E. coli exceedences of the 126 CFU/100 mL target. To reduce nonpoint source pollution for the high and moderate flow regimes, specific BMPs are described in Section 8.1 and Table 12 that will mitigate the effects of total E. coli bacteria loading to the impaired reaches.

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 total E. coli bacteria loading to Baldhill Creek, Silver Creek, and unnamed tributary. The following sections describe in detail those BMPs that will reduce total E. coli bacteria levels in Baldhill Creek, Silver Creek, and unnamed tributary.

Table 12. Management Practices and Flow Regimes Affected by Implementation of BMPs.

Management Practice	Flow Regime and Expected Reduction		
	High Flow-70%	Moderate Flow-80%	Low Flow-74%
Livestock Exclusion From Riparian Area	X	X	X
Water Well and Tank Development	X	X	X
Prescribed Grazing	X	X	X
Waste Management System	X	X	
Vegetative Filter Strip		X	
Septic System Repair		X	X

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. These BMPs include:

<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.

Water well and tank development- 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.

Prescribed grazing- 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 EPA (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 13) 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.

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 13). 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 13. 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

Table 14. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992).

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, 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 (1992) as presented by EPA (1993), suggest that vegetative filter strips are capable of removing up to 55 percent of bacteria loading to rivers and streams (Table 14). 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 (EPA, 2002).

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirements of this TMDL, a letter was sent to the following participating agencies notifying them that the draft report was available for review and public comment. Those included in the mailing are as follows:

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

In addition to notifying specific agencies of this draft TMDL report's availability, the report 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 Valley City Times-Record and the Griggs County Courier.

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

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.

Specifically, monitoring will be conducted for the pollutant (i.e., E. coli) that is currently causing impairments to the beneficial uses of the waterbody. Once a watershed restoration plan (e.g., Section 319 PIP) is implemented, monitoring will be conducted in the stream beginning two years after implementation and extending five years after the implementation project is complete.

11.0 TMDL IMPLEMENTATION STRATEGY

Implementation of TMDLs is dependent upon the availability of Section 319 NPS funds or other watershed restoration programs (e.g. USDA EQIP), as well as securing a local project sponsor and the required matching funds. Provided these three requirements are in place, a project implementation plan (PIP) is developed in accordance with the TMDL and submitted to the North Dakota Nonpoint Source Pollution Task Force and US EPA for approval. The implementation of the BMPs contained in the NPS PIP is voluntary. Therefore, success of any TMDL implementation project is ultimately dependent on the ability of the local project sponsor to find cooperating producers.

Monitoring is an important and required component of any PIP. As a part of the PIP, data are collected to monitor and track the effects of BMP implementation as well as to judge overall project success. Quality Assurance Project Plans (QAPPs) detail the strategy of how, when and where monitoring will be conducted to gather the data needed to document the TMDL implementation goal(s). As data are gathered and analyzed, watershed restoration tasks are adapted to place BMPs where they will have the greatest benefit to water quality.

12.0 REFERENCES

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Appendix A
E. coli Bacteria Data Collected for Sites 384124, 384129 and 384126 During 2009 and 2010

384124

	May		June		July		August		September	
	04-May-09	10	01-Jun-09	20	06-Jul-09	10				
	11-May-09	20	08-Jun-09	110	13-Jul-09	20				
	18-May-09	20	15-Jun-09	280	06-Jul-10	900				
	03-May-10	10	22-Jun-09	220	13-Jul-10	1900				
	10-May-10	10	29-Jun-09	500	19-Jul-10	90				
	17-May-10	10	01-Jun-10	10						
	24-May-10	70	09-Jun-10	70						
			14-Jun-10	30						
			21-Jun-10	50						
			28-Jun-10	250						
Number of Samples		7		10		5	N/A		N/A	
Geometric Mean		16		84		125	N/A		N/A	
% Exceed 409 CFU/100 mL		0%		10%		40%	N/A		N/A	
Recreational Use Assessment	Fully Supporting		Fully Supporting		FSBT		Insufficiant Data		Insufficiant Data	

