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Characterization of a Riparian Wetland Renwick Reservoir, Pembina County, ND

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Renwick Reservoir, Pembina County, ND

by
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ABSTRACT

Renwick Reservoir, on the Tongue River near Cavalier, North Dakota, was constructed in 1962 as part of a flood control project. The cost at completion was about $350,000. The reservoir was built assuming a 50-year life expectancy. North Dakota's Water Quality Assessment Plan concludes that sediment accumulation has already diminished storage capacity and negatively affected recreational uses. Primary problems include pollutants consisting of nutrients, sediment accumulation, turbid water and organic enrichment. Forty-one percent of the sediments deposited are in the newly-formed riparian wetland at the headwaters of the reservoir. This problem illustrates a need to characterize wetlands in reservoirs. Sediment samples collected throughout the wetland were analyzed by the North Dakota State Health Department (NDSHD) for nitrate and nitrite, ammonia, and phosphate content. Textural analysis was also conducted. Piezometers were designed and installed in the wetland to monitor ground water movement. Stream gaging and water sampling were conducted one mile upstream from the reservoir to determine the volume and quality of water entering the reservoir. Nutrient content was determined from the water samples by the NDSHD. Textural analyses revealed that wetland sediments are silty clays and clayey silts with a variably low sand content. Sediment sample nitrate/nitrite levels were found to be greatest near the reservoir. Ammonia concentrations were greatest in the middle and bottom sections of the 1 meter long cores, probably reflecting active denitrification and anaerobic conditions. Phosphate levels are consistent throughout the wetland. Hydraulic head measured in the piezometers

indicate upward ground water movement in the wetland. This suggests that nutrients can be released from wetland sediments into the reservoir and may exacerbate eutrophication. River discharge was found to be greatest during spring runoff and seems to be affected by precipitation only in the late summer and fall when evapotranspiration rates have diminished. Nutrient concentrations are elevated during periods of greatest river discharge. This indicates that spring runoff and evapotranspiration may be important factors that control nutrient load.

INTRODUCTION

A wetland is defined as having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophilic vegetation, and various kinds of biological activity which are adapted to the wet environment (Tarnocai, 1979). Their boundaries are part of a continuum of physical and functional characters, and may expand or contract over time depending on factors such as average annual precipitation, evapotranspiration and modifications to the watershed (Kent, 1994). They encompass a variety of different biotic communities and serve many important purposes including flood and erosion control and water purification. The purpose of this project was to characterize the sediments and groundwater movement in the recently formed riparian wetland in the headwaters of the Renwick Reservoir.

The Renwick Dam and Reservoir are in Pembina County, North Dakota, on the Tongue River about six miles west of Cavalier (Figure 1). Renwick Reservoir was constructed in 1962 by the Soil Conservation Service (SCS) as part of a Flood Control Watershed Project on the Tongue River (USDA SCS, 1992). Icelandic State Park has since been developed on the reservoir and surrounding land. The dam and reservoir are owned and operated by the North Dakota Park Service for recreational purposes. The reservoir also serves as a back-up water supply for the city of Cavalier. The Icelandic Aquifer which underlies the reservoir serves as the main source of water for Cavalier and the surrounding areas (USDA SCS, 1992).

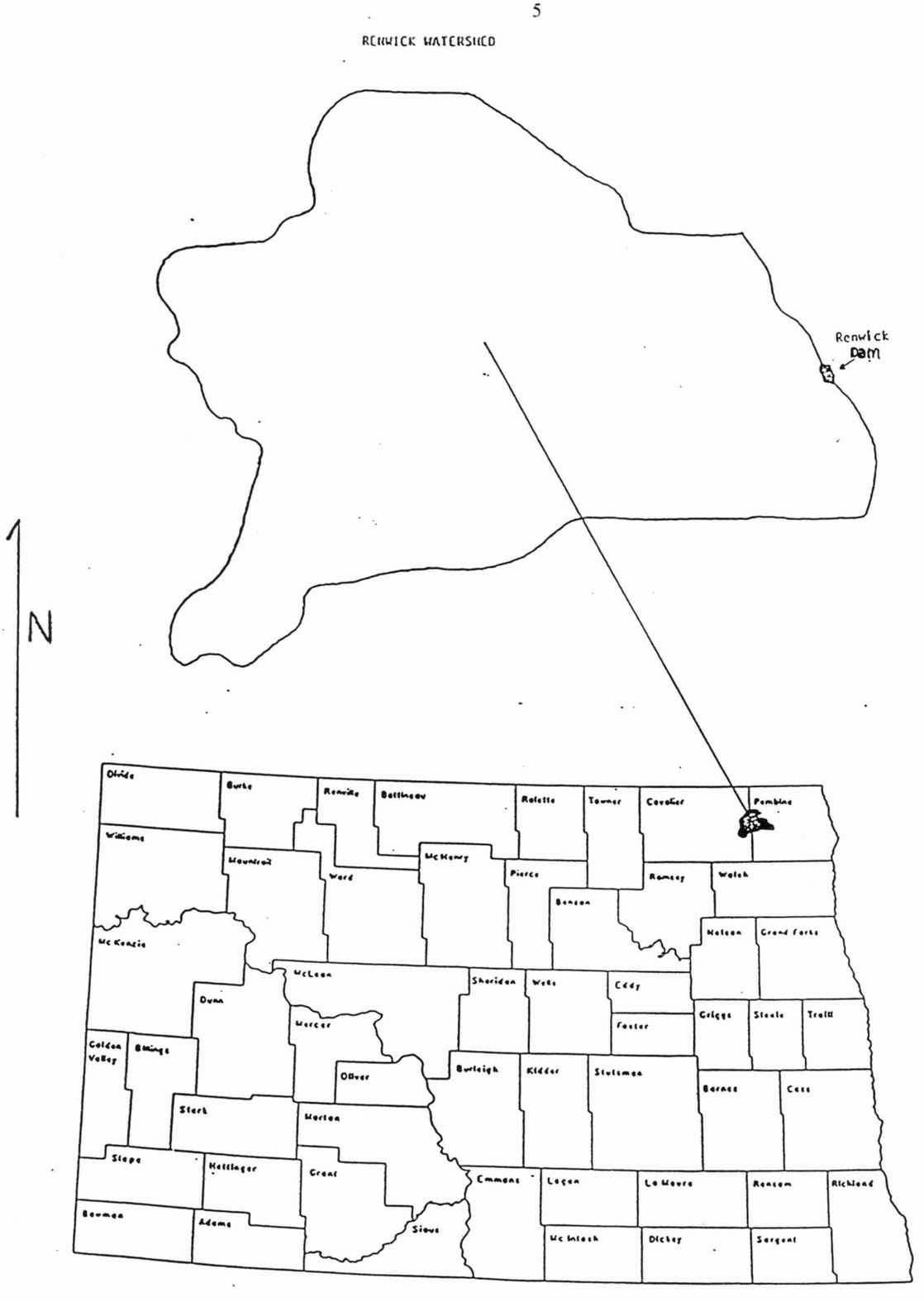


Figure 1. Location of the Renwick watershed and Renwick dam (From USDA SCS, 1992).

PROBLEM STATEMENT

In 1991 an Environmental Protection Agency demonstration project proposal was initiated by the Red River Resource, Conservation and Development Council, Soil Conservation Service and many other local sponsors. The proposal was approved by the EPA for funding through Section 319 of the Clean Water Act. This proposal was initiated to reduce nonpoint source pollution in the reservoir. North Dakota's Section 319 Water Quality Assessment Plan (1991) identifies the primary impairments to the Renwick Reservoir as pollutants consisting of nutrients, turbidity, organic enrichment, and suspended solids. This impairs cool water fisheries, recreation, domestic water supply, and agricultural use of the reservoir (319 Proposal, 1991). A 1990 sediment survey by the SCS on Lake Renwick showed that 96.5 acre-feet of sediment had accumulated in the reservoir since 1962 (Figure 2). This averaged about 118 tons per year of sediment delivery from each square mile of contributing drainage area (total drainage area contributing to the Renwick is about 44 square miles). Most sediments had been contributed by poorly managed cropland and from intensely farmed drainageways (USDA SCS, 1992). Cropland makes up about 90 percent of the land use in the Renwick watershed.

Objective

The objective of this study was to determine if nutrients and sediments from the Tongue River are trapped in the wetland and to characterize recent sediments that underlie the area. This required the collection of field and laboratory data on the interaction between the wetland, river and reservoir.

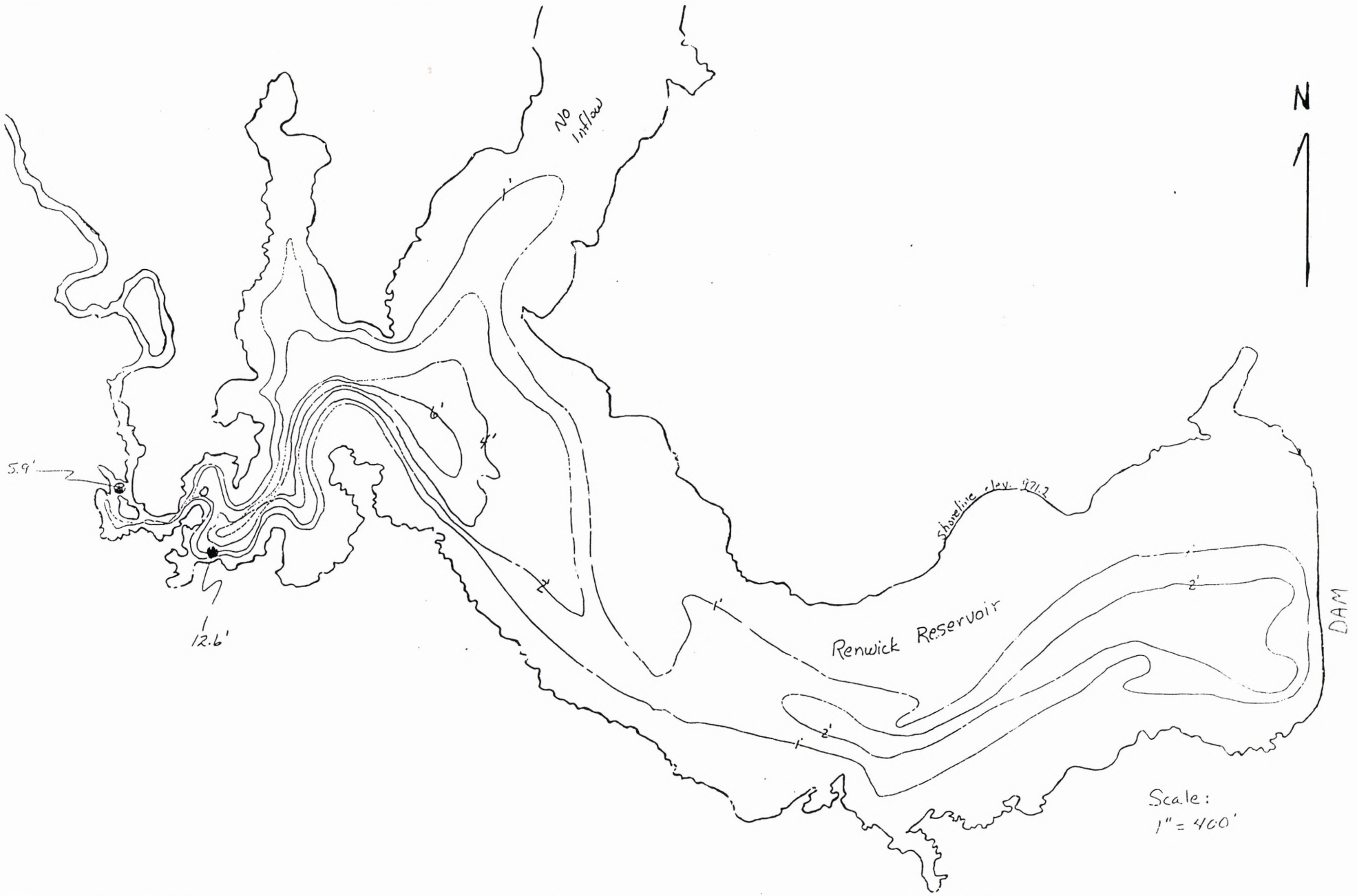


Figure 2. Contours of sediment thickness in the Renwick Reservoir (1990 Survey) (From USDA SCS, 1992).

Field tests in the wetland and surrounding areas provided data. Water quality analysis was performed by the North Dakota State Health Department (NDSHD) on water samples taken from the Tongue River one mile west of the reservoir. NDSHD data where used for characterizing ammonia, phosphate, nitrate, and nitrite levels in water entering the reservoir. Discharge of the Tongue River was measured at the same site using stream gaging equipment. Precipitation data for 1995 in Cavalier, North Dakota was received from the North Dakota State University Department of Soil Science and the National Oceanic and Atmospheric Association. Analysis of discharge, water quality, and precipitation data provide a rough estimation of sediment and nutrient load transported into the wetland during 1995.

Sediment samples were taken along three traverses in the wetland with a Modified Livingston Corer. The core samples were characterized according to size, distribution, and type and provides information about the conditions in which these sediments were deposited. The samples were also analyzed for nutrient content by the NDSHD. Comparison of the nutrient content in the sediments to the estimated nutrient load being brought in by the Tongue River shows what nutrients are immobilized within the wetland.

Piezometer nests were designed and installed in the wetland to characterize the movement of groundwater. Nests were installed near the mouth of the river, in the center of the wetland, and near the reservoir. Each nest consisted of four piezometers placed at varying depths. This provided a means of measuring pH and electrical conductivity of the pore water.

