North Dakota 2014 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads

Submitted to the US EPA
December 31, 2014

Approved
February 12, 2015

NORTH DAKOTA
DEPARTMENT *of* HEALTH

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

FEB 12 2015

Ref: 8EPR-EP

Karl Rockeman, Director
Division of Water Quality
North Dakota Department of Health
918 East Divide Avenue, 4th Floor
Bismarck, North Dakota 58501-1947

Re: The Clean Water Act Section 303(d) Total Maximum Daily Load (TMDL) Waterbody List

Dear Mr. Rockeman:

Thank you for your submittal of the North Dakota 2014 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads (Integrated Report). The U.S. Environmental Protection Agency (EPA) Region 8 has conducted a complete review of the Clean Water Act Section 303(d) waterbody list (Section 303(d) list) and supporting documentation and information. The EPA has determined that North Dakota's 2014 Section 303(d) list meets the requirements of Section 303(d) of the Clean Water Act (CWA) and the EPA's implementing regulations and approves North Dakota's 2014 Section 303(d) list.

The EPA's approval of North Dakota's 2014 Section 303(d) list extends to all waterbodies on the list with the exception of those waters that are within Indian country, as defined in 18 U.S.C. § 1151. The EPA interprets CWA Section 303(d) to require the EPA establishment or approval of section 303(d) lists only for impairments of waters with federally approved water quality standards. The enclosure describes the statutory and regulatory requirements of the CWA Section 303(d) list and a summary of the EPA's review of North Dakota's compliance with each requirement. The EPA appreciates your work to produce North Dakota's 2014 Section 303(d) list.

If you have questions, the most knowledgeable EPA staff person is Kris Jensen and she may be reached at (303) 312-6237.

Sincerely,

Martin Hestmark
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosure

North Dakota 2014 Integrated
Section 305(b) Water Quality Assessment Report and
Section 303(d) List of Waters Needing
Total Maximum Daily Loads

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 Ave.
Bismarck, North Dakota 58501-1947

701.328.5210

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PART I. EXECUTIVE SUMMARY

The Clean Water Act (CWA) contains several sections which require states to report on the quality of their waters. Section 305(b) (*State Water Quality Assessment Report*) requires a comprehensive biennial report; and Section 303(d) requires, from time to time, a list of a state's water quality-limited waters needing total maximum daily loads (TMDLs). The primary purpose of the Section 305(b) *State Water Quality Assessment Report* is to assess and report on the extent to which beneficial uses of the state's rivers, streams, lakes, reservoirs and wetlands are met. Section 305(b) of the Clean Water Act requires states to submit this assessment report every two years; the information presented in this report is for the reporting period of 2012-2013. The Section 305(b) report is a summary report that presents information on use impairment and the causes and sources of impaired or threatened uses for the state as a whole. While the Section 305(b) report is considered a summary report, Section 303(d) and its accompanying regulations (CFR Part 130 Section 7) require each state to list individual waterbodies (i.e., lakes, reservoirs, rivers, streams and wetlands) which are considered water quality limited and which require load allocations, waste load allocations and TMDLs. This list has become known as the "TMDL list" or "Section 303(d) list."

The North Dakota Department of Health (hereafter referred to as the department) currently recognizes 289 public lakes and reservoirs. Of the 289 public lakes and reservoirs recognized as public waters and included in the Assessment Database (ADB), only 200 are specifically listed in the state's water quality standards as classified lakes and therefore are assigned designated beneficial uses (Table III-1). The remaining 89 lakes and reservoirs, while included in the state's estimate of total lake acres, are not considered classified waters and therefore were not assessed for this report. By default, these waterbodies are assigned the Class 4 fisheries classification. Based on the state's Assessment Database (ADB), the 146 reservoirs have a combined surface area of 476,711 acres. Reservoirs comprise about 67 percent of North Dakota's total lake/reservoir surface acres. Of these, 411,499 acres or 58 percent of the state's entire lake and reservoir acres, are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe). The remaining 144 reservoirs share 65,217 acres, with an average surface area of 453 acres. The 143 natural lakes in North Dakota cover 236,531 acres, with approximately 102,376 acres or 43 percent attributed to Devils Lake. The remaining 142 lakes average 945 acres, with approximately 42 percent being smaller than 250 acres.

There are 56,022 miles of rivers and streams in the state. Estimates of river stream miles in the state are based on river and stream waterbodies in the ADB that are reach indexed to the 1:100,000 National Hydrography Dataset (NHD plus) and include ephemeral, intermittent and perennial rivers and streams. The estimate of river and stream miles for this report reflects an increase in 1,416 miles from what was reported in 2012.

For purposes of 2014 Section 305(b) reporting and Section 303(d) listing, the U.S. Environmental Protection Agency (EPA) is encouraging states to submit an integrated report and to follow its integrated reporting guidance, including EPA's 2006 IR guidance, which is supplemented by EPA's 2008, 2010, 2012 and 2014 IR guidance memos (http://water.epa.gov/lawregs/lawsguidance/cwa/tmdl/guidance.cfm). Key to integrated reporting is an assessment of all of the state's waters and placement of those waters into one of five categories. The categories represent varying levels of water quality standards attainment, ranging from Category 1, where all of a waterbody's designated uses are met, to Category 5, where a pollutant impairs a waterbody and a TMDL is required.

Twenty-eight (28) percent (1,274 miles) of the rivers and streams assessed for this report are fully supporting the beneficial use designated as aquatic life, while another 47 percent (2,147 miles of rivers and stream are assessed as fully supporting, but threatened for aquatic life use. In other words, if water quality trends continue, these rivers and streams may not fully support its use for aquatic life in the future. The remaining 25 percent (1,118 miles) of rivers and streams assessed for this report were assessed as not supporting aquatic life use.

NPS pollution (e.g., siltation/sedimentation and stream habitat loss or degradation) was the primary cause of aquatic life use impairment. Other forms of pollution causing impairment are trace element contamination, flow alteration and oxygen depletion. Organic enrichment creates conditions in the stream that cause dissolved oxygen (DO) to be depleted. Rivers and streams impaired by siltation/sedimentation, organic enrichment, eutrophication due to excess nutrients and habitat alteration also will result in a degradation of the biological community.

Recreation use was assessed on 7,503 miles of rivers and streams in the state. Recreation use was fully supporting, fully supporting but threatened and not supporting on 1,260 miles, 3,721 miles and 2,521 miles, respectively. Pathogens (as reflected by E. coli and fecal coliform bacteria) are the primary cause of recreation use impairment in North Dakota. Other factors affecting the use of the state's rivers and streams for recreation would be eutrophication from excessive nutrient loading, resulting in nuisance algae and plant growth. The primary sources of E. coli and fecal coliform bacteria contamination are animal feeding operations, riparian area grazing and failing or poorly designed septic systems.

Drinking water supply use is classified for 5,592 miles of rivers and streams in the state. Of the 956 miles assessed for this report, 151 miles (16 percent) were assessed as threatened for drinking water supply use.

A total of 4,126 miles of rivers and streams were identified as capable of supporting a sport fishery from which fish could be used for consumption. Based on the EPA fish tissue of 0.3 micrograms (µg) methyl-mercury/gram of fish tissue, only the Red River of the North was assessed as not supporting fish consumption. While there are many potential sources of methyl-mercury (both anthropogenic and natural), to date there have been no specific causes or sources identified for the mercury present in North Dakota fish.

A total of 200 lakes and reservoirs, representing 622,264 surface acres, are specifically listed in the state water quality standards as classified lakes and reservoirs. Each of these 200 lakes and reservoirs were assessed for this report. In some cases the only beneficial uses assessed were agriculture and industrial uses. In others cases, all designated uses were assessed. There were also 89 lakes and reservoirs which were included in the ADB, but were not assessed. The non-classified lakes represent 91,000 acres or only 13 percent of the total lake and reservoir acres in the state. One-hundred-twenty-nine (129) lakes and reservoirs, representing 590,497 acres, were assessed as fully supporting aquatic life use; in other words, they are considered capable of supporting and maintaining a balanced community of aquatic organisms. An additional 29 lakes and reservoirs representing 8,168 acres are assessed as fully supporting, but threatened. A threatened assessment means that if water quality and/or watershed trends continue, it is unlikely these lakes will continue to support aquatic life use. The lakes and reservoirs will begin to experience more frequent algal blooms and fish kills. They will display a shift in trophic status from a mesotrophic or eutrophic condition to a hypereutrophic condition. Only four lakes, totaling 706 acres, were assessed as not supporting aquatic life use. One of the primary causes of aquatic life impairment to lakes and reservoirs is low dissolved oxygen (DO) in the water column. Low DO in lakes can occur in summer (summer kills) but usually occurs in the winter under ice-cover conditions. When fish kills occur, low DO-tolerant fish species (e.g., carp, bullhead, white suckers) will be favored, resulting in a lake dominated by these rough fish species. Pollutants which stimulate the production of organic matter, such as plants and algae, can also cause aquatic life impairment. Two secondary pollutant causes are excessive nutrient loading and siltation.

Major sources of nutrient loading to the state's lakes and reservoirs are erosion and runoff from cropland; runoff from animal feeding operations (e.g., concentrated livestock feeding and wintering operations); and hydrologic modifications. Hydrologic modifications, such as wetland drainage, channelization and ditching, increase the runoff and delivery rates to lakes and reservoirs, in effect increasing the size of a lake's watershed.

Recreation use (e.g., swimming, waterskiing, boating, sailing, sunbathing) was assessed for 162 lakes and reservoirs in the state totaling 599,725 acres. Of this total, four (4) lakes, representing 6,308 acres, were assessed as not supporting use for recreation. The primary cause of use impairment is excessive nutrient loading, which results in nuisance algal blooms and noxious aquatic plant growth. Sources of nutrients causing algal blooms and weed growth were described earlier. One-hundred-twenty-one (121) lakes and reservoirs totaling 575,675 acres were assessed as fully supporting recreation use. An additional 37 lakes and reservoirs totaling 17,741 acres were assessed as fully supporting, but threatened. Nutrient loading is also linked to the negative water quality trends these lakes are experiencing. If left unchecked, these lakes will degrade to the point where frequent algal blooms and/or excessive weed growth will negatively affect recreation.

One-hundred and ninety-nine (199) classified lakes and reservoirs, representing 620,850 acres, were assigned the use for fish consumption. One (1) lake, Lake George located in Kidder County, is a class 5 lake which is defined as "not capable of supporting a fishery due to high salinity." Of the 199 lakes and reservoirs entered into the ADB and assigned a use for fish consumption, only Devils Lake, Lake Sakakawea, Lake Oahe, Lake Tschida, and Nelson Lake had sufficient methyl-mercury fish tissue data and fish population survey data necessary to calculate average concentrations and to assess fish consumption use. Based on these data and the EPA recommended fish tissue criterion for methylmercury of 0.3 µg/g, Lake Sakakawea, Devils Lake, and Lake Tschida were assessed as not supporting fish consumption use, while Lake Oahe and Nelson Lake were assessed as fully supporting fish consumption use. The remaining 194 lakes and reservoirs that support a sport fishery were not assessed for this report. Potential sources of mercury include natural sources and atmospheric deposition.

One-hundred and ninety-five (194) lakes and reservoirs, representing 620,850 acres were assigned the use for municipal drinking water supply. Of these, 5 reservoirs (Lake Sakakawea, Lake Ashtabula, Homme Dam, Bisbee Dam and Mt. Carmel Reservoir) are currently used either directly or indirectly as municipal drinking water supplies, while two others (Patterson Lake and Renwick Dam) serve as back-up water supplies in the event the primary water supplies should fail. Homme Dam, Mt. Carmel Reservoir and Lake Sakakawea were assessed as fully supporting drinking water supply use. Municipal drinking water supply use was not assessed for Lakes Ashtabula, Bisbee Dam, Patterson Lake, Renwick Dam or for the other 187 classified lakes and reservoirs which are assigned a drinking water supply use.

Section 303(d) of the CWA and its accompanying regulations require each state to list waterbodies (i.e., lakes, reservoirs, rivers, streams and wetlands) which are considered water quality limited and require load allocations, waste load allocations and TMDLs. This list has become known as the "TMDL list" or "Section 303(d) list." A waterbody is considered water quality limited when it is known that its water quality does not meet applicable standards or is not expected to meet applicable standards. Waterbodies can be water quality limited due to point source pollution, NPS pollution or both.

In considering whether or not applicable water quality standards are being met, the state should not only consider the narrative and numeric criteria set forth in the standards but also the classified uses defined for the waterbody and whether the use or uses are fully supported or not supported due to any pollutant source or cause. Where a waterbody is water quality limited, the state is required to determine in a reasonable time frame the reduction in pollutant loading necessary for that waterbody to meet water quality standards, including its beneficial uses. The process by which the pollutant-loading capacity of a waterbody is determined and the load is allocated to point and nonpoint sources is called a total maximum daily load (TMDL). While the term "total maximum daily load" implies that loading capacity is determined on a daily time scale, TMDLs can range from meeting an instantaneous concentration (i.e., an acute standard) to computing an acceptable annual phosphorus load for a lake or reservoir.

When a state prepares its list of water quality-limited waterbodies, it is required to prioritize waterbodies for TMDL development and to identify those waterbodies which will be targeted for TMDL development within the next two years. Factors to be considered when prioritizing waterbodies for TMDL development include: (1) the severity of pollution and the uses which are impaired; (2) the degree of public interest or support for the TMDL, including the likelihood of implementation of the TMDL; (3) recreational, aesthetic and economic importance of the waterbody; (4) the vulnerability or fragility of a particular waterbody as an aquatic habitat, including the presence of threatened or endangered species; (5) immediate programmatic needs, such as wasteload allocations needed for permit decisions or load allocations for Section 319 NPS project implementation plans; and (6) national policies and priorities identified by EPA.

After considering each of the six factors, the state has developed a two-tiered priority ranking. Assessment units (AUs) listed as "High" priority are: (1) lakes and reservoirs and river and stream segments for which TMDLs are scheduled to be completed and submitted to EPA by the end of 2016; or (2) lakes and reservoirs and river and stream segments for which TMDL development projects are scheduled to be started in the next two years. The majority of these "High" priority AUs were identified as such, based largely on their degree of public support and interest and the likelihood of implementation of the TMDL once completed. "Low" priority AUs are those river and stream segments and lakes and reservoirs that are scheduled for completion in the next eight years.

The 2014 TMDL list is represented by 217 AUs (27 lakes and reservoirs[1] and 189 river and stream segments) and 340 individual waterbody/pollutant combinations. For purposes of TMDL development, each waterbody/pollutant combination requires a TMDL. Of this total, the department has targeted 59 waterbodies or 64 waterbody/pollutant combinations as "High" priority. These "High" priority waterbody/pollutant combinations are AUs where the monitoring necessary for TMDL development is either completed, near completion or will be initiated in 2015 or 2016. For the remaining 157 low priority waterbodies which are in need of additional monitoring and/or TMDLs, the Department will be working with EPA to develop a method of prioritizing waterbodies and watersheds for TMDL development. This method and the state's schedule for TMDL development through 2022 will be reported in the 2016 Integrated Report.

[1]Lake Sakakawea is described by two assessment units. These include ND-10110101-001-L_00 and ND-10110205-001-L_00, which includes the Little Missouri Bay portion of the reservoir.

PART II. INTRODUCTION

The Clean Water Act (CWA) contains several sections which require states to report on the quality of their waters. Section 305(b) (*State Water Quality Assessment Report*) requires a comprehensive biennial report, and Section 303(d) requires, from time to time, a list of a state's water quality-limited waters needing total maximum daily loads (TMDLs). In its regulations implementing Section 303(d), the U.S. Environmental Protection Agency (EPA) has defined "time to time" to mean April 1 of every even-numbered year. While due at the same time, states have historically submitted separate reports to EPA under these two sections. However, in guidance provided to the states by EPA dated July 29, 2005 (EPA, 2005), EPA suggested that states combine these two reports into one integrated report. The following is a brief summary of the requirements of each reporting section.

A. Section 305(b) Water Quality Assessment Report

The primary purpose of this *State Water Quality Assessment Report* is to assess and report on the extent to which beneficial uses of the state's rivers, streams, lakes, reservoirs and wetlands are met. Section 305(b) of the Clean Water Act requires states to submit this assessment report every two years; the information presented in this report is for the reporting period of 2012-2013. The Section 305(b) report is a summary report that presents information on use impairment and the causes and sources of impaired or threatened uses for the state as a whole.

This report is not a trends report, nor should the data or information in this report be used to assess water quality trends. Factors which complicate and prohibit comparisons between reporting years include changes in the number of sites, the quality of data upon which assessment information is based and changes to the estimated river and stream miles.

B. Section 303(d) TMDL List of Water Quality-limited Waters

While the Section 305(b) report is considered a summary report, Section 303(d) and its accompanying regulations (CFR Part 130 Section 7) require each state to list individual waterbodies (i.e., lakes, reservoirs, rivers, streams and wetlands) which are considered water quality limited and which require load allocations, waste load allocations and TMDLs. This list has become known as the "TMDL list" or "Section 303(d) list."

A waterbody is considered water quality limited when it is known that its water quality does not or is not expected to meet applicable water quality standards. Waterbodies can be water quality limited due to point sources of pollution, nonpoint sources (NPS) of pollution or both.

In considering whether or not applicable water quality standards are being met, the state should not only consider the narrative and numeric criteria set forth in the standards to protect specific uses, but also the classified uses defined for the waterbody and whether the use or uses are fully supported or not supported due to any pollutant source or cause. Therefore, a waterbody could be considered water quality limited when it can be demonstrated that a beneficial use (e.g., aquatic life or recreation) is impaired, even when there are no demonstrated exceedances of either the narrative or numeric criteria. In cases where there is use impairment and no exceedance of the numeric standard, the state should provide information as to the cause of the impairment. Where the specific pollutant (e.g., copper or phosphorus) is unknown, a general cause category (e.g., metals or nutrients) should be included with the waterbody listing.

Section 303(d) of the CWA and accompanying EPA regulations and policy only require impaired and threatened waterbodies to be listed and TMDLs developed when the source of impairment is a pollutant. Pollution, by federal and state definition, is “any man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water.” Based on the definition of a pollutant provided in Section 502(6) of the CWA and in 40 CFR 130.2(d), pollutants would include temperature, ammonia, chlorine, organic compounds, pesticides, trace elements, nutrients, biochemical oxygen demand (BOD), sediment and pathogens. Waterbodies impaired by habitat and flow alteration and the introduction of exotic species would not be included in the Section 303(d) TMDL list, as these impairment categories would be considered pollution and not pollutants. In other words, all pollutants are pollution, but not all pollution is a pollutant.

Where a waterbody is water quality limited, the state is required to determine, in a reasonable timeframe, the reduction in pollutant loading necessary for that waterbody to meet water quality standards, including its beneficial uses. The process by which the pollutant loading capacity of a waterbody is determined and the load is allocated to point and nonpoint sources is called a total maximum daily load (TMDL). While the term “total maximum daily load” implies that loading capacity is determined on a daily time scale, TMDLs can range from meeting an instantaneous concentration (i.e., an acute standard) to computing an acceptable annual phosphorus load for a lake or reservoir.

Section 303(d) requires states to submit their lists of water quality-limited waterbodies “from time to time.” Federal regulations have clarified this language; therefore, beginning in 1992 and by April 1 of every even-numbered year thereafter, states are required to submit a revised list of waters needing TMDLs. North Dakota’s last TMDL list was submitted to EPA on May 22, 2012 and was approved by EPA on October 29, 2012.

This Section 303(d) list includes waterbodies not meeting water quality standards, waterbodies needing TMDLs and waterbodies which have been removed from the 2012 list. Reasons for removing a waterbody from the 2012 list include: (1) a TMDL was completed for the waterbody/pollutant combination; (2) the applicable water quality standard is now attained and/or the original basis for the listing was incorrect; (3) the applicable water quality standard is now attained due to a change in the water quality standard and/or assessment methodology; (4) the applicable water quality standard is now attained due to restoration activities; or (5) sufficient data and/or information lacking to determine water quality status and/or the original basis for listing was incorrect.

PART III. BACKGROUND

A. Atlas

Table III-1. Atlas.

Topic	Value
State Population[1]	723,393
State Surface Area (Sq. Miles)	70,700
Total Miles of Rivers and Streams[2]	56,022.14
Total Miles of Rivers and Streams by Stream Class[3]	
Class I, IA and II Streams	6,007.22
Class III Streams	50,014.92
Total Miles of Rivers and Streams by Basin	
Red River (including Devils Lake)	12,100.23
Souris River	3,847.48
Upper Missouri (Lake Sakakawea)	14,350.70
Lower Missouri (Lake Oahe)	22,754.13
James River	2,969.60
Border Miles of Shared Rivers and Streams[4]	426.57
Total Number of Lakes and Reservoirs[5]	289
Number of Natural Lakes	143
Number of Manmade Reservoirs	146
Total Acres of Lakes and Reservoirs	713,258.67
Acres of Natural Lakes	236,542.19
Acres of Manmade Reservoirs[6]	476,716.48
Total Acres of Lakes and Reservoirs by Lake Class[7]	
Class 1	411,975.65
Class 2	165,125.23
Class 3	40,624.51
Class 4-Listed	3,118.60
Class 4-Not Listed	91,000.68
Class 5	1,414.00
Acres of Freshwater Wetlands[8]	2,500,000

[1] Based on 2013 U.S. Census Bureau estimate
[2] Total miles are based on rivers and streams entered into the Assessment Database (ADB) and reach indexed to the 1:100,000 scale National Hydrography Dataset (NHD).
[3] Stream classes are defined in the *Standards of Quality for Waters of the State* (North Dakota Department of Health, 2014). In general, Classes I, IA and II streams are perennial, while Class III streams are intermittent or ephemeral.
[4] Includes the Bois de Sioux River and the Red River of the North
[5] Number includes only the lakes and reservoirs which are publicly owned and are in the ADB.
[6] Estimates based on surface acreage at full pool elevation.
[7] Lake and reservoir classes are defined in the *Standards of Quality for Waters of the State* (North Dakota Department of Health, 2014). Acreage estimates for each lake class are based on lakes and reservoirs specifically listed in the state water quality standards. Lakes not specifically listed in the state water quality standards are Class 4 by default.
[8] Estimate provided by Dahl, T.E., *Wetlands - Losses in the United States: 1780's to 1980's*, Washington, D.C., U.S. Fish and Wildlife Service Report to Congress, 1990.

B. Total Waters

The North Dakota Department of Health (hereafter referred to as the department) currently recognizes 289 public lakes and reservoirs. Of the 289 public lakes and reservoirs recognized as public waters and included in the Assessment Database (ADB), only 200 are specifically listed in the state's water quality standards as classified lakes and therefore are assigned designated beneficial uses (Table III-1). The remaining 89 lakes and reservoirs, while included in the state's estimate of total lake acres, are not considered classified waters and therefore were not assessed for this report. By default, these waterbodies are assigned the Class 4 fisheries classification.

The increase in the number of lakes and reservoirs in the ADB from 253, which was reported in the 2012 cycle, to 289 for this report is due to the addition of three (3) new classified lakes and 33 new non-classified lakes to the ADB (Appendix A). There was also a change in the number of classified lakes entered into the ADB for the 2014 reporting cycle. There were 200 classified lakes and reservoirs entered in the ADB for the 2014 cycle compared to 192 classified lakes and reservoirs entered in the ADB for the 2012 cycle. This increase in the number of classified lakes reflects the three (3) new classified lakes which were added to the ADB and the reclassification of 5 lakes from non-classified lakes in 2012 to Class 2 or 3 lakes in 2014 (Appendix A). These revisions to the lake classifications in the ADB reflect changes to the lake classifications made as part of the state's triennial water quality standards review (NDDoH, 2014).

Of the 289 public lakes and reservoirs included in the ADB, there are 146 are manmade reservoirs and 143 are natural lakes. All lakes and reservoirs included in this assessment are considered significantly publicly owned. Based on the state's Assessment Database, the 146 reservoirs have an aerial surface of 476,716 acres. Reservoirs comprise about 67 percent of North Dakota's total lake/reservoir surface acres. Of these, 411,496 acres or 58 percent of the state's entire lake and reservoir acres are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe). The remaining 144 reservoirs share 65,211 acres, with an average surface area of 450 acres.

The 143 natural lakes in North Dakota cover 236,542 acres, with approximately 102,376 acres or 43 percent attributed to Devils Lake. The remaining 142 lakes average 945 acres, with approximately 42 percent being smaller than 250 acres.

There are 56,022 miles of rivers and streams in the state. Estimates of river stream miles in the state are based on river and stream waterbodies in the ADB that are reach indexed to the 1:100,000 National Hydrography Dataset (NHD plus) and include ephemeral, intermittent and perennial rivers and streams. The estimate of river and stream miles for this report reflects an increase in 1,416 miles from what was reported in 2012. This increase is due to: 1) an increase in the number of stream assessment units; and 2) an increase in the estimated size of several river and stream assessment units (Appendix A). Previous to this report, the estimated size of river and stream assessment units entered into the ADB was based on estimates generated from EPA's reach file 3. For the 2014 Integrated Report, assessment unit sizes for rivers and streams were calculated based on the 1:100,000 NHD plus. While some river and stream assessment units decreased in size, when compared to 2012, and some remained the same size based on the NHD, the vast majority increased in size (Appendix A). For example, assessment unit ND-09010004-012-S_00, the Snake Creek watershed located in McHenry County, increased from 15.5 stream miles to 113.36 stream miles.

In this report, the state has been divided into five basins: Red River (including Devils Lake), Souris River, Upper Missouri River (Lake Sakakawea), Lower Missouri River (Lake Oahe) and James River (Figure III-1). The atlas provided in Table III-1 provides a basin-by-basin estimate of total river and stream miles.

C. Water Pollution Control Program

Chapter 1. Water Quality Standards Program

State water quality standards describe the policy of the state which is to protect, maintain and improve the quality of water for use as public and private water supplies; for propagation of wildlife, fish and aquatic life; and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses.

The state classifies its surface water resources into five categories. The assignment of a waterbody into a particular classification is based on the water quality of record (1967), existing uses at that time, hydrology and natural background factors.

Water quality standards also identify specific numeric criteria for chemical, biological and physical parameters. The specific numeric standard assigned to each parameter ensures protection of the beneficial uses for that classification. The water quality standards also contain general conditions, termed "narrative standards," applicable to all waters of the state. These general conditions contain provisions not specifically addressed in numeric criteria. These conditions add an extra level of protection for water quality.

The department has also developed a narrative biological goal for all waters of the state. The goal is to restore all surface waters to a condition similar to that of sites or waterbodies determined to be regional reference sites. The goal is non-regulatory; however, it may be used in combination with other information in determining whether aquatic life uses are attained. The state is also in the process of developing "biological criteria." These criteria will define ecological conditions in state waters and set goals for their attainment.

In addition to numeric and narrative standards and the beneficial uses they protect, a third element of water quality standards is antidegradation. The fundamental concept of antidegradation is the protection of waterbodies which currently have better water quality than applicable standards. Antidegradation policies and procedures are in place to maintain high quality water resources and prevent them from being degraded to the level of water quality standards.

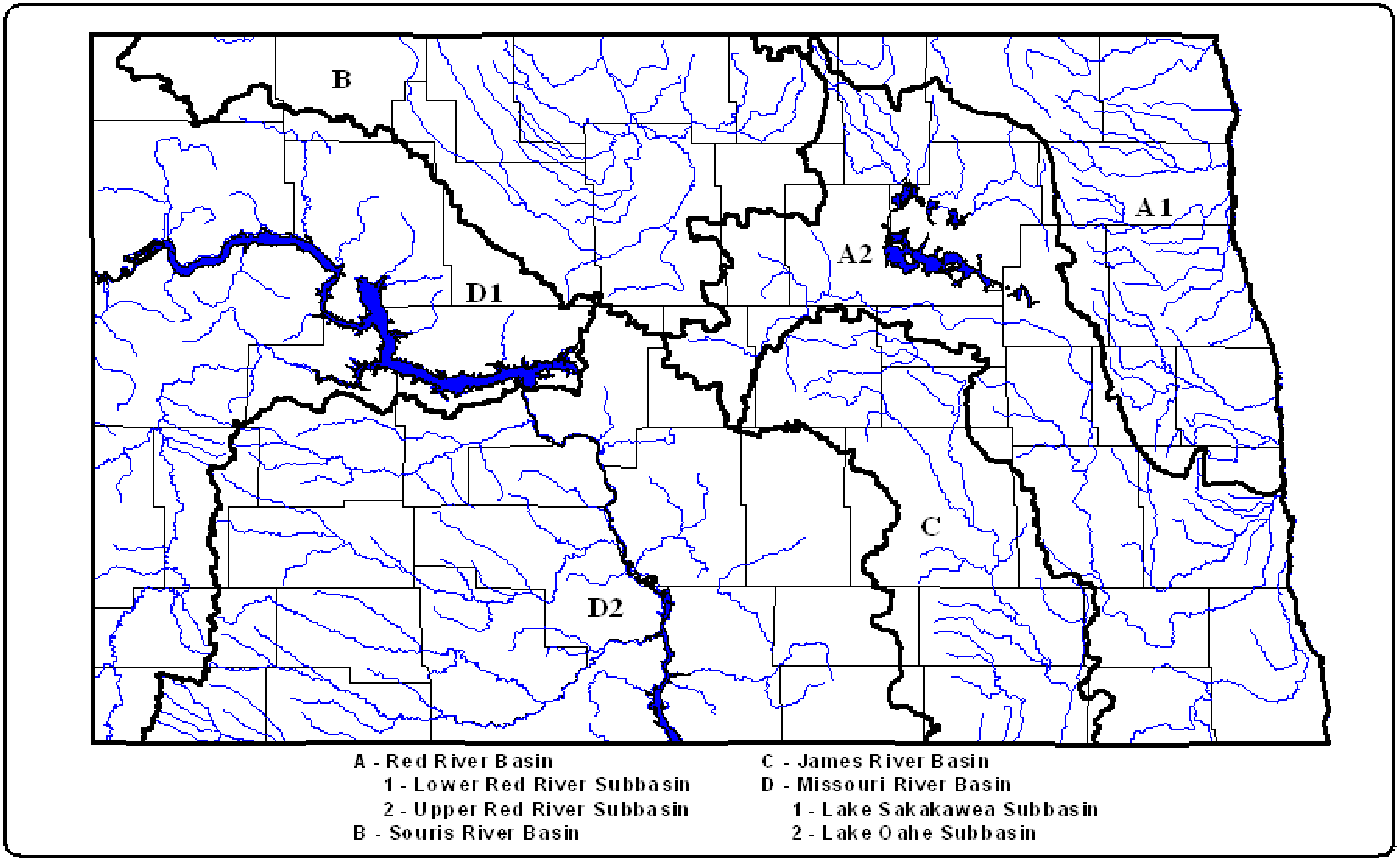

Figure III-1. Major Hydrologic Basins in North Dakota.

State water quality standards have established three categories or tiers of antidegradation protection. Category 1 is a very high level of protection and automatically applies to all Class I and IA rivers and streams, all Class 1, 2 and 3 lakes and reservoirs, and wetlands that are functioning at their optimal level. Category 1 may also apply to some Class II and III rivers and streams, but only if it can be demonstrated that there is remaining pollutant assimilative capacity, and both aquatic life and recreation uses are currently being supported. Category 2 antidegradation protection applies to Class 4 and 5 lakes and reservoirs and to Class II and III rivers and streams not meeting the criteria for Category 1. Category 3 is the highest level of protection and is reserved for Outstanding State Resource Waters. Waterbodies may only be designated Category 3 after they have been determined to have exceptional value for present and future potential for public water supplies, propagation of fish or aquatic biota, wildlife, recreation, agriculture, industry, or other legitimate beneficial uses.

The U.S. EPA requires the department to review and update, as necessary, the state water quality standards based on new information and EPA guidance a minimum of every three years. This process is termed the “triennial review.” Issues currently being considered for this review are beneficial use designations for wetlands and associated numeric criteria. Currently, wetlands are considered waters of the state and are protected by general conditions.

The department is also in the process of developing nutrient criteria which are needed to address the eutrophication of the state’s surface waters. Excessive nutrients typically manifest themselves as elevated amounts of algae in lakes and reservoirs and as epiphytic algae in streams and rivers. In preparation for the development of nutrient criteria, the department has developed a plan for developing technically defensible nutrient criteria specific to the unique resources of North Dakota. The Nutrient Criteria Development Plan (NDDoH, 2007) describes the anticipated conceptual approach for developing nutrient water quality criteria. The plan specifically focuses on lotic systems (i.e., small to large wadeable and non-wadeable streams and rivers) and lentic systems (i.e., lakes and reservoirs). The plan is intended to provide clear and meaningful guidance for the development of nutrient criteria within North Dakota. The report does not represent a binding commitment, and modification of the plan will likely be needed as new information becomes available or unanticipated issues arise.

The approach described by the Nutrient Criteria Development Plan has enabled North Dakota to explore in detail the feasibility of implementing various development concepts. The department, through funding provided by EPA Headquarters, performed a pilot project designed to evaluate a method to establish numeric standards for lentic systems. The lentic systems pilot, which focused on the Upper Red River sub-basin, was successful in 1) developing a proposed state-wide classification system for all lake and reservoir systems; and 2) applying a modeling technique for establishing numeric criteria for lentic systems in the State. Outcomes of the regional pilot project were used to determine what numeric endpoints should be set for different types of lakes and reservoirs (i.e., small versus large water bodies).

As a follow up to the state lentic systems pilot project, a second project was funded through EPA Headquarters and was completed in April 2011. Work under this EPA contract was performed with the ultimate goal of developing, calibrating, and applying regional models reflective of the watershed nutrient loading to, and eutrophication response, of the Plains lakes and reservoirs of EPA Region 8 (including portions of North Dakota, South Dakota, Montana, and Wyoming).

The results of analyzing the observed water quality data and the development and application of regional watershed loading and reservoir receiving reservoir models in Ecoregion 46 and Ecoregions 42/43 provided an appreciation of how water quality varies across the study area and how different nutrient loads delivered to the area's reservoirs may affect the in-reservoir eutrophication response.

Chapter 2. Point Source Control Program

The department regulates all releases of wastewater from point sources into waters of the state. Point source pollution is defined simply as pollution coming from a specific source, like the end of a pipe. The regulation of all point source discharges is the responsibility of the department's Division of Water Quality. The North Dakota Pollutant Discharge Elimination System (NDPDES) Program requires all point source dischargers (municipal and industrial) to obtain a permit. NDPDES permits outline technology-based and/or water quality-based limits for wastewater discharges.

Environmental regulations implemented during the last 30 years have resulted in a significant reduction in pollution from major point sources (e.g., municipal and industrial wastewater treatment facilities). There are approximately 400 facilities (25 percent industrial and 75 percent municipal) that are permitted for discharges of treated wastewater.

Since 1992, permits have been required for stormwater discharges associated with construction and industrial facilities. Permitting stormwater discharges from industrial sites, construction sites and larger municipalities has become a major portion of the NDPDES program. The department has issued four separate general permits for stormwater discharges. The general permits outline requirements for stormwater discharges from construction activities, industrial activities, mining operations, and municipal separate storm sewer systems (MS4's).

The department continues to implement the Stormwater Phase II regulations (effective December 8, 1999) to the maximum extent possible. The federal stormwater regulations have also been incorporated into the state rules. The primary focus in the area of stormwater discharges continues to be meeting the obligations of Phase II of EPA's Stormwater Rule.

There are approximately 486 facilities covered under general permits for stormwater discharges from industrial activities. Included in these general permits are requirements for monitoring and sampling of stormwater discharges. All discharge data is evaluated and used to update the standard pollution prevention practices that are currently used in the state. These facilities must implement pollution prevention plans which are intended to improve the quality of stormwater discharges.

There are approximately 2084 facilities covered for construction stormwater in the state. Several of the forms and guidance materials for the industrial and construction permit were revised or created to assist permit holders. A stormwater sampling guide was developed and posted on the department's website, as well as new stormwater pollution prevention plan templates for construction and industrial activity. The department continues to provide stormwater education, including an annual workshop on stormwater issues.

The department continues to work with the regulated small MS4s (19) on issues relating to stormwater discharges. The focus of MS4 activity continues to be development/implementation of ordinances or other regulatory mechanisms for local construction site erosion and sediment control and post construction controls. The NDDH provides information on compliance assistance activities and training conducted for permitted small MS4s. The department has developed an audit/inspection plan for Phase II MS4s to ensure that compliance is verified on an ongoing basis.

Many of the wastewater treatment systems in North Dakota consist of impoundments or lagoons. The availability of land and the low operation and maintenance costs are the main reasons for their use and acceptance in North Dakota. These wastewater stabilization pond systems discharge intermittently, and the discharges are short in duration. The average discharge duration is less than six days in length with the majority of the discharges occurring in the spring and fall. A facility discharging treated wastewater is required to monitor the discharge for quality and quantity data. This information is submitted to the department in monthly, quarterly, or semi-annual reports which are tracked and monitored for compliance with the conditions outlined in the permit.

The overall quality of wastewater is commonly indicated by 5-day biochemical oxygen demand (BOD-5) and total suspended solids (TSS). Typically, high concentrations of BOD-5 and TSS indicate poor treatment system performance which can present an environmental concern. Treated wastewater from many of the state's permitted facilities is discharged over land or through ditches or unnamed drainages before it reaches waters of the state. In such cases, it is likely the reported concentrations for BOD-5 and TSS are further reduced prior to entering a waterbody.

Generally, development of Total Maximum Daily Loads (TMDLs) has not been required for point source discharges in North Dakota. TMDL development activity occurs mainly in rural watersheds dealing with nonpoint source pollution issues. There is effective internal coordination during the development of TMDLs and waste load allocation (WLA) requirements in NDPDES permits, and no formal tracking mechanism is required or necessary in the NDPDES Program at this time. For this reporting period, no permits have been modified or reissued to implement WLAs with approved TMDLs.

Toxic pollutants in wastewater discharges are a concern, particularly for the larger cities and industries in North Dakota. They are regulated through the Industrial Pretreatment Program which the department has primacy (effective September 9, 2005) to implement in North Dakota. The cities of Grand Forks, Fargo, Bismarck, Mandan and West Fargo have approved pretreatment programs. The department continues to work closely with pretreatment personnel from select industries and municipalities on providing training and updates on issues associated with the pretreatment program.

All waters of the state shall be free from substances attributable to municipal, industrial or other discharges in concentrations or combinations which are toxic or harmful to humans, animals, plants or resident biota. This narrative water quality standard is enforced in part through appropriate whole effluent toxicity (WET) requirements in NDPDES permits. All major municipal/industrial permittees and select minors are required to monitor their discharges for

WET. Municipalities and industries sample at an appropriate frequency for WET with results submitted for the department's review. Failure of WET tests can result in toxicity identification evaluations (TIEs) to determine the cause of the toxicity in the effluent. TIEs that have been completed in the state have resulted in major and minor improvements to wastewater treatment systems.

Rules/regulations of the Safe Drinking Water Act have resulted in the movement to membrane filtration water treatment plants in the state. As a result, the department has been very active in permitting these new membrane filtration water treatment plants. The discharge of wastewater generated in the production of drinking water is not regulated by national effluent limitations guidelines, which establish technology-based effluent limitations for various industries. In the absence of a federal standard, limitations may be determined using Best Professional Judgment (BPJ) to ensure reasonable control technologies are used to prevent potential harmful effects of the discharge. In addition the department must consider and include limitations necessary to protect water quality standards applicable to the receiving waters. The challenge for the program is working with the facilities and their consultants on discharge requirements especially for low base-flow streams in the state of North Dakota. The department issued a new general permit for discharges from some types of water treatment plants.

The department continues working on addressing noncompliance in the program. The main emphasis from EPA continues to be wet weather issues like stormwater, SSO's and CAFOs. Routine inspections result in formal and informal enforcement actions. Informal enforcement can be letters requesting additional information and/or requiring repairs to best management practices (BMPs). In addition, the department issues formal warning letters citing apparent noncompliance with permit rules and water quality statutes (LOAN letters). Notices of Violation (NOVs) and Consent Agreements are issued through the Attorney General's office. The consent agreements include both upfront and suspended penalties. For each case, the collected penalty exceeded any economic benefit of non-compliance.

Impacts to water from livestock operations are an increasing concern in North Dakota. Currently, about 683 active livestock facilities have been approved to operate. Most of these are cattle, hog and dairy facilities that are part of a farmer's total farm operation The department addresses all animal feeding operations impacting water quality through mechanisms or existing programs in the state. The department incorporated the February 12, 2003 federal CAFO rules into the state program. This consisted of updates to the North Dakota Pollutant Discharge Elimination System (NDPDES) rules (NDAC 33-16-01) and Control of Pollution from Animal Feeding Operations rules (NDAC 33-16-03.1). These rules became final on January 7, 2005.

EPA's CAFO rules were challenged which resulted in new rules on CAFOs (November 2008) taking into account the Circuit Court of Appeals decision. The department has initiated the process of looking into potential state rule revisions as a result of the 2008 CAFO rule updates. Department review has determined that the current rules have sufficient authority to address the changes in the 2008 CAFO rules. The Department is proceeding with a CAFO general permit.

In the interim, the department continues to permit animal feeding operations under the current state program (NDAC 33-16-03.1) which also includes large CAFOs. For all state-permitted CAFOs, permit facility data, permit event data and inspection data are entered into the state data base system. CAFO inspections are performed yearly, and information is provided to EPA on a regular basis.

The department provides educational materials to livestock producers and the public on the impacts that livestock manure has on waters of the state. Several times each year, the department participates in presentations to producer groups. The department works closely with the Natural Resources Conservation Service (NRCS) and Ag Extension Service (NDSU) on livestock manure systems. The department coordinates with the North Dakota Department of Agriculture and the North Dakota Stockmen's Association on assessing potential water quality impacts at livestock facilities. The department also meets with individual producers on site to determine what impacts the facility may have on water quality and discuss ways to prevent water quality impacts, if needed

The Operator Training Program is an important aspect of water quality protection. North Dakota regulations require a certified operator for municipalities with populations of greater than 500. The goal of the program is to conduct an inspection of each municipal treatment system at least once every three years. These inspections verify proper system operation and reaffirm to the operator the importance of proper operation in protecting the state's water resources. The department also conducts wastewater operator training and certification seminars. In addition to the seminars, the program provides individual training and assistance to facilities encountering treatment problems.

Contracts were awarded to seven health districts in the state to provide assistance in water pollution investigations. The contracts run through the state fiscal year (July 1 - June 30) and are for a two-year period. Activities associated with these contracts are water and wastewater inspections, odor readings at animal feeding operations, initial response to spills and releases to waters of the state and initial response to complaints on water quality issues.

The growth of industrial activity related to oil and gas production and exploration continues at a rapid pace, which has affected all parts of the program. In response the department has issued a new general permit for package-type mechanical treatment plants. These plants are serving many of the crew housing facilities in the western part of the state. A large amount of the domestic wastewater generated is still hauled from sites, so the department also increased its oversight of septic system servicers, requiring additional record keeping and disposal. The stormwater program has also had a marked increase in permits for construction stormwater and industrial stormwater.

More detailed information on the activities of the Point Source Control Program is available in the Department's Performance Partnership Agreement End of Year Assessment.

Chapter 3. Nonpoint Source (NPS) Pollution Control Program

Surface water and ground water are two of North Dakota's most valuable natural resources. Water quality is affected by both natural and cultural, point source and nonpoint source (NPS) pollution, with NPS pollution being the major factor affecting surface water quality in the state. Ground water quality has remained relatively unaffected by major sources of pollution. However, some aquifers have experienced minor water quality impairments (see Part VII. Ground Water Assessment).

All rivers, streams, reservoirs and lakes assessed within the state are impacted to some degree by NPS pollution. Generally, most surface water quality impacts are associated with agricultural activities in the watersheds, with the exception of watersheds with larger cities, where NPS pollution impacts are also related to urban activities. Ground water impacts can result from the improper use of agricultural chemicals, leaking underground petroleum storage tanks and pipelines, wastewater impoundments, oil and gas exploration activities, septic systems and improperly located and maintained solid waste disposal sites.

NPS pollution control efforts to maintain or improve the beneficial uses of North Dakota's water resources are primarily accomplished through the North Dakota NPS Pollution Management Program (NPS Program). The NPS Program is a voluntary program largely dependent on the formation of partnerships and coordination with local resource managers to effectively reduce and/or prevent NPS pollution from impairing beneficial uses of the state's water resources. Over the long term, through these coordinated efforts, the cumulative benefits of the local projects will help the department achieve its mission and long-term goal as identified in the April 2010 North Dakota NPS Pollution Management Program Plan (Management Plan). The NPS Program's mission statement and long-term goal are as follows:

> North Dakota NPS Program Mission: "To protect or restore the chemical, physical and biological integrity of the waters of the state by promoting locally sponsored, incentive based, voluntary programs where those waters are threatened or impaired due to nonpoint sources of pollution."
>
> North Dakota NPS Management Program Long Term Goal: "To initiate a balanced program focused on the restoration and maintenance of the beneficial uses of the state's water resources (i.e., streams, rivers, lakes, reservoirs, wetlands, aquifers) impaired by NPS pollution."

The April 2010 Management Plan established three primary objectives that need to be realized by March 2015 to ensure progress toward the long term goal. The first objective focuses on the assessment of the water quality and beneficial use conditions in 20 waterbodies across the state. Cumulatively, the watersheds for the assessed waterbodies will include approximately 150-200 12 digit hydrologic units (HU). As a second objective, the NPS Program, through its partners, will utilize the assessment data to develop and implement restoration projects in 20 local priority watersheds. These watershed projects will be the primary means for the NPS Program to accomplish its on-the-ground restoration goals. The third objective focuses on increasing public support and awareness for local and statewide NPS pollution management efforts. This will be accomplished by coordinating the development and delivery of a variety of educational programs. These educational programs will target all age groups, with particular emphasis on those involved in agriculture.

While the short term goal of the program is to initiate 20 watershed restoration projects by 2015, it typically requires between seven and ten years to complete the planned restoration efforts within a watershed project area. Therefore, many of the watershed restoration projects initiated by 2015 are not expected to be completed until 2021-2024. In addition, with the continual start-up of new assessment efforts each year, future Integrated Reports will certainly identify new waterbodies with beneficial uses impaired by NPS pollution. As such, financial and technical needs to develop and implement new watershed restoration projects will also continue to grow throughout the effective period of the current Management Plan as well as future plans.

The local or state projects supported with Section 319 funding can be placed under one of four different categories. These project categories are: (1) development phase projects; (2) educational projects; (3) technical support projects; and (4) watershed projects. Under each of these categories, there may also be one or more different project types or subcategories.

The primary purposes of the development phase projects are to identify beneficial use impairments or threats within specific waterbodies and determine the extent to which those threats or impairments are due to NPS pollution. Typically, development phase projects involve an inventory of existing data and supplemental monitoring to allow a thorough assessment of the targeted waterbody and its watershed. Through these efforts, the local project sponsors are able to: (1) determine the extent to which beneficial uses are being impaired by NPS pollution; (2) identify specific sources and causes of the pollutants; (3) establish preliminary pollutant reduction goals or TMDLs; and (4) identify management measures needed to restore or maintain the beneficial uses of the waterbody. Projects under this category include NPS Assessment Projects and TMDL Development Projects.

Educational projects are designed to increase public awareness and understanding of various NPS pollution issues and/or the solutions to specific NPS pollution concerns. The focus of these educational efforts may range from a local source or cause of NPS pollution to statewide measures that can be initiated to reduce NPS pollution. Educational tools typically include brochures, all media (TV, radio, newspaper), workshops, tours, mentoring programs, and demonstrations. Two types of educational projects are currently being delivered in the state. The first are demonstration projects, which focus on the development of on-the-ground demonstrations for educational purposes. The other types of educational projects are the public outreach programs, which focus on statewide/local distribution of NPS pollution information.

Projects designed to deliver technical or financial assistance to other ongoing NPS pollution management projects are identified as “support projects.” These projects or programs are either offered statewide or targeted toward a “project area” that includes multiple NPS projects. The primary purpose of these projects is to deliver a specific service or “tool” to locally sponsored NPS projects. Specific types of assistance or management tools being delivered by the support projects include engineering designs, manure management planning, and technical assistance for the management of saline soils and/or soil health.

The watershed project category includes the most comprehensive projects currently implemented through the NPS Program. These projects are typically long-term efforts designed to address documented NPS pollution impacts and beneficial use impairments within priority watersheds. Common objectives for watershed projects include: (1) protection and/or restoration of impaired beneficial uses through voluntary implementation of BMPs; (2) dissemination of information on local NPS pollution concerns and effective solutions to those concerns; and (3) evaluation of progress toward identified use attainment or NPS pollutant reduction goals. In nearly all cases, the goals and objectives of the watershed projects are based on data collected through some type of development project (e.g., NPS Assessment Project, TMDL development).

Section 319 funding is the primary source of financial support for projects addressing NPS pollution. Through the 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (Active Grants), the NPS Program has provided funding to over 45 local and state projects. The budgets and status of the locally sponsored projects and NPS Program staffing are provided in Table III-2.

Statewide delivery of the NPS Program is accomplished through six main goals identified in the NPS Program Management Plan. These goals are organized as individual sections of the Management Plan, are as follows:

- Resource Assessment - This section addresses the NPS Program's existing inventory/assessment system and future needs to improve or expand assessment efforts.

- Prioritization - This section discusses existing and future prioritization methods or strategies within the NPS Program.

- Assistance - This section focuses on "how" the financial and technical assistance available through the program is delivered to state/local project sponsors.

- Coordination - Development and maintenance of partnerships with private and local/state/federal agencies and organizations are described in this section.

- Information/Education - The program's multi-year strategy for public outreach and information dissemination is described under this section.

- Evaluation/Monitoring - Program and local project evaluation/monitoring efforts are addressed in this section.

Table III-2. Status and Budgets for Projects Supported Under the Fiscal Year 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (5/1/09 -12/31/13).

Development Phase - NPS Assessment

Project Name	Status	319 Allocation	Local Match	Total Budget
Antelope Creek Watershed Assessment - Grant Co.	Active	$8,766	$5,844	$14,610
NDSU Assess Multi-Element Composition of Soil Profiles in Prairie Wetlands	Active	$100,936	$67,291	$168,227
NDSU Assessment of Increased Dust & Road Use to Western ND Wetlands	Active	$97,599	$65,066	$ 162,665
NDSU Assessment of Wetland Efficacy in Improving Tile Drain Water Quality	Complete	$17,380	$11,587	$28,967
River Keepers 2013 Monitoring Program	Complete	$6,341	$4,227	$10,568
Development Phase Fund – 2009	Active	$0	$0	$0
Development Phase Fund – 2010	Active	$9,588	$6,392	$15,980
Development Phase Fund – 2011	Active	$100,000	$66,667	$166,667
Development Phase Fund – 2012	Active	$0	$0	$0
Development Phase Fund – 2013	Active	$64,860	$43,240	$108,100
Valley City Comprehensive Bank Stability & Restoration Study	Complete	$36,000	$24,000	$60,000
Wild Rice Water Quality Data Products & Planning Tool	Active	$79,645	$53,097	$132,742
Subtotal		**$521,115**	**$347,411**	**$868,526**

Education - Demonstration

Project Name	Status	319 Allocation	Local Match	Total Budget
NDSU Vegetative Buffer Demonstration and Evaluation Program	Complete	$119,436	$79,624	$199,060
NDSU Vegetative Buffer Demonstration & Evaluation Project – Phase II	Active	$85,300	$56,867	$142,167
Discovery Farms Program	Active	$637,900	$425,267	$1,063,167
Subtotal		**$842,636**	**$561,758**	**$1,404,394**

Education - Public Outreach

Project Name	Status	319 Allocation	Local Match	Total Budget
Envirothon Program – Phase III	Active	$120,150	$80,100	$200,250
Foster County - TREES Program – Phase II	Active	$246,350	$164,233	$410,583
Menoken Farm Soil Foodweb Project	Active	$163,034	$108,689	$271,723
NDSU Eastern ND Soil Salinity Program	Active	$115,152	$76,768	$191,920
NDSU Nutrient Management Educational Support Program	Active	$360,000	$240,000	$600,000
Partners for Improving Water Quality I&E Program	Active	$325,000	$216,667	$541,667
Prairie Waters Education and Research Center	Active	$481,946	$321,297	$803,243
Project WET	Complete	$174,258	$116,172	$290,430
Project WET – Phase II	Active	$206,396	$137,597	$343,993
Ranchers Mentoring Project	Active	$290,000	$193,333	$483,333
Statewide ECO ED Camp – Phase II	Active	$81,985	$54,657	$136,642
Statewide ECO ED Camp – Phase III	Active	$289,098	$192,732	$481,830
Water Quality Mentorship and Outreach Program	Active	$495,000	$330,000	$825,000
Subtotal		**$3,348,369**	**$2,232,245**	**$5,580,614**

Table III-2 (con't). Status and Budgets for Projects Supported Under the Fiscal Year 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (5/1/09 -12/31/13).

Local Project Support (TA or FA)

Project Name	Status	319 Allocation	Local Match	Total Budget
NPS BMP Team	Complete	$72,000	$48,000	$120,000
Eastern ND Soil Salinity Specialist Program	Discontinued	$53,348	$35,565	$88,913
Livestock Pollution Prevention Program	Active	$1,297,995	$895,330	$2,163,325
NDSU Riparian Ecological Site Description Development Project	Active	$157,343	$104,895	$262,238
NPS BMP Team – Phase II	Active	$432,953	$288,635	$721,588
Stockmen's Association Manure Management Specialist – Phase II	Complete	$1,256,011	$837,341	$2,093,352
Stockmen's Association Manure Management Specialist – Phase III	Active	$825,000	$550,000	$1,375,000
Subtotal		**$4,094,650**	**$2,729,766**	**$6,824,416**

NPS Assessment - Multi Year Grant Award

Project Name	Status	319 Allocation	Local Match	Total Budget
Red River Valley Tile Drain Water Quality Assessment - Phase II	Active	$183,283	$122,189	$305,472
Subtotal		**$183,283**	**$122,189**	**$305,472**

NPS Program Staffing and Support

Project Name	Status	319 Allocation	Local Match	Total Budget
NPS Program Staffing & Support	Active	$3,205,000	$2,136,667	$5,341,667
Subtotal		**$3,205,000**	**$2,136,667**	**$5,341,667**

Table III-2 (con't). Status and Budgets for Projects Supported Under the Fiscal Year 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (5/1/09 -12/31/13).

Watershed Project

Project Name	Status	319 Allocation	Local Match	Total Budget
Antelope Creek Watershed/Wild Rice Riparian Corridor Project – Phase II	Active	$537,012	$358,008	$895,020
Barnes Co. Sheyenne River Watershed - Phase II	Active	$1,103,098	$735,399	$1,838,497
Bear Creek Watershed – Phase II	Active	$437,200	$291,467	$728,667
Beaver Creek/Seven Mile Coulee Watershed	Complete	$465,000	$310,000	$775,000
Beaver Creek/Seven Mile Coulee Watershed – Phase II	Active	$509,940	$339,960	$849,900
Coyote Creek Watershed & Little Missouri Tributaries Assessment	Active	$202,605	$135,070	$337,675
Dead Colt Creek TMDL Implementation Project	Active	$280,803	$187,202	$468,005
Dickey/LaMoure Livestock Manure Management Program	Complete	$137,015	$91,343	$228,358
James River Headwaters Watershed – Phase II	Active	$406,190	$270,793	$676,983
Kelly Creek Watershed	Active	$363,900	$242,600	$606,500
Maple River Watershed (Cass Co.)	Active	$266,472	$177,648	$444,120
Morton Co. Livestock Manure Management Program	Active	$54,448	$36,299	$90,747
Morton County Northeastern Watersheds Project	Active	$482,335	$321,557	$803,892
Northgate Dam & Short Creek Watershed	Complete	$103,024	$68,683	$171,707
Powers Lake Watershed Restoration Action Strategy – Phase II	Active	$182,350	$121,567	$303,917
Red River Riparian Project - Phase IV	Active	$400,000	$266,667	$666,667
Rush River & Brewer Lake Watershed	Active	$150,000	$100,000	$250,000
Spring Creek Watershed	Active	$475,933	$317,289	$793,222
Stutsman Co. Livestock Manure Management Program	Active	$640,000	$426,667	$1,066,667
Turtle Creek Watershed (McLean Co.)	Active	$378,600	$252,400	$631,000
Turtle River Watershed	Active	$221,639	$147,759	$369,398
Upper Red River Valley Riparian Project	Complete	$219,802	$146,535	$366,337
Wild Rice River Restoration & Riparian Project	Active	$539,381	$359,587	$898,968
Subtotal		**$8,556,747**	**$5,704,500**	**$14,261,247**
Cumulative FY09 - FY13 Grants Budget		**$20,751,800**	**$13,834,536**	**$34,586,336**

Resource Assessment

Resource Assessment Goal: To accurately and thoroughly assess beneficial use support and the sources and causes of use impairments within the state's watersheds.

Resource assessment is implemented at both the statewide and local levels. On a statewide basis, data (e.g., water quality, biological) collected by state and local staff are utilized to evaluate and document water quality and beneficial use trends of numerous waterbodies. At the local level, resource managers collect watershed-specific data to: 1) identify beneficial use impairments; 2) track water quality trends; 3) establish waterbody priorities; 4) develop watershed strategies; and/or 5) measure benefits of applied BMPs.

The locally sponsored NPS assessment or TMDL development projects are the primary means used to identify watershed priorities and management measures needed to address NPS pollution impairments. The local NPS assessments, commonly referred to as "development projects," provide the foundation for all watershed projects by identifying specific sources and causes of NPS pollutants impairing or threatening beneficial uses. This information is used to establish watershed priorities as well as to develop multi-year project implementation plans (PIPs) that address the identified beneficial use impairments. When applicable, other ND Department of Health (Department) staff will also coordinate with the local sponsors to utilize the assessment data to develop TMDLs.

Section 319 financial support for assessment projects is derived through two different means or sources. Short-term (i.e., 1-2 years) NPS assessment projects are supported with Section 319 funding available through the NPS Program's "Development Fund." The Development Funds are either reallocated funds from other NPS projects or funds budgeted for assessment projects under the NPS Program's staffing and support annual allocation. If the waterbody is also on the TMDL List, alternative funds, such as 604[b] funding, may also be used to support the assessment activities. For the multi-year or basin-wide NPS assessments, the local sponsors participate in the annual Section 319 grant application process to secure Section 319 support for the duration of the project.

Since May 2009, Section 319 and 604(b) funds have been used to support ten assessments and/or TMDL development projects. The focus of these projects is variable, including watershed-scale assessments; BMP effectiveness monitoring; or documentation of new impacts on wetlands. Table III-3 lists the budget and status for the assessment projects supported under the Section 319 and 604(b) grants administered by the Department.

Table III-3. NPS Assessment and TMDL Development Projects Supported with Section 319 and 604(b) Funds Since May 2009.

Project Name	319 Funding	604(b) Funding	Status
Antelope Creek Watershed (Grant Co.)	$8,766	$0	Active
River Keepers 2013 Monitoring Program	$ 6,341	$0	Active
Assessment of Multi-Element Composition of Soil Profiles in Prairie Wetlands	$100,936	$0	Active
Assessment of Increased Dust and Road Use Impacts on Wetlands in Western ND	$97,599	$0	Active
Assessment of Wetland Efficacy in Improving Tile Drain Water Quality	$17,380	$0	Complete
Valley City River Bank Stability and Restoration Assessment	$36,000	$0	Complete
Wild Rice Basin Water Quality Data Products & Planning Tool	$79,685	$0	Active
Spiritwood Lake Water Quality Assessment	$0	$2,190	Active
Hailstone Creek Watershed Assessment & Danzig Dam TMDL Development	$0	$47,999	Active
Matejcek Dam Watershed Assessment & TMDL Development	$0	$41,000	Active
Total	**$346,707**	**$91,189**	

Prioritization

Prioritization Goal: Based on the most current inventory and assessment data, prioritize the state's waterbodies/watersheds for future NPS pollution assessment or abatement efforts.

The NPS Program separates waterbodies into two different groups to direct the delivery of financial and technical assistance. One priority group includes waterbodies needing further assessment to determine beneficial use conditions and identify the sources and causes of pollution impacting those uses. The other group includes all waterbodies with documentation on specific use impairments as well as the sources and causes of pollutants impacting the uses. These waterbodies are the highest priorities for restoration work supported by the NPS Program.

For assessment purposes, waterbodies included on the current 303(d) list are considered high priority waterbodies for the development and implementation of watershed assessments. One exception to this is that un-listed waterbodies could also be defined as high priorities for assessment work, if significant local interest is evident. For these un-listed waterbodies, an additional step must first be initiated to review all available information (e.g., local feedback, other state agency records, land use maps, etc.) to verify local observations and determine specific assessment needs. All waterbodies defined as assessment priorities will generally require 1-2 years of data collection to clearly identify beneficial use impairments and/or the sources and causes of pollutants impairing the beneficial uses. Upon completion, these projects will provide the data needed to develop watershed-based plans focused on the reduction of the NPS pollutants impairing beneficial uses.

The second group of priority waterbodies includes all waterbodies with a completed TMDL or a comprehensive NPS pollution assessment report. The watersheds for these waterbodies are high priorities for the implementation of best management practices (BMP) that will restore the impaired uses.

Within all the priority watersheds, additional prioritization also occurs to identify specific target areas for the implementation of the best management practices. The Annualized Agricultural Nonpoint Source Pollution model (AnnAGNPS) is the current method used by the NPS Program to identifying these priority areas. The model utilizes data such as soil type, rainfall, crop rotations, slope, fertilizer rates, tillage system, etc. to identify the “cells” that are the most likely sources of nitrogen, phosphorus and/or sediment. The average size for the AnnAGNPS cells range from 30-80 acres, depending on variables such as watershed size, slope, etc. The sections where these AnnAGNPS cells are located are considered the highest priority sections in the watershed. Figures III-2 and III-3 are typical maps of AnnAGNPS priority sections for cropland and non-cropland in a watershed.

Looking forward, to further enhance watershed prioritization, the Department is also considering the implementation of a rotating basin monitoring approach as well as the development of a basin-scale Water Quality Decision Support System (WQDSS). The WQDSS will use Light Detection and Ranging (LiDAR) derived data products to provide resource managers an online tool to more accurately identify specific priority locations in the watersheds. The Wild Rice River basin in southeast ND is the first area the WQDSS will be tested and evaluated for application in other river basins. The rotating basin monitoring program will be designed to provide the additional data needed to identify priority subwatersheds for assessment or restoration work within the major river basins in the state. Although the development of these prioritization tools is still in its infancy, once completed, both tools will greatly increase state and local resource managers abilities to target limited financial and technical resources to areas that will result in the most water quality benefits.

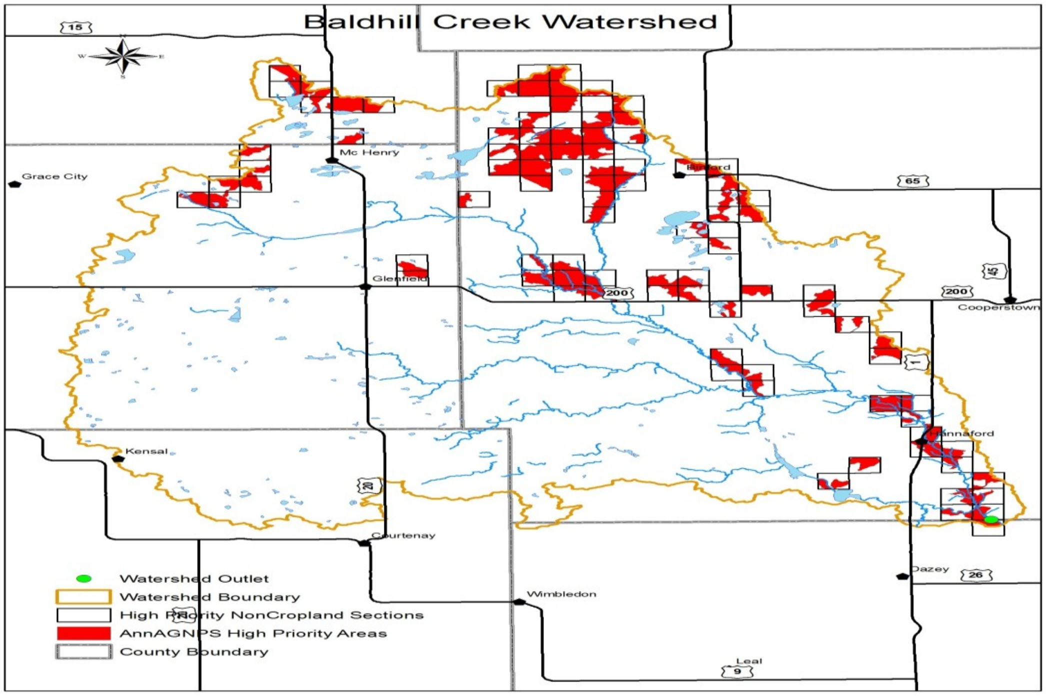

Figure III-2. AnnAGNPS Priority Sections for Non-Cropland in Baldhill Creek Watershed.

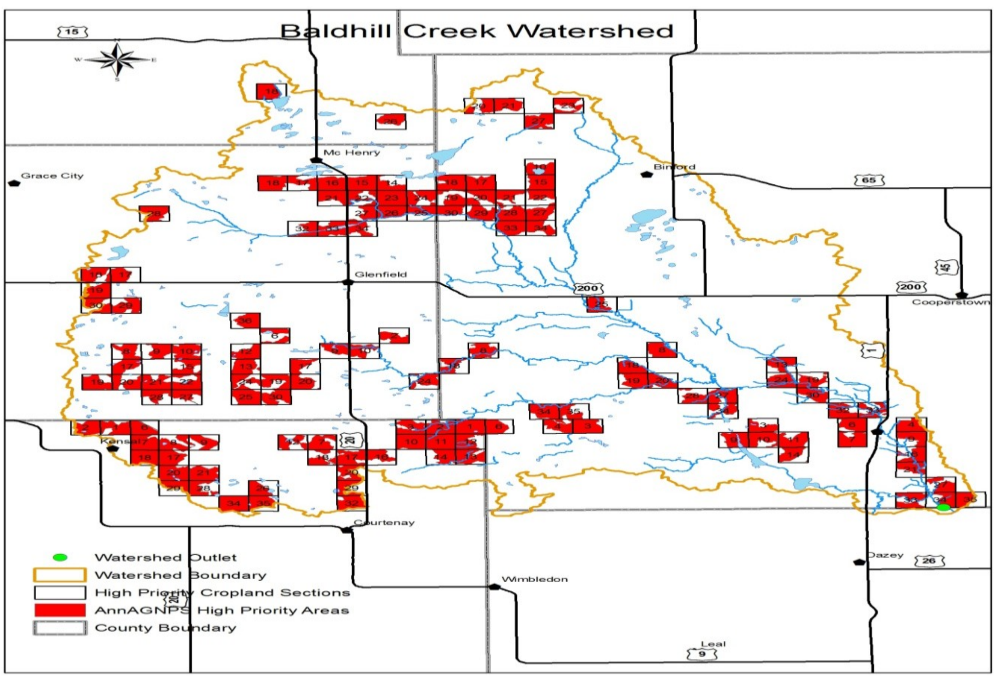

Figure III-3. AnnAGNPS Priority Sections for Cropland in Baldhill Creek Watershed.

Assistance

Assistance Goal: Provide sufficient financial and technical assistance to local resource managers (e.g., SCDs, water resource boards) to ensure accurate identification of beneficial use and water quality impairments resulting from NPS pollution and effective development and completion of projects that will restore and/or maintain the beneficial uses of waterbodies impacted by NPS pollution.

NPS Program financial and/or technical assistance generally starts during the early stages of project development and continues throughout the implementation of the projects. Types of technical assistance being provided to local projects on an annual basis include project oversight, sample analysis, PIP review and comment, sample collection and project management training, quality assurance project plan development, distribution of educational materials and biological monitoring support. Section 319 funding is the primary source of federal financial assistance used by the NPS Program and locally sponsored NPS projects in the state.

Since May 2009, approximately 15 percent of the NPS Program budget has been used to support NPS Program staff. The balance of expenditures (i.e., 85 percent) has been used to support locally sponsored NPS pollution management projects. These local projects can be grouped under one of seven NPS project categories. Specific projects supported under each category are listed in Table III-2. Table III-4 lists the cumulative expenditures and distribution of costs for NPS program staffing and the different NPS project categories during the period of May 1, 2009 through December 31, 2013.