384129

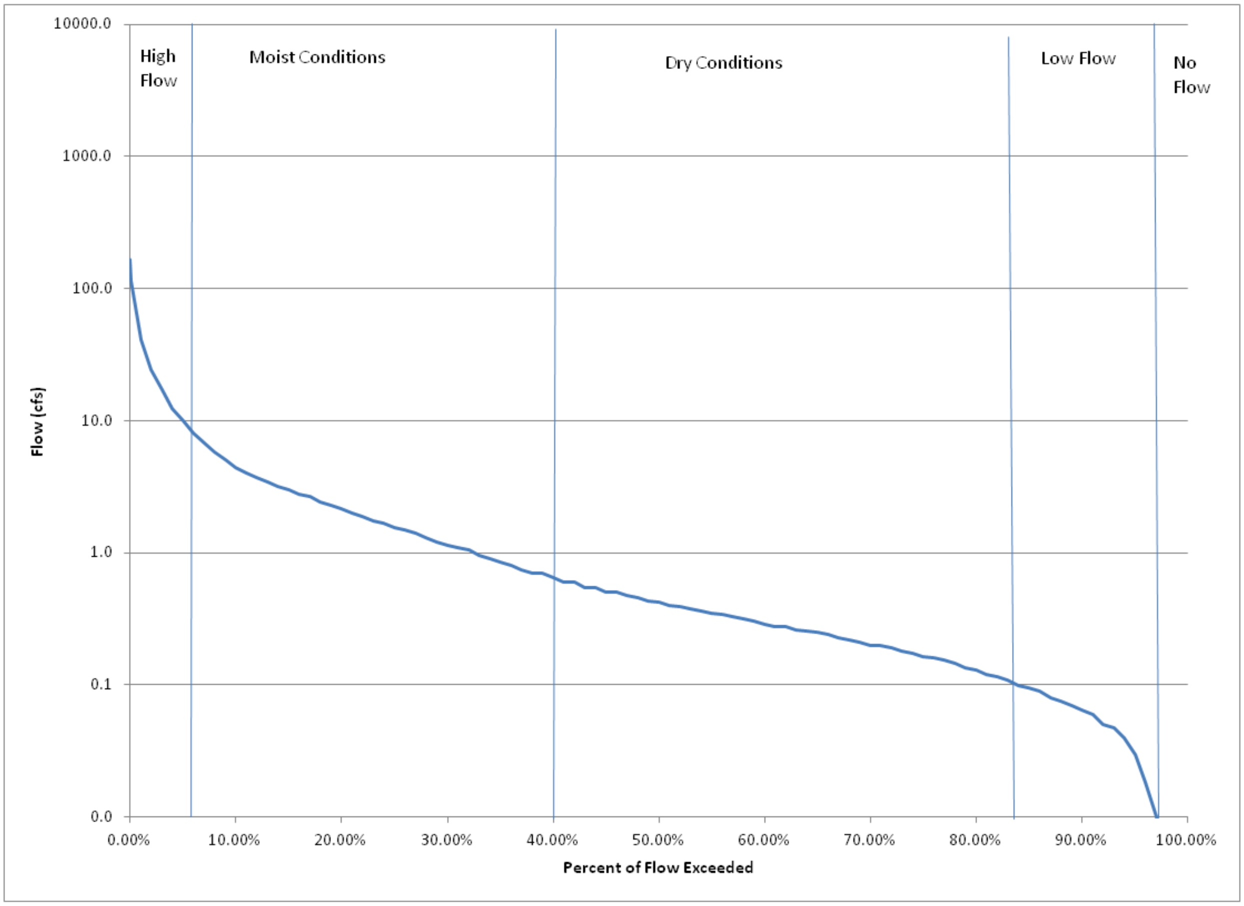
	May		June		July		August		September	
	04-May-09	10	01-Jun-09	20	06-Jul-09	130	04-Aug-09	70	07-Sep-10	620
	11-May-09	10	08-Jun-09	350	13-Jul-09	10	10-Aug-09	140	15-Sep-10	80
	18-May-09	10	15-Jun-09	110	21-Jul-09	130	17-Aug-09	130	20-Sep-10	90
	26-May-09	40	22-Jun-09	60	27-Jul-09	100	24-Aug-09	600	27-Sep-10	30
	03-May-10	10	29-Jun-09	150	06-Jul-10	1000	02-Aug-10	1000		
	10-May-10	30	01-Jun-10	50	13-Jul-10	4000	09-Aug-10	150		
	17-May-10	10	09-Jun-10	80	19-Jul-10	700	16-Aug-10	50		
	24-May-10	30	14-Jun-10	70	26-Jul-10	40	23-Aug-10	80		
			21-Jun-10	50			30-Aug-10	80		
			28-Jun-10	500						
Number of Samples		8		10		8		9		4
Geometric Mean		16		93		193		149		108
% Exceed 409 CFU/100 mL		0%		10%		38%		22%		25%
Recreational Use Assessment	Fully Supporting		Fully Supporting		Not Supporting		Not Supporting		Insufficiant Data	

384126

	May		June		July		August		September	
	04-May-09	10	01-Jun-09	40	06-Jul-09	20	04-Aug-09	60	08-Sep-09	70
	11-May-09	10	08-Jun-09	180	13-Jul-09	30	10-Aug-09	110	16-Sep-09	30
	18-May-09	40	15-Jun-09	290	21-Jul-09	120	17-Aug-09	500	21-Sep-09	10
	26-May-09	20	22-Jun-09	80	27-Jul-09	180	24-Aug-09	180	28-Sep-09	20
	03-May-10	10	29-Jun-09	100	06-Jul-10	280	31-Aug-09	30	07-Sep-10	20
	10-May-10	10	01-Jun-10	60	13-Jul-10	100	02-Aug-10	10	15-Sep-10	70
	17-May-10	10	09-Jun-10	70	19-Jul-10	30	09-Aug-10	70	20-Sep-10	420
	24-May-10	600	14-Jun-10	60	26-Jul-10	40	16-Aug-10	20	27-Sep-10	50
			21-Jun-10	100			23-Aug-10	10		
			28-Jun-10	400			30-Aug-10	10		
Number of Samples		8		10		8		10		8
Geometric Mean		22		105		68		44		43
% Exceed 409 CFU/100 mL		13%		0%		0%		10%		13%
Recreational Use Assessment	Fully Supporting but Threatened		Fully Supporting		Fully Supporting		Fully Supporting		Fully Supporting but Threatened	

