Winnebago Tribe of Nebraska
Non-Point Source Pollution Assessment Report

Environmental Protection Department

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Overview

The Winnebago Tribe of Nebraska Reservation covers approximately 113,000 acres in northeastern Nebraska and 1800 acres in northwestern Iowa. Approximately one third of the Reservation acreage is owned by the Tribe and individual tribal members. Due to its checkerboard nature, most Reservation land is owned by non-tribal members. Much of this land is involved in agricultural activities.

The Winnebago Tribe is very concerned about the condition of the natural environment and how that condition affects human health and the ecosystem. The Tribe has major concerns about the misuse of pesticides, land application of animal and other waste, bank erosion, nutrient runoff from fertilizer application and livestock grazing. Thus, addressing nonpoint source pollution issues are of a major concern.

The Winnebago Tribe utilizes funding under the Clean Water Act, Section 106: Water Pollution Control Grant Program to further understand the water resources on the Reservation by continuing and expanding the water quality monitoring program (ground and surface). The Tribe conducts and generates chemical data of ground water and physical, chemical and biological data descriptive of their surface water resources. Information generated is continually being utilized to assess the current condition of studied surface and ground water bodies, identify if these surface waters are impaired or unsafe for human contact and provide direction towards a nonpoint source management program development.

The Winnebago Reservation lies within the Missouri River Basin and Elkhorn River Basin. The Missouri River Basin contains the Blackbird-Soldier Watershed (HUC: 10230001) along the eastern side of the Reservation and the Elkhorn River Basin contains the Logan Watershed (HUC: 10220004) along the west side. All waterbodies located on the Reservation are mainly located within these two watersheds.

All creeks contained within both watersheds suffer degradation from total kjeldahl nitrogen, total nitrogen, total phosphorus and E. coli. Many creeks suffer moderate impacts due to agricultural activities, mainly non-irrigated crop production and livestock grazing and hydromodification, mainly streambank erosion and removal of riparian vegetation.

The Winnebago Tribe of Nebraska does not currently have a nonpoint source control program in place. The goal is to begin coordination with tribal departments, local, state and federal agencies, agricultural entities and private land owners to identify and implement Best Management Practices (BMPs) that best protect/prevent current and future nonpoint source pollution problems. This Nonpoint Source Assessment Report is the first step in initiating a Clean Water Act Section 319 Nonpoint Source Program.

Introduction

The Winnebago Tribe of Nebraska Reservation is located in the northern half of Thurston County and small portion in southeastern Dixon County in northeastern Nebraska and in the southwestern corner of Woodbury County in northwestern Iowa. The Reservation covers approximately 113,000 acres in Nebraska and 1800 acres in Iowa (654 on-site and 1250 off-site). Reservation land holdings extending into Iowa due to the Missouri River to the east are not accessible within the exterior boundaries of the Reservation.

The Reservation is bordered by the Omaha Indian Reservation to the south and the Dakota-Thurston County line to the north. The western boundary parallels State Highway 16 about 2 miles to its east and is divided by the Missouri River. The closest large urban centers are Sioux City, Iowa located about 20 miles north and Omaha, NE located about 80 miles to the south.

Figure 1: Winnebago Tribe of Nebraska Vicinity Map

According to the 2000 Census, approximately 2,600 people live on the Reservation. Approximately one third of the Reservation acreage is owned by the Tribe and individual tribal members. Non-tribal members, however, farm much of the land. The largest community on the Reservation is the Village of Winnebago, located on the eastern side of the Reservation, Winnebago is home to most Winnebago tribal members and accounts for almost thirty percent of the Reservation's resident population. Important sectors of employment include health and education services, manufacturing, agriculture, public administration and retail trade.

Winnebago Tribe of Nebraska was established by the Treaty of March 8, 1865. The Tribal Council governs the Winnebago Tribe and consists of a Chairman, Vice-Chairman, Secretary, Treasurer and five other members. All Council members are elected by tribal members for a three-year term while officers are appointed for a one-year term from within the Council.

In 1986, The Winnebago Tribe established jurisdiction in the area of its legal system. The Tribal Court System exists to resolve civil conflicts and to enforce the criminal law in a just and equitable manner. The Tribal Court holds general jurisdiction for the Winnebago Tribe of Nebraska.

Constitution and By-Laws were established according to the Act of Congress, dated June 18, 1934 (48 Stat. 984). The Constitution applies to the territory embraced in the Winnebago Reservation in Nebraska, as the same as described by the Treaty of March 8, 1865 (14 Stat. 671) and twenty sections included in the strip purchased in Nebraska for Wisconsin Winnebagos (18 Stat. 170, June 22, 1874) and such lands as may be added thereto by Congress or by the Tribe or affirmation of the title to lands through the courts to the Tribe, except as otherwise provided by law.

The Winnebago Tribe of Nebraska utilizes funding under the Clean Water Act, Section 106: Water Pollution Control Grant Program to further understand the water resources on the Reservation by continuing and expanding the water quality monitoring program. The Tribe conducts and generates physical, chemical and biological data descriptive of their surface water sources. Information generated is continually being utilized to assess the current condition of studied surface water bodies, identify if these surface waters are impaired or unsafe for human contact and provide direction towards program maturation.

The Winnebago Tribe of Nebraska is very concerned about the condition of the natural environment and how that condition affects human health and the ecosystem. The Tribe has major concerns about the misuse of pesticides, land application of animal and other waste, bank erosion, nutrient runoff from fertilizer application and livestock grazing. All which can potentially degrade the quality of surface water and ground water on the Reservation. Ceremonial water is drawn from natural springs and individuals, both young and old, enjoy fishing from the major streams and ponds.

The overall goal of the Winnebago Tribe is to determine the condition of the natural environment and protect the health and welfare of tribal members and other individuals residing within the exterior boundaries of the Reservation. The primary objectives to achieve this goal are:

- The Tribe will continue to strive for the development of water quality control programs such as a 319 Non-Point Source, Wetlands and Ground Water Monitoring;
- Lay groundwork for developing tribal water regulatory codes;
- Develop integrated resource management strategies such as a Watershed Approach;
- Perform water quality assessments through continued monitoring; and
- Development of approved Tribal Water Quality Standards.

Completion of a Non-Point Source Assessment Report to identify possible sources of nonpoint impacts is the first step to developing a Clean Water Act Section 319 Nonpoint Source Pollution Program.

Methodology

The assessment area encompasses the entire land base within the exterior boundaries of the Winnebago Reservation (refer to Figure 1). Data used for the analysis of nonpoint sources of pollution within the assessment area was generated by the Tribe during the implementation of the Clean Water Act Section 106: Water Pollution Control State, Interstate and Tribal Program Support (Water Quality Program) from 2001 to 2012. Chemical surface water data has been generated from 2002 to 2012. Physical and Biological surface water data has been generated from 2003 to 2012. Chemical ground water data has been generated every other from year 2008 to 2014.

Chemical data of surface water has been generated in accordance to the Quality Assurance Project Plan for the Chemical Assessment of Surface Water, Fish Tissue and Sediment (approved May 2015) and Surface Water Chemical Monitoring Sampling Plan. It follows several tracks of sampling. Due to the relationship to nonpoint source issues, only Track 1, Track 4: Fish Tissue Analysis (surface water only) and Ground Water/Domestic Drinking Water Well data is included. Dates of sampling are listed below:

- Basic Stream Monitoring (2002-2012);
- Fish Tissue Analysis (2005-2012); and
- Ground Water/Domestic Drinking Water Well (2008-2014).

Basic Stream Monitoring

Nine major creeks where chosen as sampling sites for Track 1: Basic Stream Monitoring in order to provide a good cross section of the surface water bodies on the Reservation. Three streams; Logan, Middle and Omaha Creeks cross much of the Reservation in a north-south direction. These three were chosen to have two sample sites per creek, one as the creek enters and one as it exits the Reservation. This is to determine the water quality entering the Reservation and to determine if any contaminants are being introduced within the Reservation boundaries. The remaining creeks include: Big Bear, North Omaha, Cow, Turtle, Morgan and North Blackbird creeks. All monitoring sites except Big Bear Creek are located in cropland areas where the presence of pesticides and nutrient runoff is anticipated. Table 1: Track 1 - Basic Stream Monitoring Sites demonstrates sampling locations.

Why sampling was conducted:

- To generate data of ambient stream conditions to determine current surface water health and identify normal life cycle; and

- To collect additional data of ambient stream conditions for the antidegradation provisions for future Tribal Water Quality Standards.

When sampling was conducted:

- Once every month, approximately April through September, for a total of 6 sampling sessions but pesticides approximately April through July for a total of 4 sampling sessions (2011-2012); and
- Each site consisted of field measurements using a YSI 556 MPS (2002-2009) and a YSI 650 MDS/6820-V2 Sonde (2010-2012) and a grab sample collected for analysis at a third party laboratory (2002-2012).

Identified surface water bodies were analyzed in the field for the following:

- Temperature, pH, specific conductance, total dissolved solids, dissolved oxygen and turbidity (2002-2012); and
- Flow (2011-2012).

Surface water samples were analyzed at a third party laboratory for the following (2002-2012):

- Bacteria: fecal coliforms and E coli;
- Nutrients: total phosphorus, nitrate nitrogen, nitrite nitrogen, ammonia nitrogen and total kjeldahl nitrogen (calculate total nitrogen);
- Inorganics: sodium, calcium, magnesium, total hardness, iron, manganese, sulfate, chloride and fluoride; and
- Pesticides: alachlor, metolachlor, metribuzin, simazine and atrazine.

Table 1: Basic Stream Monitoring Sites

StationID	StationName	StationType	Location	Latitude	Longitude
SiteA	Turtle Creek	Creek	11-T26N-R8E	42 14 48.75 N	96 28 55.89 W
SiteB	Omaha Creek (North)	Creek	35-T27N-R8E	42 15 48.46 N	96 29 05.26 W
SiteC	North Blackbird Creek	Creek	22-T26N-R9E	42 12 29.47 N	96 23 53.45 W
SiteD	Big Bear Creek	Creek	1-T26N-R9E	42 15 08.73 N	96 21 45.31 W
SiteE	Morgan Creek	Creek	13-T26N-R8E	42 13 26.77 N	96 28 38.54 W
SiteF	Omaha Creek (South)	Creek	25-T26N-R8E	42 11 27.99 N	96 28 38.38 W
SiteG	Middle Creek (North)	Creek	33-T27N-R6E	42 16 42.36 N	96 44 10.47 W
SiteH	Logan Creek (North)	Creek	14-T26N-R5E	42 13 29.40 N	96 49 10.47 W
SiteI	Logan Creek (South)	Creek	31-T26N-R6E	42 10 38.13 N	96 46 26.54 W
SiteJ	Middle Creek (South)	Creek	2-T25N-R6E	42 09 46.39 N	96 42 12.64 W
SiteK	Cow Creek	Creek	1-T25N-R7E	42 09 45.32 N	96 33 42.16 W
SiteL	North Omaha Creek	Creek	29-T26N-R8E	42 11 38.68 N	96 31 51.72 W

Fish Tissue Analysis (Surface Water only)

Three (3) sample sites, Ross Pond, Kelly Pond, and H-Lake were identified for Track 4: Fish Tissue Analysis due to the high frequency of recreational fishing activities carried on there. The primary goal of this study is to identify frequently fished sites where commonly consumed fish or target species are possibly chemically contaminated and may pose a risk to human health. Surface water samples are also collected from each of the identified water bodies. Grab water

samples are collected from the three ponds on the same day but not the same day as fish capture. Table 2: Track 4 – Fish Tissue Analysis Sites demonstrates sampling sites.

Why sampling will be conducted:

- To determine the surface water quality to ensure a healthy habitat for a thriving fish population.

When sampling will be conducted:

- Once during the sampling season in August through September; and
- A surface water grab sample will be collected once from each site sometime during the sampling period. Surface water sampling will be conducted on a date when weather conditions are not too adverse. Adverse weather conditions may include but not limited to heavy rain, lightning, hail and/or winds in excess of 25 mph.

Identified surface water body will be analyzed in the field for the following:

- YSI 650 MDS/6820-V2 Sonde: temperature, pH, specific conductance, total dissolved solids, dissolved oxygen and turbidity.