PREVIOUS WORK

The Renwick Dam Reservoir Sedimentation Study Report and the Red River Resource Conservation and Development Council 319 Proposal were used in analyzing the data contained in this thesis. The Sedimentation Study Report of Renwick Reservoir was completed in 1992 by the U. S. Department of Agriculture Soil Conservation Service in Bismarck, North Dakota (USDA SCS, 1992). This survey gives general information on the reservoir and describes the reservoir basin. It also documents the total amount of acre-feet of sediment that have been transported into the reservoir since it was constructed in 1962. Average annual sediment delivery per year from each square mile of contributing drainage area was calculated and sediment thickness is mapped throughout the reservoir. The Red River RC & D 319 Proposal (319 Proposal, 1991) covers three surface-water hydrologic units, including the Renwick Watershed, and the Icelandic Aquifer. It provides background information on the area and documents crop management procedures that may be voluntarily used along the Tongue River upstream from the Renwick Reservoir.

METHODS, MATERIALS and SOURCES of DATA

Stream Gaging

To determine the discharge and estimated sediment load, stream gaging was performed on the Tongue River one mile west (upstream) of the reservoir (Figure 3) from March 4th to October 29th, 1995. Discharge measurements for the remaining part of the year were estimated using the data collected.

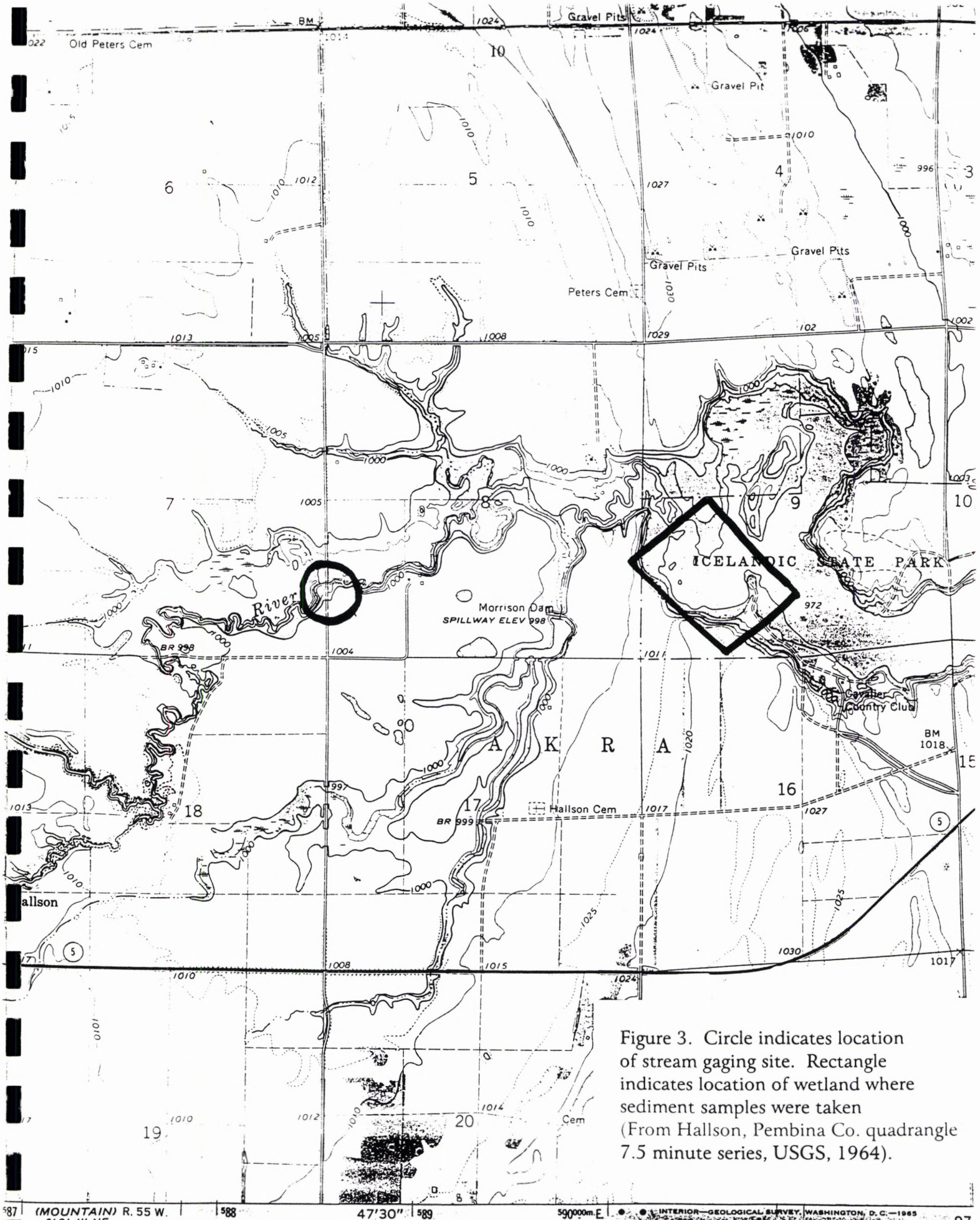


Figure 3. Circle indicates location of stream gaging site. Rectangle indicates location of wetland where sediment samples were taken (From Hallson, Pembina Co. quadrangle 7.5 minute series, USGS, 1964).

U. S. Geological Survey protocol was followed. During the spring thaw, March and April, when the stream was deep and discharge was great, a AA type meter and bridge board were used for gaging. During the rest of the year, a pygmy meter and wading rod were used (see Figures 4 and 5). This stream gaging equipment consists of a top-setting wading rod which sets the position of the Price pigmy current meter at the proper depth in the stream. The top-setting rod has a 1/2-inch hexagonal main rod for measuring depth and a 3/8-inch diameter round rod for setting the position of the current meter (Buchanan and Somers, 1973). The rod was placed in the stream so the base plate rests on the streambed, and the depth of the water was read on the graduated main rod. When the setting rod was adjusted to read the depth of the water, the meter was positioned automatically to 60% of the depth below the surface. The mean velocity was measured at this position only if the total depth of the stream was less than 2.5 feet. If the total depth was greater than 2.5 feet, velocity readings were taken at 20% and 80% of the depth below the surface. The average of these two readings was the mean velocity of the stream. Velocity was calculated by counting the number of revolutions the meter rotor makes during a measured interval of time. A rating table for the pigmy meter, established by the National Bureau of Standards, was used to determine a velocity measurement in ft/sec based on the number of revolutions over time. Velocities were measured at a predetermined interval (0.5 feet) across the stream channel. The total discharge of the stream was determined by summing the products of the partial areas of the stream cross-section and their respective average velocities (Buchanan and Somers, 1973).

4a. The Tongue River during spring thaw (picture taken at stream gaging site).

4b. The Tongue River during late summer (picture taken at stream gaging site).

Figure 4

Figure 5. Wading rod and pigmy meter used for stream gaging.

Sediment Sampling and Analysis

Sediment samples in the riparian wetland were collected using a Modified Livingston Corer while winter ice remained on the reservoir. Three traverses across the area were used to give a cross-section of the sediments (Figures 3 and 6). Traverse A is near the mouth of the river, traverse B is in the center of the wetland, and traverse C is near the reservoir. Four holes along each traverse were drilled using an ice auger and core samples were taken. The coring device consists of a steel coring tube that extracts cores one meter long (see Figure 7). The tube is equipped with a serrated cutting edge for cutting through undecomposed fibers and roots. A piston inside the tube consists of two rubber stoppers that can be tightened against the tube and a steel point. A cable is tied to the piston and as the tube is forced into the sediments, the piston is simultaneously pulled up to create suction and subsequently assure better recovery. After the core was recovered it was cut into 5 cm sample sections, bagged, labeled, and stored in a freezer at -15°C until analysis could be done (see Figure 8).

A total of twelve one-meter long cores were extracted. A sediment sample from the top, middle, and bottom section of each core was used for analysis. This was thought to be the best way to represent the wetland sediments. Thirty-six representative sediment samples were shipped in dry ice to the North Dakota State Health Department Water Quality Division where they were analyzed. Nutrients tested were ammonia, total phosphate, and nitrate plus nitrite. Soil sample extraction used the protocol described in USGS TWRI, Book 5, Ch.1, 1989. The analytical technique used for analysis of ammonia was colorimetric, automated, phenate (EPA 350.1). The analytical technique used for analysis of phosphate was colorimetric,

Figure 6. Location of traverses A, B and C in wetland (From ND Park Service, Icelandic State Park aerial photo, Section 9, 10 and 15, T.161N., R.55W, KBM Inc., Grand Forks, ND, 1986).

Figure 7. Modified Livingston Corer and extracted sample (one meter long).

Figure 8. Cutting core into 5 cm sections.

automated, block digestor, AA numerical II (EPA 365.4). The analytical technique used for analysis of nitrate/nitrite was colorimetric, automated, cadmium reduction (EPA 353.2).

Grain Size Analysis

Thirty-six different representative sediment core samples were characterized by using an American Standard Testing Materials texture analysis procedure. This procedure involved air drying then desegregating the sample until the pieces were approximately 15mm or smaller. Approximately 45 grams of a sample were weighed and put in a pint jar where it was soaked overnight in 125ml of 4% Calgon solution. A test cylinder of 125ml 4% Calgon solution was prepared to determine the hydrometer weight of the Calgon (4-4.5 grams). After soaking, the sample was put in a mechanical analysis stirrer with some distilled water and agitated for 1-2 minutes. The sample was then transferred into a settling cylinder. The cylinder was topped off with distilled water and agitated for about 45 seconds with a rubber stopper. The sample was left to settle for approximately 2.5 hours. The hydrometer reading minus the test Calgon reading was recorded obtain the clay weight. The sample was then wet sieved and the sand returned to the soaking beaker. It was dried overnight in an oven at 100^0C. The sample was then put on the Ro-Tap mechanical shaker for 10 minutes with No.10(12mm), No.18(1mm), and No.230(63microns) sieves. Sand weight was recorded; there was no gravel fraction so all weight not accounted for by the sand and clay was considered to be silt.

Groundwater Flow

In August of 1995 piezometers were designed and nests were manually installed along each traverse to measure hydraulic head, pH and electrical conductivity. Nest A was installed near the mouth of the Tongue River, nest B near the center of the wetland, and nest C near the reservoir (Figure 9). Water levels measured in the piezometers were used to define the groundwater flow conditions.

Piezometers consisted of a 10 foot length of 1/2 inch cpvc pipe with holes drilled in the bottom foot of the pipe to allow groundwater to infiltrate. It was then wrapped with landscaping fabric creating a screen to prevent sediment from plugging the holes, taped with electrical tape, and capped off at the bottom. The piezometer was placed inside a 1 1/4 inch pvc pipe casing. Holes were also drilled in the bottom foot of the casing and a steel drive point installed in the end (see Figure 10). Holding the piezometer and casing upright, two feet of pea rock were added to form the filter. Three feet of bentonite powder were placed inside the casing above the pea rock to seal the filter and screen.

Twelve piezometer assemblies were constructed and driven into the wetland sediments using a fence post driver (see Figure 11). Three nests consisting of four piezometers each were completed. Within each nest a piezometer was installed from 1 to 2 feet, 2 to 3 feet, 4 to 5 feet, and 6 to 7 feet below the surface (see Figure 12a).

Water level measurements relative to the lake level were taken twice using a tape measure, meter stick, and battery operated water-level probe (see Figure 12b). Only the second measurement event provided more accurate results due to greater instrument precision; these data are presented in this

Figure 9. Location of piezometer nests installed in wetland, designated by an X (From ND Park Service, Icelandic State Park aerial photo, Section 9, 10 and 15, T.161N., R.55W, KBM Inc., Grand Forks, ND, 1986).

Figure 10. Piezometers and their casings.

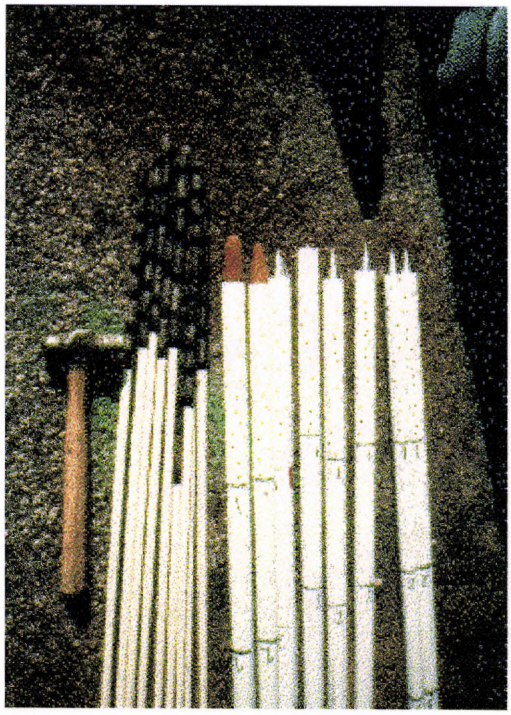
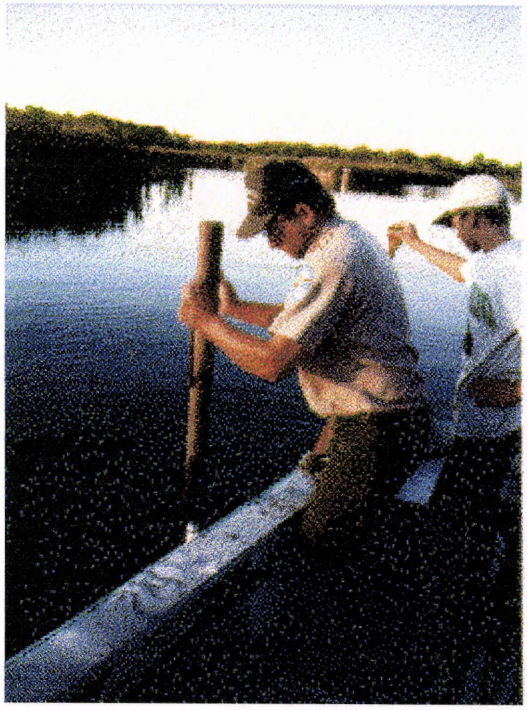
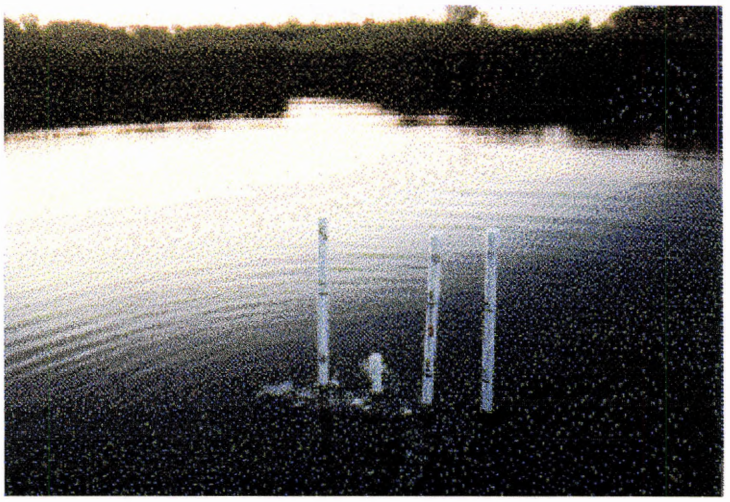


Figure 11. Henry Duray (Icelandic State Park Manager) and Andrew Duray helping to install piezometers.