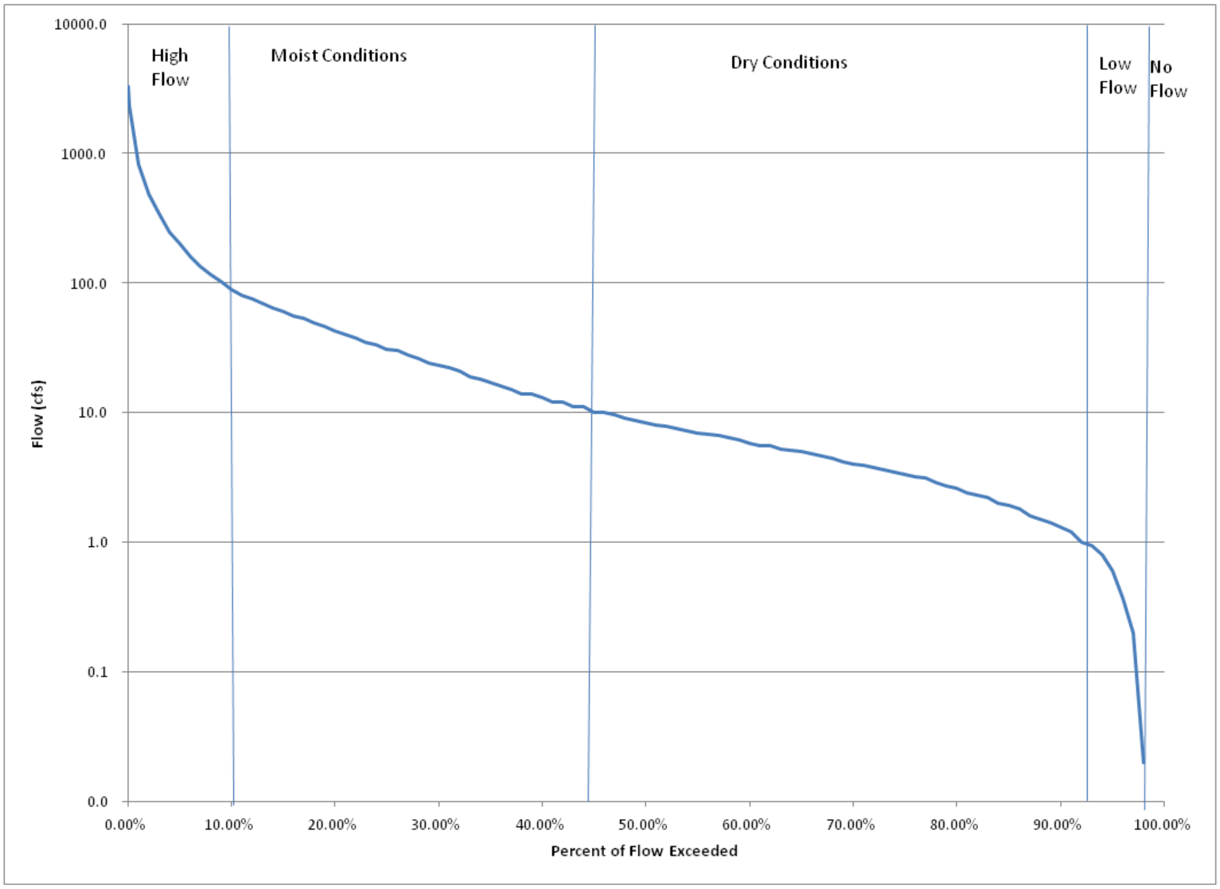
Appendix B
Flow Duration Curves for Sites 384124, 384126, and 384129

Site 384124



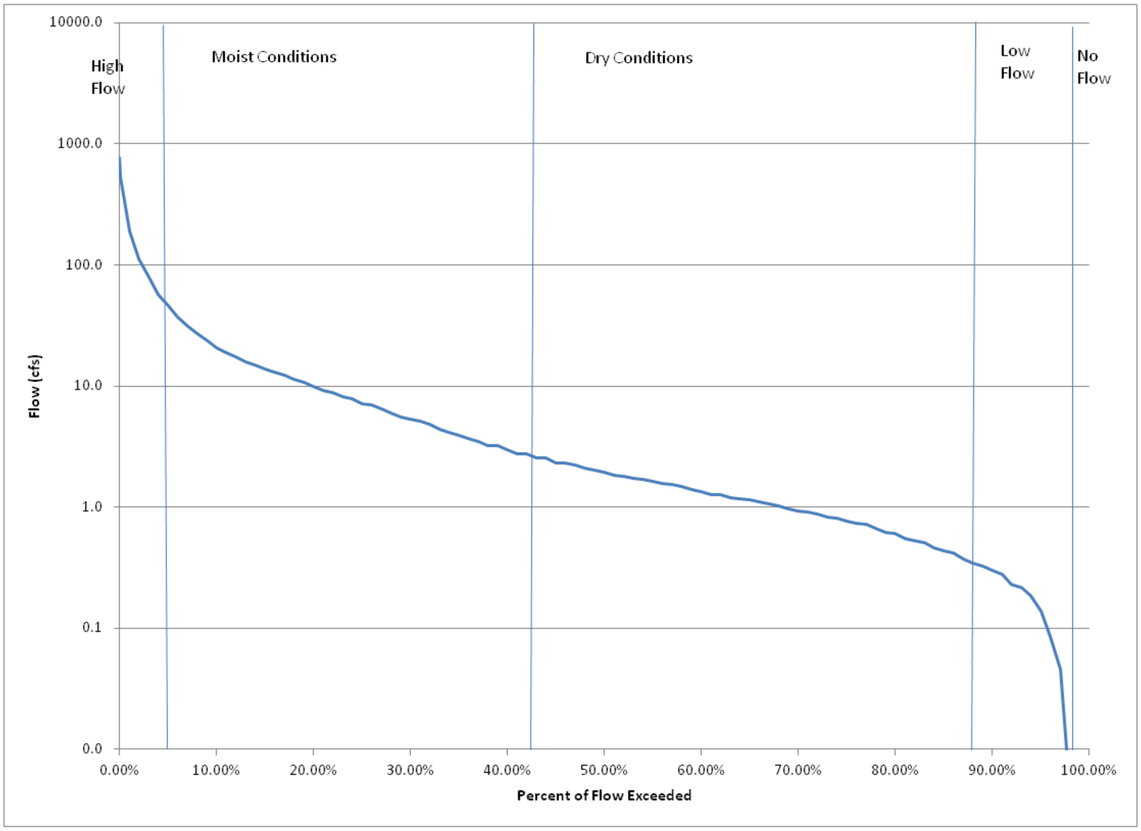
High Flow
Moist Conditions
Dry Conditions
Low Flow
No Flow
10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
Flow (cfs)
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
70.00%
80.00%
90.00%
100.00%
Percent of Flow Exceeded

Site 384126



High Flow
Moist Conditions
Dry Conditions
Low Flow
No Flow
10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
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 of Flow Exceeded