Surface water samples will be analyzed at a third party laboratory for the following:

- Bacteria: fecal coliforms and E. coli;
- Nutrients: total phosphorus, nitrate nitrogen, nitrite nitrogen, ammonia nitrogen and total kjeldahl nitrogen (calculate total nitrogen);
- Inorganic: sodium, calcium, magnesium, total hardness, iron, manganese, sulfate, chloride and fluoride;
- Heavy Metals: lead and arsenic; and
- Pesticide: alachlor, metolachlor, metribuzin, simazine and atrazine.

Table 2: Fish Tissue Analysis Sites

Station ID	Name	Type	Location	Latitude	Longitude
Site A	Kelly Pond	Pond	15-T26N-R9E	42 13 03.30 N	96 28 06.41 W
Site B	Ross Pond	Pond	27-T26N-R9E	42 11 38.74 N	96 23 30.19 W
Site C	H-Lake	Lake	2-T26N-R8E	42 15 27.59 N	96 28 55.83 W

Ground Water Monitoring

Chemical data of ground water has been generated in accordance to the Quality Assurance Project Plan for Ground Water/Domestic Drinking Water Well Assessment (approved May 2010). This monitoring is on a volunteer basis and pertains to private individual family drinking

water wells (approximately 300), domestic use only of both tribal and non-tribal individuals residing within the exterior boundaries of the Winnebago Reservation. (See Figure 1) It excludes public drinking water systems and wells used for watering livestock and irrigating crops.

Grab samples are collected from either an indoor or outdoor faucet directly connected to the domestic well source. Preferably, the outside faucet was one that is attached to the house. The indoor faucet was one located prior to a connection with any type of water softening system. All hoses, aerators, or screens are first removed from the end of the faucet. Faucet is decontaminated with either alcohol or flamed depending on faucet material and cold water tap turned on to a smooth flowing stream at a moderate pressure. Water is allowed to flow for 3-5 minutes to clear the service line. Water flow is then reduced to a stream about pencil width and collection is performed.

Surface water quality reference criteria are based on aquatic life, recreation and domestic water supply values. The criteria apply to data generated under Basic Stream Monitoring activities. Data generated under Fish Tissue Analysis (water only) activities has its own set of reference criteria. Table 3 demonstrates surface water quality reference criteria.

Table 3: Surface Water Quality Reference Criteria

Analyte (Field)	Method	Units	Detection Limit	Aquatic Life	Recreation	Domestic Water Supply
pH	YSI 556 MPS	standard units	0.01-14.0	6.5-9.0[3,6]		6.5-8.5[2]
Temperature	YSI 556 MPS	^{O} Celsius	-5 to 45	32[3]		
Total Dissolved Solids	YSI 556 MPS	mg/L	5			500[2]
Specific Conductance	YSI 556 MPS	mS/cm	0-100			0.770
Dissolved Oxygen	YSI 556 MPS	mg/L	0-50	$\geq$ 5.0[3]		
pH	YSI 650 MDS	standard units	0.01-14.0	6.5-9.0[3,6]		6.5-8.5[2]
Temperature	YSI 650 MDS	^{O} Celsius	-5 to 50	32[3]		
Total Dissolved Solids	YSI 650 MDS	mg/L	5			500[2]
Specific Conductance	YSI 650 MDS	mS/cm	0-100			0.770
Dissolved Oxygen	YSI 650 MDS	mg/L	0-50	$\geq$ 5.0[3]		
Turbidity	YSI 650 MDS	NTU	0-1000	15[7]		5[5]
Turbidity	Transparency Tube	cm	0-60	----		
Flow	Global Flow Probe	ft/sec	0.3-15	----		
Analyte (Lab)						
Fecal Coliform	SM9222D	cfu/100 ml	1		2000[3]	
E. Coli	SM9222B	cfu/100ml	1		406[3]	
E. Coli	SM9223B	MPN/100ml	1		406[3]	

Nitrate Nitrogen	EPA 300.0	mg/L	0.2			10[1]
Nitrite Nitrogen	SM4500 NO_2B	mg/L	0.02			1[1]
Total Kjeldahl Nitrogen	PAI-DK 02	mg/L	0.5	0.65[7]		
Total Nitrogen	Calculated (NO^2+NO^3+TKN)	mg/l	0.72	2.615[7]		
Ammonia Nitrogen	SM 4500-NH3 G	mg/L	0.10	0.26(chronic)[8]		0.20[5]
Sodium	EPA 200.7	mg/L	0.01			100[4]
Calcium	EPA 200.7	mg/L	0.01			80[4]
Magnesium	EPA 200.7	mg/L	0.01			30[4]
Total Hardness	SM 2340B	gr/gallon	10	20[4]		
Iron	EPA 200.7	mg/L	0.02	1[3,6]		0.3[2,3,6]
Manganese	EPA 200.7	mg/L	0.01	1(chronic)[3]		0.05[2,6]
Sulfate	EPA 300.0	mg/L	1			250[2]
Chloride	EPA 300.0	mg/L	1	230 (chronic)[6]		250[2]
Fluoride	EPA 300.0	mg/L	0.1			2.0[2]
Total Phosphorus	EPA 200.7	mg/L	0.1	0.118[7]		
Alachlor	NEP-GC/MS	ug/L	0.5	76(chronic)[3]		2.0[1]
Metolachlor	NEP-GS/MS	ug/L	0.5	100[3]		
Metribuzin	NEP-GS/MS	ug/L	0.5	100[3]		
Simazine	NEP-GS/MS	ug/L	0.5			4.0[1,3]
Atrazine	NEP-GS/MS	ug/L	0.5	12[3]		3.0[1,3]
Arsenic	EPA 200.7	mg/l	0.10	16.7(chronic)[3]		
Lead	EPA 200.8	mg/l	0.05	0.0025 (chronic)[6]		0.015[1]
Mercury	EPA 245.1	mg/l	0.0004	0.00077 (chronic)[3,6]		0.02[1]

1 National Primary Drinking Water Regulations **2** National Secondary Drinking Water Regulations
3 Title 117 – Nebraska Surface Water Quality Standards
4 Water Quality & Treatment Handbook, American Waterworks Association
5 World Health Organization **6** National Recommended Water Quality Criteria
7 Ambient Water Quality Criteria Recommendations: Ecoregion VI
8 EPA Draft 2009 Update of Aquatic Life Ambient Water Quality Criteria for Ammonia-Freshwater

Since the Tribe does not have surface water quality standards of their own, reference criteria was extrapolated from various other sources. Sources include the following:

- National Primary Drinking Water Regulations;
- National Secondary Drinking Water Regulations;
- Title 117-Nebraska Surface Water Quality Standards;
- Water Quality and Treatment Handbook, American Waterworks Association;
- World Health Organization;
- National Recommended Water Quality Criteria;
- Ambient Water Quality Criteria Recommendations: EPA Ecoregion VI;
- EPA Draft 2009 Update of Aquatic Life Ambient Water Quality Criteria for Ammonia-Freshwater;
- Environmental Contamination and Toxicology (2000 Springer-Verlog, New York Inc);

- Office of Pesticides (OPP) Aquatic Life Benchmarks: Invertebrates (Freshwater: Chronic);
- Office of Pesticides (OPP) Aquatic Life Benchmarks: Fish (Freshwater: Chronic); and
- Department of Ecology, State of Washington: Sediment Chemical Criteria.

Table 4: Surface Water Quality Criteria
Ponds & Stream (Fish)

Analyte (Field)	Method	Units	Detection Limit	Aquatic Life	Recreation	Domestic Water Supply
pH	YSI 556 MPS	standard units	0.01-14.0	6.5-9.0[3,6]		6.5-8.5[2]
Temperature	YSI 556 MPS	^{O} Celsius	-5 to 45	32[3]		
Total Dissolved Solids	YSI 556 MPS	mg/L	5			500[2]
Specific Conductance	YSI 556 MPS	mS/cm	0-100			0.770
Dissolved Oxygen	YSI 556 MPS	mg/L	0-50	$\geq$ 5.0[3]		
pH	YSI 650 MDS	standard units	0.01-14.0	6.5-9.0[3,6]		6.5-8.5[2]
Temperature	YSI 650 MDS	^{O} Celsius	-5 to 50	32[3]		
Total Dissolved Solids	YSI 650 MDS	mg/L	5			500[2]
Specific Conductance	YSI 650 MDS	mS/cm	0-100			0.770
Dissolved Oxygen	YSI 650 MDS	mg/L	0-50	$\geq$ 5.0[3]		
Turbidity	YSI 650 MDS	NTU	1-1000	15[7]		5[5]
Analyte (Lab)						
Fecal Coliform	SM9222D	cfu/100 ml	1		2000[3]	
E. Coli	SM9222B	cfu/100ml	1		406[3]	
E. Coli	SM9993B	MPN/100ml	1		406[3]	
Nitrate Nitrogen	EPA 300.0	mg/l	0.2			10[1]
Nitrite Nitrogen	SM4500 NO_2B	mg/l	0.02			1[1]
Total Kjeldahl Nitrogen	PAI-DK 02	mg/l	0.50	0.65[7]		
Total Nitrogen	Calculated (NO^2+NO^3+TKN)	mg/l	0.72	2.615[7]		
Total Ammonia Nitrogen	SM 4500-NH3 G	mg/l	0.10	Refer to Table 15[8]		0.20[5]
Sodium	EPA 200.7	mg/l	0.01			100[4]
Calcium	EPA 200.7	mg/l	0.01			80[4]

Magnesium	EPA 200.7	mg/l	0.01			30[4]
Total Hardness	SM 2340B	gr/gallon	10	20[4]		
Iron	EPA 200.7	mg/l	0.02	1[3,6]		0.3[2,3,6]
Manganese	EPA 200.7	mg/l	0.01	1 (chronic)[3]		0.05[2,6]
Sulfate	EPA 300.0	mg/l	1			250[2]
Chloride	EPA 300.0	mg/l	1			250[2]
Fluoride	EPA 300.0	mg/l	0.1			2.0[2]
Total Phosphorus	EPA 200.7	mg/l	0.1	0.118[7]		
Lead	EPA 200.8	mg/l	0.0005	0.0025 (chronic)[6]		0.015[1]
Arsenic	EPA 200.7	mg/l	0.10	16.7 (chronic)[3]		
Mercury	EPA 245.1	mg/l	0.0004	0.00077 (chronic)[3, 6]		0.02[1]
Alachlor	NEP-GC/MS	ug/L	0.5	76 (chronic)[3]		2.0[1]
Metolachlor	NEP-GC/MS	ug/L	0.5	100[3]		
Metribuzin	NEP-GC/MS	ug/L	0.5	100[3]		
Simazine	NEP-GC/MS	ug/L	0.5			4.0[1,3]
Atrazine	NEP-GC/MS	ug/L	0.5	12[3]		3.0[1,3]

1 National Primary Drinking Water Regulations **2** National Secondary Drinking Water Regulations
3 Title 117 – Nebraska Surface Water Quality Standards
4 Water Quality & Treatment Handbook, American Waterworks Association
5 World Health Organization **6** National Recommended Water Quality Criteria
7Ambient Water Quality Criteria Recommendations: Ecoregion VI
8EPA 2013 Update of Aquatic Life Ambient Water Quality Criteria for Ammonia-Freshwater

Since the Tribe does not have surface water quality standards of their own, reference criteria was extrapolated from various other sources. Sources include the following:

- National Primary Drinking Water Regulations;
- National Secondary Drinking Water Regulations;
- Title 117-Nebraska Surface Water Quality Standards;
- Water Quality and Treatment Handbook, American Waterworks Association;
- World Health Organization;
- National Recommended Water Quality Criteria;
- Ambient Water Quality Criteria Recommendations: EPA Ecoregion VI;
- EPA Draft 2009 Update of Aquatic Life Ambient Water Quality Criteria for Ammonia-Freshwater;
- Environmental Contamination and Toxicology (2000 Springer-Verlog, New York Inc);
- Office of Pesticides (OPP) Aquatic Life Benchmarks: Invertebrates (Freshwater: Chronic);
- Office of Pesticides (OPP) Aquatic Life Benchmarks: Fish (Freshwater: Chronic); and
- Department of Ecology, State of Washington: Sediment Chemical Criteria.

Ground water quality reference criteria are based on domestic water supply values. Table 5 demonstrates ground water quality reference criteria.