12a. Nest A near the mouth of the river.



12b. Water level probe is used to measure water levels in the piezometers.

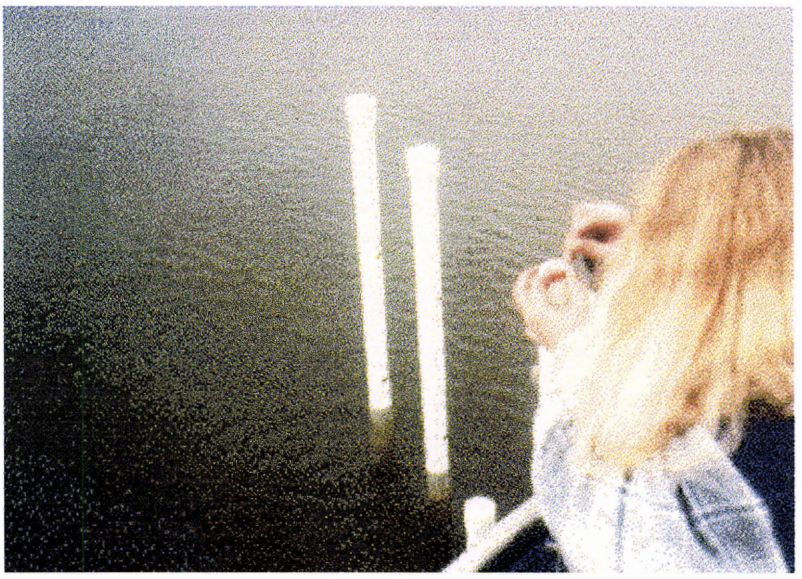


Figure 12

study. A peristaltic pump was used to obtain water samples from each of the piezometers and a Hydac meter was used to determine pH, conductivity and temperature of the samples.

Sources of Data

Sources of data include: 1.) raw field data (discharge measurements and piezometer readings) collected from March 4th to October 29th, 1995, 2.) Red River RC & D 1991 319 Proposal, 3.) the Soil Conservation Service Renwick Dam Reservoir Sedimentation Study Report (1992), 4.) water quality and sediment sample analysis reports from the North Dakota State Health Department and Consolidated Laboratories, and 5.) precipitation data from the NDSU Soil Science Department and the National Atmospheric and Oceanic Association

RESULTS

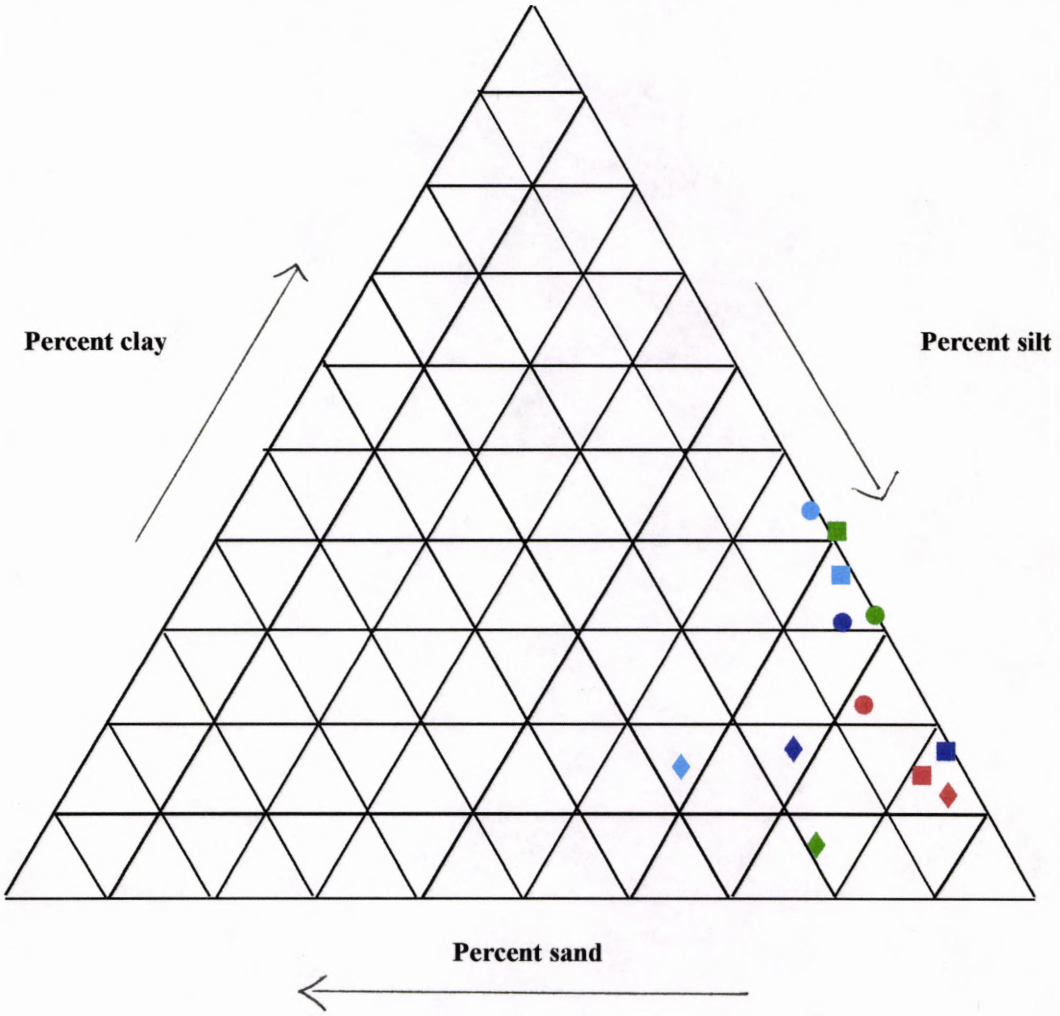
Grain Size Analysis

Textural analysis results (Appendix A) obtained for traverse A, traverse B, and traverse C are plotted on ternary diagrams (Figures 13, 14 and 15). Sand, silt and clay percentages are tabulated at the bottom of each figure. Results show a mean grain size of a silty-clay to silty-clay loam. Sand concentrations are generally low and range from 0 to 48 percent, with only a few samples containing percentages in the upper range. Sand concentrations are highest in the top layer of traverse A (triangles, Figure 13). Samples taken from traverse B have the highest sand concentration in the bottom layer of the

Figure 13. Ternary diagram showing percentages of sand, silt, and clay found in sediment samples taken from traverse A.

Traverse A

Near Mouth of River



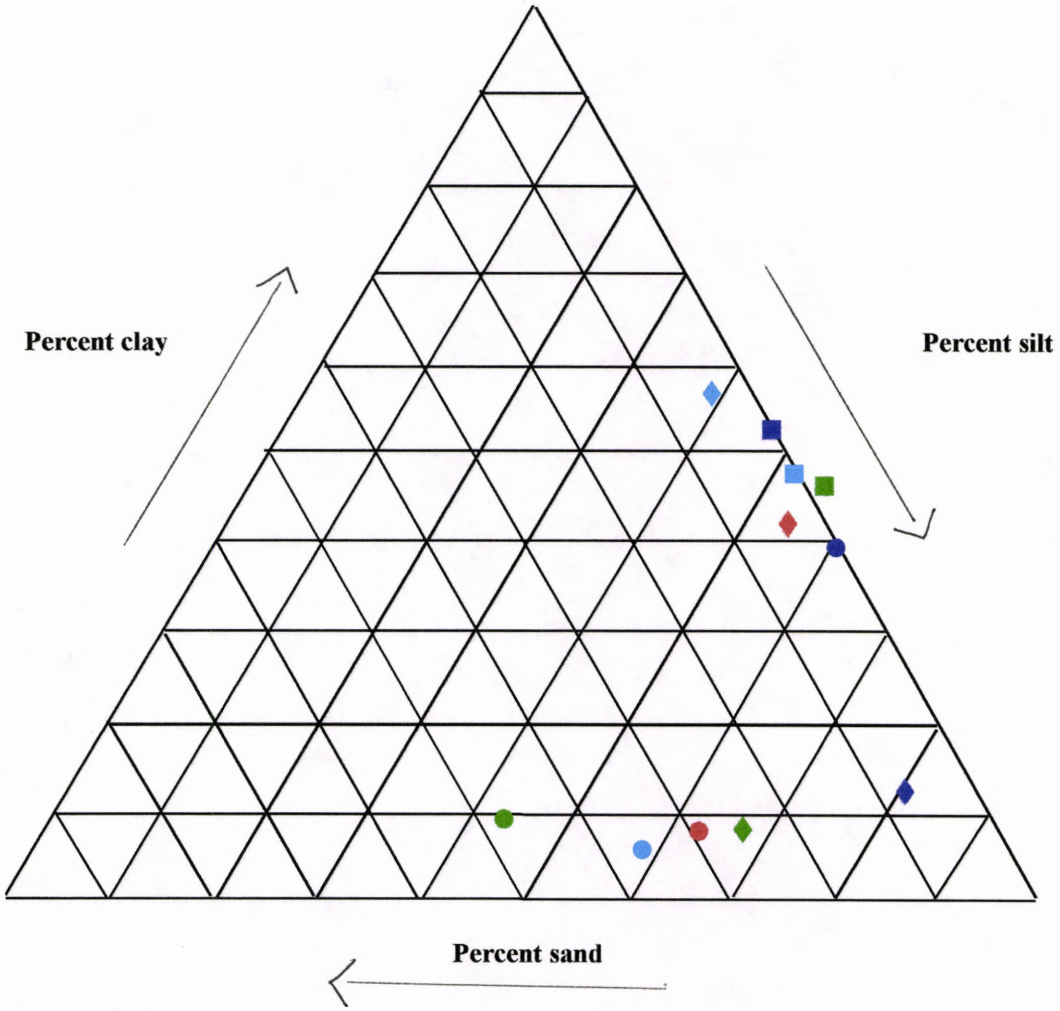
- A1, Top
  27% sand, 58% silt, 14% clay
- A1, Middle
  0% sand, 61% silt, 39% clay
- A1, Bottom
  0% sand, 58% silt, 42% clay
- A2, Top
  4% sand, 83% silt, 13% clay
- A2, Middle
  5% sand, 81% silt, 14% clay
- A2, Bottom
- A3, Top
  15% sand, 68% silt, 17% clay
- A3, Middle
  1% sand, 76% silt, 22% clay
- A3, Bottom
  2% sand, 68% silt, 30% clay
- A4, Top
  17% sand, 76% silt, 7% clay
- A4, Middle
  0% sand, 58% silt, 41% clay
- A4, Bottom

Grain-Size Analysis

Figure 14. Ternary diagram showing percentages of sand, silt, and clay found in sediment samples taken from traverse B.

