E. coli Bacteria TMDLs for the Long Lake Creek and West Branch Long Lake Creek in Emmons and Burleigh Counties, North Dakota

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Long Lake Creek watershed is a 219,081 acre sub-watershed of the Apple Creek watershed (hydrologic unit code 10130103) located in central North Dakota (Figure 1). The 303(d) listed reach of Long Lake Creek is 222.41 river miles in length beginning in the northwestern portion of Emmons County then flows northwest until its confluence with Long Lake. Long Lake Creek continues flowing from Long Lake until its confluence with Apple Creek northeast of Menoken, North Dakota. The Long Lake Creek impaired segment lies within the Level III Ecoregion, Northwestern Glaciated Plains (42).

Table 1. General Characteristics of the Long Lake Creek Watershed.

Legal Name	Long Lake Creek
Stream Classification	Class III
Major Drainage Basin	Missouri
8-Digit Hydrologic Unit	10130103
County	Emmons and Burleigh
Level III Ecoregions	Northwestern Glaciated Plains (42)
Watershed Area (acres)	219,081

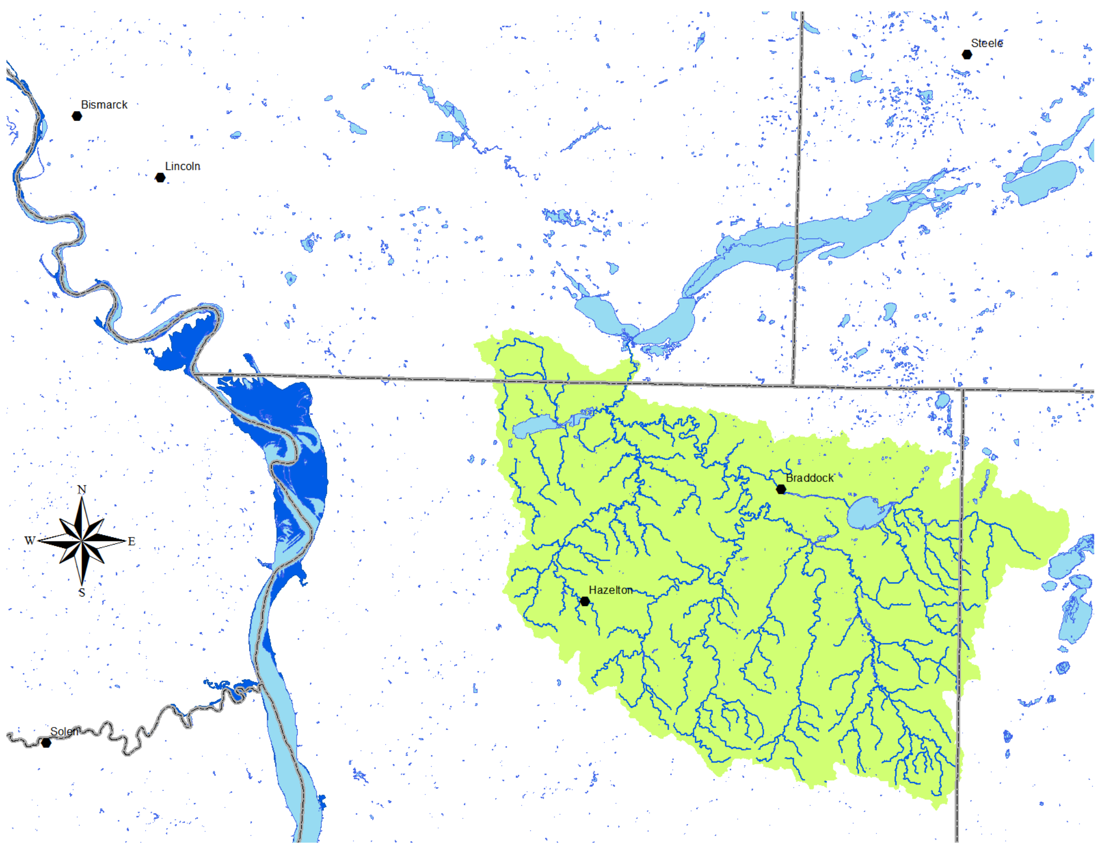

Figure 1. Long Lake Creek Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2016 Section 303(d) List of Impaired Waters Needing TMDLs (NDDoH, 2017), the North Dakota Department of Health has identified a 222.41 mile segment (ND-10130101-002-S_00) of the Long Lake Creek as fully supporting but threatened for recreational uses due to Escherichia coli (E. coli) (Table 2). The 84.35 mile segment of West Branch Long Lake Creek (ND-10130101-004-S_00) has been listed as fully supporting but threatened and not supporting recreational uses respectively, due to E. coli (Table 3, Figure 2).

Table 2. Long Lake Creek Section 303(d) Listing Information for Assessment Unit ID ND-10130101-002-S_00 (NDDoH, 2016).

Assessment Unit ID	ND-10130101-002-S_00
Waterbody Description	Long Lake Creek and tributaries located in Emmons and Burleigh Counties.
Size	152.01 miles
Designated Use	Recreation
Use Support	Fully Supporting but Threatened
Impairment	E. coli
TMDL Priority	High

Table 3. West Branch Long Lake Creek Section 303(d) Listing Information for Assessment Unit ID ND-10130101-004-S_00 (NDDoH, 2016).

Assessment Unit ID	ND-10130101-004-S_00
Waterbody Description	West Branch Long Lake Creek upstream from Braddock Dam, including tributaries.
Size	85.27 miles
Designated Use	Recreation
Use Support	Fully Supporting but Threatened
Impairment	E. coli
TMDL Priority	High

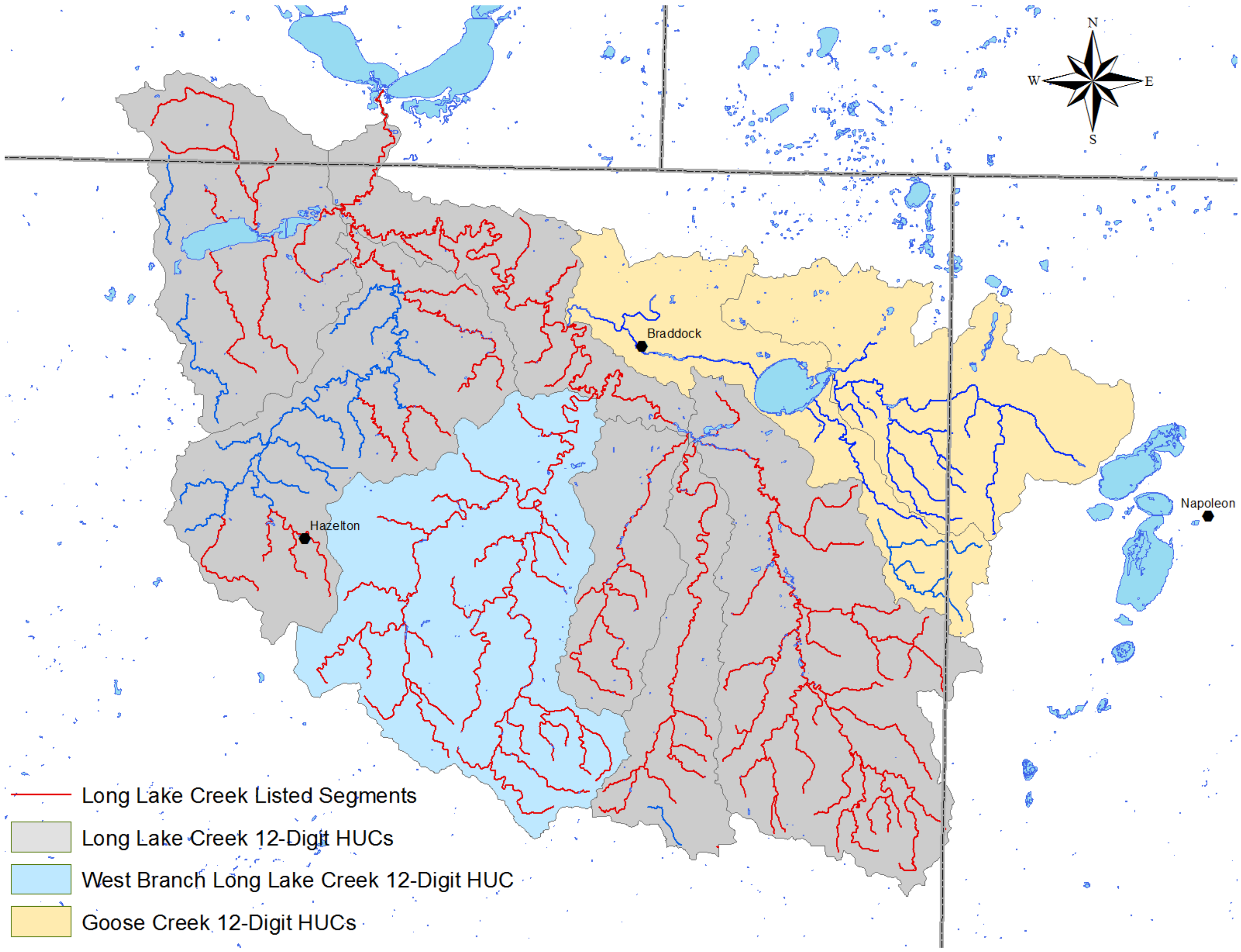

Figure 2. Long Lake Creek, West Branch Long Lake Creek TMDL Listed Segments.