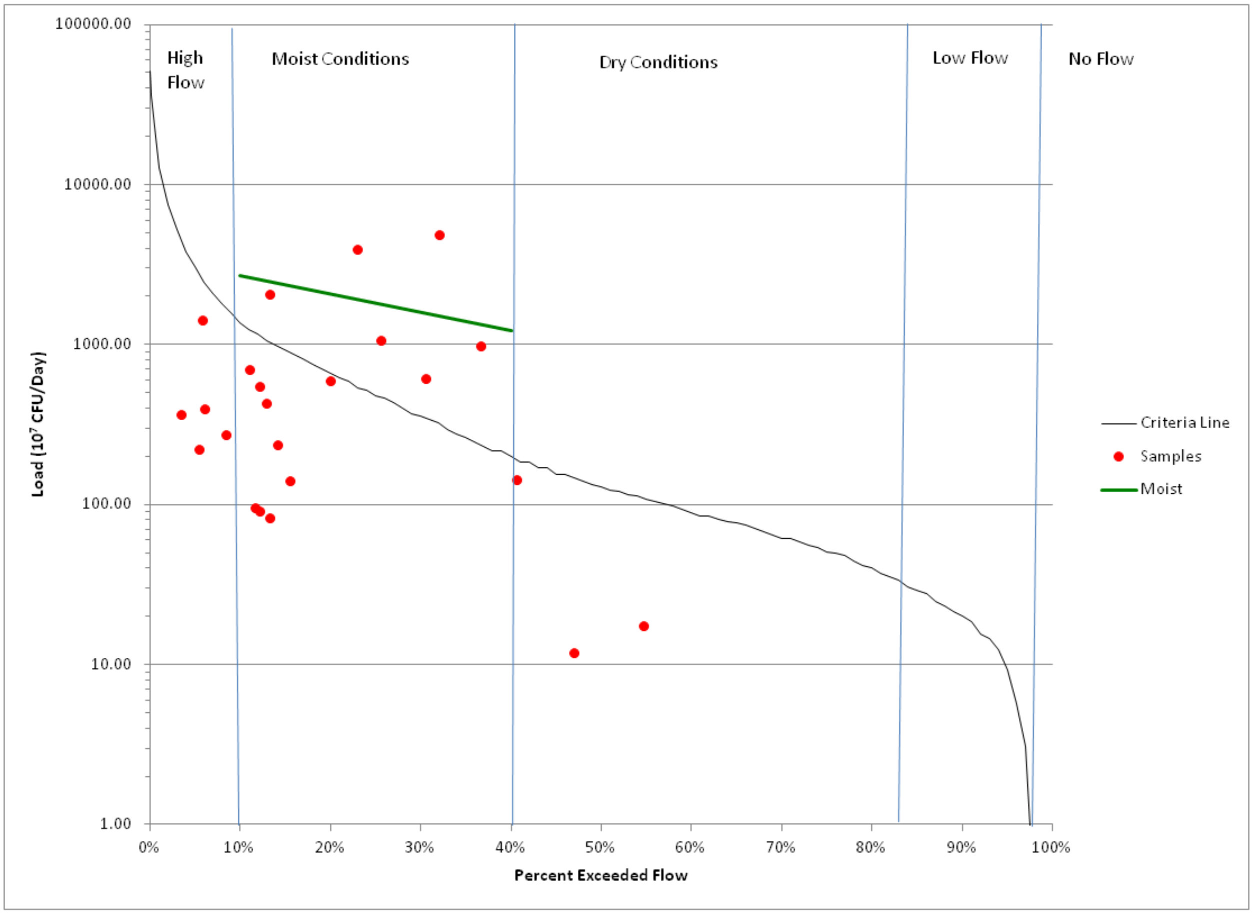
Site 384129


High Flow
Moist Conditions
Dry Conditions
Low Flow
No Flow
10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
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 of Flow Exceeded

Appendix C
Load Duration Curves, Estimated Loads, TMDL Targets, and Percent Load Reduction Required for Sites 384124, 384126, and 384129

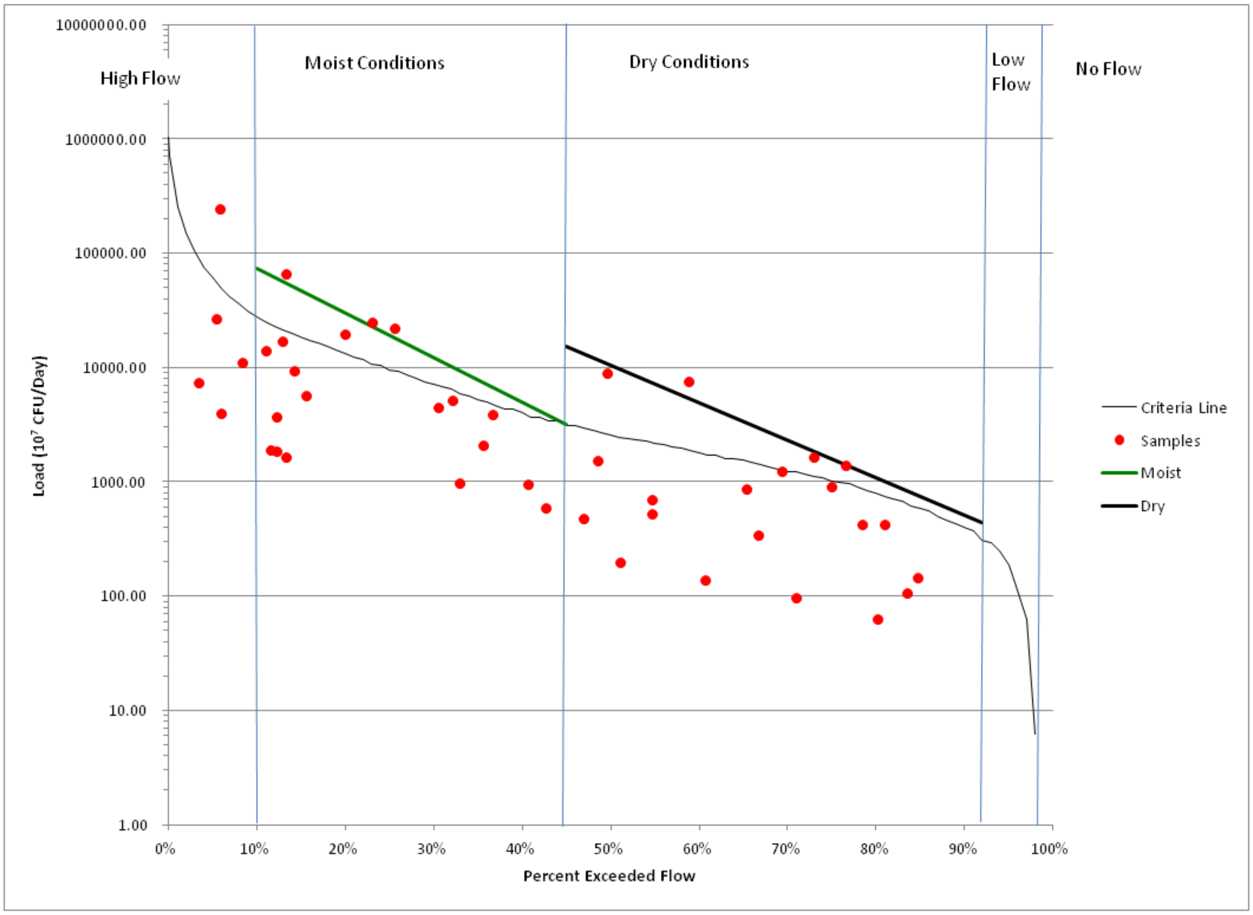
384124 Unnamed Tributary to Baldhill Creek near Highway 200