Traverse B

Center of Wetland

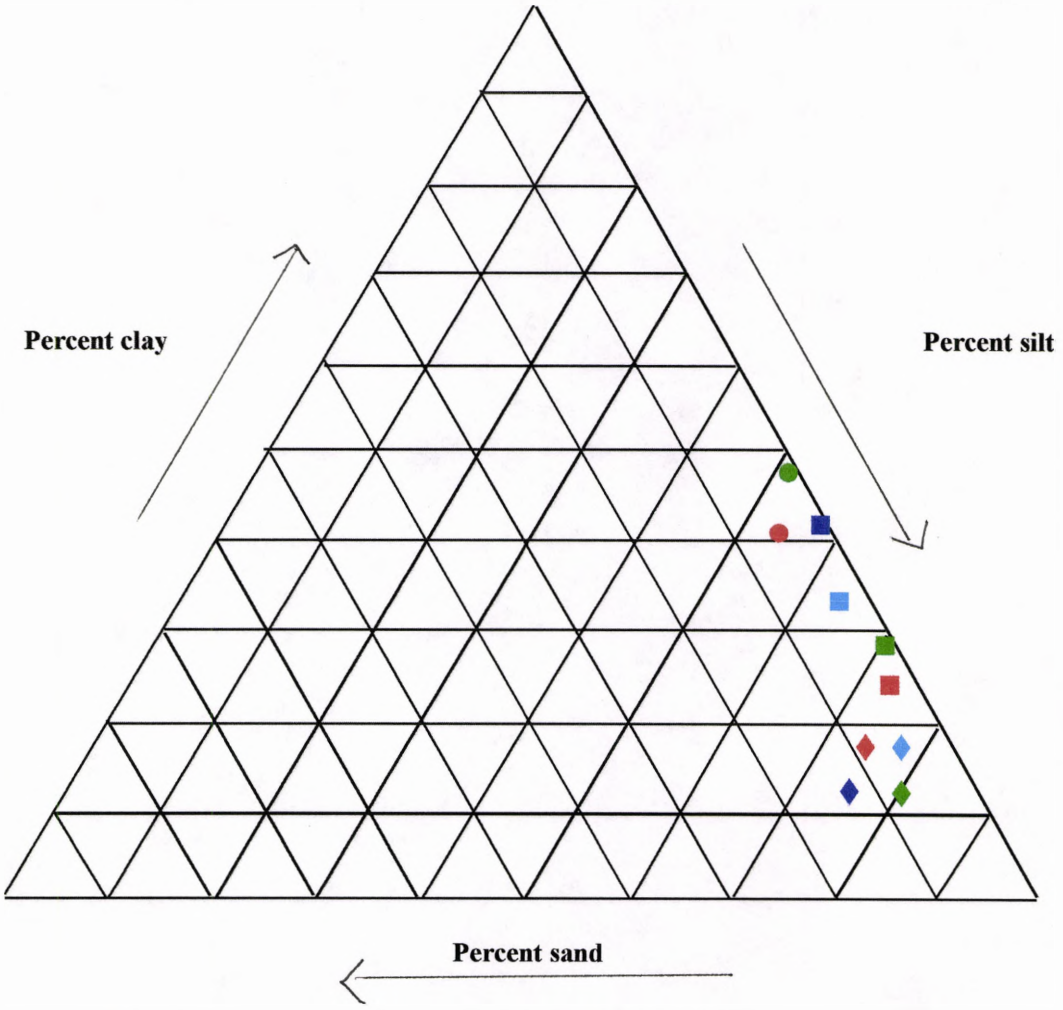


- B1, Top
  3% sand, 39% silt, 58% clay
- B1, Middle
  0% sand, 52% silt, 48% clay
- B1, Bottom
  35% sand, 57% silt, 8% clay
- B2, Top
  3% sand, 55% silt, 42% clay
- B2, Middle
  0% sand, 56% silt, 43% clay
- B2, Bottom
- B3, Top
  7% sand, 80% silt, 13% clay
- B3, Middle
  0% sand, 46% silt, 54% clay
- B3, Bottom
  0% sand, 59% silt, 41% clay
- B4, Top
  25% sand, 66% silt, 9% clay
- B4, Middle
  0% sand, 55% silt, 44% clay
- B4, Bottom

Grain-Size Analysis

Figure 15. Ternary diagram showing percentages of sand, silt, and clay found in sediment samples taken from traverse C.

Traverse C
Near Reservoir



- C1, Top
  3% sand, 79% silt, 18% clay
- C1, Middle
  1% sand, 62% silt, 37% clay
- C1, Bottom
  0% sand, 48% silt, 52% clay
- C2, Top
  8% sand, 74% silt, 18% clay
- C2, Middle
  1% sand, 72% silt, 27% clay
- C2, Bottom
- C3, Top
  11% sand, 75% silt, 14% clay
- C3, Middle
  0% sand, 57% silt, 42% clay
- C3, Bottom
  0% sand, 61% silt, 39% clay
- C4, Top
  4% sand, 80% silt, 16% clay
- C4, Middle
  .9% sand, 71% silt, 28% clay
- C4, Bottom

Grain-Size Analysis

sediments (circles, Figure 14). These are also the highest concentrations of sand noted in any of the samples. In traverse C, very little sand was found (Figure 15).

Sediment Sample Analysis

Analysis of the sediment samples taken from the wetland (Appendix B) showed low nitrate/nitrite concentration that range from non-detectable to 0.00148 mg/g. Nitrate/nitrite levels are highest in traverse A, near the reservoir (Figure 16). Ammonia levels are found to be greatest in the middle and bottom layers of the wetland while concentration in the top are relatively small in comparison (Figure 17). Phosphate levels throughout the reservoir are generally consistent and range from 0.536 to 0.982 mg/g (Figure 18).

Piezometer Results

Water levels measured in the piezometers (Appendix C) at nest A, nest B, and nest C are shown in Figure 19. A general increase in hydraulic head levels can be observed from the shallower sediments into the deeper sediments in each nest. There is one exception; in nest C there is a decrease in hydraulic head from the 4 to 5 foot to 6 to 7 foot sediment depth. All head values, except for the level in the 1 to 2 foot sediments in nest B, however, are at or above the 900 feet reservoir datum. Water samples taken from the piezometer nests showed that pH levels vary in each nest; pH and electrical conductivity generally increases from the river (nest A) to the reservoir (nest C). Electrical conductivities also increased with depth in nest A and decreased with depth in nests B and C (Figure 20 and Appendix C).

SEDIMENT SAMPLE ANALYSIS
AMMONIA

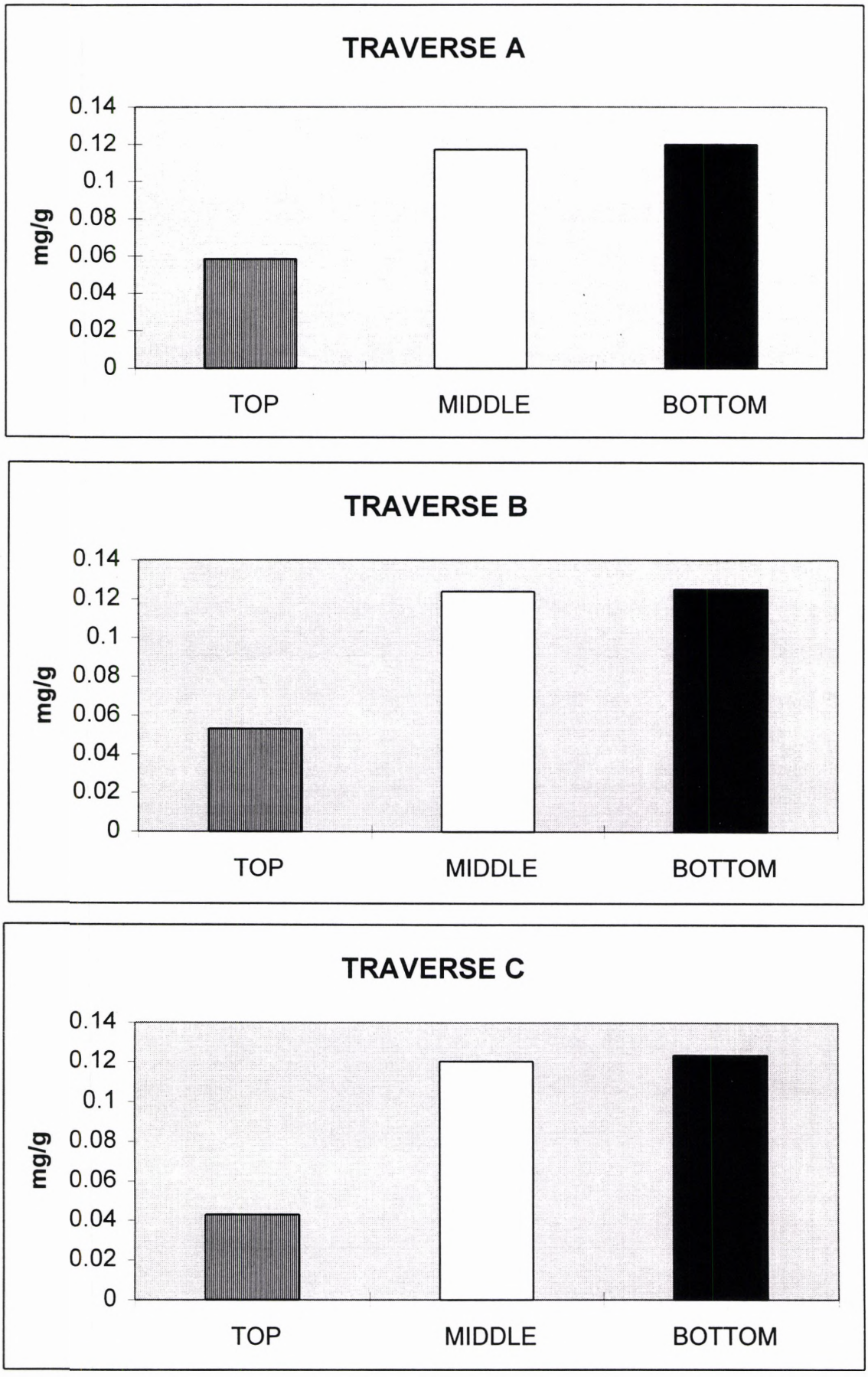


Figure 16. Average ammonia concentrations found in sediment samples taken from traverses A, B and C (Data for analyses were provided by the ND Department of Health Chemistry Division).

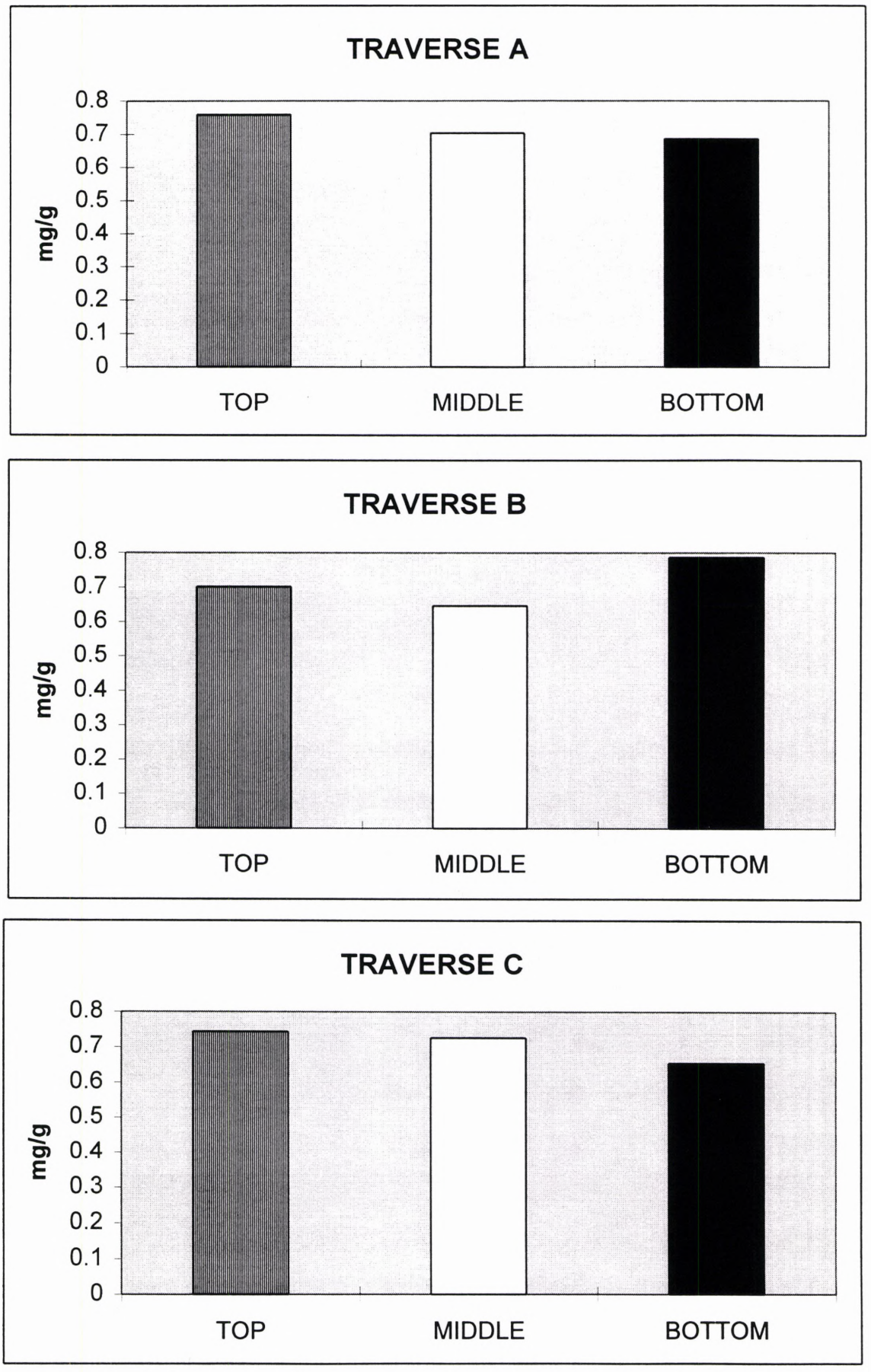
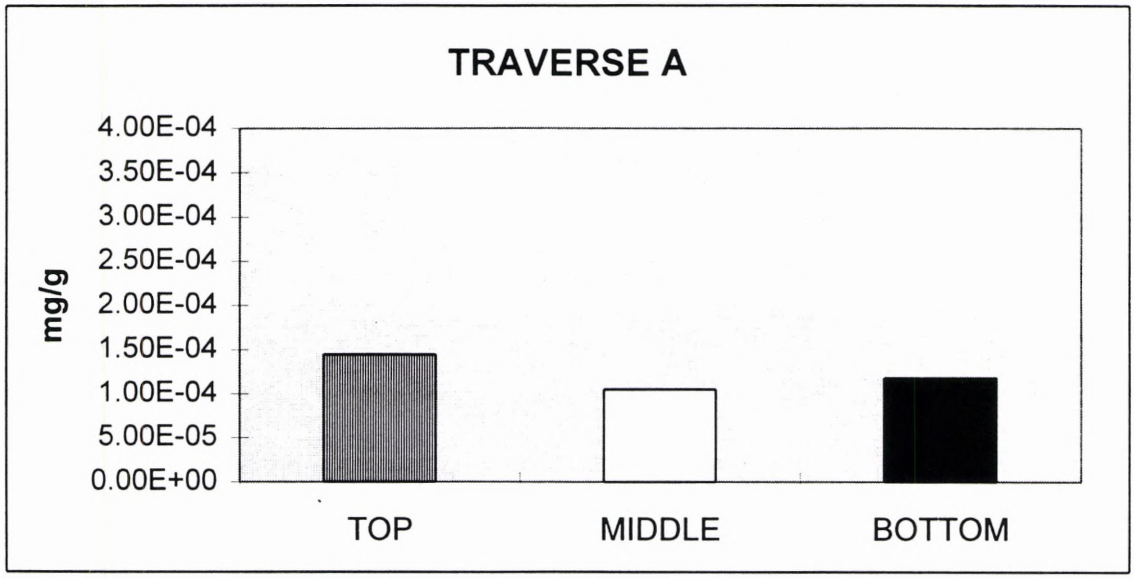
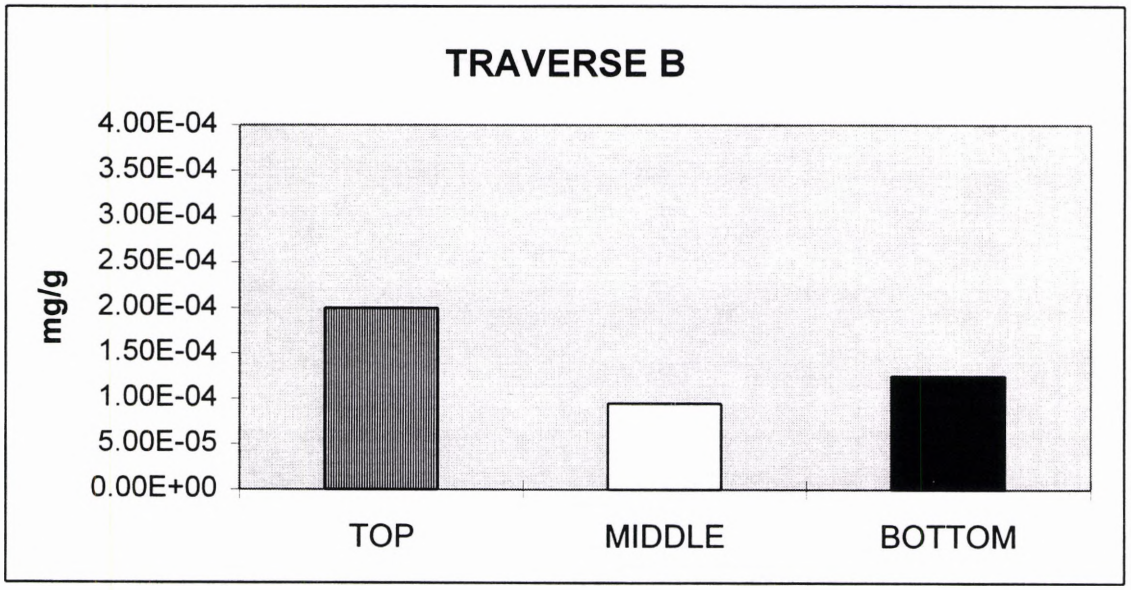