1.2 Ecoregions

The watersheds for the Section 303(d) listed segments highlighted in this TMDL lie within the Level III Northwestern Glaciated Plains (Figure 3). The Northwestern Glaciated Plains ecoregion marks the westernmost extent of continental glaciation. The youthful morainal landscape has significant surface irregularity and high concentrations of wetlands. The rise in elevation along the eastern boundary defines the beginning of the Great Plains. Land use is transitional between the intensive dryland farming on Ecoregion 46i to the east and the predominance of cattle ranching and farming to the west on the Northwestern Great Plains (43)(USGS, 2013).

Specifically, a majority of the watershed lies within Level IV ecoregion Missouri Coteau Slope (42c). This ecoregion declines in elevation from the Missouri Coteau (42a) to the Missouri River. Unlike the Missouri Coteau (42a) where there is a paucity of streams, the Missouri Coteau Slope has a simple drainage pattern and fewer wetland depressions. Due to the level to gently rolling topography, there is more cropland than on the Missouri Coteau (42a). Cattle graze on the steeper land that occurs along drainages.

The lower 303(d) listed segments of Long Lake Creek lie within the Level IV Collapsed Glacial Outwash (42b). This ecoregion formed from gravel and sand deposited by glacial meltwater and precipitation runoff over stagnant ice. Many large, shallow lakes are found in this ecoregion. During its slow retreat, the Wisconsinan glacier stalled on the Missouri escarpment for thousands of years, melting slowly beneath a mantle of sediment to create the characteristic pothole topography of the Coteau. Land use on the coteau is a mixture of tilled agriculture in flatter areas and grazing land on steeper slopes (USGS, 2013).

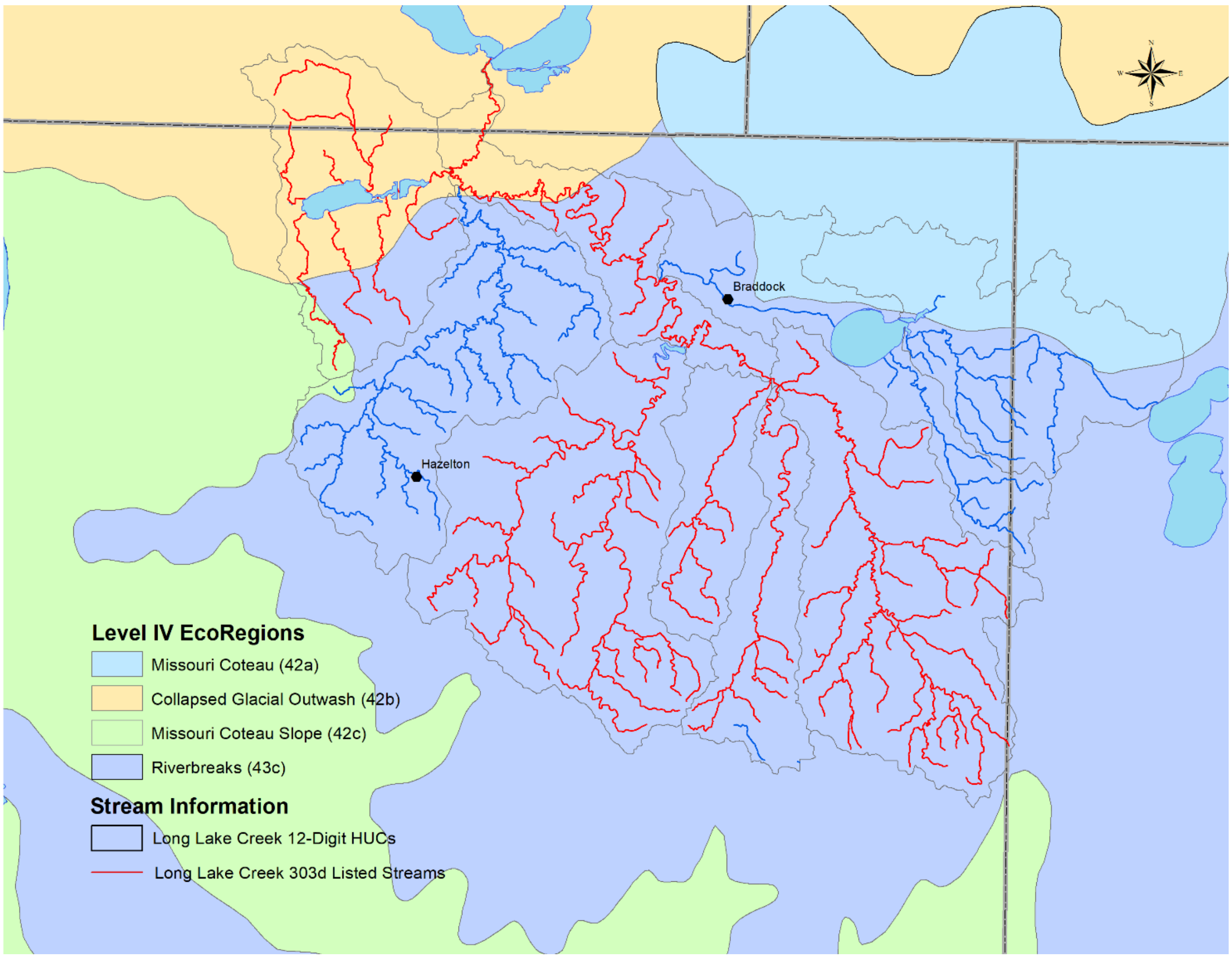

Figure 3. Level IV Ecoregions associated with Long Lake Creek and its Listed Segments.

1.3 Land Use

The dominant land use in the Long Lake Creek watershed is agriculture. According to the 2017 National Agricultural Statistical Service (NASS, 2017) land survey data, approximately 55 percent of the land is cropland, 39 percent grassland, and 6 percent consists of other minor land uses such as; open space, open water, wetlands, etc. The majority of the crops grown consist of soybeans, corn spring, wheat and sunflowers (Figure 4 - Table 4).

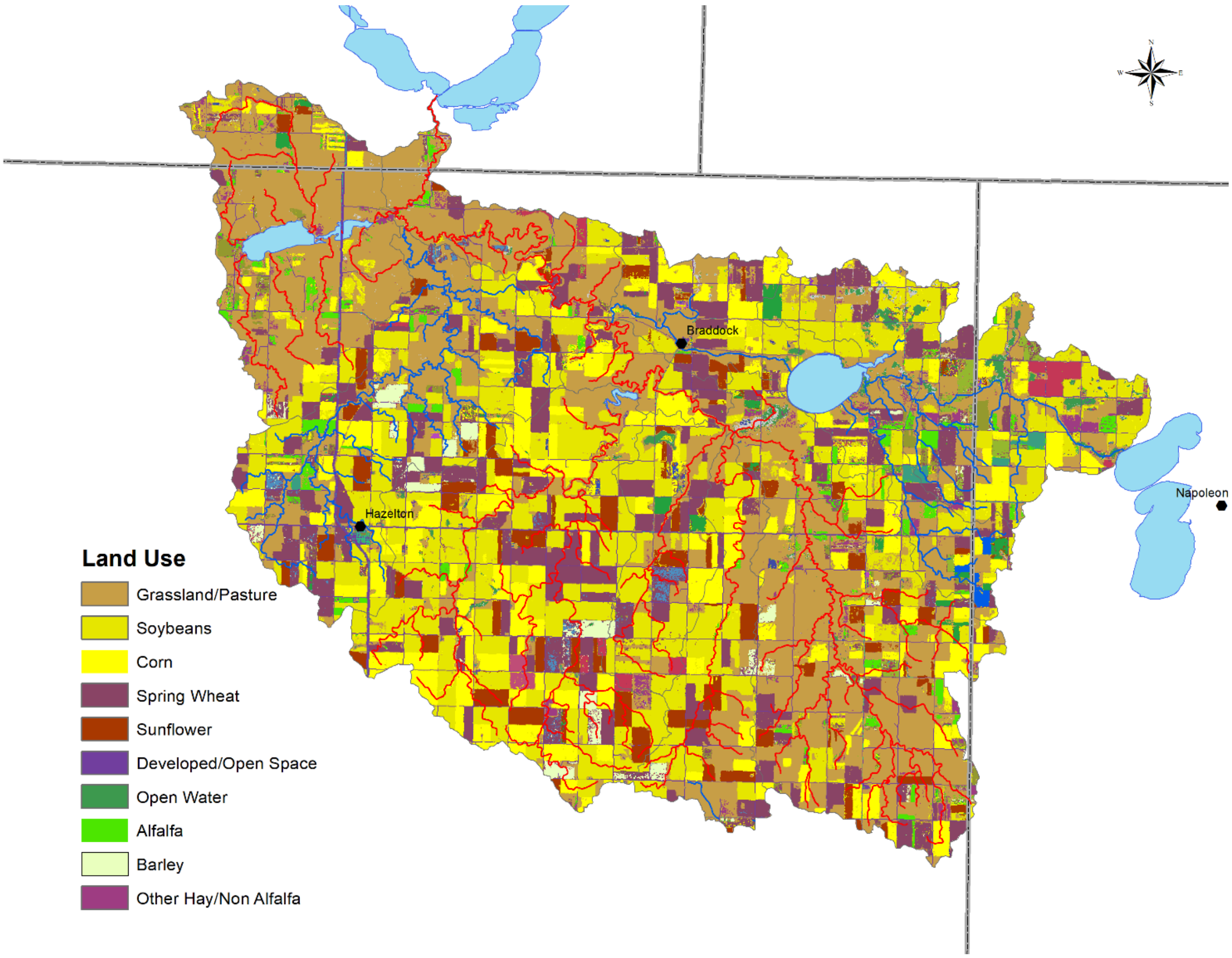

Figure 4. Land Use in the Long Lake Creek Watersheds (NASS, 2017).