Table 5: Ground Water Quality Reference Criteria

Analyte	Method	Units	Detection Limit	Reference Criteria
pH	EPA 150.1	standard units	1.0	6.5-8.5[2]
Total Dissolved Solids (TDS)	SM2540C	mg/l	10	500[2]
Specific Conductance	SM2510B	mS/cm	0.002	0.770
Fecal Coliforms	SM9222D	cfu/100 ml	1	0[1]
E. Coli	SM9223B	MPN/100ml	1	0[1]
Nitrate Nitrogen	EPA 300.0	mg/l	0.2	10[1]
Nitrite Nitrogen	SM4500 NO_2B	mg/l	0.02	1[1]
Total Kjeldahl Nitrogen (TKN)	PAI-DK 02	mg/l	0.50	----
Total Nitrogen	Calculated (TKN+Nitrite+Nitrate)	mg/l	0.72	----
Ammonia Nitrogen	SM4500-NH3G	mg/l	0.10	0.20[4]
Sodium	EPA 200.7	mg/l	0.01	20[3]
Calcium	EPA 200.7	mg/l	0.01	80[3]
Magnesium	EPA 200.7	mg/l	0.01	30[3]
Total Hardness	SM 2340B	gr/gallon	0.60	20[3]
Iron	EPA 200.7	mg/l	0.02	0.3[2]
Manganese	EPA 200.7	mg/l	0.01	0.05[2]
Sulfate	EPA 300.0	mg/l	1	250[2]
Chloride	EPA 300.0	mg/l	1	250[2]
Fluoride	EPA 300.0	mg/l	0.1	2.0[2]
Total Phosphorus	EPA 200.7	mg/l	0.1	----
Mercury	EPA 245.1	mg/l	0.0004	0.002[1]
Arsenic	EPA 200.8	mg/l	0.001	0.010[1]
Alachlor	NEP-GC/MS	ug/l	0.50	2.0[1]
Metolachlor	NEP-GC/MS	ug/l	0.50	10.0[4]
Metribuzin	NEP-GC/MS	ug/l	0.50	----
Simazine	NEP-GC/MS	ug/l	0.50	4.0[1]
Atrazine	NEP-GS/MS	ug/l	0.50	3.0[1]

1 = National Primary Drinking Water Regulations **2 =** National Secondary Drinking Water Regulations
3 = US EPA Water Quality Guidelines for Human Consumption **4 =** World Health Organization

Since ground water resources used for domestic drinking water purposes are not federally regulated, the Tribe chose to extrapolate reference criteria from various sources involving or centered around human consumption. Sources include the following:

- National Primary Drinking Water Regulations;
- National Secondary Drinking Water Regulations;
- World Health Organization; and
- National Recommended Water Quality Criteria.

Data Management

Individuals performing the day's surface and ground water collection and field measurements and physical and biological monitoring ensure pages in the field notebook contain all relevant and accurate information for each individual site.

Laboratory results were validated and verified by comparing sample identification numbers printed on the laboratory hardcopy with those written in the field notebook. Data from field measurements, laboratory analysis, physical observations, benthic macroinvertebrate capture and quality control samples were entered into a tribal database based on an excel spreadsheet system. Data from field measurements and laboratory analysis were also entered into the STORET compatible format template. An original copy of all laboratory reports, a photocopy of the field notebook pages and original tribal database sheets are placed in a project file maintained in the department. A copy of all laboratory results, field notebook pages and tribal databases are maintained by the Tribal Quality Assurance Manager as well as kept in a file located in another building. Surface water quality data will be downloaded into the STORET database warehouse as time and resources allow. Both databases are submitted electronically on a yearly basis to the Clean Water Act Section 106 Project Officer as an attachment to both the Surface Water Quality Assessment Report and Ground Water/Domestic Drinking Water Well Assessment Report.

Quality Control

All chemical surface water data was generated in accordance with the Quality Assurance Project Plan for the Chemical Assessment of Surface Water, Fish Tissue and Sediment (last update May 2015). All physical and biological surface water data was generated in accordance with the Physical and Biological Assessment of Surface Water Quality Assurance Project Plan (last update April 2016). All chemical ground water data was generated in accordance with the Quality Assurance Project Plan for Ground Water/Domestic Drinking Water Well Assessment (updated May 2010). Any spatial data produced during the implementation of physical, chemical (surface or ground) and biological monitoring was maintained in accordance to the approved Quality Assurance Project Plan for Spatial Data Collection (last update October 2016).

Quality control evaluation of results in the form of Quality Control Assessment Reports was prepared during these activities. Quality Control Assessment Reports included the following:

- One report per month after the completion of Basic Stream Monitoring and Fish Tissue Analysis (Surface Water only), incorporated in the monthly report in which the activity was completed;
- One report after the completion of Physical, Biological and Visual Habitat Assessment at all 12 sites; and
- One report after the completion of Ground Water/Domestic Drinking Water Well sampling.

All Quality Control Reports were submitted electronically on a yearly basis to the Clean Water Act Section 106 Project Officer as an attachment to the Surface Water Quality Assessment Report and the Ground Water/Domestic Drinking Water Well Assessment Report.

An individual from EPA Region 7 in Kansas City, KS serves as a technical advisor for the collection of all environmental samples.

Land Use Summary

The Reservation land base consists of cropland, woodland and pasture. Land ownership is divided by Tribal Trust, Tribal member allotments and non-tribal private property. (See Figure 2) Agriculture makes up the most of land use. Urban areas are made up of 3 Villages, Village of Thurston and Village of Emerson are located on the western edge of the Reservation along Highway 9 and populated by mainly non-tribal individuals and the Village of Winnebago located in eastern side along Highway 75/77 and populated by mainly tribal individuals.

Village of Winnebago is 0.20 square miles, all land with a population *according to the* 2010 Census of 774. Village of Emerson is 0.47 square miles, all land with a population of 840 and Village of Thurston is 0.12 square miles, all land with a population of 132. (Wikipedia)

Figure 2: Winnebago Reservation Land Ownership Map

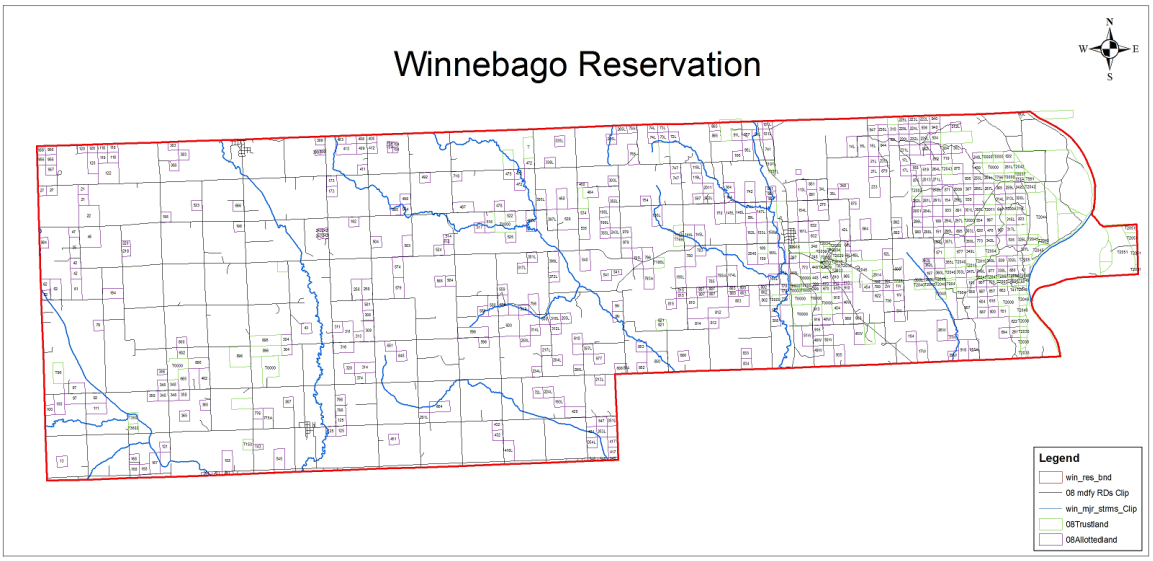

Table 6: Land Ownership Status demonstrates the land ownership in acres within the exterior boundaries of the Reservation.

Table 6: Land Ownership Status

Land Status	Acres
Total Area	113,038
Tribal Owned	5,608
Allotted Owned	23,232
Non-Tribal Owned	84,198

Source: Bureau of Indian Affairs, Winnebago Agency

Cropland acres are divided up among corn for grain, corn for silage or greenchop, oats for grain, soybeans for beans and forage-land used for all hay and haylage, grass silage and greenchop (2007 Census of Agriculture, American Indian Reservations, USDA, National Agricultural Statistics Service). Table 7: Reservation Land Use demonstrates the major areas of land use.

Table 7: Reservation Land Use

Use	Acres
Forest	10,249
Total Cropland	56,304
Irrigated Cropland	2,943
Harvested Cropland	53,178
Urban	506

Source: American Indian Reservations, 2007 Census of Agriculture, USDA, National Agricultural Statistics Service and Winnebago Forest Analysis, Forest Management Plan for 2001-2020, 1999

The Reservation lies within two distinct topographic areas: (1) the uplands, which contain a mantle of loess and (2) the bottomlands along the Missouri River and other large streams. (Final Forest Management Plan)

The dominant soil order for the Winnebago Reservation is *Mollisol* with dominant suborder of ustolls located in the western portion and udolls located in the eastern portion. (USDA NRCS Soil Taxonomy Map, 1998).

Surface and Ground Water Quality Summary

The Winnebago Reservation lies within the Missouri River Basin and Elkhorn River Basin. The Missouri River Basin contains the Blackbird-Soldier Watershed (HUC: 10230001) along the eastern side of the Reservation and the Elkhorn River Basin contains the Logan Watershed (HUC: 10220004) along the west side. Table 8 demonstrates the total miles of creeks/streams and Missouri River and total acres of ponds/lakes and wetlands.

Table 8: Surface Waterbody Summary

Total miles of creeks	486
- Miles of primary creeks	105
- Miles of intermittent creeks	381
Total miles of Missouri River	7.5
Total acres of lakes and ponds	Not Inventoried
Total acres of freshwater wetlands	3680

The major Reservation waterbodies contained in the Blackbird-Soldier Watershed include the Missouri River, Cow Creek, North Omaha Creek, Omaha Creek, North Blackbird Creek, Big Bear Creek, Turtle Creek, Morgan Creek, Kelly Pond, Ross Pond and H-Lake.
Cow Creek originates on the Winnebago Reservation in the area northeast of Thurston and flows southeasterly through Loess Hills draining approximately 15.8 square miles.

North Omaha Creek originates just north of the Reservation east of Emerson. This creek flows onto the Reservation almost immediately and continues southeasterly across the entire Reservation draining approximately 39.8 square miles.

Omaha Creek flows to the north through Loess Hills. This creek expands the entire Reservation draining approximately 37 square miles. Turtle, Morgan, Cow and North Omaha creeks are major tributaries to Omaha Creek.

North Blackbird Creek originates approximately 2 miles east of the Village of Winnebago in the Missouri River Bluffs region and flows southward off Reservation lands. This creek drains approximately 3.9 square miles.

Big Bear Creek is a small Missouri River tributary that originates in the Missouri River Bluffs region 3 miles east of the Village of Winnebago and flows directly to the river. It drains approximately 10 square miles.

The major Reservation waterbodies contained in the Logan Watershed include Logan Creek and Middle Creek.
Logan Creek has been dredged providing an entirely new channel which is only half of its original channel. Logan Creek flows through the Loess Hills portion of the Reservation and drains approximately 64.2 square miles of Reservation land.

Middle Creek also flows through the Loess Hills portion of the Reservation and drains about 30.7 square miles.

Table 9 identifies surface water designated extrapolated from Title 117-Nebraska Department of Environmental Quality: Surface Water Quality Standards (April 2012).

Table 9: Surface Water Designated Uses

Creek	Aquatic Life	Agricultural	Key Species
Omaha	Class B: Warmwater	Class A	None
Big Bear	Class B: Warmwater	None	None
North Blackbird	Class B: Warmwater	Class A	None
Cow	Class B: Warmwater	Class A	None
Turtle	Class B: Warmwater	Class A	None
Morgan	Class B: Warmwater	Class A	None
North Omaha	Class B: Warmwater	Class A	None
Middle	Class B: Warmwater	Class A	None
Logan	Class A: Warmwater	Class A	Channel Catfish

The Tribe has generated surface water quality data since 2002 to 2012 utilizing CWA 106 funding. Samples sites included in Basic Stream Monitoring has remained constant throughout the monitoring period.