Figure 17. Average phosphate concentrations found in sediment samples taken from traverses A, B and C (Data for analyses were provided by the ND Department of Health Chemistry Division).

SEDIMENT SAMPLE ANALYSIS
NITRATE/ NITRITE 29





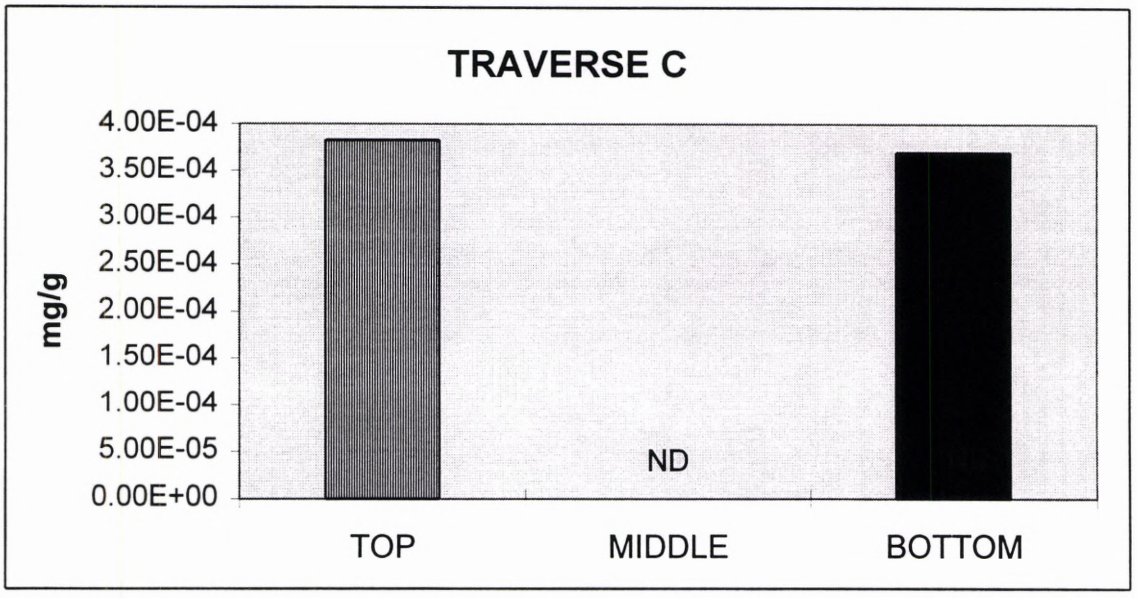


Figure 18. Average nitrate/nitrite concentrations found in sediment samples taken from traverses A, B and C (Data for analyses were provided by the ND Department of Health Chemistry Division).

WATER LEVELS

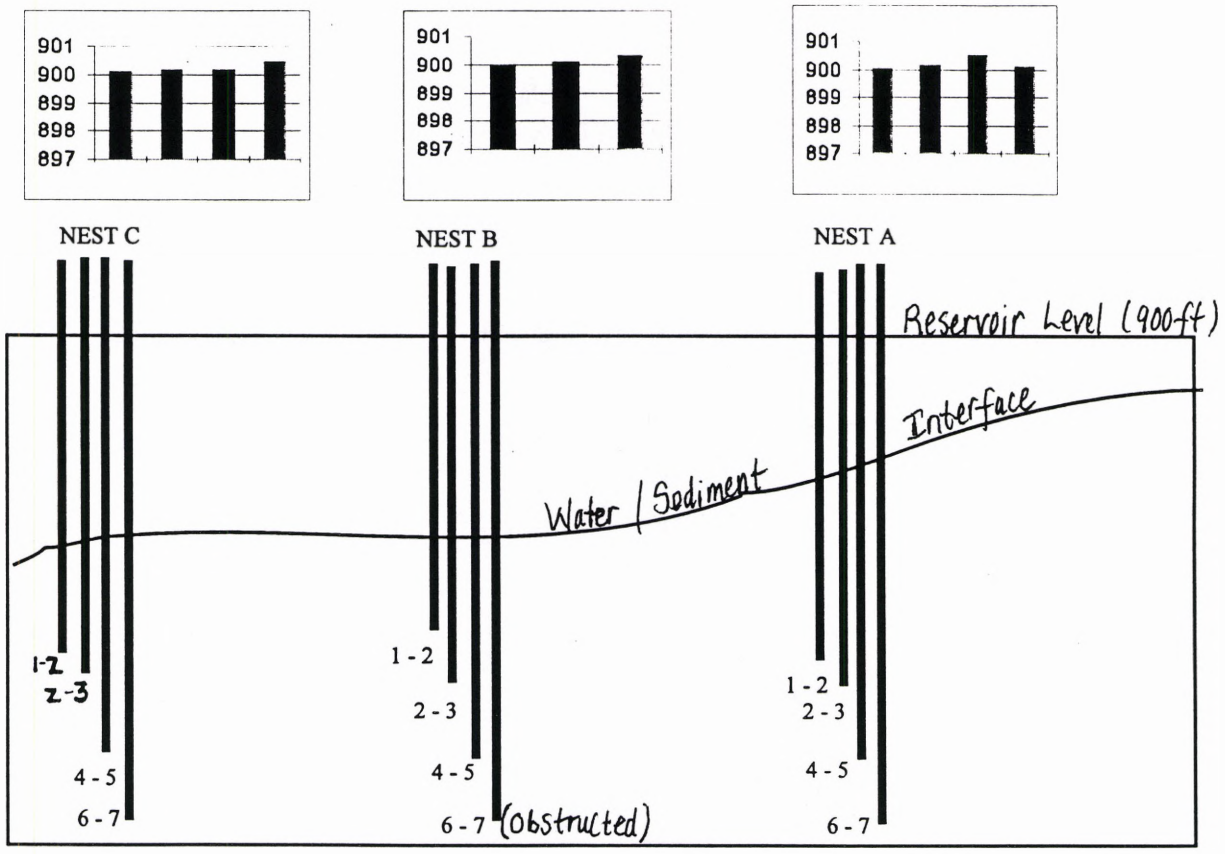


Figure 19. A cross-sectional view of piezometer nests in the wetland. Bar graphs above corresponding nests indicate the water level readings that were obtained on October 28, 1995. In nest B, readings from the 6 to 7 foot sediments were unobtainable due to an obstruction in the piezometer.

ELECTRICAL CONDUCTIVITY, pH, AND TEMPERATURE OF GROUNDWATER SAMPLES

NEST A			
Depth	**Cond. (µS/cm)**	**pH**	**Temp. (°F)**
1-2 ft.	897	7.64	40.2
2-3 ft.	927	7.95	39.0
4-5 ft.	985	7.72	40.0
6-7 ft.	1056	7.77	39.6

NEST B			
Depth	**Cond. (µS/cm)**	**pH**	**Temp. (°F)**
1-2 ft.	1180	7.90	40.3
2-3 ft.	1125	7.87	40.5
4-5 ft.	1064	7.91	40.7
6-7 ft.	------	------	------

NEST C			
Depth	**Cond. (µS/cm)**	**pH**	**Temp. (°F)**
1-2 ft.	1628	8.90	41.7
2-3 ft.	1190	8.14	42.3
4-5 ft.	1153	8.26	41.8
6-7 ft.	960	8.12	41.9

Figure 20. Electrical conductivity, pH and temperature of groundwater samples taken from piezometers (on October 28, 1995) (values not shown were unobtainable due to an obstruction of the pipe)

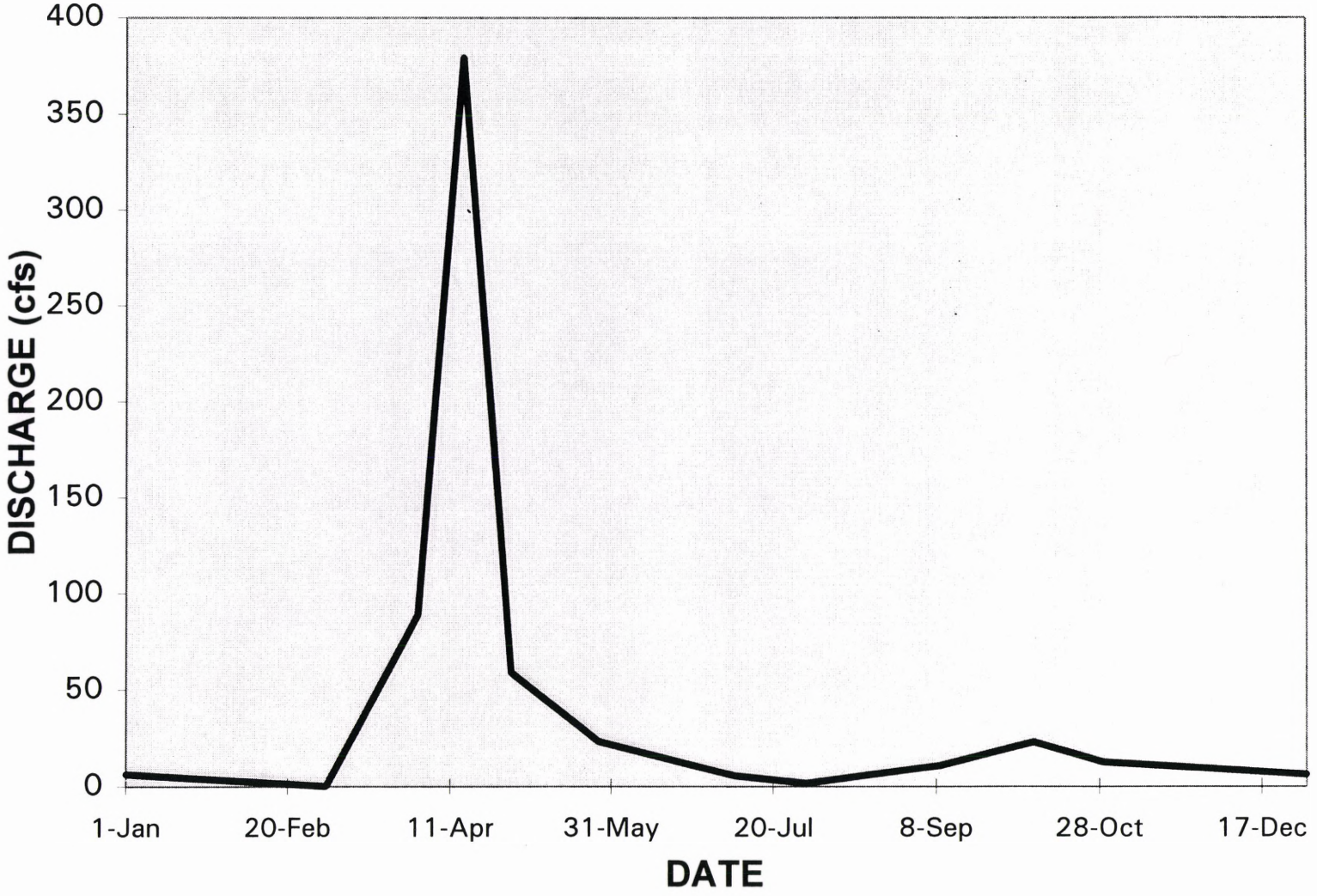
Discharge Measurements

Discharge measurements (Appendix D) from March 4 through October 29, 1995, ranged from 0 cubic feet per second on March 4 (the river was entirely frozen) to 379.24 cubic feet per second on April 15. Discharges for the months of January, February, November, and December were estimated by taking discharge obtained in October and March and averaging discharge for the months between these two readings. Discharge for the entire year was then plotted (Figure 21). These values can be compared to major precipitation events (greater than or equal to .19 inches per day) recorded during 1995 by the NOAA at the Cavalier weather station one-half mile east of the gaging site (Figure 22 and Appendix D).