Table 4. Land Use Percentages in the Long Lake Creek Watershed (NASS 2017).

Land Use Type	Acres	Percent of Total Acres
Grassland/Pasture	78,406.11	35.81%
Soybeans	47,775.78	21.82%
Corn	25,909.48	11.83%
Spring Wheat	25,692.18	11.73%
Sunflower	10,478.44	4.79%
Developed/Open Space	7,283.36	3.33%
Open Water	4,166.71	1.90%
Alfalfa	3,889.87	1.78%
Barley	2,840.69	1.30%
Other Hay/Non Alfalfa	2,802.03	1.28%
Other Uses	9,709.22	4.43%

1.4 Climate and Precipitation

Figures 5 and 6 show the average monthly precipitation and average daily temperature for the Hazelton, ND (Emmons County) High Plains Regional Climate Center from station 324083 from 1948 - 2013. McLean County has a subhumid climate characterized by warm summers with frequent hot days and occasional cool days. Average temperatures range from 11º F in winter to 69º F in summer. Precipitation occurs primarily during the warm period and is normally heavy in later spring and early summer. Average total precipitation is 19.14 inches annually.

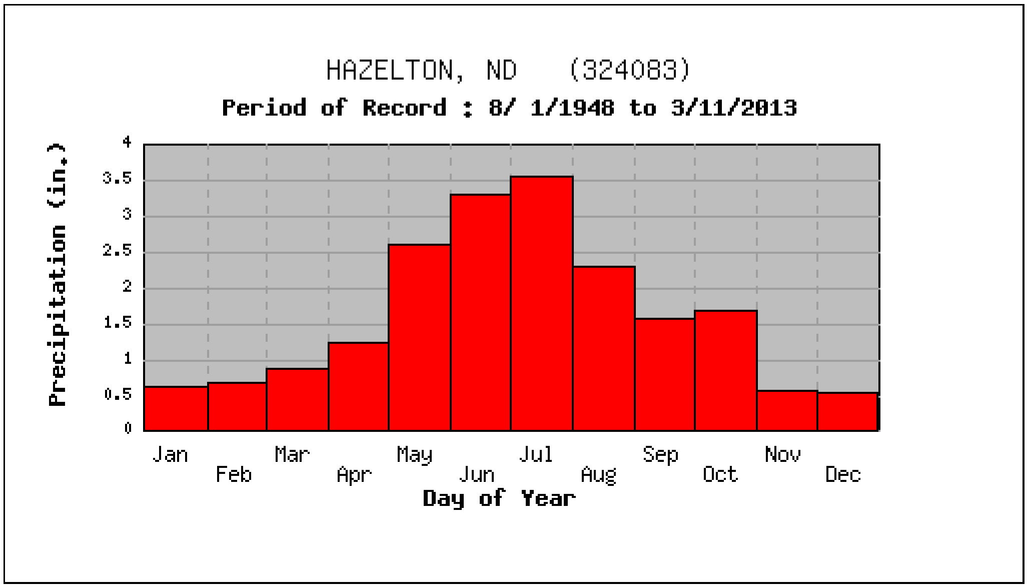

Figure 5. Average Monthly Precipitation at Hazelton, North Dakota from 1948 - 2013. (High Plains Regional Climate Center, 2014)

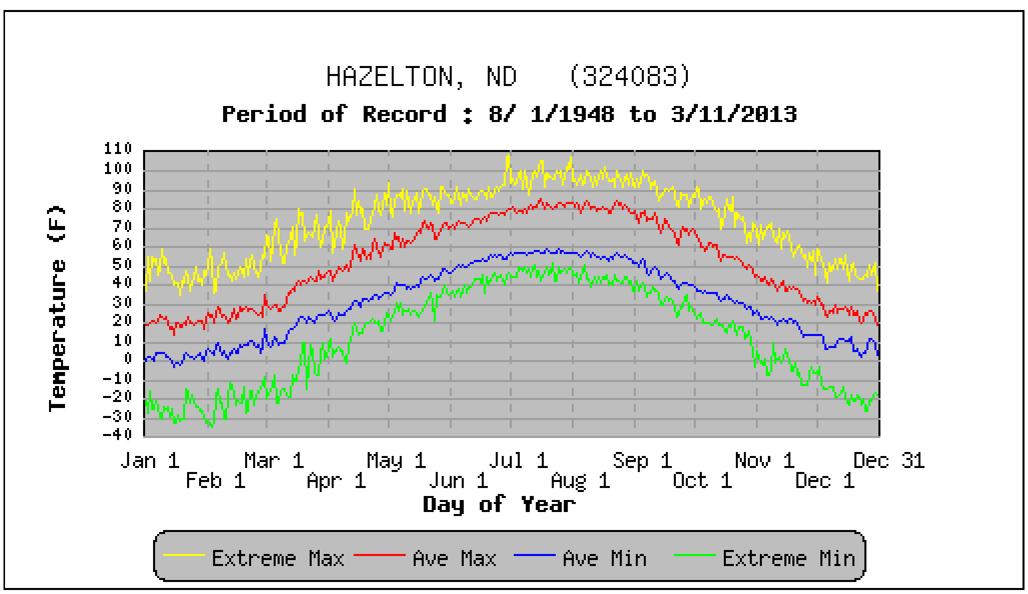

Figure 6. Average Daily Air Temperature Maximums and Minimums at Hazelton, North Dakota from 1948-2013. (High Plains Regional Climate Center, 2014)

1.5 Available Data

1.5.1 E. coli Bacteria Data

E. coli bacteria samples were collected at three locations within the TMDL listed reaches (Figure 7). Monitoring site 385538 was located above Braddock Dam on the West Branch Long Lake Creek and site 385483 was located upstream of the confluence with Long Lake. Sites were monitored weekly or when flow conditions were present during the recreation season (May-September) of 2010 and 2011by personnel from the Emmons County Soil Conservation District.

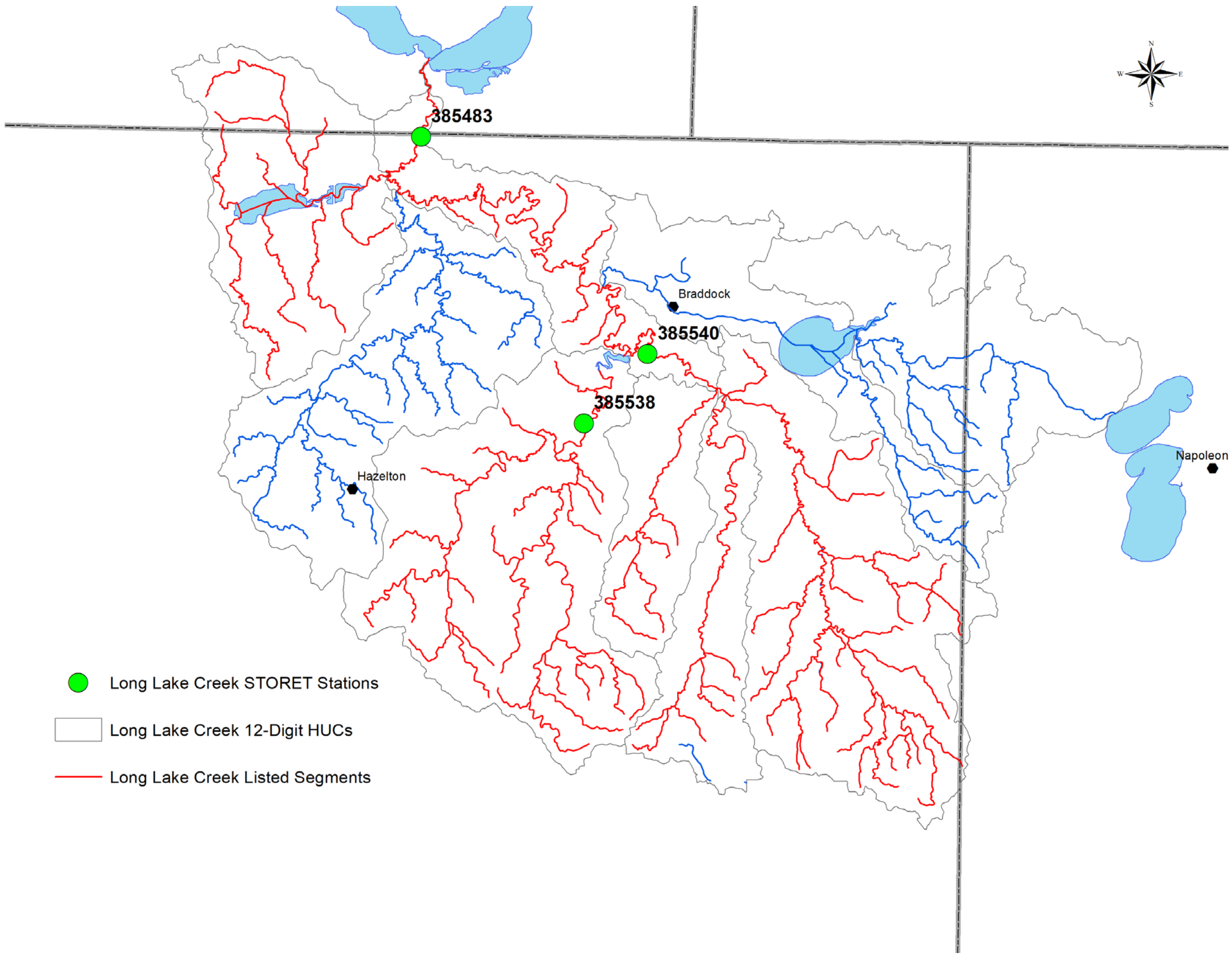

Figure 7. Long Lake Creek Watershed STORET Stations.