	Load (10^7 CFU/Day)				Load (10^7 CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
Moist	25.00%	1806.08	477.46	109.50	197765.63	52282.13	73.56%
			Total	110	197766	52282	73.56%



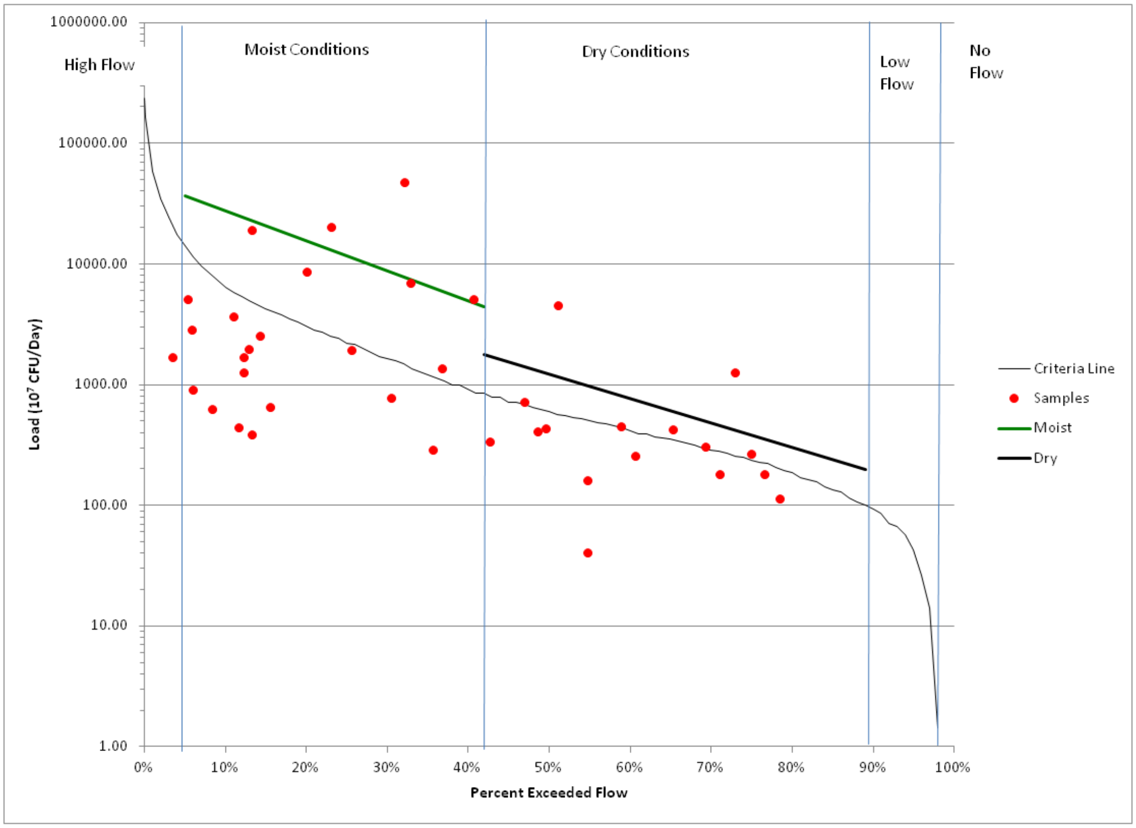
384126 Baldhill Creek near Dazey, ND

	Load (10^7CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
Moist	27.50%	15365.68	8324.35	127.75	1962965.95	1063435.68	45.83%
Dry	68.50%	2591.64	1325.73	171.55	444595.75	227428.94	48.85%
			Total	299	2407562	1290865	46.38%



384129 Silver Creek near Walum, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
Moist	23.50%	12762.12	2420.16	135.05	1723523.94	326842.01	81.04%
Dry	65.50%	594.94	348.79	171.55	102062.14	59834.43	41.37%
			Total	307	1825586	386676	78.82%



Appendix D
US EPA Region 8 TMDL Review

EPA REGION 8 TMDL REVIEW FORM AND DECISION DOCUMENT

TMDL Document Info:

Document Name:	**E. coli Bacteria TMDL for Baldhill Creek, Silver Creek, and an Unnamed Tributary to Baldhill Creek in Griggs and Stutsman Counties, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**July 16, 2012**
Review Date:	**August 10, 2012**
Reviewer:	**Vern Berry, US Environmental Protection Agency**
Rough Draft / Public Notice / Final Draft?	**Public Notice**
Notes:	

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

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

Approval Notes to the 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 TMDL review elements identified in the following 8 sections:

1. Problem Description
   a. …TMDL Document Submittal
   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 review elements 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 this review form 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 form 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

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

Review Elements:

☒ Each TMDL document submitted to EPA should include a notification of the document status (e.g., pre-public notice, public notice, final), and a request for EPA review.