Water Quality Analysis

Water quality analyses obtained from the North Dakota State Health Department for water sampled upstream from the reservoir show concentrations of nitrate/nitrite, phosphate, and ammonia in milligrams per liter. Results for the years 1993, 1994, and 1995 have been plotted (Figures 23, 24 and 25 and Appendix E). In general, peak concentrations of nutrients occur during the spring and late summer. A very high concentration of ammonia (2.15 mg/l) was detected in the spring of 1993. In late summer of that year, a very high concentration of phosphate (.952 mg/l) was detected. A decrease in ammonia and phosphate concentrations can be seen from 1993 to 1995.

1995 STREAM GAUGING ANALYSIS - 1 MILE WEST OF RESERVOIR



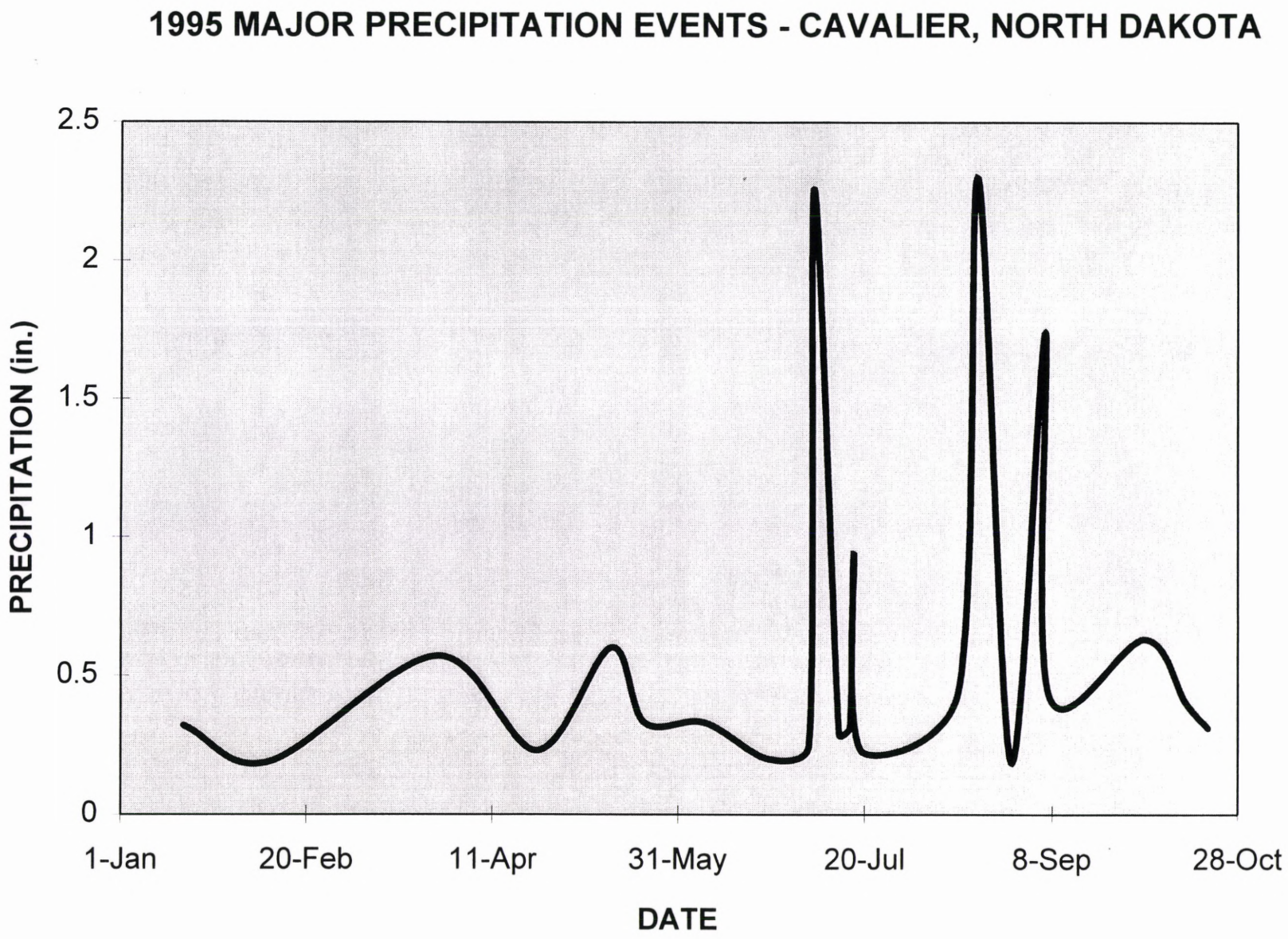


Figure 22. Precipitation events greater than or equal to .19 inches per day (recorded in 1995).

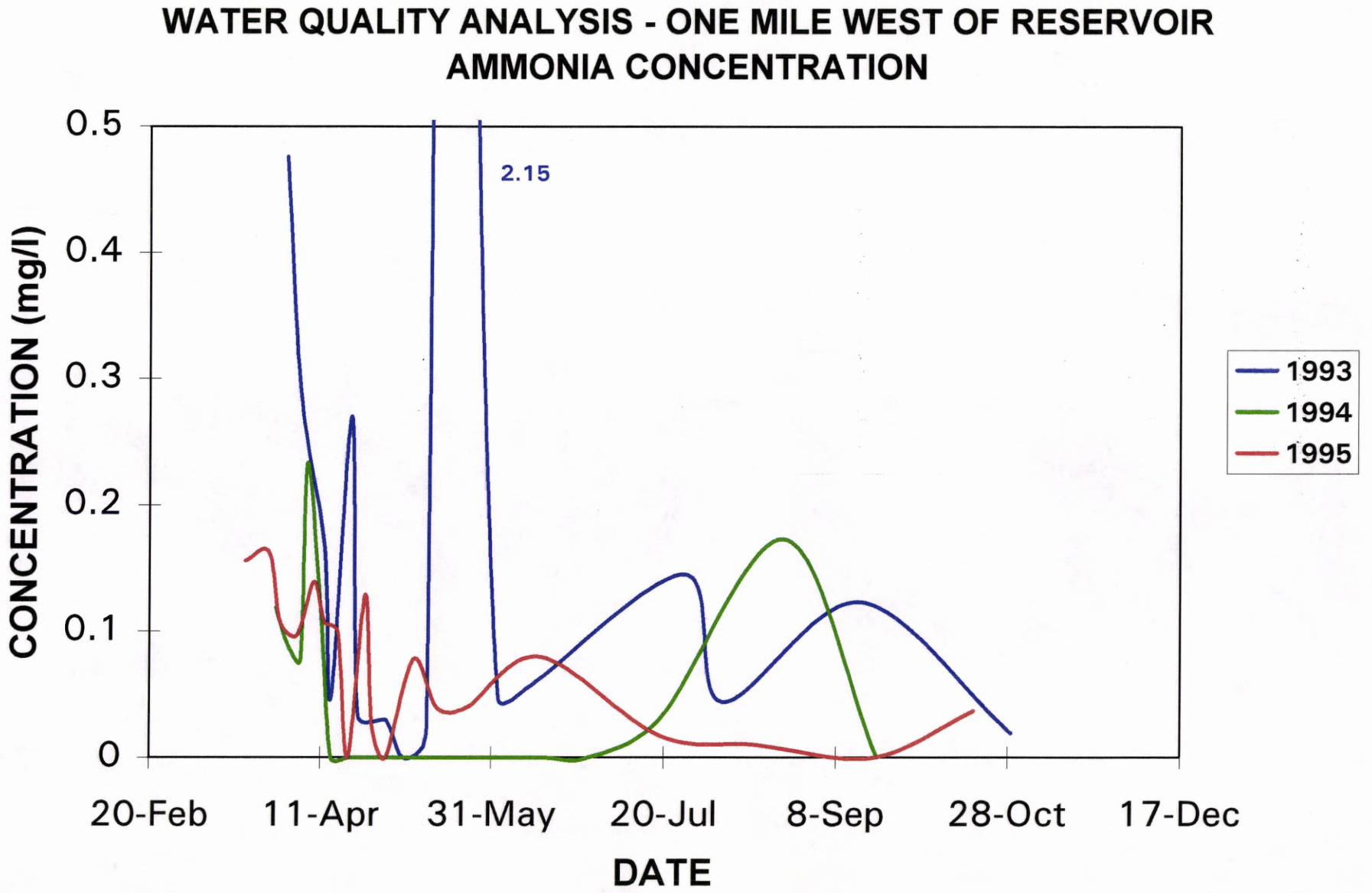


Figure 23. Ammonia concentrations found in water samples taken one mile west of Renwick Reservoir (data for analyses were provided by the ND Department of Health Chemistry Division).

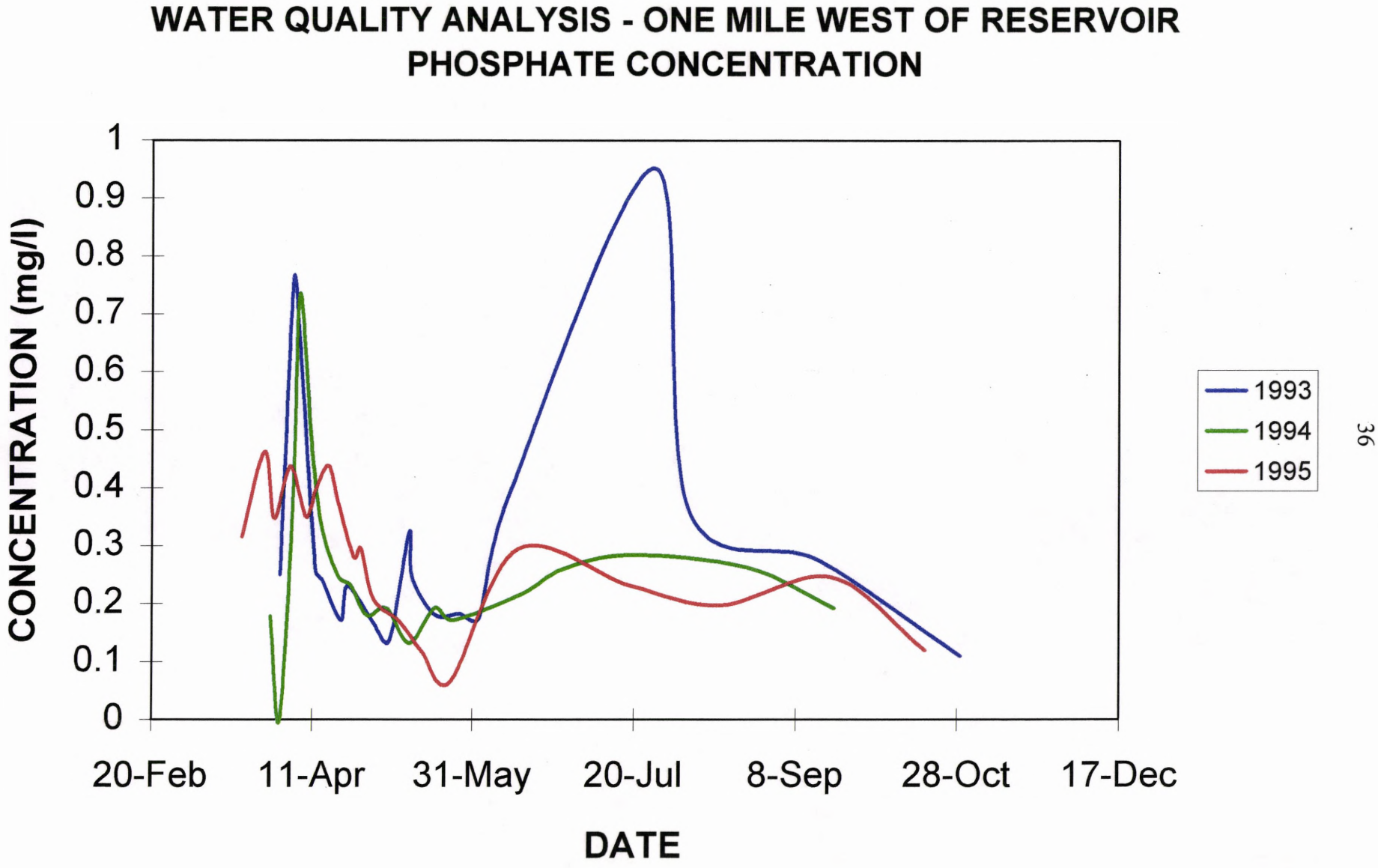


Figure 24. Phosphate concentrations found in water samples taken one mile west of Renwick Reservoir (data for analyses were provided by the ND Department of Health Chemistry Division).