Table 5 provided 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 were calculated for each month (May-September) using those samples collected during each month in 2010 and 2011.

Table 5. Summary of E. coli Bacteria Recreational Use Assessment for Sites 385538, 385540 and 385483 (2010-2011).

Sampling Site	**385538**				
Month	May	June	July	Aug	Sept
Sample n	5	9	7	10	5
Geometric Mean	31	93	132	68	32
% > 409	0	11	0	0	20
Support	[1]FS	[2]FST	FST	FS	FST
Sampling Site	**385540**				
Month	May	June	July	Aug	Sept
Sample n	5	9	7	10	4
Geometric Mean	133	189	106	96	118.3
% > 409	20	11	0	10	0
Support	[3]NS	NS	FS	FS	FS
Sampling Site	**385483**				
Month	May	June	July	Aug	Sept
Sample n	5	8	7	10	3
Geometric Mean	69	463	140	134	130
% > 409	20	38	0	10	0
Support	FST	NS	FST	FST	FST

[1]FS= Fully Supporting, [2]FST = Fully Supporting but Threatened, [3]NS = Not Supporting.

Levels of bacteria varied throughout the watershed. Both sites used for developing the load duration curves experienced elevated levels of E. coli bacteria in excess of state water quality guidelines. Also, the sites exceeded the state guidelines where more than 10% of the samples exceeded 409 CFU/100 mL for E. coli bacteria. There were significant peaks in bacteria concentrations at the sites throughout the recreational season.

Data from site 385540, while typically lower in bacteria concentrations, mirrors the peaks of the downstream site 385483 (Figure 8). It should be noted that some of the samples returned results of “too numerous to count” and the result from a second dilution was used in these situations. Available data may be found in Appendix A.

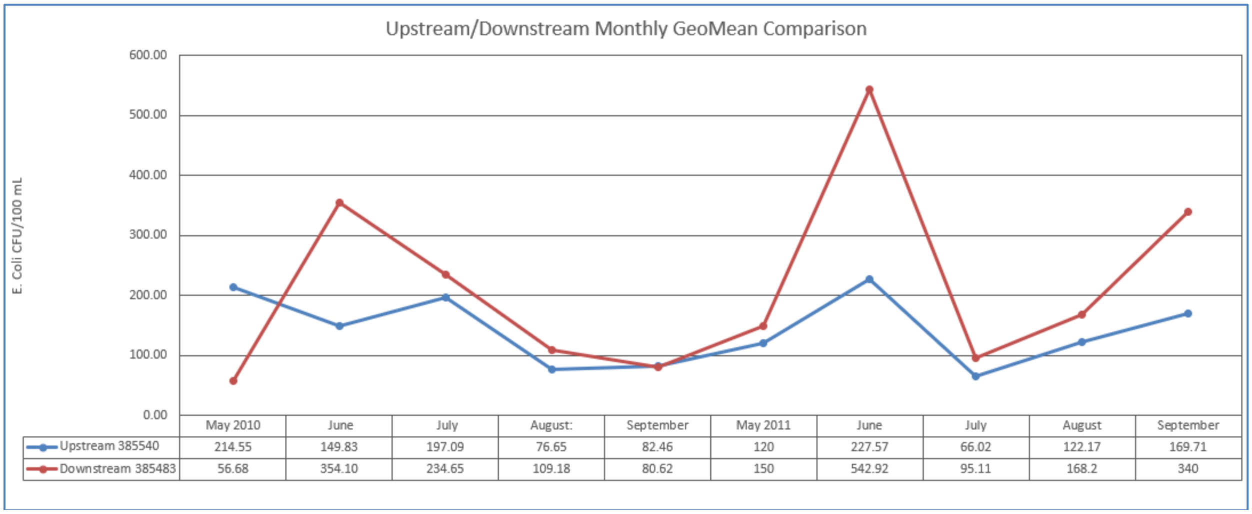

Figure 8. Comparison of Monthly Geomeans for Sites 385540 and 385483.

1.5.2 Hydraulic Discharge

Discharge was measured at two sites, Long lake Creek (385483) and West Branch Long Lake Creek (385538). Stream stage was measured using an automated stage recorder in conjunction with a standard manual staff gauge. Because of an extremely wet spring that included record flooding in 2010 and in 2011 the staff gauge was not installed until the fall of 2010 and some records were missed during the spring each year.

The automated stage recorders measured stage every hour. The flow measurements were combined with stage to calculate a hydraulic discharge rating curve. The rating curve was combined with the manual and automated stage records to calculate an estimated daily discharge.

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 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, 2016).

- 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, 2016).

2.2 Numeric Water Quality Standards

The Long Lake Creek is a Class III stream. The NDDoH definition of a Class III stream states that 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 (NDDoH 2014).

Table 6 provides a summary of the current numeric E. coli criteria which applies to all 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 all 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.

2.3 Antidegradation Policy

A third element called antidegradation is included in the water quality standards. Antidegradation policy and procedures have been established by NDDoH as necessary in the protection of waterbodies with current water quality exceeding already applicable standards. This was created to intentionally maintain these particular water resources at their high quality, above the level of water quality standards currently in place. This Policy is for activities such as Section 401, 402 and 404 of the Clean Water Act. (NDDoH, 2014).

The antidegradation implementation procedure delineates the process that will be followed by the North Dakota State Department of Health for implementing the antidegradation policy found in the Standards of Water Quality for the State of North Dakota, Rule 33-16-02.

Under this implementation procedure, all waters of the state are afforded one of three different levels of antidegradation protection. All existing users, and the water quality necessary for those uses, shall be maintained and protected. Antidegradation requirements are necessary whenever a regulated activity is proposed that may have some effect on water quality.

Regulated actions include permits issued under Section 402 (NDPDES) and 404 (Dredge and Fill) of the Clean Water Act (CWA), and any other activity requiring Section 401 water quality certification. Nonpoint sources of pollution are not included. When reviewing 404 nationwide permits, the department will issue 401 certifications only where it determines that the conditions imposed by such permits are expected to result in attainment of the applicable water quality standards, including the antidegradation requirements.

However, it is anticipated that the department will exclude certain nationwide permits from the antidegradation procedures for Category1 waters on the basis that the category of activities covered by the permit is not expected to have significant permanent effects on the quality and beneficial uses of those waters, or the effects will be appropriately minimized and temporary.

3.0 TMDL TARGET

A TMDL target is the value that is measured to judge the success of the TMDL implementation 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 a state's water quality standards. The following TMDL targets for the Long Lake Creek and West Branch of Long Lake Creek are based on the State water quality standards for E. coli bacteria. The E. coli bacteria water quality standard of 126 CFUs/100 mL is now the current applicable water quality standard for bacteria and the TMDL target for the impaired TMDL segment. In addition, no more than ten percent of the samples may exceed 409 CFUs/100 mL for E. coli bacteria. While the 126 CFUs/100 mL E. coli criterion is intended to be expressed as a 30-day geometric mean, for purposes of this TMDL, it is expressed as the daily average concentration based on individual grab samples. Expressing the E. coli TMDL in this way will ensure the TMDL will result in the target being met during all flow regimes, the criterion met, and that recreational uses will be restored.

The NDDoH will assess attainment of the E. coli bacteria standard through additional monitoring consistent with the state's water quality standards and beneficial use assessment methodology.

4.0 SIGNIFICANT SOURCES

4.1 Point Source Pollution Sources

There are two municipalities, Braddock and Hazelton, ND, within the watershed. The city of Braddock does not have a municipal sewage treatment system, rather, each residence employs an individual septic system. The city of Hazelton is permitted under NDPDES to utilize a two cell wastewater treatment system that discharges to a tributary of Long Lake Creek. This system has discharged twice since 1997, once due to high water conditions and the most recent due to construction repairs to the system. Given the distance to the impaired segment and infrequent discharges, it is unlikely to be a significant source of E. coli bacteria loadings.

There are three permitted (one large and two medium sized) animal feeding operations (AFOs) in the target watershed of the Long Lake Creek. The AFOs are zero discharge facilities and are not deemed a significant point source of E. coli bacteria loadings to the Long Lake Creek.

4.2 Nonpoint Source Pollution Sources

The TMDL listed segments which are the focus of this report are experiencing E. coli bacteria pollution from nonpoint sources in the watersheds.

Livestock production is not the dominant agricultural practice in the watershed but unpermitted animal feeding operations (AFOs) and livestock grazing and watering in proximity to the Long Lake Creek and its tributaries do exist and may be a contributor. Due to the close proximity of these unpermitted AFOs and livestock grazing and watering to the river, it is likely that this contributes E. coli bacteria to the Long Lake Creek and its tributaries.

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 likely due to backup and surfacing (EPA, 2002).

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

5.0 TECHNICAL ANALYSIS

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

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

5.1 Mean Daily Stream Flow

In central North Dakota, rain events are variable generally occurring during the months of April through September. 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 TMDL segment ND-10130101-002-S_00 and ND-10130101-004-S_00 were determined by utilizing stage and flow data collected by the soil conservation district and applying a rating curve developed by personnel from the United States Geological Service, Bismarck Office.