Table III-4. Section 319 Allocations and Expenditures per Project Category (5/01/09 -12/31/13).

Project Category	319 Allocation	319 Expenditures	Percent of Total 319 Expenditures
Development Phase - NPS Assessment	$521,115	$138,453	1.4%
Education - Demonstration	$842,636	$484,497	5.0%
Education - Public Outreach	$3,348,369	$1,628,481	16.7%
Local Project Support (TA or FA)	$4,094,650	$2,646,537	27.2%
NPS Assessment - Multi Year Grant Award	$183,283	$152,346	1.6%
NPS Program Staffing and Support	$3,205,000	$644,577	6.6%
Watershed Projects	$8,556,747	$4,030,844	41.5%
Totals	**$20,751,800**	**$9,725,735**	

Coordination

Coordination Goal: Increase the effectiveness of NPS pollution management in the state by coordinating project development and implementation efforts with local, state and federal agencies and private organizations involved with natural resource management in the state.

Initiation and maintenance of a coordinated effort with appropriate entities is one of the most important activities within the project areas. At the onset of planning, the lead sponsors are encouraged to solicit the involvement of all groups or agencies that may have an interest in the planned project. For most projects, the involvement of multiple entities has helped ensure expertise is available and, in some cases, helped projects gain additional financial support.

Given the agricultural focus of most projects, local SCDs are the lead sponsors for most (54 percent) of the current projects. The SCDs provide the local leadership necessary to implement and manage projects as well as a "familiar face" to ensure effective communication with producers. However, as the NPS Program has expanded and diversified, more projects are being sponsored by other local and regional organizations (e.g., universities, state agencies, cities, resource conservation and development councils, water resource boards).

The NPS Task Force has also helped strengthen coordination among NPS projects and similar programs sponsored by other state or federal agencies and organizations. During the annual review process, the Task Force members become aware of the goals and objectives of the local NPS projects. This, in turn, gives them the opportunity to recognize and develop new partnerships that may strengthen projects/programs managed by their agency or organization. Conversely, during the review process, the local sponsors also gain a better understanding of what the Task Force member agencies can offer to their NPS pollution management projects. Organizations represented on the North Dakota NPS Source Pollution Task Force are listed in Table III-5.

Table III-5. Agencies/Organizations Represented on the North Dakota NPS Pollution Task Force.

Agency/Organization	Agency/Organization
Energy & Environmental Research Center	NDSU Extension Service
ND Farmers Union	USDA Farm Services Agency
USFS Dakota Prairies Grassland	ND Farm Bureau
ND Game & Fish Dept.	Bureau of Land Management
US Geological Survey	US Fish & Wildlife Service
ND Geological Survey	USDA Rural Development
US Bureau of Reclamation	ND Forest Service
ND Association of Soil Conservation Districts	State Soil Conservation Committee
ND Department of Agriculture	ND Grazing Associations
US EPA Region VIII	ND Grain Growers Association
ND Pork Producers	ND Rural Water Systems Association
ND Wildlife Federation	USDA – NRCS
USDA - Ag Research Station	ND Natural Resources Trust
ND Parks & Recreation Dept.	ND Stockmen's Association
ND State Water Commission	ND Resource Conservation & Development Councils
ND Department of Health	ND Governor's Office
Red River Basin Commission	

Information and Education

<u>Information and Education Goal:</u> Increase North Dakotans' understanding of the water quality and beneficial use impairments associated with NPS pollution, and strengthen public support for the voluntary implementation of NPS pollution control activities.

A variety of educational efforts are supported by the NPS Program to increase public awareness of NPS pollution issues as well as to strengthen support for current and future NPS pollution management projects. These educational efforts can include activities such as workshops, demonstrations, tours, fact sheets, radio ads and videos. Generally, the information/education (I/E) efforts are sponsored and implemented by SCDs, resource conservation and development councils or the NDSU Extension Service. Although the goals and target audiences of the educational projects may vary, these state/locally sponsored I/E projects cumulatively form a balanced statewide NPS pollution education program. Specific I/E projects supported under the 2009, 2010, 2011, 2012 and 2013 Grants are listed in Table III-2. The primary goals of the NPS educational projects supported since May 2009 are provided in Table III-6.

Table III-6. Primary Goals and Target Audience of NPS Pollution Education Projects Supported Since May 2009.

Project Name	Primary Target Audience	Major Goals
Prairie Waters Education Center	Resource Managers & K - 12 Teachers & Students	Develop and manage an educational center to provide training and educational offerings addressing topics such as water quality monitoring; stream morphology; macroinvertebrate sampling and watershed management. Training and instruction will include both classroom style presentations and in-field educational sessions.
Discovery Farm Program	Resource Managers & Agricultural Producers	Establish a series of BMP demonstration sites on three working farms. These sites will used to evaluate the water quality benefits of various BMP. Water quality and quantity will be collected to quantify the positive or negative impacts of the applied BMP. The current focus of the program is on BMP associated with livestock manure management and tile drain management.
Envirothon Program	Students in grades 9-12	Deliver a statewide program that strengthens problem solving skills by providing the opportunity to learn and use science based information to identify and prescribe potential solutions for addressing NPS pollution and other natural resource concern.
The Regional Environmental Education Series (TREES)	Students in grades K-12	Deliver a series of lyceum-style programs to schools to create a greater appreciation for the state's water resources and increase participants understanding of the importance of the wise use of all natural resources.
NDSU Livestock Waste Technical Information & Assistance Program	Resource Managers & Livestock Producers	Maintain a statewide program focused on the development and delivery of training programs, bulletins, workshops, demonstrations, and one-on-one planning assistance to promote better management of livestock manure. The Discovery Farms Program was also initiated under this project.
ND Project WET (Water Education for Teachers)	K-12 Teachers & Students	Deliver a variety of educational offerings throughout the state to increase participants' knowledge and understanding of NPS pollution impacts to our water resources and potential solutions to those impacts.
Statewide ECO ED Program	Students in grades 6-8	Provide technical and financial assistance for local soil conservation districts to conduct one-day tours or two-day camps that provide hands-on, outdoor instruction on water quality, soil/erosion; wetlands, prairies, and woodlands.

Table III-6 (con't). Primary Goals and Target Audience of NPS Pollution Education Projects Supported Since May 2009.

Project Name	Primary Target Audience	Major Goals
Ranchers Mentoring Program	Farmers and Ranchers	Promote land management systems that will improve water quality and soil health. A network of mentors will be established to provide interested ranchers technical support and advice (from fellow ranchers) regarding management options that can be used to improve soil health and water quality as well as maintain the sustainability of their ranch or farm.
Partners for Improving Water Quality I/E Program	Resource Managers & Agricultural Producers	As a follow-up phase to the Water Quality Mentorship and Outreach Program, the project will continue to deliver a balanced educational program in southwestern ND that promotes concepts and practices that will improve cropland and grazing management and protect water quality.
NDSU Vegetative Buffer Demonstration and Evaluation Program	Resource Managers & Livestock Producers	Collect and interpret data from two vegetative buffer demonstration sites to evaluate the effectiveness in reducing water quality impacts associated with the livestock feeding areas. If appropriate, the data will also be used to establish recommendations for vegetative buffers and other BMP.
Eastern ND Soil Salinity Specialist Program	Resource Managers & Agricultural Producers	Increase landowner and resource manager awareness and understanding of soil salinity issues in eastern ND. Salinity specialists employed by the project will: 1) promote proper use and protection of saline areas; 2) train local SCD staff and others on management options for saline areas; 3) maintain demonstration sites; and 4) disseminate information regarding the management of saline areas through participation in workshops, tours, and conferences.
Menoken Farm Soil Foodweb Project	Resource Managers & Agricultural Producers	Utilize the Menoken demonstration farm to showcase farming systems that improve soil health; increase water use efficiency and improve water quality. Management of the demonstration fields will focus on the importance of continuous live roots in the soil, crop diversity; livestock grazing, and cover crops for improving soil health. Tours, newsletter, and meeting presentations will be used to disseminate information gained through the Menoken farm project.
Water Quality Mentorship and Outreach Program	Resource Managers & Agricultural Producers	Deliver a balanced educational program in southwestern ND that promotes concepts and practices that improve cropland and grazing management and protect water quality. The project also includes a mentor assistance program that supports the exchange of ideas and information between "producer-mentors" and other producers who want to incorporate new or innovative management practices into their existing grazing operations.

*Resource managers include individuals from NRCS, Extension Service, Soil Conservation Districts, 319 Projects, State Agencies, Private Organizations, Water Resource Districts, etc. who are involved in resource management planning

On an annual basis, NPS Program staff members are also involved in numerous educational events. These efforts can include presentations at local tours and workshops, display booths at county fairs and agricultural shows, instruction at ECO ED camps, assistance with Envirothon competitions, newsletter articles and dissemination of various materials.

Program Evaluation

Evaluation Goal: Evaluate the successes and failures of the NPS Pollution Management Program and identify the necessary updates to the NPS Pollution Management Program to maintain successful delivery of financial and technical assistance to local and state agencies and private organizations addressing NPS pollution.

The overall success of the NPS Program is evaluated at both the state and local levels. At the state level, success is being measured by the degree of progress toward goals set forth in the Management Plan. Locally, progress toward project-specific goals and objectives will be used to evaluate the accomplishments of the individual projects.

The long term goal of the NPS Program is to deliver a balanced program focused on the restoration and maintenance of beneficial uses impaired by NPS pollution. In the Management Plan, the NPS Program estimates it will have 20 watershed restoration projects initiated across the state by March 2015. An additional 20 watersheds will also be assessed during this period to aid in the development of future watershed-based management plans. It is expected most of these watershed projects will address one or more 303(d) listed waterbodies and involve up to 30 twelve digit hydrologic units. With 4 active NPS assessment/TMDL development projects and 22 watershed restoration projects currently being supported, the NPS Program is nearly on track with its watershed assessment target and ahead of schedule for the watershed restoration goal. Progress to achieve the NPS Program's assessment goals should be improved over the next few years with the initiation of a rotating basin monitoring program. Through the partnerships developed in the basins, greater local involvement in watershed planning is anticipated, which should result in the implementation of more local watershed assessments

A variety of water quality and land use data are collected annually to document improvements within the NPS watershed project areas. During an average year, hundreds of water quality samples are collected from numerous STORET sites within the active watershed project areas. The main parameters typically monitored include nitrogen, phosphorus, TSS, E. coli bacteria and fecal coliform bacteria. Stream discharge is also measured at many of the STORET sites to determine pollutant loadings. Upon completion of a project, a summary of the water quality data is developed and incorporated into the final project report. All final reports are entered in the EPA Grants Reporting and Tracking System (GRTS).

To gauge land use improvements, the number and type of BMPs applied are also tracked by the local NPS projects. Table III-7 lists the amounts and costs of the BMPs applied within the NPS project areas since May 2009. Sixty (60) percent of the total BMP costs listed in Table III-7 were supported with Section 319 funds. The balance of costs (i.e., 40%) was supported by the cooperating producers and/or landowners.

Table III-7. BMPs Supported Under the Fiscal Year 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (5/1/09 - 12/31/13).

Category/Practice	Amount	Units	Total Cost
Cropland Management			
Cover Crop	3,325.00	Acres	$ 55,922.19
Nutrient Management	2,707.25	Acres	$ 5,886.25
Precision Nutrient Management	529.70	Acres	$ 6,857.64
Subtotal			**$ 68,666.08**
Erosion Control			
Critical Area Planting	7.80	Acres	$8,445.47
Subtotal			**$8,445.47**
Grazing Management			
Alternative Power Source (Livestock Watering Only)	1.00	Number	$ 6,872.32
Fencing	117,630.5	Linear Feet	$ 149,690.05
Electric Fencing (Single & Multiple Strand)	18,478.4	Linear Feet	$9,694.06
Miscellaneous (Grazing Management)	4.00	Misc	$ 8,040.87
Pasture/Hayland Planting	849.40	Acres	$ 57,919.11
Pipelines	63,835.64	Linear Feet	$ 189,542.66
Prescribed Grazing	1,966.10	Acres	$ 0
Rural Water Hookup	1.00	Number	$ 1,184.54
Solar Pump	1.00	Number	$9,448.71
Spring Development	2.00	Number	$7,305.75
Trough and Tank	31.00	Number	$ 52,387.01
Use Exclusion	85.00	Acres	$1,700.00
Well (Livestock Only)	14.00	Number	$ 109,015.02
Subtotal			**$ 602,800.10**
Category/Practice	**Amount**	**Units**	**Total Cost**
Livestock Manure Management System (Full System)			
Phase I Waste Management System	12.00	System(s)	$ 1,422,025.56
Phase II Waste Management System	11.00	System(s)	$ 1,152,414.28
Phase III Waste Management System	4.00	System(s)	$ 274,711.97
Waste Management System (Coordinated With EQIP)	2.00	System(s)	$ 387,112.95
Waste Management System (Full System Completed)	6.00	System(s)	$ 1,713,127.19
Subtotal			**$ 4,949,391.95**
Livestock Manure Management System (Partial Sys)			
Fencing (Ag Waste)	37,617.00	Linear Feet	$ 36,552.10
Miscellaneous (Partial Manure Management System)	3.00	Misc	$ 28,499.25
Pipeline	1,246.00	Linear Feet	$ 6,625.12
Portable Windbreak	11,187.00	Linear Feet	$ 373,502.51
Trough & Tank	2.00	Number	$2,704.72
Water Supply (Ag Waste)	2.00	Number	$13,886.47
Watering Facility (Ag Waste: Tank, Pipeline, Well)	6.00	Number	$ 21,864.92
Well (Livestock Only)	2..00	Number	$ 7,470.84
Subtotal			**$ 491,105.93**

Table III-7 (con't). BMPs Supported Under the Fiscal Year 2009, 2010, 2011, 2012 and 2013 Section 319 Grants (5/1/09 - 12/31/13).

Category/Practice	Amount	Units	Total Cost
Miscellaneous Practices			
Cultural Resource Review	7.00	Number	$ 10,000.00
Miscellaneous Practice	3.00	Misc.	$ 4,322.08
Septic System Renovation	62.00	System(s)	$ 550,181.47
Well Decommissioning	28.00	Number	$ 34,104.18
Subtotal			**$ 598,607.73**
Riparian Area Management			
Miscellaneous Practice	8.00	Misc.	$26,111.85
Reshape/Stabilize Stream Banks (Earth Moving)	40.00	Linear Feet	$ 200.00
Riparian Easement (On Cropland)	303.00	Acres	$68,815.63
Riparian Easement (On Pasture/Rangeland)	75.30	Acres	$57,624.00
Riparian Forest Buffer	4.00	Acres	$ 5,169.08
Riparian Herbaceous Cover	5.00	Acres	$832.35
Site Prep for Trees (Heavy Mechanical)	1.50	Acres	$150.00
Streambank and Shoreline Stabilization	1,607.95	Linear Feet	$ 521,971.74
Tree Hand Plants (2' Non-Rooted Stakes)	700.00	Number	$ 2,458.25
Tree Handplants	521.00	Number	$983.93
Tree Planting – Machine (Scalp Plant/Site Pep)	1,428.15	Per 100 Feet	$ 28,561.13
Subtotal			**$ 712,877.96**
Upland Tree Planting			
Tree Tube Shelters (3 Foot)	48.00	Number	$192.00
Tree/Shrub Establishment	268.86	Per 100 Feet	$ 6,932.06
Weed Control For Tree Establishment (Weed Barrier)	188.16	Per 100 Feet	$ 9,266.50
Windbreak/Shelterbelt	68.08	Per 100 Feet	$ 4,395.60
Subtotal			**$ 20,786.16**
Vegetative Buffers			
Filter Strip	80.08	Acres	$ 11,618.09
Grassed Waterway	1,738.70	Acres	$157,291.53
Subtotal			**$ 168,909.92**
Total Costs For All BMP			**$ 7,621,591.00**

The type and amount of BMPs applied within a project area provides the most immediate means for evaluating short term progress and potential success. While the BMP information cannot replace the measurement of actual beneficial use improvements or load reductions, it does readily show how the sources and causes of NPS pollution impairments are being addressed in the state. Cumulatively, this same BMP data can also be used to evaluate if the NPS Program is maintaining an on-the-ground emphasis and focused on the appropriate NPS pollution issues. With over 68% of the NPS Program's expenditures associated with projects focused on the design and/or implementation of BMP (Table III-4), it is apparent the NPS Program and its partners are maintaining an on-the-ground emphasis.

Livestock manure management continues to be the major resource issue targeted by many of the projects supported under the NPS Program. This emphasis is very appropriate, since over 55% of the active watershed projects are focused on the reduction of E. coli bacteria concentrations associated with improper livestock manure management. This focus is on both livestock grazing management and manure management in confined feeding areas. To compliment these watershed efforts, 60% of the support projects and 36 % of the educational projects are also addressing livestock manure management to some degree.

Septic system renovations and riparian area management are two additional BMP that are starting to gain increased attention within the watershed project areas. This is particularly evident in the watershed projects located in eastern ND. Although expenditures on these two categories are still relatively low, local interest in addressing these resource concerns seems to be growing, which should result in an upward trend in riparian restoration work and/or the repair of failed septic systems. Table III-8 indicates the total expenditures under all the BMP categories recognized by the NPS Program.

Table III-8. Cumulative Section 319 Expenditures per BMP Category (5/1/09-12/31/13).

BMP Category	Expenditures	Percent Expenditures
Cropland Management/Erosion Control/Upland Tree Plantings	$ 58,737	1.3
Grazing Management	$ 361,680	7.9
Livestock Manure Management System (full & partial systems)	$ 3,264,298	71.4
Miscellaneous Practices (primarily septic systems)	$ 359,542	7.8
Riparian Area Management	$ 427,726	9.4
Vegetative Buffers (primarily grassed waterways)	$ 101,345	2.2
TOTAL	**$ 4,573,328**	100.0

As indicated in Table III-8, a significant portion of NPS Program expenditures has continued to be directed toward the improvement of livestock manure management. However, as the development and, ultimately, the implementation of the ND Nutrient Reduction Strategy proceeds, some of the NPS Program's financial resources will undoubtedly be targeted toward nutrient management in identified priority areas. Within these areas, some resources will continue to be directed toward manure management issues, but, an increasing percentage will also be used to improve nutrient management on cropland acres. This will be particularly true for watersheds in the eastern half of the state. Some of the cropland BMP that will be promoted and implemented include: cover crops, precision nutrient management, vegetative buffers, grassed waterways, crop rotations, etc. This shift in emphasis should be reflected in future reports and local watershed plans.

Although many of the active watershed projects in the state are showing positive trends in water quality, the Seven Mile Coulee watershed, in particular, has been recognized as a "SP12 watershed." SP12 is in reference to one of several EPA performance measures used to gauge progress of the NPS Program. Significant reductions in E. coli bacteria concentrations in the watershed and improvements in the status of the recreational uses of the creek were the primary reasons the watershed was afforded the SP12 recognition. The following case history describes the accomplishments in Seven Mile Coulee watershed.

Watershed Project Case History: Seven Mile Coulee Watershed Project - Recreational Uses Improved Through Best Management Practice (BMP) Implementation and Targeted Technical Assistance

Seven Mile Coulee watershed is part of the larger Beaver Creek/Seven Mile Coulee watershed project supported by the NPS Program. It should also be noted, the Beaver Creek/Seven Mile Coulee watershed project is still active through 2017, which may lead to further improvements in both watersheds. However, for the purposes of this project highlight, the following descriptions and data summaries will only focus on the Seven Mile Coulee watershed.

The primary goal of the project is to restore the recreational and aquatic uses of Seven Mile Coulee. This will be accomplished by promoting and installing BMP that address concentrated livestock feeding areas, nutrient management, riparian degradation and grazing management. A comprehensive educational program will also be initiated to increase agricultural producers' awareness and understanding of specific BMP that can be used effectively to improve soil health, reduce soil erosion and minimize nutrient inputs.

In 2006, an assessment of the Seven Mile Coulee watershed (Figures III-4 and III-5) was performed by the Stutsman County Soil Conservation District (SCD) under the direction of the North Dakota Department of Health (NDDoH). The purpose of this assessment was to evaluate the relationship between land management and degrading water quality. Assessment activities included measuring water quality and quantity, conducting a biological assessment and taking an inventory of current land use practices in the watershed.

Data collected during the assessment indicated the condition of the Seven Mile Coulee recreational uses was fully supporting but threatened due to fecal coliform bacteria. In 2012 this listing was updated to reflect the current E. coli standard and the 303(d) listing was also changed to not supporting due to E. coli bacteria concentrations. Major land use practices and potential sources of E. coli bacteria identified in the watershed included: overgrazed pasture/rangeland, riparian area grazing, improper manure application on cropland; and concentrated livestock feeding areas. The SCD and NDDoH recognized the water quality degradation could be slowed or reversed through changes in land management and the implementation of the appropriate Best Management Practices (BMPs).

Figure III-4. General Location of the Seven Mile Coulee Watershed.

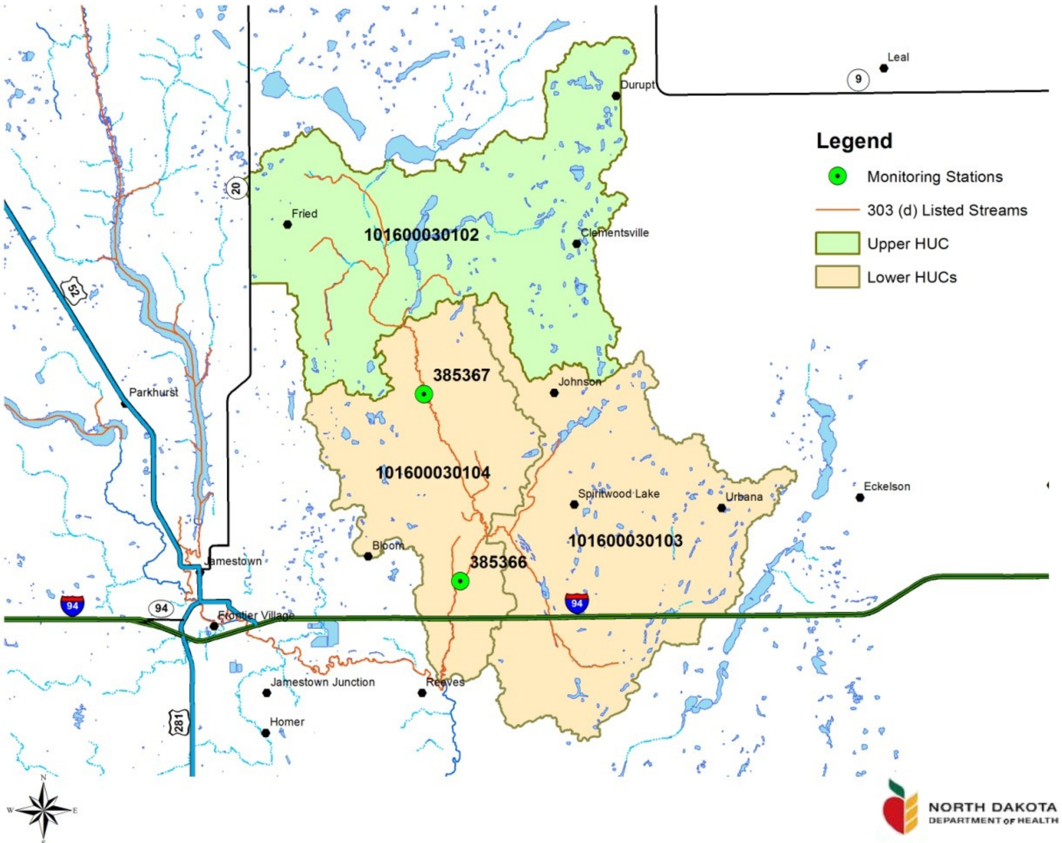

Figure III-5. Seven Mile Coulee Watershed and the Locations of the Monitoring Sites.

BMPs implemented throughout the watershed included cover crops, range planting and a livestock manure management system. Construction of the livestock manure management system involved the abandonment of the historic feeding area in HUC 101600030102 and the construction of a full containment system in HUC 101600030103 to replace the abandoned feeding area. As a result, water quality in both hydrologic units (HUs) benefited from the relocation. A second manure management system is also under construction, which will further improve water quality in the watershed. Once this second manure management system is completed, the estimated nutrient reductions associated with the two manure management systems will be annual nitrogen and phosphorus reductions of 38,964 and 18,800 pounds, respectively.

Another major effort of the project was to provide educational opportunities for producers. During the course of the project over 100 producers have attended various educational events conducted by the project sponsors. Topics addressed included subjects such as; no-till management of expired CRP acres; soil salinity management; cover crops; and manure management.

Water quality monitoring in the watershed focused on tracking improvements in annual and seasonal pollutant loadings and concentrations in the stream. Approximately 120 samples have been collected from the two stream monitoring sites. Locations of these sites, relative to the 12 digit HUs in the Seven Mile Coulee watershed, are shown in Figure III-5. The frequency of monitoring was based on the typical hydrograph of the area and involved more frequent sampling during high flow periods (i.e. spring runoff in April and May) with decreasing frequency later in the season as flow decreased.

The water quality data collected, to date, are showing improving trends in E. coli bacteria concentrations at both monitoring sites (Figures III-6 and III-7). Continued improvements are also anticipated as the additional manure management system is installed and producers begin to apply the information gained through the project's information/education events. Although all the water quality objectives for the project have not yet been fully realized, the downward trends in E. coli bacteria concentrations are encouraging.

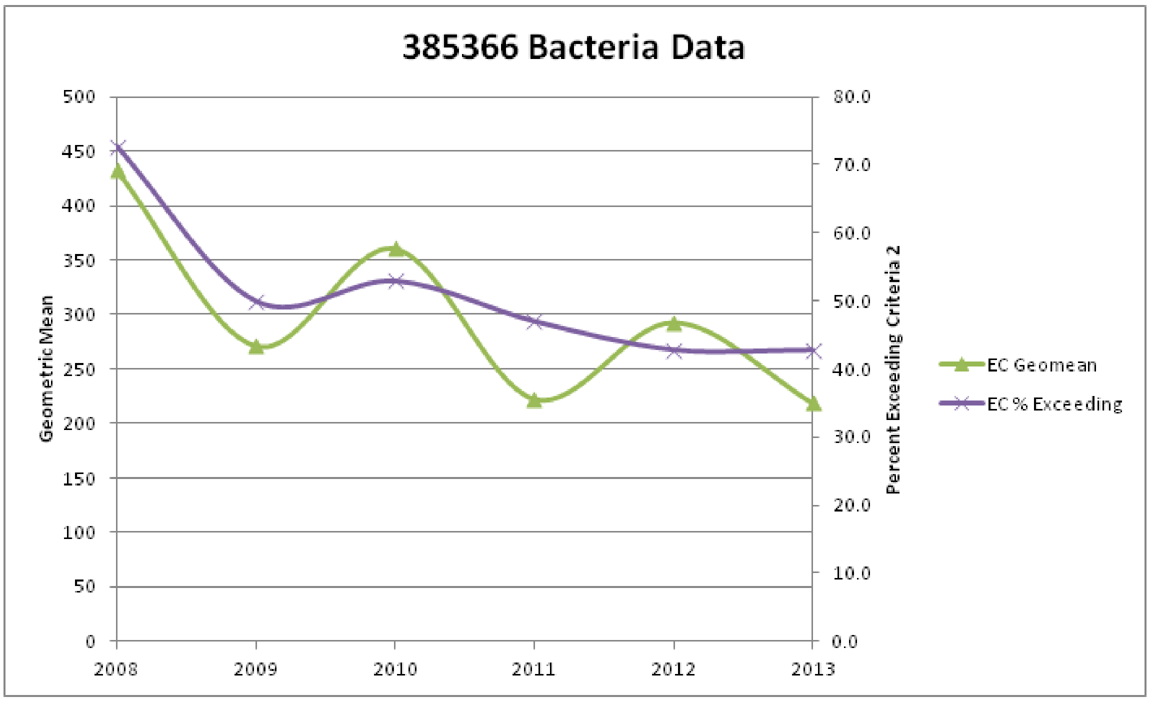

Figure III-6. E. coli Bacteria Annual (May-September) Geometric Mean Concentrations and the Percentage of Samples Exceeding the 409 CFU/100mL Water Quality Standard for Seven Mile Coulee Site 385366.

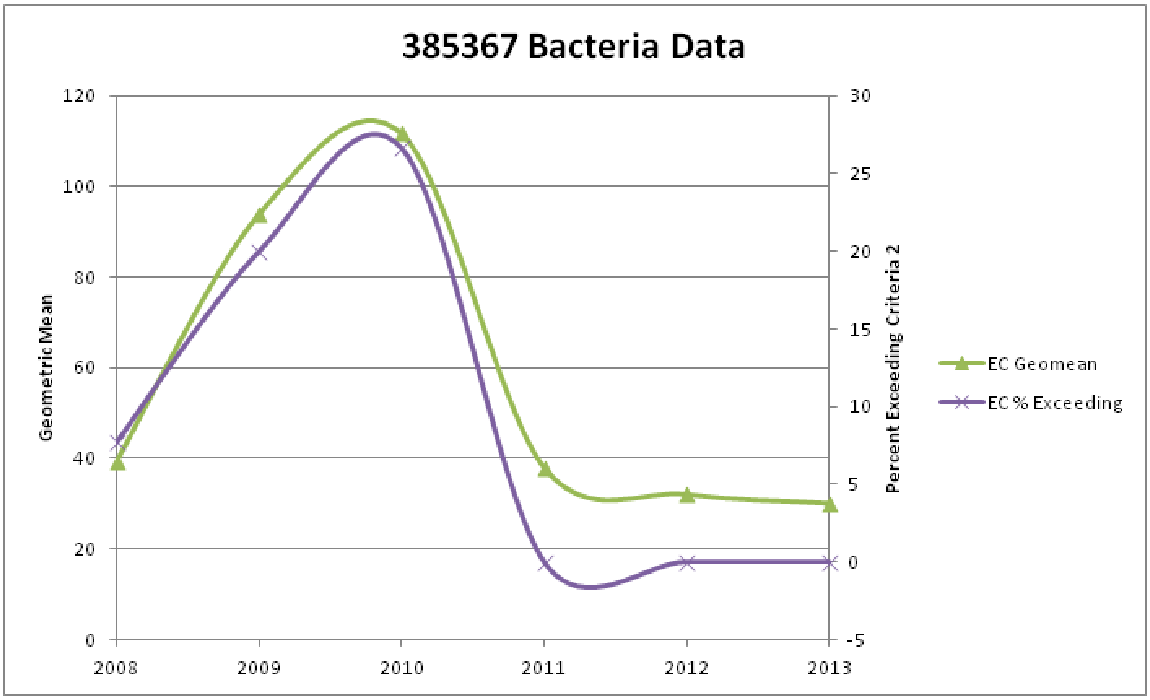

Figure III-7. E. coli Bacteria Annual (May-September) Geometric Mean Concentrations and the Percentage of Samples Exceeding the 409 CFU/100mL Water Quality Standard for Seven Mile Coulee Site 385367.

As previously indicated, the Beaver Creek/Seven Mile Coulee watershed project is still an ongoing project. Technical and financial assistance will continue to be provided in the watershed (including Seven Mile Coulee watershed) through November 2017. This extended period should result in the implementation of additional BMP, which should, in turn, improve water quality at most, if not all the monitoring sites in both watersheds. These anticipated improvements will be documented through water quality data collected for the duration of the project.

Chapter 4. Total Maximum Daily Load (TMDL) Program

Section 303(d) of the CWA and its accompanying regulations (CFR Part 130, Section 7) require each state to list waterbodies (i.e., lakes, reservoirs, rivers, streams and wetlands) that are considered water quality limited and require load allocations, waste load allocations and total maximum daily loads (TMDLs). This list has become known as the “TMDL list” or “Section 303(d) list.”

A waterbody is considered water quality limited when it is known that its water quality does not or is not expected to meet applicable standards. Waterbodies can be water quality limited due to point source pollution, NPS pollution or both. When a state prepares its list of water quality-limited waterbodies, it is required to prioritize waterbodies for TMDL development and to identify those “High” priority waterbodies that will be targeted for TMDL development within the next two to four years. Factors to be considered when prioritizing waterbodies for TMDL development include: (1) the severity of pollution and the uses which are impaired; (2) the degree of public interest or support for the TMDL, including the likelihood of implementation of the TMDL; (3) recreational, aesthetic and economic importance of the waterbody; (4) the vulnerability or fragility of a particular waterbody as an aquatic habitat, including the presence of threatened or endangered species; (5) immediate programmatic needs, such as waste load allocations needed for permit decisions or load allocations for Section 319 NPS project implementation plans; and (6) national policies and priorities identified by EPA.

After considering each of the six factors, the state has developed a two-tiered priority ranking. Assessment units (AUs) listed as “High” priority are: (1) lakes and reservoirs and river and stream segments for which TMDLs are scheduled to be completed and submitted to EPA in the next two years; or (2) lakes and reservoirs and river and stream segments for which TMDL development projects are scheduled to be started in the next two years. The majority of these “High” priority AUs were identified as such based largely on their degree of public support and interest and the likelihood of implementation of the TMDL once completed. “Low” priority AUs are those river and stream segments and lakes and reservoirs that are scheduled for completion in the next 6-10 years.

The responsibility for TMDL development for Priority 1 and 2 waterbodies in North Dakota lies primarily with the department’s Division of Water Quality - Surface Water Quality Management Program. To facilitate the development of TMDLs, the department created three regional offices located in Fargo, Bismarck and Towner, N.D. (Figure III-8). The focus of the regional TMDL/Watershed Liaison staff is to work with local stakeholders in the development of TMDL water quality assessments and TMDLs based on the 303(d) list. Technical support for TMDL development projects and overall program coordination are provided by Surface Water Quality Management Program staff also located in Bismarck, North Dakota.

Typically, TMDL development projects involve monitoring and assessment activities which will:

- Quantify the amount of a pollutant that the impaired water can assimilate and still meet water quality standards.
- Identify all sources of the pollutant contributing to the water quality impairment or threat.
- Calculate the pollutant loading entering the waterbody from each source.
- Calculate the reduction needed in the pollutant load from each source necessary for attainment of water quality standards.

The goals, objectives, tasks and procedures associated with each TMDL development project are described in project-specific Quality Assurance Project Plans.

Equally as important as the development of TMDLs is their implementation. The regional TMDL liaisons provide technical assistance to local SCDs and water resource boards in the development of NPS pollution management projects that address TMDL-listed waterbodies. The liaisons also provide technical expertise to local stakeholder groups and assist with youth and adult information/education events in their regions.

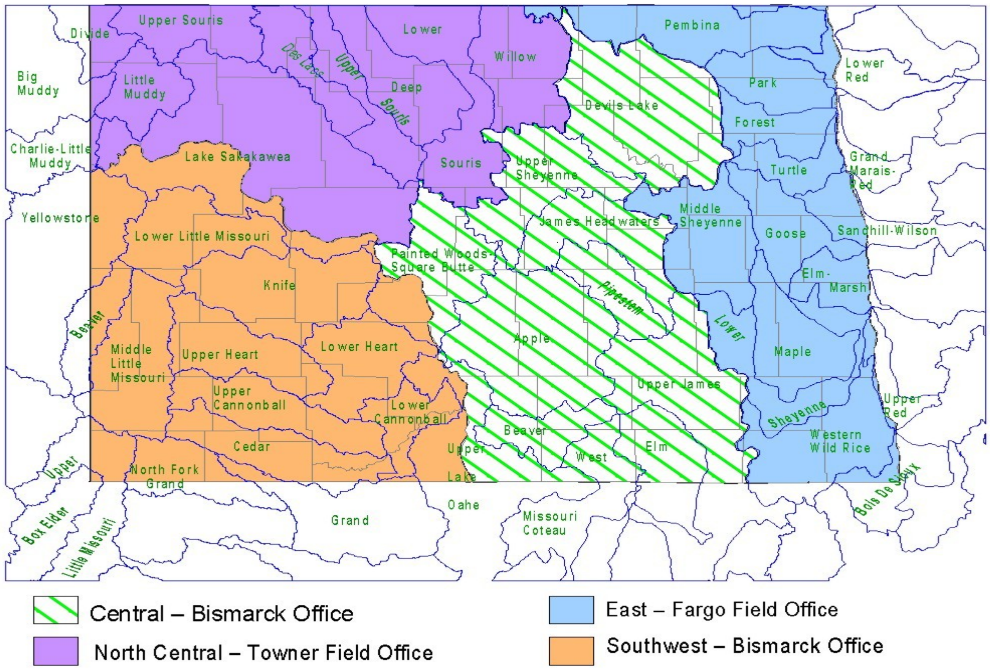

Figure III-8. Map Depicting Areas of Responsibility for Regional TMDL/Watershed Liaison Staff.

Chapter 5. Coordination with Other Agencies

North Dakota has two rivers of international significance. The Souris River originates in the Canadian province of Saskatchewan, loops through North Dakota and returns to the province of Manitoba (Figure III-1). The Red River of the North originates at the confluence of the Bois de Sioux and Ottertail Rivers at Wahpeton, North Dakota. The Red River flows north, forming the boundary between North Dakota and Minnesota before entering Manitoba. The department participates in two cross-border cooperative efforts to jointly manage and protect these rivers.

To ensure an ecosystems approach to transboundary water issues and to achieve greater operational efficiencies in the conduct of the International Joint Commission (IJC) and its responsibilities, the IJC has combined the ongoing responsibilities of the International Souris River Board of Control and the Souris River aspects of the International Souris-Red River Engineering Board into the International Souris River Board (ISRB). The ISRB operates under a directive from the IJC dated April 11, 2002. Part of the ISRB's mission is to assist the IJC in preventing and resolving disputes related to the transboundary waters of the Souris River basin.

The other international water quality effort in which the department is involved is the International Red River Board. Created by the International Joint Commission (IJC), the board monitors Red River water quality. The board also informs the IJC of trends and exceedances of water quality objectives, documents discharges and control measures, establishes a spill contingency plan and identifies future water quality issues. Board activities are detailed in annual reports. Other members of the board include Environment Canada, Manitoba Water Stewardship, EPA, USGS, U.S. Bureau of Reclamation and the Minnesota Pollution Control

Agency.

The department monitors water quality in Devils Lake and distributes historical and current data to various federal and state agencies. Information and technical expertise is provided to sponsoring agencies that are planning mitigation measures for rising lake levels.

The Red River Basin Commission (RRBC) was formed in 2002 to initiate a grass roots effort to address land and water issues in a basin-wide context. The RRBC was formed as a result of a merger between The Red River Basin Board, The International Coalition and the Red River Water Resources Council.

The RRBC is not intended to replace governmental agencies or local boards that have water management responsibilities in the basin. Rather, it was created to develop a comprehensive plan on a scale never before attempted. Another purpose of the RRBC is to foster the inter-jurisdictional coordination and communication needed to implement such a plan and to resolve disputes that inevitably will arise among varied interests during the planning process.

The RRBC is made up of a 41-member board of directors, comprised of mainly representatives of local government, including the cities, counties, rural municipalities, watershed boards, water resource districts and joint powers boards, as well as representation from First Nations, a water supply cooperative, a lake improvement association and environmental groups. There also are four at-large members. The governors of North Dakota and Minnesota and the premier of the province of Manitoba have also appointed members to the board.

D. Cost/Benefit Assessment

Costs associated with municipal point source pollution control have been extensive. Capital investments in the form of additions to and construction of new wastewater treatment facilities account for the largest expenditure of funds. While the Clean Water State Revolving Fund (CWSRF) and other state and federal programs have been the major sources of funding, many communities have upgraded wastewater treatment facilities at their own expense.

In the last two years, approximately $31 million has been obligated from the CWSRF for the construction of wastewater system improvements. The cumulative amount invested in wastewater system improvements since passage of the Clean Water Act in 1972 is approximately $601 million. In addition to the capital costs, an estimated $30 million per year is spent operating and maintaining wastewater treatment systems in the state.

While the costs of construction and maintenance of municipal wastewater treatment systems are relatively easy to compile, monetary benefits cannot be so easily quantified. Qualitative benefits include the reduction or elimination of waste loads to receiving waters (Figure III-2, page III-6) and the elimination of public health threats such as malfunctioning drain-field systems and sewer backups.

Federal, state and local governments have also made significant investments in NPS pollution controls. Since 2009, the state's Section 319 NPS Pollution Control Program has provided more than $20.7 million in financial support to more than 53 state and local projects, including more than $8.5 million to 23 watershed restoration projects. In addition to the Section 319 investment in these watershed projects, project sponsors have provided more than $5.7 million in local match to these watershed projects (Table III-2). A variety of agricultural and other BMPs have been implemented through these watershed projects (Table III-7). Total costs of these BMPs were more than $7.6 million.

While the water quality benefits of these Section 319 NPS Pollution Management Program expenditures are substantial, measuring and documenting actual pollutant reductions through monitoring continues to be extremely challenging. Alternately, EPA's STEPL model and the Animal Feedlot Runoff Risk Index Worksheet (AFRRIW) are being used to estimate the nitrogen, phosphorus and sediment reductions associated with Section 319 cost-shared BMP. Using these models, the estimated annual nitrogen, phosphorus and sediment load reductions for BMP supported under the 2008 through 2011 Section 319 Grants are 318,636 pounds, 149,256 pounds and 280 tons, respectively. Primary BMP used to achieve these reductions include grassed waterways, manure management systems, and septic system renovations.

E. Special State Concerns and Recommendations

As the dominant land use in North Dakota, agriculture has always been the primary focus of the state's NPS Pollution Management Program. This long term focus has again held true the past five years, during which time a majority of Section 319 expenditures have been associated with efforts addressing agricultural NPS pollution (see Part III. C. Chapter 3). Because of the magnitude and complexity of the agricultural industry, the department and its local partners have maintained a close working relationship with the NRCS to ensure sufficient resources are available to address NPS pollution within the project areas. State/federal/local partnerships such as this are always crucial for the success of any project addressing NPS pollution associated with agricultural production. Given the importance of this partnership, EPA must continue to work with NRCS, at the national level, to establish policies and/or agreements that will target additional USDA financial and technical support to priority NPS pollution management areas within the states. To ensure on-the-ground success of the policies, the goals of the partnership must be clearly communicated to the appropriate state and county level offices through a joint announcement signed and released by EPA and NRCS.

The effectiveness of the national Section 319 Program has been under increasing scrutiny over the past several years. While this scrutiny has some merit, the diversity and long term nature of the nation's NPS pollution challenges are often misunderstood, resulting in an inaccurate assessment of the NPS Program's value and benefits. In particular, one of the most persistent questions being expressed is what load reductions or beneficial use improvements have resulted from NPS Program expenditures. To some degree, project-specific success stories submitted to EPA and load reduction data entered in the GRTS have helped answer this question. However, these projects only represent a small portion of the universe of projects being implemented across the nation. The remaining projects are not necessarily unsuccessful, but instead, the measurement of benefits may be extremely complicated and protracted or the nature of the project does not call for water quality data collection. It is likely this larger group of projects is the reason for much of the scrutiny being directed toward the NPS Program. To dispel any misconceptions about NPS Program benefits, the EPA and states need to expand efforts to disseminate more information on the diversity of the NPS Program as well as the importance of all components of the NPS Program. The overriding message of these efforts needs to emphasize that the NPS Program is a comprehensive program where success is founded in the education and assessment projects and realized through the watershed-based projects.

The desire to meet annual nutrient and sediment load reduction goals appears to have lead to a variety of methods being used to generate load reduction data entered in GRTS. Given the diversity of these methods, the potential exists for the quality of the GRTS data to come into question. To prevent such a situation, the adequacy of current QA/QC procedures must be examined to ensure the actual or modeled data entered in the GRTS are consistent and comparable between states. EPA should also work with the states to identify a core set of models or methods that can be used for estimating load reduction data for the GRTS. Training and support for these preferred methods or models would also need to be provided by EPA to encourage adoption and ensure data quality. Additionally, in the absence of reliable load reduction data, EPA should accept the use of surrogate measures, such as the "amount of BMP applied," to describe the annual progress of locally sponsored projects.

It is very well understood that the NPS Program is largely a voluntary program, particularly in agricultural areas. As such, the success of the NPS Program is always dependent on a number of uncontrollable factors. Some of these variables include: 1) weather patterns; 2) degree of landowner interest; 3) local economies; 4) commodity prices; and 5) frequent land management or ownership changes. While most of these challenges can be dealt with over time, it is not uncommon to see some projects delayed significantly by any one of these variables. Unfortunately, the current five year time period for Section 319 grants limits the flexibility to provide the additional time needed to overcome or address any of these unforeseen impediments. The only option currently available to provide the additional time is to re-apply for subsequent 319 funding under another grant. Although this option does work, it generally interjects uncertainties regarding the approval or availability of additional financial support and it does not address management of unexpended funds that might remain under the grant that initially supported the project. Both of these issues could be more efficiently addressed by developing Section 319 grants for ten year periods rather than limiting them to five years. Under a ten year grant, states could continue to set project periods for five to seven years, but the extra time under a ten year grant award would provide the flexibility to extend a project and budget period if an unexpected delay occurs.

North Dakota has seen dramatic growth in the oil exploration sector in the last four years. With the active drilling rig count more than doubling, it is estimated that over 2000 new oil wells are being developed each year. This growth in active drilling rigs has resulted in approximately 20,000 new jobs in the area. This rapid development has caused a dramatic increase in the request for point source permits, specifically permits for storm water, wastewater discharge and dewatering/hydrostatic testing. Of particular concern is the amount of domestic wastewater produced from temporary crew housing facilities, known as "man camps". This is causing an increase in the amount of waste handled by both POTW's and septic haulers. One of the positive impacts is the increased reuse of treated wastewater for the drilling and hydraulic fracturing processes. Treating of the fracturing flow back and produced water for surface water discharge is not occurring in this area due to the availability of Class II underground injection wells.

The department continues to develop and expand its biological assessment program. It is generally believed that the instream biological community (e.g., fish, aquatic insects and algae) exposed to pollutant stresses on a continual basis is the best measure of aquatic life use. In 2005, the department initiated a two-year biological assessment project in the Red River basin using a probabilistic study design. Once completed, this project will provide an unbiased estimate of biological condition in the Red River basin of North Dakota. Data collected as part of this study will also be used to refine existing fish and macroinvertebrate Indices of Biological Integrity. In subsequent years, the department plans to continue its biological assessment program in the Souris, James and Missouri Rivers basins. This plan will only become a reality, however, if supplemental funding for monitoring programs is maintained by Congress and the EPA.

The state's water quality standards define the water quality policy of the state which is to protect, maintain and improve the quality of water for use as public and private water supplies; for propagation of wildlife, fish and aquatic life; and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses. These standards identify specific numeric criteria for chemical, biological and physical parameters. The specific numeric standard assigned to each parameter ensures protection of the beneficial uses for that classification. While nutrients and sediment are the two most prevalent pollutants affecting water quality in the state, no specific criteria exist for them in state water quality standards. EPA has developed guidance and is requiring states to develop a strategy or plan for the development of nutrient criteria. In the absence of a state plan, EPA has said it will promulgate nutrient criteria for the states. Through support provided by an EPA Nutrient Criteria grant, the department recently completed it's "Nutrient Criteria Development Plan." This plan provides the blueprint for the development of nutrient criteria for the state's rivers, streams, lakes and rivers.

The installation of tile drains in North Dakota, especially in the Red River valley, is increasing at an exponential rate and presents new challenges to improving and maintaining water quality. Tile drains are designed remove excessive sub-surface soil moisture and to reduce the movement of salts upward into the root zone. Tile drainage allows farmers to plant their fields earlier when wet spring conditions prevail, reduces the potential for drown out during heavy summer rains, and reduces soil salinity. Tile drains can also enhance crop yields and improve soil health. While the production benefits from tile drainage are clear, the cumulative water quality impacts of the water discharged from tile drains is unknown. Tile drainage water often contains high concentrations of nitrates, minerals, and some trace metals. The cumulative impacts from these drains on tributaries and subsequently the Red River are largely unknown.

In North Dakota, a large portion of the potable groundwater resource underlies agricultural areas. The department, in conjunction with the State Water Commission, is involved in several projects designed to evaluate and monitor the effects of agricultural practices on groundwater quality and quantity. The department also reviews water appropriation permits to assess potential impacts to groundwater quality. The department will need to allocate sufficient resources to continue providing project oversight and monitoring, reviewing appropriation permits and working with producers regarding irrigation and chemigation practices to protect groundwater resources.

Careful attention must be paid to the water quality and supply issues associated with the continued energy development, for example, in-situ fossil fuel recovery (oil and coal bed methane development) and the production of ethanol and biodiesel. Sufficient resources must be allocated to avoid impacts to water quality.

While efforts to protect water quality have been successful, more remains to be done to achieve the goal of restoring and maintaining the chemical, physical and biological integrity of the state's and nation's waters.

PART IV. SURFACE WATER MONITORING AND ASSESSMENT METHODOLOGY

A. Surface Water Quality Monitoring Program

Chapter 1. Monitoring Goals and Objectives

North Dakota's surface water quality monitoring program is detailed in a report entitled *North Dakota's Water Quality Monitoring Strategy for Surface Waters: 2008-2019* (NDDoH, 2014). This document describes the department's strategy to monitor and assess its surface water resources, including rivers and streams, lakes and reservoirs and wetlands. This strategy also fulfills requirements of Clean Water Act Section 106(e)(1) that requires the EPA, prior to awarding a Section 106 grant to a state, to determine that the state is monitoring the quality of its waters, compiling and analyzing data on the quality of its waters and including those data in its Section 305(b) report. An EPA guidance document entitled *Elements of a State Water Monitoring and Assessment Program* (EPA, March 2003) outlines 10 key elements of a state monitoring program necessary to meet the prerequisites of the CWA. The 10 key elements are:

- Monitoring Program Strategy.
- Monitoring Objectives.
- Monitoring Design.
- Core and Supplemental Water Quality Indicators.
- Quality Assurance.
- Data Management.
- Data Analysis/Assessment.
- Reporting.
- Programmatic Evaluation.
- General Support and Infrastructure Planning

The department's water quality monitoring goal for surface waters is ***"to develop and implement monitoring and assessment programs that will provide representative data of sufficient spatial coverage and of known precision and accuracy that will permit the assessment, restoration and protection of the quality of all the state's waters."*** In support of this goal and the water quality goals of the state and of the Clean Water Act, the department has established 10 monitoring and assessment objectives. The following objectives have been established to meet the goals of this strategy. They are:

- Provide data to establish, review and revise water quality standards.
- Assess water quality status and trends.
- Determine beneficial use support status.
- Identify impaired waters.
- Identify causes and sources of water quality impairments.
- Provide support for the implementation of new water management programs and for the modification of existing programs.
- Identify and characterize existing and emerging problems.
- Evaluate program effectiveness.
- Respond to complaints and emergencies.
- Identify and characterize reference conditions.

Chapter 2. Monitoring Programs, Projects and Studies

In order to meet the goals and objectives outlined above, the department has taken an approach which integrates several monitoring designs, both spatially and temporally. Monitoring programs include fixed station sites, stratified random sites, rotating basin designs, statewide networks, chemical parameters and biological attributes. In some cases, department staff members conduct the monitoring, while in other instances monitoring activities are contracted to other agencies such as soil conservation districts, the USGS or private consultants. In the following sections, current monitoring activities are documented in the form of narrative descriptions. These include the project or program purpose (objectives), monitoring design (selection of monitoring sites), selected parameters and the frequency of sample collection.

Ambient Water Quality Monitoring Network for Rivers and Streams

Beginning January 1, 2013, the North Dakota Department of Health (department) began implementation of a revised ambient water quality monitoring program for rivers and streams in the state. This revised monitoring program is based on recommendations provided in a recently completed report published by the US Geological Survey's North Dakota Water Science Center (USGS) entitled "Evaluation of water-quality characteristics and sampling design for streams in North Dakota, 1970–2008" (http://pubs.usgs.gov/sir/2012/5216/). In its report the USGS recommended a set of core monitoring sites representing 3 levels of sampling intensification. The highest level of sites, design level 1, consist of a network of 32 basin integrator sites located across the state (Figure IV-1, Table IV-1). These sites are sampled 8 times per year, twice in April, once each in May, June, July, August, and October, and one time in the winter (January) under ice. The next level, design level 2, consists of 23 sites (Figure IV-1, Table IV-2). These sites are sampled 6 times per year, once each in April, May, June, August and October and once under ice during the winter (January). The lowest level of sites, design level 3, consists of 26 sites located across the state (Figure IV-1, Table IV-3). These sites are only be sampled 4 times per year, once each in April, June, August and October. Under the current design, the USGS samples all of the design level 2 sites (with the exception of the Red River at Harwood which is sampled by the department) and all the design level 3 sites.

At all level 1, 2 and 3 sites field measurements are taken for temperature, dissolved oxygen, pH and specific conductance. Sampling and analysis at all level 1, 2 and 3 sites consist of general chemistry, dissolved trace elements, and total and dissolved nutrients (Table IV-4). In addition to these water quality parameters, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), and E. coli bacteria are sampled and analyzed for at all level 1 sites (Table IV-4). E. coli bacteria are only be sampled during the recreation season (May-September). In addition to sampling for these analytes, the Red River at Fargo, the Red River at Grand Forks, and the Red River at Pembina are sampled for total suspended sediment. The analysis of the total suspended sediment samples is conducted by the USGS Iowa Sediment Laboratory. All chemical analysis of samples is performed by the department's Laboratory Services Division.

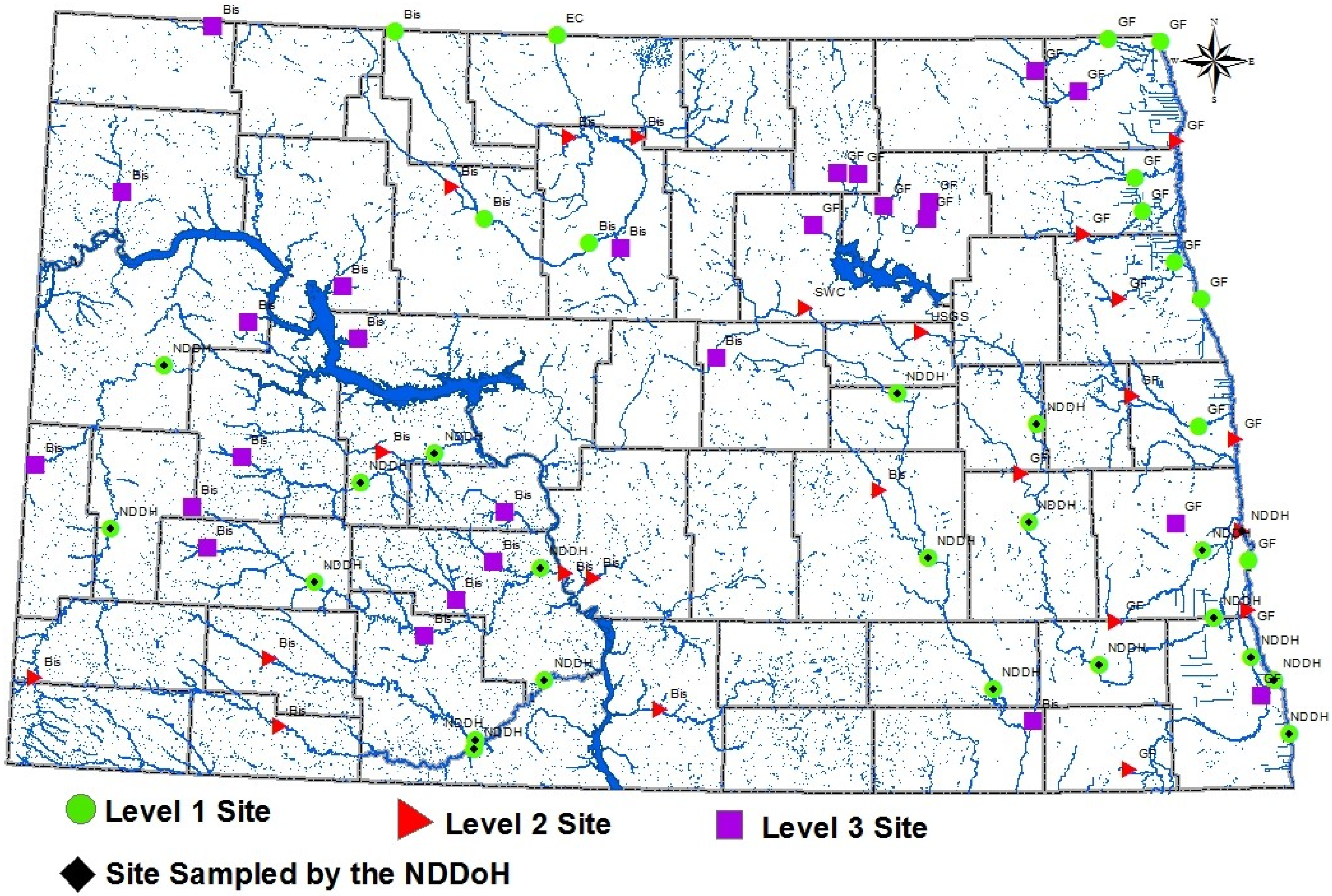

Figure IV-1. Ambient River and Stream Water Quality Monitoring Sites.

Table IV-1. Level 1 Ambient River and Stream Water Quality Monitoring Sites.

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051300	385055	Bois de Sioux River near Doran, MN	46.1522	-96.5789	1	NDDH
05051510	380083	Red River at Brushville, MN	46.3695	-96.6568	1	NDDH
05053000	380031	Wild Rice River near Abercrombie, ND	46.4680	-96.7837	1	NDDH
05054000	385414	Red River at Fargo, ND[1]	46.8611	-96.7837	1	USGS-GF
05057000	380009	Sheyenne River near Cooperstown, ND	47.4328	-98.0276	1	NDDH
05058000	380153	Sheyenne River below Baldhill Dam, ND	47.0339	-98.0837	1	NDDH
05058700	385168	Sheyenne River at Lisbon, ND	46.4469	-97.6793	1	NDDH
05059000	385001	Sheyenne River near Kindred, ND	46.6316	-97.0006	1	NDDH
05060100	384155	Maple River below Mapleton, ND	46.9052	-97.0526	1	NDDH
05066500	380156	Goose River at Hillsboro, ND	47.4094	-97.0612	1	USGS-GF
05082500	384156	Red River at Grand Forks, ND[1]	47.9275	-97.0281	1	USGS-GF
05083000	380037	Turtle River at Manvel, ND	48.0786	-97.1845	1	USGS-GF
05085000	380039	Forest River at Minto, ND	48.2858	-97.3681	1	USGS-GF
05090000	380157	Park River at Grafton, ND	48.4247	-97.4120	1	USGS-GF
05100000	380158	Pembina River at Neche, ND	48.9897	-97.5570	1	USGS-GF
05102490	384157	Red River at Pembina, ND	48.9769	-97.2376	1	USGS-GF
05114000	380091	Souris River nr Sherwood	48.9900	-101.9582	1	USGS-Bis
05117500	380161	Souris River above Minot, ND	48.2458	-101.3713	1	USGS-Bis
05120000	380095	Souris River nr Verendrye, ND	48.1597	-100.7296	1	USGS-Bis
05124000	380090	Souris River nr Westhope, ND	48.9964	-100.9585	1	Environment Canada
06336000	380022	Little Missouri River at Medora, ND	46.9195	-103.5282	1	NDDH
06337000	380059	Little Missouri River nr Watford City, ND	47.5958	-103.2630	1	NDDH
06339500	384131	Knife River nr Golden Valley, ND	47.1545	-102.0599	1	NDDH
06340500	380087	Knife River at Hazen, ND	47.2853	-101.6221	1	NDDH
06345500	380160	Heart River nr Richardton, ND	46.7456	-102.3083	1	NDDH
06349000	380151	Heart River nr Mandan, ND	46.8339	-100.9746	1	NDDH
06351200	380105	Cannonball River nr Raleigh, ND	46.1269	-101.3332	1	NDDH
06353000	380077	Cedar Creek nr Raleigh, ND	46.0917	-101.3337	1	NDDH
06354000	380067	Cannonball River at Breien, ND	46.3761	-100.9344	1	NDDH
06468170	384130	James River nr Grace City, ND	47.5581	-98.8629	1	NDDH
06470000	380013	James River at Jamestown, ND	46.8897	-98.6817	1	NDDH
06470500	380012	James River at Lamoure, ND	46.3555	-98.3045	1	NDDH

[1]USGS Real-time water quality monitoring station.

Table IV-2. Level 2 Ambient River and Stream Water Quality Monitoring Sites.

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051522	NA	Red River at Hickson, ND	46.6597	-96.7959	2	USGS-GF
05051600	385573	Wild Rice River near Rutland, ND	46.0222	-97.5115	2	USGS-GF
05054200	385040	Red River at Harwood, ND	46.9770	-96.8203	2	NDDH
05055300	385505	Sheyenne R above DL Outlet nr Flora, ND	47.9078	-99.4162	2	SWC
05056000	385345	Sheyenne River near Warwick, ND	47.8056	-98.7162	2	USGS-GF
05057200	384126	Baldhill Creek near Dazey, ND	47.2292	-98.1248	2	USGS-GF
05059700	385351	Maple River near Enderlin, ND	46.6216	-97.5740	2	USGS-GF
05064500	NA	Red River at Halstad, MN	47.3519	-96.8437	2	USGS-GF
05065500	NA	Goose River nr Portland, ND	47.5389	-97.4556	2	USGS-GF
05082625	385370	Turtle River at State Park near Arvilla, ND	47.9319	-97.5145	2	USGS-GF
05084000	NA	Forest River near Fordville, ND	48.1972	-97.7306	2	USGS-GF
05092000	380004	Red River at Drayton, ND	48.5722	-97.1476	2	USGS-GF
05116500	380021	Des Lacs River at Foxholm, ND	48.3706	-101.5702	2	USGS-Bis
05123400	384132	Willow Creek nr Willow City, ND	48.5889	-100.4421	2	USGS-Bis
05123510	384133	Deep River nr Upham, ND	48.5842	-100.8626	2	USGS-Bis
06335500	385031	Little Missouri River at Marmath, ND	46.2978	-103.9175	2	USGS-Bis
06340000	380060	Spring Creek at Zap, ND	47.2861	-101.9257	2	USGS-Bis
06342500	380028	Missouri River at USGS-Bismarck, ND	46.8142	-100.8214	2	USGS-Bis
06349500	385053	Apple Creek nr Menoken, ND	46.7944	-100.6573	2	USGS-Bis
06350000	380025	Cannonball River at Regent, ND	46.4267	-102.5518	2	USGS-Bis
06352000	384182	Cedar Creek nr Haynes, ND	46.1542	-102.4740	2	USGS-Bis
06354580	384056	Beaver Creek blw Linton, ND	46.2686	-100.2518	2	USGS-Bis
06469400	380152	Pipestem Creek nr Pingree, ND	47.1675	-98.9690	2	USGS-Bis

Through a cooperative agreement with the USGS, a “real-time water quality monitoring” was added to the Red River at Fargo (USGS site 05054000; NDDoH site 385414) and Red River at Grand Forks (USGS site 05082500; NDDoH site 384156) sites in September 2003 and May 2007, respectively. Real-time monitoring at these sites includes a continuous recording YSI Model 600 multi-probe sonde and datalogger that monitors field parameters (e.g., temperature, specific conductance, pH, dissolved oxygen and turbidity) continuously. Output from the sonde is transmitted via telemetry and the data posted “real-time” on the USGS North Dakota Water Science Center web site. As this data set has increased, regression relationships have been developed for select water quality variables (e.g., TSS, TDS, total phosphorus and total nitrogen) using the continuously recorded field parameters. These regression relationships have now been used to provide “real-time” concentration estimates of TSS, total phosphorus, total nitrogen and TDS that are posted on the USGS North Dakota Water Science Center web site (http://nd.water.usgs.gov).

Table IV-3. Level 3 Ambient River and Stream Water Quality Monitoring Sites.

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05052500	385232	Antelope Creek at Dwight, ND	46.3113	-96.7345	3	USGS-GF
05054500	380135	Sheyenne River above Harvey, ND	47.7028	-99.9490	3	USGS-Bis
05056060	385089	Mauvais Coulee Trib #3 nr Cando, ND	48.4575	-99.2243	3	USGS-GF
05056100	380207	Mauvais Coulee nr Cando	48.4481	-99.1026	3	USGS-GF
05056200	385092	Edmore Coulee nr Edmore	48.3367	-98.6604	3	USGS-GF
05056215	385093	Edmore Coulee Trib nr Webster	48.2664	-98.6809	3	USGS-GF
05056239	385091	Starkweather Coulee nr Webster, ND	48.3206	-98.9407	3	USGS-GF
05056340	380213	Little Coulee nr Leeds, ND	48.2433	-99.3729	3	USGS-GF
05060500	385302	Rush River at Amenia, ND	47.0166	-97.2143	3	USGS-GF
05099400	385287	Little South Pembina near Walhalla, ND	48.8653	-98.0059	3	USGS-GF
05101000	381279	Tongue River at Akra, ND	48.7783	-97.7468	3	USGS-GF
05113600	384135	Long Creek nr Noonan, ND	48.9811	-103.0766	3	USGS-Bis
05120500	384107	Wintering River nr Karlsruhe, ND	48.1383	-100.5399	3	USGS-Bis
06331000	380054	L Muddy bl Cow C nr Williston, ND	48.2845	-103.5730	3	USGS-Bis
06332515	NA	Bear Den Creek nr Mandaree, ND	47.7872	-102.7685	3	USGS-Bis
06332523	NA	East Fork Shell Creek nr Parshall, ND	47.9486	-102.2149	3	USGS-Bis
06332770	NA	Deepwater Creek at Mouth nr Raub, ND	47.7378	-102.1077	3	USGS-Bis
06336600	385030	Beaver Creek nr Trotters, ND	47.1631	-103.9927	3	USGS-Bis
06339100	385054	Knife River at Manning, ND	47.2361	-102.7699	3	USGS-Bis
06342260	380103	Square Butte Creek below Center, ND	47.0569	-101.1935	3	USGS-Bis
06343000	NA	Heart River nr South Heart, ND	46.8656	-102.9485	3	USGS-Bis
06344600	NA	Green River nr New Hradec, ND	47.0278	-103.0532	3	USGS-Bis
06347000	385582	Antelope Creek nr Carson	46.5453	-101.6454	3	USGS-Bis
06347500	385078	Big Muddy Creek nr Almont, ND	46.6944	-101.4674	3	USGS-Bis
06348500	NA	Sweetbriar Creek nr Judson, ND	46.8517	-101.2532	3	USGS-Bis
06470800	384215	Bear Creek nr Oakes, ND	46.2252	-98.0718	3	USGS-Bis

Table IV-4. Ambient River and Stream Water Quality Monitoring Parameters.

Field Measurements	Laboratory Analysis			
	General Chemistry	**Trace Elements**	**Nutrients**	**Biological**
Temperature	Sodium[1,2]	Aluminum[1,2]	Ammonia (Total) [2]	E. coli[3]
pH	Magnesium[1,2]	Antimony[1,2]	Nitrate-nitrite (Total) [2]	
Dissolved Oxygen	Potassium[1,2]	Arsenic[1,2]	Total Kjeldahl Nitrogen[2]	
Specific Conductance	Calcium[1,2]	Barium[1,2]	Total Nitrogen[2]	
	Manganese[1,2]	Beryllium[1,2]	Total Phosphorus[2]	
	Iron[1,2]	Boron[1,2]	Total Organic Carbon[3]	
	Chloride[1,2]	Cadmium[1,2]	Ammonia (Dissolved) [2]	
	Fluoride[1,2]	Chromium[1,2]	Nitrate-nitrite (Dissolved) [2]	
	Sulfate[1,2]	Copper[1,2]	Total Kjeldahl Nitrogen (Dissolved) [2]	
	Carbonate[2]	Lead[1,2]	Total Nitrogen (Dissolved) [2]	
	Bicarbonate[2]	Nickel[1,2]	Total Phosphorus (Dissolved)[2]	
	Hydroxide[2]	Silica[1,2]	Dissolved Organic Carbon[3]	
	Alkalinity[2]	Silver[1,2]		
	Hardness[2]	Selenium[1,2]		
	Total Dissolved Solids[3]	Thallium[1,2]		
	Total Suspended Solids[1]	Zinc[1,2]		

[1]Analyzed as dissolved.
[2]Sampled and analyzed at level 1, 2 and 3 sites.
[3]Sampled and analyzed at level 1 sites.