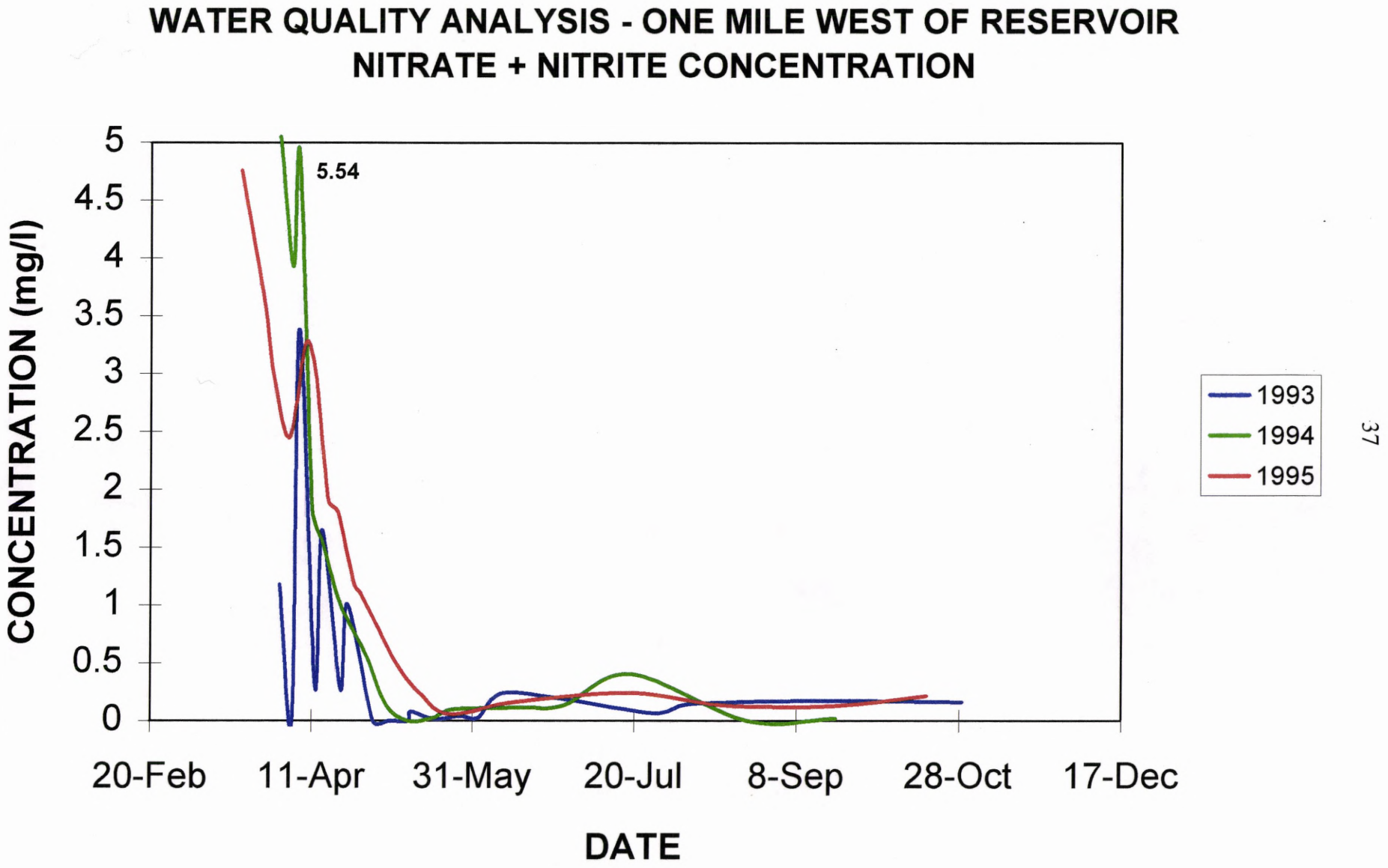


Figure 25. Nitrate/nitrite concentrations found in water samples taken one mile west of Renwick Reservoir (data for analyses were provided by the ND Department of Health Chemistry Division).

DISCUSSION

As revealed by the textural analysis, the mean grain size of the sediments in the wetland is a silty clay. Sand contents are relatively low and, as might be expected, lowest near the reservoir. Apparently, most of the sand rapidly settles due to the decrease in the velocity of the current as the water moves through the wetland from the river to the reservoir. The sand probably occurs in lenses and thin layers that were deposited during spring flooding or storm surges.

Two-thirds of the sediment samples analyzed showed no detectable levels of nitrate/nitrite while the remaining third of the samples showed levels that ranged from 0.00021- 0.00147 mg/g. Lower concentrations of nitrate/ nitrite in the bottom layers of the wetland as compared to the top layers can be attributed to the effectiveness of the denitrification process that takes place in the wetland. The observation that nitrate and nitrite concentrations are highest near the reservoir may suggest that there is some transport of nutrients due to groundwater movement from the mouth of the river to the reservoir.

Denitrification is recognized for its ability to eliminate or reduce nitrate concentrations in groundwater (Korom, 1992). The reduction may be simply from nitrate to nitrite; or it may be from nitrate to nitric oxide gas; or to nitrous oxide gas; or finally, to nitrogen gas (Payne, 1981). In denitrification, bacteria use (in a complex series of reactions) the oxygen in nitrate ion to oxidize organic carbon to CO_2. The stoichometry of the reaction is:

$$2.5C_{organic} + 2NO_3^- + 2H^- = N_2 + 2.5CO_2 + H_2O \quad \text{(Drever, 1988)}$$

The importance of this reaction is that it converts nitrate, which is important in the nutrient balance of lakes and rivers, into biologically inert molecular nitrogen (Drever, 1988).

The reaction shows that nitrate/nitrite concentrations will decrease as oxygen supplies become limiting. This is the case in the wetland, lower concentrations of nitrate/nitrite exist in the lower layers.

As oxygen supplies become more limiting and anaerobic conditions exist, nitrate/nitrite is reduced to ammonium (Korom, 1992). This is shown by the following half reactions that can be summed to give an oxidation-reduction reaction:

$$1/8NO_3^- + 5/4H^+ + e = -1/8NH_4^+ + 3/8H_2O$$

$$+ \quad 1/4CH_2O + 1/4H_2O = 1/4CO_2(g) + H^+ + e$$

$$1/8NO_3^- + 1/4CH_2O + 1/4H^+ = 1/8NH_4^+ + 1/4CO_2(g) + 1/8H_2O$$

($1/4CH_2O$ represents an organic species) (Korom, 1996)

Higher concentrations of ammonia in the bottom layers of the wetland as compared to the top layers can be once again be attributed to the denitrification process that exists in the wetland. Since the top layer is more aerobic than the deeper layers, more oxidation takes place, leaving less ammonia.

As noted in the results, upward groundwater movement probably occurs throughout most of the wetland. Because ammonia, phosphate, nitrate/nitrite were found to be trapped in the wetland sediments, these nutrients could be transported into the reservoir and may accelerate eutrophication.

An increase in the pH of the groundwater from areas near the river toward the reservoir is evident. The mineralogy of the sediment samples, however, would need to be studied before making any assumptions to why this might be

the case. More analysis should be done with the electrical conductivity, pH and temperature because they are important measures of wetland structure and function. Seasonal variations in physical or chemical parameters such as temperature or pH can modify the bioavailability of contaminants, thus changing the nature of the exposure (Kent, 1994).

Analysis of 1995 stream gaging data revealed two peaks of discharge, one in the spring and the other in the late summer. Compared with major precipitation events during the year, there seems to be correlation in the late summer but at no other time of the year. This indicates that spring thaw and evapotranspiration may be controlling factors in discharge. In early and mid-summer, when plant growth rate is greatest, precipitation is taken up by the vegetation. Later in the summer when plant growth has subsided, precipitation can runoff and increase stream discharge.

Spring and late summer peak concentrations of nutrients recorded in samples taken one mile upstream of the reservoir, seem to follow discharge patterns. This indicates that spring thaw and evapotranspiration may also be controlling factors in nutrient load. The decrease in ammonia and phosphate levels from 1993 to 1995 may indicate that the 319 Water Quality Assessment Program implemented upstream has had a positive effect in reducing nutrient concentrations. Other factors, however, such as the amount of land farmed, chemical application techniques, and climatological data must be studied before this can be verified. High concentrations of nutrients suggest unusual conditions during 1993. This could be due to a heavy application of agricultural chemicals that year, but that is only speculation. Further research is needed.

CONCLUSIONS

Mean grain size of the wetland sediment was found to be a silty clay to a silty clay loam. Sand content is relatively low and varies throughout the wetland. Sand probably occurs in sand lenses deposited during storm surges or flooding events. Less sand was found in the sediment samples near the reservoir; this is consistent with the fact that the velocity of the current decreases as the water flows from the river into the reservoir.

Sediment sample analysis showed relatively low concentrations of nitrate/nitrite in the wetland possibly due to denitrification. Higher levels of nitrate/nitrite near the reservoir may indicate the transport of nutrients by groundwater movement. Ammonia levels increase with depth in the sediments. Because the top layers of sediment are more aerobic; ammonia is oxidized near the water-sediment interface. Phosphate levels were found to vary little throughout the wetland.

Hydraulic head measured in the piezometers indicate upward groundwater movement in the wetland. This suggests that the nutrients trapped in the sediments could be transported from the wetland into the reservoir and may accelerate eutrophication.

Electrical conductivity in the water samples taken from the piezometers vary from about 900 μS/cm to 1600 μS/cm. In nest A, electrical conductivity rose going from the shallower sediments to the deeper sediments. In nest B and C, however, conductivity decreased with depth. pH levels within each nest varied randomly from sample to sample but stayed within the range of 7.64 to 8.90. An overall increase in pH, however, was observed through the wetland from the river to the reservoir.

Discharge into the wetland is greatest during the spring runoff and late summer. It seems to be affected by precipitation only in the late summer; suggesting that evapotranspiration may have a significant effect on discharge.

Nutrient levels generally paralleled stream discharge patterns. This indicates that spring runoff and evapotranspiration may also be controlling factors in nutrient load. A decrease in ammonia and phosphate concentrations from 1993 to 1995 may indicate that the 319 Water Quality Assessment Program implemented upstream has had a positive effect on the nutrient load.

APPENDICES

APPENDIX A

Textural Analyses

B17

Sample from Bottom

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A1-2

Gravel 0 Sand 0 % Silt 58 % Clay 42 %

Temperature 23°C

Time to read 6:42:00
2:29:26

Hydrometer 9:11:26

	Total Sample Weight	45.03	
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % (D ÷ A)

			1-2MM	<1MM	
E	Corrected Sample Wt. A-D	45.03			
F	Sand + Envelope		0	2.83	
G	Sand Envelope		0	2.74	
H	F-G		0	0.09	
I	Weight of Sand 1-2MM H + <1MM H		.09		0 % (I ÷ E)
J	Hydrometer Reading		25.5		
K	Calgon Hydrometer Reading		6.5		
L	Weight of Clay J-K		19.0		.42 % (L ÷ E)
M	Weight of Silt E- (I + L)		25.94		.58 % (M ÷ E)

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A1-12

Gravel 0 Sand 0 Silt 61 % Clay 39 %

Temperature 22°

Time to read 1:15:00 2:32:48

Hydrometer 3:47:48

	Total Sample Weight		45.01
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % D ÷ A

		1-2MM	<1MM	
E	Corrected Sample Wt. A-D			45.01
F	Sand + Envelope	0	3.03	
G	Sand Envelope	0	2.69	
H	F-G	0	.34	
I	Weight of Sand 1-2MM H + <1MM H	.34		0 % I ÷ E
J	Hydrometer Reading	24.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	17.5		.39 % L ÷ E
M	Weight of Silt E- (I + L)	27.17		.61 % M ÷ E

7:22

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A1-20

Gravel 0 Sand 27% Silt 58% Clay 14%

Temperature 22°C

Time to read 7:22:00
2:32:~~00~~ → 48

Hydrometer 9.5H:48

A	Total Sample Weight		45.00
B	Gravel + Envelope	2.82 Shells	
C	Gravel Envelope	2.80	
D	Weight of Gravel B-C	.02	0 % (D ÷ A)

E	Corrected Sample Wt. A-D	Shells		45.00
		1-2MM	<1MM	
F	Sand + Envelope	2.19 ~~2.05~~	~~15.25~~ 15.25	
G	Sand Envelope	2.78	2.77	
H	F-G	.01	12.48	
I	Weight of Sand 1-2MM H + <1MM H	12.48		.28 % (I ÷ E)
J	Hydrometer Reading	13		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	6.5		.14 % (L ÷ E)
M	Weight of Silt E- (I + L)	26.01		.58 % (M ÷ E)