Streamflow data for the index site was obtained from data collected by soil conservation district personnel. The index site streamflow data was then divided by the drainage area to determine streamflow per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged site to obtain estimated flow statistics for the ungauged site. Stream flow data were collected at STORET site 385483 for 2010 – 2011.

5.2 Flow Duration Curve Analysis

The flow duration curve serves as the foundation for the load duration curve used in the TMDL. Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified time period. A flow duration curve relates flow (expressed as mean daily discharge) to the percent of time those mean daily flow values have been met or exceeded. The use of *"percent of time exceeded"* (i.e., duration) provides a uniform scale ranging from 0 to 100 percent, thus accounting for the full range of stream flows for the period of record. Low flows are exceeded most of the time, while flood flows are exceeded infrequently (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 twenty-five (25) percent, associated with a stream flow of 159.0 cfs, implies that 25 percent of all observed mean daily discharge values equal or exceed 159.0 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) (EPA, 2007).

As depicted in Figure 9, the flow duration curve for site 385483, representing TMDL segment ND-10130101-002-S_00, was divided into five zones, representing high flows (0-8 percent), wet conditions (9-45 percent), dry conditions (46-77 percent), low flows (78-92 percent) and no flows (93-100 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 (Figure 9). 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.

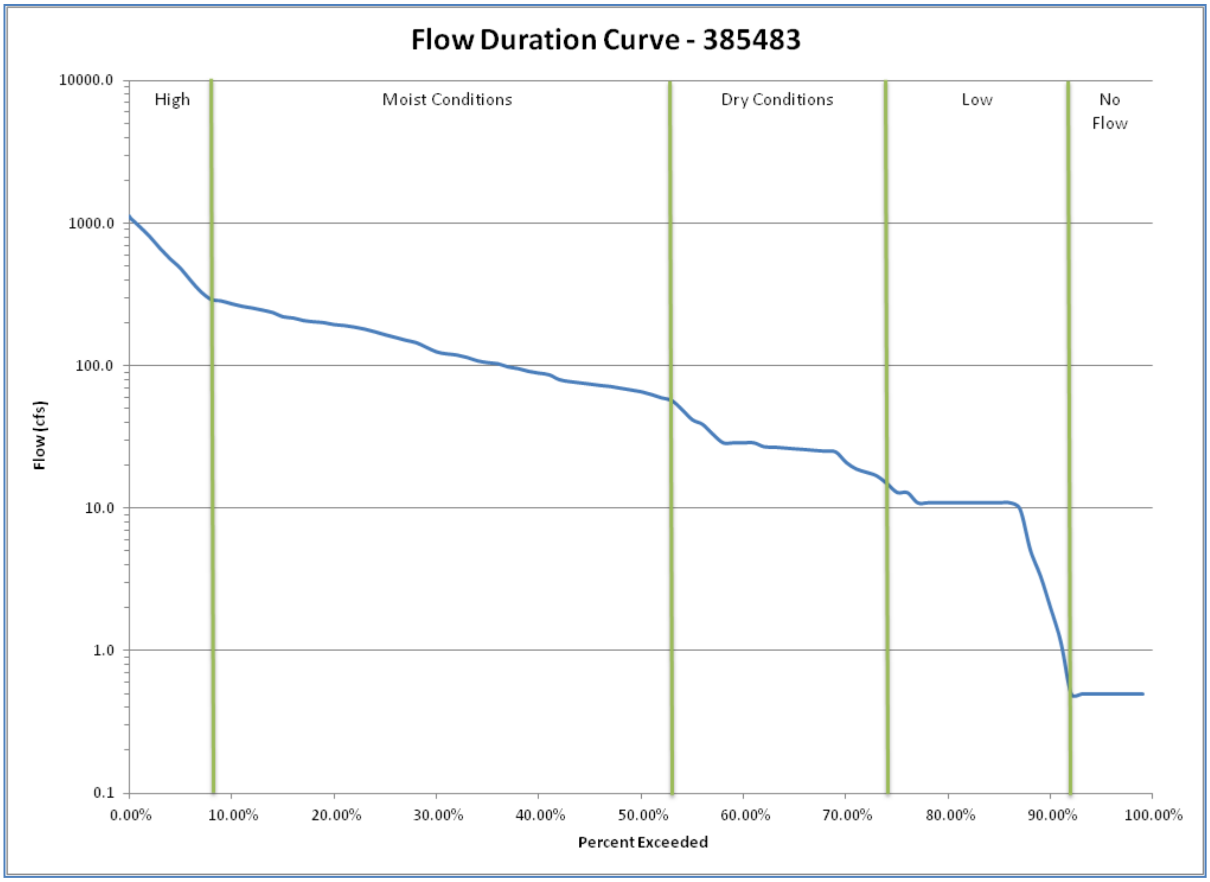

Figure 9. Flow Duration Curve for the Long Lake Creek Monitoring Station 385483 Located near Braddock, North Dakota.

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 Long Lake Creek TMDL listed segments. The load duration curve for the TMDL listed reaches were derived using the E. coli bacteria TMDL target of 126 CFU/100 mL and the flows generated as described in Sections 5.1 and 5.2. (Figures 10-11).

Observed in-stream total E. coli bacteria data obtained from monitoring site 385483 (Appendix A) were converted to a pollutant load by multiplying total 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 10-11). Points plotted above the 126 CFU/100 mL target curve exceed the previous State water quality target. Points plotted below the curve are meeting the previous 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 site 385483 depicting the regression relationship for each flow interval is provided in Figures 10-11. As there were no E. coli bacteria concentrations above the TMDL target in the high, low flow and no flow regimes for site 385483, a regression relationship and existing load could not be calculated for these flow regimes. The regression lines for the moist and dry condition flows for site 385483 were then used with the midpoint of the percent exceeded flow for that interval to calculate the existing total E. coli bacteria load for that flow interval. In the example provided in Figure 10 the regression relationship between observed E. coli bacteria loading and percent exceeded flows for the wet condition, and moist 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 9 to 45 percent is 27 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (5.86 + (-2.64*0.27))
= 141,891 x 10^7 CFUs/day

Where the midpoint of the dry condition interval from 46 to 77 percent is 61.5 percent, the existing E. coli bacteria load is:

E. coli bacteria load (10^7 CFUs/day) = antilog (6.34 + (-3.64*0.615))
= 12,734 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 (27 and 61.5 percent) exceeded flow derived from the 126 CFU/100 mL TMDL target curves are 46,863 x 10^7 CFUs/day and 8,633 x 10^7 CFUs/day respectively.

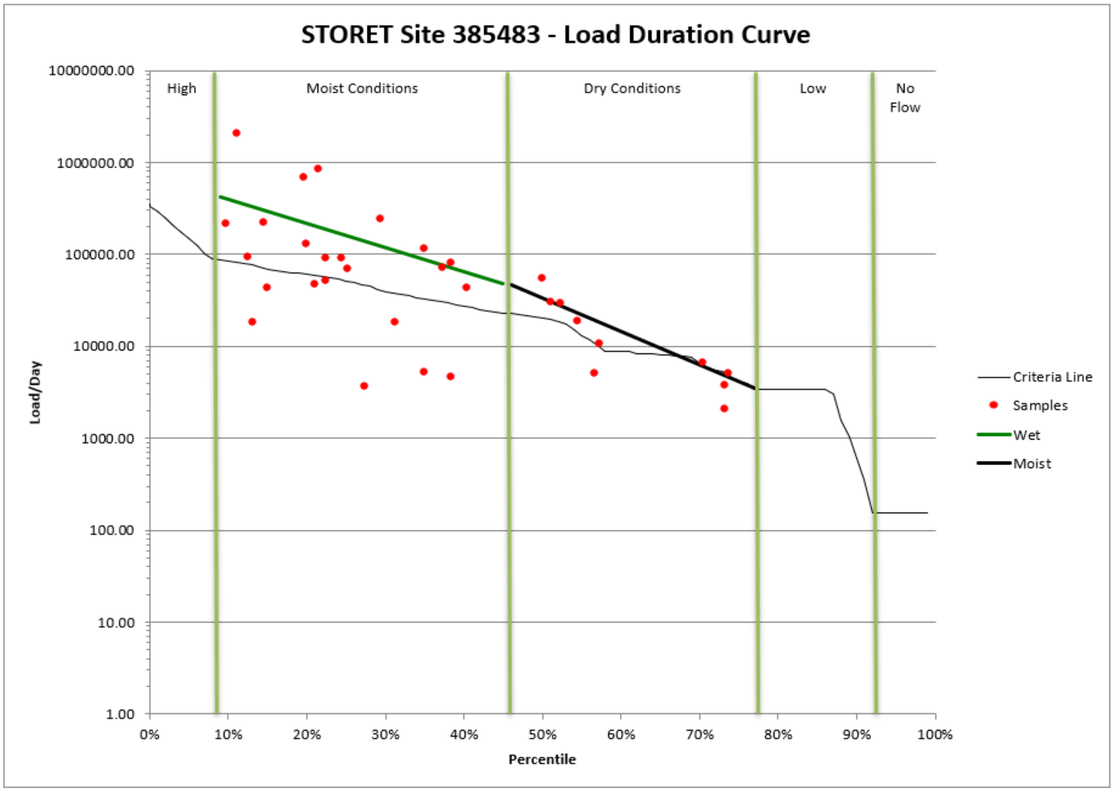

Figure 10. E. coli Bacteria Load Duration Curve for the Long Lake Creek Monitoring Station 385483.