Biological Monitoring Program

Historic Program

In response to a recognized need for more and better water quality assessment information, the department initiated a biological monitoring program in 1993. This initial program, a cooperative effort with the Minnesota Pollution Control Agency and the USGS's Red River National Water Quality Assessment Program, was conducted in 1993 and 1994 and involved approximately 100 sites in the Red River Basin. The result of this initial program was the development of the index of biological integrity (IBI) for fish in the Red River Basin. This program continued in the Red River Basin in 1995 and 1996 with the sampling of an additional 100-plus biological monitoring sites. The Upper Red River Basin, including the Sheyenne River and its tributaries, was sampled in 1995, while the Lower Red River Basin was sampled in 1996. From this initial work the program expanded to the Souris River Basin in 1997, the James River Basin in 1998 and the Missouri River Basin in 1999 and 2000. Beginning in 1995, biological monitoring was expanded to include macroinvertebrate sampling in addition to fish. The purpose of this biological monitoring program was to (1) develop an IBI for fish and macroinvertebrates and (2) provide an assessment of aquatic life use attainment for those stream reaches that were assessed.

Environmental Monitoring and Assessment Program Western Pilot Project

The rotating basin monitoring program was discontinued in 2001 while the department focused its resources in support of sampling for EPA's Environmental Monitoring and Assessment Program (EMAP) Western Pilot Project. The EMAP Western Pilot Project was the second regional pilot project within EMAP focusing on multiple resources. The first of these regional pilot projects focused on the mid-Atlantic region (Maryland, Delaware, Pennsylvania, Virginia and West Virginia). The EMAP Western Pilot Project was a five-year effort (2000-2004) targeted for the western conterminous United States. The pilot involved three EPA Regions (VIII, IX and X) and 12 states (North Dakota, South Dakota, Montana, Wyoming, Colorado, Utah, Arizona, Nevada, Idaho, California, Washington and Oregon). The purpose of the EMAP Western Pilot Project was to: (1) develop the monitoring tools (e.g., biological indicators, stream survey design methods and description[s] of reference condition) necessary to produce unbiased estimates of the ecological condition of rivers and streams that are applicable for the west; and (2) demonstrate those tools in assessments of ecological condition of rivers and streams across multiple geographic regions in the west. In addition to state- and regional-specific assessment questions, the goal of the EMAP Western Pilot's Surface Water Project is to provide answers to three general assessment questions: (1) What proportion of the perennial river and stream miles in the western United States are in acceptable (or poor) biological condition? (2) What is the relative importance of potential stressors (e.g., habitat modification, sedimentation, nutrients, temperature, toxic contaminants, grazing, urbanization) in rivers and streams across the west? (3) What are the stressors associated with the perennial rivers and streams in poor condition? In addition to answering these questions for the western 12-state region of the United States, the EMAP sampling design will allow these questions to be answered in each of the three EPA regions in the west, in each participating state and in several more spatially-intensive "focus areas" in each region. Within North Dakota, these areas are the Upper Missouri River Basin and the Northern Glaciated Plains Ecoregion.

Field sampling for the project began in 2000 and continued through 2003. Based on the EMAP study design, 64 probability-based sites (representing 4,278 perennial stream miles) were sampled within the state. Sites were chosen by EMAP staff based on a random site-selection process. By randomly selecting sites, results can be extrapolated to the entire resource population of concern (in this case, all perennial rivers and streams in the west, EPA Region VIII, North Dakota, the Missouri River Basin and the Northern Glaciated Plains Ecoregion). In addition to the 64 random sites, an additional 47 sites were chosen as targeted "reference" and "trashed" sites. Reference sites exemplify river and stream reaches that are considered "least impaired" with respect to anthropogenic (human) disturbance or stress, while "trashed" sites are believed to be impaired due to one or more anthopogenic stressors (e.g., nutrients, habitat, toxics).

Red River Basin Biological Assessment

Beginning in the spring of 2005 through 2007, the department conducted a biological monitoring and assessment project in the Red River Basin. This project was a joint effort with the Minnesota Pollution Control Agency which sampled the Minnesota side of the Red River Basin. The purposes of this project are to: (1) assess (using biological, physical and chemical data) the current biological condition of perennial, wadeable rivers and streams in the North Dakota and Minnesota portions of the Red River basin; (2) assess the current status of aquatic life use attainment of the perennial, wadeable streams of the Red River basin; (3) develop and refine indices of biological integrity for the fish and macroinvertebrate communities; and (4) investigate potential stressors to impaired aquatic life uses.

Sampling consisted of macroinvertebrates, fish, physical habitat and water chemistry. Sampling in 2005 was limited to the Lake Agassiz Plain ecoregion; however, due to above normal precipitation in June and July 2005, only nine sites (three reference and six probabilistic) were sampled for fish and physical habitat. A total of 41 sites (eight reference, nine trashed, eight duplicate Minnesota and 16 probabilistic) were sampled for macroinvertebrates in September 2005. Due, in part, to delays in securing the state FY05 supplemental grant carry-over funds and to staffing shortages caused by untimely employee resignations, sampling was again limited in 2006. Fish were not collected in 2006, and only 17 sites were sampled in the Northern Glaciated Plains ecoregion for macroinvertebrates. All sampling activities were completed in 2007. In the Lake Agassiz Plain ecoregion, a total of 24 random, 10 targeted reference and 10 targeted impaired sites were sampled for the fish indicator. A total of 25 random, 10 targeted reference and 10 targeted impaired sites were visited for the macroinvertebrate indicator in the Lake Agassiz Plain ecoregion. Within-year and among-year replicate samples were also collected as a measure of variability. In the Northern Glaciated Plains ecoregion, field sampling was conducted only for macroinvertebrates. A total of 25 random, 10 targeted reference and 10 targeted impaired sites were sampled for macroinvertebrates. Results from this project were published in a report entitled "An Ecological Assessment of Perennial, Wadable Streams in the Red River Basin of North Dakota" (NDDoH, 2012).

National Rivers and Streams Assessment

In 2008 and 2009, the department participated in the EPA-sponsored National Rivers and Streams Assessment (NRSA). The NRSA was a probabilistic assessment of the condition of the nation's rivers and streams and is designed to:

- Assess the condition of the nation's rivers and streams;
- Establish a baseline to compare future rivers and streams surveys for trends assessments;
- Evaluate changes in condition from the 2004 Wadeable Streams Assessment; and
- Help build state and tribal capacity for monitoring and assessment and promote collaboration across jurisdictional boundaries.

The NRSA is one in a series of water assessments being conducted by states, tribes, the EPA and other partners. In addition to rivers and streams, the water assessments will also focus on coastal waters, lakes and wetlands in a revolving sequence. The purpose of these assessments is to generate statistically valid reports on the condition of our nation's water resources and identify key stressors to these systems.

The goal of the NRSA is to address two key questions about the quality of the nation's rivers and streams:

- What percent of the nation's rivers and streams are in good, fair and poor condition for key indicators of water quality, ecological health and recreation?
- What is the relative importance of key stressors such as nutrients and pathogens?

The NRSA was designed to be completed during the index period of late May through September. Field crews collected a variety of measurements and samples from predetermined sampling reaches (located with an assigned set of coordinates) and from randomly selected stations along the sampling reach. The field crews also documented the physical habitat conditions along the sampling reach.

The department is also participating in the 2013 and 2014 NRSA. The 2013-2014 NRSA sample design includes 40 "base" probability sites, three (3) of which are "non-wadable" sites located on the Red River which will be sampled by the state of Minnesota. The remaining 37 NRSA "base" probability sites located on North Dakota waters includes 31 "wadable" sites and 6 "non-wadable" sites. The Department is also conducting an intensification of the NRSA in North Dakota which includes an additional 10 sites to be sampled in 2014. The goal of the intensification project is to assess the ecological condition of streams in the state with known precision and accuracy.

Ecoregion Reference Network Monitoring Program

The Ecoregion Reference Network Monitoring Program is used to support a variety of water quality management and biological monitoring and assessment activities by providing a network of biologically "least disturbed" reference sites within each of the states four major level 3 ecoregions (Lake Agassiz Plain, Northern Glaciated Plain, Northwestern Glaciated Plain, and Northwestern Great Plain) (Figure IV-2). Objectives of the Ecoregion Reference Network Monitoring Program include the development of biological indicators. Reference sites are also expected to support the development of nutrient criteria for rivers and streams and the refinement of existing clean sediment reference yields.

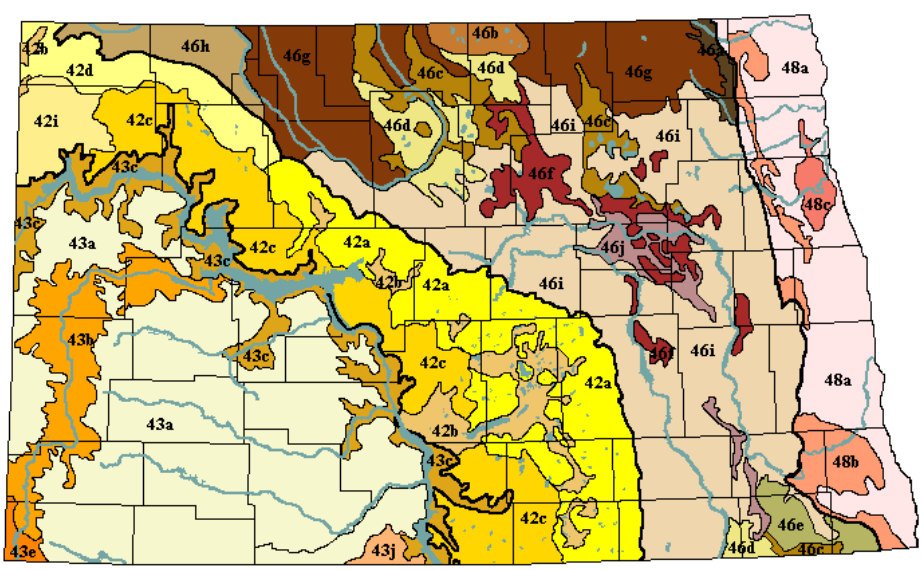

Figure IV-2. Map Depicting Ecoregions in North Dakota (Lake Agassiz Plain [48], Northern Glaciated Plain [46], Northwestern Glaciated Plain [42], Northwestern Great Plain [43]).

First introduced by the EPA in the 1980's, the ecoregion concept assumes that waterbodies reflect the character of the land they drain, and that where sites are physically comparable, chemical and biological conditions should also be comparable. As such, reference sites located within a given ecoregion can serve as benchmarks for all other sites within the same ecoregion. Reference sites, therefore, become powerful tools when assessing or comparing results from both chemical and biological monitoring stations.

The goal of the Ecoregion Reference Network Monitoring Program is to establish a minimum set of 30 "reference sites" within each of the following level 3 ecoregions or ecoregion combinations: Lake Agassiz Plain (48), Northern Glaciated Plains (46), and combination Northwestern Glaciated Plains/Northwestern Great Plains (42/43). In addition to the 30 "reference sites" per ecoregion/ecoregion combination, the department will also select and sample 30 companion "highly disturbed" or "trashed" sites. These sites will be used as a basis of comparison when selecting and calibrating metrics used in IBIs.

Reference sites and companion "trashed" sites are selected through a three step process, including: 1) landscape metric analysis using GIS; 2) site reconnaissance using digital orthoquads and aerial photos via GIS; and 3) site inspection and ground truthing.

During 2005, 2006, and 2007, as part of the Red River Biological Monitoring and Assessment Project, the department sampled 10 reference and 10 trashed sites in the Lake Agassiz Plain ecoregion and 10 reference and 10 trashed sites in the Red River basin portion of the Northern Glaciated Plains ecoregion. In 2008, another 10 reference and 10 trashed sites were sampled in the remaining portions of the Northern Glaciated Plains ecoregion. Reference site sampling will continue in 2009 with 20 reference and 20 trashed sites sampled in the combined Northwestern Glaciated Plains/Northwestern Great Plains ecoregions and 5 reference and 5 trashed sites sampled in the Northern Glaciated Plains ecoregion. In 2010 and again in 2011, 10 reference and 10 trashed sites were sampled each year in the Lake Agassiz Plain and 5 reference and 5 trashed sites will be sampled each year in the Northern Glaciated Plains ecoregion. The department's first round of reference site sampling will concluded in 2012 with the sampling of 10 reference and 10 trashed sites sampled in the combined Northwestern Glaciated Plains/Northwestern Great Plains ecoregions.

Following this first round of reference site sampling and NRSA sampling in 2013 and 2014, the department will sample reference sites in the Lake Agassiz Plain again in 2015 and in the Northern Glaciated Plains in 2016.

Lake Water Quality Assessment Program

Historic Program

The department currently recognizes 289 lakes and reservoirs for water quality assessment purposes. Of this total, 149 are manmade reservoirs and 143 are natural lakes. All lakes and reservoirs included in this assessment are considered significantly publicly owned.

Reservoirs are defined as waterbodies formed as a result of dams or dugouts constructed on natural or manmade drainages. Natural lakes are waterbodies having natural lake basins. A natural lake can be enhanced with outlet control structures, diversions or dredging. Based on the state's Assessment Database (ADB), the 146 reservoirs cover 476,716 acres. Reservoirs comprise about 67 percent of North Dakota's total lake/reservoir surface acres. Of these, 411,496 acres or 58 percent of the state's entire lake and reservoir acres are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe). The remaining 144 reservoirs share 65,211 acres, with an average surface area of 450 acres.

The 143 natural lakes in North Dakota cover 236,542 acres, with approximately 102,376 acres[1] or 43 percent attributed to Devils Lake. The remaining 142 lakes average 945 acres, with 42 percent being smaller than 250 acres.

Through a grant from the U.S. EPA Clean Lakes Program, the department initiated the Lake Water Quality Assessment (LWQA) Project from 1991-1996. During that time, the department completed sampling and analysis for 111 lakes and reservoirs in the state. The objective of the assessment project was to describe the general physical and chemical condition of the state's lakes and reservoirs, including trophic status.

The lakes and reservoirs targeted for assessment were chosen in conjunction with the North Dakota Game and Fish Department (NDGF). Criteria used during the selection process were geographic distribution, local and regional significance, fishing and recreational potential and relative trophic condition. Lakes without much historical monitoring information were given the highest priority.

The results from the LWQA Project were prepared in a functional atlas-type format. Each lake report discusses the general description of the waterbody, general water quality characteristics, plant and phytoplankton diversity, trophic status estimates and watershed condition.

From 1997-2000, LWQA Project activities were integrated into the department's rotating basin monitoring strategy. Lake Darling and the Upper Des Lacs Reservoir were sampled in 1997 as the department focused its monitoring activities in the Souris River Basin. Pipestem Dam and Jamestown Reservoir were sampled in 1998; Lake Sakakawea was sampled in 1999; and Bowman-Haley Reservoir, Patterson Lake and Lake Tschida were sampled in 2000.

Current Program

As was stated previously the department recognizes 289 public lakes and reservoirs for assessment purposes. Of this total, 121 have no monitoring data, or so little monitoring data, that water quality cannot be assessed. These remaining lakes and reservoirs are the current target of lake water quality monitoring and assessment. Beginning in 2008 and extending through 2011, the department sampled approximately 15 lakes or reservoirs each year. Through this "Targeted Lake Water Quality Assessment Project", lakes were sampled twice during the summer growing season. Classified lakes and reservoirs in the state with little or no monitoring data were targeted for monitoring and assessment under this project. This initial 4-year project has resulted in water quality and trophic status assessments for a minimum of 58 lakes in the state. Information from

[1] The estimated surface area for Devils Lake is based on a lake elevation of 1446 mean sea level (msl), which is the elevation at which water overflows to Stump Lake.

these assessments has been published in a lake atlas format and posted on the department's web site. These assessments were also be used to assess beneficial use attainment status for Section 305(b) reporting and Section 303(d) listing.

Utilizing Supplemental Section 106 Water Quality Monitoring grant funding from EPA, the department will continue 10 sample 15 lakes and reservoirs per year in 2014 and 2015. Lake and reservoirs in western North Dakota with little or no monitoring data will be targeted for LWQA sampling in 2014 and 2015.

Devils Lake and Lake Sakakawea Monitoring

In addition to inclusion in the annual LWQA Project, Devils Lake and Lake Sakakawea have received special attention. Devils Lake has increased in elevation 26 feet since 1993. In response to questions about water quality changes resulting from these water level increases, the department initiated a comprehensive water quality monitoring program in 1993 for Devils Lake. Devils Lake is currently sampled four times per year, including once during the winter.

While Devils Lake has increased in elevation over the last 12 years, Lake Sakakawea’s lake level has varied significantly since 2002. Of particular concern in North Dakota is the quality of Lake Sakakawea’s cold water fishery when the lake is at low lake levels. Since 2002, the department and the NDGF have cooperated in a project to monitor the condition of the lake. Sampling consists of weekly DO/temperature profiles and water quality samples collected once each month at seven locations.

Survey of the Nation’s Lakes

In 2007, the U.S. EPA, in partnership with the department and other state agencies, initiated the Survey of the Nation’s Lakes to answer key environmental questions about the quality of the nation’s lakes. The survey provides a snapshot of the condition of our nation’s lake resource on a broad geographic scale. Results from this assessment will allow water quality managers, the public, state agencies and others to say, with known statistical confidence, what proportion of the nation’s lakes are in poor biological condition and identify key stressors affecting this resource. Data collected from the lakes will be analyzed on both a regional and national scale. The information generated from this survey fills an important gap in meeting the requirements of the Clean Water Act. The goals of the lakes survey are to:

- Provide regional and national estimates of the condition of lakes in good, fair and poor condition.
- Explore the relative importance of key stressors such as nutrients and pathogens and their extent across the population.
- Establish a baseline to compare future surveys for trends assessment and to evaluate trends since the 1970’s National Eutrophication Study.
- Help build state and tribal capacity for monitoring and assessment.

To answer these questions and to achieve the goals of the program, the lakes survey focused on identifying and measuring relevant lake quality indicators in three basic categories: 1) ecological integrity; 2) trophic status; and 3) recreational condition. Data collected on stressors will be analyzed to explore associations between stressors and ecological condition.

For the purposes of the 2007 survey, lakes are defined as natural or manmade freshwater lakes, ponds and reservoirs in the conterminous U.S. Additional criteria included lake size greater than 10 acres (4 hectares), lake depth greater than 1 meter, and lake area greater than 1000 square meters of open water. Water bodies that were excluded include the Great Lakes (surveyed as part of the National Coastal Condition Assessment), the Great Salt Lake and other naturally saline systems, and water treatment or disposal ponds.

The lake sampling locations were selected using a modern probabilistic survey design approach. In North Dakota, the department, working in cooperation with the USGS, conducted lake sampling at 38 lakes. Four of the state's 38 lakes were replicate sampled for a total of 42 lakes sampled in North Dakota in 2007.

In 2012, the National Lake Assessment (NLA) was again implemented as a cooperative program with the states, tribes, and EPA. Forty (40) randomly selected lakes were selected by EPA in North Dakota for the 2012 NLA and sampled by the department. As a compliment to the 2012 NLA, the department also conducted a statewide intensification of the NLA by increasing the sample size to 50 lakes statewide. This will allow the Department to assess the condition of the state's lakes with known precision and accuracy.

Fish Tissue Contaminant Surveillance Program

<u>Program Background</u>

The purpose of the Fish Tissue Surveillance Program is to protect human health by monitoring and assessing the levels of commonly found toxic compounds in fish from the state's lakes, reservoirs and rivers. The department has maintained an active fish tissue monitoring and contaminant surveillance program since 1990. As part of this program, individual fish tissue samples are collected from selected lakes, reservoirs and rivers throughout the state and analyzed for methyl-mercury. For example, in 2009, the department cooperated with the North Dakota Game and Fish Department's Fisheries Division in the collection and analysis of more than 300 fish tissue samples collected from Devils Lake, Lake Sakakawea, Lake Oahe, and Alkaline Lake.

These data are then used to issue periodic species-specific fish advisories for the state's rivers, lakes and reservoirs based on risk-based consumption levels. The approach compares the estimated average daily exposure dose for specific waterbodies and species to EPA's recommended reference dose (RfD) for methyl-mercury. Using these relationships, fish tissue data are interpreted by determining the consumption rate (e.g., two meals per week, one meal per week or one meal per month) that would likely pose a health threat to the general population and to sensitive populations (i.e., children and pregnant or breast-feeding women).

NPS Pollution Management Program Monitoring

<u>Program Background</u>

Since the reauthorization of the Clean Water Act in 1987, the North Dakota NPS Pollution Management Program has used Section 319 funding to support more than 90 local projects throughout the state. While the size, target audience and design of the projects have varied significantly, they all share the same basic objectives. These common objectives are to: (1) increase public awareness of NPS pollution issues; (2) reduce/prevent the delivery of NPS pollutants to waters of the state; and (3) disseminate information on effective solutions to NPS pollution where it is threatening or impairing uses.

State and local projects currently supported with Section 319 funding essentially include three different types of projects. These project types or categories are: (1) development phase projects; (2) educational projects; and (3) watershed projects. Although most projects clearly fit into one of these categories, there are also several projects which include components from all three categories. A portion of the Section 319 funds awarded to the state have also been used to assess major aquifers in the state as well as promote and implement practices that prevent groundwater contamination.

<u>NPS Development Phase Project Monitoring</u>

Locally sponsored NPS assessment or TMDL development projects continue to be the primary means to determine watershed priorities and to prescribe specific management measures. These local assessments, commonly referred to as "development phase projects," provide the foundation for watershed implementation projects. The primary purposes of development phase projects are to identify beneficial use impairments or threats to specific waterbodies and to determine the extent to which those threats or impairments are due to NPS pollution.

Work activities during a development phase project generally involve an inventory of existing data and information and supplemental monitoring, as needed, to allow an accurate assessment of the watershed. Through these efforts, the local project sponsors are able to: (1) determine the extent to which beneficial uses are being impaired; (2) identify specific sources and causes of the impairments; (3) establish preliminary pollutant reduction goals or TMDL endpoints; and (4) identify practices or management measures needed to reduce the pollutant sources and restore or maintain the beneficial uses of the waterbody. Development phase projects are generally one to two years in length.

As is the case with TMDL development projects, responsibility for development and implementation of NPS assessment projects lies primarily with the department's Surface Water Quality Management Program. Regional TMDL development staff members are also responsible for coordinating NPS assessment projects. Technical support for assessment projects and overall program coordination are provided by Surface Water Quality Management Program staff located in Bismarck.

The goals, objectives, tasks and sampling procedures associated with each NPS assessment project are described in project-specific Quality Assurance Project Plans (QAPPs).

NPS Watershed Implementation Project Monitoring

Watershed projects are the most comprehensive projects currently implemented through the NPS Pollution Management Program. These projects are typically long-term in nature (five to 10 years, depending on the size of the watershed and extent of NPS pollution impacts) and are designed to address documented NPS pollution impacts and beneficial use impairments within approved priority watersheds. Common objectives for a watershed project are to: (1) protect and/or restore impaired beneficial uses through the promotion and voluntary implementation of best management practices (BMPs) that reduce/prevent documented NPS pollution loadings; (2) disseminate information on local NPS pollution concerns and effective solutions; and (3) evaluate the effectiveness of implemented BMPs in meeting the NPS pollutant reduction goals of the project.

To evaluate the water quality improvement effects of BMPs that are implemented as part of a Section 319 NPS watershed restoration project, Surface Water Quality Management Program staff members assist local sponsors with the development and implementation of QAPPs specific to the pollutant reduction goals or TMDL endpoints described in the watershed restoration project implementation plan. Each QAPP developed for a watershed restoration project provides a detailed description of the monitoring goals, objectives, tasks and sampling procedures.

Support Projects and Special Studies

Support projects and special studies are activities that are conducted on an as-needed basis to provide data or information to either answer a specific question or to provide program support.

Special studies provide immediate and in-depth investigations of specific water quality problems or emerging issues and usually involve practical research. In conducting practical research, the Surface Water Quality Management Program may rely on its own staff or may contract with the USGS, academia or private consultants. Examples of special studies projects conducted by the department include:

- Studies to develop nutrient criteria for streams and lakes.
- Time of travel studies, dispersion and reareation studies in support of water quality model development.
- The Lostwood National Wildlife Refuge wetland mercury assessment project.
- An assessment of dust impacts to wetlands in the Bakken region.

Support projects are activities conducted or supported by the department that result in products or tools that enhance overall program efficiency or lead to new assessment methods. Examples of support projects conducted or supported by the department include:

- Studies to evaluate or compare monitoring methods.
- The watershed and sub-watershed delineation and digitization project.

Complaint and Fish Kill Investigations

Complaint Investigations

The primary purpose for the investigation of complaints is to determine (1) whether or not an environmental or public health threat exists and (2) the need for corrective action where problems are found. Since customer service is a primary focus of the department, complaint response is a very high priority. When complaints are received by the department, they may be handled by department staff, including staff in other divisions of the Environmental Health Section, or forwarded to one of the local health districts located across the state. Once the complaint is routed to the appropriate state or local health district staff person, a field investigation is usually conducted. When problems are identified, voluntary correction is obtained in most cases. However, necessary enforcement action can be taken under the state water pollution laws (North Dakota Century Code 61-28) and regulations or under other applicable state or federal laws.

Fish Kill Investigations

Fish mortalities can result from a variety of causes and sources, some natural in origin and some induced by man. It is recognized that response time is all-important in the initial phases of a fish kill investigation. Therefore, persons reporting a fish kill are encouraged to immediately? contact the department or the NDGF during normal working hours or Emergency Response through state radio. Once a fish kill is reported, staff members from the department's Surface Water Quality Management Program and/or NDGF are dispatched to investigate. The extent of a fish kill investigation is dependent on the numbers and kinds of fish involved and the resources available at the time for the investigation. Following a decision to investigate, the investigation should continue until a cause is determined or until all known potential causes have been ruled out.

Stream Flow

Stream flow data is critical to the analysis and interpretation of water quality data. Stream flow data are used to calculate critical flow conditions for TMDLs and NDPES permitting, to estimate pollutant loading and to interpret water quality results (e.g., load duration curve analysis). The USGS and agencies of the state of North Dakota have had cooperative agreements for the collection of stream flow records since 1903. During the 2013 water year (October 1, 2012 through September 30, 2013), the USGS cooperated with numerous state, federal and local agencies in the collection and reporting of stream flow data from 101 stream flow-gauging stations.

In addition to the extensive USGS stream flow gauging network, the department conducts flow monitoring at most water quality sites associated with NPS assessment and watershed implementation projects and TMDL development projects. This ensures that flow data is available for load calculations and other data analyses.

B. Assessment Methodology

Chapter 1. Introduction

As stated earlier, for purposes of 2014 Section 305(b) reporting and Section 303(d) listing, EPA encouraged states to submit an integrated report and to follow its integrated reporting guidance, including EPA's 2006 IR guidance, which is supplemented by EPA's 2008, 2010, 2012 and 2014 IR guidance memos (http://water.epa.gov/lawregs/lawsguidance/cwa/tmdl/guidance.cfm). The purpose of this section is to briefly summarize the assessment methodology used in this integrated report. A complete description of the state's assessment methodology for surface waters is provided in Appendix B. In general, the state's assessment methodology is consistent with the state's beneficial use designations defined in the state's water quality standards (NDDoH, 2014). The assessment methodology is also consistent with the department's interpretation of the narrative and numeric criteria described in its state water quality standards (NDDoH, 2014).

Assessments are conducted by comparing all available and existing information for an assessment unit to applicable water quality criteria (narrative and numeric). This information, which is summarized by specific lake, reservoir, river reach or sub-watershed, is integrated as beneficial use assessments that are entered into a water quality assessment "accounting"/database management system developed by EPA. This system, which provides a standard format for water quality assessment and reporting, is termed the Assessment Database Version 2.3.1 (ADB).

Chapter 2. Assessment Database (ADB)

Developed by EPA, the ADB is an Access® based "accounting"/database management system that provides a standard format for water quality assessment information. It includes a software program for adding and editing assessment data and transferring assessment data between the personal computer and EPA. Assessment data, as compared to raw monitoring data, describes the overall health or condition of the waterbody by describing beneficial use impairment and, for those waterbodies where beneficial uses are impaired or threatened, the causes and sources of pollution affecting the beneficial use. The ADB also allows the user to track and report on TMDL-listed waters, including their development and approval status. A complete description of the ADB is provided in the "Water Quality Assessment Methodology for North Dakota's Surface Waters" (Appendix B).

North Dakota's ADB for the 2014 assessment cycle contains 1,777 discreet assessment units (AUs) representing 56,022 miles of rivers and streams and 289 lakes and reservoirs. Within the ADB, designated uses are defined for each AU (i.e., river or stream reach, lake or reservoir) based on the state's water quality standards. Each use is then assessed using available chemical, physical and/or biological data.

As part of integrated Section 305(b) and Section 303(d) reporting to EPA, the state also provides a copy of the ADB with the 2014 assessment cycle data. While the Section 303(d) TMDL list in Tables VI-1 through VI-5 provides all Category 5 waterbodies, the listing of all Category 1, 2, 3, 4A, 4B and 4C waterbodies are provided to EPA through the ADB.

Chapter 3. Beneficial Use Designation

Water quality reporting requirements under Sections 305(b) and 303(d) of the CWA require states to assess the extent to which their lakes and reservoirs and rivers and streams are meeting water quality standards applicable to their waters, including beneficial uses as defined in their state water quality standards. In addition to beneficial uses, applicable water quality standards also include narrative and numeric standards and antidegradation policies and procedures. While Section 305(b) requires states and tribes to provide only a statewide water quality summary, Section 303(d) takes this reporting a step further by requiring states to identify and list the individual waterbodies that are not meeting applicable water quality standards and to develop TMDLs for those waters. Both Section 305(b) reporting and Section 303(d) listing accomplish this assessment by determining whether the waterbody or AU is supporting its designated beneficial uses.

Beneficial uses are not arbitrarily assigned to AUs, but rather are assigned based on the *Standards of Quality for Waters of the State* (NDDoH, 2014). These regulations define the protected beneficial uses of the state's rivers, streams, lakes and reservoirs. Six beneficial uses (aquatic life, recreation, drinking water, fish consumption, agriculture, industrial and fish consumption) were assessed for purposes of Section 305(b) reporting and Section 303(d) listing.

All waterbodies or AUs entered into the ADB and, therefore, all stream classes (I, IA, II and III) and all lake classes (1-5) are assigned aquatic life and recreation beneficial uses. All Class I, IA and II rivers and streams and all lakes are assigned the drinking water beneficial use.

While not specifically identified in state standards, fish consumption is protected through both narrative and numeric human health criteria specified in the state's water quality standards. Fish consumption has been assigned to all Class I, IA and II rivers and streams, to those Class III streams known to provide a sport fishery and to all Class 1 through 4 lakes.

Other beneficial uses identified in the state's water quality standards are agriculture (e.g., stock watering and irrigation) and industrial (e.g., washing and cooling). These uses are applicable to all stream classes and, unless available data provide evidence of impairment, are presumed to be fully supporting.

Chapter 4. Sufficient and Credible Data Requirements

For water quality assessments, including those done for purposes of Section 305(b) assessment and reporting and 303(d) listing, the NDDoH will use only what it considers to be sufficient and credible data. Sufficient and credible data are chemical, physical, and biological data that, at a minimum, meet the following criteria:

- Data collection and analysis followed known and documented quality assurance/quality control procedures.

- Water column chemical or biological data are 10 years old or less for rivers and streams and lakes and reservoirs, unless there is adequate justification to use older data (e.g., land use, watershed, or climatic conditions have not changed). There is no age limit for fish tissue mercury data. Years of record are based on the USGS water year. Water years are from October 1 in one year through September 30 of the following year. It should be noted that it is preferable to split the year in the fall when hydrologic conditions are stable, rather than to use calendar years. Data for all 10 years of the period are not required to make an assessment.

- There are a minimum of 10 chemical samples collected in the 10-year period for rivers and streams. The 10 samples may range from one sample collected in each of 10 years or 10 samples collected all in one year.

- There should be a minimum of two samples collected from lakes or reservoirs collected during the growing season, May-September. The samples may consist of two samples collected the same year or samples collected in separate years.

- A minimum of five E. coli samples are collected during any 30-day consecutive period (e.g., calendar month) from May through September. The five samples per month may consist of five samples collected during the month in the same year or five samples collected during the same calendar month, but pooled across multiple years (e.g., two samples collected in May 2005, two samples collected in May 2008 and one sample collected in May 2012).

- For all chemical criteria that are expressed as a 30-day arithmetic average (e.g., chloride, sulfate, radium 226 and 228, and boron) a minimum of four daily samples must be collected during any consecutive 30-day period. Samples collected during the same day shall be averaged and treated as one daily sample.

- A minimum of two biological samples (fish and/or macroinvertebrate) are necessary in the most recent 10-year period. Samples may be collected from multiple sites within the assessment stream reach, multiple samples collected within the same year, or individual samples collected during multiple years. Samples may consist of a minimum of two fish samples, two macroinvertebrate samples, or one fish and one macroinvertebrate sample. Samples should be collected from sites considered to be representative of the AU. At a minimum one site should be located at the downstream end of the assessed stream reach.

- The mean methylemercury concentration is estimated from a minimum of 3 composite samples (preferred) or 9 individual fish samples representative of the filet. When composite samples are used, each composite sample should consist of a minimum of three individual fish per composite with the smallest fish in the composite no less than 75% of the largest fish by length. Each composite sample should also be representative of a distinct age class of the target fish species in the waterbody. In other words, if three composite samples are collected, one composite should represent small fish, one representing medium sized fish and one representing large fish in the population.

- If individual fish samples are collected then a minimum of 9 fish samples should be used to estimate the mean methylmercury concentration. The same criteria used to collect a composite sample should be used for individual fish samples where fish should be representative of at least three size classes and a minimum of three fish should be collected per size class (3 size classes times 3 fish per size class equals 9 fish). In cases where individual fish samples are used, then the number of fish per size class should be equal.

Chapter 5. Existing and Available Water Quality Data

River and Stream Assessment Data

<u>Chemical Data</u>

Beginning January 1, 2013, the department began implementation of a revised ambient water quality monitoring program for rivers and streams in the state (see Part IV. A. Chapter 2. Water Quality Monitoring Program, Projects and Studies). The revised network, which is operated in conjunction with the USGS-North Dakota Water Science Center and the North Dakota State Water Commission, consists of 81 sites located on 45 rivers and streams in the state.

Prior to 2013, the department operated a network of 34 ambient chemical monitoring sites. Where practical, sites were collocated with USGS flow gauging stations, thereby facilitating the analysis of chemical data with stream hydrologic data. All of these sites were established as basin or sub-basin integrator sites, where the chemical characteristics measured at each of these sites reflect water quality effects in the entire watershed.

The department also uses historic water quality data collected by the USGS. Many of these historic water quality monitoring sites were maintained by the USGS through cooperative agreements with other agencies (e.g., North Dakota State Water Commission, U. S. Bureau of Reclamation and U.S. Army Corps of Engineers), through international agreements (e.g., the Souris River Bilateral Agreement) or with the department itself.

In addition to the current 81-station ambient chemical monitoring network, the department cooperates with local project sponsors (e.g., soil conservation districts and water resource districts) in small watershed monitoring and assessment projects and in waterbody-specific TMDL development projects. These projects entail intensive water quality monitoring, stream flow measurements, land use assessments and biological assessments. Where lake water quality is a concern, lake monitoring also is included in the sampling and analysis plan. The goal of these small watershed monitoring and assessment projects and TMDL development projects is to estimate pollutant loadings to the lake or stream and, where appropriate, set target load reductions (i.e., TMDLs) necessary to improve beneficial uses (e.g., aquatic life and recreation). Most of these projects are followed by Section 319 NPS Pollution Management Program watershed implementation projects. Water quality data collected through these cooperative efforts also are used in assessment of waterbodies for the Section 305(b) report and the TMDL list.

Based on the department's "credible and sufficient data requirements," only the previous 10 years of water column chemistry data will be used for assessments. Years of record are based on the USGS water year. Water years are from October 1 (or one year) through September 30 of the following year. It should be noted that it is preferable to split the year in the fall when hydrologic conditions are stable, rather than to use calendar years. Data for all 10 years of the period are not required to make an assessment**.** For purposes of assessments conducted for 2014 Section 305(b) report and Section 303(d) list, the period of record will be from October 1, 2003 through September 30, 2013.

Biological Data

In response to the growing need for better water quality assessment information, the department initiated a biological monitoring program in 1993 and 1994. This program, which was a cooperative effort with the Minnesota Pollution Control Agency and the USGS's Red River National Water Quality Assessment Program, involved approximately 100 sites in the Red River Basin. The result of this initial program was the development of the Index of Biotic Integrity (IBI) for fish in the Lake Agassiz Plain ecoregion of the Red River Basin. The program continued in the Red River Basin in 1995 and 1996. The Upper Red River Basin, including the Sheyenne River and its tributaries, was sampled in 1995, while the Lower Red River Basin was sampled in 1996. Following these initial monitoring efforts in the Red River Basin, biological monitoring was expanded statewide with sampling in the Souris River Basin in 1997, the James River Basin in 1998, the Lake Sakakawea subbasin of the Missouri River Basin in 1999 and the Lake Oahe subbasin of the Missouri River Basin in 2000. Beginning in 1995, biological monitoring was expanded to include macroinvertebrate sampling in addition to fish.

Following these initial biological monitoring and IBI development efforts, the department intiated it's Ecoregion Reference Network Monitoring Program. The Ecoregion Reference Network Monitoring Program is used to support a variety of water quality management and biological monitoring and assessment activities by providing a network of biologically "least disturbed" reference sites within each of the states four major level 3 ecoregions (Lake Agassiz Plain, Northern Glaciated Plain, Northwestern Glaciated Plain, and Northwestern Great Plain) (Figure 1). Objectives of the Ecoregion Reference Network Monitoring Program include the development of biological indicators. Reference sites are also expected to support the development of nutrient criteria for rivers and streams and the refinement of existing clean sediment reference yields.

The goal of the Ecoregion Reference Network Monitoring Program is to establish a minimum set of 30 "reference sites" within each of the following level 3 ecoregions or ecoregion combinations: Lake Agassiz Plain (48), Northern Glaciated Plains (46), and combination Northwestern Glaciated Plains/Northwestern Great Plains (42/43). In addition to the 30 "reference sites" sampled per ecoregion/ecoregion combination, the department also selected and sampled 30 companion "highly disturbed" or "trashed" sites. These sites are being used as a basis of comparison when selecting and calibrating metrics used in IBIs. To date, the department has developed final multi-metric IBIs for fish in the Lake Agassiz Plain ecoregion and macroinveretebrates in the Lake Agassiz Plain (48) and Northern Glaciated Plain (46) level III ecoregions.

Lake and Reservoir Assessment Data

From 1991 through 1996 the department conducted a Lake Water Quality Assessment (LWQA) Project. During that time, the department completed sampling and analysis for 111 lakes and reservoirs in the state. The objective of the assessment project was to describe the general physical and chemical condition of the state's lakes and reservoirs.

The lakes and reservoirs targeted for assessment were chosen in conjunction with the NDGF. Criteria used during the selection process were geographic distribution, local and regional significance, fishing and recreational potential and relative trophic condition. Lakes without much historical monitoring information were given the highest priority.

The results from the LWQA Project have been prepared in a functional atlas-type format. Each lake report discusses the general description of the waterbody, general water quality characteristics, plant and phytoplankton diversity, trophic status assessments and watershed condition.

One of the most useful measures of lake water quality is trophic condition. Trophic condition is a means of expressing a lake's productivity as compared to other lakes in a district or geographical area. In general, oligotrophic lakes are deep, clear lakes with low primary production, while eutrophic lakes are shallow and contain macrophytes and/or algae. Eutrophic lakes are considered moderately to highly productive.

The trophic condition or status was assessed for each of the lakes and reservoirs included in the LWQA. Accurate trophic status assessments are essential for making sound preservation or improvement recommendations. In order to minimize errors in classification, a multiple indicator approach was initiated.

Beginning in 1997, LWQA Project activities were integrated into the department's rotating basin monitoring strategy. Lake Darling and the Upper Des Lacs Reservoir were sampled as the department focused its monitoring activities in the Souris River Basin in 1997. Pipestem Dam and Jamestown Reservoir were sampled in 1998; Lake Sakakawea was sampled in 1999; and Bowman-Haley Reservoir, Patterson Lake and Lake Tschida were sampled in 2000.

In addition to its inclusion in the annual LWQA Project, Devils Lake and Lake Sakakawea have received special attention. Devils Lake has increased in elevation approximately 25 feet since 1993 and is now spilling over into East and West Stump Lakes. In response to questions regarding water quality changes resulting from these water level increases, the department initiated a comprehensive water quality monitoring program in 1993 for Devils Lake. Devils Lake is sampled approximately four times per year, including once during the winter.
While Devils Lake has increased in elevation during the last 12 years, Lake Sakakawea's lake level has varied significantly since 2002. Of particular concern in North Dakota is the quality of Lake Sakakawea's cold water fishery. Since 2002, the department and the NDGF have cooperated in a project to monitor the condition of the lake. Sampling consists of weekly DO/temperature profiles and water quality samples collected once each month at seven locations. Beginning in 2003 through 2011, the U.S. Army Corps of Engineers also conducted water quality monitoring at several fixed-station sites on Lake Sakakawea.

Beginning in 2005 and continuing in 2006 and 2007 the department initiated a cooperative Lake Water Quality Assessment Project with the NDGF Fisheries Division. The goal of this long-term monitoring and assessment project is to: (1) monitor the chemical, physical and biological character of the state's lakes and reservoirs; (2) use chemical, physical and biological indicators to assess the current water quality condition and trophic status of monitored lakes and reservoirs; (3) determine spatial differences among lakes and reservoirs; and (4) determine temporal trends in lake water quality by comparing project data to Lake Water Quality Assessment data or other historic water quality data. Assessment information generated from this project will be used by both the NDGF and the North Dakota Department of Health's Division of Water Quality to prioritize lakes, reservoirs and their watersheds for lake maintenance and improvement projects (i.e., Save Our Lakes, Total Maximum Daily Loads, Section 319 Nonpoint Source Pollution Management Program). Samples are collected from each lake or reservoir two to four times per year and are coordinated with existing NDGF district lake sampling activities (e.g., standard adult fish population sampling, summer water quality sampling, fall reproduction sampling and winter water quality sampling). At a minimum, two samples are collected during the year, one during the summer (June, July and/or August) and one during the winter under ice cover (January or February). Sixty lakes within five of the six NDGF districts were targeted for sampling in 2005/2006. Ten lakes were targeted for sampling in 2006/2007, and six lakes were targeted in 2007/2008.

Beginning in 2008 and extending through 2011, the department sampled approximately 15 lakes or reservoirs each year. Through this "Targeted Lake Water Quality Assessment Project", lakes were sampled twice during the summer growing season. Classified lakes and reservoirs in the state with little or no monitoring data were targeted for monitoring and assessment under this project. This initial 4-year project has resulted in water quality and trophic status assessments for a minimum of 58 lakes in the state. Information from these assessments has been published in a lake atlas format and posted on the department's web site.

Fish Consumption Use Assessment Data

The department has maintained an active fish tissue monitoring and contaminant surveillance program since 1990. As part of this program, individual fish tissue samples are collected from the state's major lakes, reservoirs and rivers and analyzed for methyl-mercury. These data are then used to issue species-specific fish advisories for the state's rivers, lakes and reservoirs. These data have also been used to assess fish consumption use for the integrated report.

Other Agency/Organization Assessment Data

In addition to the water quality data available through existing department programs and projects and that provided by the USGS, the department also requested data from other agencies and organizations. In a letter dated July 15, 2013, the department requested all readily available and credible data from 21 agencies and organizations believed to have water quality data (Appendix C). In response to this request, the department received notification from only one organization as to the availability of additional data. The River Keepers, located in Fargo, ND, indicated they had additional data available for the Red River in the Fargo-Moorhead area. While the North Dakota State Water Commission did respond to the request for additional data, it was determined that their data had already been provided to the department by the USGS.

Chapter 6. Beneficial Use Assessment Methodology

The assessment methodology or decision criteria used to assess aquatic life, recreation, drinking water, fish consumption, agricultural, and industrial uses where they are assigned to the state's surface waters is provided in Appendix B. All water quality assessments entered into the ADB for Section 305(b) reporting and Section 303(d) TMDL listing are based on "sufficient and credible" monitoring data. Physical and chemical monitoring data used for these assessments included conventional pollutants (e.g., DO, pH, temperature, ammonia, and fecal coliform and E. coli bacteria) and toxic pollutants (e.g., trace elements and pesticides) data collected between October 1, 2003 and September 30, 2013. Biological monitoring data used for this report included fish community and macroinvertebrate community data collected by the department between 1999 and 2013. If more than one site occurred within a delineated AU, data from all sites and for all years were pooled for analysis.

Chapter 7. Assessment Categories

Key to integrated reporting is an assessment of all of the state's waters and placement of those waters into one of five assessment categories. Guidance provided by the U.S. EPA (U.S. EPA, 2005) provides for five assessment categories representing varying levels of water quality standards attainment. These assessment categories range from Category 1, where all of a waterbody's designated uses are met, to Category 5, where a pollutant impairs a waterbody and a TMDL is required (Table IV-5). These category determinations are based on consideration of all existing and readily available data and information consistent with the state's assessment methodology (Appendix B).

Beginning with the 2010 Integrated Report and Section 303(d) list of impaired waterbodies needing TMDLs, the department has identified a subcategory to Category 5 waterbodies. This subcategory, termed Subcategory 5A, includes rivers, streams, lakes or reservoirs that were assessed and listed in earlier Section 303(d) lists, including the 2008 list, but where the original basis for the assessment decision and associated cause of impairment is questionable. These Subcategory 5A waterbodies include rivers and streams listed for biological impairments based on only one sample for the entire segment or on samples collected more than 10 years ago, waterbodies listed for sediment/siltation impairments, or lakes and reservoirs where the assessments are based on one sampling event or on data that are greater than 10 years old. These waterbodies will remain on the 2014 Section 303(d) list, but will be targeted for additional monitoring and assessment during the next two to four years.

Table IV-5. Assessment Categories for the Integrated Report.

Assessment Category	Assessment Category Description
Category 1	All of the waterbody's designated uses have been assessed and are fully supporting.
Category 2	Some of the waterbody's designated uses are fully supporting, but there is insufficient data to determine if remaining designated uses are fully supporting.
Category 3	Insufficient data to determine whether any of the waterbody's designated uses are met.
Category 4	At least one of the waterbody's beneficial uses is not supported or has been assessed as fully supporting, but threatened, but a TMDL is not needed. This category has been further sub-categorized as: • 4A - waterbodies that are impaired or threatened, but TMDLs needed to restore beneficial uses have been approved or established by EPA; • 4B - waterbodies that are impaired or threatened, but do not require TMDLs because the state can demonstrate that "other pollution control requirements (e.g., BMPs) required by local, state or federal authority" • (see 40 CFR 130.7[b][1][iii]) are expected to address all waterbody-pollutant combinations and attain all water quality standards in a reasonable period of time; and • 4C - waterbodies that are impaired or threatened, but the impairment is not due to a pollutant.
Category 5	At least one of the waterbody's beneficial uses is not supported or has been assessed as fully supporting, but threatened, and a TMDL is needed. • 5A – waterbodies currently listed on the Section 303(d) list, but are targeted for additional monitoring and assessment during the next two to four years. **Note:** This also includes waterbodies which are assessed as impaired based on biological data alone and for which there are no known pollutant causes of the impairment. These impaired waterbodies will be target for additional stressor identification monitoring and assessment.

PART V. SECTION 305(b) WATER QUALITY ASSESSMENT

A. Rivers and Streams Water Quality Assessment

Chapter 1. Assessment Category Summary

In EPA's guidance for preparing the Integrated Report, the states were encouraged to report on their waters based on five assessment categories (Table IV-1). In broad terms, the five assessment categories are as follows:

- Category 1: All designated uses are met.
- Category 2: Some designated uses are met, but there are insufficient data to determine if remaining designated uses are met.
- Category 3: There are insufficient data to determine whether any designated uses are met.
- Category 4: Water is impaired or threatened, but a TMDL is not needed for one of three reasons: (a) a TMDL already has been approved for all pollutants causing impairment; (b) the state can demonstrate that "other pollutant control requirements required by local, state or federal authority" are expected to address all waterbody-pollutant combinations and attain all water quality standards in a reasonable period of time; or (c) the impairment or threat is not due to a pollutant.
- Category 5: The waterbody is impaired or threatened for at least one designated use, and a TMDL is needed.

In addition to these five broad categories, the department has identified a subset of Category 5 waterbodies as Subcategory 5A. This subcategory includes rivers, streams, lakes or reservoirs that were assessed and listed in previous Section 303(d) lists, including the 2008 list, but where the original basis for the assessment decision and associated cause of impairment is questionable. These Subcategory 5A waterbodies include rivers and streams listed for biological impairments based on only one sample for the entire segment or on samples collected more than 10 years ago, waterbodies listed for sediment/siltation impairments, waterbodies listed for fecal coliform bacteria impairments, or lakes and reservoirs where the assessments are based on one sampling event or on data that are greater than 10 years old. These waterbodies will remain on the 2014 Section 303(d) list, but they will be targeted for additional monitoring and assessment during the next two to four years.

The ADB that has been submitted to EPA as part of this Integrated Report provides an assessment category for each lake, reservoir, river or stream AU.

Table V-1 provides a summary of the number of river and stream AUs and total miles of rivers and streams in each category that were assessed for this report. Seven (7) AUs, totaling 126 miles, were classified as Category 1, meaning all uses were assessed and fully supporting. A total of 1242 AUs totaling 47,594 miles were assessed as Category 2. These are AUs where at least one designated use was assessed as fully supporting, but the other uses were not assessed. In most cases, agriculture and industrial uses were assessed as fully supporting with the remaining aquatic life, recreation and/or municipal water supply uses not assessed. A total of 49 AUs were assessed as Category 4 where at least one designated use was impaired or threatened, but where a TMDL is not required. Of these, 46 AUs do not need TMDLs because TMDLs have already been completed and approved by EPA (Category 4A) and 3 AUs do not need a TMDL because the cause of the impairment is not a pollutant (Category 4C). These are typically river and stream reaches where habitat degradation or flow alteration is impairing aquatic life use. A total of 189 AUs (5,992 miles) were assessed where at least one beneficial use is impaired and a TMDL is required. These Category 5 AUs are provided in a list in Tables VI-1 through VI-4.

Table V-1. Assessment Category Summary for Rivers and Streams in North Dakota (Miles).

Category	Description	Number AUs	Total Size (miles)
1	All uses met	7	126.00
2	Some uses met, others not assessed	1242	47,593.83
3	No uses assessed	0	0
4A	Some or all uses impaired or threatened, but a TMDL(s) has been approved for all impaired uses.	46	2,260.63
4B	Some or all uses impaired or threatened, but other pollutant controls will result in water quality standards attainment.	0	0
4C	Some or all uses impaired or threatened, but impairment is not due to a pollutant.	3	50.08
5	Some or all uses impaired or threatened, and a TMDL is required. Includes category 5A waterbodies.	189	5,991.60

Chapter 2. Water Quality Summary

Twenty-eight (28) percent (1,274 miles) of the rivers and streams assessed for this report are fully supporting the beneficial use designated as aquatic life (Table V-2), while another 47 percent (2,147 miles) of rivers and stream are assessed as fully supporting, but threatened for aquatic life use. In other words, if water quality trends continue, these rivers and streams may not fully support its use for aquatic life in the future. The remaining 25 percent (1,118 miles) of rivers and streams assessed for this report were assessed as not supporting aquatic life use (Table V-2).

Table V-2. Individual Use Support Summary for Rivers and Streams in North Dakota (Miles).

Use	Fully Supporting	Fully Supporting, but Threatened	Not Supporting	Not Assessed	Insufficient Information for Assessment	Total Size
Aquatic Life	1,273.67	2,146.53	1,117.59	48,107.53	3,376.82	56,022.14
Fish Consumption	91.13	0	398.17	3,637.06	0	4,126.36
Recreation	1,260.45	3,721.08	2,521.49	48,251.40	267.72	56,022.14
Drinking Water Supply	804.80	151.48	0	2,491.49	2,144.51	5,592.28
Agriculture	56,022.14	0	0	0	0	56,022.14
Industrial	56,022.14	0	0	0	0	56,022.14

NPS pollution (e.g., siltation/sedimentation and stream habitat loss or degradation) was the primary cause of aquatic life use impairment (Table V-3). Other forms of pollution causing impairment are trace element contamination, flow alteration and oxygen depletion. Organic enrichment creates conditions in the stream that cause dissolved oxygen (DO) to be depleted. Rivers and streams impaired by siltation/sedimentation, organic enrichment, eutrophication due to excess nutrients and habitat alteration also will result in a degradation of the biological community. Typically, species composition will shift from an aquatic community comprised of intolerant species (e.g., mayflies, caddisflies, stoneflies and darters) to an aquatic community dominated by tolerant species (e.g., midges, carp and bullheads).

Table V-3. Impairment Summary for Rivers and Streams in North Dakota.

Impairment	Miles
Total Fecal Coliform/E. coli Bacteria	6,242.57
Physical Habitat Alterations	2,023.71
Biological Indicators	2,024.62
Sedimentation/Siltation	1,720.79
Oxygen Depletion	539.70
Mercury in Fish Tissues	398.17
Trace Metals in the Water Column	305.64
Flow Alterations	305.20
Total Dissolved Solids/Sulfates	64.59
Nutrients	49.78
Temperature	40.72

The primary sources of pollutants affecting aquatic life use in the state are cropland erosion and runoff, animal feeding operations and poor grazing management (Table V-4). Poor grazing management includes riparian grazing and season-long grazing, which result in the deterioration of the plant community or cause a shift in the plant community away from native grass and forb species to non-native invader species. Evidence of poor grazing practices would include cattle trailing, gully erosion, poor water infiltration rates resulting from soil compaction and severe streambank erosion. Other sources linked to aquatic-life use impairment are point-source discharges, urban runoff and hydrologic modifications (e.g., upstream impoundments, low-head dams, channelization, flow regulation and diversion, riparian vegetation removal and wetland drainage) (Table V-4).

Recreation use was assessed on 7,503 miles of rivers and streams in the state. Recreation use was fully supporting, fully supporting but threatened and not supporting on 1,260 miles, 3,721 miles and 2,521 miles, respectively (Table V-2). E. coli or Fecal coliform bacteria data collected from monitoring stations across the state were the primary indicators of recreation use attainment (see Part IV. B., Chapter 6. "Beneficial Use Assessment Methodology"). For this reason, pathogens (as reflected by E. coli and fecal coliform bacteria) are the primary cause of recreation use impairment in North Dakota (Table V-3). Other factors affecting the use of the state's rivers and streams for recreation would be eutrophication from excessive nutrient loading, resulting in nuisance algae and plant growth. The primary sources of E. coli and fecal coliform bacteria contamination are animal feeding operations, riparian area grazing and failing or poorly designed septic systems (Table V-4).

Table V-4. Impairment Source Summary for Rivers and Streams in North Dakota.

Source	Miles
Riparian Grazing	6,367.86
Animal Feeding and Handling Operations	4,194.58
Crop Production (Dry Land)	2,273.25
Loss of Riparian Habitat	2,084.20
Source Unknown	1,302.80
Stormwater Runoff	736.64
Highway and Road Runoff	611.92
On-site Treatment Systems (Septic Systems)	507.81
Streambank Modification	484.69
Channel Erosion/Incision from Upstream Hydromodifications	474.05
Wetland Loss (Drainage/Filling)	467.84
Rangeland/Pastureland Grazing	422.38
Upstream Impoundments	346.26
Hydrostructure Flow Regulation/Modification	244.65
Channelization	234.54
Natural Sources	210.41
Natural Conditions-Water Quality Standards Use Attainability Analysis Needed	128.35
Municipal Point Source Discharges	89.67
Land Development	85.94
Source Outside State Jurisdiction or Border	68.33
Industrial Point Source Discharge	27.33
Dam Construction	13.08
Golf Courses	13.02
Flow Alteration from Water Diversion	8.48

Drinking water supply use is classified for 5,592 miles of rivers and streams in the state. Of the 956 miles assessed for this report, 151 miles (16 percent) were assessed as threatened for drinking water supply use (Table V-2).

A total of 4,126 miles of rivers and streams were identified as capable of supporting a sport fishery from which fish could be used for consumption (Table V-2). The Red River of the North

(398.17 miles) and the Missouri River from Garrison Dam to Lake Oahe are the only two rivers listed in the state's fish consumption advisory. Methyl-mercury data collected for these advisories were used to estimate the average methyl-mercury concentration for fish in each of these rivers (see Part IV. B. Chapter 6. "Beneficial Use Assessment Methodology – Fish Consumption Assessment Methodology for Rivers and Lakes," page IV-32). Based on the recommended EPA fish tissue criterion of 0.3 μg methyl-mercury/gram of fish tissue, only the Red River of the North was assessed as not supporting fish consumption. The Missouri River below Garrison Dam (91.13 miles) is assessed as fully supporting fish consumption use based on the EPA fish tissue criterion for methyl-mercury. While there are many potential sources of methyl-mercury, both anthropogenic and natural, to date there have been no specific causes or sources identified for the mercury present in North Dakota fish (Tables V-3 and V-4).

B. Lakes and Reservoirs Water Quality Assessment

Chapter 1. Assessment Category Summary

Of the 289 public lakes and reservoirs included in the Assessment Database (ADB), only 200 are included in the state's water quality standards as classified lakes and therefore are assigned designated beneficial uses. Beneficial use assessments for the remaining 89 lakes and reservoirs, while included in the state's estimate of total lake acres, were not conducted for this report. Where sufficient data were available, these 89 lakes and reservoirs were assessed for trophic status (Table V-9). Table V-5 provides an assessment category summary for the 200 classified lakes and reservoirs in the state. One lake was classified as Category 1, meaning all uses were assessed and were fully supporting. One-hundred-fifty-two (152) lakes and reservoirs totaling 152,296 acres were assessed as Category 2. These are lakes and reservoirs where at least one designated use, mostly agriculture use and industrial use, was assessed as fully supporting, but the other uses were not assessed. A total of 20 lakes and reservoirs were assessed as Category 4A, meaning at least one designated use was impaired or threatened, but a TMDL is not required because a TMDL already has been completed and approved by EPA. Twenty-seven (27) lakes and reservoirs totaling 463,866 acres were assessed where at least one beneficial use is impaired and a TMDL is required. These Category 5 lakes and reservoirs are provided in the state's TMDL list (Tables VI-1 through VI-4).

Table V-5. Assessment Category Summary for Lakes and Reservoirs in North Dakota (Acres).

Category	Description	Number AUs	Total Size (acres)
1	All uses met	1	1,414.0
2	Some uses met, others not assessed	152	152,296.1
3	No uses assessed	0	0
4A	Some or all uses impaired or threatened, but a TMDL(s) has been approved for all impaired uses.	20	4,687.8
4B	Some or all uses impaired or threatened, but other pollutant controls will result in water quality standards attainment.	0	0
4C	Some or all uses impaired or threatened, but impairment is not due to a pollutant.	0	0
5	Some or all uses impaired or threatened and a TMDL is required.	27	463,866.2

Chapter 2. Water Quality Summary

As stated in Chapter 1, a total of 200 lakes and reservoirs, representing 622,264 surface acres, are specifically listed in the state water quality standards as classified lakes and reservoirs. Each of these 200 lakes and reservoirs were assessed for this report. In some cases the only beneficial uses assessed were agriculture and industrial uses. In others cases, all designated uses were assessed. There were also 89 lakes and reservoirs which were included in the ADB, but were not assessed. The non-classified lakes represent 91,000 acres or only 13 percent of the total lake and reservoir acres in the state.

For purposes of this report, the term "aquatic life use" is synonymous with biological integrity and is defined as the ability of a lake or reservoir to support and maintain a balanced, adaptive community of aquatic organisms (e.g., fish, zooplankton, phytoplankton, macroinvertebrates, vascular plants) having a species composition, diversity and functional organization comparable to that of least-impaired reference lakes and reservoirs in the region (modified from Karr et al., 1981). One-hundred-twenty-nine (129) lakes and reservoirs, representing 590,497 acres, were assessed as fully supporting aquatic life use (Table V-6); in other words, they are considered capable of supporting and maintaining a balanced community of aquatic organisms. An additional 29 lakes and reservoirs representing 8,168 acres are assessed as fully supporting, but threatened (Table V-6). A threatened assessment means that if water quality and/or watershed trends continue, it is unlikely these lakes will continue to support aquatic life use. The lakes and reservoirs will begin to experience more frequent algal blooms and fish kills. They will display a shift in trophic status from a mesotrophic or eutrophic condition to a hypereutrophic condition. Only four lakes, totaling 706 acres, were assessed as not supporting aquatic life use (Table V-6).

Table V-6. Individual Use Support Summary for Lakes and Reservoirs in North Dakota (Acres).

Use	Fully Supporting	Fully Supporting, but Threatened	Not Supporting	Not Assessed	Insufficient Information for Assessment	Total Size
Aquatic Life	590,496.6	8,167.8	705.8	21,500.7	1,393.1	622,264.1
Fish Consumption	70,619.0	0	448,933.5	101,297.6	0	620,850.1
Recreation	575,674.9	17,741.4	6,308.5	22,040.2	499.0	622,264.1
Drinking Water Supply	342,070.5	0	0	278,779.6	0	620,850.1
Agriculture	622,264.1	0	0	0	0	622,264.1
Industrial	622,264.1	0	0	0	0	622,264.1

One of the primary causes of aquatic life impairment to the state's lakes and reservoirs is low DO in the water column (Table V-7). Low DO in lakes can occur in summer (summer kills), but usually occurs in the winter under ice-cover conditions. Low-DO and winter kills occur when senescent plants and algae decompose, consuming available oxygen. Because the lake is ice covered, re-aeration is minimal, and the lake goes anoxic resulting in a fish kill. Fish kills are the most apparent impact to sensitive fish species (e.g., walleye, trout, bass, bluegill, crappie, northern pike), but impacts to other DO-sensitive aquatic organisms also may occur. When fish kills occur, low DO-tolerant fish species (e.g., carp, bullhead, white suckers) will be favored, resulting in a lake dominated by these rough fish species.

Pollutants that stimulate the production of organic matter also can cause aquatic life impairment. Two secondary pollutant causes are excessive nutrient loading and siltation (Table V-7). Major sources of nutrient loading to the state's lakes and reservoirs are erosion and runoff from cropland, runoff from animal feeding operations (e.g., concentrated livestock feeding and wintering operations) and hydrologic modifications (Table V-8). Hydrologic modifications, such as wetland drainage, channelization and ditching, increase the runoff and delivery rates to lakes and reservoirs in effect increasing the size of a lake's watershed. Nutrients, sediment and organic matter that would be retained in wetlands under normal conditions become part of the lake's external budget.

Other sources of nutrient loading that affect lakes in the state are point source discharges from municipal wastewater treatment facilities, urban/stormwater runoff and shoreline development (Table V-8).

Table V-7. Impairment Summary for Lakes and Reservoirs in North Dakota.

Impairment	Acres
Nutrients	24,403.2
Oxygen Depletion	6,445.0
Sedimentation/Siltation	4,185.0
Turbidity	1,191.0
Total Dissolved Solids	36.8
Mercury in Fish Tissues	448,933.5

Shoreline or cabin development directly contributes nutrients to lakes in many ways. Typically, lake cabins or homes use septic systems (tanks and drain fields) to contain their wastewater. Many of these systems are poorly designed, poorly maintained or nonexistent. Poorly designed septic systems provide a direct path of nutrients from the cabin to the lake. In addition, cabins or homes along lakes can contribute nutrients through fertilizer runoff from lawns.

Shoreline development can indirectly lead to increased nutrient loading when development results in a loss of the natural vegetation surrounding the lake. This buffer, between the lake and its watershed, provides for the assimilation of nutrients and retention of sediments contained in the runoff from the surrounding landscape. When this buffer is lost or degraded due to development, nutrients, sediment and other chemicals (e.g., pesticides, road salts) are afforded a direct path to the lake.

The previously mentioned sources are considered external or watershed-scale sources of nutrient loading. Another source that can represent a significant portion of the nutrient budget at times is internal cycling, particularly in those lakes that periodically go anoxic either during ice cover or through thermal stratification in the summer. Under these circumstances, phosphorus and reduced forms of nitrogen (e.g., ammonia) can be released into the water column. The increased nutrient concentrations impair use by stimulating noxious weed growth and algal blooms.

Recreation use (e.g., swimming, waterskiing, boating, sailing, sunbathing) was assessed for 162 lakes and reservoirs in the state totaling 599,725 acres. Of this total, four (4) lakes, representing 6,308 acres, were assessed as not supporting use for recreation (Table V-6). The primary cause of use impairment is excessive nutrient loading, which results in nuisance algal blooms and noxious aquatic plant growth (Table V-7). Sources of nutrients causing algal blooms and weed growth were described earlier (Table V-8).

One-hundred-twenty-one (121) lakes and reservoirs totaling 575,675 acres were assessed as fully supporting recreation use. An additional 37 lakes and reservoirs totaling 17,741 acres were assessed as fully supporting, but threatened (Table V-6). Nutrient loading is also linked to the negative water quality trends these lakes are experiencing. If left unchecked, these lakes will degrade to the point where frequent algal blooms and/or excessive weed growth will negatively affect recreation.

One-hundred and ninety-nine (199) classified lakes and reservoirs, representing 620,850 acres, were assigned the use for fish consumption (Table V-6). One (1) lake, Lake George located in Kidder County, is a class 5 lake which is defined as "not capable of supporting a fishery due to high salinity." Of the 199 lakes and reservoirs entered into the ADB and assigned a use for fish consumption, only Devils Lake, Lake Sakakawea, Lake Oahe, Lake Tschida, and Nelson Lake had sufficient methyl-mercury fish tissue data and fish population survey data necessary to calculate average concentrations and to assess fish consumption use. Based on these data and the EPA recommended fish tissue criterion for methylmercury of 0.3 µg/g, Lake Sakakawea, Devils Lake, and Lake Tschida were assessed as not supporting fish consumption use, while Lake Oahe and Nelson Lake were assessed as fully supporting fish consumption use (Table V-6). The remaining 194 lakes and reservoirs that support a sport fishery were not assessed for this report.

Sources of methyl-mercury in fish remain largely unknown. Potential sources of mercury include natural sources and atmospheric deposition. Results of a report prepared by the department show an increase in mercury concentrations in the fillets of walleye, northern pike and chinook salmon in Lake Sakakawea following the drought and recent filling of the lake (Pearson et al., 1997). One possible reason for the higher mercury concentrations in fish is that the lake may be experiencing an increase in the rate of mercury methylization due to greater amounts of organic matter in the lake following flooding. The drought of the late 1980s and early 1990s lowered the lake level, allowing vast areas of dry lake bed to re-vegetate. When the lake began refilling in 1993, the vegetation was flooded and began decomposing. The organic matter provided to the lake during this period is thought to have favored the methylization process. This is a microbial process whereby bacteria present in the lake convert elemental mercury to its more bioavailable methyl-mercury form. The increase in bioavailable mercury in the lake is reflected in higher mercury concentrations in fish.

One-hundred and ninety-five (194) lakes and reservoirs, representing 620,850 acres were assigned the use for municipal drinking water supply. Of these, 5 reservoirs (Lake Sakakawea, Lake Ashtabula, Homme Dam, Bisbee Dam and Mt. Carmel Reservoir) are currently used either directly or indirectly as municipal drinking water supplies, while two others (Patterson Lake and Renwick Dam) serve as back-up water supplies in the event the primary water supplies should fail. Homme Dam, Mt. Carmel Reservoir and Lake Sakakawea were assessed as fully supporting drinking water supply use (Table V-6). Municipal drinking water supply use was not assessed for Lakes Ashtabula, Bisbee Dam, Patterson Lake, Renwick Dam or for the other 187 classified lakes and reservoirs which are assigned a drinking water supply use.

Table V-8. Impairment Source Summary for Lakes and Reservoirs in North Dakota.

Source	Acres
Source Unknown (Associated with Mercury in Fish)	443,915.5
Crop Production (Dryland)	24,340.2
Internal Nutrient Recycling	21,806.3
Riparian Grazing	14,495.5
Animal Feeding and Handling Operations	13,881.4
On-site Treatment Systems (Septic Systems)	9,882.2
Rangeland/Pastureland Grazing	8,073.9
Wetland Loss (Drainage/Filling)	8,046.3
Anoxia Due to Thermal Stratification/Eutrophication	6,445.0
Sediment Resuspension	2,141.6
Upstream Impoundments	2,073.4
Streambank Modification	392.5
Loss of Riparian Habitat	194.0
Stormwater Runoff	100.1
Land Application of Biosolids/Septage Disposal	55.2
Flow Alteration for Water Diversion	36.8
Highway and Road Runoff	36.8

Chapter 3. Trophic Status

When sufficient data were available, all reservoirs and natural lakes were assessed for trophic status, these included lakes not specifically classified in the state's water quality standards, but were included in the ADB database. For purposes of this report, "trophic status" refers to the present condition or measure of eutrophication of the waterbody at the time of the assessment.