No monitoring has been conducted on the Missouri River. If needed, the Tribe will obtain information from United States Geographical Survey (USGS) or the United States Army CORP of Engineers (USACE).

No monitoring has been conducted on the wetlands.

Surface water and fish tissue data has been generated at Kelly Pond, Ross Pond and H-Lake.

All creeks contained within both watersheds suffer degradation from total kjeldahl nitrogen, total nitrogen, total phosphorus and E. coli. Many creeks suffer moderate impacts due to agricultural activities, mainly row crops, making up the dominant land use.

The Winnebago Reservation lies within the Central Midwest Region and draws its ground water mainly from the Lower Cretaceous Aquifer, one of the 30 regional principal aquifers with the greatest amount of ground water use. Unconsolidated and semi-consolidated sand and gravel aquifers, mostly in glacial deposits, are positioned above the main aquifer. (USGS: Ground Water Availability in the United States)

Ground water quality data has been generated from the Ground Water/Domestic Drinking Water Well Project supported by CWA 106 funding in 2008, 2010, 2012 and 2014. This project was on a volunteer basis and pertains to private individual family drinking water wells (approximately 300), domestic use only of both tribal and non-tribal individuals residing within the exterior boundaries of the Winnebago Reservation. In 2008, 22 ground water samples were collected all within close proximity of the Village of Winnebago. In 2010, only 4 ground water samples were collected all within close proximity of the Village of Winnebago. In 2012, 12 ground water samples were collected all within close proximity of the Village of Winnebago. In 2014, only 9

ground water samples were collected, 7 within close proximity of the Village of Winnebago and 2 located approximately 3 to 4 miles west of the Village of Winnebago.

Results

The Winnebago Reservation is checkerboard in nature and dominated by agricultural activities. The Tribe has major concerns about the misuse of pesticides, proper maintenance and operation of concentrated animal feed operation facilities, nutrient runoff from fertilizer application and improper livestock grazing. Lack or dwindling buffer strips of natural vegetation and increased encroachment of row crop planting have increased the occurrence and severity of bank erosion. This erosion results in decreased bank stability, channel alteration, decreased flow rates, increased turbidity levels and increased sediment loading.

The status of known and potential impairments to surface water bodies is summarized in Table 10. 'Severity' ranking is listed low to high according to the concentration(s), duration(s) and potential cumulative effects of impairment created by the known pollutants. Information extrapolated from Appendix B1-B12: 2002-2012 Basic Stream Monitoring and Appendix C1-C3.

Table 10: Winnebago Reservation Surface Waterbody Results

Waterbody	Name	Miles	Monitored	Known Pollutants	Potential Source	Severity
Creek	Omaha	37	2002-2012	Turbidity, E. coli TP, TKN, TN	Possible agricultural, cattle grazing, erosion	High
Creek	Big Bear	10	2002-2012	Turbidity TP, TKN, TDS, E. coli	Natural runoff, erosion	Unknown
Creek	Turtle	Unknown	2002-2012	Turbidity E. coli TP,TKN, TN	Possible agricultural, cattle grazing	High
Creek	Morgan	Unknown	2002-2012	Turbidity, E. coli TP,TN	Possible agricultural, cattle grazing, erosion	High
Creek	North Blackbird	3.9	2002-2012	Turbidity, TP E. coli TN, TKN	Possible agricultural, erosion	Unknown
				Turbidity, E. coli	Possible agricultural,	

Creek	Cow	15.8	2002-2012	TP, TKN, TN	erosion,	High
Creek	North Omaha	39.8	2002-2012	Turbidity, E. coli TP, TKN, TN	Possible agricultural, erosion	High
Creek	Middle	30.7	2002-2012	Turbidity, E. coli TP, TKN, TN, TDS	Possible agricultural, cattle grazing, erosion	High
Creek	Logan	64.2	2002-2012	Turbidity, E. coli, TKN TP, TN, TDS	Possible agricultural, erosion	High
River	Missouri	7.5	No	N/A	N/A	N/A
Pond	Kelly	5.0	2005-2012	TKN	Natural runoff, stormwater runoff	Low
Pond	Ross	Unknown	2005,2007,2009 and 2011	TKN	Possible agricultural, natural runoff	Unknown
Lake	H-Lake	5.0	2005, 2007 and 2009	TKN	Natural runoff	Unknown
Wetlands	Unknown	Unknown	No	N/A	N/A	N/A

Note: TP = Total Phosphorus
TKN = Total Kjeldahl Nitrogen
TDS = Total Dissolved Solids
TN = Total Nitrogen

In 2008, the parameters of specific conductance, total dissolved solids, ammonia nitrogen, sodium, manganese, iron, total hardness and calcium resulted in values above the numeric reference criteria. One well resulted in an extremely high level of nitrate nitrogen.

In 2010, the parameters of specific conductance, total dissolved solids, ammonia nitrogen, sodium, manganese, iron, total hardness and calcium once again resulted in values above the numeric reference criteria. Three of the four wells sampled were also monitored in 2008.

In 2012, the parameters of specific conductance, total dissolved solids, ammonia nitrogen, manganese, total hardness, calcium and magnesium resulted in values above the numeric reference criteria. The well monitored in 2008 still resulted in an extremely high level of nitrate nitrogen. Eight of the twelve wells sampled were also monitored in 2008 and one was monitored in 2008 and 2010.

The status of known and potential impairments to ground water sources is summarized in Table 11. ‘Severity’ ranking is listed low to high according to the concentration(s), duration(s) and

potential cumulative effects of impairment created by the known pollutants. Information extrapolated from Appendix D1-D4: 2008-2014 Domestic Drinking Water Wells.

Table 11: Winnebago Reservation Ground Water Results

Waterbody	Name	Miles	Monitored	Known Pollutants	Potential Source	Severity
Ground Water	N/A	Unknown	2008-2014	Specific Conductance, Total Dissolved Solids, Total Hardness, Calcium, Manganese, Sodium, Iron	Certain types of rock and/or soils	High
Ground Water	N/A	Unknown	2008-2014	Ammonia Nitrogen	Unknown	Unknown
Ground Water	N/A	Unknown	2008-2014	Magnesium, E. coli	Certain types of rock and/or soils, animal grazing runoff	Low
Ground Water	N/A	Unknown	2008-2014	Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus, Metribuzin	Possible agricultural	Unknown

The parameters of specific conductance, total dissolved solids, ammonia nitrogen, manganese, total hardness and calcium consistently resulted in values above the numeric reference criteria during the three years of monitoring throughout the well locations. The source of pollutants and severity is currently unknown. The extremely high level of nitrate nitrogen tends to be an isolated case rather than normal even though the source is unknown still presents a severe human health threat to those individuals who utilize the ground water as their drinking water source.

Cattle Grazing

It is common practice to graze cattle in fields after harvest thus utilizing any remaining crops left behind and taking advantage of savings created by the deposit of natural fertilizer. This activity sometimes involves nearby streams without usually causing adverse or extensive impacts. Possibly due to the drought conditions experienced in 2012, this was not the case.
Wire had been strung across Turtle Creek located in Blackbird-Soldier Watershed allowing cattle access from both banks near the monitoring location. This caused total loss of vegetation of both upper banks, extensive destruction of both lower banks and channel, increased bacteria, iron, turbidity as well as many other chemical parameter levels. (See Figure 3: Turtle Creek)

On September 19, 2012, Basic Stream Monitoring was conducted. Due to disturbance, no field measurements were taken. Surface water collected resulted in extremely elevated levels of calcium, magnesium, manganese, total phosphorus, iron, total kjeldahl nitrogen, ammonia nitrogen, total nitrogen, fecal coliform and E. coli. Appendix A: 2012 Surface Water Sampling at Turtle Creek demonstrates impacts to the receiving creek.

Figure 3: Turtle Creek

Similar observation was made along Morgan Creek also a part of the Blackbird-Soldier Watershed. This location was not near a monitoring location so no surface water sampling was conducted. (See Figure 4: Morgan Creek)

Figure 4: Morgan Creek

Land Application of Cattle Manure

The last interesting situation experienced during the 2012 Sampling Season was the result of land application of cattle manure generated at a concentrated animal feed operation facility on a field along Middle Creek. On September 5, 2012, while conducting Concentrated Animal Feed Operation Monitoring upstream and downstream of the facility discharge site. First observation was water flowing from drain field point source discharge sites, discoloration of soil on a field and odd odor located along the right bank of Middle Creek. Surface water samples collected resulted in increased specific conductance, total dissolved solid, sodium, calcium, manganese, chloride, fluoride, nitrite nitrogen and total phosphorus levels for both the upstream and downstream locations.

This particular situation may not be able to be categorized as a nonpoint source because the point of contamination to the receiving water was a point source discharge from the effluent pipe coming off the drain field. What it does demonstrate is that there are potential contaminants in lieu of runoff created by a rainfall event.

Discussion

Surface water quality of ponds on the Winnebago Reservation overall appears to be meeting designated uses. Surface water quality of streams and creeks on the Winnebago Reservation overall appears to not be meeting designated uses. Higher turbidity levels and sediment loading can, at the very least, be attributed to the fact that the creeks on the Reservation are classified as muddy bottom low-gradient creeks. The source of many occurrences of streambank erosion can identified as a natural condition. This sloughing off of bank structure creates higher turbidity levels and localized areas of sediment loading. The Reservation is also a highly agricultural area with non-irrigated and some irrigated crop production being identified as one of the dominant land uses. Many fields are planted within mere feet of the banks attributing in a decline of natural vegetation resulting in visible runoff and bank erosion. Nutrient impacts are evident as demonstrated by high levels of total phosphorus and total nitrogen. Minerals such as iron, calcium and magnesium consistently result above reference criteria. E. coli levels resulting consistently above the reference criteria in most of the water bodies may be attributed to natural condition especially in areas where signs of wildlife are observed (Ex: animal tracks and/or trails). Once again, there are those areas that may also suffer impacts from localized sources such as concentrated animal feed operations, land application of manure and cattle grazing.

Ground water quality of domestic drinking water wells monitored on the Winnebago Reservation, at least within a 4-mile radius of the Village of Winnebago overall appears to be meeting the reference criteria. Specific conductance, total dissolved solids, total hardness, calcium, manganese, sodium and iron consistently resulting in higher concentrations may be due mainly from natural land conditions and rock formations from which the ground water is withdrawn. Source of increased ammonia nitrogen concentrations identified in certain wells is unknown at this time. Source of increased nitrate nitrogen levels identified in an isolated well may be attributed to agricultural activities but significant nexus is undetermined at this time. Due to no identified reference criteria, the severity of total phosphorus, TKN, total nitrogen, metribuzin is also unknown at this time. Ground water quality for the more central to western regions of the Reservation is unknown. More monitoring data is required.

Water quality is a reflection of the land use in the watershed. Land use on the Reservation is greatly centered around agriculture involved in row crops and to a lesser extent pasture and/or hayfields. (See Table 7: Reservation Land Use) Potential impacts due to agricultural activities have been identified as moderate. This land condition identifier makes it all the more critical to address nonpoint source issues and to initiate proper and most affective BMPs. Table 12 identifies many key participants and their potential roles.