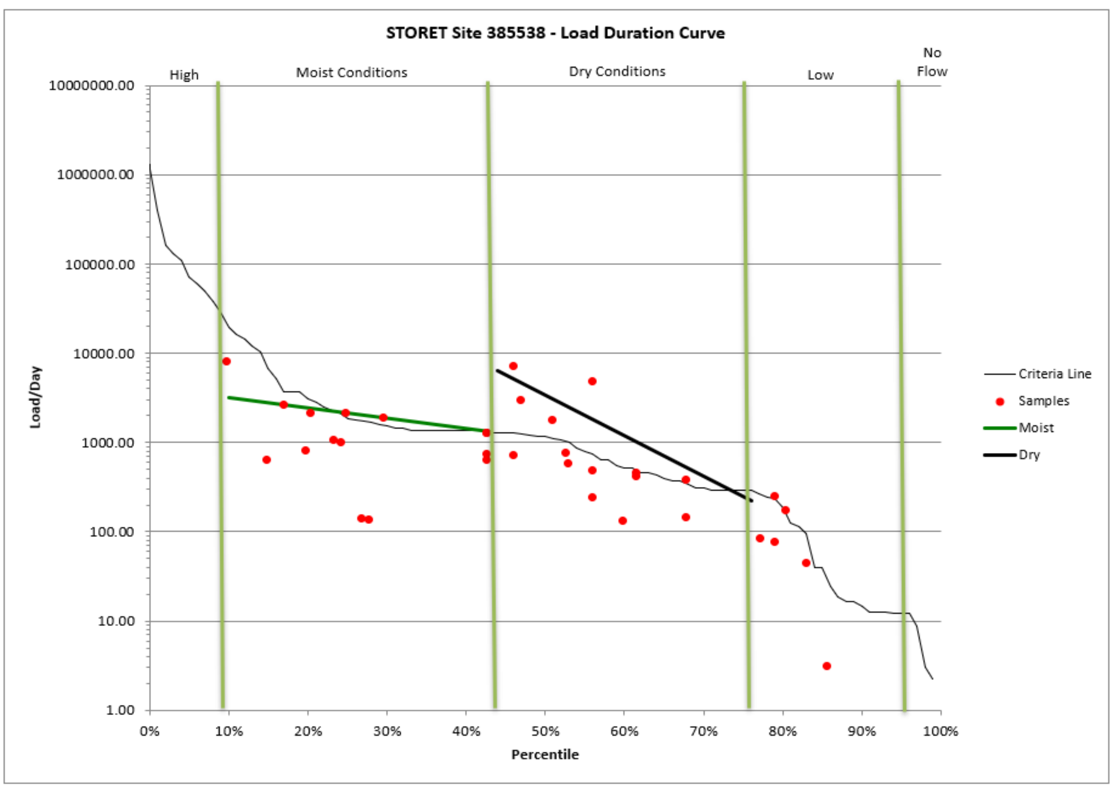

Figure 11. E. coli Bacteria Load Duration Curve for the West Branch Long Lake Creek/Long Lake Creek Monitoring Station 385538.

5.4 Waste Load Allocation (WLA) Analysis
The city of Hazelton is permitted under NDPDES to utilize a two-cell wastewater treatment system that discharges to a tributary of Long Lake Creek. This system has discharged twice since 1997, once due to high water conditions and the most recent due to construction repairs to the system. Given the distance to the impaired segment and infrequent discharges, it is unlikely to be a significant source of E. coli bacteria loadings. Therefore, it will not be assigned a WLA.

5.5 Loading Sources

The majority of load reductions can generally be allotted to nonpoint sources. Based on best professional judgment, the general focus of Best Management Practices (BMPs) and load reductions for the listed waterbody should be on unpermitted animal feeding operations, and riparian grazing adjacent to or in close proximity to Long Lake Creek and the West Branch of Long Lake Creek.

One of the more important concerns regarding nonpoint sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, exceedences of the E. coli bacteria standard was observed in two flow regimes (i.e., Moist and Dry Conditions) at site 385483, representing assessment unit ND-10130101-002-S_00 (Figure 10) and site 385538, representing assessment unit ND-10130101-004-S_00 (Figure 11).

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to E. coli bacteria loading. Animals grazing in the riparian area contribute E. coli bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high flow or under moist and dry conditions (Table 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 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 fecal 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 these TMDLs. The MOS was calculated as ten percent of the TMDL.

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 TMDLs included in this report address seasonality because the flow duration curve for the Long Lake Creek (ND-10130101-002-S_00) and the West Branch Long Lake Creek ND-10130101-004-S_00 were developed using four 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 one of the listed segments. The TMDL provides a summary of average daily loads by flow regime necessary to meet the water quality target (i.e. TMDL). The TMDL for the segment and flow regime provides an estimate of the existing daily load, and an estimate of the average daily loads necessary to meet the E. coli bacteria 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. Tables 9-10 provide a summary of the TMDLs for the listed segments.

Table 8. TMDL Summary for the Long Lake Creek (STORET Site 385483).

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	E. Coli Bacteria	See Section 2.1
TMDL Target	126 CFU/100 mL	Based on the current State water quality standard for E. coli bacteria. Monitoring will be conducted to determine compliance with the current water quality standard of 126 CFU/100 mL
WLA	Point Source Contributions	There are no significant point source contributions.
LA	Nonpoint Source Contributions	Loads are a result of nonpoint sources (i.e., rangeland, pasture land, etc.)
Margin of Safety (MOS)	Explicit	10 percent

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 nonpoint 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 the Long Lake Creek ND-10130101-002-S_00.

	Flow Regime			
	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load		141,891.32	12,734.06	
TMDL	174,071[1]	46,863.01	8,632.66	11[1]
WLA	No Data Available for Flow Regime	0	0	No Data Available for Flow Regime
LA		42,176.51	7,769.4	
MOS		4,686.30	863.26	

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

Table 10. E. coli Bacteria TMDL (10^7 CFU/day) for the West Branch Long Lake Creek ND-10130101-004-S_00.

	Flow Regime			
	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load		2,064.33	1,184.27	
TMDL	109,930[1]	1,788.19	524.13	0[1]
WLA	No Data Available for Flow Regime	0	0	No Reduction Necessary
LA		1,609.38	471.72	
MOS		178.81	52.41	

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

8.0 ALLOCATION

Nonpoint source pollution is the sole contributor to elevated E. coli bacteria levels in the Long Lake Creek watershed. Due to periodic discharges and the distance to the impaired segment, the permitted municipal facility (Hazelton, ND) has not been given a WLA.

The E. coli bacteria samples and load duration curve analysis of the impaired reach identified the moist and dry condition flow regimes as the time of E. coli bacteria exceedances of the 126 CFU/100 mL target. To reduce NPS pollution for the moist and dry condition flow regimes, specific "Best management practices" (BMPs) are described in Section 8.1 that will mitigate the effects of E. coli bacteria loading to the impaired reach.

To achieve the TMDL targets identified in the report, it will require the wide spread support and voluntary participation of landowners and residents in the watershed. The TMDLs described in this report are a plan to improve water quality by implementing 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, (EPA, 2001). This TMDL plan is put forth as a recommendation for what needs to be accomplished for the Long Lake Creek and associated 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.

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 Long Lake Creek. The following describe in detail those BMPs that will reduce E. coli bacteria levels in Long Lake Creek.

8.1 Household Septic Systems

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 failures arise 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 E. coli 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).

8.2 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:

Livestock exclusion from riparian areas- 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 USEPA (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 11) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month, with water developments and fencing, bacteria levels were reduced significantly.

Table 11. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Grazing Strategy		Geometric Mean E. coli 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

8.3 Other Recommendations

Waste management system- Waste management systems can be effective in controlling up to 90 percent of E. coli bacteria loading originating from confined animal feeding areas (Table 12). A waste management system is made up of various components designed to control non point 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.

Vegetative filter strip- Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, E. coli bacteria to streams. The effectiveness of filter strips and other BMPs in removing E. coli bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993), suggest that vegetative filter strips are capable of removing up to 55 percent of E. coli bacteria loading to rivers and streams (Table 12). 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).

Table 12. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

Practice[b] Category	Runoff[c] Volume	Total[d] Phosphorus (%)	Total[d] Nitrogen (%)	Sediment (%)	E. coli (%)
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.

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDLs for the Long Lake Creek, was mailed to participating agencies, partners, and to those who requested a copy. Those included in the mailing of a hard copy are as follows:

- Burleigh and Emmons County Soil Conservation Districts;
- Burleigh and Emmons County Water Resource Boards;
- Natural Resource Conservation Service (State Office); and
- U.S. Environmental Protection Agency, Region VIII

In addition to mailing copies of this TMDL report to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at https://deq.nd.gov/WQ/3_Watershed_Mgmt/2_TMDLS/TMDLs_Comments.aspx.

A 30-day public notice soliciting comment and participation was also published in the Bismarck Tribune and Emmons County Record.

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

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

11.0 TMDL IMPLEMENTATION STRATEGY

Currently, there have been no watershed/water quality improvement projects planned, initiated or completed in the watershed.

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 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.