Accurate trophic status assessments are essential to making sound management decisions. In order to minimize errors in classification, all existing chemical, physical, quantitative and qualitative data were used in making final trophic status assessments.

Because there are no TSIs specific to North Dakota waters, Carlson's TSI (Carlson, R. E. 1977, "A Trophic State Index for Lakes," *Limnology and Oceanography*, 22(2):361-369) was chosen as the initial method to describe a lake's or reservoir's trophic status. Carlson's TSI was selected because it is commonly used by limnologists and because it was developed for Minnesota, a state geographically close to North Dakota.

An attempt was made to gather enough chemical and ancillary data to group as many of North Dakota's 289 lakes/reservoirs into one of four trophic states (Table V-9). The four trophic states, in order of increasing productivity, are oligotrophic, mesotrophic, eutrophic and hypereutrophic. Adequate data was available to assess the trophic status of 168 of the 289 lakes and reservoirs entered into the ADB database. The majority of the state's assessed lakes and reservoirs range from mesotrophic to eutrophic. Twenty-nine (29) lakes and reservoirs were assessed as hypereutrophic. There were no lakes or reservoirs assessed as oligotrophic in the state.

Table V-9. Trophic Status Summary for Lakes and Reservoirs in North Dakota.

Trophic Status	Number of Lakes	Acreage of Lakes
Oligotrophic	0	0.0
Mesotrophic	52	444,297.6
Eutrophic	87	156,800.2
Hypereutrophic	29	14,557.5
Not Assessed	121	97,603.4
Total Number of Lakes	289	766,337.0

Chapter 4. Control Methods

NPS pollution, particularly from agricultural lands and feedlots, is the main source of pollutants leading to the degradation of the state's lakes and reservoirs. North Dakota's Section 319 NPS Pollution Management Program is very active in reducing agricultural NPS pollution (see Part III. C. Chapter 3. “NPS Pollution Management Program”). This program has kept thousands of tons of soil, along with attached contaminants, out of the state's lakes and reservoirs.

Currently, the Section 319 NPS Pollution Management Program is providing cost-sharing for five (5) watershed restoration projects that have a direct impact on lakes or reservoirs in the state. These include Dead Colt Creek Dam, Northgate Dam, Short Creek Dam, Powers Lake and Brewer Lake. These projects treat entire watersheds through the promotion of sustainable agricultural and sound land management practices. Landowner participation is voluntary, with incentives provided by cost-share programs.

Point source pollution has the potential to severely impact individual lakes and reservoirs and is the second largest pollution problem. Protection of lakes and reservoirs from point source discharges is accomplished through the NDPDES Program (see Part III. C. Chapter 2. “Point Source Control Program”). While the NDPDES Program is thought of as regulating only industrial and municipal discharges, permits also are required for stormwater discharges and large animal feeding operations.

Chapter 5. Restoration/Rehabilitation Efforts

The primary intent of the Section 319 NPS Pollution Management Program is to control NPS pollution to lakes and reservoirs on a watershed scale. This program is complemented by the North Dakota Game and Fish Department’s “Save Our Lakes” program. The main goal of the “Save Our Lakes” program is “to enhance and restore North Dakota’s aquatic habitat resources in order to protect the fishery of North Dakota.” In general, this encompasses shoreline enhancement projects, sediment dam installation, sediment removal, grass and tree plantings, cross fencing, alternate water sources, the installation of passive low water draw-downs, cost-share assistance for animal waste management systems and the establishment of exclusion areas in riparian corridors.

Chapter 6. Acid Effects on Lakes and Reservoirs

Acid precipitation and acid mine drainage pose significant threats to some of the nation's lakes and streams. Most surface waters in North Dakota are naturally alkaline ($pH>7$), while rainfall is naturally acidic ($pH<7$). Surface waters are able to resist acidification by what is termed “buffering capacity.” In surface waters, buffering capacity is maintained largely by the carbonate (CO_3^{-2}) and bicarbonate (HCO_3^{-1}) ions in solution. These ions are collectively measured with hydroxide ions (OH^{-1}) as total alkalinity. Acidification in surface waters occurs when the buffering capacity is exhausted, thus causing a reduction in pH. North Dakota's lakes are highly alkaline and, as a result, do not show acidity caused by anthropogenic sources.

Chapter 7. Toxic Effects on Lakes and Reservoirs

Currently, mercury is the only contaminant assessed as causing lake and reservoir use impairment. As stated previously, elevated mercury concentrations in the tissues of fish have resulted in site-specific consumption advisories for Devils Lake, Lake Sakakawea and Lake Oahe and a general fish consumption advisory for all lakes and reservoirs in the state. Again, very little is known about the source of the mercury contamination in fish from these lakes. It is likely, however, that sources are both natural and anthropogenic.

C. Wetlands Assessment Program

Chapter 1. Background

Wetlands have long been regarded as nuisance areas or wastelands which only serve to impede agriculture, urban or transportation development. It is only recently that the ecological and social functions and values of wetlands been realized. It is now scientifically proven that wetlands are important for the storage of flood waters, for providing fish and wildlife habitat, for recharging ground water and for retaining and cycling chemical pollutants and particulates. Recently, wetlands have been recognized as a significant source for carbon sequestration. This could make wetlands an important component in the campaign to prevent global warming.

While these are important wetland functions, probably the best known function of wetlands in North Dakota is that of waterfowl production. Most of North Dakota's remaining wetlands are located in an area known as the Prairie Pothole Region. This area extends from the Missouri Coteau in central North Dakota eastward to the glacial Lake Agassiz Plain, also known as the Red River Valley. The region covers roughly 300,000 square miles and exists as a wide band extending from central Alberta southwest into northwestern Iowa (Figure V-1). The Prairie Pothole Region, with its many types of wetlands, is arguably the most biologically diverse and productive habitat in North America.

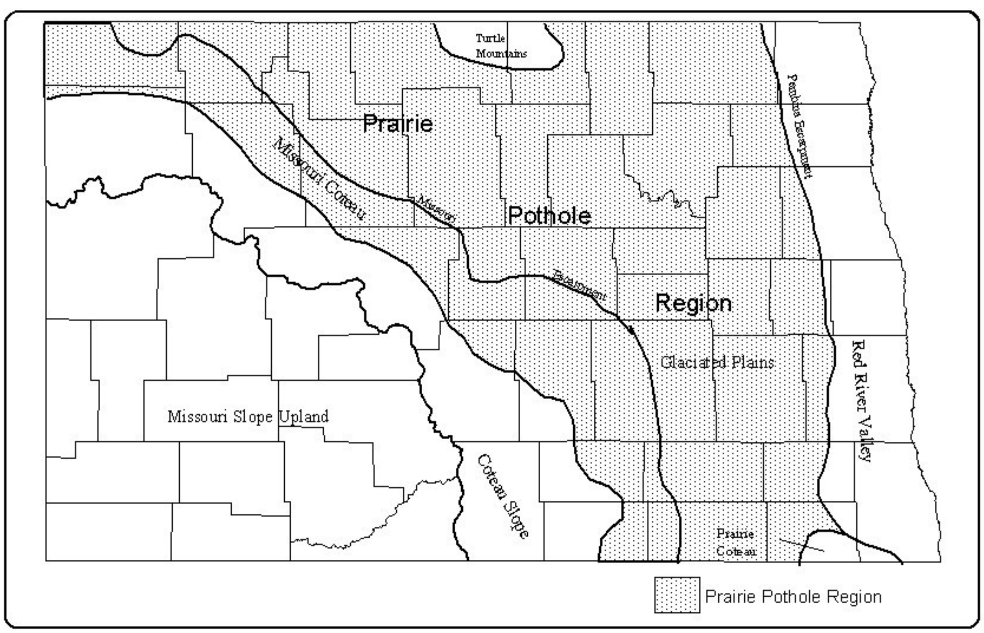

Figure V-1. Prairie Pothole Region.

Chapter 2. Extent of Wetland Resources

There seem to be as many ways to classify wetlands as there are wetlands themselves. The U. S. Fish and Wildlife Service first began to classify wetlands based on a system developed by Martin et al. (1953). This classification system was then modified by Stewart and Kantrud (1971), specifically for the Prairie Pothole Region of North America. With the Stewart and Kantrud classification system, vegetational zones are described in detail, along with the plant species most commonly found in the zone. These zones are used to identify phases which indicate the wetland's water regime or disturbed bottom soil (e.g., cropland tillage). Seven wetland classes are identified with the Stewart and Kantrud system. These include the familiar Class I - ephemeral ponds, Class II - temporary ponds, Class III - seasonal ponds and lakes, Class IV - semi-permanent ponds and lakes, and Class V -permanent ponds and lakes. Also included in the Stewart and Kantrud system are Class VI - alkali ponds and lakes, and Class VII - fens. Along with each class, there are five subclasses, A through E, based on variations in surface water salinity. Those familiar with the Stewart and Kantrud classification system refer to temporary depressional wetlands as Class II wetlands, seasonal wetlands as Class III wetlands and semi-permanent wetlands as Class IV.

In 1979, the U.S. Fish and Wildlife Service adopted the Cowardin et al. (1979) classification system for wetlands and deep water habitats of the United States. The Cowardin et al. classification system was developed to be used with the National Wetlands Inventory. In the highest level of classification, wetlands are grouped into five ecological systems: palustrine, lacustrine, riverine, estuarine and marine. The palustrine class includes only wetlands, whereas each of the four other systems includes wetlands and associated deep-water habitats. For purposes of classification, deep-water habitats are defined as areas where water is greater than 6.6 feet deep. In North Dakota, only the palustrine, lacustrine and riverine wetland types exist.

Brinson (1993) developed a classification system for use by the U.S. Army Corps of Engineers. This classification system, termed the Hydrogeomorphic (HGM) classification system, is based upon the wetland's position in the landscape (i.e., geomorphic setting), dominant source of water and the flow and fluctuation of water in the wetland. Brinson (1993) describes seven HGM wetland classes: riverine, depressional, slope, mineral soil flats, organic soil flats, estuarine fringe and lacustrine fringe.

In North Dakota, wetlands are classified into four broad categories according to the State Engineer's drainage rules. The state wetland classification includes temporary wetlands, seasonal wetlands, semi-permanent wetlands and permanent wetlands. The following are brief descriptions of each wetland class, as adopted by the North Dakota State Game and Fish Director and the State Engineer.

"Temporary wetlands" are shallow depressions which hold water or are waterlogged from spring runoff until early June. In years with normal runoff and precipitation, these areas may be tilled for crop production. In years with high runoff or heavy spring rain, these areas may not dry out until mid-July. They cannot be tilled, but may be used for hayland or pasture. Temporary wetlands frequently reflood during heavy summer and fall rains. Sheet water, as defined in North Dakota's Century Code 61-32-02, does not fall under the temporary wetland classification.

“Seasonal wetlands” are depressions, which normally hold water from spring runoff until mid-July. In years with normal runoff and precipitation, these wetlands cannot be tilled but may be used for hayland and pasture. In low runoff or dry years, these areas may be tilled for crop production but commonly reflood with heavy summer and fall rains.

“Semi-permanent wetlands” are located in well-defined depressions or basins. In normal years, these areas hold water throughout the summer. Semi-permanent wetlands generally become dry only in years of below normal runoff and precipitation. Freshwater semi-permanent wetlands (commonly called cattail sloughs) are characterized by a predominance of cattail and bulrush vegetation in scattered areas of open water. Saline semi-permanent wetlands have a preponderance of alkali bulrush in scattered areas of open water.

“Permanent wetlands” are located in well-defined basins which characteristically hold water throughout the year. The wetlands become dry only after successive years of below normal runoff and precipitation. Freshwater permanent wetlands typically have a border of aquatic vegetation and predominant open-water areas in the interior. Saline permanent wetlands are typically devoid of emergent vegetation and exhibit a white, salt-encrusted shoreline.

Currently, there are no accurate estimates of state wetland acreage based on wetland class. Statewide, it is estimated there are approximately 2.5 million acres of wetlands. When compared to the approximately 4.9 million acres of wetlands which covered North Dakota prior to development, this represents a 49 percent reduction in wetlands. Stewart and Kantrud (1973) divided the state into four biotic regions: the Prairie Pothole Region, the Lake Agassiz Plain Region, the Coteau Slope Region and the Southwestern Slope Region. They estimated that 81 percent of the wetlands in the state are located in the Prairie Pothole Region. More than 90 percent of all wetlands in the state are considered natural basin wetlands, commonly referred to as prairie potholes. Furthermore, it is estimated that 78 to 79 percent of wetland basins in the Prairie Pothole Region are less than one acre in size (Ron Reynolds, personal communication). While the rate of wetland loss in the state seems to be decreasing, it is safe to assume that wetland losses still exceed wetland gains.

Chapter 3. Integrity of Wetland Resources

Wetland integrity should be thought of in terms of whether a wetland performs a set of functions or uses which would be expected for natural or "reference" wetlands of a similar class or type. The USDA NRCS and the U.S. Army Corps of Engineers have described 11 specific functions within three general functional categories for temporary and seasonal Prairie Pothole wetlands (Lee et al., 1997) (Table V-10). Therefore, whenever a wetland's function is diminished, it can be said that wetland integrity is diminished.

Hydrologic manipulation (e.g., drainage, wetland consolidation, channelization, filling) continues to be the greatest impact on the integrity of the state's wetlands. While not as dramatic, other factors such as chemical contamination, nutrient loading (i.e., eutrophication) and sedimentation can also affect a wetland's function and, therefore, its chemical, physical and biological integrity.

Landscape level changes outside the edge of the wetland basin can also negatively affect wetland integrity. Changes to the landscape, such as road construction, cropland conversion, urbanization or the drainage of adjacent wetlands, all affect wetland functions. Cowardin et al. (1981) found 40 percent of wetlands were cultivated to the wetland edge, 33 percent were in pasture and 7 percent were hayed within a 3,877-square-mile area of the Prairie Pothole Region.

When viewed on a larger scale, wetlands are part of a larger unit known as a wetland complex. Wetland complexes are aggregates of individual wetland basins which are hydrologically connected. A typical wetland complex includes recharge wetlands, flow-through wetlands and discharge wetlands. Recharge wetlands are typically located at higher elevations in the landscape and receive the majority of their hydrologic budgets from precipitation and surface runoff. Recharge wetlands get their name because they recharge ground water. Flow-through wetlands, as their name implies, receive surface- and ground-water inflow and then outflow to both surface and ground water. Discharge wetlands receive the majority of their hydrologic budgets from ground-water discharge and rarely outflow to surface water. Because recharge wetlands receive most of their water through precipitation and surface-water inflow, they tend to be fresher. Discharge wetlands, which receive most of their water from ground water, tend to be higher in total dissolved solids.

Due to this hydraulic linkage in the landscape, any land use change which affects or changes the hydrologic relationship of wetlands in the complex can and will affect the hydrologic or physical integrity of each wetland basin in the complex. This, in turn, affects both the chemical and biological integrity of wetlands in the complex.

Table V-10. Definitions of Functions for Temporary and Seasonal Prairie Pothole Wetlands (Lee et al., 1997).

Physical/Hydrologic Functions
Maintenance of Static Surface Water Storage. The capacity of the wetland to maintain a hydrologic regime that supports static storage, soil moisture in the unsaturated zone and ground water interactions. **Maintenance of Dynamic Surface Water Storage**. The capacity of the wetland to maintain a hydrologic regime that supports dynamic storage, soil moisture in the unsaturated zone and ground water interactions. **Retention of Particulates**. Deposition and retention of inorganic and organic particulates (>0.45 Φm) from the water column, primarily through physical processes.
Biogeochemical Functions
Elemental Cycling. Short- and long-term cycling of elements and compounds on-site through the abiotic and biotic processes that convert elements (e.g., nutrients and metals) from one form to another; primarily recycling processes. **Removal of Imported Elements and Compounds**. Nutrients, contaminants, and other elements and compounds imported to the wetland that are removed from cycling processes.
Biotic and Habitat Functions
Maintenance of Characteristic Plant Community. Characteristic plant communities not dominated by non-native or nuisance species. Vegetation is maintained by mechanisms, such as seed dispersal, seed banks and vegetative propagation which respond to variations in hydrology and disturbances, such as fire and herbivores. The emphasis is on the temporal dynamics and structure of the plant community as revealed by species composition and abundance. **Maintenance of Habitat Structure Within Wetland**. Soil, vegetation and other aspects of ecosystem structure within a wetland required by animals for feeding, cover and reproduction. **Maintenance of Food Webs Within Wetland**. The production of organic matter of sufficient quantity and quality to support energy requirements of characteristic food webs within a wetland. **Maintenance of Habitat Interspersion and Connectivity Among Wetland**. The spatial distribution of an individual wetland in reference to adjacent wetlands within the complex. **Maintenance of Taxa Richness of Invertebrates**. The capacity of a wetland to maintain characteristic taxa richness of aquatic and terrestrial invertebrates. **Maintenance of Distribution and Abundance of Vertebrates.** The capacity of a wetland to maintain characteristic density and spatial distribution of vertebrates (aquatic, semi-aquatic and terrestrial) that utilize wetlands for food, cover and reproduction.

Chapter 4. Wetland Water Quality Standards

As the lead water quality agency in the state, the department is responsible for developing and implementing water quality standards. In general, the *State Water Quality Standards* (NDDoH, 2014) are regulations which specify the beneficial uses of lakes, reservoirs, rivers and streams in North Dakota. The standards include narrative descriptions, numeric criteria and an antidegradation policy to protect beneficial uses. Common beneficial uses for the state's lakes and rivers are recreation (e.g., swimming, wading, boating, skiing), fishing, drinking water supply and aquatic life. Agriculture (i.e., stock watering and irrigation) and industrial uses for water are also recognized.

The *State Water Quality Standards* already include wetlands in the state's definition of waters of the state. However, beneficial uses have not yet been assigned to wetlands, nor have numeric limits been assigned to protect those uses. Wetlands have been provided some water quality protection by applying North Dakota's narrative standards to wetlands. These narrative standards, also known as the "free from" standards, prohibit the disposal of garbage, oil or any toxic pollutant to wetlands.

Chapter 5. Wetland Monitoring and Assessment Program

Wetlands are often ignored in state water quality monitoring and assessment programs. However, with more than 2.5 million acres of wetlands in the state, the department believes wetland monitoring and assessment should be an important component of its overall water quality monitoring and assessment strategy. The primary objectives of the Wetland Monitoring and Assessment Program are to develop biological indicators and assessment methodologies for wetlands and to use those indicators and methods to monitor and assess wetland condition at varying spatial scales (e.g.,. individual wetland, wetland complex, watershed, ecoregion). Secondary objectives of the Wetland Monitoring and Assessment Program are to: 1) refine and apply these methods to evaluate the effectiveness of wetland mitigation and restoration programs and projects; and 2) support the development of water quality standards for wetlands.

EPA recommends wetland assessment projects use the three tiered approach in the form of landscape assessment (level I), rapid assessment (level II), and intense assessment (level III) (EPA, 2006, Kentula, 2007). Recent studies have successfully used this methodology to determine wetland health (Brooks et al. 2004, Wardrop et al. 2007). Each level of assessment provides the resource manager with wetland condition information with varying levels of accuracy. Since most level I assessment methods are larger scale landscape assessments based on remote sensing data (Phillips et al. 2005, Mita et al. 2007, Wardrop et al. 2007), they are considered the least accurate. They also require fewer resources and are generally less costly to implement. Once developed, level I assessments, using remote sensing, require no field work and can be done from an office. These assessments are typically general assessments, intending to give the surveyor a first glimpse into the landscape condition of wetlands in an area.

Level III assessment methods, on the other hand, are considered the most accurate since they require field data collection at the wetland scale. Level III assessment methods are also resource intensive and quite costly to implement.

Recent efforts to establish level II wetland assessment methods have come in the form of rapid assessments (Mack et al. 2001, Collins et al. 2008). Rapid assessment methods are less time and financially intensive than level III methods utilizing IBI's; however, the information is less detailed. Rapid assessments can be used where level III surveys are not possible or too expensive to conduct.   Rapid assessments are meant to give a rapid on the ground assessment of wetland condition, and identify possible stressors to the biotic communities.

Since the early 1990's the department has been active in the development of wetland monitoring methods and sampling designs to assess the quality (i.e., biological integrity) wetland resources across the state. In particular, the department has developed an active research program in collaboration with academic partners at North Dakota State University and the University of North Dakota to monitor and assess wetlands.

Working in collaboration with its academic partners, the department now has available assessment methods for each level of wetland assessment. The following is a brief description of methods which have been developed for each level of wetland assessment.

Level III Assessment

Since it's beginning, the key to the development of the department's Wetland Monitoring and Assessment Program has been the development of biological indicators which can be used as a level III wetland assessment tool for assessing the ecological condition of wetlands. While the development of widely applicable and robust indicators for macroinvertebrates has met with limited success, the development of an index of biological integrity (IBI) for wetland plants has been extremely successful.

DeKeyser et al. (2003) developed an IBI for seasonal wetlands in the Prairie Pothole Region (PPR) that is termed the Index of Plant Community Integrity (IPCI). An IPCI was also developed to quantitatively assess the condition of temporary and semi-permanent wetlands of the Northwestern Glaciated Plains (NWGP) ecoregion of North Dakota (DeKeyser 2000, Kirby and DeKeyser 2003).

The IPCI for temporary, seasonal, and semi-permanent wetlands was further evaluated over a wider variety of disturbances and a larger geographic area including sites in the Northern Glaciated Plains (NGP) and sites in other sub-ecoregions of the NWGP in northeastern Montana and North and South Dakota (Hargiss 2005, Hargiss et al. 2008). These IBIs can now be applied in level III assessments throughout the Northern Glaciated Plains and Northwestern Glaciated Plains ecoregions of North Dakota, South Dakota, and Montana.

Level II Assessment

The level II, North Dakota Rapid Assessment Method (NDRAM), was developed by researchers at North Dakota State University for the Missouri River Coteau Regional Wetland Assessment Pilot Project (see below) (Hargiss 2009). The NDRAM incorporates metrics from other rapid assessment methods for wetlands currently being used around the nation, as well as characteristics specific to the Prairie Pothole Region (Mack 2001, Collins et al. 2008). The NDRAM assesses the three factors needed for a site to be considered a wetland: hydrology; hydric soils; and hydric vegetation (Tiner 1999). It takes into account physical and biological characteristics of a site, as well as stressors affecting the site.

The NDRAM can be used to predict wetland condition using a rapid process for temporary, seasonal, or semi-permanent wetlands and is completed with a general walking survey. The NDRAM is conducted by walking around the wetland observing the vegetation, land use, management, and hydrologic features. This information is then used to complete the NDRAM field form.

The first step to completing the NDRAM involves filling out a general site description, land owner and land use information, amount and type of cover, and filling out a site map. This information may be useful during return visits to the site to determine trends and changes at the site. The portion of the NDRAM used to determine the final score utilizes a three metrics system. The three metrics used are: 1) buffers and surrounding land use; 2) hydrology, habitat alteration, and development; and 3) vegetation. Metric 1 is worth 20 points and includes two parts: 1a) average buffer width; and 1b) intensity of surrounding land use. Metric 1a calculates the average buffer on a scale from 0 to 10 points ranging from very narrow (<10 meters wide around the wetland) to wide (50 meters or more). Metric 1b assesses the intensity of surrounding land use on a scale from 0 to 10 points ranging from high (urban area or row crop) or very low (native prairie and/or light to moderate grazing).

Metric 2, which assesses hydrology, habitat alteration, and development, is worth a total of 57 points, and includes 6 sections: 2a) substrate/soil disturbance; 2b) plant community and habitat development; 2c) habitat alteration and recovery from current and past disturbance; 2d) management; 2e) modifications to natural hydrologic regime; and 2f) potential of wetland to reach reference (native) condition for the area. Metric 2a is worth a potential 7 points and asks the rater to assess the soil/substrate disturbance on a scale from undisturbed to recent or no recovery. Metric 2b is potentially worth 12 points and assesses the plant community and habitat development on a scale from poor to excellent. Metric 2c assesses habitat alteration and recovery on a scale from most suitable to recent or no recovery and is worth a potential 10 points. Metric 2d assesses the management techniques used at a site and is worth 4 points. Management techniques are rated on a gradient starting with cropped sites as the 0 points valued, restored, CRP, idle, or hayed areas at the 2 point level and burned or moderately grazed areas at the 4 point level. Metric 2e assesses modifications that have occurred within the wetland basin. It is worth a potential 12 points and rates sites on a scale from no modifications to recent or no recovery. Metric 2f assesses the potential of a wetland for a potential 12 points on a scale from no potential to excellent potential.

Metric 3 assesses the vegetation of a site, is worth a potential 23 points and encompasses two parts: 3a) invasive species; and 3b) overall condition. Metric 3a has a potential three points possible for a site absent of invasive species, but it is possible for a site to lose 3 points if invasives are extensive (covering >75% aerial cover). Metric 3b is worth a potential 20 points and rates sites on a condition gradient from very poor to very good.

Scores for each metric are added to produce a total score between 0 and 100. A score of 0 is indicative of a site in very poor condition, while a score of 100 indicates a native condition reference site.

Level I Assessment

While an IBI approach to wetland assessment using the IPCI can provide very precise information on the biological condition of individual wetlands or populations of wetlands within regions (e.g., watersheds or ecoregions), it does require the use of personnel skilled in wetland plant identification and can be costly to implement, especially on large regional scales. In order to find a wetland assessment method that is less costly to implement, the department has also collaborated with NDSU's Soil Sciences Department to develop a regional-scale wetland assessment methodology using satellite remotely sensed data and GIS tools. This approach was developed by assembling calibration and verification IPCI data from wetlands sampled previously and by using multi-spectral Landsat Thematic Mapper ™ and Enhanced Thematic Mapper (ETM+) satellite data. The result, termed the Landscape Wetland Condition Assessment Model (LWCAM) is used to predict wetland condition through the use of GIS software (Mita et al. 2007).

The LWCAM uses LANDSAT TM and ETM+ satellite data as a means of classifying, mapping, and quantifying landscape land cover components. Wetlands are assessed as a data point representing a single landscape. A 0.283 km^2 (300m radius extent) buffer is delineated from the center of each wetland. Landscape characteristics (i.e., metrics) are then analyzed within this buffer. A three-year temporal-scale analysis (e.g., 2002, 2003, 2004 map years) is generally selected to allow for the comparison of different wetland landscapes or the same landscape model at different times. Landscape pattern metrics are derived from land cover components within the landscape extent using the ArcView-for-FRAGSTAT program.

LWCAM data are analyzed according to the system used by Mita et al. (2007). The landscape metrics are quantified in terms of the individual patches, classes (specific land cover), and the landscape unit as a whole. Metric values at the class level are computed by summing and averaging over all patches of the same type, while landscape level metrics are summarized from class level information. Based on the metrics, wetlands were grouped according to condition of Good, Intermediate, and Poor. Intermediate wetlands are further separated into trending towards Good or trending towards Poor based on habitat fragmentation characteristics.

Regional Scale Wetland Assessment Pilot Project

In March 2008, the department received a Section 104(b)(3) Wetland Protection Grant to implement Phase III of a regional wetland condition assessment for the Missouri Coteau ecoregion. Estimating the wetland quality for the Missouri Coteau ecoregion within North Dakota was conducted as a three phase process: Phase I = Reconnaissance; Phase II = Field Survey; and Phase III = Data Entry and Analysis. Phase I entailed compiling a GIS database for a section of the Missouri Coteau (Figure V-2) which is approximately 2,500 km2. The database includes orthophotos and National Wetland Inventory (NWI) layers, and includes a layer in which a random set of points have been placed on the landscape utilizing a probabilistic sample design. Further, around each point a 750m X 750m quadrat was formed as a sample area. Quadrat locations were visually identified during the process of obtaining landowner permission. Standard operating procedures for Phase II of this project were drafted, tested, and refined on 7 of the quadrats. Also, initial development of a rapid assessment method needed in Phase II was accomplished during this time period. The prediction of the wetland plant community condition on the wetlands located in each of the quadrats using the Landscape Level Wetland Condition Assessment and Monitoring (LWAM) Model was completed.

The field survey phase (Phase II) of this project entailed assessing 255 seasonal wetlands with the North Dakota Rapid Assessment (NDRAM), the Hydrogeomorphic (HGM) Model method, and the Index of Plant Community Integrity (IPCI) method. An additional 719 wetlands were surveyed utilizing the NDRAM. Each wetland was mapped using a GPS unit and pictures were taken. The majority of time during Phase II of the study was spent assessing wetlands in the field. Data was organized and entered into databases developed at North Dakota State University (NDSU). During this same time period, researchers from the United State Department of Agriculture (USDA), Agricultural Research Service (ARS), and the University of North Dakota (UND) were conducting field analysis of landscape level assessment methods of not only the wetland plant communities, but also hydrologic aspects.

The final phase of this project (Phase III) has been completed and the results are available in a report entitled *Estimating Wetland Quality for the Missouri Coteau Ecoregion in North Dakota* (Dekeyser et al., 2009) focused on data analysis and reporting. Data obtained from the LWCAM, IPCI, HGM, and NDRAM models were analyzed utilizing relevant statistical methods such as analysis of variance, multivariate analysis, and structural equation modeling. The products of this analysis were, but not limited to: 1) a measure of the capability, variability, and reliability of the landscape and rapid methods as compared to the IPCI method to estimate wetland plant community condition; 2) identification of those HGM environmental variables most effecting wetland plant community composition; 3) determination of sample size needed utilizing a probabilistic design to effectively estimate wetland condition for large areas within an ecoregion; 4) an estimate of wetland acres based on plant community characteristics within the surveyed area; 5) an estimate of the condition of the wetland plant communities of the surveyed area; and 6) a repeatable tool for the state of North Dakota to accurately estimate wetland plant community condition on a regional basis within the Prairie Pothole Region (PPR).

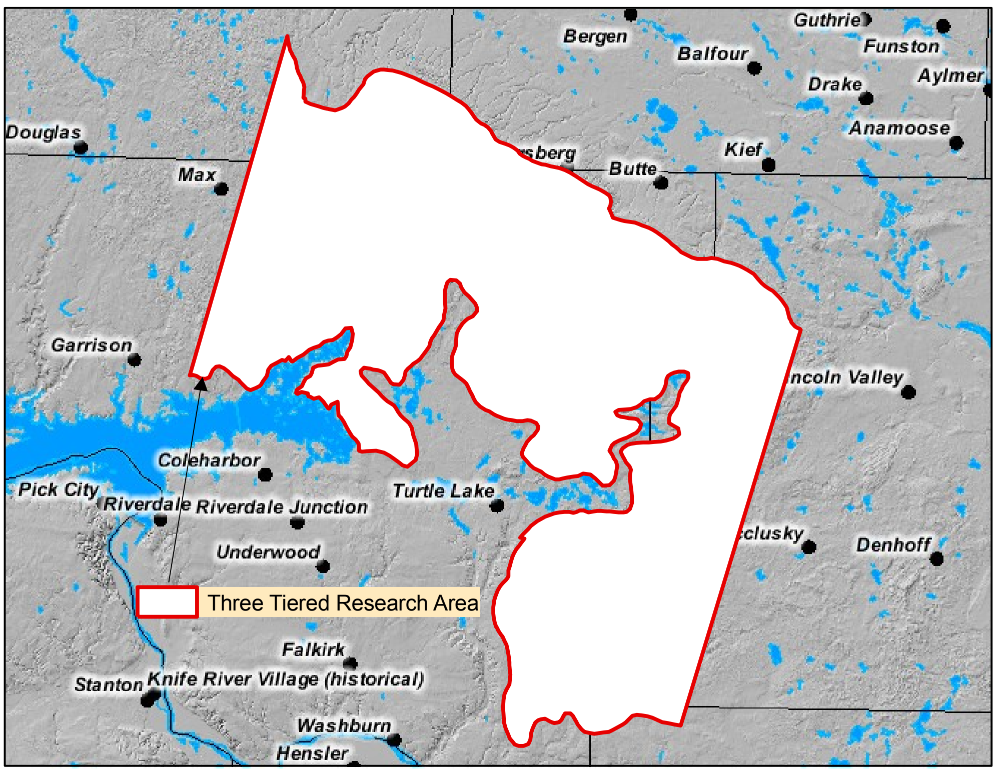

Figure V-2. Research Area Within the Missouri Coteau Ecoregion of North Dakota (outlined in red).

National Wetland Condition Assessment and State Intensification Project

In July 2011, the department completed sampling as part of the EPA-sponsored National Wetland Condition Assessment (NWCA). The NWCA is a probabilistic assessment of the condition of the nation's wetlands and is designed to:

- Determine the ecological integrity of wetlands at regional and national scales;
- Build state and tribal capacity for monitoring and analyses;
- Promote collaboration across jurisdictional boundaries;
- Achieve a robust, statistically-valid set of wetland data; and
- Develop baseline information to evaluate progress.

The NWCA is one in a series of water assessments being conducted by states, tribes, the EPA and other partners. In addition to wetlands, the water assessments will also focus on coastal waters, river and stream, and lakes in a five-year revolving sequence. The purpose of these assessments is to generate statistically valid reports on the condition of our nation's water resources and identify key stressors to these systems.

The goals of the NWCA are to:

1. Produce a national report that describes the quality of the nation's wetlands.
2. Help States and Tribes implement wetland monitoring and assessment programs to guide policy development and project decision-making.
3. Advance the science of wetlands monitoring and assessment.

The sampling design for the NWCA is a probability-based network that will provide statistically-valid estimates of ecological condition for a population of wetlands with known confidence. It is designed using modern survey techniques. Sample points are selected at random to represent the condition of wetlands across the country. The survey design was developed in partnership with the US FWS Wetlands Status and Trends Program.

When completed, the 2011 NWCA will provide the baseline for wetland quality in the United States and will build on the success of the US FWS Wetland Status and Trends (S&T) Report. Just as the S&T Report characterizes wetland acreage by category across the country, the NWCA will characterize wetland condition nationwide for many of the same wetland classes. When paired together, the two efforts will provide the public and government agencies with comparable, national information on wetland quantity and quality. The data will be an integrated evaluation of the cumulative effects of actions that either degrade wetlands or protect and restore their ecological condition.

Some of the key questions the NWCA should help answer include:

- What is the extent of wetland acreage that supports healthy ecosystems?
- How widespread are the most significant problems affecting wetland quality?
- What is the nature of gains and losses in wetlands acreage?

- What are the characteristics of wetlands soils and what services do they provide on the landscape?
- To what extent do buffers mitigate the effects of stressors on wetland condition?

D. Public Health/Aquatic Life Concerns

Examples of public health or aquatic life concerns include fishing advisories or bans, pollution-caused fish kills or abnormalities, known sediment contamination, discontinued use of drinking water supplies, closure of swimming areas or incidents of waterborne disease. Unlike many other states, North Dakota has had no reported incidents of drinking water supply restrictions or swimming beach closures for the reporting period 2013 to 2014.

Fish kills occur periodically in the lakes and rivers of the state. When they do occur, it is generally the result of low-water conditions, heavy snow cover or both. Because most fish kills occur during the winter, documenting their occurrence and extent is difficult. In most instances, the occurrence of fish kills is inferred through spring test netting by the North Dakota Game and Fish Department.

The primary public health concern in the state associated with lakes and streams in North Dakota is mercury contamination. In March 1991, the state issued its first fish consumption advisory for lakes and rivers. As new data are collected and analyzed, the department updates the consumption advisory. As stated previously, the consumption advisory for all rivers and lakes in the state is due to elevated concentrations of methyl-mercury in fish tissues. To date, no specific source of mercury contamination has been identified.

PART VI. NORTH DAKOTA SECTION 303(d) LIST OF WATER QUALITY-LIMITED WATERS NEEDING TMDLs

A. Background

Section 303(d) of the CWA and its accompanying regulations (CFR Part 130, Section 7) require each state to list waterbodies (i.e., lakes, reservoirs, rivers, streams and wetlands) that are considered water quality limited and require load allocations, waste load allocations and total maximum daily loads (TMDLs). This list has become known as the "TMDL list" or "Section 303(d) list."

A waterbody is considered water quality limited when it is known that its water quality does not or is not expected to meet applicable standards. Waterbodies can be water quality limited due to point source pollution, NPS pollution or both.

In considering whether or not applicable water quality standards are being met, the state should consider not only the narrative and numeric criteria set forth in the standards but also the classified uses defined for the waterbody and whether the uses are fully supported or not supported due to any pollutant source or cause. Therefore, a waterbody could be considered water quality limited when it can be demonstrated that a beneficial use (e.g., aquatic life or recreation) is impaired, even when there are no demonstrated exceedances of either the narrative or numeric criteria. In cases where there is a use impairment but no exceedance of the numeric standard, the state should provide information as to the cause of the impairment. Where the specific pollutant (e.g., copper or phosphorus) is unknown, a general cause category (e.g., metals or nutrients) should be included with the waterbody listing.

Section 303(d) and accompanying EPA regulations and policy require only impaired and threatened waterbodies to be listed, and TMDLs are developed when the source of impairment is a pollutant. Pollution, by federal and state definition, is "any man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water." Based on the definition of a pollutant provided in Section 502(6) of the CWA and in 40 CFR 130.2(d), pollutants would include temperature, ammonia, chlorine, organic compounds, pesticides, trace elements, nutrients, biochemical oxygen demand (BOD), sediment and pathogens. Waterbodies impaired by habitat and flow alteration and the introduction of exotic species would not be included in the Section 303(d) TMDL list, as these impairment categories would be considered pollution and not pollutants. In other words, all pollutants are pollution, but not all pollution is a pollutant.

Where a waterbody is water quality limited, the state is required to determine in a reasonable time frame the reduction in pollutant loading necessary for that waterbody to meet water quality standards, including its beneficial uses. The process by which the pollutant-loading capacity of a waterbody is determined and the load is allocated to point and nonpoint sources is called a total maximum daily load (TMDL). While the term "total maximum daily load" implies that loading capacity is determined on a daily time scale, TMDLs can range from meeting an instantaneous concentration (i.e., an acute standard) to computing an acceptable annual phosphorus load for a lake or reservoir.

Section 303(d) requires states to submit their lists of water quality-limited waterbodies "from time to time." Federal regulations have clarified this language; therefore, beginning in 1992 and by April 1 of every even-numbered year thereafter, states are required to submit a revised list of waters needing TMDLs. North Dakota's 2012 TMDL list was submitted to EPA in May 2012 and was approved on October 29, 2012. This 2014 Section 303(d) list includes waterbodies not meeting water quality standards, waterbodies needing TMDLs and waterbodies that have been removed from the 2012 list. Reasons for removing a waterbody from the 2012 list include: (1) a TMDL was completed for the waterbody/pollutant combination; (2) the applicable water quality standard is now attained and/or the original basis for the listing was incorrect; (3) the applicable water quality standard is now attained due to a change in the water quality standard and/or assessment methodology; (4) the applicable water quality standard is now attained due to restoration activities; or (5) sufficient data and/or information is lacking to determine water quality status and/or the original basis for listing was incorrect.

Along with the TMDL list, states are required to provide documentation to the EPA Regional Administrator in support of the state's decision to list or not list waterbodies. Information supporting North Dakota's 2014 TMDL list is provided in Part IV. B. "Assessment Methodology." At a minimum, a state's supporting information should include: (1) a description of the methodology used to develop the list; (2) a description of the data and information used to develop the list; (3) the rationale for any decision to not use this information; (4) the rationale for removing waterbodies previously listed as water quality limited; and (5) a summary of comments received on the list during the state's public comment period.

Following opportunity for public comment, the state must submit its list to the EPA Regional Administrator. The EPA Regional Administrator then has 30 days to either approve or reject the listings. If the EPA Regional Administrator rejects a state submittal, EPA has 30 days to develop a list for the state. This list also is required to undergo public comment prior to finalization.

B. Prioritization of TMDL-Listed Waters

When a state prepares its list of water quality-limited waterbodies, it is required to prioritize waterbodies for TMDL development and to identify those "High" priority waterbodies that will be targeted for TMDL development within the next two to four years. Factors to be considered when prioritizing waterbodies for TMDL development include: (1) the severity of pollution and the uses which are impaired; (2) the degree of public interest or support for the TMDL, including the likelihood of implementation of the TMDL; (3) recreational, aesthetic and economic importance of the waterbody; (4) the vulnerability or fragility of a particular waterbody as an aquatic habitat, including the presence of threatened or endangered species; (5) immediate programmatic needs, such as waste load allocations needed for permit decisions or load allocations for Section 319 NPS project implementation plans; and (6) national policies and priorities identified by EPA.

After considering each of the six factors, the state has developed a two-tiered priority ranking. Assessment units (AUs) listed as "High" priority are: (1) lakes and reservoirs and river and stream segments for which TMDLs are scheduled to be completed and submitted to EPA by the end of 2016; or (2) lakes and reservoirs and river and stream segments for which TMDL development projects are scheduled to be started in the next two years. The majority of these

“High” priority AUs were identified as such based largely on their degree of public support and interest and the likelihood of implementation of the TMDL once completed. “Low” priority AUs are those river and stream segments and lakes and reservoirs that are scheduled for completion in the next 6-10 years.

The department has also identified a subcategory to Category 5 waterbodies. This subcategory, termed Subcategory 5A, includes “Low” priority lakes and reservoirs and river and stream segments that were assessed and listed in previous Section 303(d) lists, but where the original basis for the assessment decision and associated cause of impairment is questionable. These Subcategory 5A waterbodies include: (1) rivers and streams listed for biological impairments based on only one sample for the entire segment or on samples collected more than 10 years ago; (2) waterbodies listed for sediment/siltation impairments; (3) waterbodies listed for fecal coliform bacteria impairments; and (4) lakes and reservoirs where the assessments are based on one sampling event or on data that are greater than 10 years old. These waterbodies will remain on the 2014 Section 303(d) list, but they will be targeted for additional monitoring and assessment during the next two to four years.

Waterbodies for which fish consumption use is impaired due to methyl-mercury are also considered “Low” priority. TMDL development for methyl-mercury-contaminated waterbodies is complicated by several factors, including: (1) the uncertainty regarding the fate and transport of atmospheric sources of mercury and (2) the complexity of the biological and geochemical interactions that affect the conversion of elemental mercury to methyl-mercury and its bioaccumulation rate in fish.

C. Public Participation Process

Public comments were solicited on the draft 2014 TMDL list through a public notice published in the following daily newspapers: Fargo Forum, Grand Forks Herald, Bismarck Tribune, Minot Daily News, Dickinson Press and Williston Daily Herald (Appendix D). The public notice encouraged interested parties to obtain a copy of the draft TMDL list by contacting the department in writing, by phone or by accessing the list through the department’s website at www.ndhealth.gov.

Comments on the draft TMDL list were also requested through mail or email from individuals and specific agencies and organizations. These included the South Dakota Department of Environment and Natural Resources, Minnesota Pollution Control Agency (Detroit Lakes Regional Office), the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the US Army Corps of Engineers, the North Dakota Game and Fish Department, the North Dakota State Water Commission, the Red River Basin Commission, individuals on the North Dakota State Water Pollution Advisory Board and EPA Region VIII. Comments on the draft 2014 TMDL list were only received from EPA Region VIII. These comments and the Department’s response are provided in Appendix E. When appropriate, these comments were incorporated in this final 2014 Integrated Report.

D. Listing of Impaired Waters Needing TMDLs

As stated previously For purposes of 2014 Section 305(b) reporting and Section 303(d) listing, the U.S. Environmental Protection Agency (EPA) is encouraging states to submit an integrated report and to follow its integrated reporting guidance, including EPA's 2006 IR guidance, which is supplemented by EPA's 2008, 2010, 2012 and 2014 IR guidance memos (http://water.epa.gov/lawregs/lawsguidance/cwa/tmdl/guidance.cfm). This guidance suggests that states place their assessed waterbodies into one of five assessment categories (Table IV-3). Waterbodies (also referred to as AUs) assessed as Category 5 (including subcategory 5A) form the basis of the state's Section 303(d) TMDL list. Tables VI-1, VI-2, VI-3 and VI-4 provide a list of AUs in the Souris, Red, Missouri and James River Basins, respectively, that are impaired and in need of TMDLs. These impaired waters also are depicted graphically for the Souris River Basin (Figure VI-1), the Upper and Lower Red River Basins (Figures VI-2 and VI-3), the Lake Sakakawea and Lake Oahe subbasins of the Missouri River Basin (Figures VI-4 and VI-5) and the James River Basin (Figure VI-6).

The 2014 TMDL list is represented by 217 AUs (27 lakes and reservoirs[1] and 189 river and stream segments) and 340 individual waterbody/pollutant combinations. For purposes of TMDL development, each waterbody/pollutant combination requires a TMDL. Of the 340 individual waterbody/pollutant combinations listed in Tables V-1 through V-4, 133 waterbody/pollutant combinations were further identified as Category 5A. These waterbodies will be targeted for additional monitoring in the next two to four years to verify the current use impairment assessments and pollutant causes.

E. De-listing of 2012-Listed TMDL Waters

Table VI-5 provides a list of lakes, reservoirs, rivers and streams that were listed in the previous 2012 TMDL list but that have been removed from this year's Section 303(d) list submittal. AUs were removed from the TMDL list for a number of reasons. The following are the primary reasons for de-listing an AU:

- A TMDL was completed for the waterbody/pollutant combination.
- The applicable water quality standard is now attained and/or the original basis for the listing was incorrect.
- The applicable water quality standard is now attained due to a change in the water quality standard and/or assessment methodology.
- The applicable water quality standard is now attained due to restoration activities.
- Sufficient data and/or information is lacking to determine water quality status and/or the original basis for listing was incorrect.

[1]Lake Sakakawea is described by two assessment units. These include ND-10110101-001-L_00 and ND-10110205-001-L_00, which includes the Little Missouri Bay portion of the reservoir.

1. The data used to conduct the assessment are now more than 10 years old. Based on best professional judgment, the assessment is no longer believed to be valid. This would occur if it is believed that water quality has been altered due to significant changes in land use and/or due to climatic changes.

2. The original assessment was based only on best professional judgment.

3. The original assessment was based on data extrapolated from a monitoring station(s) located in an adjacent AU.

For the 2012 and 2014 Integrated Reports, there were also a special set of de-listings for fecal coliform bacteria impairments. Since the department no longer has a water quality standard for fecal coliform bacteria, and now only has an E. coli standard, waters which were previously listed as impaired for recreation use due to fecal coliform bacteria, but where current water quality data show an E. coli impairment were de-listed for fecal coliform and re-listed for E. coli. Waterbodies which were assessed previously for fecal coliform, but where there are no E. coli data remained listed as impaired for fecal coliform bacteria. These waterbodies will be targeted for additional E. coli monitoring as part of the TMDL development process.

F. TMDL Development and Monitoring Schedule

The responsibility for TMDL development in North Dakota lies primarily with the department's Division of Water Quality - Surface Water Quality Management Program. TMDL development staff are located in three regional field offices in Bismarck, Fargo and Towner, N.D. Technical support for TMDL development projects and overall program coordination are provided by Surface Water Quality Management Program staff also located in Bismarck, N.D.

Historically, the technical and financial resources necessary to complete the state's TMDL development priorities have hampered the pace of TMDL development in the state. Recently, however, the state's TMDL program has seen an improvement in the financial resources available for TMDL development projects. While still significantly short of the funding necessary to meet the state's TMDL development schedule, EPA and the state of North Dakota have made available additional grants and funding to complete TMDLs. Examples of these new financial resources include the TMDL development grants available through EPA Regional VIII and CWA Section 319 grants administered by the state's Nonpoint Source Pollution Management Program.

With the continued commitment to adequate TMDL development staffing and with a continuation in the growth of funding for TMDL development projects in the state, the department is confident it will meet its TMDL development schedule.

The 2014 Section 303(d) TMDL list for North Dakota has targeted 59 waterbodies or 64 waterbody/pollutant combinations as "High" priority. These "High" priority waterbody/pollutant combinations represent 19 percent of all "High" and "Low" priority Category 5 waterbody/pollutant combinations on the list. These "High" priority waterbody/pollutant combinations are AUs for which the monitoring necessary for TMDL development is either completed, near completion or will be initiated in 2015 or 2016. For the remaining 157 low priority waterbodies which are in need of additional monitoring and/or TMDLs, the Department will be working with EPA to develop a method of prioritizing waterbodies and watersheds for TMDL development. This method and the state's schedule for TMDL development through 2022 will be reported in the 2016 Integrated Report.

Table VI-1. 2014 List of Section 303(d) TMDL Waters for the Souris River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09010003-001-S_00	Souris River from its confluence with Oak Creek downstream to its confluence with the Wintering River. Located in McHenry	51.97 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Oxygen, Dissolved	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09010003-003-S_00	Wintering River, including all tributaries. Located in SW McHenry and NE McLean counties.	210.41 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09010003-005-S_00	Souris River from its confluence with the Wintering River downstream to its confluence with Willow Creek. Located in NE McHenry County.	74.91 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	H	No
					Escherichia coli	H	No
ND-09010004-001-S_00	Willow Creek from its confluence with Ox Creek downstream to its confluence with the Souris River.	39.39 Miles					
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	L	Yes
ND-09010008-001-S_00	Souris River from the N.D./Saskatchewan border downstream to Lake Darling.	43.55 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
ND-09010008-003-S_00	Souris River from Lake Darling downstream to its confluence with the Des Lacs River. Located in Northern Ward County.	33.11 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Benthic-Macroinvertebrate Bioassessments	L	Yes

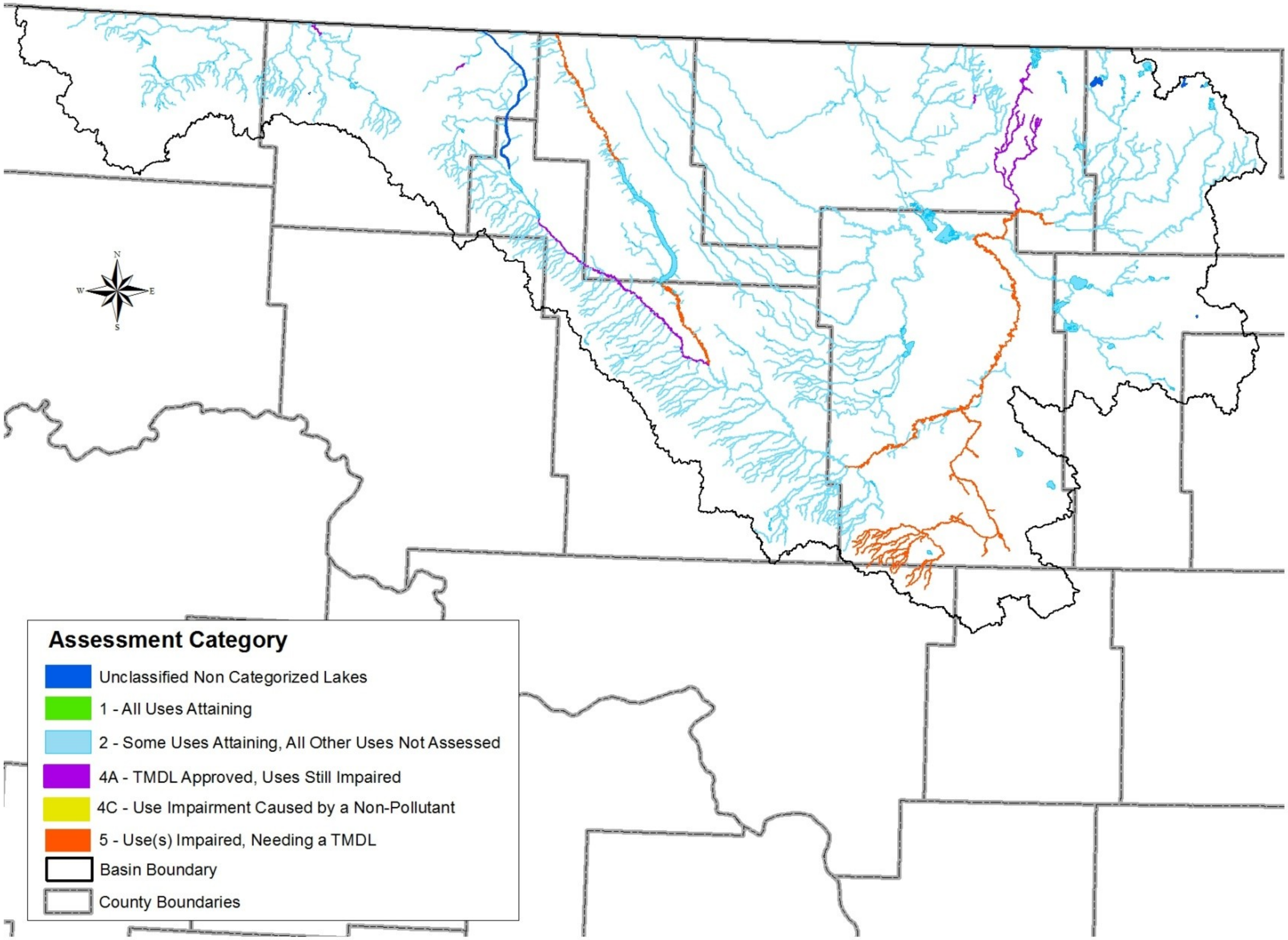

Figure VI-1. Graphical Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the Souris River Basin.

Table VI-2. 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020101-001-S_00	Bois De Sioux River from the ND-SD border, downstream to its confluence with the Rabbit River on MN side. Located in the SE corner of Richland County.	13.08 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020101-002-S_00	Bois De Sioux River from its confluence with the Rabbit River (MN), downstream to its confluence with the Ottertail River. Located on the Eastern border of Richland	15.32 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Benthic-Macroinvertebrate Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-09020104-001-S_00	Red River of the North from its confluence with the Ottertail River downstream to its confluence with the Whiskey Creek on the MN side. Located in Eastern Richland	27.33 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-09020104-002-S_00	Red River of the North from its confluence with Whiskey Creek, downstream to its confluence with the Wild Rice River. Located in NE Richland and SE Cass	52.28 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020104-003-S_00	Red River of the North, from its confluence with the Wild Rice River, downstream to the 12th Ave bridge in Fargo, ND (just upstream from Moorhead, MN waste water discharge). Eastern Cass County.	21.56 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020104-004-S_00	Red River of the North, from the 12th Ave N. bridge in Fargo, ND downstream to its confluence with the Sheyenne River. Eastern Cass County.	20.04 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020104-005-S_00	Red River of the North from its confluence with the Sheyenne River, downstream to its confluence with the Buffalo River on the MN side of the border. Located in NE Cass	10.45 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020105-001-S_00	Wild Rice River from its confluence with the Colfax Watershed, downstream to its confluence with the Red River Of The North. Located in NE Richland and SE Cass	38.58 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Oxygen, Dissolved	L	No
					Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020105-002-L_00	Mooreton Pond	36.8 Acres					
			Fish and Other Aquatic Biota	Not Supporting			
					Total Dissolved Solids	L	No
ND-09020105-003-S_00	Wild Rice River from its confluence with a tributary about 3.6 miles NE of Great Bend, ND downstream to its confluence with the Colfax Watershed. Located in Eastern Richland County.	47.49 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Oxygen, Dissolved	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020105-005-S_00	Antelope Creek, in Richland County, from its headwaters downstream to its confluence with the Wild Rice River.	40.72 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Benthic-Macroinvertebrate Bioassessments	L	Yes
					Temperature, water	L	Yes
					Sedimentation/Siltation	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020105-009-S_00	Wild Rice River from Elk Creek (ND-09020105-010-S_00), downstream to its confluence with a tributary 3.5 miles NE of Great Bend, ND (ND-09020105-008-S_00). Located in South Central Richland County.	53.43 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Oxygen, Dissolved	L	No
					Sedimentation/Siltation	L	Yes
ND-09020105-010-S_00	Elk Creek, including all tributaries. Located in SE Ransom, NE Sargent, and West Central Richland Counties.	26.05 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020105-012-S_00	Wild Rice River from its confluence with Shortfoot Creek (ND-09020105-016-S_00) downstream to its confluence with Elk Creek (ND-09020105-010-S_00).	45.68 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Sedimentation/Siltation	L	Yes
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020105-014-S_00	Unnamed tributary to the Wild Rice River (ND-09020105-012-S_00) located near Milnor, ND in NE Sargent County.	25.25 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020105-016-S_00	Shortfoot Creek from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries.	24.78 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020105-017-S_00	Unnamed tributaries to the Wild Rice River (ND-09020105-015-S), including Crooked Creek.	43.5 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020105-018-S_00	Wild Rice River from its confluence with the Silver Lake Diversion downstream to Lake Tewaukon.	20.09 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020105-019-S_00	Wild Rice River upstream from its confluence with Wild Rice Creek, including all	62.51 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020105-020-S_00	Wild Rice Creek from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries.	8.68 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	H	No
ND-09020105-022-S_00	Wild Rice River from its confluence with Wild Rice Creek downstream to its confluence with the Silver Lake Diversion.	5.66 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	H	No
ND-09020107-001-S_00	Red River of the North from its confluence with the Buffalo River downstream to its confluence with the Elm River.	29.37 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020107-004-S_00	Elm River from its confluence with the South Branch Elm River downstream to its confluence with the North Branch Elm River	11.98 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	No
ND-09020107-006-S_00	Elm River from the dam NE of Galesburg, ND downstream to its confluence with the South Branch Elm River.	29.97 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020107-008-S_00	Elm River from the dam NW of Galesburg, ND downstream to the dam NE of Galesburg.	21.34 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020107-011-S_00	North Branch Elm River, downstream to its confluence with the Elm River.	32.94 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Combination Benthic/Fishes Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
ND-09020107-013-S_00	North Branch Elm River upstream from its confluence with Unnamed tributary	59.41 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Combination Benthic/Fishes Bioassessments	L	Yes

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ND-09020107-014-S_00	Red River of the North from its confluence with the Elm River, downstream to its confluence with the Marsh River.	30.33 Miles					
			Fish Consumption	Not Supporting	Methylmercury	L	No
ND-09020107-017-S_00	South Branch Elm River from Hunter Dam downstream to its confluence with the Elm River.	15.77 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020109-001-S_00	Goose River from a tributary upstream from Hillsboro, ND downstream to its confluence with the Red River Of The North.	30.88 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Fishes Bioassessments	L	No
ND-09020109-007-S_00	North Branch Goose River, downstream to its confluence with the Goose River.	36.87 Miles					
			Fish and Other Aquatic Biota	Not Supporting	Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-09020109-011-S_00	Goose River from its confluence with Beaver Creek, downstream to its confluence with the South Branch Goose River.	19.32 Miles					
			Fish and Other Aquatic Biota	Not Supporting	Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020109-013-S_00	South Branch Goose River from its confluence with the Middle Branch Goose River downstream to its confluence with the Goose River	9.21 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	No
ND-09020109-015-S_00	South Branch Goose River downstream to its confluence with the Middle Branch Goose River.	43.2 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020109-017-S_00	Middle Branch Goose River, from its confluence with a tributary watershed near Sherbrooke, ND (ND-09020109-019-S_00), downstream to its confluence with the South Branch Goose River.	17.89 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020109-020-S_00	Middle Branch Goose River downstream to its confluence with tributary watershed near Sherbrooke, ND (ND-09020109-019-S).	35.23 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Fishes Bioassessments	L	Yes
					Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-09020109-022-S_00	Goose River from its confluence with Spring Creek downstream to its confluence with Beaver Creek	30.68 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020109-024-S_00	Beaver Creek from the Golden Lake Diversion, downstream to its confluence with the Goose River.	25.41 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	L	Yes
ND-09020109-027-S_00	Beaver Creek, downstream to the Golden Lake diversion channel.	36.89 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Sedimentation/Siltation	L	Yes
					Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	L	Yes
ND-09020109-029-S_00	Spring Creek, including tributaries	124.61 Miles					
			Recreation	Not Supporting			
					Fecal Coliform	L	Yes
ND-09020109-034-S_00	Little Goose River from Little Goose River National Wildlife Refuge downstream to the Goose River.	32.32 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Sedimentation/Siltation	L	Yes
					Fishes Bioassessments	L	Yes

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020201-006-L_00	Devils Lake	102376 Acres					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020201-021-S_00	Calio Coulee, upstream from Chain Lake including all tributaries.	73.65 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-09020202-001-L_00	Warsing Dam	53.4 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Oxygen, Dissolved	L	No
					Sedimentation/Siltation	L	No
					Nutrient/Eutrophication Biological Indicators	L	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-09020202-001-S_00	Sheyenne River from its confluence with the Warsing Dam Watershed, downstream to the end of the hydrologic unit. Located along the Benson and Eddy County Line.	9.16 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
ND-09020202-003-L_00	Buffalo Lake	534 Acres					
			Fish and Other Aquatic Biota	Not Supporting			
					Nutrient/Eutrophication Biological Indicators	L	No
			Recreation	Not Supporting			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-09020202-004-S_00	Sheyenne River from its confluence with Big Coulee (ND-09020202-007-S_00), downstream to its confluence with the Warsing Dam Watershed (ND-09020202-	40.55 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Benthic-Macroinvertebrate Bioassessments	L	No
ND-09020202-006-S_00	Sheyenne River from Harvey Dam, downstream to its confluence with Big Coulee (ND-09020202-007-S_00). Located near the Pierce, Benson and Wells County	34.58 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020203-001-L_00	Lake Ashtabula	5467 Acres					
			Recreation	Not Supporting			
					Nutrient/Eutrophication Biological Indicators	H	No
ND-09020203-002-S_00	Baldhill Creek from tributary watershed (ND-09020203-005-S_00) downstream to Lake Ashtabula. Located in Griggs and Barnes County.	30.18 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-09020203-005-L_00	Carlson-Tande Reservoir	15.2 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
					Oxygen, Dissolved	L	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-09020203-007-L_00	McVille Dam	36.7 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	No
					Oxygen, Dissolved	L	No
					Nutrient/Eutrophication Biological Indicators	L	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-09020203-012-S_00	Pickerel Lake Creek, including all tributaries. Located in NE Griggs County.	34 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Benthic-Macroinvertebrate Bioassessments	L	No
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020203-013-S_00	Unnamed tributary watershed to the Sheyenne River (ND-09020203-001-S). Located in northern Griggs County.	33.72 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020204-001-S_00	Sheyenne River, from its confluence with an unnamed tributary watershed (ND-09020204-014-S), downstream to its confluence with the Maple River. Located in	26.75 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	H	Yes
ND-09020204-003-L_00	Brewer Lake	117.8 Acres	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	No
ND-09020204-003-S_00	Sheyenne River from its confluence with the Maple River, downstream to its confluence with the Red River Of The North. Located in Eastern Cass County.	18.93 Miles	**Recreation**	Not Supporting	Fecal Coliform	H	Yes
ND-09020204-004-S_00	Rush River from its confluence with an unnamed tributary watershed (ND-09020204-012-S), downstream to its confluence with the Sheyenne River.	16.58 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020204-007-S_00	Rush River downstream to an unnamed tributary watershed (ND-09020204-012-S_00). Located in north central Cass	41.4 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Sedimentation/Siltation	L	No
					Fishes Bioassessments	L	No
ND-09020204-015-S_00	Sheyenne River, from its confluence with tributary watershed (ND-09020204-016-S_00), downstream to tributary ND-09020204-014-S_00. Located along the Richland and Cass County border.	28.04 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	No
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020204-017-S_00	Sheyenne River from unnamed tributary (ND-09020204-018-S_00), downstream to unnamed tributary watershed (ND-09020204-016-S_00). Located in northern Ransom and Richland County.	57.49 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	No
					Benthic-Macroinvertebrate Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
ND-09020204-022-S_00	Sheyenne River from tributary near Lisbon (ND-09020204-0024-S_00), downstream to its confluence with Dead Colt Creek (ND-09020204-021-S_00). Located in central Ransom County.	11.55 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020204-023-S_00	Timber Coulee, including all tributaries. Located in south central Ransom County.	32.69 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020204-025-S_00	Sheyenne River, from its confluence with a tributary near Highway 46 (ND-09020204-025-S_00) downstream to its confluence with a tributary near Lisbon, ND (ND-09020204-024-S_00).	46.96 Miles					
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	H	Yes
ND-09020204-027-S_00	Sheyenne River, from its confluence with a tributary watershed below Valley City (ND-09020204-028-S_00), downstream to its confluence with a tributary near Highway 46 (ND-09020204-026-S_00). Located in south central Barnes County.	34.05 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Benthic-Macroinvertebrate Bioassessments	L	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020204-034-S_00	Sheyenne River from its confluence with a tributary above Valley City, near railroad bridge, (ND-09020204-038-S_00) downstream to its confluence with a tributary below Valley City (ND-09020204-028-S_00). Located in Central Barnes County.	13.29 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-09020204-040-S_00	Sheyenne River from Lake Ashtabula downstream to its confluence with a tributary above Valley City, near rail road bridge (ND-09020204-038-S_00). Located in Central Barnes County.	13.69 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
ND-09020205-001-S_00	Maple River, from its confluence with Buffalo Creek downstream to its confluence with the Sheyenne River. Located in Eastern Cass County.	28.56 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Combination Benthic/Fishes Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020205-003-S_00	Swan Creek from its confluence with the Maple River upstream to the Casselton Reservoir, including all tributaries. Located in Central Cass County.	61.07 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Combination Benthic/Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-09020205-006-S_00	Buffalo Creek from Embden Dam, downstream to the Maple River. Located in S.C. Cass County.	30.86 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020205-010-S_00	Maple River, from its confluence with a tributary near Leonard, ND (ND-09020205-011-S_00) downstream to its confluence with Buffalo Creek. Located in south central Cass County.	48.33 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
ND-09020205-012-S_00	Maple River from its confluence with the South Branch Maple River downstream to its confluence with a tributary near Leonard, ND. Located in S.W. Cass County.	26.15 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Oxygen, Dissolved	L	No
					Fishes Bioassessments	L	Yes
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020205-015-S_00	Maple River from its confluence with a tributary watershed near Buffalo, ND (ND-09020205-019-S_00) downstream to its confluence with the South Branch Maple River. Located in western Cass County.	40.09 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020205-017-S_00	Unnamed tributary watershed to the Maple River (ND-09020205-015-S_00). Located in S.E. Barnes County.	56.35 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020205-018-S_00	Unnamed tributary watershed to the Maple River (ND-09020205-015-S_00). Located in Eastern Barnes County.	155.28 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No
ND-09020205-024-S_00	Maple River downstream to its confluence with a tributary near the Steele, Cass, and Barnes County Line (ND-09020205-023-	28.28 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Fishes Bioassessments	L	Yes
					Oxygen, Dissolved	L	No
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020301-001-S_00	Red River of the North, from its confluence with the Marsh River (Mn), downstream to its confluence with the Sand Hill River (Mn). Located in Eastern Trail County.	21.2 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020301-002-S_00	English Coulee from its confluence with a tributary upstream from Grand Forks, ND downstream to its confluence with the Red River Of The North (Lower Reach).	8.48 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Oxygen, Dissolved	L	No
					Total Dissolved Solids	L	No
					Sedimentation/Siltation	L	No
					Selenium	L	No
			Recreation	Not Supporting			
					Sedimentation/Siltation	L	No
					Escherichia coli	H	No
ND-09020301-005-S_00	English Coulee from its confluence with a major control structure, downstream to its confluence with a tributary that is upstream from Grand Forks, ND (Middle Reach).	12.1 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Selenium	L	No
					Oxygen, Dissolved	L	No
					Total Dissolved Solids	L	No
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020301-006-S_00	English Coulee from its headwaters, downstream to a major control structure.	14.08 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Total Dissolved Solids	L	No
					Oxygen, Dissolved	L	No
					Selenium	L	No
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-09020301-007-S_00	Red River of the North from its confluence with the Sand Hill River (Mn), downstream to its confluence with Cole Creek.	31.03 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020301-010-S_00	Red River of the North from its confluence with Cole Creek, downstream to its confluence with the Red Lake River.	7.99 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020301-011-S_00	Cole Creek, including tributaries	35.64 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020301-014-S_00	Red River of the North from its confluence with the Red Lake River, downstream to its confluence with English Coulee.	3.78 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020306-001-S_00	Red River of the North from its confluence with English Coulee, downstream to the confluence with Grand Marais Creek (Mn).	8.76 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020306-003-S_00	Red River of the North from its confluence with Grand Marais Creek (Mn), downstream to its confluence with the Turtle River.	12.37 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020306-004-S_00	Red River of the North from its confluence with the Turtle River, downstream to its confluence with the Forest River.	31.44 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020306-005-S_00	Red River of the North from its confluence with the Forest River, downstream to its confluence with the Park River.	21.6 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020307-001-S_00	Turtle River from its confluence with Salt Water Coulee, downstream to its confluence with the Red River Of The North.	29.93 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Sedimentation/Siltation	L	Yes
					Cadmium	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes
			Municipal and Domestic	Fully Supporting But Threatened			
					Cadmium	L	No
					Selenium	L	No
					Chloride	L	No
					Arsenic	L	No
					Sulfates	L	No
ND-09020307-006-S_00	Turtle River from its confluence with Kelly Slough, downstream to its confluence with Salt Water Coulee.	0.64 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	Yes
					Cadmium	L	No
					Selenium	L	No
ND-09020307-007-S_00	Fresh Water Coulee from its confluence with Salt Water Coulee downstream to its confluence with the Turtle River.	6.43 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Selenium	L	No
					Cadmium	L	No
ND-09020307-016-S_00	Kelly Slough from the control structure at Kelly Slough National Wildlife Refuge downstream to its confluence with the Turtle	2.65 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Cadmium	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020307-019-S_00	Turtle River from its confluence with a tributary NE of Turtle River State Park, downstream to its confluence with Kelly	25.43 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Cadmium	L	No
					Selenium	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes
			Municipal and Domestic	Fully Supporting But Threatened			
					Arsenic	L	No
					Cadmium	L	No
					Selenium	L	No
ND-09020307-021-S_00	Turtle River from its confluence with South Branch Turtle River downstream to its confluence with a tributary NE oF Turtle River State Park.	13.71 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combination Benthic/Fishes Bioassessments	L	No
					Selenium	L	No
					Cadmium	L	No
			Municipal and Domestic	Fully Supporting But Threatened			
					Arsenic	L	No
					Selenium	L	No
					Cadmium	L	No
ND-09020307-024-S_00	South Branch Turtle River downstream to Larimore Dam.	18.24 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Cadmium	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020307-031-S_00	North Branch Turtle River from its confluence with Whiskey Creek, downstream to its confluence with South Branch Turtle	14.88 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Cadmium	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020308-001-S_00	Forest River from Lake Ardoch, downstream to its confluence with the Red River Of The	15.49 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Benthic-Macroinvertebrate Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes
ND-09020308-002-L_00	Whitman Dam	149.7 Acres					
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	Yes
ND-09020308-003-L_00	Matejcek Dam	130 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	H	No
					Oxygen, Dissolved	H	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	H	No
ND-09020308-015-S_00	Forest River from its confluence with South Branch Forest River, downstream to its confluence with a tributary near Highway 18.	13.04 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Fishes Bioassessments	L	Yes
					Benthic-Macroinvertebrate Bioassessments	L	Yes
					Selenium	L	No
ND-09020308-017-S_00	South Branch Forest River from its confluence with Unnamed tributary watershed (ND-09020308-018-S) downstream to Fordville Dam.	7.96 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-09020308-023-S_00	Middle Branch Forest River from Matecjek Dam, downstream to its confluence with North Branch Forest River.	8.71 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Fishes Bioassessments	L	Yes
ND-09020308-029-S_00	North Branch Forest River from its confluence with tributary near Highway 32 (ND-09020308-033-S) downstream to its confluence with Middle Branch Forest River	12.31 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combination Benthic/Fishes Bioassessments	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020310-001-L_00	Homme Dam	194 Acres	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	No
ND-09020310-001-S_00	Park River from its confluence with Salt Lake Outlet (ND-09020310-009-S_00), downstream to its confluence with the Red River Of The North.	11.58 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	No
					Selenium	L	No
ND-09020310-003-S_00	Willow Creek from Dam NE of Mountain, ND downstream to Salt Lake.	39.5 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	No
ND-09020310-010-S_00	Park River from its confluence with a tributary east of Grafton, ND (ND-09020310-012-S_00), downstream to its confluence with the outlet from Salt Lake (ND-09020310-009-S_00).	14.39 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Selenium	L	No
ND-09020310-013-S_00	Park River from the confluence of the South Branch Park River and the Middle Branch Park River, downstream to its confluence with a tributary east of Grafton, ND (ND-09020310-012-S_00).	6.67 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Selenium	L	No
ND-09020310-014-S_00	South Branch Park River from its confluence with A tributary (ND-09020310-015-S) downstream to its confluence with the Middle Branch Park River	4.57 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Combination Benthic/Fishes Bioassessments	L	No
ND-09020310-016-S_00	South Branch Park River from its confluence with A tributary near Park River, ND (ND-09020310-018-S) downstream to its confluence with a tributary (ND-09020310-	16.39 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Selenium	L	No
					Combination Benthic/Fishes Bioassessments	L	Yes