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

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information ☐ N/A

Summary: *The notification of the availability of the public notice draft TMDL document was submitted to EPA via a letter received on July 16, 2012. The letter includes the details of the public notice, explains how to obtain a copy of the TMDL, and requests the submittal of comments to NDDoH by August 20, 2012.*

Comments: *No comments.*

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Review Elements:

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

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

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

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

Summary:
Physical Setting and Listing History:
This TMDL document includes three impaired stream segments within the Middle Sheyenne River sub-basin (HUC 09020203) in east-central North Dakota. The three impaired segments are located in Griggs and Barnes Counties which cover a watershed area of approximately 488,125 acres.

The three impaired segments included in this TMDL document are: 1) Baldhill Creek from tributary watershed (ND-09020203-005-S_00) downstream to Lake Ashtabula (30.21 miles; ND-09020203-002-S_00); 2) Silver Creek, including Gunderson Creek and all tributaries (38.51 miles; ND-09020203-004-S_00); and 3) Unnamed Tributary water to Baldhill Creek (ND-09020203-007-S_00) located in NW Griggs County (16.07 miles; ND-09020203-008-S_00). These segments are listed as impaired for E. coli bacteria and are a high priority for TMDL development.

CHAPTER 33-16-02.1, Appendix 1 of the North Dakota Century Code assigns the following classifications for the stream segments in this TMDL document. All tributaries not specifically mentioned in Appendix 1 are classified as Class III streams:

Class II – Baldhill Creek
Class III – Silver Creek; Unnamed tributary to Baldhill Creek

The designated uses for Class II and Class III streams are discussed in the Water Quality Standards section below.

***Impairment status**:*
The 2012 North Dakota Integrated Report identifies Baldhill Creek, Silver Creek and the Unnamed Tributary to Baldhill Creek as not supporting the following beneficial uses:

Stream Segment	**Beneficial Use Not Supported**	**Cause**	**Priority**
Baldhill Creek ND-09020203-002-S_00	*Recreation – fully supporting but threatened*	*Escherichia coli*	*High*
Silver Creek ND-09020203-004-S_00	*Recreation – not supporting*	*Escherichia coli*	*High*
Unnamed Tributary to Baldhill Creek ND-09020203-008-S_00	*Recreation – not supporting*	*Escherichia coli*	*High*

Comments: *The TMDL document title on the cover page says the impaired segments are in Griggs and Stutsman Counties. However, the text on page 1, as well as the maps, indicates that the segments are located in Griggs and Barnes Counties. Please correct the title to match the rest of the document.*

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).

Review Elements:

☒ 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 identified 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 Baldhill Creek, Silver Creek and Unnamed Tributary to Baldhill Creek stream segments addressed by this TMDL document are impaired based on E. coli concentrations impacting the recreational uses.*

Baldhill Creek is a Class II stream. The quality of the waters in Class II streams shall be the same as the quality of Class I streams, except that additional treatment may be required to meet the drinking water requirements. The streams may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, irrigation, bathing, or swimming. The quality of waters in both Class II and III must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Silver Creek and the Unnamed Tributary to Baldhill Creek are Class III streams. The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Numeric criteria for E. coli in North Dakota, Class II and Class III streams have been established and are presented in the excerpted Table 6 shown below. Discussion of additional applicable water quality standards for these stream segments can be found on pages 8 – 10 of the TMDL document.

Table 6. North Dakota Bacteria Water Quality Standards for Class II and III 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 10 percent of samples collected during any consecutive 30-day period shall individually exceed the standard.

Comments: *Section 2.1, page 9 references a document "NDDoH, 2011". However, details of this document reference are not included in Section 12.0 References. Please correct.*

2. Water Quality Targets

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

Review Elements:

☒ 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

<u>Summary:</u> *The water quality targets for these TMDLs are based on the numeric water quality standards for E. coli bacteria established to protect the recreational beneficial uses for Baldhill Creek, Silver Creek and the Unnamed Tributary to Baldhill Creek. The E. coli target for each impaired segment is: 126 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target for each stream segment was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the targets will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standard.*

Effective January 2011, the North Dakota Department of Health 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.

Comments: *No comments.*

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each identified source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each identified source (or source category) should be specified and quantified. 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.

Review Elements:

☒ The TMDL should include an identification of the 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 the anthropogenic sources of the pollutant of concern have been identified, characterized, and 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 2007 National Agricultural Statistics Service (NASS) data. In 2007, the dominant land use in the Baldhill Creek watershed was agriculture, primarily crop production. Approximately 68 percent of the landuse in the watershed was cropland, 18 percent was grassland/pastureland, and the remaining 13 percent was wetlands, developed space, barren or woods. The majority of the crops grown consisted of soybeans, spring wheat, corn, sunflowers and barley.*

Section 4.0, Significant Sources beginning on page 10, provides the pollutant source analysis for the three listed segments in the Baldhill Creek watershed. There is one municipal point source located in Hannaford, ND located on Baldhill Creek segment ND-09020203-002-S. This facility is permitted through the North Dakota Pollutant Discharge Elimination System Program. The Hannaford facility discharges intermittently into Baldhill Creek, generally for short periods of time. A waste load allocation for this discharge is included in the TMDL for Baldhill Creek segment ND-09020203-002-S.