Blackbird-Soldier Watershed
NPS Pollution Category: Agriculture
Subcategory: Feedlots, Cattle Grazing, Non-irrigated Crop Production

- Bank slumping due to crop production and cattle grazing (sediment, turbidity, TDS and E. coli)
- Loss of riparian and streambank vegetation from cattle grazing (sediment, TDS and turbidity)
- Contaminated runoff due to cattle grazing (E. coli)
- Contaminated runoff due to non-irrigated crop production (nutrients)

Blackbird-Soldier Watershed
NPS Pollution Category: Hydromodification
Subcategory: Streambank Erosion, Riparian and Streambank Vegetation Removal, Natural Runoff

- Loss of riparian and stream bank vegetation from tree removal (sediment, turbidity and TDS)
- Bank slumping due to rainfall events (turbidity, sediment, TKN and TDS)

Blackbird-Solider Watershed
NPS Pollution Category: Urban Runoff
Subcategory: Storm Sewers, Surface Runoff

- Contaminated runoff due to storm water from road surfaces (TKN and TDS)

Logan Watershed
NPS Pollution Category: Agriculture
Subcategory: Feedlots, Non-irrigated Crop Production, Irrigated Crop production, Manure Application

- Bank slumping due to crop production (sediment, turbidity, TDS and E. coli)
- Contaminated runoff due to non-irrigated crop production (nutrients)
- Contaminated runoff from land application of manure and/or urine (E coli and other inorganics)

Logan Watershed
NPS Pollution Category: Hydromodification
Subcategory: Streambank Erosion, Riparian and Streambank Vegetation Removal, Natural Runoff, Channelization

- Loss of riparian and stream bank vegetation from tree removal (sediment, turbidity and TDS)
- Bank slumping due to rainfall events (turbidity, sediment, TKN and TDS)

Logan Watershed
NPS Pollution Category: Urban Runoff
Subcategory: Surface Water Runoff

- Contaminated runoff due to storm water from road surfaces (TKN and TDS)

Selection of Best Management Practices (BMPs)

Table 12: Core Participants for BMPs

Participant	Role
Environmental Protection Department, Winnebago Tribe of Nebraska	Implements surface and ground water monitoring and pollution control activities. Provides NPS education/outreach. Provides BMP(s) oversight.
Department of Land Management, Winnebago Tribe of Nebraska	Provides technical assistance.
Tribal Council, Winnebago Tribe of Nebraska	Provides tribal legal authorization for activities.
US Department of Agriculture	Provide federal policy on protecting natural resources.
Bureau of Indian Affairs	Provides technical assistance, education, legal services and financial resources.
US Army CORP of Engineers	Provides technical assistance.
Natural Resource District	Provides technical assistance, education and demonstration projects.
US Environmental Protection Agency	Provides technical and financial resources. Provides oversight of surface water quality monitoring.
US Fish and Wildlife	Provides technical assistance, education and financial resources.
Natural Resources Conservation Service	Provides technical services.
Private Landowner	Provides insight, cooperation and implementation of BMP(s).
Environmental Health Department, Winnebago Tribe of Nebraska	Provides technical assistance, education and potential implementation of BMP(s).
Indian Health Service	Provides technical assistance and potential financial resources.

The model for the tribal decision making process regarding choosing BMPs most suitable to address each category of non-point source pollution identified in the NPS assessment report is as follows (ST 2008):

1. Identify all BMPs that are appropriate to each type of NPS pollution through research and consultation with federal agencies identified in Table 12.

2. Determine which of the above BMPs are suitable in terms of scale, environment and existing infrastructure.

3. Determine likely effectiveness of locally appropriate BMPs in reducing NPS loading through research, modeling and consultation.

4. Consult with other relevant agencies and jurisdictions to include responsible party, Tribal Council, Land Management Department and Winnebago Tribal Attorneys to determine which

BMPs would best support cooperative efforts.

5. Determine which BMPs will have the most favorable results per unit cost. Identify multiple funding options and develops formal cooperative agreement(s).

Once the most appropriate BMP(s) has been selected, then a public participation process will be initiated. This process includes the following:

1. Present options to Winnebago Tribal Council during an open forum meeting to allow tribal leadership, tribal members and non-tribal public an opportunity to consider options and provide comment.

2. Publish outcomes of meeting in Winnebago News, Pender Times and on Winnebago Tribe Facebook page for further exposure and comment.

3. Consult with other relevant agencies and jurisdictions to include responsible party, Tribal Council and Winnebago Tribal Attorneys to determine which if identified BMP supports cooperative efforts.

4. Publish identified BMP in Winnebago News, Pender Times and on Winnebago Tribe Facebook page.

Table 13 demonstrates the NPS category, potential source, responsible party and a potential funding source. The BMP(s) listed are name only; no specifics have been identified at this time.

Table 13: NPS Category and Other Information

NPS Category	Source	BMP(s)	Responsible Party	Potential Funding Source
Agriculture	Nutrient Runoff	Buffer Strips, Terraces, Crop Rotation	Private Landowner, BIA	BIA, USDA
Agriculture	Erosion	Buffer Strips, Terraces	Private Landowner, BIA	BIA, USDA
Agriculture	Manure Application, Manure Runoff	Manure Transfer	Private Landowner	USDA
Agriculture	Livestock Grazing	Prescribed Grazing	Private Landowner	USDA
Agriculture	Pesticide Application	Buffer Strips	Private Landowner, BIA	BIA, USDA
Hydromodification	Erosion	Streambank Stabilization	USACE, Tribe	USACE, EPA 319
Road, Highways		Runoff	Tribal Roads Dept,	Tribe, BIA, DOT,

and Bridges	Runoff	Management	BIA,DOT	County, State
Construction	Stormwater Runoff, Erosion, Hazardous Chemical Spills	Runoff Management and Diversion	Tribe, County, State, Private Landowner, Building Contractor	Tribe, County, State
Urban, Residential	Sormwater Runoff, Lawn Fertilizer and Pesticide Application, Wastewater Runoff	Septic System and Drainfield Construction and Maintenance, Runoff Management and Diversion	Private Landowner, Tribal Health Dept	Tribe, County, State
Land Condition	Natural Condition, Natural Rock Formation	Water Softening System	IHS, Tribal Environmental Health Dept, Private Landowner	Tribe, IHS, USDA

Existing NPS Control Programs

The Winnebago Tribe does not currently have a nonpoint source control program in place. The goal is to begin coordination with tribal departments, local, state and federal agencies, agricultural entities and private land owners to identify and implement BMPs that best remove/prevent current and future nonpoint source pollution problems. This Nonpoint Source Assessment Report is the first step in initiating a Nonpoint Source Program.

Some BMPs include but limited to education/outreach, buffer strips of natural vegetation, terrace construction, bank stabilization construction, crop rotation and no-till farming practices.

Conclusions

The Winnebago Tribe of Nebraska has been concerned with water quality (surface and ground) for many years. The Tribe, through efforts of the Environmental Protection Department utilizing Clean Water Act Section 106: Pollution Control Grant Program funding has generated physical, chemical and biological data demonstrating the water quality conditions on the Reservation.

Water bodies located in both the Logan Watershed and Blackbird-Soldier Watershed on the Reservation demonstrate evidence of impacts caused from nonpoint source pollution issues. These include nutrient runoff, erosion and sedimentation caused by agricultural activities, hydromodification and urban runoff.

Land ownership between Tribal Trust, Allotted and Private Non-tribal presents the Tribe with a major concern involving jurisdiction. A Nonpoint Source Program may face obstacles that may only be hurtled through means of communication, cooperation, respect, consideration and mutual goals.

Currently, the Winnebago Tribe does not have a nonpoint source pollution program in place. The goal is to begin coordination with tribal departments, local, state and federal agencies, agricultural entities and private land owners to identify and implement BMPs that best remove/prevent current and future nonpoint source pollution problems. This Nonpoint Source Assessment Report is the first step in iniating a Nonpoint Source Pollution Program. Once developed will seek to address the implementation of established as well as new BMPs relating to non-irrigated and irrigated crop activities, fertilizer and pesticide use, erosion control and road maintenance in order to remove current and prevent future nonpoint source pollution issues on the Winnebago Reservation.

References Cited

- US, Environmental Protection Agency, 2010, Handbook for Developing and Managing Tribal Nonpoint Source Pollution Programs Under Section 319 of the Clean Water Act, Part 1: The Clean Water Act Section 319 Program, Example from Suquamish Tribe (ST 2008), page 1-36
- USGS, Ground Water Availability in the United States, U.S. Geological Survey Circular 1323 (July 2008)
- Winnebago Tribe of Nebraska Website. www.winnebagotribe.com
- Winnebago Forest Analysis, Forest Management Plan 2001-2020, April 1999
- Winnebago Tribe of Nebraska, Wikipedia
- Final Forest Management Plan, Winnebago Indian Reservation, NE, 2009-2023, 2009
- Title 117, Nebraska Department of Environmental Quality, Surface Water Quality Standards, October 2012

Appendix A: 2012 Surface Water Sampling Data: Turtle Creek

Parameter	Units	Reference Value	29-May	16-Jul	17-Aug	19-Sep	9-Oct	15-Nov
Time			1015	1130	1115	1115	1100	1145
Temp	0 C	32	14.27	None	14.74	None	8.41	3.57
pH	None	6.5-8.5	8.23	None	None	None	8.29	8.51
Sec Cond	mS/cm	0.770	0.700	None	0.586	None	0.728	0.662
TDS	mg/l	500	455	None	381	None	473	430
DO	mg/l	5.0	10.27	None	12.02	None	11.90	15.01
Turbidity	NTU	5.0	None	None	16.0	None	12.6	6.7
Flow	feet/second	N/A	1.11	1.18	1.15	1.07	1.21	1.03
Tot Hard	gr/gal	20	22.9	23.0	19.0	42.8	22.7	21.1
Calcium	mg/l	80	106	101	80.8	160	101	95.4
Magnesium	mg/l	30	30.9	34.1	29.9	81.0	33.2	29.9
Sodium	mg/l	100	12.9	13.7	12.7	13.8	13.3	12.5
Manganese	mg/l	0.05	0.47	0.97	0.07	12.4	0.14	0.28
Tot Phos	mg/l	N/A	0.4	0.6	0.05	6.1	0.05	0.05
Iron	mg/l	0.3	9.83	14.90	0.87	248.00	0.76	0.39
Chloride	mg/l	250	6	7	5	6	6	6
Sulfate	mg/l	250	31	31	30	31	31	35
Fluoride	mg/l	2.0	0.4	0.5	0.3	0.4	0.4	0.5
Nitrate	mg/l	10.0	6.3	6.5	6.6	5.6	3.7	4.4
Nitrite	mg/l	1.0	0.08	0.10	0.03	0.06	0.11	0.03
TKN	mg/l	N/A	2.12	3.47	0.25	15.10	0.62	0.25
Total Nitrogen	mg/l	N/A	8.50	10.07	6.88	20.76	4.43	4.68
Amm Nitrogen	mg/l	0.20	0.38	0.21	0.05	0.86	0.05	0.05
Fec Coliform	cfu/100ml	2000	3800	12100	310	>241960	548	440
E. coli	MPN/100ml	406	>2419.6	>2419.6	2420	84000	1046	1300
Alachlor	ug/l	2	0.25	0.25	None	None	None	None
Atrazine	ug/l	3	0.25	0.25	None	None	None	None
Metolachlor	ug/l	N/A	0.25	0.25	None	None	None	None
Metribuzin	ug/l	N/A	0.25	0.25	None	None	None	None
Simazine	ug/l	4	0.25	0.25	None	None	None	None