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020310-020-S_00	South Branch Park River from its confluence with a tributary watershed near Adams, ND (ND-09020310-022-S_00), downstream to Homme Dam.	16.58 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Benthic-Macroinvertebrate Bioassessments	L	No
					Fishes Bioassessments	L	Yes
ND-09020310-023-S_00	South Branch Park River downstream to A tributary watershed near Adams, ND (ND-09020310-022-S).	35.47 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Benthic-Macroinvertebrate Bioassessments	L	No
ND-09020310-037-S_00	North Branch Park River from its confluence with a tributary near Highway 32 downstream to its confluence with Cart Creek.	27.63 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020310-039-S_00	North Branch Park River from a tributary watershed (ND-09020310-043-S_00) near Milton, ND downstream to its confluence with a tributary near Highway 32.	15.66 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Fishes Bioassessments	L	Yes
ND-09020310-044-S_00	Cart Creek from its confluence with A tributary 2 miles east of Mountain, ND downstream to its confluence with North	37.22 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Benthic-Macroinvertebrate Bioassessments	L	No
ND-09020311-001-S_00	Red River of the North from its confluence with the Park River, downstream to its confluence with a small tributary north of	19.08 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020311-003-S_00	Red River of the North from its confluence with a small tributary north of Drayton, ND downstream to its confluence with Two	28.82 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-09020311-005-S_00	Red River of the North from its confluence with Two Rivers, downstream to its confluence with the Pembina River.	17.84 Miles	**Fish Consumption**	Not Supporting	Methylmercury	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020311-007-S_00	Red River of the North from its confluence with the Pembina River, downstream to the US/Canada border.	2.9 Miles					
			Fish Consumption	Not Supporting			
					Methylmercury	L	No
ND-09020316-001-S_00	Pembina River from its confluence with the Tongue River downstream to its confluence with the Red River of the North.	8.63 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Cadmium	L	No
					Copper	L	No
					Lead	L	No
					Selenium	L	No
			Municipal and Domestic	Fully Supporting But Threatened			
					Arsenic	L	No
					Lead	L	No
			Recreation	Fully Supporting But Threatened			
					Fecal Coliform	L	Yes
ND-09020316-002-L_00	Renwick Dam	220 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-09020316-002-S_00	Tongue River from its confluence with Big Slough downstream to its confluence with the Pembina River.	11.47 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Combination Benthic/Fishes Bioassessments	L	No
ND-09020316-006-S_00	Tongue River from its confluence with a tributary N.E. of Cavalier, ND downstream to its confluence with Big Slough. Currently this ID also includes the portion known as the Tongue River Cuttoff.	22.76 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Combination Benthic/Fishes Bioassessments	L	Yes
					Sedimentation/Siltation	L	Yes

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020316-009-S_00	Tongue River from Renwick Dam, downstream to a tributary N.E. of Cavalier,	14.59 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Sedimentation/Siltation	L	Yes
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020316-011-S_00	Tongue River from Herzog Dam watershed downstream to Renwick Dam.	8.07 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combination Benthic/Fishes Bioassessments	L	Yes
ND-09020316-019-S_00	Tongue River downstream to Senator Young Dam.	18.3 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Combined Biota/Habitat Bioassessments	L	No
ND-09020316-021-S_00	Pembina River from its confluence with a tributary west of Neche, ND downstream to its confluence with the Tongue River.	28.47 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Lead	L	No
					Cadmium	L	No
					Selenium	L	No
					Sedimentation/Siltation	L	Yes
					Copper	L	No
			Municipal and Domestic	Fully Supporting But Threatened			
					Arsenic	L	No
					Cadmium	L	No
					Lead	L	No
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No

Table VI-2 (con't). 2014 List of Section 303(d) TMDL Waters for the Red River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-09020316-023-S_00	Pembina River from its confluence with a tributary N.E. of Walhalla, ND downstream to its confluence with a tributary west of Neche, ND.	32.24 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Benthic-Macroinvertebrate Bioassessments	L	No
					Fishes Bioassessments	L	Yes
			Municipal and Domestic	Fully Supporting But Threatened			
					Cadmium	L	No
					Arsenic	L	No
					Lead	L	No
ND-09020316-025-S_00	Pembina River from its confluence with Little South Pembina River, downstream to its confluence with a tributary N.E. of Walhalla, ND.	13.07 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Selenium	L	No
					Fishes Bioassessments	L	Yes
			Municipal and Domestic	Fully Supporting But Threatened			
					Cadmium	L	No
					Lead	L	No
					Arsenic	L	No

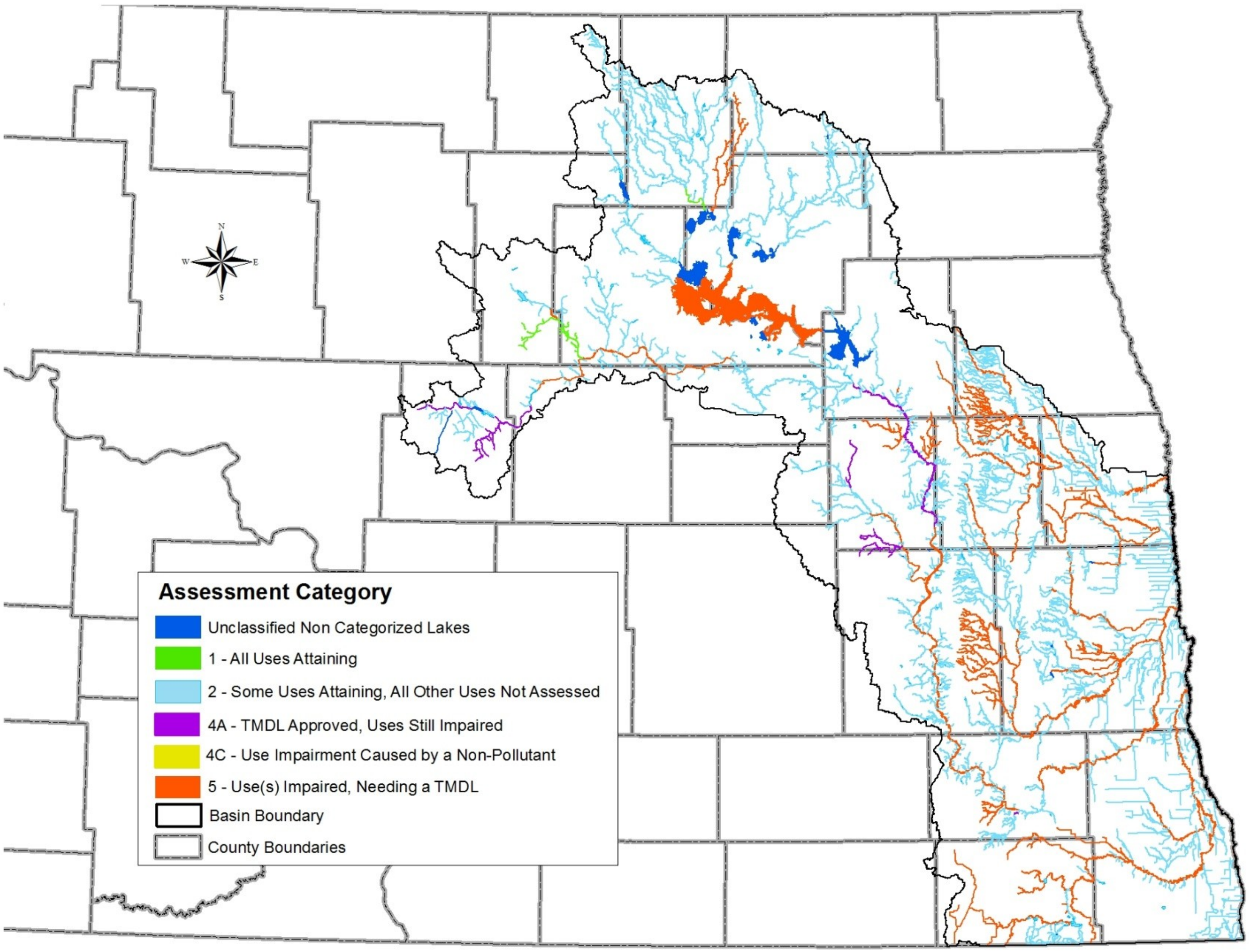

Figure VI-2. Graphical Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the Upper Red River Basin.

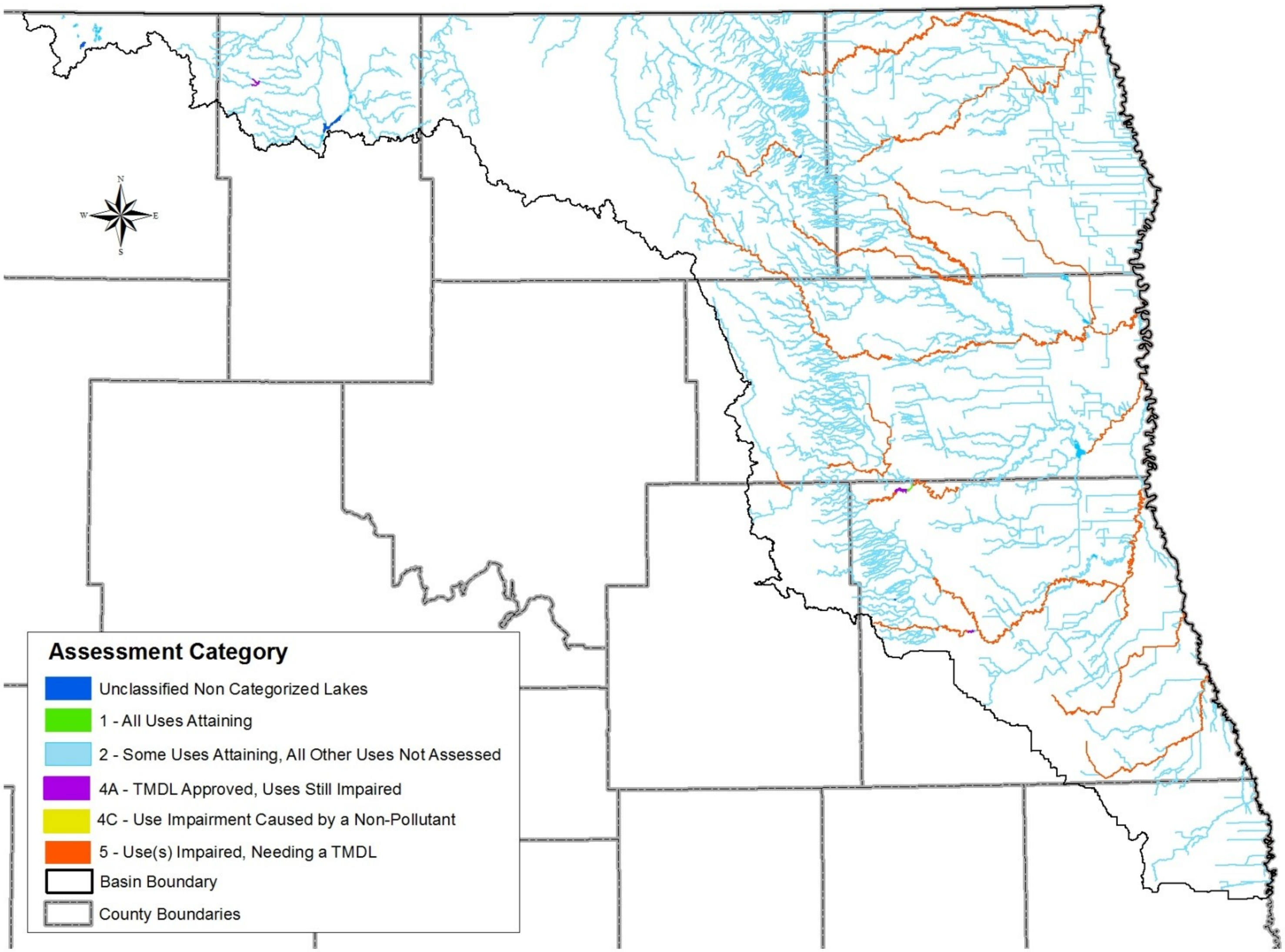

Figure VI-3. Graphical Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the Lower Red River Basin.

Table VI-3. 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10110101-001-L_00	Powers Lake	950.6 Acres	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	No
ND-10110101-009-L_00	Stanley Reservoir	253 Acres	**Recreation**	Fully Supporting But Threatened	Nutrient/Eutrophication Biological Indicators	L	No
ND-10110101-021-L_00	Lake Sakakawea, including Little Missouri Bay (ND-10110205-001-L_00)	318820.9 Acres	**Fish Consumption**	Not Supporting	Methylmercury	L	No
ND-10110101-056-S_00	Handy Water Creek, including all tributaries. Located in Eastern McKenzie County.	42.09 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-10110101-080-S_00	Little Knife River from Stanley Reservoir, downstream to Lake Sakakawea. Located in Central Mountrail County.	44.95 Miles	**Recreation**	Not Supporting	Fecal Coliform	L	Yes
ND-10110102-001-L_00	Cottonwood Lake	227.7 Acres	**Recreation**	Not Supporting	Nutrient/Eutrophication Biological Indicators	L	No
ND-10110102-001-S_00	Little Muddy River from its confluence with East Fork Little Muddy River, downstream to Lake Sakakawea. Located in Central Williams County.	25.82 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	L	Yes
ND-10110203-001-S_00	Little Missouri River from its confluence with Little Beaver Creek downstream to its confluence with Deep Creek. Located in Slope County.	77.52 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	L	No
ND-10110203-025-S_00	Little Missouri River from its confluence with Deep Creek, downstream to its confluence with Andrew's Creek. Located in Billings and Slope Counties.	48.85 Miles	**Recreation**	Not Supporting	Escherichia coli	L	No
ND-10110205-001-S_00	Little Missouri River from its confluence with Beaver Creek downstream to highway 85. Located in McKenzie County.	58.18 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	L	No

Table VI-3 (con't). 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10110205-033-S_00	Little Missouri River from Hwy 85 downstream to its confluence with Cherry Creek. Located in McKenzie and Dunn	21 Miles					
			Recreation	Fully Supporting But Threatened	Escherichia coli	L	No
ND-10130101-002-S_00	Square Butte Creek from its confluence with Otter Creek downstream to its confluence with the Missouri River. Located in Morton	2.83 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130101-009-S_00	Square Butte Creek from Nelson Lake downstream to its confluence with Otter Creek. Located in Oliver and Morton	38.3 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
			Recreation	Not Supporting	Fecal Coliform	L	Yes
ND-10130101-020-S_00	Turtle Creek from Lake Ordway downstream to its confluence with the Missouri River. Located in Mclean County.	27.71 Miles					
			Recreation	Not Supporting	Escherichia coli	H	No
ND-10130101-035-S_00	Turtle Creek from Turtle Lake to Lake Ordway. Located in McLean County.	0.94 Miles					
			Recreation	Not Supporting	Escherichia coli	H	No
ND-10130101-036-S_00	Upper Turtle Creek watershed above Turtle Lake including all tributaries and tributary from Crooked Lake, between Long Lake and Strawberry Lake, and tributary flowing into Camp Lake.	32.74 Miles					
			Recreation	Not Supporting	Escherichia coli	H	No
ND-10130103-002-S_00	Long Lake Creek and unnamed tributaries located in Emmons and Burleigh Counties.	210.11 Miles					
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No
ND-10130103-003-L_00	Braddock Lake	91.2 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	No
ND-10130103-004-S_00	West Branch Long Lake Creek upstream from Braddock Dam, including tributaries. Located in Emmons County.	85.27 Miles					
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No

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Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10130103-006-S_00	Goose Creek and tributaries, located in Emmons County.	54.08 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-10130103-010-L_00	Lake Isabel	805.7 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Oxygen, Dissolved	H	No
					Nutrient/Eutrophication Biological Indicators	H	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	H	No
ND-10130103-012-L_00	Rudolph Lake	71.1 Acres					
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-10130103-013-L_00	Mitchell Lake	298.1 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Oxygen, Dissolved	L	No
					Nutrient/Eutrophication Biological Indicators	L	No
ND-10130104-001-L_00	Beaver Lake	953.1 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	No
					Oxygen, Dissolved	L	No
					Nutrient/Eutrophication Biological Indicators	L	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	L	No
ND-10130201-002-S_00	Knife River from its confluence with Antelope Creek downstream to its confluence with the Missouri River. Located in Mercer	20.6 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-10130201-003-S_00	Knife River from its confluence with Spring Creek downstream to its confluence with Antelope Creek. Located in Mercer County.	17.94 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No

Table VI-3 (con't). 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10130201-014-S_00	Antelope Creek from its confluence with East Branch Antelope Creek Watershed (ND-10130201-016-S) downstream to its confluence with the Knife River. Located in Mercer County.	8.52 Miles					
			Recreation	Not Supporting	Fecal Coliform	L	Yes
ND-10130201-016-S_00	East Branch Antelope Creek upstream from Antelope Creek, including tributaries. Located in Mercer County.	82.05 Miles					
			Recreation	Not Supporting	Fecal Coliform	L	Yes
ND-10130201-017-S_00	Antelope Creek main stem downstream to its confluence with East Branch Antelope Creek Watershed (ND-10130201-016-S). Located in Mercer County.	21.24 Miles					
			Recreation	Not Supporting	Fecal Coliform	L	Yes
ND-10130201-020-S_00	Goodman Creek downstream to its confluence with Spring Creek, located in	29.34 Miles					
			Recreation	Not Supporting	Escherichia coli	H	No
ND-10130201-035-S_00	Knife River from its confluence with Coyote Creek downstream to its confluence with Spring Creek. Located in Mercer County.	14.7 Miles					
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No
ND-10130201-042-S_00	Knife River from its confluence with Branch Knife River downstream to its confluence with Coyote Creek. Located in Dunn and Mercer Counties.	36.06 Miles					
			Recreation	Not Supporting	Escherichia coli	H	No
ND-10130202-001-L_00	Lake Tschida	5018 Acres					
			Fish Consumption	Not Supporting	Methylmercury	L	No
			Recreation	Fully Supporting But Threatened	Nutrient/Eutrophication Biological Indicators	L	No
ND-10130202-012-S_00	Heart River from its confluence with Plum Creek downstream to its confluence with Govt' Creek. Located in Stark County.	20.02 Miles					
			Recreation	Fully Supporting But Threatened	Escherichia coli	L	No

Table VI-3 (con't). 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10130202-050-S_00	Heart River from Patterson Lake, downstream to its confluence with the Green River. Located in Stark County.	25.12 Miles					
			Fish and Other Aquatic Biota	Not Supporting			
					Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-10130203-002-L_00	Crown Butte Dam	31.2 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Sedimentation/Siltation	L	No
ND-10130203-006-S_00	Antelope Creek from a tributary watershed near Elgin, ND (ND-10130203-054-S) downstream to its confluence with the Heart	30.87 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-10130203-007-L_00	Danzig Dam	147.5 Acres					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	H	No
					Oxygen, Dissolved	H	No
					Sedimentation/Siltation	H	No
			Recreation	Fully Supporting But Threatened			
					Nutrient/Eutrophication Biological Indicators	H	No
ND-10130203-009-S_00	Heart River from its confluence with Fish Creek downstream to its confluence with Dead Heart Slough. Located in Morton	33.95 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	L	No
ND-10130203-033-S_00	Hailstone Creek from Danzig Dam downstream to its confluence with Big Muddy Creek. Located in Morton county.	28.07 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-10130203-034-S_00	Sims Creek from its confluence with Cut Bank Creek downstream to its confluence with Hailstone Creek. Located in Morton	9.1 Miles					
			Recreation	Not Supporting			
					Escherichia coli	H	No
ND-10130203-041-S_00	Hailstone Creek upstream from Danzig Dam, including tributaries. Located in Morton	60.03 Miles					
			Recreation	Fully Supporting But Threatened			
					Escherichia coli	H	No

Table VI-3 (con't). 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10130203-055-S_00	Antelope Creek upstream from its confluence with a tributary watershed in Grant County (ND-10130203-054-S).	130.14 Miles	**Recreation**	Not Supporting	Escherichia coli	H	No
ND-10130204-014-S_00	Thirty Mile Creek from its confluence with Springs Creek downstream to its confluence with the Cannonball River. Located in Hettinger County.	40.87 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Benthic-Macroinvertebrate Bioassessments	L	Yes
			Recreation	Fully Supporting But Threatened	Escherichia coli	H	No
ND-10130204-017-S_00	Thirty Mile Creek from tributary watershed (ND-10130204-019-S_00), downstream to its confluence with Springs Creek. Located in Hettinger County.	20.07 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	H	No
ND-10130205-001-S_00	Cedar Creek from its confluence with Hay Creek, downstream to its confluence with the Cannonball River. Located on border of Grant and Sioux Counties.	41.14 Miles	**Recreation**	Not Supporting	Escherichia coli	H	No
ND-10130205-003-L_00	Cedar Lake	198.5 Acres	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130205-021-S_00	Plum Creek, including all tributaries. Located in Adams County.	66.72 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	L	Yes
ND-10130205-033-S_00	Cedar Creek from Cedar Lake, downstream to its confluence with Chanta Peta Creek. Located in Adams County.	44.05 Miles	**Fish and Other Aquatic Biota**	Not Supporting	Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-10130205-042-S_00	Cedar Creek from its confluence with South Fork Cedar Creek, downstream to Cedar Lake. Located in Slope and Bowman County.	31.84 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes

Table VI-3 (con't). 2014 List of Section 303(d) TMDL Waters for the Missouri River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10130205-043-S_00	North Fork Cedar Creek, including all tributaries. Located in Slope County.	14.81 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130205-044-S_00	Unnamed tributaries to Cedar Creek (ND-10130205-042-S_00). Located in Slope and Bowman counties.	84.74 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130205-045-S_00	South Fork Cedar Creek, including all tributaries. Located in Bowman County.	22.2 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130205-046-S_00	Cedar Creek upstream from its confluence with South Fork Cedar Creek, including all tributaries. Located in Bowman and Slope Counties.	50.03 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10130205-047-S_00	North Cedar Creek, including all tributaries. Located in Slope County.	116.42 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
			Recreation	Not Supporting	Fecal Coliform	L	Yes
ND-10130206-001-S_00	Cannonball River from its confluence with Dogtooth Creek, downstream to Lake Oahe. Border of Morton and Sioux County.	28.44 Miles	**Recreation**	Not Supporting	Escherichia coli	H	No
ND-10130303-001-S_00	Flat Creek, downstream to Mirror Lake. Located in Adams County.	19.12 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Nutrient/Eutrophication Biological Indicators	L	Yes
ND-10130303-003-S_00	Flat Creek from Mirror Lake downstream to the ND-SD border. Located in Adams	22.39 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	L	Yes

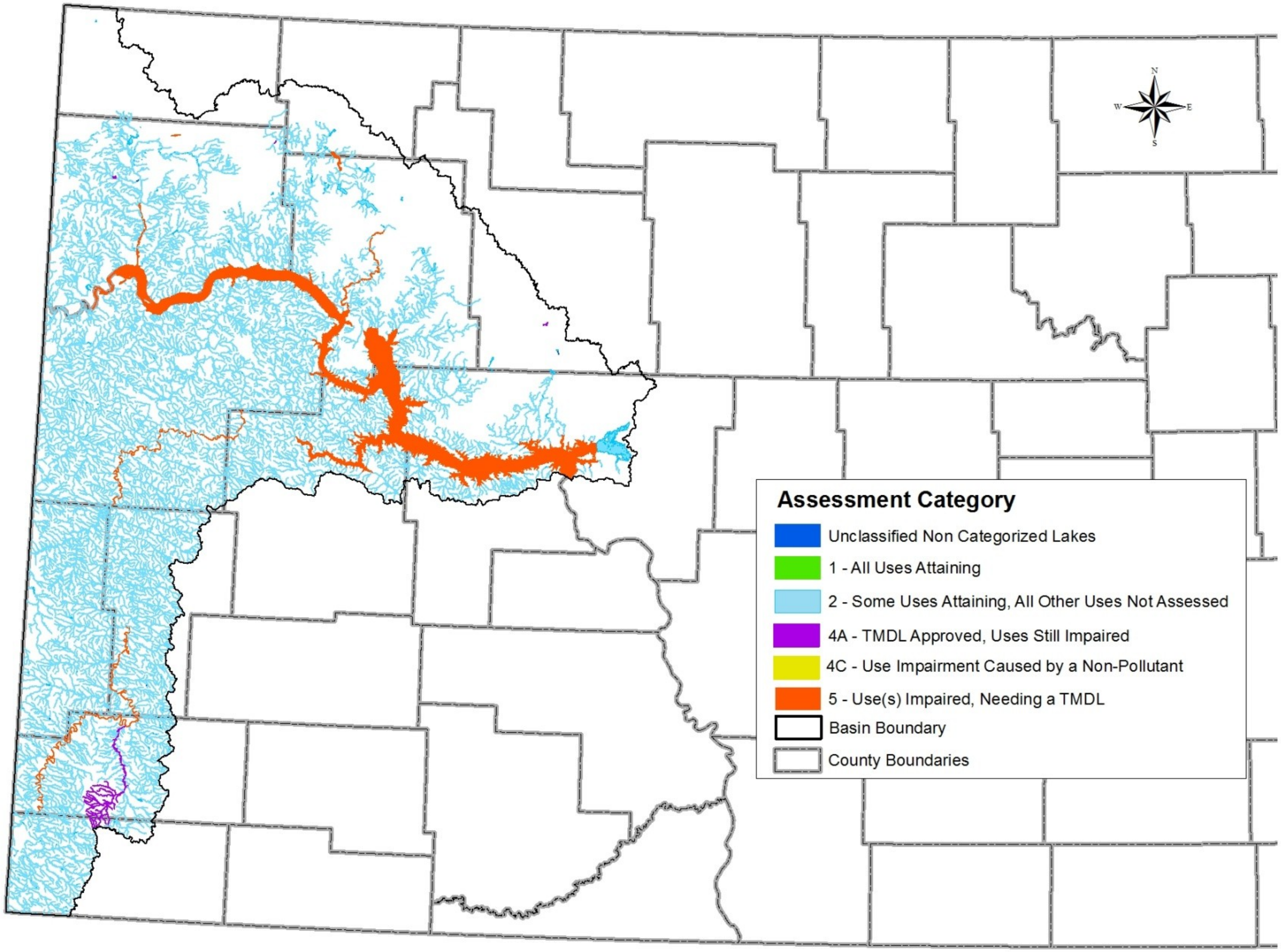

Figure VI-4. Graphic Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the Lake Sakakawea/Missouri River Basin.

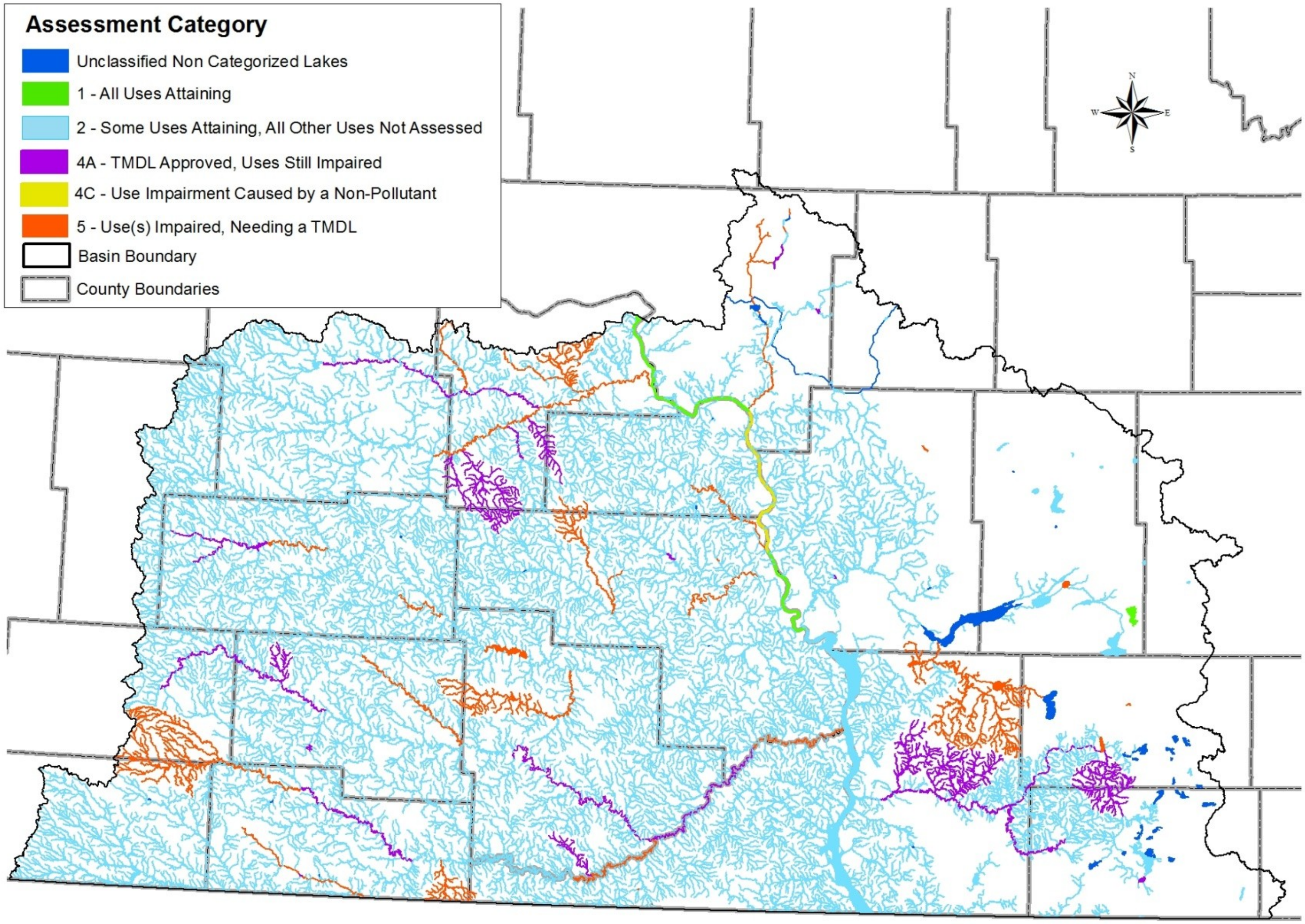

Figure VI-5. Graphical Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the Lake Oahe/Missouri River Basin.

Table VI-4. 2014 List of Section 303(d) TMDL Waters for the James River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10160001-002-L_00	Jamestown Reservoir	2073.4 Acres	**Recreation**	Fully Supporting But Threatened	Nutrient/Eutrophication Biological Indicators	H	No
ND-10160001-002-S_00	James River downstream from Jamestown Reservoir to its confluence with Pipestem Creek, including one tributary.	4.74 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Benthic-Macroinvertebrate Bioassessments	L	Yes
ND-10160001-003-S_00	James River from Arrowwood Lake, downstream to Jim Lake, including Mud	5.18 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Oxygen, Dissolved	L	No
ND-10160001-006-S_00	James River from Jim Lake, downstream to Jamestown Reservoir. The length of this segment may be open for interpretation, depending upon how far the Jamestown Reservoir backs up on full pool.	7.23 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	L	No
ND-10160001-013-S_00	James River from its confluence with Big Slough, downstream to its confluence with Rocky Run.	20.27 Miles	**Recreation**	Not Supporting	Escherichia coli	L	No
ND-10160001-018-S_00	Rocky Run from its confluence with a tributary watershed west of Cathay, ND, downstream to its confluence with Rosefield	14.53 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	L	Yes
ND-10160001-021-S_00	Rocky Run from its beginning, downstream to its confluence with a tributary watershed located west of Cathay, ND (ND-10160001-020-S_00).	24.3 Miles	**Recreation**	Fully Supporting But Threatened	Fecal Coliform	L	Yes
ND-10160001-023-S_00	James River from its confluence with Rocky Run, downstream to its confluence with Lake Juanita Outlet (ND-10160001-027-S_00).	21.94 Miles	**Recreation**	Not Supporting	Escherichia coli	L	No
ND-10160002-001-L_00	Pipestem Reservoir	1877 Acres	**Recreation**	Fully Supporting But Threatened	Nutrient/Eutrophication Biological Indicators	H	No

Table VI-4 (con't). 2014 List of Section 303(d) TMDL Waters for the James River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10160003-005-S_00	Beaver Creek from its confluence with Buffalo Creek, downstream to its confluence with the James River, situated in SE	16.05 Miles	**Recreation**	Fully Supporting But Threatened	Escherichia coli	H	No
ND-10160003-008-S_00	Buffalo Creek from its beginning, downstream to its confluence with Beaver Creek (ND-10160003-005-S_00).	32 Miles	**Recreation**	Not Supporting	Escherichia coli	H	No
ND-10160003-013-S_00	Seven Mile Coulee, including all tributaries. Located in Eastern Stutsman County.	40.32 Miles	**Recreation**	Not Supporting	Escherichia coli	H	No
ND-10160004-001-S_00	Elm River from Pheasant Lake, downstream to the ND/SD border and Elm Lake.	5.58 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-002-S_00	Maple River from its confluence with South Fork Maple River, downstream to the ND/SD border.	41.87 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-005-S_00	Elm River, downstream to Pheasant Lake. Located in Dickey County.	13.79 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-006-S_00	Upper Elm River, including all tributaries. Located in Dickey County.	15.24 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-007-S_00	Bristol Gulch, including all tributaries. Located in Dickey County.	45.93 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-008-S_00	Unnamed tributaries to the Elm River (ND-10160004-005-S_00). Located in Dickey County.	21.69 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-009-S_00	Unnamed tributary to Pheasant Lake. Located in Dickey County.	2.53 Miles	**Fish and Other Aquatic Biota**	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes

Table VI-4 (con't). 2014 List of Section 303(d) TMDL Waters for the James River Basin in North Dakota.

Assessment Unit ID	AU Description	AU Size	Designated Use	Use Support	Impairment	TMDL Priority	5A
ND-10160004-013-S_00	Maple River from its confluence with Maple Creek, downstream to its confluence with South Fork Maple River. Located in Dickey	16.08 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-015-S_00	South Fork Maple River from its confluence with three tributaries, downstream to its confluence with the Maple River. Located in Dickey County.	14.92 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-022-S_00	Maple Creek, downstream to its confluence with the Maple River. Located in Lamoure County.	34.45 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes
ND-10160004-026-S_00	Maple River from Schlect-Thom Dam, downstream to its confluence with Maple Creek. Located in Lamoure County.	20.52 Miles					
			Fish and Other Aquatic Biota	Fully Supporting But Threatened	Sedimentation/Siltation	L	Yes

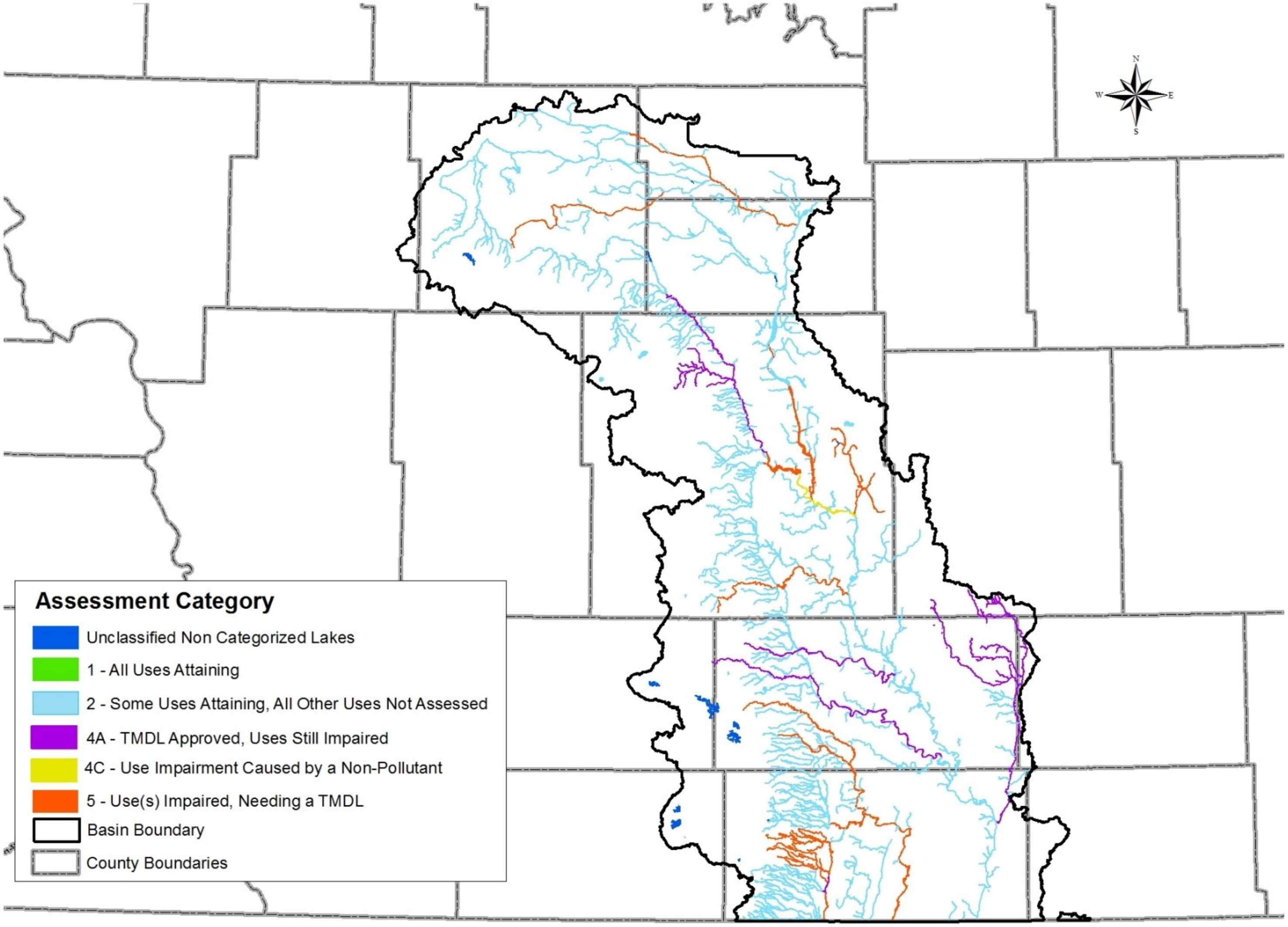

Figure VI-6. Graphical Depiction of 2014 Section 303(d) Listed Waters Needing TMDLs (Category 5) in the James River Basin.

Table VI-5. 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020101-002-S_00 - Bois De Sioux River from its confluence with the Rabbit River (MN), downstream to its confluence with the Ottertail River. Located on the Eastern border of Richland County.	15.31 Miles	***Recreation***	*Fecal Coliform*	Applicable WQS attained; due to change in WQS. The fecal coliform standard has recently been replaced with an E. coli standard in the state water quality standards. E. coli data collected for this assessment unit supports an assessment of fully supporting, but threatened for recreational use. This assessment replaces the previous fecal coliform use impairment listing for this assessment unit.
ND-09020104-002-S_00 - Red River of the North from its confluence with Whiskey Creek, downstream to its confluence with the Wild Rice River. Located in NE Richland and SE Cass Counties.	52.3 Miles	***Recreation***	*Fecal Coliform*	Applicable WQS attained; threatened water no longer threatened. Based on monthly (May-September) E. coli data collected by River Keepers in 2010, 2011, 2012 and 2013, this segment of the Red River is meeting water quality standards for E. coli bacteria. Therefore, recreation use is assessed as fully supporting.
ND-09020104-003-S_00 - Red River of the North, from its confluence with the Wild Rice River, downstream to the 12th Ave bridge in Fargo, ND (just upstream from Moorhead, MN waste water discharge). Eastern Cass County.	21 Miles	***Recreation***	*Escherichia coli*	Applicable WQS attained; threatened water no longer threatened. Based on a memo written for the Minnesota Pollution Control Agency (MPCA) by Houston Engineering, Inc. (dated August 13, 2013) which contains an analysis of E. coli data collected by the MPCA, the North Dakota Department of Health, the city of Faro, the city of Moorhead and River Keepers from 2002-2012, this segment of the Red River is now meeting water quality standards for E. coli bacteria. Therefore recreation use is assessed as fully supporting.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020104-004-S_00 - Red River of the North, from the 12th Ave N. bridge in Fargo, ND downstream to its confluence with the Sheyenne River. Eastern Cass County.	21.1 Miles	***Recreation***	*Escherichia coli*	Applicable WQS attained; threatened water no longer threatened. Based on a memo written for the Minnesota Pollution Control Agency (MPCA) by Houston Engineering, Inc. (dated August 13, 2013) which contains an analysis of E. coli data collected by the MPCA, the North Dakota Department of Health, the city of Faro, the city of Moorhead and River Keepers from 2002-2012, this segment of the Red River is now meeting water quality standards for E. coli bacteria. Therefore recreation use is assessed as fully supporting.
ND-09020104-005-S_00 - Red River of the North from its confluence with the Sheyenne River, downstream to its confluence with the Buffalo River on the MN side of the border. Located in NE Cass County.	10.45 Miles	***Recreation***	*Fecal Coliform*	Applicable WQS attained; threatened water no longer threatened. Based on a memo written for the Minnesota Pollution Control Agency (MPCA) by Houston Engineering, Inc. (dated August 13, 2013) which contains an analysis of E. coli data collected by the MPCA, the North Dakota Department of Health, the city of Faro, the city of Moorhead and River Keepers from 2002-2012, this segment of the Red River is now meeting water quality standards for E. coli bacteria. Therefore recreation use is assessed as fully supporting.
ND-09020105-001-S_00 - Wild Rice River from its confluence with the Colfax Watershed, downstream to its confluence with the Red River Of The North. Located in NE Richland and SE Cass Counties.	38.6 Miles	***Recreation***	*Fecal Coliform*	Applicable WQS attained; threatened water no longer threatened. Based on monthly (May-September) E. coli data collected by River Keepers in 2010, 2011, 2012 and 2013, this segment of the Red River is meeting water quality standards for E. coli bacteria. Therefore, recreation use is assessed as fully supporting.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020105-018-S_00 - Wild Rice River from its confluence with the Silver Lake Diversion downstream to Lake Tewaukon.	18.82 Miles	***Recreation***	*Fecal Coliform*	Applicable WQS attained; due to change in WQS. The fecal coliform standard has recently been replaced with an E. coli standard in the state water quality standards. E. coli data collected for this assessment unit supports an assessment of fully supporting, but threatened for recreational use. This assessment replaces the previous fecal coliform use impairment listing for this assessment unit.
ND-09020202-004-S_00 - Sheyenne River from its confluence with Big Coulee (ND-09020202-007-S_00), downstream to its confluence with the Warsing Dam Watershed (ND-09020202-003-S).	40.37 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020202-012-S_00 - Sheyenne River from Coal Mine Lake downstream to Harvey Dam. Located along the Sheridan and Wells County border.	20.8 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020202-013-S_00 - Unnamed tributary watershed to the Sheyenne River (ND-09020202-012-S). Located in Eastern Sheridan County.	36.24 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020202-015-S_00 - Sheyenne River, downstream to Sheyenne Lake. Located in North Central Sheridan County.	16.7 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020203-001-S_00 - Sheyenne River from Tolna Dam outlet (ND-09020203-020-S) downstream to Lake Ashtabula. Located in Southern Nelson and Eastern Griggs County.	93.81 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020203-002-S_00 - Baldhill Creek from tributary watershed (ND-09020203-005-S_00) downstream to Lake Ashtabula. Located in Griggs and Barnes County.	30.21 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020203-004-S_00 - Silver Creek, including Gunderson Creek and all tributaries. Located in southern Griggs County.	38.51 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020203-008-S_00 - Unnamed tributary watershed to Baldhill Creek (ND-09020203-007-S). Located in NW Griggs County.	16.07 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). A TMDL for E. coli bacteria was completed and approved by EPA on September 27, 2012.
ND-09020203-009-S_00 - Unnamed tributaries to Baldhill Creek (ND-09020203-007-S). Located in eastern Foster and western Griggs County.	28.01 Miles	***Recreation***	*Escherichia coli*	Data and/or information lacking to determine water quality status; original basis for listing was incorrect (Category 3). Original TMDL listing was based on data collected at a site that was inaccurately associated with this waterbody. The site and associated data were actually associated with waterbody ND-09020203-008-S_00 which is currently listed as "Not Supporting" recreation use due to E. coli bacteria.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020203-018-S_00 - Sheyenne River, downstream to the Tolna Dam outlet (ND-09020203-020-S). Located in Benson, Eddy, and Nelson Counties.	56.61 Miles	***Fish and Other Aquatic Biota***	*Sedimentation/Siltation*	Applicable WQS attained; threatened water no longer threatened. Based on extensive chemical and field monitoring data and six (6) macroinvertebrate samples collected in 2007, this segment of the Sheyenne River is assessed as "fully supporting" aquatic life use.
ND-09020307-019-S_00 - Turtle River from its confluence with a tributary NE of Turtle River State Park, downstream to its confluence with Kelly Slough.	25.27 Miles	***Recreation***	*Fecal Coliform*	TMDL approved or established by EPA (4A). A TMDL for both fecal coliform and E. coli bacteria was approved by EPA on August 22, 2013.
ND-09020307-021-S_00 - Turtle River from its confluence with South Branch Turtle River downstream to its confluence with a tributary NE oF Turtle River State Park.	13.9 Miles	***Recreation***	*Fecal Coliform*	TMDL approved or established by EPA (4A). A TMDL for both fecal coliform and E. coli bacteria was approved by EPA on August 22, 2013.
ND-09020307-024-S_00 - South Branch Turtle River downstream to Larimore Dam.	18.42 Miles	***Recreation***	*Fecal Coliform*	TMDL approved or established by EPA (4A). A TMDL for both fecal coliform and E. coli bacteria was approved by EPA on August 22, 2013.
ND-09020307-031-S_00 - North Branch Turtle River from its confluence with Whiskey Creek, downstream to its confluence with South Branch Turtle River.	15.26 Miles	***Recreation***	*Fecal Coliform*	TMDL approved or established by EPA (4A). A TMDL for both fecal coliform and E. coli bacteria was approved by EPA on August 22, 2013.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020310-001-L_00 - Homme Dam	194 Acres			
		Fish and Other Aquatic Biota		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on October 9, 2012.
		Recreation		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on October 9, 2012.
ND-09020310-001-S_00 - Park River from its confluence with Salt Lake Outlet (ND-09020310-009-S_00), downstream to its confluence with the Red River Of The North.	15.06 Miles			
		Fish and Other Aquatic Biota		
			Cadmium	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for cadmium, therefore the waterbody is not impaired for aquatic life uses due to the pollutant cadmium.
			Copper	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for copper, therefore the waterbody is not impaired for aquatic life uses due to the pollutant copper.
			Lead	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for lead, therefore the waterbody is not impaired for aquatic life uses due to the pollutant lead.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020310-010-S_00 - Park River from its confluence with a tributary east of Grafton, ND (ND-09020310-012-S_00), downstream to its confluence with the outlet from Salt Lake (ND-09020310-009-S_00).	14.68 Miles			
		Fish and Other Aquatic Biota		
			Cadmium	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for cadmium, therefore the waterbody is not impaired for aquatic life uses due to the pollutant cadmium.
			Copper	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for copper, therefore the waterbody is not impaired for aquatic life uses due to the pollutant copper.
			Lead	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013 at an upstream monitoring location, there are no exceedences of the acute or chronic aquatic life criteria for lead, therefore the waterbody is not impaired for aquatic life uses due to the pollutant lead.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-09020310-013-S_00 - Park River from the confluence of the South Branch Park River and the Middle Branch Park River, downstream to its confluence with a tributary east of Grafton, ND (ND-09020310-012-S_00).	6.83 Miles			
		Fish and Other Aquatic Biota		
			Cadmium	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013, there are no exceedences of the acute or chronic aquatic life criteria for cadmium, therefore the waterbody is not impaired for aquatic life uses due to the pollutant cadmium.
			Copper	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013, there are no exceedences of the acute or chronic aquatic life criteria for copper, therefore the waterbody is not impaired for aquatic life uses due to the pollutant copper.
			Lead	Applicable WQS attained; threatened water no longer threatened. Based on 9 water quality samples collected by the USGS North Dakota Water Science Center from 2003-2013, there are no exceedences of the acute or chronic aquatic life criteria for lead, therefore the waterbody is not impaired for aquatic life uses due to the pollutant lead.
ND-10110203-001-S_00 - Little Missouri River from its confluence with Little Beaver Creek downstream to its confluence with Deep Creek. Located in Slope County.	75.79 Miles			
		Recreation		
			Fecal Coliform	Applicable WQS attained; due to change in WQS. The fecal coliform standard has recently been replaced with an E. coli standard in the state water quality standards. E. coli data collected for this assessment unit supports an assessment of fully supporting, but threatened for recreational use. This assessment replaces the previous fecal coliform use impairment listing for this assessment unit.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-10110203-003-S_00 - Deep Creek from the confluences of East Branch Deep Creek and West Brach Deep Creek downstream to its confluence with the Little Missouri River. Located in Slope County.	42.51 Miles			
		Recreation		
			Fecal Coliform	
				TMDL approved or established by EPA (4A). A TMDL for fecal coliform bacteria and E. coli bacteria was approved by EPA on October 9, 2012.
ND-10110203-004-S_00 - West Branch Deep Creek, including tributaries. Located in Slope County.	117.25 Miles			
		Recreation		
			Fecal Coliform	
				TMDL approved or established by EPA (4A). A TMDL for fecal coliform bacteria and E. coli bacteria was approved by EPA on October 9, 2012.
ND-10130101-002-L_00 - Brush Lake	200 Acres			
		Fish and Other Aquatic Biota		
			Nutrient/Eutrophication Biological Indicators	
				TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.
			Oxygen, Dissolved	
				TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012. The nutrients TMDL addresses the dissolved oxygen impairment as demonstrated in the TMDL document.
		Recreation		
			Nutrient/Eutrophication Biological Indicators	
				TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-10130101-003-L_00 - Crooked Lake	375 Acres			
		Fish and Other Aquatic Biota		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.
			Oxygen, Dissolved	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012. The nutrients TMDL addresses the dissolved oxygen impairment as demonstrated in the TMDL document.
		Recreation		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.
ND-10130103-003-L_00 - Braddock Lake	91.2 Acres			
		Fish and Other Aquatic Biota		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.
			Oxygen, Dissolved	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012. The nutrients TMDL addresses the dissolved oxygen impairment as demonstrated in the TMDL document.
		Recreation		
			Nutrient/Eutrophication Biological Indicators	TMDL approved or established by EPA (4A). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012.
ND-10130103-007-S_00 - Hay Creek downstream to its confluence with Apple Creek. Located in Burleigh County.	15.78 Miles			
		Fish and Other Aquatic Biota		
			Sedimentation/Siltation	Applicable WQS attained; according to new assessment method. Based on results of the Hay Creek Sediment and Geomorphic Assessment which was prepared and published by Houston Engineering, Inc. in a Technical Memorandum dated May 20, 2013, Hay Creek's sediment yield currently meets the criteria for stable sites. The report also presents a series of channel cross sections from 2001 and 2012 which shows no significant change in channel morphology. It is therefore assumed that sediment is no longer a cause of aquatic life use impairment.

Table VI-5 (con't). 2012 Section 303(d) TMDL Waters in the State Which Have Been De-listed for 2014.

Assessment Unit ID/Description	AU Size	Impaired Use	Pollutant	Rationale for De-listing
ND-10130204-001-S_00 - Cannonball River from its confluence with Snake Creek, downstream to its confluence with Cedar Creek. Located in Grant County.	34.16 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). An E. coli bacteria was completed and approved for this waterbody on March 25, 2014.
ND-10130204-007-S_00 - Cannonball River from its confluence with Sheep Creek downstream to its confluence with Snake Creek. Located in Grant County.	46.7 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). An E. coli bacteria was completed and approved for this waterbody on March 25, 2014.
ND-10130204-032-S_00 - Cannonball River from its confluence with Philbrick Creek downstream to its confluence with Indian Creek. Located in Hettinger and Slope County.	54.25 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). An E. coli bacteria was completed and approved for this waterbody on April 21, 2014.
ND-10130204-044-S_00 - Dead Horse Creek, including all tributaries. Located in Hettinger County.	40.18 Miles	***Recreation***	*Escherichia coli*	TMDL approved or established by EPA (4A). An E. coli bacteria was completed and approved for this waterbody on April 21, 2014.

PART VII. GROUND WATER ASSESSMENT

A. Ground Water Extent and Uses

Chapter 1. Aquifer Description

Ground water underlies the land surface throughout all of North Dakota and is present in both unconsolidated deposits and bedrock. Unconsolidated deposits are loose beds of sand, gravel, silt or clay that are of glacial origin. Aquifers in the unconsolidated deposits are called glacial drift aquifers and are the result of glacial outwash deposits. Glacial drift aquifers are generally more productive than aquifers found in the underlying bedrock and provide better quality water. Approximately 206 glacial drift aquifers have been identified and delineated throughout the state. The locations and aerial extent of the major glacial drift aquifers in the state are shown in Figure VII-1. It is estimated that 60 million acre-feet (AF) of water are stored in the major glacial drift aquifers in the state.

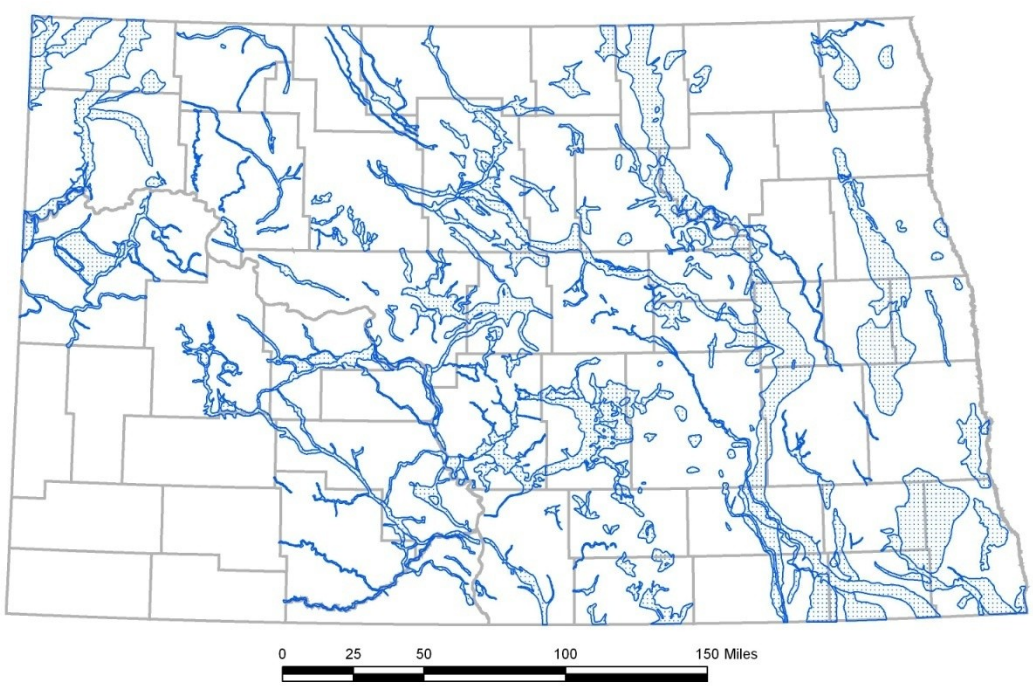

Figure VII-1. Major Glacial Drift Aquifers in North Dakota.

The bedrock underlying North Dakota consists primarily of shale and sandstone that generally (except in southwestern North Dakota) underlie the unconsolidated deposits. Bedrock aquifers underlie the entire state and tend to be more continuous and widespread than glacial drift aquifers. Water contained within bedrock aquifers occurs primarily along fractures in the rock, and the water produced is generally more mineralized and saline than water from glacial drift aquifers. The major bedrock aquifers that underlie North Dakota are shown in Figure VII-2. The amount of water available in the bedrock aquifers is unknown.

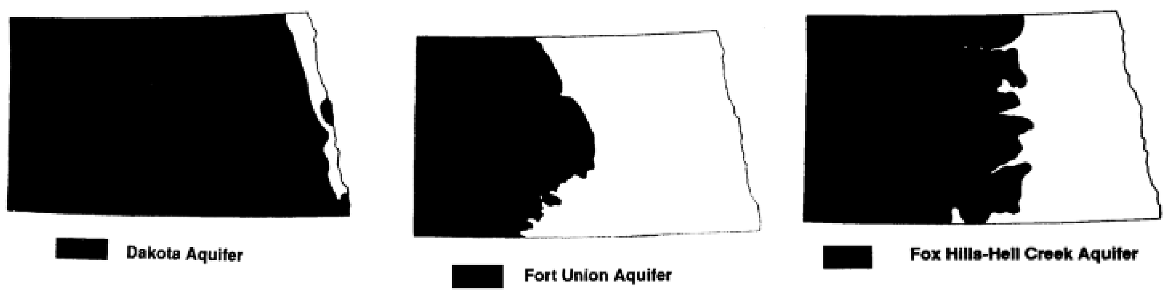

Figure VII-2. Location and Extent of North Dakota's Primary Bedrock Aquifers.

North Dakota has completed a multi-agency effort to assess and map the major ground water resources found within the state's boundaries. The County Ground Water Studies Program provides a general inventory of the state's ground water resources and was completed through a cooperative effort of the North Dakota State Water Commission (SWC), the North Dakota Geological Survey, the United States Geological Survey, county water resource districts and county commission boards. The country ground water studies identified the location and extent of major aquifers, hydraulic properties of the aquifers, water chemistry, estimated well yields and the occurrence and movement of ground water, including sources of recharge and discharge. The county studies were prepared in three parts:

- Part I describes the geology.
- Part II provides basic ground water data, including descriptive lithologic logs of test holes and wells, water levels in observation wells and water chemistry analyses.
- Part III describes the general hydrogeology.

The County Ground Water Studies are available for all counties in North Dakota. The SWC and other federal and state agencies continue to evaluate the ground water resources and expand the available knowledge of the quantity and quality of these resources.

Chapter 2. Ground Water Use

Ground water use in North Dakota has historically been categorized as agricultural (irrigation or livestock watering), industrial and domestic (private or public). Ninety-four (94) percent of the incorporated communities in the state rely on ground water from private wells, municipal distributions systems and/or rural water systems. Ground water is virtually the sole source of all water used by farm families and residents of small communities having no public water distribution system.

As indicated in Table VII-1, the highest consumptive use of ground water is related to irrigation.

Table VII-1. 2005 Reported Ground Water Use in North Dakota.

Type of Water Use	Amount of Water Used (acre-feet)	Percent of Total Water Used (%)
Irrigation	111,581	61
Municipal	27,782	15
Livestock	17,589	10
Rural Water Systems/Other	10,479	6
Industrial	9,648	5
Rural Domestic	5,887	3
Total	**182,966**	**100**

Notes: 1 acre-foot = 325,850 gallons
Data was obtained from the North Dakota State Water Commission website.

B. Ground Water Contamination Sources

Chapter 1. Contaminant Source Description

Contamination of ground water from manmade and natural sources has been detected in every county of the state. The degree to which contamination incidents are investigated or remediated is a function of the contaminant, its impact on the beneficial use of the resource and the overall risk it poses to the public or the environment. The following are the highest priority contaminant sources which have caused adverse impacts on the beneficial use of ground water resources throughout the state:

- Agricultural chemical facilities
- Animal feedlots
- On-farm agricultural mixing and loading procedures
- Above ground and underground storage tanks
- Surface impoundments
- Large industrial facilities
- Spills and releases

Common contaminants associated with these facilities include organic pesticides, nitrates, halogenated solvents, petroleum hydrocarbon compounds, sulfates, chlorides and total dissolved solids.

Chapter 2. Ground Water Contaminant Source Databases

The major sources of ground water contamination were determined utilizing a combination of professional experience and a review of existing department computer databases. Several databases maintained by the Division of Water Quality compile information relating to the type of regulated activity, its size and location and, in some cases, regional ground water quality information. The primary databases used to identify the major sources of ground water contamination are:

Concentrated Animal Feeding Operations (CAFO) Database

Since 1972, North Dakota has maintained an active concentrated animal feeding operations (CAFO) permit program. The program is designed to protect the quality of the state's water resources through oversight of the construction and management of CAFOs. The program regulates animal feeding operations and can require design or operational modifications to protect the quality of the waters of the state. Regulatory authority is provided in North Dakota Century Code (NDCC) 61-28 and North Dakota Administrative Code (NDAC) 33-16, which can require specific actions for construction, water quality monitoring, animal disposal, contingency planning and animal waste disposal. The CAFO database provides location, operation and contact information. The database is updated as needed to reflect changes in the program, such as the approval of new operations or modifications to existing operations. At present, information regarding 762 facilities is listed in the CAFO database.

Underground Injection Control (UIC) Program Class I/Class V Database

The Underground Injection Control (UIC) Program regulates the injection of liquid waste into the ground where it may have the potential to adversely impact underground sources of drinking water. The department has regulatory primacy to oversee and enforce the Class I and Class V UIC Programs. As part of this effort, the department completed a statewide survey designed to identify the type, location and use of small industrial or commercial injection systems. The State had previously developed and maintained a UIC Class V database to catalog information obtained during the survey and to document inspection and enforcement activities. Class I well information was recently added to the UIC database.

In response to EPA's effort to create a national UIC database, North Dakota's existing database was updated to include the data fields required in the national database. The new database facilitates the electronic submission of inspection and enforcement information to EPA, which has reduced the State's reporting burden. The new Class I/Class V database was submitted to EPA for a Quality Assurance/Quality Control review. EPA approved the dataset, and all reporting is now conducted through updates to the database and quarterly submittals of the information to EPA. At present, 4 active class V Wells and 792 active Class V wells are in the database.

Spill Response/Contaminant Release Database

The department maintains databases which track the initial response and subsequent follow-up action at locations where contaminants released to the environment impact water quality. Site location, contaminant type, responsible party and a historical record of activities conducted at the site are maintained.

Ambient Ground Water Quality Monitoring Database

The Ambient Ground Water Quality Program was developed to monitor ground water quality in the 50 most vulnerable aquifers in the state. In general, vulnerability was determined based upon natural geologic conditions, total appropriated water use and land use. The program was originally designed to identify the occurrence of about 60 different pesticides in ground water. New pesticides are added from time to time in response to increased production of specialty crops and/or new pest infestations. The Ambient Ground Water Quality Database contains all the data obtained through the implementation of the monitoring program. This includes sample location, analytical results and other site-specific information.

C. Ground Water Protection Programs

In 1967, North Dakota enacted legislation enabling the state regulation of activities which have caused, or which have the potential to cause, adverse impacts to the quality of the waters of the state. NDCC 61-28 entitled, "Control, Prevention and Abatement of Pollution of Surface Waters," not only defines the statement of policy for surface and ground water quality protection, but also sets specific prohibitions and penalties for violation of the state law. Since the enactment of NDCC 61-28, the state has pursued a policy to:

> "...act in the public interest to protect, maintain and improve the quality of the waters of the state for continued use as public and private water supplies, propagation of wildlife, fish and aquatic life and for domestic, agricultural, industrial and recreational and other legitimate beneficial uses...."

North Dakota has historically envisioned ground water quality protection to include a mix of financial and technical cooperation among federal, state and local governmental agencies and private entities. Since the early 1970s, the department has continued to build upon existing ground water protection capacities through the attainment of primacy for federal programs or through cooperative working relationships with other state, federal and local entities.

The following are brief descriptions of the programs administered by the department's Division of Water Quality.