There are four known animal feeding operations (AFOs) in the contributing watershed of Baldhill Creek, Silver Creek and unnamed tributary. The four AFOs in the Baldhill Creek watershed include one small (0-300 animal units (AUs)) AFO and three medium (301-999 AUs) AFOs which have a permit to operate. All four AFOs are zero discharge facilities and are not deemed significant point sources of E. coli bacteria loading to Baldhill Creek, Silver Creek, or the Unnamed Tributary.

The E. coli bacteria pollution to these segments originates from nonpoint sources in the watershed. Livestock grazing and watering in proximity to these streams is common along the TMDL listed segments. Intense early summer storms can cause overland flooding and rising river levels. Due to the close proximity of livestock grazing and watering to these stream segments, it is likely that runoff from these activities contribute to the E. coli bacteria pollution in the Baldhill Creek watershed.

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.

Septic system failure might also 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 system design. 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.

<u>Comments</u>: *The first sentence of Section 1.3, Land Use, cites NASS 2007 land cover data. However, the description of Figure 4, Land Use in the Baldhill Creek Watershed, cites NASS 2006 data. Please revise as necessary to include the correct year of the land use dataset.*

Section 4.1, Point Source Pollution Sources, mentions using 20 cfu/100 mL E. coli concentration from the DMR, in the WLA calculation for Hannaford. To be consistent with the WLA calculations in Section 5.4 the value should be changed to 126 cfu/100 mL.

4. TMDL Technical Analysis

TMDL determinations should be supported by an analysis of the available data, discussion of the known deficiencies and/or gaps in the data set, and an appropriate level of technical analysis**.** This applies to **<u>all</u>** of the components of a TMDL document. It is vitally important that the technical basis for **<u>all</u>** 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:

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

Where:

TMDL	=	Total Maximum Daily Load (also called the Loading Capacity)
LAs	=	Load Allocations
WLAs	=	Wasteload Allocations
MOS	=	Margin Of Safety

Review Elements:

☒ 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:

- the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
- the distribution of land use in the watershed (e.g., urban, forested, agriculture);
- 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…;
- 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);
- 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 Baldhill Creek watershed TMDLs describes 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 each Section 303(d) listed waterbody, LDCs were developed for each stream segment. Daily stream flow values were collected at the USGS gage station 05057200 located on Baldhill Creek segment ND-09020203-002-S_00 near Dazey, ND. This gage station is collocated with the NDDoH monitoring station 384126. Flows for the ungaged water quality monitoring sites 384124 (Unnamed Tributary segment ND-09020203-008-S_00) and 384129 (Silver Creek segment ND-09020203-004-S_00) were determined by utilizing the Drainage-Area Ratio Method developed by the USGS. The Drainage-Area Ratio Method assumes that the streamflow at the ungaged site is hydrologically similar (same per unit area) to the stream gaging station used as an index.

The LDCs were derived for each segment using the daily flow record, the 126 CFU/100 mL TMDL target (i.e., state water quality standard) and the observed E. coli data collected from the three monitoring stations (see Figure 6 of the TMDL document for a map of the monitoring locations).

Observed in-stream E. coli bacteria data, obtained from the monitoring stations, were converted to pollutant loads by multiplying E. coli bacteria concentrations by the mean daily flow and a conversion factor. These loads were plotted against the percent exceeded of the flow on the day of sample collection (see Figures 11, 12 and 13 in the TMDL document). Points plotted above the 126 CFU/100 mL target curve exceeded the State water quality standard or TMDL target. Points plotted below the curve are meeting the State water quality standard of 126 CFU/100 mL.

To estimate the required percent reductions in loading needed to achieve the TMDL for each stream segment, 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 (see Appendix C in the TMDL document).

The LDCs represent flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the three Baldhill Creek watershed 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 each of the listed stream segments at each flow regime. Tables 9, 10 and 11 show the loading capacity load (i.e., TMDL load) for each of the listed segments in the Baldhill Creek watershed.*

Comments: *No Comments.*

4.1 Data Set Description

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

Review Elements:

☒ 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 Baldhill Creek TMDL data description and summary are included in the Available Data section (Section 1.5), in tables throughout the document and in the data tables in Appendix A. Recent water quality monitoring was conducted from May – September 2009-2010 and included 44 E. coli samples at station 384126 on Segment 002, Baldhill Creek, 39 E. coli samples at station 384129 on Segment 004, Silver Creek and 22 E. coli samples at station 384124 on Segment 008, Unnamed Tributary to Baldhill Creek . The data set also includes approximately 20 years of flow record from USGS gauging station 05057200 (co-located with sampling station 384126). The flow data, the E. coli data and the TMDL targets, were used to develop the E. coli load duration curves for the three segments of the Baldhill Creek watershed.*

Comments: *No Comments.*

4.2 Waste Load Allocations (WLA):

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

Review Elements:

☒ EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and 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 Baldhill Creek watershed, there is a municipal point source located in Hannaford, ND located on Baldhill Creek segment ND-09020203-002-S. Based on a review of the NDPDES Discharge Monitoring Repots (DMRs) for the city of Hannaford, the city has discharge five times from 1994-2011. The average total volume of wastewater discharged each time was 10.0 million gallons and the average discharge period was 5 days (range 3-8 days). The water quality standard for E. coli bacteria was used to estimate the WLA for the TMDL. Based on these assumptions a daily load of* 9.54×10^9 *CFUs/day was estimated for the WLA used for TMDL segment ND-09020203-002-S.*

There are no point source discharges to the Silver Creek segment (ND-09020203-004-S_00) or to the Unnamed Tributary to Baldhill Creek (ND-09020202-008-S_00). Therefore, the E. coli WLA for these segments are zero.