Note: N/A = Non applicable
None = No results
> = Greater than

Appendix B1: 2002-2012 Basic Stream Monitoring - Big Bear Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	0.66	22.09	12.53	12.67	11	Yes
pH	S.U.	6.5-9.0	7.20	8.36	8.03	8.00	11	Yes
Specific Conductance	mS/cm	0.770	0.569	0.979	0.836	0.831	11	No
Total Dissolved Solids	mg/l	500	370	636	545	548	11	No
Dissolved Oxygen	mg/l	Greater than 5.0	6.75	16.14	9.83	10.57	11	Yes
Turbidity	NTU	15.0	1.4	118.3	7.8	24.6	3	No
Total Hardness	gr/gal	20	16.9	33.5	29.4	28.5	11	No
Total Phosphorus	mg/l	0.118	0.05	3.9	0.1	0.25	11	No
Chloride	mg/l	230	0.05	7	4	4	11	Yes
Sulfate	mg/l	250	34	127	84	84	11	Yes
Fluoride	mg/l	2.0	0.05	0.9	0.4	0.3	11	Yes
Calcium	mg/l	80	102	144	126	124	5	No
Magnesium	mg/l	30	35.0	47.4	40.9	41.2	5	No
Manganese	mg/l	1	0.31	1.23	0.57	0.63	5	Yes
Sodium	mg/l	100	9.4	13.8	12.3	12.1	5	Yes
Iron	mg/l	1	0.23	8.32	2.02	2.46	5	No
Nitrate Nitrogen	mg/l	10.0	0.1	5.8	1.0	0.9	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.07	0.02	0.03	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	7.14	0.90	0.85	11	No
Total Nitrogen	mg/l	2.615	0.36	2.71	1.43	1.59	6	Yes
Ammonia Nitrogen	mg/l	0.26	0.05	0.33	0.05	0.09	11	Yes
Fecal Coliforms	cfu/100ml	2000	2	10500	560	825	11	Yes
E. coli	MPN/100ml	406	10	6932	597	974	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	0.1	0.1	0.1	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B2: 2002-2012 Basic Stream Monitoring – North Blackbird Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	1.22	22.08	12.10	10.57	11	Yes
pH	S.U.	6.5-9.0	7.41	8.54	8.15	8.07	11	Yes
Specific Conductance	mS/cm	0.770	0.341	0.765	0.710	0.690	11	Yes
Total Dissolved Solids	mg/l	500	222	497	463	450	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	6.78	17.01	9.82	10.62	11	Yes
Turbidity	NTU	15.0	2.7	96.4	11.6	18.2	3	No
Total Hardness	gr/gal	20	15.2	27.7	21.8	21.7	11	No
Total Phosphorus	mg/l	0.118	0.05	1.3	0.08	0.17	11	No
Chloride	mg/l	230	4	9	5	5	11	Yes
Sulfate	mg/l	250	14	89	21	21	11	Yes
Fluoride	mg/l	2.0	0.1	0.7	0.4	0.4	11	Yes
Calcium	mg/l	80	89.0	107	96.4	96.6	5	No
Magnesium	mg/l	30	28.6	35.1	31.0	31.6	5	No
Manganese	mg/l	1	0.04	0.52	0.16	0.23	5	Yes
Sodium	mg/l	100	13.9	17.8	15.2	15.3	5	Yes
Iron	mg/l	1	0.17	7.58	0.79	1.47	5	No
Nitrate Nitrogen	mg/l	10.0	1.7	10.0	8.4	8.1	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.12	0.04	0.4	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.62	0.57	0.70	11	No
Total Nitrogen	mg/l	2.615	4.47	10.62	8.76	8.93	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	4.24	0.05	0.08	11	Yes
Fecal Coliforms	cfu/100ml	2000	0	8100	518	588	11	Yes
E. coli	MPN/100ml	406	10	2900	472	787	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	1.2	0.1	0.15	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B3: 2002-2012 Basic Stream Monitoring - Omaha Creek (North)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	2.06	24.00	15.31	15.24	11	Yes
pH	S.U.	6.5-9.0	7.56	8.88	8.20	8.15	11	Yes
Specific Conductance	mS/cm	0.770	0.527	0.785	0.720	0.708	11	Yes
Total Dissolved Solids	mg/l	500	343	510	468	461	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	6.17	18.06	9.74	10.49	11	Yes
Turbidity	NTU	15.0	9.5	380.1	41.1	72.1	3	No
Total Hardness	gr/gal	20	18.3	26.8	22.3	22.1	11	No
Total Phosphorus	mg/l	0.118	0.05	1.6	0.3	0.35	11	No
Chloride	mg/l	230	4	12	8	9	11	Yes
Sulfate	mg/l	250	21	44	32	31	11	Yes
Fluoride	mg/l	2.0	0.2	0.8	0.4	0.4	11	Yes
Calcium	mg/l	80	90.3	123	103	103	5	No
Magnesium	mg/l	30	26.4	36.9	28.8	29.5	5	Yes
Manganese	mg/l	1	0.19	1.69	0.30	0.40	5	Yes
Sodium	mg/l	100	15.5	18.7	17.3	17.4	5	Yes
Iron	mg/l	1	0.54	35.70	2.95	5.23	5	No
Nitrate Nitrogen	mg/l	10.0	2.7	8.4	6.1	5.8	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.12	0.06	0.06	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.14	0.93	1.10	11	No
Total Nitrogen	mg/l	2.615	4.19	9.72	6.93	7.00	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.36	0.05	0.09	11	Yes
Fecal Coliforms	cfu/100ml	2000	54	44000	1435	2805	11	No
E. coli	MPN/100ml	406	68	5654	2517	3225	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	1.8	0.1	0.15	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B4: 2002-2012 Basic Stream Monitoring - Omaha Creek (South)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	1.94	22.98	14.64	14.50	11	Yes
pH	S.U.	6.5-9.0	6.80	9.04	8.13	8.03	11	Yes
Specific Conductance	mS/cm	0.770	0.621	0.767	0.718	0.706	11	Yes
Total Dissolved Solids	mg/l	500	404	499	467	459	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	6.41	17.27	9.10	10.14	11	Yes
Turbidity	NTU	15.0	13.9	162.4	41.0	48.0	3	No
Total Hardness	gr/gal	20	18.7	25.0	21.9	21.7	11	No
Total Phosphorus	mg/l	0.118	0.05	0.8	0.2	0.3	11	No
Chloride	mg/l	230	5	11	7	8	11	Yes
Sulfate	mg/l	250	25	43	28	29	11	Yes
Fluoride	mg/l	2.0	0.05	0.8	0.4	0.4	11	Yes
Calcium	mg/l	80	91.6	103	104	101	5	No
Magnesium	mg/l	30	25.7	30.4	28.6	28.6	5	Yes
Manganese	mg/l	1	0.19	0.82	0.33	0.36	5	Yes
Sodium	mg/l	100	14.9	18.2	16.5	16.5	5	Yes
Iron	mg/l	1	0.50	13.00	2.83	3.82	5	No
Nitrate Nitrogen	mg/l	10.0	3.2	6.5	6.7	6.2	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.02	0.11	0.05	0.06	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	15.60	0.82	1.01	11	No
Total Nitrogen	mg/l	2.615	4.49	9.26	7.31	7.29	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.38	0.05	0.09	11	Yes
Fecal Coliforms	cfu/100ml	2000	120	123300	1580	1955	11	Yes
E. coli	MPN/100ml	406	52	7945	2420	2533	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	1.0	0.1	0.13	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B5: 2002-2012 Basic Stream Monitoring - Turtle Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	1.41	22.74	14.96	13.84	11	Yes
pH	S.U.	6.5-9.0	7.20	9.01	8.15	8.09	10	Yes
Specific Conductance	mS/cm	0.770	0.507	0.826	0.730	0.616	11	Yes
Total Dissolved Solids	mg/l	500	329	537	475	469	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	5.48	18.30	10.49	10.67	11	Yes
Turbidity	NTU	15.0	6.7	443.1	24.7	74.8	3	No
Total Phosphorus	mg/l	0.118	0.05	2.1	0.2	0.4	11	No
Chloride	mg/l	230	4	9	6	6	11	Yes
Sulfate	mg/l	250	27	47	33	34	11	Yes
Fluoride	mg/l	2.0	0.1	0.8	0.4	0.4	11	Yes
Calcium	mg/l	80	80.8	132	107	107	5	No
Magnesium	mg/l	30	29.5	42.6	31.3	32.6	5	No
Manganese	mg/l	1	0.07	3.44	0.34	0.58	5	Yes
Sodium	mg/l	100	12.5	15.5	13.9	14.1	5	Yes
Iron	mg/l	1	0.39	63.60	2.71	8.99	5	No
Nitrate Nitrogen	mg/l	10.0	3.3	8.7	6.3	6.1	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.17	0.06	0.07	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	13.70	0.93	1.44	11	No
Total Nitrogen	mg/l	2.615	4.43	14.60	7.10	7.75	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.38	0.05	0.11	11	Yes
Fecal Coliforms	cfu/100ml	2000	60	28200	1255	4026	11	No
E. coli	MPN/100ml	406	55	12926	2094	3509	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	0.1	0.1	0.1	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B6: 2002-2012 Basic Stream Monitoring - Morgan Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	2.23	23.03	13.29	13.48	11	Yes
pH	S.U.	6.5-9.0	7.30	9.10	8.03	7.99	11	Yes
Specific Conductance	mS/cm	0.770	0.609	0.762	0.702	0.688	11	Yes
Total Dissolved Solids	mg/l	500	393	488	456	447	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	6.66	16.11	9.69	10.87	11	Yes
Turbidity	NTU	15.0	4.9	72.4	26.7	28.5	3	No
Total Hardness	gr/gal	20	18.2	23.7	22.0	21.7	11	No
Total Phosphorus	mg/l	0.118	0.05	0.4	0.1	0.2	11	No
Chloride	mg/l	230	0.5	7	6	5	11	Yes
Sulfate	mg/l	250	2	35	27	27	11	Yes
Fluoride	mg/l	2.0	0.05	0.8	0.4	0.4	11	Yes
Calcium	mg/l	80	91.6	111	101	10.1	5	No
Magnesium	mg/l	30	26.2	31.0	29.0	28.9	5	Yes
Manganese	mg/l	1	0.11	1.12	0.34	0.36	5	Yes
Sodium	mg/l	100	11.8	14.2	13.1	13.1	5	Yes
Iron	mg/l	1	0.33	7.89	1.55	2.14	5	No
Nitrate Nitrogen	mg/l	10.0	0.3	6.8	4.1	4.2	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.08	0.04	0.04	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	3.40	0.58	0.64	11	Yes
Total Nitrogen	mg/l	2.615	2.26	6.46	5.00	4.90	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.56	0.05	0.08	11	Yes
Fecal Coliforms	cfu/100ml	2000	5	90066	450	3042	11	No
E. coli	MPN/100ml	406	13	67776	542	4101	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	2.4	0.1	0.1	8	Yes
Metolachlor	ug/l	100	0.4	5.7	0.4	0.5	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B7: 2002-2012 Basic Stream Monitoring – North Omaha Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	-0.02	21.13	13.94	13.39	11	Yes
pH	S.U.	6.5-9.0	7.37	8.27	8.07	7.99	11	Yes
Specific Conductance	mS/cm	0.770	0.627	0.758	0.723	0.710	11	Yes
Total Dissolved Solids	mg/l	500	407	493	470	461	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	5.91	14.90	9.48	10.09	11	Yes
Turbidity	NTU	15.0	15.2	122.5	60.4	64.4	3	No
Total Hardness	gr/gal	20	17.5	25.4	21.7	21.7	11	No
Total Phosphorus	mg/l	0.118	0.05	0.5	0.3	0.3	11	No
Chloride	mg/l	230	5	8	7	7	11	Yes
Sulfate	mg/l	250	26	44	31	32	11	Yes
Fluoride	mg/l	2.0	0.2	0.7	0.4	0.4	11	Yes
Calcium	mg/l	80	91.4	120	102	101	5	No
Magnesium	mg/l	30	27.5	34.1	29.1	29.1	5	Yes
Manganese	mg/l	1	0.17	0.66	0.37	0.39	5	Yes
Sodium	mg/l	100	14.8	18.8	17.4	17.0	5	Yes
Iron	mg/l	1	0.55	11.70	4.48	4.71	5	No
Nitrate Nitrogen	mg/l	10.0	4.1	7.9	6.5	6.3	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.15	0.04	0.05	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.58	0.91	1.03	11	No
Total Nitrogen	mg/l	2.615	4.59	9.18	7.34	7.31	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.15	0.05	0.06	11	Yes
Fecal Coliforms	cfu/100ml	2000	30	36000	910	1324	11	Yes
E. coli	MPN/100ml	406	45	6400	1173	1378	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	0.7	0.1	0.1	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B8: 2002-2012 Basic Stream Monitoring - Cow Creek