Chapter 1. Wellhead and Source Water Protection Programs

The 1996 Amendments to the Safe Drinking Water Act established the Source Water Protection Program to serve as an overall umbrella of protection efforts for all public water systems, including ground water- and surface water-dependent systems. In North Dakota, the Wellhead Protection Program focuses on the ground water-dependent systems, while the Source Water Protection Program addresses surface water-dependent systems. The Source Water Protection Program involves the delineation of a protection area along rivers or reservoirs that provide source water for the system and an inventory of potential contaminant sources within the protection area. Under both wellhead and source water protection, the department assesses the system's susceptibility to potential contaminant sources found in the protection area.

The 1996 Amendments to the Safe Drinking Water Act required all states to complete the minimum elements of wellhead and source water protection (delineation, contaminant source inventory and susceptibility) by May 2003. The department completed the mandatory elements for all of the Community Water Systems and all of the Non-community Water Systems in the state by the required deadline.

North Dakota continues to promote and implement the Source Water Assessment Program. Public water systems are encouraged to implement the voluntary elements of wellhead and source water protection. These elements include the development of management strategies, contingency planning and public awareness programs. The department works with, and provides assistance to, all public water systems who desire to follow through with the voluntary elements of the program.

Following the completion of source water assessment requirements in 2003, the Wellhead Protection Program began conducting source water monitoring and contaminant source studies for ground water-dependent community public water systems that have been rated as susceptible or for systems that have had detections of organic or inorganic contaminants regulated by the Safe Drinking Water Act National Primary Drinking Water Regulations. Source water monitoring typically involves the use of existing monitoring wells at contaminant release sites or the use of private water supply wells in or near the wellhead protection area. Source water monitoring is accomplished through coordination with the local public water system and the department's divisions of Municipal Facilities and Waste Management.

D. Ground Water Quality

Chapter 1. Ambient Ground Water Monitoring Program

Ambient ground water quality monitoring activities are conducted by several agencies, with the primary activities being conducted by the North Dakota SWC and the department. The monitoring programs have been developed to assess ground water quality and/or quantity in the major aquifer systems located throughout the state. The monitoring is designed to evaluate the condition of ground water quality as it relates to inorganic/organic chemical constituents and the occurrence of selected agricultural chemical compounds. Additional water quality information is collected as part of the Safe Drinking Water Act requirements through the monitoring of public drinking water programs.

The maintenance of a baseline description of ground water quality is an essential element of any statewide comprehensive ground water protection program. In recent years, concern for the quality of North Dakota's environment and drinking water has increased as it is learned that many states in the country have experienced ground water contamination from a variety of point and nonpoint sources of pollution.

In North Dakota, a large portion of the potable ground water resource underlies agricultural areas. Prior to the inception of the Ambient Ground Water Monitoring Program in 1992, only limited data were available to assess the impact of agricultural chemicals on the state's ground water quality. The goal of the Ambient Ground Water Monitoring Program is to provide an assessment of the quality of North Dakota's ground water resources with regard to agricultural chemical contamination.

Several glacial drift aquifers have been monitored each year of the program since 1992. The monitoring conducted in 1996 marked the completion of the first five-year cycle of monitoring high-priority glacial drift aquifers in the state. The second five-year cycle of monitoring began in 1997, during which time the aquifers sampled five years earlier in 1992 were resampled. The third five-year cycle of monitoring was completed in 2006, and the fourth five-year cycle was completed in 2011. Conducting the monitoring on five-year cycles, preferably using most of the same wells for sampling, will provide a temporal assessment of agricultural chemical occurrence in specific aquifers.

In September 2013, the Department implemented the Western Ambient Water Quality Program to establish a ground water quality baseline and to analyze the potential impacts to groundwater as a result of developing oil and gas resources within the Williston Basin.

Chapter 2. Underground Injection Control (UIC) Program

The department's Class I and V Underground Injection Control (UIC) Programs have been administered in accordance with UIC rules and program descriptions. Program activities include administration of the program grant, permitting, surveillance and inspections, quality assurance, enforcement, data management, public participation, training, technical assistance and Class V assessment activities. The current UIC inventory includes four active Class I wells and 792 active Class V injection wells of various subclasses. The UIC Program coordinates with other programs, including the Resource Conservation and Recovery Act (RCRA), Underground Storage Tank (UST), National Pollutant Discharge Elimination System (NPDES) and Wellhead/Source Water Protection to identify activities which may threaten groundwater quality.

Chapter 3. Additional Ground Water-Related Projects

Ground Water Protection Program staff work on many projects related to the protection of the ground water resources of North Dakota. Projects include special monitoring projects; review of sites for livestock feeding operations; review of sites for landfill operations; and working on emergency response, investigations and cleanup of releases to the environment.

Facility Location Reviews

The Ground Water Protection Program takes the lead or assists other programs and agencies in evaluating the impacts land use activities may have on ground water quality. Site reviews or preliminary site reviews are conducted for new feedlot or CAFO operations, landfill or waste disposal facilities and industrial facilities. The Ground Water Protection Program also conducts special monitoring projects at CAFO facilities in the state to evaluate/identify potential ground water quality changes. In addition, site reviews are conducted for on-site sewage systems in new residential subdivisions to assess potential ground water impacts.

Water Appropriation and Monitoring

The department reviews water appropriation permits to assess potential impacts to ground water quality. Proposed water uses includes agricultural, public water supply, recreational and industrial uses.   A cooperative project with the SWC is underway involving the Karlsruhe aquifer to identify causes and potential solutions to nitrate increases in irrigated areas. Meetings were conducted with SWC personnel and local residents to discuss survey results and ongoing research. Currently, voluntary measures such as BMPs and reduced nutrient application rates are being implemented and evaluated in these areas. One of the irrigators has voluntarily installed shallow recovery/production wells to recover nitrate in the area of highest contamination. Residential drinking water wells are being monitored to ensure there is no danger to public health.

Contaminant Release Sites

The Ground Water Protection Program coordinates with the UST Program, RCRA/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Program and the Drinking Water Program to provide technical oversight relating to the assessment and remediation of ground water contamination incidents. The majority of sites are related to fuel storage facilities, although other types of storage sites include pesticides, nutrients/fertilizers, chlorinated solvents, metals and trace metals, and other inorganic compounds.

Pesticide Use Exemption Evaluations

The department also reviews applications for pesticide use exemptions (Federal Insecticides, Fungicides and Rodenticides Act Section 18 Requests) for potential impacts to surface or ground water.   Comments regarding each request are provided to the North Dakota Department of Agriculture.

Emergency Response and Spills

Additional project oversight is provided by the Ground Water Protection Program staff for a wide variety of emergency response and release incidents. The Ground Water Protection Program provides technical assistance to the Division of Emergency Management to address potential water quality impacts from accidental or intentional releases. The department continues to work with the North Dakota Oil and Gas Division on response to oilfield spills, using the one-stop online spill reporting capabilities which were added to the department web site, with automatic notification to appropriate department personnel. The Ground Water Protection Program also provides oversight or technical comment either directly to the responsible party or through the appropriate oversight agency on other ground water contamination projects. Typical projects include sites that require one or more of the following activities: site assessment, selection and implementation of appropriate corrective action, and sample collection and data review/evaluation.

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Appendix A

Changes Made To Assessment Units Entered into the Assessment Database for the 2014 Integrated Reporting Cycle

New Lake and Reservoir Assessment Units Added to the Assessment Database (ADB) in 2014

Assessment Unit ID	Assessment Unit Name	AU Size (acres)	Water Quality Standards Classification
ND-09020202-005-L_00	Sheyenne Lake	570	Non-Class Lake or Impoundment
ND-09020202-006-L_00	Coal Mine Lake	628	Class 4 Lakes, Marginal Fishery
ND-09020315-008-L_00	Rock Lake	100	Non-Class Lake or Impoundment
ND-10110205-001-L_00	Little Missouri Bay (Lake Sakakawea)	22718.6	Class 1 Lakes, Cold Water Fishery
ND-10130101-023-L_00	Lake Ordway	307	Non-Class Lake or Impoundment
ND-10130101-024-L_00	Turtle Lake	848	Non-Class Lake or Impoundment
ND-10130101-025-L_00	Camp Lake	104	Non-Class Lake or Impoundment
ND-10130102-007-L_00	Dollinger-Schnabel Lake	822	Non-Class Lake or Impoundment
ND-10130103-021-L_00	Napoleon Lake	1780	Non-Class Lake or Impoundment
ND-10130104-002-L_00	Doyles Lake	268.5	Non-Class Lake or Impoundment
ND-10130104-003-L_00	Kautz Lake	180	Non-Class Lake or Impoundment
ND-10130104-004-L_00	Logan County (Mueller) WMA	1335	Non-Class Lake or Impoundment
ND-10130104-005-L_00	Thurn Lake	95	Non-Class Lake or Impoundment
ND-10130104-006-L_00	Hauff Lake	528	Non-Class Lake or Impoundment
ND-10130104-007-L_00	Roesler Lake	564	Non-Class Lake or Impoundment
ND-10130104-008-L_00	Dewald Lake	546	Non-Class Lake or Impoundment
ND-10130106-007-L_00	Lepp Lake	209	Non-Class Lake or Impoundment
ND-10130106-008-L_00	Railroad Lake	333	Non-Class Lake or Impoundment
ND-10130106-009-L_00	Miller Lake	783	Non-Class Lake or Impoundment
ND-10130106-010-L_00	Lehr WMA	598	Non-Class Lake or Impoundment
ND-10130106-011-L_00	Nagel Lake (Koepplin WPA)	220	Non-Class Lake or Impoundment
ND-10130106-012-L_00	Mudd Lake	989	Non-Class Lake or Impoundment
ND-10130106-013-L_00	Homestead Lake	397	Non-Class Lake or Impoundment
ND-10130106-014-L_00	Pudwill Lake	601	Non-Class Lake or Impoundment
ND-10130106-015-L_00	Rueb-Eszlinger Lake	237	Non-Class Lake or Impoundment
ND-10130106-016-L_00	Dorfman Lake	1149	Non-Class Lake or Impoundment
ND-10130106-017-L_00	Pfeifle Lake	247	Non-Class Lake or Impoundment
ND-10130106-018-L_00	Becker-Schlepp Lake	383	Non-Class Lake or Impoundment
ND-10160001-006-L_00	Hurdsfield Lake	583	Non-Class Lake or Impoundment
ND-10160001-007-L_00	Mud Lake	197	Class 3 Lakes, Warm Water Fishery
ND-10160001-008-L_00	New Rockford Reservoir	11.6	Non-Class Lake or Impoundment
ND-10160003-011-L_00	Kleingartner Lake	496	Non-Class Lake or Impoundment
ND-10160003-012-L_00	Erickson Lake	1656	Non-Class Lake or Impoundment
ND-10160004-009-L_00	Flood Lake	1054	Non-Class Lake or Impoundment
ND-10160004-010-L_00	Diamond Lake	399	Non-Class Lake or Impoundment
ND-10160004-011-L_00	Harr Lake	379	Non-Class Lake or Impoundment
ND-10160004-012-L_00	McIntosh WMA	880	Non-Class Lake or Impoundment

Lake and Reservoir Assessment Units Where the Assessment Unit ID Changed from 2012 to 2014

2014 Assessment Unit ID	2012 Assessment Unit ID	Assessment Unit Name	AU Size (acres)
ND-09010004-006-L_00	ND-09020313-006-L_00	School Section Lake	395
ND-09010007-001-L_00	ND-09010001-001-L_00	Short Creek Dam	111.5
ND-09010007-002-L_00	ND-09010001-002-L_00	Truax Mine	7
ND-09010007-003-L_00	ND-09010001-003-L_00	Baukol-Noonan East Mine Pond	6.5
ND-09010008-001-L_00	ND-09010001-004-L_00	Lake Darling	8698
ND-09010007-004-L_00	ND-09010001-005-L_00	Baukol-Noonan Spillway Pond	0.95
ND-09010007-005-L_00	ND-09010001-006-L_00	Baukol-Noonan Dam	41.46
ND-09020316-001-L_00	ND-09020313-001-L_00	Mount Carmel Reservoir	337
ND-09020316-002-L_00	ND-09020313-002-L_00	Renwick Dam	220
ND-09020315-001-L_00	ND-09020313-004-L_00	Hooker Lake	34.5
ND-09020315-002-L_00	ND-09020313-005-L_00	Dion Lake	82.1
ND-09020315-003-L_00	ND-09020313-006-L_00	School Section Lake	395
ND-09020315-004-L_00	ND-09020313-007-L_00	Lake Upsilon	414
ND-09020315-005-L_00	ND-09020313-010-L_00	Jensen Lake	43.9
ND-09020315-006-L_00	ND-09020313-011-L_00	Armourdale Dam	79.8
ND-09020316-003-L_00	ND-09020313-012-L_00	Senator Young Dam	29.9
ND-09020315-007-L_00	ND-09020313-013-L_00	Gravel Lake	102.4

Lake and Reservoir Assessment Units Where There is a Change in the Waterbody Size Estimate for 2014

Assessment Unit ID	Assesment Unit Name	2012 AU Size (acres)	2014 AU Size (acres)	Comment
ND-10130102-006-L_00	Lake Oahe	112,000	69,959	AU size revised to be consistent with North Dakota Game and Fish Department size estimate. Estimate confirmed through GIS.

New River and Stream Assessment Units Added to the Assessment Database (ADB) in 2014

Assessment Unit ID	AU Size (Miles)	Comment
ND-09010004-003-S_00	9.45	New assessment unit for 2014.This assessment unit was created to account for the tributary that flow into Willow Lake (ND-09010004-012-L_00).
ND-09010004-013-S_00	3.84	New assessment unit for 2014.
ND-09010004-014-S_00	4.58	New assessment unit for 2014.
ND-09020104-009-S_00	4.64	New assessment unit for 2014.
ND-09020105-023-S_00	39.37	New assessment unit for 2014.
ND-09020105-024-S_00	24.57	New assessment unit for 2014.
ND-09020109-037-S_00	0.74	New assessment unit for 2014.
ND-09020109-038-S_00	0.89	New assessment unit for 2014.
ND-09020301-015-S_00	1.07	New assessment unit for 2014.
ND-09020315-003-S_00	64.54	New assessment unit for 2014.
ND-10060005-005-S_00	5.86	New assessment unit for 2014.This was formerly assigned to assessment unit ND-10100004-026-S_00 (Tributaries to the Yellowstone River). There was no assessment unit ID for the Missouri River from the MT border to its confluence with the Yellowstone River.
ND-10060005-006-S_00	18.85	New assessment unit for 2014.This assessment unit was formerly assigned as ND-10100004-002-S_00 which has been deleted from the ADB.
ND-10100004-027-S_00	1.43	New assessment unit for 2014.
ND-10130101-032-S_00	10.95	New assessment unit for 2014.This watershed assessment unit did not have its own assessment unit ID and was inappropriately labeled as Van Osting Dam watershed. This new assessment unit will result in Van Osting Dam watershed having a smaller size.
ND-10130101-033-S_00	16.39	New assessment unit for 2014.
ND-10130101-034-S_00	0.58	New assessment unit for 2014.
ND-10130101-035-S_00	0.94	New assessment unit for 2014.
ND-10130101-036-S_00	32.74	New assessment unit for 2014.
ND-10130101-037-S_00	14.90	New assessment unit for 2014.
ND-10130103-016-S_00	37.73	New assessment unit for 2014.This was formerly assigned assessment unit ID ND-10130103-002-S_00 (Long Lake Creek Watershed). The portion of Long Lake Creek Watershed which includes the tributaries to Lakes Isabel has been assigned a new assessment unit ID.

ND-10130103-017-S_00	62.09	New assessment unit for 2014.This was formerly assigned assessment unit ID ND-10130103-002-S_00 (Long Lake Creek Watershed). The portion of Long Lake Creek Watershed which includes the tributaries to Long Lake Refuge has been assigned a new assessment unit ID.
ND-10130103-018-S_00	28.26	New assessment unit for 2014.This was formerly assigned assessment unit ID ND-10130103-002-S_00 (Long Lake Creek Watershed). The portion of Long Lake Creek Watershed Below Long Lake has been assigned a new assessment unit ID.
ND-10130104-017-S_00	84.54	New assessment unit for 2014.
ND-10130106-003-S_00	4.62	New assessment unit for 2014.
ND-10130106-004-S_00	16.05	New assessment unit for 2014.The 1:24,000 topographic map GIS coverage was used to digitize the tributaries to Clear Lake.
ND-10130206-034-S_00	2.42	New assessment unit for 2014.
ND-10130303-005-S_00	1.80	New assessment unit for 2014.
ND-10160001-040-S_00	12.26	New assessment unit for 2014.
ND-10160001-041-S_00	19.09	New assessment unit for 2014.

2012 River and Stream Assessment Units Which Were Removed from the Assessment Database (ADB) in 2014

2012 Assessment Unit ID	AU Description	Explanation for Removal
ND-09020201-036-S_00	Tributary Between Lake Alice and Lake Irvine	Due to high water levels in both Lake Alice and Lake Irvine, this tributary connection between the two lakes no longer physically exists.
ND-09020204-044-S_00	Tributary to the Rush River	The stream segment which was identified in the 2012 ADB as Assessment Unit ND-09020204-011-S_00 was originally thought to be a tributary to the Rush River . ND-09020204-011-S_00 was corrected and included with ND-09020204-006-S_000 (Lower Branch Rush River Watershed). ND-09020204-044-S_00 was then reassigned to Assessment Unit ND-09020204-011-S_00.
ND-10130206-006-S_00	Tributaries to Lake Oahe	The stream segments identified as ND-10130206-006-S_00 are not tributaries directly to Lake Oahe, but are actually tributaries to the Cannonball River (ND-10130206-001-S_00). Since ND-10130206-002-S_00 is currently described as “Tributaries to the Cannonball River”, the stream segments that were assigned to ND-10130206-S_00 was added to ND-10130206-002-S_00 and ND-10130206-006-S_00 was removed from the ADB.
ND-10160001-016-S_00	Tributary to Rocky Run	This stream segment was connected to an upstream AU segment (ND-10160001-014-S_00). Segment ND-10160001-016-S_00 became part of ND-10160001-014-S_00 and ND-10160001-016-S_00 was removed from the ADB.

River and Stream Assessment Units Where the Assessment Unit ID Changed from 2012 to 2014

2012 Assessment Unit ID	**2014 Assessment Unit ID**	**AU Size (miles)**
ND-09010001-001-S_00	ND-09010008-001-S_00	43.51
ND-09010001-002-S_01	ND-09010006-001-S_00	20.97
ND-09010001-002-S_02	ND-09010006-002-S_00	181.49
ND-09010001-003-S_00	ND-09010008-002-S_00	56.11
ND-09010001-004-S_00	ND-09010007-001-S_00	94.43
ND-09010001-005-S_00	ND-09010007-002-S_00	109.39
ND-09010001-006-S_00	ND-09010008-003-S_00	33.11
ND-09010001-007-S_01	ND-09010008-004-S_00	31.34
ND-09010001-007-S_02	ND-09010008-005-S_00	20.92
ND-09010001-008-S_00	ND-09010008-006-S_00	60.98
ND-09010001-009-S_00	ND-09010008-007-S_00	63
ND-09010001-010-S_00	ND-09010008-008-S_00	47.97
ND-09010001-011-S_00	ND-09010008-009-S_00	47.3
ND-09010001-012-S_00	ND-09010008-010-S_00	56.93
ND-09010001-013-S_00	ND-09010008-011-S_00	23.62
ND-09010001-014-S_00	ND-09010008-012-S_00	60.51
ND-09010001-015-S_00	ND-09010008-013-S_00	21.79
ND-09010001-016-S_00	ND-09010008-014-S_00	8.34
ND-09010001-017-S_00	ND-09010008-015-S_00	10.6
ND-09010001-018-S_00	ND-09010008-016-S_00	49.16
ND-09010001-019-S_00	ND-09010008-017-S_00	26.97
ND-09020313-001-S_00	ND-09020316-001-S_00	8.63
ND-09020313-002-S_00	ND-09020316-002-S_00	11.47
ND-09020313-003-S_00	ND-09020316-003-S_00	26.46
ND-09020313-004-S_00	ND-09020316-004-S_00	30.2
ND-09020313-005-S_00	ND-09020316-005-S_00	42.43
ND-09020313-006-S_00	ND-09020316-006-S_00	22.76
ND-09020313-007-S_00	ND-09020316-007-S_00	107.63
ND-09020313-008-S_00	ND-09020316-008-S_00	46.88
ND-09020313-009-S_00	ND-09020316-009-S_00	14.59
ND-09020313-010-S_00	ND-09020316-010-S_00	17.43

ND-09020313-011-S_00	ND-09020316-011-S_00	8.07
ND-09020313-012-S_00	ND-09020316-012-S_00	5.24
ND-09020313-013-S_00	ND-09020316-013-S_00	37.83
ND-09020313-014-S_00	ND-09020316-014-S_00	38.99
ND-09020313-015-S_00	ND-09020316-015-S_00	8.55
ND-09020313-016-S_00	ND-09020316-016-S_00	9.67
ND-09020313-017-S_00	ND-09020316-017-S_00	19.28
ND-09020313-018-S_00	ND-09020316-018-S_00	9.96
ND-09020313-019-S_00	ND-09020316-019-S_00	18.3
ND-09020313-020-S_00	ND-09020316-020-S_00	35.63
ND-09020313-021-S_00	ND-09020316-021-S_00	28.47
ND-09020313-022-S_00	ND-09020316-022-S_00	8.92
ND-09020313-023-S_00	ND-09020316-023-S_00	32.24
ND-09020313-024-S_00	ND-09020316-024-S_00	34.15
ND-09020313-025-S_00	ND-09020316-025-S_00	13.07
ND-09020313-026-S_00	ND-09020316-026-S_00	12.09
ND-09020313-027-S_00	ND-09020316-027-S_00	22.02
ND-09020313-028-S_00	ND-09020316-028-S_00	7.96
ND-09020313-029-S_00	ND-09020316-029-S_00	8.73
ND-09020313-030-S_00	ND-09020316-030-S_00	105.18
ND-09020313-031-S_00	ND-09020316-031-S_00	13.57
ND-09020313-032-S_00	ND-09020316-032-S_00	57.37
ND-09020313-033-S_00	ND-09020316-033-S_00	38.07
ND-09020313-034-S_00	ND-09020316-034-S_00	16.84
ND-09020313-035-S_00	ND-09020316-035-S_00	61.4
ND-09020313-036-S_00	ND-09020316-036-S_00	13.71
ND-09020313-037-S_00	ND-09020316-037-S_00	
ND-09020313-038-S_00	ND-09020316-038-S_00	
ND-09020313-039-S_00	ND-09020316-039-S_00	10.92
ND-09020313-040-S_00	ND-09020316-040-S_00	34.99
ND-09020313-041-S_00	ND-09020316-041-S_00	
ND-09020313-042-S_00	ND-09020316-042-S_00	
ND-09020313-043-S_00	ND-09020316-043-S_00	71.75
ND-09020313-044-S_00	ND-09020315-001-S_00	80.52
ND-09020313-045-S_00	ND-09020315-002-S_00	11.84

ND-09020313-046-S_00	ND-09020315-004-S_00	50.24
ND-09020313-047-S_00	ND-09020315-005-S_00	9.99
ND-09020313-048-S_00	ND-09020315-006-S_00	47.17
ND-10100004-002-S_00	ND-10060005-006-S_00	18.85

River and Stream Assessment Units Where There is a Decrease in the Waterbody Size Estimate for 2014

Assessment Unit ID	2012 AU Size (miles)	2014 AU Size (miles)	Comment
ND-09010003-007-S_00	65.2	55.91	This segment was an absolute mess. There were numerous circular segments. I re drew the entire segment up to the Canadian border so the value entered is exactly correct.
ND-09010003-008-S_00	76.9	75.83	One circular segment was removed right where it dumps into the Souris.
ND-09010004-001-S_00	46.75	38.86	I made numerous corrections in this area, especially around Willow City ND. This resulted in slight changes to 3 or 4 IDs nearby.
ND-09010004-002-S_00	82.4	82.26	About the same. Just entering the actual calculated value from the NHD.
ND-09010004-003-S_01	58	57.65	About the same. Just entering the actual calculated value from the NHD, especially after creating the new ID of 003-S_00.
ND-09010004-004-S_00	10.5	9.69	Made numerous corrections in this area, especially around Willow City ND. This resulted in slight changes to 3 or 4 IDs nearby.
ND-09010004-005-S_00	118.15	109.53	There was roughly a 1 mile segment that was not supposed to be part of this segment. Once removed, it reduced the miles.
ND-09010004-006-S_00	61.3	61.28	About the same. Just entering the actual calculated value from the NHD.
ND-09010004-008-S_00	21.7	21.11	About the same. Just entering the actual calculated value from the NHD.
ND-09010004-010-S_00	9.25	7.51	The value in the ADB was a little high. No errors were found??
ND-09010005-001-S_00	21	20.06	There was a weird segment that is actually an old river bed, and should not have been considered part of this ID. I removed it.
ND-09010005-005-S_00	17.6	17.19	No corrections were made. Just entering calculated value.
ND-09010006-001-S_00	21.6	20.97	The GIS file was wrong. Most of the tribs were considered the main stem. After making the corrections, it came out to be nearly exactly what the ADB had.
ND-09010006-002-S_00	198.62	181.49	The GIS file was wrong. Most of the tribs were considered the main stem. After making the corrections it came out much closer to what was entered into the ADB.
ND-09010008-004-S_00	37.2	31.34	Numerous redundant loops were removed, and areas where the channel had changed were updated.
ND-09010008-005-S_00	22.4	20.92	Numerous redundant loops were removed, and areas where the channel had changed were updated.
ND-09010008-006-S_00	61.2	60.98	On small loop was removed.
ND-09010008-008-S_00	48	47.97	No errors. Just entering calculated value.
ND-09010008-012-S_00	60.8	60.51	No errors. Just entering calculated value.
ND-09010008-015-S_00	12.2	10.6	No changes.
ND-09010008-016-S_00	54.4	49.16	4 circular loops were removed resulting in less miles.
ND-09020104-002-S_00	52.3	52.28	No changes.
ND-09020104-004-S_00	21.1	20.04	Small changes where tribs and the Sheyenne dump into the Red.
ND-09020105-010-S_00	22.71	26.05	

ND-09020104-007-S_00	18.22	17.96	I gave more detail to this segment since it skirted the city of Fargo. Resulted in slightly less than what was calculated.
ND-09020105-020-S_00	118.17	8.68	No explanation. The value entered in the ADB was extremely over estimated as there is less than 9 miles in the NHD for Wild Rice Creek. Maybe someone thought it was supposed to be Wild Rice River and watershed??
ND-09020107-013-S_00	62.18	59.41	There has been much drainage going on here. When correcting all of the non existing meanders from where the stream used to be, to the existing drainages the mileage came out much closer to what is in the ADB.
ND-09020107-016-S_00	35.16	33.97	I used a photo and redrew all 5 segments with high detail.
ND-09020107-017-S_00	15.93	15.77	A few small corrections and a little more detail below Hunter dam.
ND-09020107-019-S_00	18.94	17.84	No corrections.
ND-09020109-002-S_00	16.21	14.29	No errors were fixed. The ADB was just a couple miles high for whatever reason.
ND-09020109-007-S_00	37.12	36.87	No errors fixed.
ND-09020109-008-S_00	33.47	33.44	No errors fixed.
ND-09020109-010-S_00	34.55	31.95	No errors fixed.
ND-09020109-017-S_00	17.99	17.89	No corrections made, just entering calculated value.
ND-09020109-018-S_00	21.51	20.64	No corrections made, just entering calculated value.
ND-09020109-019-S_00	86.16	85.46	One disconnected segment was joined and a little more detail was given in that area.
ND-09020109-020-S_00	35.84	35.23	About the same. Just entering the actual calculated value from the NHD.
ND-09020109-027-S_00	37.01	36.89	More detail was drawn in near the diversion. If detail was created for the entire reach, it would dramatically increase the miles for this segment.
ND-09020109-036-S_00	70.14	43.02	035 and 036 were flip flopped. The correction was made.
ND-09020201-001-S_00	24.7	24.66	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-002-S_00	24.08	11.16	I made some adjustments to these segments since the lake has consumed much of the tail end of them. I'm assuming that's why the ADB had such a high value.
ND-09020201-004-S_00	25.96	17.03	The value entered in the ADB was very high for whatever reason.
ND-09020201-006-S_00	18.24	15.65	There was a segment that was incorrect. It initially stopped at trib south of Edmore. After correcting it netted a small decrease.
ND-09020201-007-S_00	52.15	49.5	There was a segment that was incorrect. It initially stopped at trib south of Edmore. After correcting it netted a small decrease.
ND-09020201-008-S_00	17.41	17.16	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-009-S_00	22.2	21.68	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-010-S_00	10.68	10.55	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-013-S_00	51.3	28.69	There was a large segment that was mislabeled in this general area, affecting 013, 014, 015, and 016.
ND-09020201-016-S_00	27.71	26.85	There was a large segment that was mislabeled in this general area, affecting 013, 014, 015, and 016.
ND-09020201-018-S_00	6.7	6.18	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-021-S_00	98.8	73.65	The value entered in the ADB was very high for whatever reason.

ND-09020201-022-S_00	12.54	11.55	The value entered in the ADB was slightly high.
ND-09020201-023-S_00	36.52	33.98	The value entered in the ADB was slightly high.
ND-09020201-024-S_00	18.69	18.26	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-025-S_00	46.38	46.32	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-027-S_00	58.28	56.52	The value entered in the ADB was slightly high.
ND-09020201-028-S_00	21.89	21.36	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-029-S_00	23.88	23.25	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-030-S_00	37.79	37.54	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-031-S_00	22.83	22.23	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-032-S_00	10.16	9.9	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-033-S_00	1.56	1.51	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-034-S_00	103.44	102.07	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-037-S_00	9.09	8.96	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-038-S_00	1.49	1.46	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-043-S_00	38.67	38.53	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-044-S_00	3.35	3.3	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-046-S_00	4.57	4.46	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-047-S_00	11.06	7.77	There was a loop in this segment that was redundant and it added unnecessary mileage. So, I removed it.
ND-09020201-050-S_00	7.34	6.54	A small segment is actual Devils Lake, so when that was corrected it resulted in a small decrease.
ND-09020201-052-S_00	3.67	3.6	About the same. Just entering the actual calculated value from the NHD.
ND-09020202-006-S_00	35.06	34.58	Slightly more detail was drawn in near Harvey Dam.
ND-09020202-008-S_00	52.66	51.81	About the same. Just entering the actual calculated value from the NHD.
ND-09020202-009-S_00	13.38	11.33	The upper portion of this segment crossed into a closed basin. Using the DEM and the HUC boundaries, it was shortened so that it didn't cross into the other HUC. Resulting in a 2 mile reduction.
ND-09020202-012-S_00	20.8	19.42	This ID was shortened as some of it was actually Harvey Dam. After renaming, it resulted in this ID being shorter.
ND-09020202-014-S_00	8.1	6.61	One of the tribs was renamed to 018 as it actually dumped into Harvey Dam.
ND-09020203-007-S_00	35.36	35.15	Very close to what was in the ADB. Just entering the calculated value.
ND-09020203-009-S_00	30.5	28.01	A few disconnected segments were joined to the main stem of 007.
ND-09020203-017-S_00	56.1	47.79	Some minor corrections were made as to where the segment actually dumps into the lake. The new calculated value was slightly less than originally calculated.
ND-09020203-018-S_00	56.61	56.15	Some redundant circular segments were removed resulting in a value that is much closer to what was in the ADB.
ND-09020203-020-S_00	1.74	1.72	Very close to what was in the ADB. Just entering the calculated value.

ND-09020204-003-S_00	19.01	18.94	About the same.
ND-09020204-004-S_00	17.6	16.58	Minor corrections resulting in slightly less miles.
ND-09020204-011-S_00	19.27	3.61	This ID was -044, however due to a fix, 044 was deleted and it became 011.
ND-09020205-018-S_00	156.7	155.28	A segment was removed that was actually an old river bed, making it a duplicate or redundant segment.
ND-09020205-021-S_00	22.2	21.45	There is a lot of channelizing going on in this area. I fixed some blaringly obvious errors resulting in just a little less than the ADB and original calculation.
ND-09020205-023-S_00	53.97	50.76	There is a lot of channelizing going on in this area. I fixed some blaringly obvious errors resulting in just a little less than the ADB and original calculation.
ND-09020301-001-S_00	21.35	21.2	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-002-S_00	5.53	5.48	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-004-S_00	27.65	27.57	The last tributary, and the upper reaches of English Coulee, were flip flopped. After correcting it was very close to value in the ADB.
ND-09020301-005-S_00	6.16	6.14	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-007-S_00	31.13	31.03	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-008-S_00	25	24.87	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-009-S_00	36.01	35.9	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-010-S_00	8.06	7.99	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-012-S_00	31.29	31.01	About the same. Just entering the actual calculated value from the NHD.
ND-09020301-013-S_00	59.99	54.55	The furthest upper reach of Cole Creek was labeled as a tributary to. After fixing it decreased the mileage for this ID.
ND-09020301-014-S_00	4.02	3.78	About the same. Just entering the actual calculated value from the NHD.
ND-09020306-003-S_00	12.62	12.37	About the same. Just entering the actual calculated value from the NHD.
ND-09020306-004-S_00	31.94	31.44	ADB value was slightly higher. Just entering the actual calculated value from NHD.
ND-09020306-005-S_00	22.02	21.61	ADB value was slightly higher. Just entering the actual calculated value from NHD.
ND-09020307-008-S_00	17.23	16.27	No corrections.
ND-09020307-031-S_00	15.26	14.88	A small redundant circle was removed.
ND-09020307-033-S_00	11.89	11.22	More detail was drawn in near the two dams among this segment.
ND-09020307-034-S_00	21.34	19.9	No fixes were made, just entered calculated value.
ND-09020307-038-S_00	20.21	19.43	There is a significant amount of straightening in the middle of this segment so I used photos and made it more true to what's going on out there resulting in a slight reduction in miles from the original calc.
ND-09020307-040-S_00	24.68	23.75	A little more detail was drawn in where this watershed dumps into Skunk Coulee.
ND-09020308-001-S_00	16.17	15.49	I removed at least one redundant circular loop resulting in a lower number than the initial calculation.
ND-09020308-003-S_00	13.21	7.99	There were 3 or 4 circular segments deleted from this ID. They were actually just old river be meanders from the Forest River and were not actually tributaries.
ND-09020308-008-S_00	6.77	6.65	About the same. Just entering the actual calculated value from the NHD.

ND-09020308-012-S_00	2.92	1.54	Value in ADB was slightly high. No errors were found in NHD.
ND-09020308-014-S_00	6.55	5.29	Even 5.29 is questionable. However, the streams are found in the NHD layer, so even though a photo indicates there really isn't a stream there anymore, I entered the NHD calculated value.
ND-09020308-025-S_00	9.96	9.8	More detail was drawn in near Whitman dam.
ND-09020308-028-S_00	32.42	30.42	Some of this ID was actually Whitman Dam, so after making it 002-L, it lowered the miles.
ND-09020308-031-S_00	67.32	64.85	No corrections were made. Just entering calculated value.
ND-09020308-032-S_00	12.04	11.77	Minor detail correction near the hiway 32 tributary. No mile change from initial calc but still a little lower than old ADB value.
ND-09020310-001-S_00	15.06	11.54	There was a long segment labeled as -001, however it is actually -002 or tribs to 001. So miles were reduced.
ND-09020310-003-S_00	40.27	39.5	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-006-S_00	11.51	11.19	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-010-S_00	14.68	14.39	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-012-S_00	12.16	11.95	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-022-S_00	30.98	29.73	A circular segment was removed resulting in a little less than the originally calculated value.
ND-09020310-031-S_00	42.92	41.53	A few minor corrections were made towards the tail end of this segment, in a very low flat area.
ND-09020310-032-S_00	24	22.97	A very short break was connected.
ND-09020310-037-S_00	41.62	27.63	There was quite a difference between the ADB and the calculated value. No errors were found in the NHD so the ADB value was wrong.
ND-09020310-041-S_00	13.72	12.1	There was a slight error on the north side of Milton ND. The description referenced a dam, but no dam is present so the description was changed and the small error was fixed.
ND-09020310-042-S_00	26.82	25.99	No changes.
ND-09020310-045-S_00	66.95	64.75	No real errors found. Just entering the calculated value.
ND-09020311-003-S_00	30.3	28.82	Very close to exact. Just entering the calculated value.
ND-09020311-006-S_00	11.37	10.47	No fixes were made, just entered calculated value.
ND-09020311-007-S_00	3	2.9	No errors were found. Just entering the calculated value.
ND-09020315-001-S_00	127.84	80.52	This watershed was revamped. Some of this ID was reassigned to a new id of ND-09020315-003-S.
ND-09020315-005-S_00	10.3	9.99	No corrections made, just entering calculated value.
ND-09020315-006-S_00	65.54	47.17	Part of this should have been part of Mauvais Coulee, so after corrected in resulted in a big decrease.
ND-09020316-001-S_00	8.76	8.63	There was 1 trib that should have been labeled as -003. I fixed that which decreased to a closer value that is in the ADB.
ND-09020316-004-S_00	32.36	30.2	There were some redundant loops in some of these tribs. Once removed it netted a smaller value.

ND-09020316-007-S_00	113.59	107.63	There were numerous fixes where these tribs dump into the Tongue and circular redundant segments. I fixed and removed all.
ND-09020316-008-S_00	50.7	46.88	I redrew this entire watershed zooming in real close with the latest photo. This is about as accurate as it gets.
ND-09020316-009-S_00	15.91	14.59	A small fix near where it connects to 006.
ND-09020316-010-S_00	17.76	17.43	Very close to ADB value.
ND-09020316-012-S_00	6.67	5.24	The value in the ADB was a little high. No errors were found.
ND-09020316-013-S_00	39.52	37.83	There was one disconnected segment that I attached, but still not quite what was in the ADB.
ND-09020316-014-S_00	41.77	38.99	No fixes were made, just entered calculated value.
ND-09020316-015-S_00	8.69	8.55	A small correction to the shorter trib, using a photo.
ND-09020316-016-S_00	10.82	9.67	There was a small segment that should have been 018. After renaming, resulted in slightly less miles for this segment.
ND-09020316-017-S_00	20.18	19.28	About the same. Just entering the actual calculated value from the NHD.
ND-09020316-018-S_00	10.21	9.96	One small segment was added to this as it was previously labeled as 016 resulting in slightly more miles and closer to original ADB value.
ND-09020316-019-S_00	18.94	18.3	About the same. Just entering the actual calculated value from the NHD.
ND-09020316-020-S_00	38.71	35.63	No fixes were made, just entered calculated value.
ND-09020316-021-S_00	32.72	28.47	I nearly redrew this entire segment using a 2012 photo. There were numerous fixes too.
ND-09020316-023-S_00	36.97	32.24	I redrew this entire segment. This is as accurate as it gets.
ND-09020316-025-S_00	13.09	13.07	I did a little work on correcting the Pembina and once finished it was real close to what was in the ADB.
ND-09020316-026-S_00	15.53	12.09	There were numerous remnant channels of the Pembina considered tribs. I removed them as they all went in circles.
ND-09020316-031-S_00	14.31	13.57	There were a few disconnected tribs to this segment, so while I was in connecting those, I tidied up this stream just a small amount. Then entered the correct amount.
ND-09020316-033-S_00	39.19	38.07	No corrections were made. Just entering calculated value.
ND-09020316-034-S_00	17.82	16.84	I removed a redundant circle in part of this segment, and added more detail in that area. If more detail was done, it would get up to the original ADB value in a hurry.
ND-09020316-035-S_00	64.68	61.4	No corrections were made. Just entering calculated value.
ND-10060005-002-S_00	8.79	8.77	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10060005-003-S_00	8.57	6.28	Value in ADB was slightly high. No errors were found in NHD.
ND-10060005-004-S_00	67.83	57.27	Value in ADB was slightly high. No errors were found in NHD.
ND-10060006-001-S_00	38.72	38.67	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10060006-002-S_00	64.17	63.59	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10060006-003-S_00	11.33	9.33	Value in ADB was slightly high. No errors were found in NHD.

ND-10100004-001-S_00	21.62	20.97	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-003-S_00	4.37	3.96	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-004-S_00	28.89	28.86	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-006-S_00	92.55	92.43	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-007-S_00	70.47	62.83	The value entered into the ADB was slightly high for whatever reason?
ND-10100004-009-S_00	64.47	64.13	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-011-S_00	8	7.96	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-013-S_00	32.71	31.89	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-014-S_00	40.95	40.6	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-015-S_00	31.12	31.03	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-017-S_00	75.08	74.98	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-019-S_00	14.34	14.25	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-021-S_00	103.72	102.67	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-022-S_00	10.41	9.85	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-023-S_00	89.96	89.3	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-024-S_00	30.11	29.83	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-026-S_00	53.91	23.54	This area of the NHD was a mess. It is a very complex flow pattern. Many of the segments were wrongly labeled as -002.
ND-10110101-002-S_00	29.17	29.07	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-006-S_00	97.38	94.93	The value entered into the ADB was slightly high for whatever reason?
ND-10110101-011-S_00	66.3	59.87	Due to the error fix for -010, it netted a decrease in miles for this unit.
ND-10110101-015-S_00	33.46	33.25	There was one small segment at the headwaters of this unit that was wrongly labeled. After correction it came out very close to ADB entry.
ND-10110101-018-S_00	75.21	70.45	The value entered into the ADB was slightly high for whatever reason?
ND-10110101-019-S_00	33.96	33.78	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-020-S_00	24.39	24.2	About the same. Just entering the actual calculated value from the NHD.

ND-10110101-021-S_00	7.99	7.92	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-022-S_00	31.68	31.44	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-023-S_00	5.87	5.83	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-024-S_00	17.16	16.98	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-026-S_00	6.44	6.42	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-027-S_00	16.7	16.62	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-029-S_01	5	2.85	After the corrections to 029-S_00, it netted a small decrease for this unit.
ND-10110101-031-S_00	84.08	81.51	The value entered into the ADB was slightly high for whatever reason?
ND-10110101-041-S_00	22.84	22.63	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-045-S_00	23.43	23.25	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-049-S_00	19.44	19.19	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-050-S_00	32.8	32.45	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-051-S_00	30.26	29.99	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-053-S_00	29.83	29.42	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-054-S_00	31.35	31.07	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-056-S_00	42.41	42.09	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-057-S_00	28.97	28.65	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-065-S_00	59.43	58.28	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-066-S_00	40.66	39.69	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-067-S_00	16.07	14.31	Slight decrease. The value in the ADB was slightly high.
ND-10110101-068-S_00	18.28	18.11	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-070-S_00	14.62	14.11	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-072-S_00	31.25	29.71	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-074-S_00	30.16	29.97	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-076-S_00	156.26	149.08	The value in the ADB was a little high. There was one segment removed that actually was a 075 so it resulted in even less miles.
ND-10110101-077-S_00	13.86	13.74	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-078-S_00	35.74	35.42	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-079-S_00	25.38	25.1	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-080-S_00	45.44	44.95	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-083-S_00	45.86	44.88	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-084-S_00	8.89	8.82	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-002-S_00	95.64	90.21	The tail end of two segments was notched off to match the HUC boundary.
ND-10110102-004-S_00	37.6	37.01	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-005-S_00	114.43	112.5	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-006-S_00	26.88	26.47	About the same. Just entering the actual calculated value from the NHD.

ND-10110102-007-S_00	30.61	30.03	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-008-S_00	148.54	146.08	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-009-S_00	12.21	12	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-010-S_00	31.28	30.72	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-011-S_00	35.22	34.52	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-012-S_00	6.6	6.44	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-013-S_00	14.7	14.37	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-014-S_00	36.75	35.04	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-015-S_00	32.66	31.94	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-016-S_00	37.91	37.09	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-017-S_00	58.27	55.55	The way upper reaches of the Little Muddy was wrong. I used the topo to correct it.
ND-10110102-019-S_00	39.38	30.3	Some of this watershed was labeled wrong (see -020). After correcting, it netted a large decrease to this ID.
ND-10110201-002-S_00	128.6	14.05	Due to the numerous tribs, this increase might be due to the RF3 NHD conversion. And, I added a little more detail by connecting a few broken segments right along the border.
ND-10110201-003-S_00	35.96	35.72	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-009-S_00	9.09	7.62	The wrong watershed was labeled. This was actually a trib to Little Missouri. Flip flopped and entered correct miles.
ND-10110203-026-S_00	73.51	72.77	An old little Missouri river bed segment was removed.
ND-10110203-046-S_00	24.45	23.11	No corrections were made. Just entering calculated value.
ND-10110203-057-S_00	9.89	9.85	A redundant circle was removed and the value became real close to the ADB value.
ND-10110203-082-S_00	42.41	23.73	Value in ADB was very high. No errors were found in NHD.
ND-10110204-002-S_00	21.75	17.52	There was a very small segment that ever so slightly crosses the MT border. I added that back in, but the ADB value was still quite high.
ND-10110204-004-S_00	52.09	51.35	About the same. Just entering the actual calculated value from the NHD.
ND-10110205-001-S_00	58.94	58.18	I redrew this entire segment as there were multiple areas where there were loops, and disconnected tribs emptying into this segment.
ND-10110205-002-S_00	96.01	88.22	I fixed nearly every one of these segments where they emptied into the Little Mo. Resulting in a significant decrease.
ND-10110205-019-S_00	43.05	42.9	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-020-S_00	5.93	4.01	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-021-S_00	97.27	94.23	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-033-S_00	23.79	21	There were 3 or 4 redundant loops along the river. Once removed it resulted in a little less miles from calculate.
ND-10110205-057-S_00	126.68	89.42	No errors were found. The value in the ADB was almost 40 miles high.
ND-10110205-059-S_00	21.03	20.85	There were 5 or 6 circular redundant parts to this segment. I removed them.
ND-10130101-003-S_00	86.08	73.06	There were a lot of redundant streams running in all directions as they approached the

			Missouri river. When those were removed it resulted in a few less miles.
ND-10130101-005-S_00	64.13	26.04	Not sure why such a decrease. Must have been an error in the ADB??
ND-10130101-007-S_00	115.79	17.94	No Explanation. The value entered in the ADB was way high for some reason by nearly 100 miles??
ND-10130101-010-S_00	150.92	150.64	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-011-S_00	10.28	2.09	Most of this watershed was wrongly labeled as Mosbrucker Dam watershed. A new ID was created for that resulting in less actual miles for this watershed.
ND-10130101-015-S_00	23.56	22.97	Many redundant streams running in all directions representing the Missouri river. After cleaning it up, it was much more representative of actual, and what was in the ADB.
ND-10130101-018-S_00	10.98	10.45	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-024-S_00	140.2	138.49	After a couple small error fixes, and the RF3 to NHD conversion, it appears to be very close to what was in the ADB.
ND-10130101-027-S_00	115.83	107.2	This used to contain the diversion. After some correcting, it reduced the value.
ND-10130101-028-S_00	14.53	10.74	There were many redundant streams associated with this in the NHD layer. After fixing them, the miles came out slightly less than what was in the ADB.
ND-10130101-030-S_00	44.57	41.54	A few small fixes in the area where it confluences with the Missouri resulted in a small decrease in miles.
ND-10130102-008-S_00	142.49	90.63	The ADB value was grossly high. The area real close to where it dumps into Oahe was revised slightly, but it only increased the value by 1 mile. Not sure why the value was so high in the ADB.
ND-10130102-012-S_00	22.76	21.12	The upper two reaches were flip flopped. After correcting, the numbers still came out very close.
ND-10130102-018-S_00	116.69	47.7	I can't explain this except for that the value in the ADB was grossly exaggerated.
ND-10130102-019-S_00	36.65	36.17	I shortened up the area where it dumps into Lake Oahe.
ND-10130102-020-S_00	15.3	14.99	I shortened up the area where it dumps into Lake Oahe.
ND-10130102-026-S_00	107.75	18.9	Since there were two conflicting descriptions for this watershed, this ID is now just the Main Stem of Oak Creek. All the other tribs will be assigned -035.
ND-10130102-029-S_00	16.61	14.9	Many of the tribs were actually part of the lake. So after fixing it, it lessened the amount of miles of tribs to Rice Lake.
ND-10130102-030-S_00	11.8	11.05	After removing many of the redundant pieces that are typically found near the Missouri, the miles were much closer to the value in the ADB.
ND-10130102-031-S_00	23.34	23.11	About the same. Just entering the actual calculated value from the NHD.
ND-10130102-035-S_00	102.81	80.75	Since there were two conflicting descriptions for this watershed, this ID is now the tributaries to Oak Creek. And the main stem of Oak Creek will be assigned -026.
ND-10130104-015-S_00	121.48	36.25	This ID was split and a new ID was created, 017. So it reduced the miles dramatically. The remainder is now 017.
ND-10130201-010-S_00	18.45	18.3	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-011-S_00	55.49	54.12	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-012-S_00	57.04	56.41	About the same. Just entering the actual calculated value from the NHD.

ND-10130201-014-S_00	8.57	8.52	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-016-S_00	83.04	82.05	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-017-S_00	21.32	21.24	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-019-S_00	84.79	84.63	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-036-S_00	61.06	58.4	The ADB value was slightly high. I only made a very slight adjustment near the upper ends of this reach which did not have any effect on the length.
ND-10130201-047-S_00	73.72	69.84	One disconnected segment was joined, lessening the difference slightly.
ND-10130201-051-S_00	35.46	34.57	More detail was drawn in where it connects with 048.
ND-10130201-062-S_00	31.39	21.94	Didn't find any errors. Value in ADB was roughly 10 miles high.
ND-10130202-042-S_00	20.26	18.97	A small correction at the junction with the South Fork Green River.
ND-10130202-044-S_00	10.08	9.28	More detail was drawn in near the confluence with the Green River, and both of the tributaries had some minor changes as they were obviously wrong. Water can't flow up hill, at least according to the 10 m DEM.
ND-10130202-047-S_00	54.57	54.44	This ID was joined with 048. I used the HUC boundaries to split them. Also resulted in slightly less miles.
ND-10130202-063-S_00	7.93	7.54	No corrections were made. Just entering calculated value.
ND-10130203-018-S_00	9.44	8.85	Since there were only two segments, I took the time to place them directly over the stream using a photo. One of the segments oddly had a straight line shot when the stream clearly meandered. It did result in it getting closer to ADB value.
ND-10130203-037-S_00	27.54	13.08	About half of what the ADB had. Could not find anything wrong.
ND-10130203-044-S_00	8.87	7.81	No errors were fixed. ADB just slightly high.
ND-10130203-047-S_00	85.41	80.41	One segment was removed and added to -047.
ND-10130203-054-S_00	66.96	33.44	About half of what the ADB had. Could not find anything wrong.
ND-10130203-064-S_00	50.71	48.42	This segment was real accurate and no changes were made. So the original ADB value was just a bit high.
ND-10130204-025-S_00	2.35	2.03	The outlet segment was also included in this ID, so I renamed it to 031, or tribs to Cannonball.
ND-10130204-037-S_00	17.53	13.99	All of the area under the dam was changed to ND-10130204-006-L_00 to be consistent with other dams. Resulted in less miles for the watershed.
ND-10130204-052-S_00	30.7	30	The extreme headwaters of this segment was wrong as it crossed the HUC boundary. So I used the 1:24k Topo and redrew it and it corrected that.
ND-10130205-004-S_00	43.63	40.54	No fixes were made, just entered calculated value.
ND-10130205-005-S_00	39.63	33.5	I fixed 3 broken segments, however the ADB value is still high. The only explanation is if it originally included the extents that reached into SD.
ND-10130205-009-S_00	40.84	17.16	I'm assuming that the ADB value included portions that are in SD hence the reason why it was so much higher.
ND-10130205-010-S_00	168.31	55.56	The calculated value was significantly less than what was in the ADB. Really no explanation except that it's possible that tributaries in SD were initially counted, but shouldn't have been??

ND-10130205-011-S_00	42.89	41.48	No errors were found. Just entering the calculated value.
ND-10130205-021-S_00	79.34	66.72	A few small broken segments were fixed, however the ADB value was still significantly high.
ND-10130205-027-S_00	26.55	25.86	About the same. Just entering the actual amount calculated in the NHD.
ND-10130206-013-S_00	7.08	7.07	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-014-S_00	33.1	31.58	Part of the Raleigh Reservoir watershed was labeled as this ID. So after correcting it decreased this ID's miles, and will increase -015.
ND-10130206-032-S_00	17.49	17.13	About the same. Just entering the actual calculated value from the NHD.
ND-10130301-001-S_00	36.31	24.94	A few small errors were corrected by the Bowman Haley Dam. But value in ADB was still significantly higher for some reason.
ND-10130301-003-S_00	17.86	13.97	The value in the ADB was a few miles high.
ND-10130301-006-S_00	21.04	20.26	About the same. Just entering the actual calculated value from the NHD.
ND-10130301-007-S_00	67.58	60.33	The value in the ADB was a few miles high. Not sure why?
ND-10130301-014-S_00	28.77	27.59	No corrections made, just entering calculated value.
ND-10130301-016-S_00	2.18	1.84	Actual calculated value is just slightly less than what was in the ADB.
ND-10130301-020-S_00	27.29	6.02	A significant area was removed from this ID. It was actually tribs to Spring Creek, not BH Dam. Reduced the number of miles.
ND-10130301-023-S_00	48.02	47.76	I extended the stream to match the description in the ADB, which is down to the confluence of the N. Fork Grand River. Came out to be real close then.
ND-10130303-001-S_00	21.03	19.12	The value in the ADB was slightly high.
ND-10130303-002-S_00	37.79	36.51	A new ID was created because one of these segments is actually a trib to Mirror Lake. So, -005 was created resulting in roughly a 2 mile decrease for this ID.
ND-10130303-003-S_00	24.11	22.39	ADB was slightly high.
ND-10130303-004-S_00	87.27	77.92	The ADB value was very high. Only explanation is that it is along the ND/SD border and maybe the initial estimation included some of the tribs that got cut off from the border??
ND-10160001-025-S_00	23.36	23.27	About the same. Just entering the value in the NHD.
ND-10160001-026-S_00	4.05	4.02	About the same. Just entering the value in the NHD.
ND-10160001-027-S_00	0.45	0.19	About the same. Just entering the value in the NHD.
ND-10160001-030-S_00	3.18	3.15	About the same. Just entering the value in the NHD.
ND-10160001-031-S_00	17.69	17.59	About the same. Just entering the value in the NHD.
ND-10160001-035-S_00	12.24	6.13	The value entered in the ADB was twice of what it should be.
ND-10160001-037-S_00	17.5	1.44	Most of this ID was renamed as tribs to James River bypass.
ND-10160001-038-S_00	5.25	3.26	Part of this ID is now tributaries to the bypass channel. Hence a reduction in miles.
ND-10160002-001-S_00	25.21	21.95	This segment and -004 were flip flopped at the headwaters area. Renamed based off of 1:24k topo.
ND-10160003-015-S_00	10.42	10.41	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-036-S_00	18.79	18.17	About the same. Just entering the actual calculated value from the NHD.

River and Stream Assessment Units Where There is an Increase in the Waterbody Size Estimate for 2014

Assessment Unit ID	2012 AU Size (miles)	2014 AU Size (miles)	Comment
ND-09010003-001-S_00	51	51.97	I drew in really good detail around the Velva area. It was pretty messed up as it appears that put in some sort of diversion around the town.
ND-09010003-002-S_00	41.8	78.79	The value entered in the ADB was way low. Can't really explain that great of a difference except that it may have been an entry error. I did make some corrections in the Velva area giving it more details.
ND-09010003-003-S_00	207.8	210.41	There were 3 or 4 areas where segments were disconnected. This is a real flat area, so it was tough to determine the exact flow pattern, but using a 10 m DEM, I connected the segments to their nearest counterpart.
ND-09010003-004-S_00	28.9	29.32	A couple corrections where the tribs empty into the Souris.
ND-09010003-010-S_00	80.3	85.79	A couple segments were added to this. They were previously labeled as 007, the main stem of the Souris.
ND-09010004-007-S_00	42.5	42.96	About the same. Just entering the actual calculated value from the NHD.
ND-09010004-009-S_00	43.7	57.27	The value in the ADB was quite low. Calculated value was entered.
ND-09010004-011-S_00	9.1	11.05	The value in the ADB was a little low. No errors were found??
ND-09010004-012-S_00	15.4	113.36	No Explanation. The value entered in the ADB was way low for some reason. Most likely due to RF3 layer having a lower resolution that the 1:100k NHD layer.
ND-09010005-002-S_00	43.5	46.21	ADB was just wrong. No real corrections were made.
ND-09010005-003-S_00	176.6	181.69	Two floating segments were connected resulting in an even greater difference.
ND-09010005-004-S_00	116.7	121.39	A large correction was made joining the watershed so that it flows into Buffalo Lodge Lake.
ND-09010005-006-S_00	100.9	104.57	No corrections were made. Just entering calculated value.
ND-09010007-001-S_00	87.2	94.43	There were many fixes, including more detail especially downstream of the dam, and near the middle where there is a low slough like area.
ND-09010007-002-S_00	108.9	109.39	Very close to what was entered in the ADB.
ND-09010008-001-S_00	43.4	43.51	Just a few small corrections were made where tribs dumped into this segment giving it a little more detail and accuracy.
ND-09010008-002-S_00	53.1	56.11	Some corrections were made near the point where these tribs empty into the Souris.
ND-09010008-003-S_00	20.3	33.11	Some redundant segments were removed; however it still ended up being much higher than value in ADB. It is a very windy river so maybe the detail of the RF3 to NHD conversion added that much??
ND-09010008-007-S_00	49.5	63	There was an error or a loop in the upper portion of the watershed. I removed the loop as it is obviously not a correct flow pattern. It only dropped a mile or so, and the value in the ADB was quite low.
ND-09010008-010-S_00	45.4	56.93	No errors were found, so increase must be due to RF2 NHD conversion.
ND-09010008-011-S_00	23.4	23.62	No errors. Just entering calculated value.

ND-09010008-013-S_00	21	21.79	No corrections were made. Just entering calculated value.
ND-09010008-014-S_00	8.3	8.34	No corrections were made. Just entering calculated value.
ND-09010008-017-S_00	25	26.97	A couple minor changes near the area where some of these tribs emptied into Lake Darling.
ND-09020101-003-S_00	69.12	76.58	There was a small correction made.
ND-09020101-004-S_00	15.03	16.99	Value in ADB was slightly low. No errors were fixed.
ND-09020104-003-S_00	21	21.56	No changes.
ND-09020104-006-S_00	25.26	27.02	I removed a couple small segments that were circular loops, which lowered it a little closer to the ADB value, but still a little off.
ND-09020104-008-S_00	38.78	39.09	There were a couple of segments removed from this ID, and named -009, a new ID for 2014.
ND-09020105-008-S_00	57.6	72.63	The value entered in the ADB was 15 miles low.
ND-09020105-010-S_00	22.71	26.05	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-09020105-013-S_00	12.02	12.74	No corrections were made. Just entering calculated value.
ND-09020105-014-S_00	15.33	25.25	This segment was extended by a 10 miles as the photo depicted an obvious canal that has been created.
ND-09020105-016-S_00	16.16	24.78	No errors were found. Can't explain the discrepancy so I entered the calculated value from the NHD.
ND-09020105-019-S_00	57.06	62.51	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-09020107-002-S_00	6.54	6.95	No changes.
ND-09020107-005-S_00	8.14	8.18	There was a small segment that had the wrong ID. After fixing it was much closer to the ADB value.
ND-09020107-007-S_00	21.06	21.1	After making a small correction, the numbers come out almost exactly.
ND-09020107-008-S_00	20.49	21.34	About a mile difference is all. No explanation why.
ND-09020107-009-S_00	5.28	5.85	A small correction and it came out very close to what is in the ADB.
ND-09020107-010-S_00	27.73	28.19	About the same.
ND-09020107-015-S_00	103.35	105	Numerous corrections were made to the drains; however, the miles came much closer to the ADB value.
ND-09020109-001-S_00	27.68	30.88	There were a few old meanders that were included. I removed them and the value got closer to the ADB value.
ND-09020109-004-S_00	28.28	33.7	There was a large error in which part of this ID was wrongly labeled as 09020107-013. After the correction, it made the miles much closer, but ADB still about 5 miles short.
ND-09020109-006-S_00	5.03	5.68	No errors were fixed. ADB just low.
ND-09020109-009-S_00	48.09	48.35	A few small corrections resulting in a value real close to the original ADB value.
ND-09020109-015-S_00	33.35	43.2	Two small segments of this ID were wrongly labeled as 016. After the correction it lowered the miles to 43 but it is still much higher than the 33 that was in the ADB.
ND-09020109-016-S_00	72.56	72.92	After a couple small error fixes, it appears to be very close to what was in the ADB.

ND-09020109-021-S_00	17.74	45.86	The value entered in the ADB was way low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-09020109-024-S_00	24.81	25.41	A little more detail was made close to the diversion channels.
ND-09020109-026-S_00	3.1	3.93	This diversion wasn't really drawn in before. I corrected the line so that it connects from Beaver creek to S Golden Lake.
ND-09020109-034-S_00	28.64	32.32	The way most upper segment of this river was labeled as a trib. After correcting, it resulted in roughly 4 miles addition.
ND-09020109-035-S_00	48.39	62.04	035 and 036 were flip flopped. The correction was made. There were also other segments corrected where they were broken, or obviously rerouted due to channeling.
ND-09020201-003-S_00	9.14	10.06	The segment in the NHD was only about half completed. So I used the topo map and finished the segment and it came out to be real close with what was in the ADB.
ND-09020201-005-S_00	26.27	28.1	There was a segment that was incorrect. It initially stopped at trib south of Edmore. After correcting it netted a small increase.
ND-09020201-011-S_00	26.7	32.68	I extended a very clear canal going off to the NW which resulted in a few more miles than initially figured.
ND-09020201-012-S_00	30.73	37.34	A segment of this unit was labeled as -013. After fixing it netted a 7 mile increase. It should decrease -013 by roughly the same amount.
ND-09020201-014-S_00	6.28	18.31	There was a large segment that was mislabeled in this general area, affecting 013, 014, 015, and 016.
ND-09020201-015-S_00	27.63	27.66	There was a large segment that was mislabeled in this general area, affecting 013, 014, 015, and 016.
ND-09020201-017-S_00	6.32	9.4	One segment of this unit was wrongly labeled as 017 and it should have been 018. Also, I connected the segment so that it connects with Morrison lake as it says in the description.
ND-09020201-019-S_00	4.93	7.57	A small portion was just hanging in the middle of nowhere. I connected it to Dry Lake as the description states. Netted a slight increase in miles.
ND-09020201-020-S_00	26.4	28.25	A small increase from the ADB entry, most likely due to the RF3 NHD conversion. The calculated value was low since the segment did not connect to the lake as the description states. After connecting, it was real close to the ADB value.
ND-09020201-026-S_00	19.28	21.91	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-035-S_00	72.56	74.01	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-039-S_00	8.74	9.06	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-040-S_00	10.83	11.14	About the same. Just entering the actual calculated value from the NHD.
ND-09020201-041-S_00	12.69	17.54	There was one small segment missing connecting this ID to Hurricane Lake. After fixing that, and probably due to the RF3 NHD conversion, it netted a slight increase.
ND-09020201-042-S_00	27.89	30.1	There were a few missing connecting segments. Netted a small increase.
ND-09020201-045-S_00	30.43	35.49	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-09020201-048-S_00	14.19	16.74	There was a missing connecting point about midway of this unit. I connected the two which resulted in a slight increase.
ND-09020201-049-S_00	12.03	14.64	A couple missing segments were filled in between.
ND-09020201-051-S_00	14.04	14.27	About the same. Just entering the actual calculated value from the NHD.

ND-09020202-010-S_00	10.49	23.2	One small segment was labeled as -008, so it added about 1 mile to it, but most of the increase can only be explained by going from RF3 to NHD.
ND-09020202-011-S_00	27.59	30.46	One broken or missing segment fix. Resulted in an even bigger difference.
ND-09020202-013-S_00	36.24	37.53	One connection was made resulting in a slight increase.
ND-09020202-015-S_00	16.7	16.94	About the same. Just entering the actual calculated value from the NHD.
ND-09020202-016-S_00	64.91	76.81	Two new ID's were created, Sheyenne Lake and Coal Mine Lake, which reduced the mileage, however the ADB value was still quite low.
ND-09020202-018-S_00	2.03	3.17	A tributary was added to this ID resulting in a mile increase for this ID, and a decrease for 014.
ND-09020203-001-S_00	93.81	94.89	Very close to what was in the ADB. Just entering the calculated value.
ND-09020203-003-S_00	19.4	20.82	Tricky area, but when zoomed in tight enough, and using a DEM, and HUCs, I corrected the flow in the Cooperstown area. Obviously some channelizing going on here most likely to inhibit flooding for the town of Cooperstown.
ND-09020203-011-S_00	27.16	27.86	I extended the upper portion of this watershed where there was obvious water resulting in a little more that what was in the ADB.
ND-09020203-012-S_00	28.04	34	The value in the ADB was a little low. No errors were found??
ND-09020203-016-S_00	109.6	113.4	A few corrections were made. I joined a couple disconnected segments, and cleared up the area around Cooperstown.
ND-09020203-019-S_00	20.2	20.97	I cleaned it up a bit where the new Devils Lake outlet was installed.
ND-09020203-023-S_00	15.51	28.65	I added a significant amount of detail to the upper reaches of this ID using the 1:24k topo map.
ND-09020204-006-S_00	37.56	37.81	After some obvious corrections, it was reduced to almost exactly what was in the ADB.
ND-09020204-010-S_00	23.61	30.53	No errors were found. The value in the ADB was 7 miles low.
ND-09020204-012-S_00	36.3	36.4	About the same.
ND-09020204-018-S_00	20.2	20.9	Only a couple small corrections by giving more detail where these tribs dump into the Sheyenne.
ND-09020204-020-S_00	16.9	17.15	I redrew this entire segment. This is as accurate as it gets.
ND-09020204-021-S_00	0.84	0.87	Minor correction where it dumps into the Sheyenne.
ND-09020204-043-S_00	15.54	16.35	There was a couple small segments right off of the dam that were labeled as tribs. I changed them and it lowered the calculated value a little closer to the ADB value.
ND-09020205-002-S_00	52.5	85.41	The only assumption I have is that it’s possible the RF3 layer did not contain the ditches that are now in the NHD, which would explain why there are roughly 30 more miles with the more detail.
ND-09020205-022-S_00	121.3	127.96	There was a couple floating segments towards the upper reaches of this ID. I connected them.
ND-09020301-002-S_00	5.48	8.48	Reach indexing corrected. Additional stream segment added.
ND-09020301-003-S_00	22.97	29.1	The value in the ADB was slightly low.
ND-09020301-005-S_00	6.14	12.1	Reach indexing corrected.
ND-09020301-006-S_00	8.76	14.08	Reach indexing corrected.

ND-09020301-006-S_00	7.98	8.76	The last tributary, and the upper reaches of English Coulee, were flip flopped. After correcting it was very close to value in the ADB.
ND-09020301-011-S_00	26.51	35.64	The furthest upper reach of Cole Creek was labeled as a tributary to. After fixing it increased the mileage difference even more than it initially was.
ND-09020306-001-S_00	8.65	8.76	About the same. Just entering the actual calculated value from the NHD. Initial calc was wrong as there was a tributary wrongly labeled.
ND-09020306-002-S_00	5.33	6.13	About the same. Just entering the actual calculated value from the NHD. Initial calc was wrong as there was a tributary wrongly labeled.
ND-09020307-005-S_00	46.64	47	Very close to what was in the ADB, especially after correcting a small segment of this ID that was formerly labeled as 09020308-005.
ND-09020307-017-S_00	4.78	6.8	The value in the ADB was a couple miles low. Just entering the calculated value from NHD.
ND-09020307-035-S_00	0.4	2.15	This ID was extended where the photo clearly showed the drainage way.
ND-09020308-005-S_00	97.22	98.3	Part of 09020307-005 was assigned to this ID. After fixing, it was much closer to what was in the ADB.
ND-09020308-006-S_00	22.24	23.31	Close to what was in the ADB.
ND-09020308-007-S_00	10.48	11.57	Since Lake Ardoch is not in our ADB, I renamed the segments underneath the waterbody resulting in a slight increase.
ND-09020308-009-S_00	31.51	64.1	The value entered in the ADB was way low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-09020308-027-S_00	15.53	16.43	More detail near Whitman, and the upper reaches where it appears there has been some canal work going on.
ND-09020308-029-S_00	12.07	12.31	Minor detail correction near the hiway 32 tributary. No mile change from initial calc but still a little higher than old ADB value.
ND-09020308-033-S_00	36.09	36.74	One segment was deleted near the hiway 32 tributary.
ND-09020308-035-S_00	6.46	8.12	More detail was drawn in using the 1:24k topo resulting in more miles than both calculations.
ND-09020308-037-S_00	25.67	26.71	There was one disconnected segment that I attached resulting in an even greater difference than the ADB value.
ND-09020310-002-S_00	7.26	10.32	The segment described in the -001 description was added to this ID netting an increase in miles.
ND-09020310-004-S_00	12.08	13.07	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-005-S_00	13.57	13.59	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-007-S_00	9.14	10.16	ADB value was 1 mile low. Just entering the NHD value.
ND-09020310-008-S_00	5.92	7.44	A small segment located right in the Salt Lake area was removed, however when I lined up the NHD to the stream it netted an increase.
ND-09020310-009-S_00	0.24	0.33	About the same. Just entering the actual calculated value from the NHD.
ND-09020310-011-S_00	11.71	12.89	ADB value was 1 mile low. Just entering the NHD value.
ND-09020310-021-S_00	42.47	45.02	No corrections were made. Just entering calculated value.