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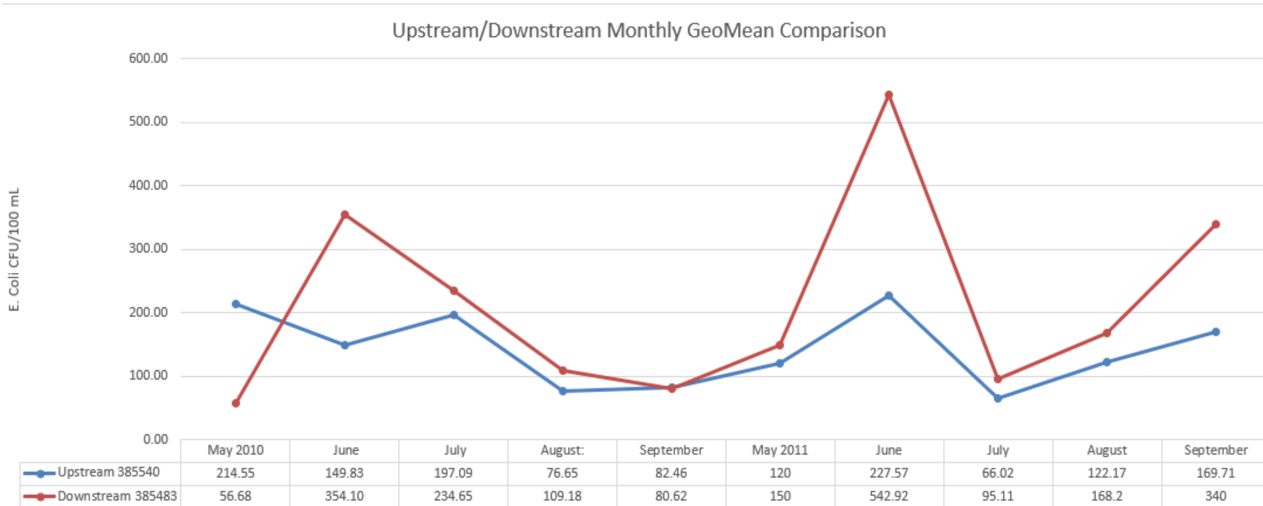
Appendix A
E. coli Bacteria Data Collected for Sites 385538, 385540, and 385483 for 2010 and 2011

385538	May		June		July		August		September	
	5/3/2010	150	6/1/2010	90	7/6/2010	120	8/2/2010	90	9/13/2010	10
	5/10/2010	10	6/19/2010	60	7/21/2010	130	8/9/2010	30	9/27/2010	10
	5/18/2010	10	6/22/2010	40	7/27/2010	80	8/18/2010	90	9/7/2011	10
	5/26/2010	60	6/28/2010	100	7/5/2011	130	8/25/2010	40	9/15/2011	50
	5/23/2011	30	6/1/2011	140	7/12/2011	200	8/31/2010	60	9/21/2011	700
			6/9/2011	110	7/18/2011	70	8/4/2011	120		
			6/16/2011	800	7/25/2011	300	8/8/2011	70		
			6/23/2011	50			8/17/2011	120		
			6/28/2011	40			8/23/2011	70		
							8/30/2011	50		
Geometric Mean	30.64		93.23		131.54		67.82		32.27	
% Exceeded 409	0%		11%		0%		0%		20%	
Recreational Use	FS[1]		FST[2]		FST		FS		FST	
# of Samples	5		9		7		10		5	

FS[1]= Fully Supporting, FST[2] = Fully Supporting but Threatened, NS[3] = Not Supporting.

385540	May		June		July		August		September	
	5/3/2010	470	6/1/2010	90	7/6/2010	110	8/2/2010	140	9/13/2010	170
	5/10/2010	230	6/19/2010	70	7/21/2010	290	8/9/2010	30	9/27/2010	40
	5/18/2010	70	6/22/2010	400	7/27/2010	240	8/18/2010	90	9/7/2011	90
	5/26/2010	280	6/28/2010	200	7/5/2011	100	8/25/2010	70	9/21/2011	320
	5/23/2011	20	6/1/2011	140	7/12/2011	190	8/31/2010	100		
			6/9/2011	320	7/18/2011	50	8/4/2011	70		
			6/16/2011	540	7/25/2011	20	8/15/2011	120		
			6/22/2011	140			8/17/2011	810		
			6/28/2011	180			8/23/2011	60		
							8/30/2011	60		
Geometric Mean	133.48		188.97		105.50		95.76		118.30	
% Exceeded 409	20%		11%		0%		10%		0%	
Recreational Use	NS[3]		NS		FS		FS		FS	
# of Samples	5		9		7		10		4	

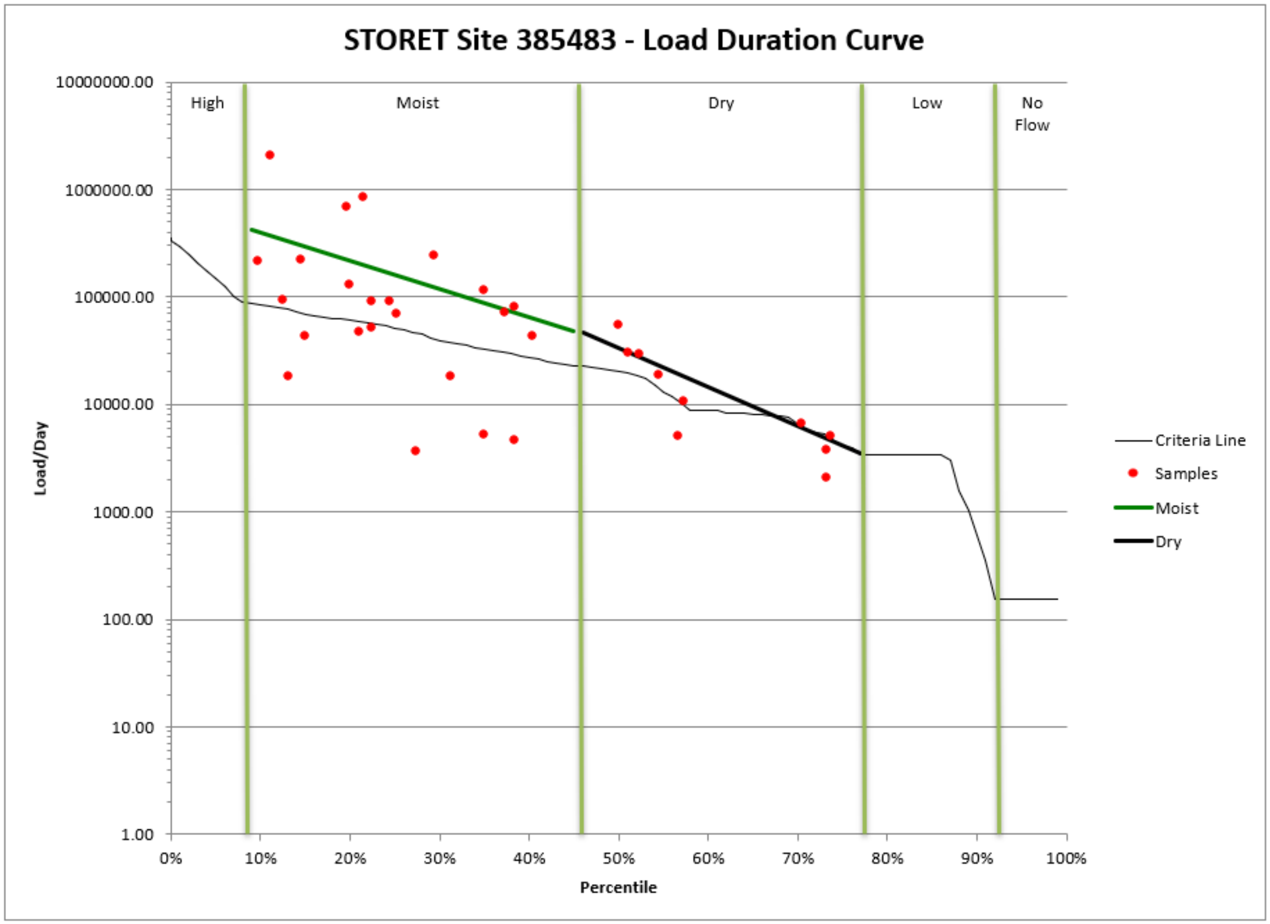


385483	May		June		July		August		September	
	5/3/2010	20	6/1/2010	740	7/6/2010	200	8/2/2010	170	9/13/2010	130
	5/10/2010	20	6/22/2010	300	7/21/2010	340	8/9/2010	130	9/27/2010	50
	5/18/2010	60	6/28/2010	200	7/27/2010	190	8/19/2010	60	9/15/2011	340
	5/26/2010	430	6/1/2011	100	7/5/2011	110	8/25/2010	90		
	5/23/2011	150	6/9/2011	270	7/12/2011	310	8/31/2010	130		
			6/16/2011	3200	7/18/2011	30	8/4/2011	200		
			6/22/2011	390	7/25/2011	80	8/8/2011	220		
			6/28/2011	1400			8/17/2011	1800		
							8/23/2011	100		
							8/30/2011	100		
Geometric Mean	68.86		462.53		140.06		161.79		130.26	
% Exceeded 409	20%		38%		0%		10%		0%	
Recreational Use	FST		NS		FST		FST		FST	
# of Samples	5		8		7		10		3	