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	0.27	21.30	13.41	12.53	11	Yes
pH	S.U.	6.5-9.0	7.52	8.45	8.05	7.97	11	Yes
Specific Conductance	mS/cm	0.770	0.664	0.788	0.753	0.743	11	Yes
Total Dissolved Solids	mg/l	500	432	512	490	483	11	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	5.25	15.36	9.90	10.40	11	Yes
Turbidity	NTU	15.0	18.4	82.1	33.2	37.2	3	No
Total Hardness	gr/gal	20	18.7	26.3	22.4	22.5	11	No
Total Phosphorus	mg/l	0.118	0.05	0.6	0.3	0.3	11	No
Chloride	mg/l	230	7	10	8	8	11	Yes
Sulfate	mg/l	250	30	53	34	34	11	Yes
Fluoride	mg/l	2.0	0.2	0.7	0.4	0.4	11	Yes
Calcium	mg/l	80	91.0	126	106	106	5	No
Magnesium	mg/l	30	26.5	37.6	28.7	29.4	5	Yes
Manganese	mg/l	1	0.18	0.62	0.35	0.35	5	Yes
Sodium	mg/l	100	16.8	29.3	20.0	19.8	5	Yes
Iron	mg/l	1	0.38	9.01	2.26	2.60	5	No
Nitrate Nitrogen	mg/l	10.0	3.8	8.3	6.2	6.5	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.09	0.04	0.04	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.95	0.72	0.85	11	No
Total Nitrogen	mg/l	2.615	5.59	9.45	7.04	7.41	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.14	0.05	0.05	11	Yes
Fecal Coliforms	cfu/100ml	2000	10	4500	460	710	11	Yes
E. coli	MPN/100ml	406	23	12976	639	1342	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	1.4	0.1	0.2	8	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B9: 2002-2012 Basic Stream Monitoring - Logan Creek (North)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	-0.05	27.25	16.07	15.67	11	Yes
pH	S.U.	6.5-9.0	7.53	8.49	8.09	8.05	11	Yes
Specific Conductance	mS/cm	0.770	0.779	1.073	0.989	0.966	11	No
Total Dissolved Solids	mg/l	500	506	698	643	628	11	No
Dissolved Oxygen	mg/l	Greater than 5.0	5.22	18.79	8.86	9.76	11	Yes
Turbidity	NTU	15.0	12.3	150.6	37.1	48.9	3	No
Total Hardness	gr/gal	20	22.0	40.0	28.5	28.6	11	No
Total Phosphorus	mg/l	0.118	0.05	0.8	0.4	0.4	11	No
Chloride	mg/l	230	7	37	15	16	11	Yes
Sulfate	mg/l	250	131	222	178	184	11	Yes
Fluoride	mg/l	2.0	0.05	0.9	0.3	0.3	11	Yes
Calcium	mg/l	80	102	154	137	134	5	No
Magnesium	mg/l	30	28.9	44.5	36.3	35.6	5	No
Manganese	mg/l	1	0.08	0.87	0.26	0.29	5	Yes
Sodium	mg/l	100	25.9	45.3	36.6	37.5	5	Yes
Iron	mg/l	1	0.75	18.30	3.81	4.22	5	No
Nitrate Nitrogen	mg/l	10.0	2.3	9.5	6.7	6.3	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.07	0.02	0.02	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	11.90	0.79	1.09	11	No
Total Nitrogen	mg/l	2.615	4.06	12.79	7.40	7.38	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	1.24	0.05	0.07	11	Yes
Fecal Coliforms	cfu/100ml	2000	8	5400	374	858	11	Yes
E. coli	MPN/100ml	406	0	4962	512	1094	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	7.8	0.1	0.3	8	Yes
Metolachlor	ug/l	100	0.4	1.1	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B10: 2002-2012 Basic Stream Monitoring - Logan Creek (South)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	-0.05	27.47	15.64	15.64	11	Yes
pH	S.U.	6.5-9.0	7.54	8.40	8.10	8.07	11	Yes
Specific Conductance	mS/cm	0.770	0.778	1.072	0.990	0.962	11	No
Total Dissolved Solids	mg/l	500	506	697	644	625	11	No
Dissolved Oxygen	mg/l	Greater than 5.0	6.36	18.67	8.71	9.72	11	Yes
Turbidity	NTU	15.0	12.3	128.3	39.9	49.7	3	No
Total Hardness	gr/gal	20	22.3	35.3	28.3	28.1	11	No
Total Phosphorus	mg/l	0.118	0.1	0.7	0.4	0.4	11	No
Chloride	mg/l	230	7	38	15	16	11	Yes
Sulfate	mg/l	250	153	229	175	182	11	Yes
Fluoride	mg/l	2.0	0.05	0.9	0.3	0.3	11	Yes
Calcium	mg/l	80	102	150	135	133	5	No
Magnesium	mg/l	30	29.4	43.3	35.8	35.2	5	No
Manganese	mg/l	1	0.10	0.81	0.24	0.29	5	Yes
Sodium	mg/l	100	26.9	44.3	35.3	37.0	5	Yes
Iron	mg/l	1	0.68	18.00	4.34	4.45	5	No
Nitrate Nitrogen	mg/l	10.0	0.05	10.7	6.6	6.0	11	No
Nitrite Nitrogen	mg/l	1.00	0.01	0.07	0.01	0.02	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.73	0.83	1.02	11	No
Total Nitrogen	mg/l	2.615	1.44	11.80	7.36	7.03	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	1.12	0.05	0.07	11	Yes
Fecal Coliforms	cfu/100ml	2000	0	6100	400	806	11	Yes
E. coli	MPN/100ml	406	21	7308	581	1392	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	6.8	0.1	0.2	8	Yes
Metolachlor	ug/l	100	0.4	1.5	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B11: 2002-2012 Basic Stream Monitoring - Middle Creek (North)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	0.84	28.07	16.87	16.18	11	Yes
pH	S.U.	6.5-9.0	7.69	8.58	8.14	8.09	11	Yes
Specific Conductance	mS/cm	0.770	0.591	0.939	0.895	0.878	11	No
Total Dissolved Solids	mg/l	500	384	611	582	571	11	No
Dissolved Oxygen	mg/l	Greater than 5.0	2.63	17.53	10.26	10.63	11	Yes
Turbidity	NTU	15.0	9.5	105.0	39.9	39.5	3	No
Total Hardness	gr/gal	20	15.7	29.0	26.0	25.6	11	No
Total Phosphorus	mg/l	0.118	0.05	0.6	0.2	0.2	11	No
Chloride	mg/l	230	8	13	10	10	11	Yes
Sulfate	mg/l	250	80	187	92	97	11	Yes
Fluoride	mg/l	2.0	0.2	0.9	0.4	0.4	11	Yes
Calcium	mg/l	80	55.0	129	120	115	5	No
Magnesium	mg/l	30	31.9	40.2	36.3	35.7	5	No
Manganese	mg/l	1	0.10	2.98	0.22	0.35	5	Yes
Sodium	mg/l	100	27.7	34.4	29.4	30.2	5	Yes
Iron	mg/l	1	0.47	7.32	2.56	3.22	5	No
Nitrate Nitrogen	mg/l	10.0	0.1	12.1	8.6	8.9	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.18	0.04	0.05	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	3.70	1.01	0.99	11	No
Total Nitrogen	mg/l	2.615	0.66	12.76	10.23	10.09	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.51	0.05	0.07	11	Yes
Fecal Coliforms	cfu/100ml	2000	10	3300	500	632	11	Yes
E. coli	MPN/100ml	406	17	3400	932	1008	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	4.6	0.1	0.4	8	Yes
Metolachlor	ug/l	100	0.4	4.6	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix B12: 2002-2012 Basic Stream Monitoring - Middle Creek (South)

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	-0.02	25.03	15.43	15.13	11	Yes
pH	S.U.	6.5-9.0	7.63	8.61	8.14	8.10	11	Yes
Specific Conductance	mS/cm	0.770	0.593	0.904	0.868	0.839	11	No
Total Dissolved Solids	mg/l	500	369	588	564	546	11	No
Dissolved Oxygen	mg/l	Greater than 5.0	6.43	16.65	8.94	9.85	11	Yes
Turbidity	NTU	15.0	5.5	144.4	24.1	42.0	3	No
Total Hardness	gr/gal	20	15.3	29.2	24.7	24.0	11	No
Total Phosphorus	mg/l	0.118	0.05	0.6	0.3	0.3	11	No
Chloride	mg/l	230	11	47	14	16	11	Yes
Sulfate	mg/l	250	45	109	75	76	11	Yes
Fluoride	mg/l	2.0	0.2	0.9	0.4	0.4	11	Yes
Calcium	mg/l	80	54.8	132	112	108	5	No
Magnesium	mg/l	30	30.4	38.3	33.6	34.0	5	No
Manganese	mg/l	1	0.13	1.26	0.27	0.30	5	Yes
Sodium	mg/l	100	19.7	51.5	30.6	32.3	5	Yes
Iron	mg/l	1	0.30	9.96	3.06	3.65	5	No
Nitrate Nitrogen	mg/l	10.0	0.7	10.9	7.9	8.1	11	Yes
Nitrite Nitrogen	mg/l	1.00	0.02	0.15	0.06	0.07	6	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	5.31	0.94	1.05	11	No
Total Nitrogen	mg/l	2.615	2.28	12.01	9.61	9.28	6	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.17	0.05	0.07	11	Yes
Fecal Coliforms	cfu/100ml	2000	10	5200	960	989	11	Yes
E. coli	MPN/100ml	406	62	12976	1313	1923	6	No
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	8	Yes
Atrazine	ug/l	12	0.1	0.9	0.1	0.1	8	Yes
Metolachlor	ug/l	100	0.4	1.2	0.4	0.4	8	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	8	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	8	Yes

Appendix C1: 2005-2011 Ross Pond

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	16.21	23.69	20.93	20.28	3	Yes
pH	S.U.	6.5-9.0	8.11	9.33	8.35	8.53	4	Yes
Specific Conductance	mS/cm	0.770	0.252	0.414	0.374	0.353	4	Yes
Total Dissolved Solids	mg/l	500	164	269	243	230	4	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	4.01	9.58	8.70	7.43	3	Yes
Total Hardness	gr/gal	20	7.4	12.3	10.7	10.3	4	Yes
Total Phosphorus	mg/l	0.118	0.05	0.1	0.05	0.06	4	Yes
Chloride	mg/l	230	0.5	2	2	1.4	4	Yes
Sulfate	mg/l	250	6	10	8	8	4	Yes
Fluoride	mg/l	2.0	0.2	0.4	0.3	0.3	4	Yes
Calcium	mg/l	80	17.9	44.3	31.9	31.4	3	Yes
Magnesium	mg/l	30	19.8	24.6	24.2	22.9	3	Yes
Manganese	mg/l	1	0.05	0.10	0.10	0.08	3	Yes
Sodium	mg/l	100	8.2	9.8	9.6	9.2	3	Yes
Iron	mg/l	1	0.11	0.32	0.13	0.19	3	Yes
Nitrate Nitrogen	mg/l	10.0	0.1	0.1	0.1	0.1	4	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	3	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.66	1.16	1.00	1.06	4	No
Total Nitrogen	mg/l	2.615	0.77	1.27	1.00	1.01	3	Yes
Ammonia Nitrogen	mg/l	0.26	0.05	0.05	0.05	0.05	4	Yes
Fecal Coliforms	cfu/100ml	2000	0	240	6	63	4	Yes
E. coli	MPN/100ml	406	10	500	301	270	3	Yes
Alachlor	ug/l	76	0.2	0.25	0.2	0.2	4	Yes
Atrazine	ug/l	12	0.1	0.9	0.18	0.34	4	Yes
Metolachlor	ug/l	100	0.25	0.4	0.4	0.36	4	Yes
Metribuzin	ug/l	100	0.1	0.25	0.1	0.14	4	Yes
Simazine	ug/l	4.0	0.1	0.25	0.1	0.14	4	Yes

Appendix C2: 2005-2012 Kelly Pond

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Temperature	0 Celsius	32	16.30	26.08	20.49	20.84	4	Yes
pH	S.U.	6.5-9.0	7.62	8.85	8.12	8.17	5	Yes
Specific Conductance	mS/cm	0.770	0.232	0.431	0.296	0.329	5	Yes
Total Dissolved Solids	mg/l	500	151	280	197	214	5	Yes
Dissolved Oxygen	mg/l	Greater than 5.0	2.79	9.68	7.25	6.74	4	Yes
Total Hardness	gr/gal	20	5.5	12.4	9.1	9.0	6	Yes
Total Phosphorus	mg/l	0.118	0.05	0.2	0.05	0.08	6	Yes
Chloride	mg/l	230	5	8	7	6	6	Yes
Sulfate	mg/l	250	5	14	8	8	6	Yes
Fluoride	mg/l	2.0	0.05	0.3	0.2	0.2	6	Yes
Calcium	mg/l	80	19.8	47.7	31.8	33.3	5	Yes
Magnesium	mg/l	30	16.2	24.9	18.9	20.3	5	Yes
Manganese	mg/l	1	0.05	0.37	0.20	0.19	5	Yes
Sodium	mg/l	100	11.4	15.1	13.6	13.2	5	Yes
Iron	mg/l	1	0.10	0.56	0.18	0.24	5	Yes
Nitrate Nitrogen	mg/l	10.0	0.1	0.1	0.1	0.1	6	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	5	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	0.25	1.41	0.88	0.90	6	No
Total Nitrogen	mg/l	2.615	0.36	1.52	0.89	0.99	5	Yes
Ammonia Nitrogen	mg/l	0.26	0.05	0.05	0.05	0.05	6	Yes
Fecal Coliforms	cfu/100ml	2000	0	80	23	32	6	Yes
E. coli	MPN/100ml	406	4	62	20	23	5	Yes
Alachlor	ug/l	76	0.2	0.25	0.23	0.23	6	Yes
Atrazine	ug/l	12	0.1	0.25	0.18	0.18	6	Yes
Metolachlor	ug/l	100	0.25	0.4	0.33	0.33	6	Yes
Metribuzin	ug/l	100	0.1	0.25	0.18	0.18	6	Yes
Simazine	ug/l	4.0	0.1	0.25	0.18	0.18	6	Yes