ND-09020310-039-S_00	15.52	15.66	There was a slight error on the north side of Milton ND. The description referenced a dam, but no dam is present so the description was changed and the small error was fixed.
ND-09020310-043-S_00	7.99	11.84	There was a slight error on the north side of Milton ND. The description referenced a dam, but no dam is present so the description was changed and the small error was fixed.
ND-09020310-046-S_00	54.21	55.44	Two segments were connected, and a circular segment was redrew using a DEM.
ND-09020311-001-S_00	19.02	19.08	Very close to exact. Just entering the calculated value.
ND-09020311-002-S_00	9.74	13.96	There were some corrections made to this area using a detailed DEM. Many manmade drainages have replaced the natural flow, and using the DEM and photo I was able to correct some of this.
ND-09020311-004-S_00	138.99	152.53	There were some corrections made to this area using a detailed DEM. Many manmade drainages have replaced the natural flow, and using the DEM and photo I was able to correct some of this.
ND-09020311-009-S_00	51.48	70.55	There were a few floating segments NW of Pembina that I connected using a DEM and a very detailed photo. Resulted in an even greater difference.
ND-09020315-002-S_00	4.58	11.84	This watershed was revamped. Some of this ID was reassigned to -003, and it now is from the north end outlet structure to Mauvais coulee.
ND-09020315-004-S_00	46.02	50.24	Some of the GIS streams were mislabeled as Rock Lake tribs and the trib to the west was labeled as 048 when in actuality when you look up in Canada, its part of Mauvais coulee. Increased miles.
ND-09020316-002-S_00	11.31	11.47	I redrew this entire reach zooming in real close with the latest photo. This is about as accurate as it gets.
ND-09020316-003-S_00	21.9	26.46	The small trib that was labeled as -001 was added to this one making for even a bigger difference of what was in the ADB.
ND-09020316-005-S_00	40.3	42.43	Numerous corrections were made to the drains; however, the miles stayed exactly the same as the original calculation.
ND-09020316-006-S_00	22.54	22.76	I redrew this entire reach zooming in real close with the latest photo. This is about as accurate as it gets.
ND-09020316-011-S_00	7.94	8.07	I gave the stream a little more detail using a photo towards the upper end of this reach.
ND-09020316-022-S_00	7.85	8.92	There were a few redundant pieces fixed, along with more detail using the latest photo.
ND-09020316-024-S_00	32.46	34.15	1 segment was connected.
ND-09020316-027-S_00	19.11	22.02	I redrew this entire segment. This is as accurate as it gets. And I extended it a couple miles north of the border so that some of the tribs in ND could be connected.
ND-09020316-028-S_00	7.3	7.96	Redrew some of this segment to make it more accurate.
ND-09020316-029-S_00	8.54	8.73	Some minor corrections where the tribs dumped into the Pembina.
ND-09020316-030-S_00	103.02	105.18	A couple segments were reattached, and I connected three segments reaching just north of the border.
ND-09020316-032-S_00	51.9	57.37	There were three segments that were NOT attached to the Little Pembina (031). I attached them and recalculated and entered this amount which was 6 or 7 miles more than the ADB value.

ND-09020316-036-S_00	12.4	13.71	There were actually 2 watersheds flowing into Mt Carmel Dam. The ADB described it as 1 watershed. I added the second and re summed up the miles and changed the description to say "watersheds".
ND-09020316-039-S_00	10.87	10.92	Only a slight modification to the upper most part of the segment and near the city of Langdon more detail was drawn in.
ND-09020316-040-S_00	13.1	34.99	There was a very large segment missing in the center of this ID. I filled it in using a photo which was very clear and obvious of its location.
ND-09020316-043-S_00	62.24	71.75	The value in the ADB was roughly 10 miles low for whatever reason. Updated to correct amount.
ND-10060005-001-S_00	8.65	9.29	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-005-S_00	94.48	95	Very close to the value in the ADB. Just putting the actual calculated value in the NHD. There was also 1 small segment that was wrongly labeled and after fixing it netted a small increase from the ADB, and a small decrease from the original calculation in the NHD.
ND-10100004-008-S_00	19.3	20.79	There was 1 small segment of the mainstem that was labeled as a tributary to. After correcting it netted a small increase in miles.
ND-10100004-010-S_00	52.63	52.73	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-012-S_00	100.23	111.43	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10100004-016-S_00	35.37	35.61	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-018-S_00	50.27	50.41	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10100004-025-S_00	21.15	25.24	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-001-S_00	29.54	29.85	There were numerous errors in the NHD. After correcting them, the miles came out surprisingly close to what was in the ADB.
ND-10110101-003-S_00	774.02	813.81	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-004-S_00	49.24	53.21	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-005-S_00	15.05	15.23	A small error where Paulsen Creek was not physically connected to White Earth. Once fixed it resulted in a very slight increase in miles.
ND-10110101-007-S_00	78.31	80.52	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-010-S_00	18.58	26.88	There was an error of the upper portion of this Unit being labeled as tribs to White Earth Creek. After fixing it netted an increase in miles.
ND-10110101-012-S_00	4.59	4.99	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-014-S_00	8.18	8.4	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-016-S_00	83.23	88.84	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-017-S_00	27.98	28.44	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-025-S_00	4.16	4.62	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-028-S_00	23.76	24.24	About the same. Just entering the actual calculated value from the NHD.

ND-10110101-029-S_00	14.47	16.83	There were a few segments labeled as 029-S_01, and after correcting it netted a slight increase.
ND-10110101-030-S_00	108.6	109.62	There was one small segment that was not connected and I fixed it so it netted an increase in miles.
ND-10110101-032-S_00	57.35	57.71	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-033-S_00	125.07	127.07	A few fixes but ended up real close to ADB value.
ND-10110101-034-S_00	103.69	129.56	There were a mess of errors in the bottoms of the Missouri. After fixing it netted a value somewhere right in the middle of the ADB and the previously calculated value.
ND-10110101-035-S_00	82.63	86.35	About the same. Just entering the actual calculated value from the NHD. A few minor fixes were made which resulted in a few extra miles.
ND-10110101-036-S_00	10.82	13.88	A few fixes of connecting the ID to the Missouri resulted in a few extra miles.
ND-10110101-037-S_00	19.83	19.91	The reach indexed file had the wrong watershed labeled as Indian Creek. After fixing it, it came out to be real close to what was entered into the ADB.
ND-10110101-038-S_00	24.19	24.56	One small correction where the creek meets Lake Sakakawea. Miles are still real close to ADB value and original calculated value.
ND-10110101-039-S_00	40.06	47.98	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-040-S_00	123.49	128.14	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-042-S_00	25.67	26.17	One small correction, otherwise very close to calculated and ADB value.
ND-10110101-043-S_00	35.74	37.5	A few corrections and the calculated value was much closer to the ADB value. Increase is most likely due to RF3 to NHD conversion.
ND-10110101-044-S_00	137.97	147.17	A couple small segments were not connected, and most likely due to the RF3 to NHD conversion netted 10 additional miles.
ND-10110101-046-S_00	63.79	65.28	There was 1 small segment not attached to the mainstem. Other than that very close to ADB value.
ND-10110101-047-S_00	142.63	149.56	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-048-S_00	105.73	109.29	A couple small segments were not connected, and most likely due to the RF3 to NHD conversion netted additional miles.
ND-10110101-052-S_00	12.64	13.14	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-055-S_00	10.07	100.1	No Explanation. The value entered in the ADB was way low for some reason. Most likely due to RF3 layer having a lower resolution that the 1:100k NHD layer.
ND-10110101-058-S_00	21.48	21.93	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-059-S_00	38.61	42.39	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-060-S_00	55.14	55.48	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-061-S_00	45.11	46.11	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-062-S_00	11.42	11.46	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-063-S_00	19.57	23.11	Slight increase, most likely due to the RF3 NHD conversion as no errors were found.
ND-10110101-064-S_00	62.44	62.79	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-069-S_00	9.27	10.11	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-071-S_00	93.69	130.09	No Explanation. The value entered in the ADB was way low for some reason. Most

			likely due to RF3 layer having a lower resolution that the 1:100k NHD layer.
ND-10110101-073-S_00	95.11	96.71	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-075-S_00	22.14	36.53	No Explanation. The value entered in the ADB was way low for some reason. Most likely due to RF3 layer having a lower resolution that the 1:100k NHD layer.
ND-10110101-081-S_00	5.15	5.84	About the same. Just entering the actual calculated value from the NHD.
ND-10110101-082-S_00	145.27	145.38	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-001-S_00	24	25.82	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-003-S_00	20.32	20.61	About the same. Just entering the actual calculated value from the NHD.
ND-10110102-018-S_00	113.48	120.15	The way upper reaches of the Little Muddy was wrong. I used the topo to correct it.
ND-10110102-020-S_00	32.76	36.97	Part of this ID was labeled as Scorio Creek Watershed (-019). After correcting, it netted a large increase to this ID.
ND-10110201-001-S_00	51.24	53.2	A few circular areas were removed, and then it was much closer to the ADB value.
ND-10110201-004-S_00	45.92	46.96	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-005-S_00	42.89	43.87	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-006-S_00	50.26	51.32	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-007-S_00	8.64	8.78	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-008-S_00	47.43	48.82	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-010-S_00	83.14	84.7	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-011-S_00	21.75	22.24	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-012-S_00	16.95	17.59	About the same. Just entering the actual calculated value from the NHD.
ND-10110201-013-S_00	25.37	26.45	Roughly the same, no errors. About 1 mile low in the ADB.
ND-10110201-014-S_00	17.4	21.36	The broken segments caused by using the state border to clip the stream layer, were reconnected along the border resulting in an amount very close to first calculation. There was also one ID that was wrongly labeled and I fixed that too.
ND-10110201-015-S_00	42.19	52.91	There were two errors in the GIS layer. 1 trib was mislabeled as trib to little Missouri, and 1 was mislabeled as Little Beaver Creek. After correcting it netted 5 more miles than ADB value. Also connected a segment that crossed the border.
ND-10110201-016-S_00	7.03	7.2	About the same. Just entering the actual calculated value from the NHD.
ND-10110202-001-S_00	6.1	8.16	Gave it a little more detail right at the ND SD border.
ND-10110202-002-S_00	11.83	11.97	About the same. Just entering the actual calculated value from the NHD.
ND-10110202-003-S_00	7.32	11.23	A slight increase from the ADB. No explanation? Just a wrong value in the ADB.
ND-10110203-001-S_00	75.79	77.52	There were 5 circular loops along the river. Once I removed them, the miles were much closer to ADB value.
ND-10110203-002-S_00	164	170.17	No corrections were needed. Just entering the correct calculated value.
ND-10110203-005-S_00	89.36	94.09	One tributary was connected, resulting in slightly more than the original calculation.
ND-10110203-025-S_00	48.25	48.85	Two or three circular redundant loops were removed, resulting in a value real close to the original ADB value.
ND-10110203-032-S_00	68.56	78.9	Increase most likely due to RF3 to NHD conversion.

ND-10110203-033-S_00	3.2	4.88	Increase possibly due to higher resolution from RF3 to NHD. No errors found in GIS layer.
ND-10110203-040-S_00	50.93	53.15	There was one disconnected segment that I connected, and one segment that was given just a little more detail.
ND-10110203-045-S_00	72.61	95.88	There was a little discrepancy fix as to where the headwaters are for Andrews Creek, so that was fixed as to the 1:100 K topo map. However, the value in the ADB was still extremely low.
ND-10110203-052-S_00	36.25	36.81	This segment previously included the Dam. I corrected resulting in a shorter length by 1 mile.
ND-10110203-053-S_00	38.43	39.67	A mile was added to this segment as it was previously allocated to 052 and should have been to this one.
ND-10110203-058-S_00	13.4	13.59	A few disconnected segments were joined to the main stem of the Heart.
ND-10110203-066-S_00	40.97	41.76	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-001-S_00	35.57	35.86	After a couple small error fixes, and the RF3 to NHD conversion, it appears to be very close to what was in the ADB.
ND-10110204-003-S_00	20.04	20.19	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-005-S_00	2.27	2.48	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-006-S_00	16.23	16.26	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-007-S_00	70.12	70.61	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-008-S_00	37.15	37.32	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-009-S_00	50.75	51.63	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-010-S_00	7.91	7.93	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-011-S_00	99.8	110.05	There is a small cluster of tribs that was labeled as tribs to Little Beaver Creek; however they actually flow into Beaver Creek in Mt.
ND-10110204-012-S_00	38.23	38.53	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-014-S_00	25.65	25.67	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-015-S_00	29.45	29.46	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-016-S_00	19.98	20.05	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-017-S_00	7.58	7.63	About the same. Just entering the actual calculated value from the NHD.
ND-10110204-018-S_00	73.4	73.96	About the same. Just entering the actual calculated value from the NHD.
ND-10110205-013-S_00	24.88	24.89	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-014-S_00	13.32	13.57	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-015-S_00	18.13	18.8	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-018-S_00	32.46	32.49	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-027-S_00	34.38	37.31	Nearly the same value. Only changed right at Little Mo confluence.
ND-10110205-045-S_00	31.78	34.81	No errors were fixed. Value was just wrong.
ND-10110205-049-S_00	32.5	36.74	A small segment previously labeled as 10110205-002 was added to this ID resulting in slightly higher number.

ND-10110205-058-S_00	90.18	135.16	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10110205-068-S_00	66.44	71.91	No errors found. ADB value was just low.
ND-10110205-069-S_00	41.34	83.04	The value entered in the ADB was way low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130101-001-S_00	27.42	32.14	Small error in the reach indexed layer near where it confluences with the Missouri and where it meets the New Johns diversion segment.
ND-10130101-002-S_00	1.79	2.83	Combination of going from RF3 to NHD and a small error in the reach indexed layer near where it confluences with the Missouri.
ND-10130101-004-S_00	16.46	16.9	Many redundant streams running in all directions representing the Missouri river. After cleaning up, it resulted in a more accurate and small number of miles.
ND-10130101-006-S_00	97.75	119.08	Increase most likely due to RF3 to NHD conversion.
ND-10130101-008-S_00	49.65	50.65	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-009-S_00	38.15	38.3	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-012-S_00	18.93	19.04	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-013-S_00	44.64	44.9	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-014-S_00	2.08	6.05	There were two additional tribs that were wrongly labeled as tribs to the Missouri. After fixing, it netted an increase to this entity ID.
ND-10130101-016-S_00	31.14	35.41	There was a small segment that was initially indexed as 10130201-005. When corrected it resulted in a small increase for 10130101-016.
ND-10130101-017-S_00	27.59	28.3	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-019-S_00	154.86	158.97	After fixes, it is very close to original value. Just putting in actual calculated from NHD.
ND-10130101-020-S_00	27.46	27.7	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-021-S_00	62.65	65.36	This segment was cleaned up in the Lake Ordway and Missouri River area. Still very close to original.
ND-10130101-022-S_00	29.18	29.69	There were many redundant streams associated with this in the NHD layer. After fixing them, the miles came out real close to what was in the ADB.
ND-10130101-023-S_00	84.76	85.06	Very close to original value. Just putting in actual calculated from NHD. Increase most likely due to RF3 to NHD conversion.
ND-10130101-025-S_00	37.2	37.61	Very close to original value. Just putting in actual calculated from NHD.
ND-10130101-026-S_00	74.26	93.77	A correction near the New Johns diversion, and on the diversion itself.
ND-10130101-029-S_00	9.54	16.18	There was a small error where the NHD had some of these tribs flowing into Burnt Creek. After fixing it resulted in a slight increase for this entity ID and a slight decrease for 031, or tribs to Burnt Creek.
ND-10130101-031-S_00	129.55	136.14	A few small fixes in the area where it confluences with the Missouri resulted in a small increase in miles.
ND-10130102-001-S_00	159.99	186.18	The value in the ADB was a little low. Roughly 25 miles. A couple small errors were fixed but assuming the difference is due to more detail in the NHD layer than the RF3 layer.

ND-10130102-002-S_00	22.28	23.51	One small area was fixed where there was a segment or trib disconnected from the main stem.
ND-10130102-003-S_00	15.33	15.7	No fixes.
ND-10130102-004-S_00	72.57	76.37	A small segment was connected to the main stem. Also, a little more detail in that area.
ND-10130102-005-S_00	21.29	21.77	Just a slight correction around the Welk Dam area. Otherwise real close to both values.
ND-10130102-006-S_00	20.86	21.18	Just a slight correction around the Welk Dam area. Otherwise real close to both values.
ND-10130102-007-S_00	55	58.27	A slight drainage correction and a disconnected segment 4 miles downstream of Welk dam.
ND-10130102-010-S_00	15.58	15.85	There was a segment that should have actually been Lake Oahe. After correcting, it came out to be much closer to what was in the ADB.
ND-10130102-011-S_00	18.31	18.69	Very close, just entering the calculated number.
ND-10130102-013-S_00	42.14	43.8	There was one continuous segment that dumped into two streams. I used the 10m DEM to determine the midpoint and made a break. It added slightly to this set of segments.
ND-10130102-014-S_00	63.29	63.69	A large chunk of this unit was wrongly ID'd. After the correction, it came out to be much closer to what was entered in the ADB.
ND-10130102-015-S_00	56.33	61.8	The ADB was very low, and there was a broken segment. After fixing, it resulted in even more mileage.
ND-10130102-016-S_00	126.98	129.38	After making all the corrections mentioned in 011-015, this is the correct value for all the tribs going into the Little Heart.
ND-10130102-022-S_00	95.11	97.57	About the same. Just entering the actual calculated value from the NHD.
ND-10130102-023-S_00	410.81	421.93	Increase most likely due to RF3 to NHD conversion.
ND-10130102-024-S_00	119.72	123.57	Increase most likely due to RF3 to NHD conversion.
ND-10130102-025-S_00	47.21	49.42	A couple small fixes in missing segments netted a slight increase in miles.
ND-10130102-027-S_00	70.59	151.32	The value entered in the ADB was way low. I did draw in roughly 10 more miles to connect some of the watershed using a topo, but not sure why so low otherwise.
ND-10130102-028-S_00	17.14	17.98	About the same. Just entering the actual calculated value from the NHD.
ND-10130102-032-S_00	24.3	26.12	Increase most likely due to RF3 to NHD conversion.
ND-10130102-033-S_00	34.55	36.95	Increase most likely due to RF3 to NHD conversion.
ND-10130102-034-S_00	11.8	12.36	Increase most likely due to RF3 to NHD conversion.
ND-10130103-001-S_00	15.33	17.41	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130103-002-S_00	152.01	210.11	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130103-003-S_00	7.01	7.1	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-004-S_00	84.35	86.14	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-005-S_00	74.77	75.86	Slight increase possibly due to the RF3 to NHD conversion.

ND-10130103-006-S_00	9.05	53.05	The reach index file (GIS Layer) had an error in that part of Long Lake Creek was indexed as Goose Creek. I corrected the ID in the GIS layer from -006 to -002 and recalculated the miles for Goose Creek. The same was done for LL Creek.
ND-10130103-007-S_00	15.78	15.95	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-008-S_00	24.95	25.13	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-009-S_00	44.54	45.3	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-012-S_00	172.5	173.38	About the same. Just entering the actual calculated value from the NHD.
ND-10130103-013-S_00	143.16	154.67	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130103-014-S_00	55.15	59.55	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130103-015-S_00	24.66	24.91	About the same. Just entering the actual calculated value from the NHD.
ND-10130104-001-S_00	8.43	13.49	Beaver Creek was labeled according so, right up to the HUC boundary resulting in slightly less than original.
ND-10130104-002-S_00	29.37	35.11	ADB was off, and there was one short segment that had the wrong ID and was changed to this ID, making it even a greater difference. Also added segments right up to beaver creek line in middle of bay.
ND-10130104-003-S_00	14.9	15.24	No fixes. Just entering calculated amount.
ND-10130104-004-S_00	108.56	113.1	One disconnected segment was joined creating an even larger difference.
ND-10130104-013-S_00	29.64	38.56	Didn’t find any errors. Value in ADB was roughly 10 miles low.
ND-10130104-014-S_00	43.45	45.4	There was a small missing segment connected resulting in an even greater difference.
ND-10130104-016-S_00	108.21	113.05	One segment that was associated with 017, was renamed to this ID resulting in an even greater difference.
ND-10130106-001-S_00	67.25	70.53	The value in the ADB was just slightly low.
ND-10130106-002-S_00	23.46	25.54	There were two segments labeled as tribs to lake Hoskins, but are actually tribs to Dry Lake. So a new ID was created for them and it lowered the mileage and is now very close to what the ADB value was.
ND-10130201-002-S_00	19.83	22.6	The value entered in the ADB was low. Increase can only be explained by increase in resolution going from RF3 to NHD.
ND-10130201-005-S_00	44.48	44.5	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10130201-013-S_00	95.19	96.38	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-015-S_00	16.7	20.25	The value in the ADB was a few miles low.
ND-10130201-018-S_00	23.87	23.91	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-033-S_00	41.58	43.48	One small disconnected segment was attached resulting in an even greater difference.
ND-10130201-045-S_00	137.89	181.46	There was roughly 39 miles of this watershed, or ID, missing. Starting from 1 mile south of the Mercer Co border. I used the 1:24k NHD layer and added it to the rest of the hydrology.
ND-10130201-048-S_00	27.44	29.38	Some minor corrections and detail were given at opposite ends of this segment.

ND-10130201-053-S_00	11.11	11.3	Very minor correction and detail where it dumps into the Branch Knife.
ND-10130201-054-S_00	37.22	53.12	There was one small segment fix area; however after correcting it, it only resulted in a couple miles less. So the ADB was just way low, possibly due to RF3 NHD conversion.
ND-10130201-059-S_00	16.97	17.06	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-060-S_00	28.34	28.56	About the same. Just entering the actual calculated value from the NHD.
ND-10130201-061-S_00	138.11	145.16	Increase most likely due to RF3 to NHD conversion.
ND-10130201-063-S_00	69.9	70.33	About the same. Just entering the actual calculated value from the NHD.
ND-10130202-004-S_00	139.87	147.14	No corrections were made. Just entering calculated value.
ND-10130202-014-S_00	65.22	66.04	A small segment was removed from this ID as it was wrongly labeled. Should have been 015.
ND-10130202-015-S_00	72.59	73.37	A small segment was added to this ID, it was formerly with 014.
ND-10130202-025-S_00	25.18	25.5	A very minute correction was made where one of the tribs empties into it.
ND-10130202-031-S_00	20.58	20.88	About the same. Just entering calculated value.
ND-10130202-032-S_00	34.08	39.41	Value in ADB was roughly 5 miles low for whatever reason??
ND-10130202-034-S_00	53.01	53.75	About the same. Just entering calculated value.
ND-10130202-035-S_00	47.97	48.89	About the same. Just entering calculated value.
ND-10130202-048-S_00	81.51	82.43	This ID was joined with 047. I used the HUC boundaries to split them. Also resulted in slightly less miles.
ND-10130202-049-S_00	82.23	82.96	One small correction where it meets the south fork Green River.
ND-10130202-057-S_00	12.75	12.77	One redundant circle was removed along the creek resulting in a value almost exactly what was in the ADB.
ND-10130202-062-S_00	52.06	54.89	Two segments were connected to the mainstem resulting in a slightly longer length than the original calculation.
ND-10130202-068-S_00	75.02	79.4	There were numerous floating segments. I joined them all and made a couple other small corrections by giving it detail.
ND-10130203-001-S_00	7.25	8.5	Made a small adjustment near the confluence with the Missouri which actually increased the value a slight bit making it further from what was in the ADB.
ND-10130203-003-S_00	26.4	26.62	About the same. Just entering the actual calculated value from the NHD.
ND-10130203-004-S_00	7.62	7.72	There was a segment that was incorrectly labeled. Should have been -021. After correction, the value was much closer to what was in the ADB.
ND-10130203-006-S_00	30.3	30.87	A small correction near one of the tributaries.
ND-10130203-007-S_00	109.25	113.42	Just a small correction made to antelope creek, not to this id. Not sure of why the initial 4 mile discrepancy.
ND-10130203-009-S_00	33.52	33.95	One disconnected segment was joined and a little more detail was given in that area.
ND-10130203-016-S_00	13.73	17.56	No errors were found. The value in the ADB was 4 miles low. Possibly due to RF3 NHD conversion??
ND-10130203-021-S_00	72.14	72.63	One disconnected segment was joined.
ND-10130203-032-S_00	30.66	32.55	A small segment was added that was -045.

ND-10130203-045-S_00	55.45	59.87	One segment was removed and added to -032, and one was added that was -045. Net result just a little lower than original calc.
ND-10130203-048-S_00	7.96	8.28	A correction was made near the Glen Ullin Reservoir. The main flow pattern now goes thru a channel on the south side of the Reservoir which was not part of the NHD. I added it and recalculated the miles. It's now closer to the value that was in the ADB.
ND-10130203-049-S_00	13.66	14.46	I added a segment using the 1:24k topo as it was obviously contributing to Gerving Dam.
ND-10130203-055-S_00	113.47	130.14	There were no errors that I could find. Difference must be due to conversion.
ND-10130204-001-S_00	34.16	34.89	About the same. Just entering the actual calculated value from the NHD.
ND-10130204-002-S_00	85.62	88.97	About the same. Just entering the actual calculated value from the NHD.
ND-10130204-006-S_00	38.74	49.32	The value entered in the ADB was roughly 10 miles low. Could be due to the conversion.
ND-10130204-010-S_00	76.68	81.74	I connected two tribs that were disconnected to the main stem.
ND-10130204-022-S_00	46.43	47.32	Very close to ADB value. No corrections were made to this segment.
ND-10130204-023-S_00	34.89	38.88	There was one segment that was disconnected. I connected it using a DEM and photo. It was a little tricky as it was a real flat area, but I used my best judgment based off of the resources I had. It added a half mile to the original calc, resulting in an even greater difference from ADB.
ND-10130204-031-S_00	80.91	84.62	The small segment out of Mott Dam watershed was added to this, and the segment NW of Regent, resulting in an even greater difference from ADB value.
ND-10130204-032-S_00	54.25	55.19	Very close to the value in the ADB. Just putting the actual calculated value in the NHD.
ND-10130204-036-S_00	22.65	26.27	There were a couple segments wrongly labeled as watershed to the Dam. After fixing, it resulted in an increase and an even greater difference from the ADB.
ND-10130204-039-S_00	14.74	14.99	One redundant loop was removed making it a little closer to the ADB value.
ND-10130204-041-S_00	23.16	28	There was a disconnected segment that was labeled as 042, but after using a DEM and a photo, it turns out it should have been this ID, 041. So it added a few miles to it.
ND-10130204-042-S_00	65.91	68.01	Part of this segment was renamed to -041. Also there was a disconnected segment fixed.
ND-10130204-043-S_00	27.92	30.06	A couple disconnected segments were fixed, resulting in even greater difference.
ND-10130204-046-S_00	148.07	158.27	Numerous floating segments were corrected. This resulted in an even greater difference than the original ADB value.
ND-10130204-047-S_00	33.25	33.93	I corrected a few areas by giving a little bit more detail where it was blatantly wrong. The end result was still very close to both values.
ND-10130204-048-S_00	40.42	42.37	One error was corrected, a segment just north of White Lake cut across a field that it should not have. I joined it in the right place.
ND-10130204-049-S_00	28.54	30.22	I gave a little more detail right in the White lake area.
ND-10130204-051-S_00	11.7	13.52	There were no errors that I could find. I drew in a little more detail at the junction with 052 and 054.
ND-10130204-053-S_00	33.69	44.53	A circular part was removed.

ND-10130205-012-S_00	49.99	56.14	There were a couple disconnected pieces, and I fixed them and entered the correct mileage.
ND-10130205-014-S_00	16.73	18.23	ADB was low, and there was one small disconnected segment.
ND-10130205-019-S_00	59.8	64.45	There was a short disconnect. After fixing, it resulted in an even greater difference.
ND-10130205-020-S_00	137.06	151.9	There were numerous broken segments. I connected the ones I could using a DEM resulting in even more miles.
ND-10130205-024-S_00	67.56	69.25	The ADB value was just slightly low. A couple small corrections in the stream detail were made where tribs connected to this mainstem.
ND-10130205-025-S_00	23.47	24.1	About the same. Just entering the actual amount calculated in the NHD.
ND-10130205-026-S_00	48.81	55.77	ADB value was considerably low. I did connect a few broken segments and renamed one segment that was actually a trib to 027.
ND-10130205-028-S_00	34.14	44.74	There was one segment added to this ID. It was wrongly labeled as 026 before.
ND-10130205-029-S_00	72.53	78.84	There was one redundant circle along the creek that I removed, and I also connected a broken segment.
ND-10130205-030-S_00	38.33	38.43	One redundant circle was removed along the creek.
ND-10130205-032-S_00	159.95	172.7	There were a couple disconnected pieces, and I fixed them and entered the correct mileage resulting in an even greater difference from the value that was in the ADB.
ND-10130205-033-S_00	43.06	44.05	A couple small detail changes near tribs, but still very close to ADB.
ND-10130205-035-S_00	29.19	30	A couple small detail changes near tribs, but still very close to ADB.
ND-10130205-036-S_00	64.23	67.28	On disconnected segments was joined to the main stem of the Chanta Peta Creek resulting in an even greater difference.
ND-10130205-039-S_00	29.26	34.05	There was an unfinished segment. I used a photo, and a DEM and it was rather obvious how the segment should have been completed. It added a few miles to the segment.
ND-10130205-041-S_00	47.9	51.12	A few small corrections on two segments that were not attached to the mainstem.
ND-10130205-042-S_00	30.86	31.84	I zoomed in tight and detailed the stream near where it dumps into Cedar Lake. It actually increases the mileage.
ND-10130205-044-S_00	81.25	84.74	There was a floating segment labeled -045. I zoomed in real tight and used a 10m DEM to figure out the elevations and see how the water should flow. Turns out it actually caused the ID to go from a 045 to 044 which increased this mileage slightly.
ND-10130205-045-S_00	21.99	22.2	After the fixes in 042 and 045, the mileage came out to be real close to what was in the ADB for this ID.
ND-10130206-001-S_00	20.83	28.44	After a few small corrections, the 8 mile net increase is most likely due to the RF3 NHD conversion.
ND-10130206-002-S_00	185.62	188.42	There were a few mile long segments that were labeled as the Chanta Peta, but it is clearly an unnamed trib to the Cannonball. Stream segments identified as ND-10130206-006-S_00 were also added to this AU. So after the correction, it netted a 3 mile increase in this ID.
ND-10130206-003-S_00	3.23	5.42	There was one small error in the NHD where part of this segment was labeled as a tributary, but after fixing it still was a couple miles off from value in the ADB. Can't explain difference??

ND-10130206-004-S_00	61.72	64.82	There were two segments in which a new ID had to be made (ND-10130206-034-S_00) as they are not part of this ID. So after correcting it netted a small decrease in the calculated, but a small increase in the ADB value.
ND-10130206-005-S_00	95.3	98.5	A slight increase. No errors, so must be due to the RF3 NHD conversion.
ND-10130206-007-S_00	21.15	21.58	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-008-S_00	6.4	6.53	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-009-S_00	10.36	12.66	There was a small segment not connected to Dogtooth Creek as the description states. After correcting that, and probably due to the RF3 NHD conversion, it netted a 2.3 mile increase.
ND-10130206-010-S_00	30.07	30.63	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-011-S_00	2.69	2.75	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-012-S_00	83.36	88.95	There were 2 segments that were not connected. After fixing those it increased the miles from the calculated number by a mile and a half, and the rest is most likely due to the RF3 NHD conversion.
ND-10130206-015-S_00	5.94	7.08	Part of this ID was labeled as tribs to Dogtooth. Correction netted an increase. See 014 description.
ND-10130206-016-S_00	9.78	9.92	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-017-S_00	35.74	36.38	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-018-S_00	29.62	30.12	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-019-S_00	4.79	4.89	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-020-S_00	109.68	111.49	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-021-S_00	79.36	80.75	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-022-S_00	12.54	12.69	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-023-S_00	28.89	31.81	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-024-S_00	55.63	59.44	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-025-S_00	63.09	63.48	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-026-S_00	37.87	45.55	There were numerous floating segments that were not actually connected to the Cannonball as the description states. Using photos, DEMs, etc, I used my best judgment to connect the segments to the Cannonball. That only netted an increase in 2 miles from the calculated value. The ADB value was also low to begin with, probably RF3 to NHD conversion.
ND-10130206-027-S_00	23.52	24.66	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-028-S_00	86.07	87.66	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-029-S_00	15.1	15.42	About the same. Just entering the actual calculated value from the NHD.
ND-10130206-030-S_00	34.11	34.52	About the same. Just entering the actual calculated value from the NHD.

ND-10130206-031-S_00	53.07	54.34	About the same. Slight increase. Just entering the actual calculated value from the NHD.
ND-10130206-033-S_00	137.21	152.69	Numerous floating segments not connected to the Cannonball as the description states. Using photos, DEMs, etc, I used my best judgment to connect the segments to the Cannonball. That netted an increase in 4 miles. Other must be RF3 to NHD conversion.
ND-10130301-002-S_00	36.33	36.94	Right along the border there were a few missing squiggles that went in and out of ND. I connected the dots, and the miles were very close to the value in the ADB.
ND-10130301-004-S_00	26.51	27.46	There were a couple tribs labeled as tribs to Dam, however, they were more like tribs to Grand River.
ND-10130301-005-S_00	44.25	44.8	About the same. Just entering the actual calculated value from the NHD.
ND-10130301-008-S_00	47.06	58.57	There were a few errors where tributaries were labeled as Grand Fork. After making them tribs, it obviously increased the mileage for this ID.
ND-10130301-009-S_00	33.69	38.61	There was an error. After fixing resulted in more miles.
ND-10130301-010-S_00	84.73	86.48	A few missing segments filled in and a couple mislabeled corrections.
ND-10130301-011-S_00	28.44	31.19	I modified the end of this segment right where it meets the BH Dam.
ND-10130301-012-S_00	28.06	28.3	About the same just entering the correct value.
ND-10130301-013-S_00	22.02	24.02	One small area was disconnected. I fixed it and it resulted in even a larger difference.
ND-10130301-015-S_00	53.48	67.72	A significant area was added to this ID because it was wrongly labeled as tribs to BH Dam and it was actually tribs to Spring Creek.
ND-10130301-022-S_00	73.57	75.76	One circular segment was removed resulting in slightly less than original calculation.
ND-10130301-025-S_00	16.13	16.48	Very close. Just a small correction near Buffalo Springs Lake.
ND-10130301-026-S_00	23.68	24.13	Very close. Just a small correction near Buffalo Springs Lake.
ND-10130301-027-S_00	142.97	158.21	Just the few small corrections made. So, no idea why it was 15 miles different.
ND-10130301-029-S_00	11.46	20.05	I used the 1:24k topo and gave more detail to this watershed.
ND-10130301-030-S_00	5.78	9.58	There were a couple tributaries in ND that also dump into Bull Hook further down in SD. When these are included, it netted a slight increase in miles.
ND-10160001-002-S_00	4.52	4.74	About the same. Just entering the actual calculated value from the NHD.
ND-10160001-003-S_00	3.01	5.18	This ID was extended to include Mud Lake so that we did not have to create an ID named Mud Lake.
ND-10160001-006-S_00	6.69	7.23	Roughly the same, however a couple small areas were corrected to more correctly show how the water flows.
ND-10160001-032-S_00	24.97	24.98	About the same. Just entering the value in the NHD.
ND-10160001-039-S_00	33.91	36.3	About the same. Just entering the value in the NHD.
ND-10160002-004-S_00	31.09	37.51	The upper most segment, or beginning of this reach, was flip flopped with -001. Renamed according to 1:24k topo.
ND-10160002-009-S_00	38.12	46.19	There were actually 3 different disconnects or unfinished segments. After fixing it added to the initial amount and increased the difference.
ND-10160002-010-S_00	29.22	30.5	A couple small corrections at either end, and in the middle in a low area.

ND-10160002-011-S_00	72.74	73.03	A correction in the middle of -010, in a low area where the trib wasn't real clear and complete.
ND-10160002-016-S_00	65.98	68.75	There was one redundant loop removed, and two disconnected segments connected.
ND-10160003-002-S_00	33.35	37.64	There were 3 broken segments. I connected them using a DEM and photo. Added a mile to initial calculation. ADB was low.
ND-10160003-004-S_00	57.1	65.31	There were numerous broken segments. After fixing, it resulted in even a bigger difference.
ND-10160003-011-S_00	34.54	37.21	One disconnected segment was joined and a little more detail was given towards the upper reaches of this ID.
ND-10160003-016-S_00	9.95	10.64	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-018-S_00	23.82	26.21	There was a loop in the stream segment at the upper reaches of this ID. I straightened that out and followed the obvious coulee using an aerial photo, resulting in a slight increase in miles.
ND-10160003-021-S_00	15.61	15.71	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-024-S_00	14.25	15.07	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-026-S_00	8.26	8.9	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-027-S_00	34.5	42.25	There were numerous floating segments. After correcting, and connecting them, it increase the miles slightly.
ND-10160003-028-S_00	34.9	37.76	There were a few floating segments, and a couple corrections resulting in less mileage.
ND-10160003-029-S_00	38.65	38.82	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-030-S_00	18.02	18.03	About the same. Just entering the actual calculated value from the NHD.
ND-10160003-031-S_00	11.81	31.68	The value entered in the ADB was way low. There was one small segment wrongly labeled, but the Increase can mostly only be explained by the increase in resolution going from RF3 to NHD.
ND-10160003-034-S_00	58.42	68.81	There was a significant segment missing. I connected them resulting in even a bigger mileage difference than what was in the ADB.
ND-10160003-035-S_00	33.36	33.57	There were 7 broken segments in this ID. After connecting them, the mileage was much closer to the original value in the ADB.
ND-10160003-037-S_00	16.65	22.63	There was a disconnected segment and after fixing, it resulted in even more miles different than ADB. Not sure why the difference.
ND-10160004-003-S_00	114.75	127.95	Numerous broken segments. After fixing it resulted in even more mileage difference than the ADB. So ADB value was low to begin with.
ND-10160004-011-S_00	23.52	26.32	I extended part of a reach by about a mile where there are obviously large amounts of water. However, the ADB still was slightly low.
ND-10160004-012-S_00	35.2	37.41	No errors were found. So ADB value was just low for whatever reason?
ND-10160004-013-S_00	15.79	16.08	Roughly the same, just entering the value from the NHD.
ND-10160004-014-S_00	16.03	19.12	No errors were found. So ADB value was just low for whatever reason?
ND-10160004-015-S_00	14.53	14.92	Small correction near the junction of the three tribs. There was a broken segment.
ND-10160004-017-S_00	85.34	88.54	Small correction near the junction of the three tribs.
ND-10160004-018-S_00	27.3	27.82	Small correction near the junction of the three tribs.

ND-10160004-019-S_00	9.65	11.05	A slight modification was made near the dam. The dam segment stretched too far out into the actual stream.
ND-10160004-020-S_00	1.4	1.54	About the same. Just entering the actual calculated value from the NHD.
ND-10160004-021-S_00	7.82	8.03	Small correction near the junction of the three tribs.
ND-10160004-022-S_00	33.91	34.45	About the same. Just entering the actual calculated value from the NHD.
ND-10160004-023-S_00	23.99	27.41	One small segment was connected to Maple Creek; however without that correction the ADB was still slightly low.
ND-10160004-027-S_00	3.19	3.88	About the same. Just entering the actual calculated value from the NHD.
ND-10160004-030-S_00	1.91	2.75	I added a little more detail to the tributary using a photo, which netted a slight increase in miles.

Appendix B

Water Quality Assessment Methodology for North Dakota's Surface Waters

Water Quality Assessment Methodology for North Dakota's Surface Waters

North Dakota Department of Health
Division of Water Quality

Revised
December 2013

Water Quality Assessment Methodology
for North Dakota's Surface Waters

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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I. INTRODUCTION

A. Background

The federal Clean Water Act (CWA) provides the regulatory context and mandate for state water quality monitoring and assessment programs. The North Dakota Department of Health (NDDoH) has been designated as the state water pollution control agency for purposes of the federal CWA and, as such, is authorized to take all actions necessary or appropriate to secure for the state all benefits of the CWA and similar federal acts (NDCC 61-28-04). State law establishes policy to protect, maintain, and improve the quality of waters of state, while the overall goal of the federal CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

Various sections in the CWA require states to conduct specific activities to monitor, assess, and protect their waters. These activities include:

- Develop and adopt water quality standards designed to protect designated beneficial uses (Section 303);

- Establish and maintain monitoring programs to collect and analyze water quality data (Section 106). Reporting on the status of waters and the degree to which designated beneficial uses are supported (Section 305[b]);

- Identify and prioritize waters that are not meeting water quality standards (Section 303[d]);

- Assess the status and trends of water quality in lakes and identifying and classifying lakes according to trophic condition (Section 314); and

- Identify waters impaired due to nonpoint sources of pollution as well as identifying those sources and causes of nonpoint source pollution (Section 319).

B. North Dakota's Surface Water Resources

Based on the state's Assessment Database, the 146 reservoirs have an aerial surface of 476,716 acres. Reservoirs comprise about 67 percent of North Dakota's total lake/reservoir surface acres. Of these, 411,499 acres or 58 percent of the state's entire lake and reservoir acres are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe). The remaining 144 reservoirs share 65,217 acres, with an average surface area of 453 acres.

The 143 natural lakes in North Dakota cover 236,531 acres, with approximately 102,376 acres or 43 percent attributed to Devils Lake. The remaining 142 lakes average 945 acres, with approximately 42 percent being smaller than 250 acres.

There are 56,009 miles of rivers and streams in the state. Estimates of river stream miles in the state are based on river and stream waterbodies in the ADB that are reach indexed to the 1:100K National Hydrography Dataset (NHD plus) and include ephemeral, intermittent and perennial rivers and streams.

One of the most significant water resource types in the state are wetlands. There are an estimated 2.5 million acres of wetlands in the state. The majority of these wetlands are temporary, seasonal, semi-permanent and permanent depressional wetlands located in what is commonly called the Prairie Pothole Region.

C. Purpose and Scope

Water quality standards provide the fundamental benchmarks by which the quality of all surface waters are measured. It is the water quality standards that are used to determine impairment. As a general policy, the assessment procedures described in this methodology are consistent with the NDDoH's interpretation of the state's water quality standards.

For purposes of Section 305(b) reporting and Section 303(d) listing, the US Environmental Protection Agency (EPA) encourages states to submit an integrated report (IR) and to follow its integrated reporting guidance, including EPA's 2006 IR guidance, which is supplemented by EPA's 2008, 2010, 2012 and 2014 IR guidance memos (http://water.epa.gov/lawregs/lawsguidance/cwa/tmdl/guidance.cfm). Key to integrated reporting is an assessment of all of the state's waters and placement of those waters into one of five assessment categories. The categories represent varying levels of water quality standards attainment, ranging from Category 1, where all of a waterbody's designated uses are fully supporting, to Category 5, where a pollutant impairs a waterbody and a TMDL is required (Table 1). These category determinations are based on consideration of all existing and readily available data and information consistent with the state's water quality assessment methodology.

The purpose of this document is to describe the assessment methodology used in the state's biennial integrated report. This information, which is summarized by specific lake, reservoir, river reach or sub-watershed, is integrated as beneficial use assessments that are entered into a water quality assessment "accounting"/database management system developed by EPA. This system, which provides a standard format for water quality assessment and reporting, is termed the Assessment Database (ADB).

Table 1. Assessment Categories for the Integrated Report

Assessment Category	Assessment Category Description
Category 1	All of the waterbody's designated uses have been assessed and are fully supporting.
Category 2	Some of the waterbody's designated uses are fully supporting, but there is insufficient data to determine if remaining designated uses are fully supporting.
Category 3	Insufficient data to determine whether any of the waterbody's designated uses are met.
Category 4	At least one of the waterbody's beneficial uses is not supported or has been assessed as fully supporting, but threatened, but a TMDL is not needed. This category has been further sub-categorized as: • 4A - waterbodies that are impaired or threatened, but TMDLs needed to restore beneficial uses have been approved or established by EPA; • 4B - waterbodies that are impaired or threatened, but do not require TMDLs because the state can demonstrate that "other pollution control requirements (e.g., BMPs) required by local, state or federal authority" • (see 40 CFR 130.7[b][1][iii]) are expected to address all waterbody-pollutant combinations and attain all water quality standards in a reasonable period of time; and • 4C - waterbodies that are impaired or threatened, but the impairment is not due to a pollutant.
Category 5	At least one of the waterbody's beneficial uses is not supported or has been assessed as fully supporting, but threatened, and a TMDL is needed. • 5A – waterbodies currently listed on the Section 303(d) list, but are targeted for additional monitoring and assessment during the next two to four years. **Note:** This also includes waterbodies which are assessed as impaired based on biological data alone and for which there are no known pollutant causes of the impairment. These impaired waterbodies will be target for additional stressor identification monitoring and assessment.

II. WATER QUALITY STANDARDS

A. Background

As stated previously, water quality standards are the fundamental benchmarks by which the quality of all of the state's surface waters are assessed. It is the state's water quality standards that are ultimately used to determine beneficial use impairment status.

Water quality standards were first adopted into North Dakota administrative code beginning in the late 1960's. "Water quality standards" is a term which is used in both a broad and narrow sense. In its broadest sense, water quality standards include all the provisions and requirements in water quality rules and regulations, including minimum wastewater treatment requirements and effluent limits for point source dischargers. In the more narrow sense, water quality standards define the specific uses we make of waters of the state and set forth specific criteria, both numeric and narrative, that define acceptable conditions for the protection of these uses, including antidegradation provisions (Appendix A). The term "water quality standards" is used in the more narrow sense throughout this document.

Water quality reporting requirements under Sections 305(b) and 303(d) of the CWA require states to assess the extent to which their lakes, reservoirs, rivers, and streams are meeting water quality standards applicable to their waters, including beneficial uses as defined in their state water quality standards. In addition to beneficial uses, applicable water quality standards also include narrative and numeric standards and antidegradation policies and procedures. While

Section 305(b) requires states and tribes to provide only a statewide water quality summary, Section 303(d) takes this reporting a step further by requiring states to identify and list the individual waterbodies that are not meeting applicable water quality standards and to develop TMDLs for those waters. Both Section 305(b) reporting and Section 303(d) listing accomplish this assessment by determining whether a waterbody is supporting its designated beneficial uses.

B. Beneficial Use Designation

The protected beneficial uses of the state's surface waters are defined in the *Standards of Quality for Waters of the State* (Appendix A). The state's water quality standards provide for four stream classes (I, IA, II, and III) and five lake classes (1-5). While considered "waters of the state" and protected under the state's narrative standards, the state's water quality standards do not define beneficial uses for wetlands.

All classified lakes, reservoirs, rivers, and streams in the state are protected for aquatic life and recreation. Protection for aquatic life means surface waters are suitable for the propagation and support of fish and other aquatic biota, including aquatic macroinvertebrates, and that these waters will not adversely affect wildlife in the area. Protection of all surface waters, except wetlands, for recreation means waters should be suitable for direct body contact activities such as bathing and swimming and for secondary contact activities such as boating, fishing, and wading.

Class I, IA, and II rivers and streams and all classified lakes and reservoirs are designated for use as municipal and drinking water supplies. Specifically, these waters shall be suitable for use as a source of water supply for drinking and culinary purposes after treatment to a level approved by the NDDoH.

While not specifically identified in state water quality standards, fish consumption is protected through both narrative and numeric human health criteria specified in the state's water quality standards (Appendix A). The state's narrative water quality standards provide that surface waters shall be "free from materials attributable to municipal, industrial, or other discharges or agricultural practices" which will "render any undesirable taste to fish flesh or, in any way, make fish inedible." In addition, the state's statewide fish consumption advisory applies to all waters known to provide a sport fishery.

Other beneficial uses identified in the state's water quality standards are agriculture (e.g., stock watering and irrigation) and industrial (e.g., washing and cooling). These uses apply to all classified rivers, streams, lakes, and reservoirs.

Four beneficial uses (aquatic life, recreation, drinking water, and fish consumption) are typically assessed for purposes of Section 305(b) reporting and Section 303(d) listing. All waterbodies included in the assessment database (ADB) and, therefore, all stream classes (I, IA, II, and III) and all lake classes (1-5) are assigned aquatic life and recreation beneficial uses. All Class I, IA, and II rivers and streams and all classified lakes and reservoirs are assigned the drinking water beneficial use. Fish consumption use is assumed to apply to all Class I, IA, and II rivers and streams, to those Class III streams known to provide a sport fishery, and to all Class 1 through 4 lakes and reservoirs.

C. Numeric Water Quality Standards

A numeric water quality standard is considered a safe concentration of a pollutant in water, associated with a specific beneficial use. Numeric standards are associated with all use classes. Ideally, if the numeric standard is not exceeded, the use will be protected. However, nature is very complex and variable, and the NDDoH may use a variety of assessment tools (e.g., chemical and biological monitoring) to fully assess beneficial uses. With few exceptions, protection for aquatic life and/or drinking water uses will also provide protection for less sensitive uses (e.g., agriculture and industrial uses). For some pollutants, numeric standards may applicable to more than one use and may be more stringent for one use than another. For example, the drinking water standard for selenium is 50 μg/L, while the chronic aquatic life standard is 5 μg/L.

As is the case for most states, the state of North Dakota's numeric standards for toxic pollutants are based on the EPA's aquatic life criteria. The EPA develops and publishes these criteria as required by Section 304(a) of the CWA. Most numeric standards have two parts, a chronic value and an acute value. The chronic standard is the highest concentration of a toxicant to which organisms can be exposed indefinitely with no harmful effects, including growth and reproduction. The acute standard protects aquatic organisms from potential lethal effects of a short-term "spike" in the concentration of the toxicant.

In the development of aquatic life criteria and associated standards, the EPA and the NDDoH have addressed some of the many toxicological, water chemistry, and practical realities the affect a toxicant's impact on aquatic biota. For example, pollutant concentrations and flow volumes vary in effluents and in receiving streams over time, aquatic organisms generally can tolerate higher concentrations of toxicants for shorter periods of time, and the sensitivity of aquatic organisms to toxicants often varies over their lifespan. EPA's approach for expressing water quality standards addresses varying toxicant concentrations, length of an averaging period for the standard, and the number of acceptable exceedances over time. These concepts are highly relevant to the interpretation of water quality standards and the assessment of waterbodies based on available data. In the development and implementation of numeric water quality standards, these concepts are referred to as:

- Magnitude;
- Duration; and
- Frequency.

Magnitude refers to the concentration of a given pollutant and is represented by the numeric standard. For example, the chronic and acute standards for copper are 14.0 and 9.3 μg/L, respectively. This is the "magnitude" of copper that, if not exceeded in water, will protect aquatic biota from chronic and acute effects.

Duration refers to the period of time the measured concentration of a toxicant can be averaged and still provide the desired level of protection to the aquatic community. In the context of toxicity to aquatic organisms, it would be unrealistic to consider a standard as an instantaneous maximum concentration never to be exceeded. On the other hand, toxicant concentrations averaged over too long a time could be under-protective, if it allowed exceedingly high lethal concentrations to be masked by the average. In general, EPA recommends a 4-day averaging period for chronic standards and a 1-hour averaging period for acute standards.

Frequency refers to the number of times a standard may be exceeded over a prescribed time period and still provide adequate protection. EPA guidance and state water quality standards specify that the numeric standards, both chronic and acute, should not be exceeded more than once in three years. The three year time frame is based on studies of the time its takes for aquatic communities to recover from a major disturbance.

D. Narrative Water Quality Standards

A narrative water quality standard is a statement(s) that prohibits unacceptable conditions from occurring in or upon surface waters, such as floating debris, oil, scum, garbage, cans, trash, or any unwanted or discarded material. Narrative standards also prohibit the discharge of pollutants, which alone or in combination with other substances, can 1) cause a public health hazard or injury to the environment; 2) impair existing or reasonable beneficial uses of surface waters; or 3) directly or indirectly cause concentrations of pollutants to exceed applicable standards. Narrative standards are often referred to as “free froms” because they help keep surface waters free from very fundamental and basic forms of water pollution (e.g., sediment and nutrients).

The association between narrative standards and beneficial use impairment is less well defined than it is for numeric standards. Because narrative standards are not quantitative, the determination that one has been exceeded typically requires a “weight-of-evidence” approach to the assessment showing a consistent pattern of water quality standards violations. The narrative standards relevant to this guidance document are found in state water quality standards Section 33-16-02.1-08 (Appendix A). These standards protect surface waters and aquatic biota from:

- Eutrophication (particularly lakes and reservoirs);
- Impairment of the biological community (exemplified by the Index of Biotic Integrity); and
- Impairment of fish for human consumption.

E. Antidegradation Policies and Procedures

In addition to numeric and narrative standards and the beneficial uses they protect, a third element of water quality standards is antidegradation. The fundamental concept of antidegradation is the protection of waterbodies whose water quality is currently better than applicable standards. Antidegradation policies and procedures are in place to maintain high quality water resources and prevent them from being degraded down to the level of water quality standards.

State water quality standards has established three categories or tiers of antidegradation protection (Appendix A). Category 1 is a very high level of protection and automatically applies to all Class I and IA rivers and streams, all Class 1, 2, and 3 lakes and reservoirs, and wetlands that are functioning at their optimal level. Category 1 may also apply to some Class II and III rivers and streams, but only if it can be demonstrated that there is remaining pollutant assimilative capacity, and both aquatic life and recreation uses are currently being supported. Category 2 antidegradation protection applies to Class 4 and 5 lakes and reservoirs and to Class II and III rivers and streams not meeting the criteria for Category 1. Category 3 is the highest level of protection and is reserved for Outstanding State Resource Waters. Waterbodies may only be designated Category 3 after they have been determined to have exceptional value for present and prospective future use for public water supplies, propagation of fish or aquatic biota, wildlife, recreational purposes, or agricultural, industrial, or other legitimate beneficial uses.

III. ASSESSMENT DATABASE

North Dakota's Assessment Database (ADB) contains 1,777 discreet assessment units (AUs) representing 56,009 miles of rivers and streams and 289 lakes and reservoirs. Within the ADB, designated uses are defined for each AU (i.e., river or stream reach and lake or reservoir) based on the state's water quality standards. Each use is then assessed using available chemical, physical and/or biological data.

With an estimated 56,009 miles of rivers and streams and 713,248 acres of lakes and reservoirs, it is impractical to adequately assess each and every mile of stream or every acre of lake. However, the NDDoH believes it is important to: 1) accurately assess those waters for which beneficial use assessment information is available; and 2) account for those stream miles and lake acres that are not assessed or for which there are insufficient data to conduct an assessment. As a result, the NDDoH has adopted the ADB to manage water quality assessment information for the state's rivers, streams, lakes, and reservoirs.

Developed by EPA, the ADB is an Access® based "accounting"/database management system that provides a standard format for water quality assessment information. It includes a software program for adding and editing assessment data and transferring assessment data between the personal computer and EPA. Assessment data, as compared to raw monitoring data, describes the overall health or condition of the waterbody by describing beneficial use impairment and, for those waterbodies where beneficial uses are impaired or threatened, the causes and sources of pollution affecting the beneficial use. The ADB also allows the user to track and report on TMDL-listed waters, including their development and approval status and de-listing rationale.

To create North Dakota's ADB, the state's 56,009 miles of rivers and streams and 289 lakes and reservoirs have been delineated into 1,777 discreet AUs. An AU can be an individual lake or reservoir, a specific river or stream reach or a collection of stream reaches in a sub-watershed. North Dakota's ADB is currently represented by 1,487 river and stream AUs and 290 lake and reservoir AUs (Note, Lake Sakakawea is represented by two assessment units in the ADB, one for the main reservoirs and one for the Little Missouri Bay segment of the reservoir.). Each of these AUs is then assessed individually, based on the availability of sufficient and credible data. In order to delineate and define AUs used in the ADB, the NDDoH follows a general set of guidelines:

1. Each AU is within the eight-digit USGS hydrologic unit.

2. Each river and stream AU is composed of stream reaches of the same water quality standards classification (I, IA, II or III).

3. To the extent practical, each AU is within a contiguous Level IV ecoregion.

4. Mainstem perennial rivers are delineated as separate AUs. Where these rivers join with another major river or stream within the eight-digit hydrologic unit, the river was further delineated into two or more AUs.

5. Tributary rivers and streams, which are named on USGS 1:100,000 scale planimetric maps or the National Hydrography Dataset (NHD), are delineated as separate AUs. These AUs may be further delineated, based on stream order or water quality standards classification.

6. Unnamed ephemeral tributaries to a delineated AU are consolidated into one unique AU. This is done primarily for accounting purposes so that all tributary stream reaches identified in the NHD are included in the ADB.

7. Stream reaches, which are identified in the NHD and on USGS 1:24,000 scale maps and which do not form either an indirect or direct hydrologic connection with a perennial stream, are not included in the ADB. This would include small drainages that originate and flow into closed basin lakes or wetlands. (Note: These delineation criteria do not apply to tributaries to Devils Lake)

The ADB provides an efficient accounting and data management system. It also allows for the graphical presentation of water quality assessment information by linking assessments contained in the ADB to the NHD file through "reach indexing" and geographic information systems (GIS). In order to facilitate the GIS data link, the NDDoH has "reach-indexed" each AU in the ADB to the NHD file. The product of this process is a GIS coverage that can be used to graphically display water quality assessment data entered in the ADB. An example can be seen in Figure 1, which depicts each of the reach-indexed AUs delineated in the Knife River Sub-basin (10130201).

Assessments completed and entered into the ADB also form the basis for the state's Section 319 Nonpoint Source (NPS) Assessment Report and Management Plan. Because of the way the NDDoH's Surface Water Quality Management Program is structured, there is complete integration of the state's Section 305(b) Water Quality Assessment Report, the Section 303(d) TMDL List and the Section 319 NPS Assessment Report and Management Plan.

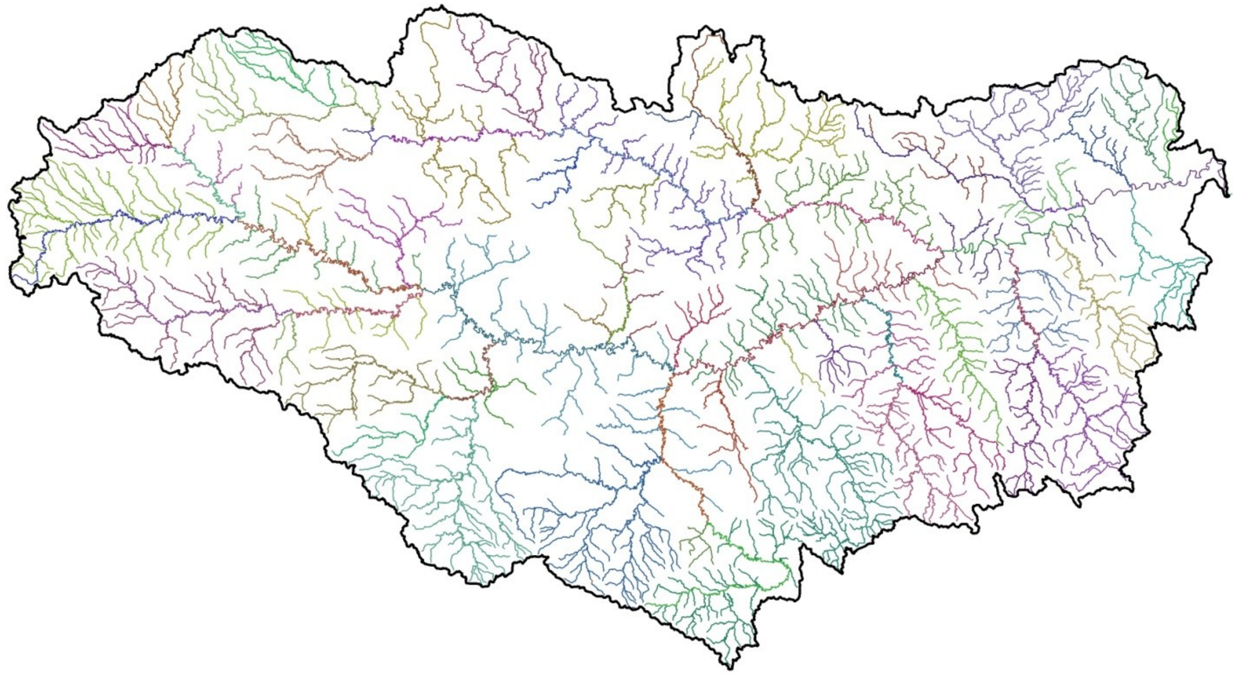

Figure 1. Map of Reach-Indexed Assessment Units Delineated in the Knife River Sub-basin (10130201).

IV. SUFFICIENT AND CREDIBLE DATA REQUIREMENTS AND OVERWHELMING EVIDENCE

A. Sufficient and Credible Data Requirements

For water quality assessments, including those done for purposes of Section 305(b) assessment and reporting and 303(d) listing, the NDDoH will use only what it considers to be sufficient and credible data. Sufficient and credible data are chemical, physical, and biological data that, at a minimum, meet the following criteria:

- Data collection and analysis followed known and documented quality assurance/quality control procedures.

- Water column chemical, biological or fish tissue data are 10 years old or less for rivers and streams and lakes and reservoirs, unless there is adequate justification to use older data (e.g., land use, watershed, or climatic conditions have not changed). Years of record are based on the USGS water year. Water years are from October 1 in one year through September 30 of the following year. It should be noted that it is preferable to split the year in the fall when hydrologic conditions are stable, rather than to use calendar years. Data for all 10 years of the period are not required to make an assessment.
- There are a minimum of 10 chemical samples collected in the 10-year period for rivers and streams. The 10 samples may range from one sample collected in each of 10 years or 10 samples collected all in one year.

- There should be a minimum of two samples collected from lakes or reservoirs collected during the growing season, April-November. The samples may consist of two samples collected the same year or samples collected in separate years.

- A minimum of five E. coli samples are collected during any 30-day consecutive period (e.g., calendar month) from May through September. The five samples per month may consist of five samples collected during the month in the same year or five samples collected during the same calendar month, but pooled across multiple years (e.g., two samples collected in May 2007, two samples collected in May 2008 and one sample collected in May 2012).

- For all chemical criteria that are expressed as a 30-day arithmetic average (e.g., chloride, sulfate, radium 226 and 228, and boron) a minimum of four daily samples must be collected during any consecutive 30-day period. Samples collected during the same day shall be averaged and treated as one daily sample.

- A minimum of two biological samples (fish and/or macroinvertebrate) are necessary in the most recent 10-year period per assessment unit. Samples may be collected from multiple sites within the assessment stream reach, multiple samples collected within the same year, or individual samples collected during multiple years. Samples may consist of a minimum of two fish samples, two macroinvertebrate samples, or one fish and one macroinvertebrate sample. Samples should be collected from sites considered to be representative of the AU. At a minimum one site should be located at the downstream end of the assessed stream reach.

- The mean methylemercury concentration is estimated from a minimum of 3 composite samples (preferred) or 9 individual fish samples representative of the filet. When composite samples are used, each composite sample should consist of a minimum of three individual fish per composite with the smallest fish in the composite no less than 75% of the largest fish by length. Each composite sample should also be representative of a distinct age class of the target fish species in the waterbody. In other words, if three composite samples are collected, one composite should represent small fish, one representing medium sized fish and one representing large fish in the population.

- If individual fish samples are collected then a minimum of 9 fish samples should be used to estimate the mean methylmercury concentration. The same criteria used to collect a composite sample should be used for individual fish samples where fish should be representative of at least three size classes and a minimum of three fish should be collected per size class (3 size classes times 3 fish per size class equals 9 fish). In cases where individual fish samples are used, then the number of fish per size class should be equal.

B. Overwhelming Evidence

There are situations where a single set of data is all that is needed to make a use support determination. For example, a single set of water chemistry data may be sufficient to establish that a waterbody is not supporting aquatic life use. In such situations where a single data set irrefutably proves that impairment exists, an impairment determination may be based on this "overwhelming evidence."

A number of factors are evaluated when making a determination as to whether data can be used as a basis for an "overwhelming evidence" assessment. Factors include the technical soundness of the methods used to collect the data and the spatial and temporal coverage of the data as it relates to the waterbody being assessed. Data quality and data currency (i.e., how old are the data?) are also factors which are considered.

Data cannot be overwhelming evidence unless the methods used for collection and analysis meets the most stringent standards for reliability and validity. The person evaluating the data must be certain that the data are representative of actual current waterbody conditions. The data must be representative of the spatial extent of the waterbody and of relevant temporal patterns. Data more than three or four years old should not be used as overwhelming evidence unless there is a strong basis for concluding that conditions have not changed since the data were collected.

V. BENEFICIAL USE ASSESSMENT METHODOLOGY

A. Aquatic Life Use Assessment Methodology for Rivers and Streams

The following is a description of the assessment methodology or decision criteria used to assess aquatic life and recreation uses where they are assigned to rivers and streams in the state. The methodologies used to assess drinking water and fish consumption uses are the same for both rivers and lakes and are provided in separate sections of this document.

All water quality assessments entered into the ADB for Section 305(b) reporting and Section 303(d) TMDL listing are based on "sufficient and credible" monitoring data. Physical and chemical monitoring data used for these assessments includes conventional pollutant (e.g., dissolved oxygen, pH, temperature, ammonia, fecal coliform bacteria, and E. coli bacteria) and toxic pollutant (e.g., trace elements and pesticides) data collected for the most recent 10-year period. Biological monitoring data used for assessment includes fish and macroinvertebrate data collected by the NDDoH during the last 10 years (i.e., 2003-2012), EPA National River and Stream Assessment data collected in 2008 and 2009, and Red River mainstem biological assessment data collected in 2010.

As stated previously, use impairment for the state's rivers and streams is assessed for aquatic life and recreation. The following is the beneficial use decision criteria utilized for these assessments.

The NDDoH uses both chemical and biological data when assessing aquatic life use support for the state's rivers and streams. In some cases, both chemical data and biological data are used to make an assessment determination for an AU. Where both data are available, the NDDoH uses a weight-of-evidence approach in making an assessment decision. For example, if there are chemical data that do not show an aquatic life use impairment, but there are sufficient and credible biological data to show an impairment to the aquatic community, then the use-support decision will be to list the river or stream AU as "not supporting."

1. Chemical Assessment Criteria

In general, aquatic life use determinations utilizing chemical data are based on the number of exceedances of the current *Standards of Quality for Waters of the State* (Appendix A) for DO, pH, and temperature and on the number of exceedances of the acute or chronic standards for ammonia, aluminum, arsenic, cadmium, copper, cyanide, lead, nickel, selenium, silver, zinc, and chromium. The acute and chronic water quality standards for trace metals are expressed as total recoverable metals and not as dissolved metals. However, where dissolved metals data are available, use support assessments are made by applying the dissolved metals data to the water quality standards expressed as the total recoverable fraction. Further, for acute and chronic criteria that are hardness dependent (i.e., cadmium, copper, chromium (III), lead, nickel, silver, and zinc), where hardness of the sample is greater than 400 mg/L, the hardness value used in the criteria calculation will be capped at 400 mg/L.

The following are the use support decision criteria that the NDDoH uses to assess aquatic life use based on chemical data:

- *Fully Supporting:*

  For the conventional pollutants DO, pH, and temperature, the standards of 5 mg/L (daily minimum) for DO, 7.0 to 9.0 (Class I and IA streams and all lakes) and 6.0 to 9.0 (Class II and III streams) for pH and 29.4 EC (85 EF) (maximum) for temperature are not exceeded in the AU. Consistent with state water quality standards (Appendix A), if the DO or pH standard is exceeded, but in 10 percent or less of the samples and there is no record of lethality to aquatic biota, then the AU is also assessed as “fully supporting”.