There are four known animal feeding operations (AFOs) in the contributing watershed of Baldhill Creek, Silver Creek and the Unnamed Tributary. The four AFOs in the Baldhill Creek watershed include one small (0-300 animal units (AUs)) AFO and three medium (301-999 AUs) AFOs which have a permit to operate. All four AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to Baldhill Creek, Silver Creek, or the Unnamed Tributary.

Comments: *Section 4.1, page 10 says that the WLA for Hannaford was calculated using the DMR concentration of 20 cfu/100 mL. It is likely that the E. coli effluent limitation in the permit is based on the WQS concentration of 126 cfu/100 mL. This section should be changed to reflect the permit limit and to be consistent with the language in Section 5.4. The NDPDES number for the Hannaford facility needs to be added to the TMDL document.*

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.

Review Elements:

☒ 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 the 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 2007 National Agricultural Statistics Service (NASS) data. In 2007, the dominant land use in the Baldhill Creek watershed was agriculture. Approximately 68 percent of the landuse in the watershed was cropland, 18 percent was grassland, pastureland or conservation reserve program lands and the remaining 13 percent was water, wetlands, developed space, barren or woods. The majority of the crops grown consist of soybeans, spring wheat, corn, sunflowers and barley.*

The E. coli bacteria pollution to this segment is originating from nonpoint sources in the watershed. Intense early summer storms can cause overland flooding and rising river levels.

Due to the close proximity of livestock grazing and watering to the river, it is likely that they contribute to the E. coli bacteria pollution in the listed segments in the Baldhill Creek watershed.

Wildlife and failing septic systems may also contribute to the E. coli bacteria found in the water quality samples, but most likely in a lower concentration.

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, moist and dry condition, 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 medium impact at moist condition 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 E. coli bacteria contamination.

Source specific data are limited so aggregate LAs are assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table. Aggregate load allocations for each of the three impaired segments in the Baldhill Creek watershed are included in Tables 9, 10 and 11 of the TMDL document.

Table 7. 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)

***<u>Comments</u>**: No comments.*

4.4 Margin of Safety (MOS):

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

Review Elements:

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

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

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

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

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

<u>Summary:</u> *The Baldhill Creek TMDL document includes explicit MOSs for each of the three listed segments in the watershed. The MOSs were derived by calculating 10 percent of the loading capacity for each segment. The explicit MOS for the Baldhill Creek, segment 002, is* *included in Table 9; the explicit MOS for the Silver Creek, segment 004, is included in Table 10; and the explicit MOS for the Unnamed Tributary, segment 008, is included in Table 11 of the TMDL document.*

***Comments**: No comments.*

4.5 Seasonality and variations in assimilative capacity:

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

Review Elements:

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

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

***Summary**: By using the load duration curve approach to develop the TMDL allocations seasonal variability in fecal coliform loads are taken into account. The highest steam flows typically occur during late spring, and the lowest stream flows typically occur during the winter months. The TMDL also considers seasonality because the fecal coliform criteria are in effect from May 1 to September 30, as defined by the recreation season in North Dakota.*

***Comments**: No comments.*

5. Public Participation

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

Review Elements:

☒ 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. Letters notifying stakeholders of the availability 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: *No comments.*

6. Monitoring Strategy

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

Review Elements:

☐ 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: *Once a watershed restoration plan (e.g., Section 319 PIP) is developed and implemented, monitoring will be conducted in the stream beginning two years after implementation and extending five years after the implementation project is complete.*

Comments: *No comments.*

7. Restoration Strategy

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

Review Elements:

☐ 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: *Implementation of these TMDLs are dependent upon the availability of Section 319 NPS funds or other watershed restoration programs (e.g. USDA EQIP), as well as securing a local project sponsor and the required matching funds. Provided these three requirements are in place, a project implementation plan (PIP) will be developed in accordance with the TMDL and submitted to the North Dakota Nonpoint Source Pollution Task Force and US EPA for approval. The implementation of the BMPs contained in the NPS PIP is voluntary. Therefore, success of any TMDL implementation project is ultimately dependent on the ability of the local project sponsor to find cooperating producers.*

Comments: *No comments.*

8. Daily Loading Expression

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

Review Elements:

☒ 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 Baldhill Creek E. coli TMDL document includes daily loads expressed as colonies per day for the three listed stream segments in the watershed. The daily TMDL loads for each segment are included in TMDL section (Section 7.0) of the document.*

Comments: *No comments.*

Appendix E
NDDoH Response to Comments

US EPA Region 8 Comment: The TMDL document title on the cover page says the impaired segments are in Griggs and Stutsman Counties. However, the text on page 1, as well as the maps, indicates that the segments are located in Griggs and Barnes Counties. Please correct the title to match the rest of the document.

NDDoH Response: Corrections made where requested.

US EPA Region 8 Comment: Section 2.1, page 9 references a document "NDDoH, 2011". However, details of this document reference are not included in Section 12.0 References. Please correct.

NDDoH Response: Reference added to Section 12.0.

US EPA Region 8 Comment: The first sentence of Section 1.3, Land Use, cites NASS 2007 land cover data. However, the description of Figure 4, Land Use in the Baldhill Creek Watershed, cites NASS 2006 data. Please revise as necessary to include the correct year of the land use dataset.

Section 4.1, Point Source Pollution Sources, mentions using 20 cfu/100 mL E. coli concentration from the DMR, in the WLA calculation for Hannaford. To be consistent with the WLA calculations in Section 5.4 the value should be changed to 126 cfu/100 mL.

NDDoH Response: Corrections made where requested.

US EPA Region 8 Commens: Section 4.1, page 10 says that the WLA for Hannaford was calculated using the DMR concentration of 20 cfu/100 mL. It is likely that the E. coli effluent limitation in the permit is based on the WQS concentration of 126 cfu/100 mL. This section should be changed to reflect the permit limit and to be consistent with the language in Section 5.4. The NDPDES number for the Hannaford facility needs to be added to the TMDL document.

NDDoH Response: Corrections made where requested.