Appendix C3: 2005-2009 H-Lake

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
Specific Conductance	mS/cm	0.770	0.755	0.882	0.853	0.830	3	No
Total Dissolved Solids	mg/l	500	491	573	554	539	3	No
Total Hardness	gr/gal	20	14.8	18.6	18.5	17.3	3	Yes
Total Phosphorus	mg/l	0.118	0.05	0.1	0.1	0.08	3	Yes
Chloride	mg/l	230	14	16	16	15	3	Yes
Sulfate	mg/l	250	85	238	213	179	3	Yes
Fluoride	mg/l	2.0	0.3	1.00	0.5	0.6	3	Yes
Calcium	mg/l	80	62.7	81.0	77.5	73.7	3	Yes
Magnesium	mg/l	30	23.4	30.0	23.4	27.1	3	Yes
Manganese	mg/l	0.05	0.29	0.49	0.30	0.36	3	No
Sodium	mg/l	100	61.2	69.5	63.3	64.7	3	Yes
Iron	mg/l	0.3	0.28	0.80	0.28	0.45	3	No
Nitrate Nitrogen	mg/l	10.0	0.1	0.1	0.1	0.1	3	Yes
Total Kjeldahl Nitrogen	mg/l	0.65	1.01	1.20	0.74	0.98	3	No
Ammonia Nitrogen	mg/l	0.26	0.05	0.05	0.05	0.05	3	Yes
Fecal Coliforms	cfu/100ml	2000	0	10	4	7	3	Yes
Alachlor	ug/l	76	0.2	0.2	0.2	0.2	3	Yes
Atrazine	ug/l	12	0.1	0.1	0.1	0.1	3	Yes
Metolachlor	ug/l	100	0.4	0.4	0.4	0.4	3	Yes
Metribuzin	ug/l	100	0.1	0.1	0.1	0.1	3	Yes
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	3	Yes

Due to only two data points, water temperature, pH, dissolved oxygen, nitrite nitrogen, E. coli and total nitrogen were omitted from the calculations.

Appendix D1: 2008 Domestic Drinking Water Wells

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
pH	S.U.	6.5-8.5	7.18	7.67	7.54	7.48	22	Yes
Specific Conductance	mS/cm	0.770	0.614	1.287	0.808	0.848	22	No
Total Dissolved Solids	mg/l	500	396	820	501	541	22	No
Mercury	mg/l	0.002	0.0002	0.0002	0.0002	0.0002	8	Yes
Arsenic	mg/l	0.010	0.00025	0.0026	0.00025	0.0009	8	Yes
Total Hardness	gr/gal	20	19.1	30.2	22.6	23.7	21	No
Total Phosphorus	mg/l	*	0.05	0.2	0.05	0.06	22	----
Chloride	mg/l	250	1	65	6	15	22	Yes
Sulfate	mg/l	250	12	334	93	107	22	Yes
Fluoride	mg/l	2.0	0.2	1.6	0.7	0.8	22	Yes
Calcium	mg/l	80	93.1	160	117	118	21	No
Magnesium	mg/l	30	19.1	49.2	25.0	25.5	21	Yes
Manganese	mg/l	0.05	0.005	1.86	0.11	0.21	22	No
Sodium	mg/l	20	10.6	80.2	18.0	31.0	21	No
Iron	mg/l	0.3	0.005	2.07	0.46	0.50	22	No
Nitrate Nitrogen	mg/l	10.0	0.1	17.4	0.1	2.0	22	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	22	Yes
Total Kjeldahl Nitrogen	mg/l	*	0.25	3.76	0.25	0.62	21	----
Total Nitrogen	mg/l	*	0.36	17.66	0.85	2.70	21	----
Ammonia Nitrogen	mg/l	0.20	0.05	0.67	0.19	0.27	21	No
Fecal Coliforms	cfu/100ml	0	0	280	0	19	24	No
E. coli	MPN/100ml	0	0	0	0	0	23	Yes
Alachlor	ug/l	2.0	0.2	0.2	0.2	0.2	22	Yes
Atrazine	ug/l	3.0	0.1	0.1	0.1	0.1	22	Yes
Metolachlor	ug/l	10.0	0.4	0.4	0.4	0.4	22	Yes
Metribuzin	ug/l	*	0.1	0.1	0.1	0.1	22	----
Simazine	ug/l	4.0	0.1	0.1	0.1	0.1	22	Yes

Note: * = No Reference Criteria Established
---- = No Result

Appendix D2: 2010 Domestic Drinking Water Wells

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
pH	S.U.	6.5-8.5	7.15	7.36	7.31	7.28	4	Yes
Specific Conductance	mS/cm	0.770	0.607	1.238	1.070	0.996	4	No
Total Dissolved Solids	mg/l	500	288	662	561	518	4	No
Mercury	mg/l	0.002	0.0002	0.0004	0.0002	0.0003	4	Yes
Arsenic	mg/l	0.010	0.0005	0.004	0.0008	0.0015	4	Yes
Total Hardness	gr/gal	20	15.6	26.3	24.2	23.3	4	No
Total Phosphorus	mg/l	*	0.05	0.1	0.05	0.06	4	----
Chloride	mg/l	250	0.5	39	28	24	4	Yes
Sulfate	mg/l	250	12	237	189	157	4	Yes
Fluoride	mg/l	2.0	0.3	1.6	1.2	1.1	4	Yes
Calcium	mg/l	80	87.7	135	126	119	4	No
Magnesium	mg/l	30	22.1	27.3	24.8	24.8	4	Yes
Manganese	mg/l	0.05	0.005	0.28	0.18	0.16	4	No
Sodium	mg/l	20	11.1	69.7	57.6	49.0	4	No
Iron	mg/l	0.3	0.01	7.32	0.73	2.20	4	No
Nitrate Nitrogen	mg/l	10.0	0.1	9.0	0.1	2.33	4	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	4	Yes
Total Kjeldahl Nitrogen	mg/l	*	0.25	0.25	0.25	0.25	4	----
Total Nitrogen	mg/l	*	0.36	9.26	0.36	2.59	4	----
Ammonia Nitrogen	mg/l	0.20	0.05	0.54	0.46	0.38	4	No
Fecal Coliforms	cfu/100ml	0	0	2	0	1	4	No
E. coli	MPN/100ml	0	0	8	0	2	4	No
Alachlor	ug/l	2.0	0.25	0.25	0.25	0.25	4	Yes
Atrazine	ug/l	3.0	0.25	0.25	0.25	0.25	4	Yes
Metolachlor	ug/l	10.0	0.25	0.25	0.25	0.25	4	Yes
Metribuzin	ug/l	*	0.25	0.25	0.25	0.25	4	----
Simazine	ug/l	4.0	0.25	0.25	0.25	0.25	4	Yes

Note: * = No Reference Criteria Established
---- = No Result

Appendix D3: 2012 Domestic Drinking Water Wells

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
pH	S.U.	6.5-8.5	7.06	7.35	7.23	7.23	9	Yes
Specific Conductance	mS/cm	0.770	0.647	1.412	0.860	0.910	9	No
Total Dissolved Solids	mg/l	500	322	938	490	542	9	No
Mercury	mg/l	0.002	0.0002	0.0010	0.0002	0.0004	9	Yes
Arsenic	mg/l	0.010	0.0005	0.005	0.001	0.002	6	Yes
Total Hardness	gr/gal	20	19.6	29.3	23.3	23.9	9	No
Total Phosphorus	mg/l	*	0.05	0.1	0.06	0.07	9	----
Chloride	mg/l	250	2	64	12	17	9	Yes
Sulfate	mg/l	250	11	373	103	120	9	Yes
Fluoride	mg/l	2.0	0.2	1.9	0.6	0.8	9	Yes
Calcium	mg/l	80	98.4	145	115	116	9	No
Magnesium	mg/l	30	20.2	47.9	28.8	27.2	9	Yes
Manganese	mg/l	0.05	0.005	1.69	0.11	0.26	9	No
Sodium	mg/l	20	10.9	96.7	19.3	34.9	9	No
Iron	mg/l	0.3	0.005	1.06	0.32	0.40	9	No
Nitrate Nitrogen	mg/l	10.0	0.1	17.4	0.2	3.0	9	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	9	Yes
Total Kjeldahl Nitrogen	mg/l	*	0.25	0.92	0.25	0.35	9	----
Total Nitrogen	mg/l	*	0.36	17.66	1.03	3.37	9	----
Ammonia Nitrogen	mg/l	0.20	0.05	0.51	0.05	0.21	9	Yes
Fecal Coliforms	cfu/100ml	0	0	0	0	0	9	Yes
E. coli	MPN/100ml	0	0	0	0	0	9	Yes
Alachlor	ug/l	2.0	0.25	0.25	0.25	0.25	9	Yes
Atrazine	ug/l	3.0	0.25	0.25	0.25	0.25	9	Yes
Metolachlor	ug/l	10.0	0.25	0.25	0.25	0.25	9	Yes
Metribuzin	ug/l	*	0.25	0.25	0.25	0.25	9	----
Simazine	ug/l	4.0	0.25	0.25	0.25	0.25	9	Yes

Note: * = No Reference Criteria Established
---- = No Result

Appendix D4: 2014 Domestic Drinking Water Wells

Parameter	Units	Reference Criteria	Minimum Value	Maximum Value	Median	Average	Count	Met Criteria
pH	S.U.	6.5-8.5	7.13	7.36	7.25	7.24	9	Yes
Specific Conductance	mS/cm	0.770	0.649	1.630	0.953	1.031	9	No
Total Dissolved Solids	mg/l	500	392	1270	582	680	9	No
Mercury	mg/l	0.002	0.0002	0.0002	0.0002	0.0002	9	Yes
Arsenic	mg/l	0.010	0.0005	0.028	0.003	0.006	9	Yes
Total Hardness	gr/gal	20	19.5	34.6	24.3	25.6	8	No
Total Phosphorus	mg/l	*	0.05	0.54	0.05	0.12	9	----
Chloride	mg/l	250	2.4	100	26.2	32.5	9	Yes
Sulfate	mg/l	250	33.6	529	157	185	9	Yes
Fluoride	mg/l	2.0	0.3	1.7	0.7	0.9	9	Yes
Calcium	mg/l	80	89.15	181.5	123.5	124.4	8	No
Magnesium	mg/l	30	22.70	49.86	28.04	31.05	8	No
Manganese	mg/l	0.05	0.005	1.30	0.14	0.28	8	No
Sodium	mg/l	20	8.31	115.9	23.08	42.64	8	No
Iron	mg/l	0.3	0.025	2.74	0.31	0.64	9	No
Nitrate Nitrogen	mg/l	10.0	0.1	14.7	0.1	2.3	9	Yes
Nitrite Nitrogen	mg/l	1.00	0.01	0.01	0.01	0.01	9	Yes
Total Kjeldahl Nitrogen	mg/l	*	0.25	0.25	0.25	0.25	9	----
Total Nitrogen	mg/l	*	0.36	14.96	0.36	2.60	9	----
Ammonia Nitrogen	mg/l	0.20	0.05	0.47	0.21	0.22	9	No
Fecal Coliforms	cfu/100ml	0	0	1	0	0.1	9	Yes
E. coli	MPN/100ml	0	0	0	0	0	9	Yes
Alachlor	ug/l	2.0	0.25	0.25	0.25	0.25	9	Yes
Atrazine	ug/l	3.0	0.25	0.25	0.25	0.25	9	Yes
Metolachlor	ug/l	10.0	0.25	0.25	0.25	0.25	9	Yes
Metribuzin	ug/l	*	0.25	0.25	0.25	0.25	9	----
Simazine	ug/l	4.0	0.25	0.25	0.25	0.25	9	Yes

Note: * = No Reference Criteria Established
---- = No Result