  For ammonia and other toxic pollutants (e.g., trace elements and organics), aquatic life is assessed as “fully supporting” if the acute or chronic standard is not exceeded during any consecutive three-year period.

- *Fully Supporting but Threatened*:

  For DO and pH, one or more standards were exceeded in greater than 10 percent to 25 percent of the measurements taken during the 10-year assessment period. The temperature standard is exceeded, but in 10 percent or less of the measurements taken during the 10-year assessment period.

  For ammonia and other toxic pollutants, the acute or chronic standard was exceeded once or twice during any consecutive three-year period during the 10-year assessment period.

- *Not Supporting*:

  For DO and pH, one or more standards were exceeded in greater than 25 percent of the measurements taken during the 10-year assessment period. The temperature standard is exceeded in greater than 10 percent of the measurements taken during the 10-year assessment period.

  For ammonia and other toxic pollutants, the acute or chronic standard was exceeded three or more times during any consecutive three-year period during the 10-year assessment period.

2. Biological Assessment Criteria

Aquatic-life use, or biological integrity, can be defined as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of the natural habitats of the region." (Karr, 1981) When the aquatic community (e.g., fish and macroinvertebrates) is similar to that of "least disturbed" habitats in the region, termed "reference condition," aquatic life use can be assessed as fully supporting. When the aquatic community deviates significantly from reference condition, it is assessed as not supporting aquatic life use.

While chemical data provides an indirect assessment of aquatic life use impairment, direct measures of the biological community are believed to be a more accurate assessment of aquatic-life use or biological integrity. The state water quality standards (Appendix A) describe a narrative biological goal that "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the NDDoH to be regional reference sites." This narrative standard also states that it is the intent of the state, in adopting this narrative goal, "to provide an additional assessment method that can be used to identify impaired surface waters."

IBI Development

The NDDoH began a stream biological monitoring and assessment program in 1993. In order to interpret these biological data and to develop a biological assessment methodology, the NDDoH has adopted the "multi-metric" index of biological integrity (IBI) approach to assess biological integrity or aquatic-life use support for rivers and streams. The multi-metric index approach assumes that various measures of the biological community (e.g., species richness, species composition, trophic structure, and individual health) respond to human-induced stressors (e.g., pollutant loadings or habitat alterations). Each measure of the biological community, termed a "metric," is evaluated and scored on a scale of 0-100 . The higher the score, the better will be the biological condition and, presumably, the lower the pollutant or habitat impact.

Final metrics which go into each IBI are selected after a large set of candidate metrics go through a series of data reduction steps. First, each of the candidate metrics are evaluated through the use of histograms, to ensure each has an adequate range of data. The second step includes a "signal to noise analysis" to evaluate the variation of each metric. Values of less than 1 are eliminated from further consideration. The third step involves tests for responsiveness, including subjecting candidate metrics to the Mann-Whitney U Test and evaluating box plots used to distinguish metric scores from "reference" and "disturbed" sites. A Mann-Whitney U Test is a nonparametric test that evaluates the difference between the medians of two independent data sets (i.e., reference and disturbed sites). Metrics with $p > 0.20$ are eliminated due to a lack of response. Metrics with p values less than 0.20 are retained for further evaluation and subjected to box plot analysis. If the box plots for the metric does not distinguish between reference and disturbed, that metric is eliminated. Finally, a correlation matrix is completed using all remaining metrics that are not eliminated due to low responsiveness or other poor predictive characteristics. When metric pairs are highly correlated ($r>0.80$) one of the pair is eliminated to reduce redundancy within the final set of metrics.

Once the final metrics are determined for an IBI, raw metric values are transformed into standardized metric scores. All metric scores are computed using the following equations developed by Minns et al. (1994) that standardizes metrics on a scale of 0 to 100.

Metrics that decrease with impairment:

$$Ms = (M_R/M_{MAX}) \times 100$$

Metrics that increase with impairment:

$$Ms = (M_{MAX} - M_R) / (M_{MAX} - M_{MIN}) \times 100;$$

Where Ms = standardized metric value;
M_R = the raw metric value;
M_{MAX} = the maximum value; and
M_{MIN} = the minimum metric value.

Maximum (M_{MAX}) and minimum (M_{MIN}) values for each metric are set at the 95th and 5th percentiles, respectively, of the entire data set. The overall IBI score is then calculated as the mean of all standardized metric scores.

To date, the NDDoH has developed final multi-metric IBIs for fish in the Lake Agassiz Plain ecoregion and macroinveretebrates in the Lake Agassiz Plain (48) and Northern Glaciated Plain (46) level III ecoregions (Figure 2).

A revised fish IBI for the Lake Agassiz Plain ecoregion was published in a report entitled *Fish Index of Biotic Integrity for Wadable Streams in the Lake Agassiz Plain (48) Ecoregion* (NDDoH, 2011a). This IBI is based on 7 metrics (Table 2).

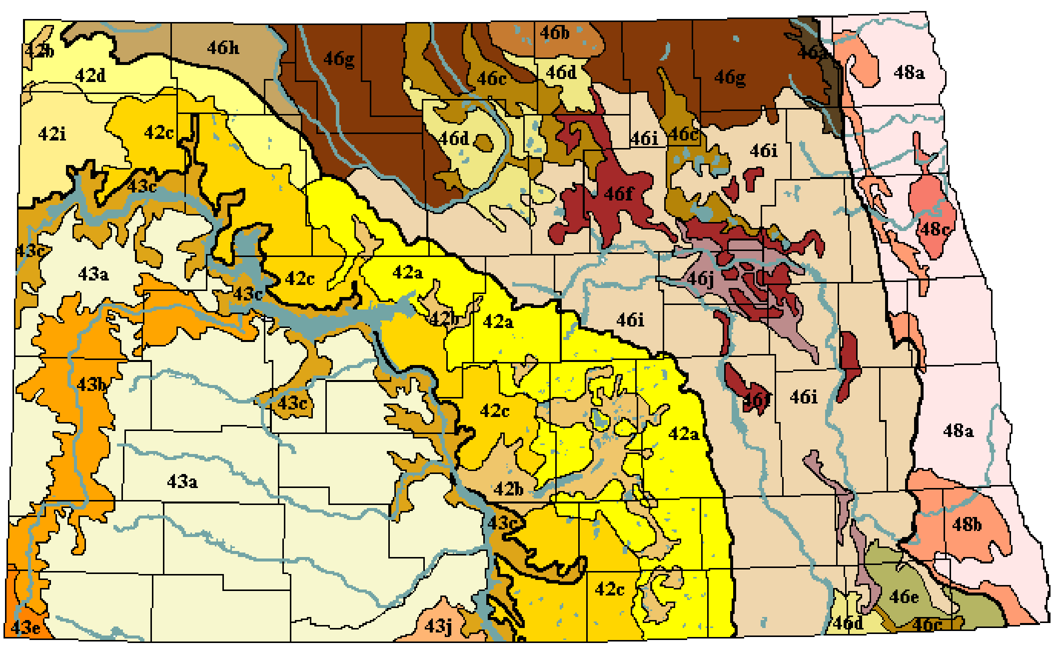

Figure 2. Map Depicting Ecoregions in North Dakota (Lake Agassiz Plain [48], Northern Glaciated Plain [46], Northwestern Glaciated Plain [42], Northwestern Great Plain [43]).

Table 2. Lake Agassiz Plain (48) Ecoregion Fish IBI Metrics.

Final Metric	Category	Response to Perturbation
CPUE (Fish/Minute)	Abundance	Decrease
Percent Dominant Taxon	Composition	Increase
Percent Generalist, Omnivore Individuals	Trophic	Increase
Percent Insectivore Biomass	Trophic	Decrease
Percent Lithophilic Individuals	Reproductive	Decrease
Percent Minnow and Darter Taxa	Richness	Decrease
Total Taxa	Richness	Decrease

The macroinvertebrate IBI which was developed for the Lake Agassiz Plain (48) ecoregion was published in a report entitled *Macroinvertebrate Index of Biotic Integrity for the Lake Agassiz Plain Ecoregion (48) of North Dakota* (NDDoH, 2011b). The macroinvertebrate IBI for the Lake Agassiz Plain ecoregion is based on 7 metrics (Table 3). The macroinvertebrate IBI which was developed for the Northern Glaciated Plain (46) ecoregion was published in the report entitled *Macroinvertebrate Index of Biotic Integrity for the Northern Glaciated Plain Ecoregion (46) of North Dakota* (NDDoH, 2010). The macroinvertebrate IBI for the Northern Glaciated Plain ecoregion is based on 6 metrics (Table 4).

Table 3. Lake Agassiz Plain (48) Ecoregion Macroinvertebrate IBI Metrics.

Final Metric	Category	Response to Perturbation
Diptera Taxa	Richness	Decrease
Hilsenhoff Biotic Index	Tolerance	Increase
Percent EPT	Composition	Decrease
Scraper Taxa	Trophic	Decrease
Shannon Weiner Index	Composition	Decrease
Sprawler Taxa	Habit	Decrease
Total Taxa	Richness	Decrease

Table 4. Northern Glaciated Plain (46) Ecoregion Macroinvertebrate IBI Metrics.

Final Metric	Category	Response to Perturbation
Percent EPT	Composition	Decrease
Percent Non-Insect Individuals	Composition	Increase
Percent Univoltine Individuals	Life Cycle/Composition	Decrease
Tolerant Taxa	Tolerance	Increase
Hilsenhoff Biotic Index (HBI)	Tolerance	Increase
Swimmer Taxa	Habit	Increase

Beneficial Use Assessment Scoring Thresholds

In order to assess biological condition or aquatic life support of rivers and streams, we need to be able to compare what we are measuring to some estimate what would be expected to be good biological condition or fully supporting aquatic life use for the river or stream. This is also referred to as the river or stream's "biological potential." Setting reasonable expectations for a biological indicator, like an IBI, is one of the greatest challenges to making an assessment of biological condition. Is it appropriate to take a historical perspective, and try to compare current conditions to some estimate of pre-Columbian conditions, or to pre-industrial conditions, or to some other point in history? Or is it acceptable to assume that some level of anthropogenic disturbance is a given, and simply use the best of today's conditions as the measuring stick against which everything else is assessed? The answers to all these questions relate to the concept of "reference condition" (Bailey et al. 2004, Stoddard et al. 2006).

Due to the difficulty of estimating historical conditions for most biological indicators, the Department has adopted the "least-disturbed condition" as the operational definition of reference condition. "Least-disturbed condition" is found in conjunction with the best available physical, chemical and biological habitat conditions for a given area or region (e.g., ecoregion) given the current state of the landscape. "Reference" or "least-disturbed" condition is described by evaluating data collected at sites selected based on a set of explicit criteria defining what is "best" or "least-disturbed" by human activities. These criteria vary from ecoregion to ecoregion in the state, and are developed iteratively with the goal of identifying a set of sites which are influenced the least by human activities. The Department's procedure for selecting reference sites is described in Appendix B.

Once a set of "reference sites" are selected for a given ecoregion in the state, they are sampled using the same methods employed at sites used to develop the IBI or where assessments are conducted. The range of conditions (e.g., habitat variables, chemical concentrations, or IBI scores) found at these "reference sites" describes a distribution of values , and extremes of this distribution are used to set thresholds which are used to distinguish sites that are in relatively good condition from those that are clearly not. One common approach, and the one used by the Department, is to examine the range or statistical distribution of IBI scores for a set of reference sites within an ecoregion (Barbour et al. 1999), and, depending on the reference site sample size, to use the 5^{th} or 10^{th} percentile of this distribution to separate the most disturbed (i.e., poor biological condition) sites from moderately disturbed (i.e., fair biological condition) sites. Similarly, the 25^{th} or 50^{th} percentile of the distribution is used to distinguish between moderately disturbed sites and those in "least-disturbed condition." Details on how these thresholds were set for each multi-metric IBI developed by the Department are available in each of the three IBI reports referenced above, while the IBI scoring thresholds for each biological condition class and use support category are provided in Tables 5, 6 and 7.

Table 5. Scoring Thresholds by Biological Condition Class and Aquatic Life Use Support Category for the Lake Agassiz Plain Ecoregion Fish IBI.

IBI Score	Biological Condition Class	Aquatic Life Use Support
≥71	Good	Fully Supporting
<71 and ≥48	Fair	Fully Supporting, but Threatened
<48	Poor	Not Supporting

Table 6. Scoring Thresholds by Biological Condition Class and Aquatic Life Use Support Category for the Lake Agassiz Plain Ecoregion Macroinvertebrate IBI.

IBI Score	Biological Condition Class	Aquatic Life Use Support
≥76	Good	Fully Supporting
<76 and ≥45	Fair	Fully Supporting, but Threatened
<45	Poor	Not Supporting

Table 7. Scoring Thresholds by Biological Condition Class and Aquatic Life Use Support Category for the Northern Glaciated Plain Ecoregion Macroinvertebrate IBI.

IBI Score	Biological Condition Class	Aquatic Life Use Support
≥66	Good	Fully Supporting
<66 and ≥40	Fair	Fully Supporting, but Threatened
<40	Poor	Not Supporting

Aquatic Life Use Support Assessment

Site and Data Requirements

For Section 305(b) assessment and Section 303(d) listing purposes, use assessments based on biological data should ideally be done at the Assessment Unit (AU) scale. The number of sites and samples necessary to conduct an assessment depends on the spatial and temporal variability inherent to the AU. For AUs that are represented by a relatively small, homogeneous stream reach, one site located on the AU may be sufficient. For larger more complex AUs, multiple sample sites with multiple samples collected over time may be necessary. When the number of sites located within an AU is limited, it may be necessary to split the AU into smaller segments and then to assess the smaller AU segment represented by the site. In general, best professional judgment should be used to determine the adequacy of sites and samples when making a use support decision for an AU based on biological data, but as a rule of thumb one should follow these general guidelines.

1. Sites should be located within the AU such that each site represents a homogeneous reach within the AU.

2. At least one site should be located near the downstream end of the assessed stream reach.

3. Additional sites should be located a minimum of 2.5 miles (4 km) apart or where there are significant changes in the hydrology or geomorphology of the stream, or where there is a significant change in landuse adjacent to the stream.

4. When the AU consists of a mainstem segment and tributaries, sites should be located on the mainstem above and below the tributaries as well as on the tributary stream(s).

While it may be possible to conduct an assessment based on one site located within the AU, a minimum of two samples are required to conduct an assessment. Samples should be collected within the last 10 years and may consist of two or more samples collected at one site or one sample collected each at two or more sites. For assessment purposes, a sample consists of one biological assemblage sampled at one point in time. Therefore, two samples may be represented by two biological assemblages (e.g., fish and macroinvertebrates) sampled at the same time or the same biological assemblage sampled at the same site twice. When the same biological assemblage is sampled at the same site, samples should be collected at least 30 days apart.

Using the appropriate biological condition and aquatic life use support scoring thresholds for the biological assemblage and ecoregion, an aquatic life use support assessment is made for each sample collected within the AU. Using each sample aquatic life use support assessment, an overall assessment of the AU is made using the following use support decision criteria:

- *Fully Supporting*:

  Use support assessments for all samples are fully supporting.

- *Fully Supporting, but Threatened*:

  Use support assessment for all samples are fully supporting, but threatened; or

  Use support assessment for at least one sample is fully supporting, and use support assessments for all other samples are not supporting.

- *Not Supporting*:

  Use support assessments for all samples are not supporting.

Section 303(d) Listing Criteria

When biological data results in an aquatic life use support decision that the AU is either fully supporting, but threatened or not supporting and if there are no other chemical or habitat data which can be used to list a pollutant cause, then the AU should be listed on the 303(d) list as category 5A (Table 1), but with the condition that it will be targeted for further stressor identification monitoring and assessment. Only after a stressor identification assessment is completed will the AU be targeted for TMDL development.

Other Biological Assessment Data

The NDDoH recognizes that there may be biological data that are available for waterbodies in the state that meet the sufficient and credible data requirements. Where these data are available the NDDoH encourages the use of this information to make aquatic life use support decisions. While it is not possible to assess these sites or waterbodies as fully supporting, sites that are exemplified by low taxa richness, presence of pollutant tolerant taxa and/or low density, can be assessed as not supporting aquatic life use.

B. Recreation Use Assessment Methodology for Rivers, Streams, Lakes and Reservoirs

Recreation use is any activity that relies on water for sport or enjoyment. Recreation use includes primary contact activities such as swimming and bathing and secondary contact activities such as boating, fishing, and wading. Recreation use in rivers, streams, lakes and reservoirs is considered fully supporting when there is little or no risk of illness through either primary or secondary contact with the water. The state's recreation use support assessment methodology for rivers, streams, lakes and reservoirs is based on the state's numeric water quality standards for E. coli bacteria (Appendix A).

For each assessment based on E. coli data, the following criteria are used:

- Assessment Criterion 1: For each assessment unit, the geometric mean of samples collected during any 30-day consecutive period (e.g., calendar month) from May 1 through September 30 does not exceed a density of 126 CFUs per 100 mL. A minimum of five samples collected during a 30-day consecutive period (e.g., calendar month) is required to compute the geometric mean. If necessary, samples may be pooled by calendar month across years.

- Assessment Criterion 2: For each assessment unit, less than 10 percent of samples collected during any 30-day consecutive period (e.g., calendar month) from May 1 through September 30 exceed a density of 409 CFUs per 100 ml. A minimum of ten samples collected during a 30-day consecutive period is required to compute the percent of samples exceeding the criteria. If necessary, samples may be pooled by calendar month across years.

  The two criteria are then applied using the following use support decision criteria:

  - Fully Supporting: Both criteria 1 and 2 are met.
  - Fully Supporting but Threatened: Criterion 1 is met, but 2 is not.
  - Not Supporting: Criterion 1 is not met. Criteria 2 may or may not be met.

C. Aquatic Life and Recreation Use Assessment Methodology for Lakes and Reservoirs

The following is a description of the assessment methodology or decision criteria used to assess aquatic life and recreation uses for lakes and reservoirs in the state based on trophic response indicators. The methodology used to assess the drinking water, fish consumption, agricultural, and industrial uses is the same for both rivers and lakes and is provided in a separate section of the document.

1. Aquatic Life and Recreation

The state's narrative water quality standards (Appendix A) form the basis for aquatic life and recreation use assessment for Section 305(b) reporting and the Section 303(d) TMDL list. State water quality standards contain narrative criteria that require lakes and reservoirs to be "free from" substances "which are toxic or harmful to humans, animals, plants, or resident aquatic biota" or are "in sufficient amounts to be unsightly or deleterious." Narrative standards also prohibit the "discharge of pollutants" (e.g., organic enrichment, nutrients, or sediment), "which alone or in combination with other substances, shall impair existing or reasonable beneficial uses of the receiving waters."

Trophic status indicators are used by the Department as the primary means to assess whether a lake or reservoir is meeting the narrative standards. Trophic status is a measure of the productivity of a lake or reservoir and is directly related to the level of nutrients (i.e., phosphorus and nitrogen) entering the lake or reservoir from its watershed and/or from the internal recycling of nutrients. Highly productive lakes, termed "hypereutrophic," contain excessive phosphorus and are characterized by large growths of weeds, bluegreen algal blooms, low transparency, and low dissolved oxygen (DO) concentrations. These lakes experience frequent fish kills and are generally characterized as having excessive rough fish populations (carp, bullhead, and sucker) and poor sport fisheries. Due to the frequent algal blooms and excessive weed growth, these lakes are also undesirable for recreational uses such as swimming and boating.

Mesotrophic and eutrophic lakes, on the other hand, have lower phosphorus concentrations, low to moderate levels of algae and aquatic plant growth, high transparency, and adequate DO concentrations throughout the year. Mesotrophic lakes do not experience algal blooms, while eutrophic lakes may occasionally experience algal blooms of short duration, typically a few days to a week.

Due to the relationship between trophic status indicators and the aquatic community (as reflected by the fishery) or between trophic status indicators and the frequency of algal blooms, trophic status becomes an effective indicator of aquatic life and recreation use support in lakes and reservoirs. For purposes of this assessment methodology, it is assumed that hypereutrophic lakes do not fully support a sustainable sport fishery and are limited in recreational uses, whereas mesotrophic lakes fully support both aquatic life and recreation use. Eutrophic lakes may be assessed as fully supporting, fully supporting but threatened, or not supporting their uses for aquatic life or recreation.

Eutrophic lakes are further assessed based on: 1) the lake or reservoir's water quality standards fishery classification; 2) information provided by North Dakota Game and Fish Department Fisheries Division staff, local water resource managers and the public; 3) the knowledge of land use in the lake's watershed; and/or 4) the relative degree of eutrophication. For example, a eutrophic lake, which has a well-balanced sport fishery and experiences infrequent algal blooms, is assessed as fully supporting with respect to aquatic life and recreation use. A eutrophic lake, which experiences periodic algal blooms and limited swimming use, would be assessed as not supporting recreation use. A lake fully supporting its aquatic life and/or recreation use, but for which monitoring has shown a decline in its trophic status (i.e., increasing phosphorus concentrations over time), would be assessed as fully supporting, but threatened.

It is recognized that this assessment procedure ignores the fact that, through natural succession, some lakes and reservoirs may display naturally high phosphorus concentrations and experience high productivity. While natural succession or eutrophication can cause high phosphorus concentrations, research suggests that these lakes are typically eutrophic and that lakes classified as hypereutrophic are reflecting external nutrient loading in excess of that occurring naturally.

Since trophic status indicators specific to North Dakota waters have not been developed, Carlson's trophic status index (TSI) (Carlson, 1977) has been chosen to assess the trophic status of lakes or reservoirs. To create a numerical TSI value, Carlson's TSI uses a mathematical relationship based on three indicators: 1) Secchi Disk Transparency in meters (m); 2) surface total phosphorus concentration expressed as µg/ L; and 3) chlorophyll-a concentration expressed as µg/L.

This numerical value, ranging from 0-100, corresponds to a trophic condition with increasing values indicating a more eutrophic (degraded) condition. Carlson's TSI estimates are calculated using the following equations and is also depicted graphically in Figure 3.

- Trophic status based on Secchi Disk Transparency (TSIS):
  $TSIS = 60 - 14.41 \ln (SD)$
  Where SD = Secchi disk transparency in meters.

- Trophic status based on total phosphorus (TSIP):
  $TSIP = 14.20 \ln (TP) + 4.15$
  Where TP = Total phosphorus concentration in $\mu g\ L^{-1}$.

- Trophic status based on chlorophyll-a (TSIC):
  $TSIC = 9.81 \ln (TC) + 30.60$
  Where TC = Chlorophyll-a concentrations in $\mu g\ L^{-1}$.

In general, of the three indicators, it is believed that chlorophyll-a is the best indicator of trophic status, since it is a direct measure of lake productivity. Secchi disk transparency should be used next, followed by phosphorus concentration. In theory, for a given lake or reservoir, the measures of chlorophyll-a, Secchi disk transparency, and phosphorus concentration are all interrelated and should yield similar trophic status index values. This, however, is usually not the case. Many lakes and reservoirs in the state are shallow and windswept causing non-algal turbidity to limit light penetration. This situation may result in a lake having a high phosphorus concentration, low Secchi disk transparency, and low chlorophyll-a concentration. In other instances, other micronutrients may be limiting algal growth even though excessive phosphorus is present.

When conducting an aquatic life and recreation use assessment for a lake or reservoir, the average trophic status index score should be calculated for each indicator. When the trophic status index scores for each indicator (chlorophyll-a, Secchi disk transparency, and phosphorus concentration) each result in a different trophic status assessment then the assessment should be based first on chlorophyll-a, followed by Secchi disk transparency. Only when there are not adequate chlorophyll-a and/or Secchi disk transparency data available to make an assessment should phosphorus concentration data be used.

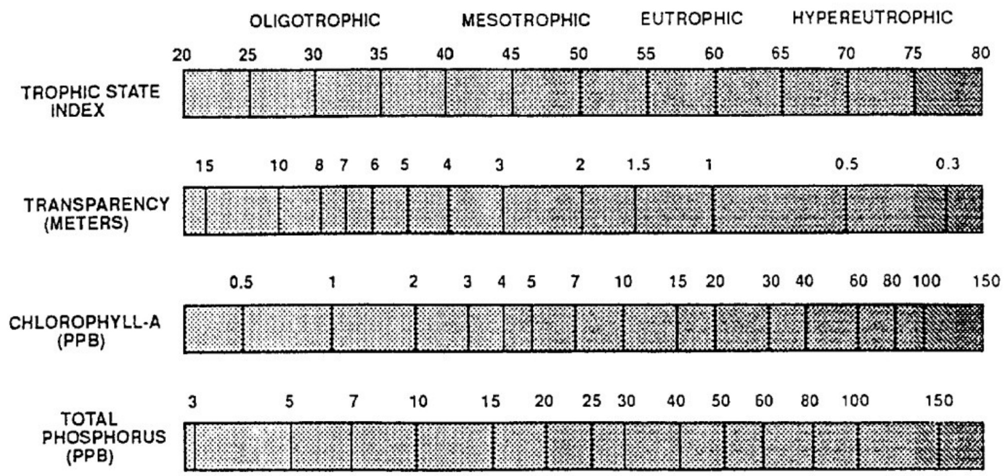

Figure 3. A Graphic Representation of Carlson's TSI.

D. Drinking Water Supply Use Assessment Methodology for Rivers, Lakes, and Reservoirs

Drinking water is defined as "waters that are suitable for use as a source of water supply for drinking and culinary purposes, after treatment to a level approved by the NDDoH" (Appendix A). All Class I, IA, and II rivers and streams, with the exception of the Sheyenne River from its headwaters to 0.1 mile downstream from Baldhill Dam, and all lakes and reservoirs classified in the state water quality standards (Appendix A), with the exception of Lake George in Kidder County, are assigned the drinking water supply beneficial use. While most lakes and reservoirs are assigned this use, few currently are used as a drinking water supply. Lake Sakakawea is the current drinking water supply for the Southwest Water Pipeline and the cities of Garrison, Parshall, Pick City, and Riverdale.

Drinking water use is assessed by comparing ambient water quality data to the state water quality standards (Tables 1 and 2 in Appendix A). Ambient water chemistry data are compared to the water quality standards for chloride, sulfate, and nitrate (Table 8) and to the human health standards for Class I, IA, and II rivers and streams (see Table 2 in Appendix A). Drinking water supply is not a designated use for Class III rivers and streams or for the Sheyenne River from its headwaters to 0.1 mile downstream from Baldhill Dam. The human health standard for Class I, IA, and II rivers and streams considers two means of exposure: 1) ingestion of contaminated aquatic organisms; and 2) ingestion of contaminated drinking water.

Drinking water use is also protected through the state's narrative water quality standards. To paraphrase, narrative standards provide language that waters of the state shall be free from materials that produce a color or odor, or other conditions to such a degree as to create a nuisance. Further, state narrative standards provide language that states that waters of the state shall be "free from substances….in concentrations or combinations which are toxic or harmful to **humans**, animals, plants, or resident biota." There shall also be "no discharge of pollutants, which …..shall cause a public health hazard or injury to environmental resources."

Table 8. State Water Quality Standards for Chloride, Sulfate, and Nitrate (Appendix A).

	Water Quality Standards (mg/L)		
Stream Classification	**Chloride[1]**	**Sulfate[1]**	**Nitrate[2]**
Class I	100	250	10
Class IA	175	450[3]	10
Class II	250	450	10

[1]Expressed as a 30-day arithmetic average based on a minimum of four daily samples collected during the 30-day period.
[2]The water quality standard for nitrite of 1 mg/L shall also not be exceeded.
[3] The site specific sulfate standard for the Sheyenne River from its headwaters to 0.1 mile downstream from Baldhill Dam is 750 mg/L.

In order to make beneficial use determinations for drinking water, the following decision criteria are used:

- *Fully Supporting:*

  Based on Numeric Standards: No exceedances of the water quality standard for nitrate, one or fewer exceedances of the 30-day average standards for chloride or sulfate, and no exceedances of any of the human health standards.

  Based on Narrative Standards: No drinking water complaints on record in the last two years.

- *Fully Supporting but Threatened:*

  Based on Numeric Standards: The fully supporting, but threatened use assessment designation is not applied to the drinking water use. Waters are either assessed as fully supporting or not supporting based on chemical data applied to the numeric standards.

  Based on Narrative Criteria: No impairment based on the numeric criteria, but a declining trend in water quality over time suggests a measurable increase in the cost to treat water for drinking water supply may occur if the trend continues.

- *Not Supporting*:

  Based on Numeric Criteria: One or more exceedances of the water quality standard for nitrate, two or more exceedances of the 30-day average criteria for chloride or sulfate, or one or more exceedances of any of the human health standards.

Based on Narrative Criteria: Knowledge of taste and odor problems or increased treatment costs have been associated with pollutants.

E. Fish Consumption Use Assessment Methodology for Rivers, Lakes and Reservoirs

As stated previously, the state's narrative water quality standards provide that surface waters shall be "free from materials attributable to municipal, industrial, or other discharges or agricultural practices" which will "render any undesirable taste to fish flesh or, in any way, make fish inedible." Fish consumption use is assumed to apply to all Class I, IA, and II rivers and streams, to those Class III streams known to provide a sport fishery and to all Class 1 through 4 lakes and reservoirs.

The beneficial use assessment methodology for fish consumption is based on the U.S. Environmental Protection Agency's (EPA) recommended methylmercury fish tissue criterion of 0.3 µg/g (EPA, 2001), and is consistent with the state's fish advisory guidelines for the general population. The EPA recommended mercury criterion is based on a reference dose (based on noncancer human health effects) of 0.0001 mg methylemercury/kg body weight-day minus the relative source contribution which is estimated to be 2.7×10^{-5} mg methylmercury/kg body weight-day. The EPA criterion assumes an average human body weight default value of 70 kg (154 pounds) for adults and an average meal size of 0.0175 kg (6 ounces).

The Department's assessment methodology for fish consumption is also based on the US EPA's "Guidance for Implementing the January 2001 Methylymercury Water Quality Criterion, Final" (EPA, 2009) and "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories", volume 1 (EPA, 2000). Based on these two guidance documents a waterbody is assessed for fish consumption use using the mean concentration of at least one piscivorous game fish species (e.g., walleye, sauger, northern pike, catfish, largemouth bass, or small mouth bass) found in the waterbody. The mean methylemercury concentration is estimated from a minimum of 3 composite samples (preferred) or 9 individual fish samples representative of the filet. When composite samples are used, each composite sample should consist of a minimum of three individual fish per composite with the smallest fish in the composite no less than 75% of the largest fish by length. Each composite sample should also be representative of a distinct age class of the target fish species in the waterbody. In other words, if three composite samples are collected, one composite should represent small fish, one representing medium sized fish and one representing large fish in the population.

If individual fish samples are collected then a minimum of 9 fish samples should be used to estimate the mean methylmercury concentration. The same criteria used to collect a composite sample should be used for individual fish samples where fish should be representative of at least three size classes and a minimum of three fish should be collected per size class (3 size classes times 3 fish per size class equals 9 fish). In cases where individual fish samples are used, then the number of fish per size class should be equal.

The EPA recommends using the t-test to determine whether the mean methylmercury concentration in fish tissue samples in a waterbody exceeds the criterion with statistical significance. The t-statistic is used to test the null hypothesis that the mean concentration of methylmercury in fish is equal to or less than the fish tissue criterion of 0.3 µg/g. The alternate hypothesis is that the mean concentration of methylmercury in fish is greater than the criterion. Where the null hypothesis is true the result is an assessment where fish consumption is "fully supporting." Where the null hypothesis is rejected in favor of the alternative hypothesis then fish consumption use is assessed as "not supporting." For purposes of the state's assessment methodology the 0.05 significance level ($p \leq 0.05$) has been selected. This means there is a 5% chance of rejecting the null hypothesis when it is really true (Type I error).

The t-test (t_c) is calculated from the sample mean (z) and variance (s^2) from the sample data as:

$$t_c = (z-c) / s$$

Where,

t_c = test statistic;

z = mean methylmercury concentration;

c = methylmercury criterion; and

s = standard deviation of the mean.

The null hypothesis of no difference is rejected in favor of the alternative hypothesis of exceedance if:

$$t_c > t_{\alpha,n-1}$$

Where, $t_{\alpha,n-1}$ is the tabulated value of the Student-t distribution corresponding to the level of significance α=0.05 and n-1 degrees of freedom (n=sample size) (Table 9).

Table 9. One-sided Student-t Distribution Values for α=0.05 and n-1 Degrees of Freedom.

	n-1 degrees of freedom									
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Student-t value	2.920	2.353	2.132	2.015	1.943	1.895	1.860	1.833	1.812	1.796

Fish Consumption Use Assessment Example

A sample of nine individual walleye representing three size classes (three fish per class) were collected from Jensen Lake and analyzed for mercury. The mercury samples were collected as dorsal plugs and are assumed to represent the concentration of mercury in the filet of each fish.

Size Class	Length (inches)	Mercury Concentration (µg/g)
Small	12	0.23
	12.5	0.24
	13.6	0.27
Medium	16.5	0.33
	17.1	0.36
	18.0	0.38
Large	23	0.45
	23.5	0.46
	24.2	0.47

The mean concentration (z) for the nine samples (n=9) is 0.35 with a variance (s^2) equal to 0.008828. Based in this mean and variance the test statistic is calculated as:

$$t_c = (z-c) / s$$

$$t_c = (0.35-0.3)/0.09396$$

$$t_c = 0.532$$

The null hypothesis of no difference between the mean and the criterion is accepted if $t_c > t_{\alpha,n-1,}$ where α=0.05 and n-1=8. Since t_c = 0.532 is not greater than $t_{\alpha,n-1}$ = 1.860 (Table 1) then the null hypothesis is rejected in favor of the alternative hypothesis that the mean methylmercury concentration is greater than the criterion and fish consumption use for Jensen Lake is assessed as not supporting.

F. Agricultural Use Assessment Methodology for Rivers, Lakes and Reservoirs

Agricultural uses are defined in the state water quality standards as " waters suitable for irrigation, stock watering, and other agricultural uses, but not suitable for use as a source of domestic supply for the farm unless satisfactory treatment is provided." While not specifically stated in state water quality standards, the numeric standards for pH (6.0-9.0), boron (750 µg/L as a 30-day average), sodium (less than 50% of cation based on mEq/L), and radium (5 pCi/L as a 30-day average) are intended for the protection of agricultural uses. Further, state water quality standards provide for the protection of agricultural uses by providing language that states that waters of the state shall be "free from substances….in concentrations or combinations which are toxic or harmful to humans, **animals, plants**, or resident biota."

In order to make beneficial use determinations for agricultural uses, the following decision criteria are used:

- *Fully Supporting:*

  Based on Numeric Standards: Ten percent or less of the samples exceed the water quality standard for pH or sodium and one or fewer exceedances of the 30-day average criteria for boron or radium.

  Based on Narrative Standards: Water supply supports normal crop and livestock production.

- *Fully Supporting but Threatened:*

  Based on Numeric Standards: The fully supporting, but threatened use assessment designation is not applied to agricultural use. Waters are either assessed as fully supporting or not supporting based on chemical data applied to the numeric standards.

  Based on Narrative Standards: No impairment based on the numeric criteria, but a declining trend in water quality over time suggests a measurable decrease in crop and/or livestock production may occur if the trend continues.

- *Not Supporting*:

  Based on Numeric Standards: Greater than 10 percent of samples are exceeded for the water quality standard for pH or sodium, or two or more exceedances of the 30-day average criteria for boron or radium.

  Based on Narrative Standards: At least on pollutant has been demonstrated to cause a measurable decrease in crop or livestock production.

G. Industrial Use Assessment Methodology for Rivers, Lakes and Reservoirs

Industrial uses are defined in the state water quality standards as "waters suitable for industrial purposes, including food processing, after treatment." While there are no specific numeric criteria in the state's water quality standards intended to protect industrial uses, it is assumed that if the state's narrative standards are met, or if other numeric water quality standards are met, the beneficial uses for industry will also be met.

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Appendix A

Standards of Quality for Waters of the State

Appendix B

Standard Operating Procedure for the Selection of Reference and Disturbed Sites for Biological Monitoring in North Dakota

STANDARD OPERATING PROCEDURE FOR THE SELECTION OF REFERENCE AND DISTURBED SITES FOR BIOLOGICAL MONITORING IN NORTH DAKOTA

Summary

The North Dakota Department of Health (NDDH) utilizes reference (least impaired) and disturbed (most impaired) physical conditions to provide an estimate of natural and human induced variability in biological community structure and in stream habitat quality. Sites are also used to develop threshold values and compile Indices of Biological Integrity (IBI). When selecting reference or disturbed conditions the NDDH Surface Water Quality Management Program (SWQMP) must account for natural and climatic variability across the state of North Dakota. To account for environmental variability in North Dakota, the state's total land area was separated into four regions by US Geological Survey Level III Ecoregions and each area was evaluated individually.

The first step in site selection involves a remote sensing component which utilizes an ESRI ArcView Geographic Information System (GIS), ArcView extensions and various GIS data layers. The Analytical Tool Interface for Landscape Assessments (ATtILA) extension allows users to calculate many common landscape metrics including: landscape characteristics, riparian characteristics, human stressors and physical characteristics. Grouped metrics are used to estimate anthropogenic stressors in a 1000 meter (m) circular buffer around distinct sampling points located on perennial flowing waters of the state. Ultimately a final site score is calculated based on the varying metric scores in the buffer. The most disturbed points are classified with the highest scores while the least disturbed points receive the lowest scores. The highest scoring disturbed sites and lowest scoring reference sites then move to the second evaluation step.

The second screening step is to evaluate each site individually by using additional GIS layers. Sites are plotted and examined for landscape attributes which may result in the site not being suitable for sample collection (e.g. water was too deep). Layers used in screening step two include but are not limited to: roads; aerial photos; public and private land ownership; township, range and section grids; county boundaries; and dam structures. The remaining viable sampling locations are then evaluated with another level of screening.

The third screening step involves site reconnaissance, also known as 'ground truthing'. During this step, SWQMP personnel visit sites to evaluate reference or disturbed using best professional judgment. Some important features to consider while 'ground truthing' are stream geomorphology, stream habitat alterations (e.g. dams, rip-rap), land use in or adjacent to the riparian zone, and other human influences at or near site locations.

Software and Data Layers/Sources

___ ArcView 3.X (ArcView version 3.2a or higher recommended)

Extensions:

___ ArcView 3.X Spatial Analyst Extension
___ Analytical Tool Interface for Landscape Assessments (ATtILA2004v1.0) Extension (EPA)
___ Buffer Theme Builder Extension
___ Display Points Lat/Long Extension
___ Divided line by adding points evenly Extension
___ Grid & Theme Projector version 2 Extension
___ XTools Extension (9/15/03)

Datasets and Layers:

___ Ecoregion GIS Layer (USGS)
___ National Agriculture Imagery Program (NAIP) 2005 Aerial Photography (NRCS) or Digital Orthophoto Quarter Quadrangles (DOQQ) (USGS)
___ National Elevation Dataset (NED) (USGS)
___ National Hydrography Dataset (NHD) (USGS)
___ National Land Cover Data (NLCD) (USGS)
___ North Dakota Public Land Ownership Layer
___ State and County Roads GIS Layer (North Dakota GIS Hub)
___ Township, Range and Section Grid

Procedures

Step 1: Remote Sensing

1. Create a new ArcView 3.X GIS project. Set the map coordinate system to *Universal Transverse Mercator* (UTM) zone 14N (North). Set map coordinate units to decimal degrees. Set map distance units to meters.

2. Select stream reaches in the NHD shapefile that fall inside the target watershed or study area. Create a new shapefile with the selected features. Perennial streams should be selected using the following F_CODEs in the NHD attribute table: 33400, 33600, 46003, 46006, and 55800.

3. Use the *Divide Line by Adding Points Evenly* extension to add points along the NHD shapefile features at intervals of 2000 meters.

4. Make sure the map coordinate system is set to UTM zone 14N. Next use the *Display Points Lat & Long Extension* to add Latitude and Longitude coordinates for each point to the shapefile's attribute table.

5. Use the *Buffer Theme Builder*'s "Create Buffer Theme" button to produce a shapefile of 1000 meter buffers around each potential sampling site in the point shapefile created in step 3.

6. Create a slope grid in percent from a statewide NED grid. Use the map calculator in spatial analyst and the function *[grid].slope (zFactor, percentRise)* to derive slopes where *zFactor* is the conversion factor if x, y, and z are in different units and *percentRise* equals true for percent slope and false for degree slope.

7. With the new Buffer Theme selected as the reporting unit, select and calculate the desired metrics in each of the four groups: landscape characteristics, riparian characteristics, human stressors and physical characteristics. Metric scores result from the evaluation of the NLCD grid, a roads layer, precipitation, and population density. Metrics should be chosen for their sensitivity. The most sensitive metrics will have the most variability in scores and will make site characteristic differentiation simpler.

8. Once the most sensitive metrics are chosen, use ATtILA to calculate an index score for each assessment unit. Scores are based on a summation of quantile rankings. The number of quantiles is user-defined.

9. Select the assessment units with the lowest and highest index scores, which are a measure of human disturbance. Lowest scores will be the least disturbed reference assessment units or "best available" sites in the study population and the highest scores will be the most disturbed sites.

Step 2: Digital Media Screening

10. Use aerial photography, GIS layers and best professional judgment to evaluate land uses within the selected assessment units. This screening step is mainly used to exclude best available sites with obvious landuse and waterbody characteristics that may disrupt or prohibit sample collection.

    Characteristics of Concern

    Reference Sites

    - Animal feeding operations near the waterbody
    - Heavily grazed or degraded riparian area
    - Debris or trash in the water body riparian area
    - Stream banks with large areas of mass wasting

    Reference and Disturbed Sites

    - Areas with significant human alteration (e.g. concrete channels)
    - Dam structures creating deep pools

    GIS Layers used:

    - National Agriculture Imagery Program (NAIP) 2005 Aerial Photography (NRCS) <u>or</u> Digital Orthophoto Quarter Quadrangles (DOQQ) (USGS)
    - Federal and State Highways, County Roads and Township Roads
    - Designated Public Lands and Township, Range, and Sections Grids
    - Dam Structures Point Features

Step 3: Landowner Verification and Site Visitation

11. Before a site visit is scheduled, it is advisable to research the identity of the person(s) or group(s) that own land adjacent to or around a potential monitoring location. The inquiry into the property ownership may prove more useful than waiting to contact local residents during an initial site visit and reduce the time expended to obtain permission to access the site. If the land is determined to be held publicly, an effort should be made to contact any and all renters (e.g., producers renting North Dakota State Land Department School Sections).

12. Once permission to access a site is obtained, a site visit should be scheduled. When first arriving at a site it is important to observe any property ownership signage or placards declaring "No Trespassing" or that hazardous conditions are present. If permission to access has been granted, proceed to the site coordinates.

13. Upon reaching the site coordinates, begin to verify the Level 2 assessment screening of GIS layers and aerial photography. Characteristics of the site location that should be examined include but are not limited to; landuse(s) in and around the stream, stream geomorphology, water depth and obstructions to the flow of water. The site investigator should keep a log of notes pertaining to site characteristics and comment on any features present in aerial photos, county maps, or landowner atlases that could be used during future sampling visits.

    A useful tool for examining stream conditions is the Rapid Geomorphic Assessment (RGA) which was developed by the United States Department of Agriculture. The RGA method classifies stream channel stability and the habitat quality of riparian areas and may be used calculate a general stream and habitat score to classify potential Reference and Disturbed sampling locations. The RGA form and instructions for its completion can be found on the following pages.

RAPID GEOMORPHIC ASSESSMENT (RGA) FORM CHANNEL STABILITY & HABITAT RANKING SCHEME

Station Name: ____________________

Station Description: ____________________

Date: __________ Time: ________ Slope: ______% Pattern: meander/ straight/ braided

Crew: ____________________ Pictures (circle): u/s, d/s, x-sec, LB, RB

1. Primary bed material

Bedrock	Boulder/Cobble	Gravel	Sand	Silt/Clay
0	1	2	3	4

2. Bed/bank protection

Yes	No	(with)	1 bank	2 banks
0	1		2	3

3. Degree of incision (relative elev. of "normal" low water if floodplain/terrace is 100%)

0-10%	11-25%	26-50%	51-75%	76-100%
4	3	2	1	0

4. Degree of constriction (relative decrease in top-bank width from up to downstream)

0-10%	11-25%	26-50%	51-75%	76-100%
0	1	2	3	4

5. Streambank erosion (dominant process each bank)

	None	Fluvial	Mass Wasting (failures)
Inside or left	0	1	2
Outside or right	0	1	2

6. Streambank instability (percent of each bank failing)

	0-10%	11-25%	26-50%	51-75%	76-100%
Inside or left	0	0.5	1	1.5	2
Outside or right	0	0.5	1	1.5	2

7. Established riparian vegetative cover (woody or stabilizing perennial grasses each bank)

	0-10%	11-25%	26-50%	51-75%	76-100%
Inside or left	2	1.5	1	0.5	0
Outside or right	2	1.5	1	0.5	0

8. Occurrence of bank accretion (percent of each bank with fluvial deposition)

	0-10%	11-25%	26-50%	51-75%	76-100%
Inside or left	2	1.5	1	0.5	0
Outside or right	2	1.5	1	0.5	0

9. Sum of All Values [ ]

Instructions for Completion of a Rapid Geomorphic Assessment Form

Define a representative reach 6-20 channel widths long.

1. **Primary bed material**

Bedrock	The parent material that underlies all other material. In some cases this becomes exposed at the surface. Bedrock can be identified as large slabs of rock, parts of which may be covered by other surficial material.
Boulder/Cobble	All rocks greater than 64 mm median diameter.
Gravel	All particles with a median diameter between 64.0 — 2.00 mm
Sand	All Particles with a median diameter between 2.00 — 0.063 mm
Silt-Clay	All fine particles with a median diameter of less than 0.063 mm

2. Bed/bank protection

Yes	Mark if the channel bed is artificially protected, such as rip rap or concrete.
No	Mark if the channel bed is not artificially protected and is composed of natural material.
Protection	
1 Bank	Mark if one bank is artificially protected, such as with rip rap or concrete.
2 Banks	Mark if two banks are artificially protected.

3. Degree of incision (Relative elevation of "normal" low water; floodplain/terrace @ 100%)

Calculated by measuring water depth at deepest point across channel, divided by bank height from bank top to bank base (where slope breaks to become channel bed). This ratio is given as a percentage and the appropriate category marked.

4. Degree of constriction (Relative decrease in top-bank width from up to downstream)

Often found where obstructions or artificial protection are present within the channel. Taking the reach length into consideration, channel width at the upstream and downstream parts of the reach is measured and the relative difference calculated.

5. Stream bank erosion (Each bank)

The dominant form of bank erosion is marked separately for each bank, left and right, facing in a downstream direction.

If the reach is a meandering reach, the banks are viewed in terms of 'Inside, Outside' as opposed to 'Left, Right' (appropriate for questions *5-8).* Inside bank, being the inner bank of the meander, if the stream bends to the left as you face downstream, this would be the left bank. Outside bank, being the outer bank, on your right as you face downstream in a stream meandering left.

None	No erosion
Fluvial	Fluvial processes, such as undercutting of the bank toe, cause erosion.
Mass Wasting	Mass movement of large amounts of material from the bank is the method of bank erosion. Mass Wasting is characterized by high, steep banks with shear bank faces. Debris at the bank toe appears to have fallen from higher up in the bank face. Includes, rotational slip failures and block failures.

6. Stream bank instability (Percent of each bank failing)

If the bank exhibits mass wasting, mark percentage of bank with failures over the length of the reach. If more than 50% failures are marked, the dominant process is mass wasting (see question *5)*.

7. Established riparian woody-vegetative cover (Each bank)

Riparian woody-vegetative cover represents most permanent vegetation that grows on the stream banks. Distinguished by its woody stem, this includes trees and bushes but does not include grasses. Grasses grow and die annually with the summer and thus do not provide any form of bank protection during winter months whilst permanent vegetation does.

8. Occurrence of bank accretion (Percent of each bank with fluvial deposition)

The percentage of the reach length with fluvial deposition of material (often sand, also includes fines and gravels) is marked.

9. Sum of All Values

Sum all category values for question one through eight. Lower aggregate scores indicate more stable geomorphology and improved habitat. Higher scores indicate unstable geomorphology and decreased habitat.

Appendix C

Agency and Organization Data Request

Letter, Form and Contacts

July 15, 2013

Contact

Dear :

The Clean Water Act requires states and tribes to monitor and assess the quality of its lakes, reservoirs, rivers, streams and wetlands and to report on the status and condition of its surfaces waters every two years. The next report, which will be a consolidation of both the Section 305(b) Water Quality Assessment Report and Section 303(d) List of Impaired Waters Needing Total Maximum Daily Loads is due to the US Environmental Protection Agency on April 1, 2014. The North Dakota Department of Health is the primary agency for water quality monitoring and assessment in the state of North Dakota and is therefore responsible for assessing the state's surface waters and preparing the integrated report.

As part of its responsibility, the Department maintains a network of water quality monitoring sites where it collects data on the chemical, physical and biological quality. While these data will be used to provide an assessment of the state's surface water quality, the Department is also requesting additional data that may be used for the 2014 report. If your agency or organization has chemical, physical or biological water quality data that you believe would be beneficial to the state's water quality assessment then please fill out the attached form and return it to me at your earliest convenience.

If you have any questions concerning this request, please contact me at 701.328.5214. Your cooperation in this matter is appreciated.

Sincerely,

Michael J. Ell
Environmental Administrator
Division of Water Quality

Letter Contacts

Ms. Allison Schlag
Dakota Prairies Grasslands
US Forest Service
240 W Century Ave
Bismarck, ND 58503

Dr. Gerald Groenwald
Energy and Environmental Research Center
University of ND
PO Box 9018
Grand Forks, ND 58202-9018

Mr. Jim Zeigler
Minnesota Pollution Control Agency
714 Lake Ave, No. 220
Detoit Lakes, MN 56501

Mr. Edward Murphy
North Dakota Geological Survey
600 E Boulevard Ave.
Bismarck, ND 58505-0840

Mr. Darrin Kron
Water Quality Monitoring and Assessment Section
Montana Dept. of Environmental Quality
1520 E 6th Ave
PO Box 200901
Helena, MT 59620

Mr. Jim Feeney
Watershed Protection Program
SD Dept of Environment and Natural Resources
Joe Foss Building
523 E Capitol Ave
Pierre, SD 57501-3181

Mr. David Hodgson
Bureau of Land Management
99 23rd Ave W, Ste A
Dickinson, ND 58601-2202

Water Quality Data Summary for North Dakota

Contact Person: ______________________________

Address: ______________________________

____

____

Phone: ______________________________

Email: ______________________________

Data Description: ______________________________

____

____

____

____

____

Data Period of Record: ______________________________

____

Were the data collected according standard operating procedures and/or by following a documented quality assurance/quality control plan?

Yes No Other: ______________________________

Data Availability (e.g., electronic, report): ______________________________

____

If you have any questions concerning this information, please contact Mike Ell at 701.328.5214

Please return form to: Mike Ell, North Dakota Department of Health, Division of Water Quality, 918 E Divide Ave, 4th Floor, Bismarck, ND 58501-1947

Appendix D

Public Notice Statement Requesting Public Comment on the State of North Dakota's Draft 2014 Section 303(d) List

PUBLIC NOTICE STATEMENT

Notice of submittal to the U.S. Environmental Protection Agency (EPA) and a request for public comment on the State of North Dakota's draft 2014 Section 303(d) List of Waters Needing Total Maximum Daily Loads (TMDLs).

1. Summary

Section 303(d) of the Clean Water Act (CWA) and its accompanying regulations (CFR Part 130 Section 7) requires each state to identify waterbodies (i.e., lakes, reservoirs, rivers, streams, and wetlands) which are considered water quality limited and require load allocations, waste load allocations, or total maximum daily loads. A waterbody is considered water quality limited when it is known that its water quality does not meet applicable water quality standards or is not expected to meet applicable water quality standards. Waterbodies can be water quality limited due to point sources of pollution, nonpoint sources of pollution, or both.

Section 303(d) of the Clean Water Act requires states to submit their lists of water quality limited waterbodies "from time to time." Federal regulations have clarified this language, therefore, beginning in 1992 and by April 1st of every even numbered year thereafter, states were required to submit a revised list of waters needing TMDLs. This list has become known as the "TMDL list" or "Section 303(d) list." The state of North Dakota last submitted its TMDL list to EPA on May 22, 2012. This list, referred to as the "2012 list" was approved by EPA on October 29, 2012. The draft 2014 Section 303(d) list, which will be submitted to EPA as part of the integrated Section 305(b) water quality assessment report and Section 303(d) TMDL list, includes a list of waterbodies not meeting water quality standards and which need TMDLs, and a list of waterbodies which have been removed from the "2012 list."

Following an opportunity for public comment, the state must submit its list to the EPA Regional Administrator. The EPA Regional Administrator then has 30 days to either approve or disapprove the state's listings. The purpose of this notice is to solicit public comment on the draft "2014 list" prior to formally submitting the list to the EPA Regional Administrator.

2. Public Comments

Persons wishing to comment on the State's draft 2014 Section 303(d) List of Waters Needing TMDLs may do so, in writing, within thirty (30) days of the date of this public notice. Comments must be received within this 30-day period to ensure consideration in the EPA approval or disapproval decision. All comments should include the name, address and telephone number of the person submitting comments, and a statement of the relevant facts upon which they are based. All comments should be submitted to the attention of the Section 303(d) TMDL Coordinator, North Dakota Department of Health, Division of Water Quality, 918 East Divide Avenue, 4th Floor, Bismarck, ND 58501 or by email at mell@nd.gov. The 2014 Section 303(d) TMDL list may be reviewed at the above address during normal business hours or by accessing it through the Department's web address (http://www.ndhealth.gov). Copies may also be requested by writing to the Department at the above address or by calling 701.328.5210.

Public Notice Number ND-2014-027

Appendix E

EPA Region 8 Comments on the State of North Dakota's Draft 2014 Section 303(d) List and the North Dakota Department of Health's Responses

Draft 2014 IR EPA Region 8 Comments by Kris Jensen on December 12, 2014 and the Department's Response

US EPA Region 8 Summary Comment:
When I ran a cycle-to-cycle comparison report for any missing waters in ADB, it brought up only one which should be added to the pollutant count for the 2014 IR.

ND-09020204-007-S_00	Rush River	Rush River downstream to an unnamed tributary watershed (ND-09020204-012-S_00). Located in north central Cass County.	RIVER	41.4 MILES	Fishes Bioassessments

Department Response to Comment:
For the draft 2014 IR, the aquatic life use impairment cause was in advertently changed from "Fishes Bioassessments" to "Benthic Macroinvertebrate Bioassessments." For the final 2014 IR listing, the aquatic life use impairment cause was changed back to "Fishes Bioassessments."

US EPA Region 8 Summary Comment:
Please clarify the sulfate cause included for the municipal and domestic use for ND-09020107-014-S_00, Red River, listed as category 3, insufficient information.

Department Response to Comment:
For this waterbody there were not sufficient data available to make a use attainment assessment for the municipal and domestic water supply use, but based on those data that were available, concentrations for some samples exceeded the state sulfate standard of 250 mg/L. The sulfate cause has been associated with an assessment of "Insufficient Information" as a means to recognize that there were limited data and that elevated sulfate may be a problem in the future.

US EPA Region 8 2014 IR Delisitng Comment:
Please revise the de-listing rationales for the Park River segments (3), pps. 50-52 for copper and lead, replacing the word "cadmium" in each with either "copper" or "lead".

Department Response to Comment:
Done.

US EPA Region 8 2014 IR De-listing Comment:
We currently have concerns with the de-listing rationale for ND-10110101-056-S_00, Handy Water Creek, and are unclear whether it meets the criteria for delisting. The rationale indicates the AU ID was originally placed in Category 3, although that may be a typo that should say Category 5. ADB shows the water was originally listed in 2004. Previous cycle data shows the original assessment determination was made utilizing the Rapid Bioassessment Protocol III. Where would these data results normally be housed? Were they uploaded in STORET? I am available to discuss this prior to the finalization of the IR.

Department Response to Comment:
If available, these data would be in the Department's in-house EDAS database. It is likely that if these data are available, they are greater than 10 years old. Since the actual data used to make the original use assessment cannot be found and since there are not more current data available to make a new assessment, this waterbody has been put back on the Section 303(d) list as "Not Supporting" aquatic life use due to benthic macroinvertebrate bioassessments. The number of waterbodies and waterbody/pollutant combinations reported has been increase by one as has the number of Category 5 waterbodies. The miles of rivers and streams not supporting aquatic life use and the miles of rivers and streams impaired due to biological indicators has been increase by 42.09 miles to account for this waterbody.

US EPA Region 8 2014 IR Clarification on Drinking Water Supply Use:
Paragraph 5 on page I-3 may be confusing in terms of the drinking water supply use. It is unclear from the last sentence whether the five reservoirs listed as municipal supplies and the two back-up lakes were all assessed for the drinking water supply use.

Department Response to Comment:
Paragraph 5 on page 3 of Part I, Executive Summary and the accompanying paragraph on the bottom of page 10 in Part V, Section 305(b) Water Quality Assessment, have been rewritten to provide more clarity.

US EPA Region 8 2014 IR ADB Comment:
ND-09020203-007-L_00 McVille Dam: Missing assessment dates for the two uses included in the listing.

Department Response to Comment:
Assessment dates of 2/1/2004 and 2/1/2002 were added to the aquatic life use and recreation use assessments, respectively. These dates correspond to the first time these uses were assessed and listing in the Integrated Report.

US EPA Region 8 2014 IR ADB Comment:
ND 10-110205-001-S_00 Little Missouri River: ADB is showing "Not supporting" as well as "threatened" for the recreation use. Previous cycle information indicates that the two assessment determinations started showing up in the 2008 cycle; in 2006, the AU ID was listed as "not supporting".

Department Response to Comment:
The appropriate recreation use assessment for this waterbody is "not supporting." The "T" flag which is associated with this use assessment is an error. It has been deleted from the ADB for the 2014 cycle as well as with assessments in the ADB going back to the original assessment and listing in 2008.

US EPA Region 8 2014 IR ADB Comment:
AU Descriptions are missing for several of the lakes and reservoirs, although they are present in ADB.

Department Response to Comment:
While detailed AU descriptions are provided for river and stream waterbodies listed in the 2014 list of impaired waters needing TMDLs, since lakes and reservoirs are discrete waterbodies only the lake or reservoir name is provided as a description.

Draft 2014 IR EPA Region 8 Comments by Vern Berry on December 12, 2014 and the Department's Response

Comments Requiring Revision/Response:

- Executive Summary, pages I-1 – I-4: the summary number of assessed waters do not add up in some instances:
  - * Page I-1, second paragraph – mentions 289 lakes/reservoirs => 143 natural lakes; 146 reservoirs. Reservoirs include: "…the two mainstem Missouri River reservoirs…" and the "…remaining 143 reservoirs…" We assume that the "remaining" number of reservoirs should be "144".

    Department Response: Change made, the number should be 144.

  - * Page I-2, last paragraph – mentions 289 lakes/reservoirs => 200 classified; 89 un-classified. Then it goes right into a summary of the aquatic life assessment results => 158 fully supporting; a subset of 29 lakes are fully supporting, but threatened; and 4 are not supporting. Were all 200 of the classified lakes assessed for aquatic life use? Are the 29 FSBT lakes really a subset of the FS lakes, or are they separate so that there would be a total of 158+29+4 = 191 lakes assessed for aquatic life use? Then 9 were not assessed?

    Based on the summary information in Table V-6, we assume the 29 FSBT lakes are a subset of the 158 FS lakes and the total number assessed for aquatic life is: 129 FS + 29 FSBT + 4 NS = 162. If so, then we recommend adding a statement to the first sentence of the aquatic life use summary for lakes and reservoirs that provides the total number assessed. Also, for consistency with the format of Table V-6, we recommend that the number and acres be separated for each individual use support category (e.g., 129 (590,490.6 acres) FS; 29 (8,167.8 acres) FSBT; 4 (705.8 acres) NS), rather than expressing the FSBT as a subset of the FS. We recommend using a similar format for each of the use summary paragraphs.

    Department Response: Yes, the 29 "fully supporting, but threatened" lakes are a subset of the 158 fully supporting lakes discussed on Page I-2, last paragraph, and again on page V-8, paragraph 2. These two paragraphs were rewritten to clarify the number of lakes and lake acres included in each assessment category. The first paragraph of page V-3 was also re-written to clarify the number of rivers and streams assessed for aquatic life use in both the "fully supporting" and fully supporting, but threatened" categories.

  - * Page I-3, Fish Consumption Use summary – There are 200 classified lakes/reservoirs and 199 of those are assigned a fish consumption use, then 1 must not have any fish or the fish are not suitable for consumption? Which lake? Of the 199, 5 are named as having sufficient data to assess the fish consumption use and the "…remaining 193…" were not assessed. We assume the remaining number should be "194".

Department Response: This paragraph, as well as the third paragraph on page V-10, were rewritten to include a sentence which describes Lake George as a class 5 lake which is "not capable of supporting a sport fishery due to high salinity."

* Page I-4, last paragraph – the mention of 64 WBPCs being targeted for TMDL completion by the end of 2016 is not consistent with the description of TMDL prioritization on page VI-2 (says 64 will be completed or started). Also the description of "high priority" WBPCs in this context is linked to the completion of monitoring. We understand why it may be helpful to explain it that way in the executive summary and we know that the monitoring data must be available before a TMDL can be developed. However, availability of data is not one of the priority ranking factors listed in Part VI.B – we assume that the WBPCs were determined to be a priority first, then data was collected so that TMDLs could be written. Is that why the data is/will be available for these 64 high priority listings and not the 156 low priority waters? Perhaps the sentence could be rewritten, consider something like: "As a result of these waterbody/pollutant combinations being ranked as "High" priority for TMDL development (see Part VI.B), the monitoring for these AUs have either been completed, are near completion or have recently been initiated." Lastly, the end of the paragraph mentions developing a long term TMDL schedule through "2023" – the new WQ-27 measure endpoint will be 2022, please revise the year to match.

  Department Response: The Department's two-tier TMDL priority ranking is intended to recognize that, in many cases, monitoring is needed prior to TMDL development and that monitoring will be initiated for many "High" priority waterbodies in the next 2-4 years. It should also be recognized that there will also be a number of TMDLs completed for some "High" priority waterbodies. The following sentence was added to the paragraph on page I-5 and to the last paragraph on page VI-5 in hopes of providing clarity on this point.

  "These "High" priority waterbody/pollutant combinations are AUs for which the monitoring necessary for TMDL development is either completed, near completion or will be initiated in 2015 or 2016."

  The year 2023 was also changed to 2022 as requested.

- Part VI, Table VI-5, 2012 303(d) De-listed Waters: The de-listed waters for Brush Lake (page VI-53), Crooked Lake and Braddock Lake (both page VI-54) each say that "A TMDL for dissolved oxygen was approved by EPA…" The final TMDL documents for those waterbodies didn't include separate dissolved oxygen loading calculations, allocations, etc. Therefore, the EPA approvals did not include "dissolved oxygen TMDLs". However, the state's TMDL document demonstrated the linkages between the nutrient (total phosphorus) TMDL and the dissolved oxygen impairment. The EPA TMDL approvals for these waters acknowledged those linkages and our TMDL tracking system shows that we approved total phosphorus TMDLs that addressed the nutrient/eutrophication/biological indicators impairments and the dissolved oxygen impairments on the 2012 303(d) list. To accurately reflect our TMDL approvals for these three waters we suggest the de-listing rationale for each be re-written. We suggest a sentence similar to: "TMDL approved or established by EPA (4a). A TMDL for nutrients (total phosphorus) was approved by EPA on November 30, 2012. The nutrients TMDL addresses the dissolved oxygen impairment as demonstrated in the TMDL document."

Department Response: The suggested changes were made to the delisting justifications for Brush Lake, Crooked Lake and Braddock Lake, both in Table VI-5 and in the delisting comments in the ADB for these waterbodies.

Comments for Consideration (no revision/response required):

- Part VI.F, TMDL Development and Monitoring Schedule, page VI-5, last paragraph: The summary description of the 2014 303(d) list mentions 59 waterbodies or 64 waterbody / pollutant combinations (WBPCs) identified as "high priority" or "targeted" for TMDL completion by the next 303(d) list in 2016. These 64 high priority WBPCs include the following impairments: 54 E.coli and/or fecal coliform; 6 nutrient/eutrophication/biological indicators; 3 dissolved oxygen and 1 sedimentation/siltation. The distribution by basin is: Souris – 2; Red – 32; Missouri – 25; and James – 5.

  States have a significant amount of discretion in the prioritization of the WBPCs on their 303(d) list. The EPA only requires states to consider the severity of the impairment and the designated uses of the waters in the priority ranking process. States may use additional priority ranking factors suggested by EPA and/or add their own factors. The EPA expects that the resulting high priority WBPCs represent the impairments the state intends to have completed TMDLs in the subsequent two years until the next 303(d) list.

  EPA's past reviews of state's 303(d) lists did not ask for details of the specific factors used, how they were weighted, or resulting scores for each listing and did not question the total number of high priority listings or the impairment causes chosen. Only recently, EPA and the states have discussed new ideas and tools that can be used to improve the prioritization process to help define which waters are most important for restoration and protection. These refinements in the prioritization process should allow for additional coordination and integration with other water quality entities within the state and allow for increased transparency and public input.

  North Dakota's 2014 Integrated Report was well underway when these ideas and tools were discussed in detail. Therefore, there's no expectation that the 2014 prioritization process would be revised to reflect this new information. However, in anticipation of a revised prioritization process that will be more fully developed by the 2016 IR cycle we'd like to make a few points on the 2014 high priority WBPCs for consideration when you begin working on the 2016 303(d) list (these are not intended to be a comprehensive list of the many considerations or factors that should be part of future prioritization efforts):

  1. The number of high priority WBPCs (i.e., 64) are significantly more than the average 2-year total number of TMDLs submitted and approved in the past. We

realize that ND expanded the definition of high priority listings to include those the state ***plans to complete*** as well as those that are ***scheduled to begin*** in the next two years. This approach is closer to a 4-year schedule which would address an average of 16 impairments per year (may be a bit high depending on the complexity and level of stakeholder involvement in developing the TMDLs). We also acknowledge that EPA's workload caused delays in timely approval of TMDLs submitted by ND. However, for the 2016 303(d) list, we encourage ND to include only the high priority WBPCs which will have a "completed TMDL" during that 2-year period until the next cycle. ND's description of longer term plans for developing TMDLs, non-TMDL alternative plans or protection plans can be included another part of the IR or in separate documentation (e.g., WQ-27 priority area identification).

2. ND's draft 2014 303(d) list contains 338 WBPCs. The majority of the listings are located in the Red River basin (70%), followed by the Missouri River basin (20%), the James River basin (7%) and the Souris River basin (3%). In comparison, the 64 high priority WBPCs are disproportionally located, with nearly 40% in the Missouri River basin and 50% in the Red River Basin. As ND considers a new basin management framework and prioritization strategy a few questions worth consideration may include: Should the location of the high priority waterbodies or WBPCs, which are targeted for TMDL completion in each 2-year listing cycle, have a similar proportionate basin distribution as the larger 303(d) list? Will the location of the waters targeted for non-TMDL alternative plans or protection plans be similarly distributed? Or, if a water quality rotating basin approach is adopted, should the 2-year targeted listings all be located in the basin(s) that is next up for restoration plan development according to the rotating basin schedule?

3. Approximately 84% of the 64 high priority WBPCs targeted for TMDL completion, are for E. coli and/or fecal coliform and all of those are impairing the recreational use. As ND makes further progress on a nutrient reduction strategy, nutrient water quality standards and nutrient assessment methodology, we anticipate that nutrient-related impairments will become a significant percentage of the high priority, targeted listings on some future 303(d) list (e.g., 2 or 3 list cycles from now). Until then, as ND considers a new basin management framework and prioritization strategy, a few questions worth consideration may include: Should pathogen impairments be prioritized using some measure of recreational importance or intensity of use? Should the high priority WBPCs targeted for each 2-year cycle have some proportional balance based on the designated use? For example, if 55% of the total listed WBPCs are impairing the Fish/Aquatic use and 30% of the total listed WBPCs are impairing the Recreational use - Should the high priority, targeted WBPCs reflect a similar balance? Or, should some of the impaired uses have a higher proportional weighting due to the importance of that use (e.g., drinking water supply)? Of course similar to how pathogen impairments could be prioritized, the fish/aquatic

life impairments could be prioritized based on the importance of the fishery or the intensity of the use.