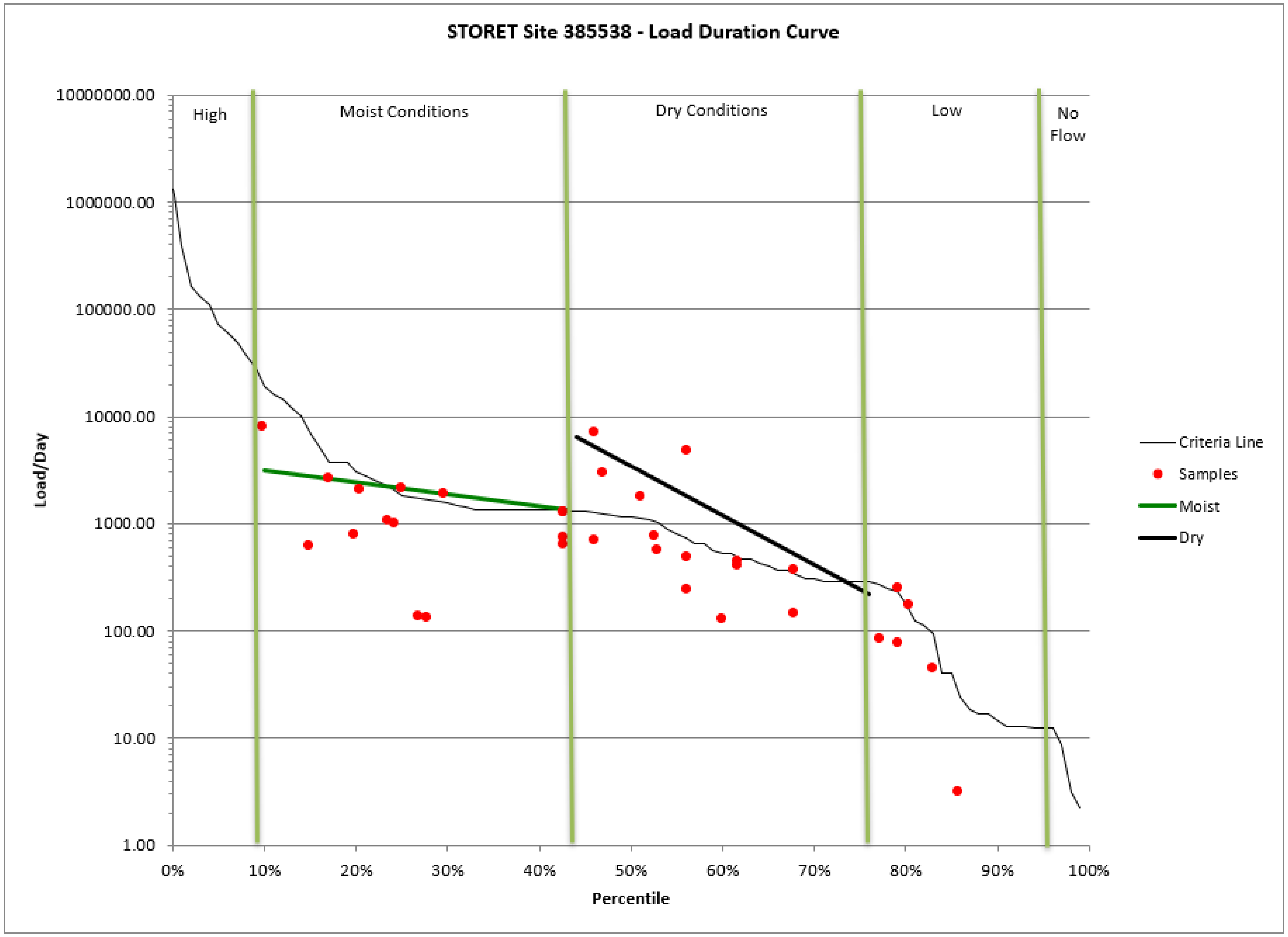
FS[1]= Fully Supporting, FST[2] = Fully Supporting but Threatened, NS[3] = Not Supporting.

Appendix B
Estimated Loads, TMDL Targets, Percentage of Reduction Required and Load Duration Curves for Sites 385483 and 385538

	Load (10^7CFU/Day)				Load (10^7CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
Moist	27.00%	141891.32	46863.01	131.40	18644519.55	6157798.96	66.97%
Dry	61.50%	12734.06	8632.66	113.15	1440858.52	976785.36	32.21%
			Total	245	20085378	7134584	64.48%



	Median Percentile	Load (10^7 CFU/Day) Existing	TMDL	Days	Load (10^7 CFU/Period) Existing	TMDL	Percent Reduction
Moist	26.50%	2064.33	1788.19	120.45	248648.54	215387.92	13.38%
Dry	60.00%	1184.27	524.13	116.80	138323.30	61217.88	55.74%
			Total	237	386972	276606	28.52%



Appendix C
Summary of Comments from US EPA Region 8 and NDDoH Response

1. Section 1, Figures 2, 3, 4 & 7 show impaired tributaries in the Hawk Creek sub-watershed (near headwaters and City of Hazelton), however based on NDDoH's WQ Data Portal map and 2016 IR map there's no indication those tributaries are impaired. Revise the maps in each Figure if that was an error or explain what data/information was used to determine those tributaries are impaired and when they were added to the AU. While there are several potential sources in that sub-watershed it does not appear to be part of the currently listed AU as shown in the following screenshots from the WQ data portal and 2016 IR respectively.

   NDDoH Response: New maps were inserted that correctly reflect the listed reaches.

2. Section 1.5, Available Data – Figure 7 shows 3 monitoring sites, the text says data was collected at 2 sites. The NDDoH Data Portal has E. coli data for all 3 sites. Site 385540 is located on the impaired segment of Long Lake Creek upstream of Braddock Dam. Comparing the data from the upper site (385540) to the lower site (385483) could be helpful for understanding sources as well as planning and implementation. While the concentration generally increases from upstream to downstream, the water quality at the upper site is also above the target concentration for many of the same months as the lower site. Looking at a plot of the flow for the same time period shows that the higher concentrations are often associated with higher in-stream flows. It is recommended to mention the available data at the upper site and add a graph.

   NDDoH Response: Data from site 385540 was added to Section 1.5 and a plot comparing the upstream and downstream data included.

3. Section 4.1, Point Sources – Says the city of Hazelton "has discharged twice since 1997, once due to high water conditions and the most recent due to construction repairs to the system." Using the measuring tool in EPA WATERS GeoViewer, Hazelton's discharge is approximately 14 river-miles from the impaired segment of Long Lake Creek, and NDDoH's general permit that covers this discharge doesn't require E. coli monitoring. Given the lack of data, distance to the impaired segment and infrequent discharges, it's overkill to derive a WLA for this facility since it's unlikely to contribute much if any load to Long Lake Creek.

   NDDoH Response: The WLA was removed for the City of Hazelton based on the recommendation.

4. Section 4.2, Nonpoint Sources – Says AFOs, livestock grazing & watering "may exist and be a contributor." TMDL source identification must not be based on speculation. Given the available data and information it is safe to say that those nonpoint sources "***do exist and are contributors.***"

   NDDoH Response: The language was changed as recommended.

5. Section 5.2, Flow Duration Curve – The flow estimate example from the Figure 8 curve, at the 25th percentile, seems to be wrong, (2,158 cfs). The flow curve tops out at ~1000 cfs, and at 25% it's ~200 cfs. Check the numbers and revise accordingly.

   NDDoH Response: The data was corrected and accurately reflects the flow duration curve.

6. Section 5.4, WLA - See previous comment on Section 4.1.

   NDDoH Response: Recommended change was addressed.

7. Section 5.5, Goose Creek Loading - Although it's possible to create a LDC without any data from the impaired segment, it doesn't mean that it will result in a scientifically defensible, approvable

TMDL. It's unclear how Goose Creek was assessed as impaired and added to the 303(d) list without any data. This section should be deleted or revised (not called a TMDL). However, the information from the simulated LDC may be useful to guide implementation planning. Consider developing an alternative plan for this AU instead.

NDDoH Response: This TMDL was removed as per the recommendation and may be addressed in future watershed activities. Since there has never been any data to support listing the Goose Creek Watershed AU as impaired, the NDDoH plans to de-list it from the 2018 list of impaired waters. The NDDoH believes it was listed in error as there are no data to support the initial listing.

8. Section 7.0, Table 10 High & Low flow regimes and Table 11 Low flow regime - is it "no reduction necessary" or "no data"? Load reduction or allocations cannot be calculated if there's no data, as shown for those flow regimes in Figures 9 & 10.

   NDDoH Response: The changes were made to reflect the lack of samples during high flow events.

   The Table 10 & 11 TMDL loads for the Low flow regime seems wrong. The LDC (Fig 9) for Long Lake Creek at the mid-point of the Low flow appears to be ~400; and the LDC (Fig 10) for West Branch Long Lake Creek is >10. Check the numbers and revise accordingly.

   NDDoH Response: The TMDLs accurately reflect the listed segment and its flow regime. Long Lake Creek is the mainstem and experiences higher flows than West Branch Long Lake Creek, therefore there will be a difference in midpoint values.

9. Section 7.0, Table 12 - See previous comment on Section 5.5. This is not an approvable TMDL, therefore this table should be deleted or revised (e.g., estimated target loads instead of TMDL loads) and moved to another section for use in implementation planning.

   NDDoH Response: Changes made as previously suggested.

10. Sections 10 & 11, Monitoring and Implementation Plans - Have any 319 projects been proposed, initiated or completed in this watershed, county or area of the state (south-central ND)? If so, we recommend adding a summary of those projects.

    NDDoH Response: There are no current projects in the watershed or counties the listed segments are located in, therefore no summary is needed.