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A2-2

Gravel 0 Sand 5% Silt 74% Clay 21%

Temperature ~~A3~~ 22°

Time to read 1:20:00 2:32:48

Hydrometer 3:52:48

Total Sample Weight 45.03

B Gravel + Envelope 0

C Gravel Envelope 0

D Weight of Gravel B-C 0 % D ÷ A

E Corrected Sample Wt. A-D 45.03

		1-2MM	<1MM
F	Sand + Envelope	0	5.12
G	Sand Envelope	~~2.81~~ 0	2.81
H	F-G	0	2.31

I Weight of Sand 1-2MM H + <1MM H 2.31 .05 % I ÷ E

J Hydrometer Reading 16.0

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K ~~10.5~~ 9.5 .21 % L ÷ E

M Weight of Silt E- (I + L) 33.22 .74 % M ÷ E

TOP

TEXTURAL ANALYSIS

Batch Designation: 2 — Gravel 0% Sand 5% Silt 81% Clay 14%

Beaker Number: _____ — Temperature: 22°

Sample Designation: A2-7 — Time Set Up: 8:54:00

2:32:48

Time to Read Hydrometer: 10:26:48

A) Total Sample Weight: 45.03

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.03 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	4.81
G) Sand Envelope	0	2.77
H) F-G	0	2.04

I) Weight of Sand: 2.04 (1-2mm H + <1mm H) — .05 % (I / E)

J) Hydrometer Reading: 13.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 6.5 (J-K) — .14 % (L / E)

M) Weight of Silt: 36.49 (E - I - L) — .81 % (M / E)

Harrer & Holth

bot

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A2-14

Gravel 0 Sand 4% Silt 83% Clay 13%

Temperature 23°C

Time to read 6:49:00
2:29:26

Hydrometer 9:18:26

Total Sample Weight 45.03

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 — 0 % (D ÷ A)

E Corrected Sample Wt. A-D 45.03

	1-2MM (shells & organics)	<1MM
F Sand + Envelope	2.81 ~~2.87~~	~~4.17~~ 4.17
Sand Envelope	2.76	2.73
F-G	.05	1.44

I Weight of Sand 1-2MM H + <1MM H 1.44 — .04 % (I ÷ E)

J Hydrometer Reading 12.5

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 6.0 — .13 % (L ÷ E)

M Weight of Silt E- (I + L) 37.54 — .83 % (M ÷ E)

TEXTURAL ANALYSIS

51

Batch Designation 2 Gravel 0% Sand 2% Silt 68% Clay 30%

Beaker Number

Temperature 22°

Sample Designation A3-2

Time Set Up 9:15:00

2:32:48

Time to Read Hydrometer 11:47:46

A) Total Sample Weight 44.99

B) Gravel + Envelope 0

C) Gravel Envelope 0

D) Weight of Gravel 0 (B-C) 0 % (D / A)

E) Corrected Sample Weight 44.99 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	3.41
G) Sand Envelope	0	2.73
H) F-G	0	.68

I) Weight of Sand .68 (1-2mm H + <1mm H) .02 % (I / E)

J) Hydrometer Reading 20.0

K) Calgon Hydrometer Reading 6.5

L) Weight of Clay 13.5 (J-K) .30 % (L / E)

M) Weight of Silt 30.81 (E - I - L) .68 % (M / E)

TOP

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A3-9

Gravel 0 Sand 1% Silt 76% Clay 22%

Temperature 23°C

Time to read 6:57:00
2:29:26

Hydrometer 9:26:26

Total Sample Weight 45.00

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 — 0 ÷ A %

E Corrected Sample Wt. A-D 45.00

		1-2MM	<1MM
F	Sand + Envelope	0	3.44
G	Sand Envelope	0	2.78
H	F-G	0	.66

I Weight of Sand 1-2MM H + <1MM H .66 — .01 % (I ÷ E)

J Hydrometer Reading 16.5

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 10.0 — .22 % (L ÷ E)

M Weight of Silt E- (I + L) 34.34 — .76 % (M ÷ E)

TEXTURAL ANALYSIS

53

Batch Designation: 2 — Gravel 0 Sand 15% Silt 68% Clay 17%

Beaker Number: _____ — Temperature: 21°

Sample Designation: A3-15 — Time Set Up: 4:34:00

2:36:30

Time to Read Hydrometer: 70:10:30

A) Total Sample Weight: 44.99

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D/A)

E) Corrected Sample Weight: Shell Pieces & organics — 44.99 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	2.83	9.51
G) Sand Envelope	2.75	2.76
H) F-G	.08	6.75

H) 0 %

I) Weight of Sand: 6.75 (1-2mm H + <1mm H) — .15 % (I/E)

J) Hydrometer Reading: 14.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 7.5 (J-K) — .17 % (L/E)

M) Weight of Silt: 30.74 (E-I-L) — .68 % (M/E)

TEXTURAL ANALYSIS

Batch Designation: 2 — Gravel 0% Sand 1% Silt 68% Clay 31%

Beaker Number:

Temperature: 22°

Sample Designation: A4-2

Time Set Up: 9:21:00 / 2:32:48

Time to Read Hydrometer: 11:53:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm	
F) Sand + Envelope	0	3.23	
G) Sand Envelope	0	2.70	
H) F-G	0	.53	
I) Weight of Sand (1-2mm H + <1mm H)	.53		.01 % (I / E)
J) Hydrometer Reading	20.5		
K) Calgon Hydrometer Reading	6.5		
L) Weight of Clay (J-K)	14		.31 % (L / E)
M) Weight of Silt (E - I - L)	30.49		.68 % (M / E)

TOP

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation A4-9

Gravel 0% Sand 0% Silt 58% Clay 41%

Temperature 22°

Time to read 1:27:08 2:32:48

Hydrometer 3:59:48

Total Sample Weight 45.04

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 — 0 % (D ÷ A)

E Corrected Sample Wt. A-D 45.04

		1-2MM	<1MM
F	Sand + Envelope	0	3.16
G	Sand Envelope	0	2.75
H	F-G	0	.41

I Weight of Sand 1-2MM H + <1MM H .41 — 0 % (I ÷ E)

J Hydrometer Reading 15.0

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 18.5 — .41 % (L ÷ E)

M Weight of Silt E- (I + L) 26.13 — .58 % (M ÷ E)

TEXTURAL ANALYSIS

Batch Designation: 2 — Gravel 0 Sand 17% Silt 76% Clay 7%

Beaker Number: _____ — Temperature: 22°

Sample Designation: A4-19 — Time Set Up: 1:40:00 / 2:32:48

Time to Read Hydrometer: 4:12:48

A) Total Sample Weight: 45.01

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.01 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	~~2.95~~ 2.80	~~10.28~~ 10.38
G) Sand Envelope	2.75	2.74
H) F-G	.20	7.54

I) Weight of Sand: 7.74 (1-2mm H + <1mm H) — .17 % (I / E)

J) Hydrometer Reading: 9.5

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 3.0 (J-K) — .07 % (L / E)

M) Weight of Silt: 34.27 (E - I - L) — .76 % (M / E)

TOP

TEXTURAL ANALYSIS

57

Batch Designation: 2 — Gravel 0% Sand 35% Silt 57% Clay 8%

Beaker Number:

Temperature: 21° (1536.5)

Sample Designation: B1-2

Time Set Up: 4:05:00 (2:30:30)

Time to Read Hydrometer: 6:41:30

A) Total Sample Weight	wood chips	45.02
B) Gravel + Envelope	2.78	
C) Gravel Envelope	2.74	
D) Weight of Gravel (B-C)	.04	0 % (D/A)

Wood chips

E) Corrected Sample Weight	some CS mostly wood chips		45.02 (A-D)
	1-2mm	<1mm	
F) Sand + Envelope	2.84	16.60	
G) Sand Envelope	2.72	2.70	
H) F-G	.12	15.9	
I) Weight of Sand (1-2mm H + <1mm H)	16.02		.35 % (I/E)
J) Hydrometer Reading	10.0		
K) Calgon Hydrometer Reading	6.5		
L) Weight of Clay (J-K)	3.5		.08 % (L/E)
M) Weight of Silt (E-I-L)	25.5		.57 % (M/E)

TOP

TEXTURAL ANALYSIS

58

Batch Designation: 2 — Gravel 0% Sand 0% Silt 52% Clay 48%

Beaker Number:

Temperature: 22°

Sample Designation: B1-9

Time Set Up: 9:00:00

Time to Read Hydrometer: 2:32:48 / 11:32:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	2.72
G) Sand Envelope	0	2.68
H) F-G	0	0.04

I) Weight of Sand: .04 (1-2mm H + <1mm H) — 0 % (I / E)

J) Hydrometer Reading: 28.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 21.5 (J-K) — .48 % (L / E)

M) Weight of Silt: 23.48 (E - I - L) — .52 % (M / E)

7:48

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation B1-15

Gravel 0% Sand 3% Silt 39% Clay 58%

Temperature 22°C

Time to read 7:48:00
2:32:48

Hydrometer 10:20:48

Total Sample Weight 44.98

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 — 0 % (D ÷ A)

E Corrected Sample Wt. A-D 44.98 (some shells)

		1-2MM	<1MM
F	Sand + Envelope	2.76	3.95
G	Sand Envelope	2.71	2.74
H	F-G	.05	1.21

I Weight of Sand 1-2MM H + <1MM H 1.21 — .03 % (I ÷ E)

J Hydrometer Reading 24.0

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 17.5 — .39 % (L ÷ E)

M Weight of Silt E- (I + L) 26.27 — .58 % (M ÷ E)

TEXTURAL ANALYSIS

60

Batch Designation: 2 — Gravel 0% Sand 29% Silt 62% Clay 9%

Beaker Number: ____ — Temperature: 22°

Sample Designation: B2-2 — Time Set Up: 9:31:00

Time to Read Hydrometer: 2:32:00 / 12:03:00

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 2.74 (wood chips)

C) Gravel Envelope: 2.66

D) Weight of Gravel: .08 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm (wood chips)	<1mm
F) Sand + Envelope	2.83	15.90
G) Sand Envelope	2.71	2.73
H) F-G	.12 +.08	13.17

I) Weight of Sand: 13.17 (1-2mm H + <1mm H) — .29 % (I / E)

J) Hydrometer Reading: 10.5

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 4 (J-K) — .09 % (L / E)

M) Weight of Silt: 27.85 (E - I - L) — .62 % (M / E)

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TEXTURAL ANALYSIS

61

Batch Designation: 2 — Gravel 0% Sand 0% Silt 56% Clay 43%

Beaker Number:

Temperature: 22°

Sample Designation: B2-7

Time Set Up: 9:38:00

Time to Read Hydrometer: ~~2:32:48~~ 12:10:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	2.90
G) Sand Envelope	0	2.73
H) F-G	0	.17

I) Weight of Sand: .17 (1-2mm H + <1mm H) — 0 % (I / E)

J) Hydrometer Reading: 26.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 19.5 (J-K) — .43 % (L / E)

M) Weight of Silt: 25.35 (E - I - L) — .56 % (M / E)

TEXTURAL ANALYSIS

62

Batch Designation: 1 — Gravel 0 Sand 3% Silt 55% Clay 42%

Beaker Number: _____ — Temperature: 23° C

Sample Designation: B2-15 — Time Set Up: 6:35:00

2:29:26

Time to Read Hydrometer: 9:04:26

A) Total Sample Weight: 45.01

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

==========

E) Corrected Sample Weight: 45.01 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	4.10
G) Sand Envelope	0	2.77
H) F-G	0	1.33

I) Weight of Sand: 1.33 (1-2mm H + <1mm H) — .03 % (I / E)

J) Hydrometer Reading: 25.5

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 19.0 (J-K) — .42 % (L / E)

M) Weight of Silt: 24.68 (E - I - L) — .55 % (M / E)

TOP

Texture Analysis 8:15

Batch Designation 1

Beaker Number

Sample Designation B3-2

Gravel 0 Sand 0 Silt 59% Clay 41%

Temperature 22°C

Time to read 8:15:00 / 2:32:48

Hydrometer 10:47:48

Total Sample Weight 45.00

B Gravel + Envelope 0

Gravel Envelope ~~5.550~~

D Weight of Gravel B-C 0 — 0 % (D ÷ A)

E Corrected Sample Wt. A-D 45.00

	1-2MM	<1MM
F Sand + Envelope	~~5.550~~ 0	~~5.00~~ 2.89
G Sand Envelope	~~5.000~~ 0	~~5.00~~ 2.77
H F-G	0	.12

I Weight of Sand 1-2MM H + <1MM H .12 — 0 % (I ÷ E)

J Hydrometer Reading 25.0

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 18.5 — .41 % (L ÷ E)

M Weight of Silt E- (I + L) 26.38 — .59 % (M ÷ E)

8:09

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation B3-10

Gravel 0 Sand 0 Silt 46% Clay 54%

Temperature 22°C

Time to read 8:09:00 / 2:32:48

Hydrometer 10:41:48

Total Sample Weight 45.00

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 % (D ÷ A)

E Corrected Sample Wt. A-D 45.00

	1-2MM	<1MM
F Sand + Envelope	0	2.83
G Sand Envelope	0	2.81
H F-G	0	.02

I Weight of Sand 1-2MM H + <1MM H: .02 — 0 % (I ÷ E)

J Hydrometer Reading 31.0

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K: 24.5 — .54 % (L ÷ E)

M Weight of Silt E- (I + L): 20.48 — .46 % (M ÷ E)

TOP

TEXTURAL ANALYSIS

65

Batch Designation: 2 — Gravel 0% Sand 7% Silt 80% Clay 13%

Beaker Number: _____ — Temperature: 22°

Sample Designation: B3-18 — Time Set Up: 9:25:00

2:32:48

Time to Read Hydrometer: 11:57:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	5.87
G) Sand Envelope	0	2.77
H) F-G	0	3.1

I) Weight of Sand: 3.1 (1-2mm H + <1mm H) — .07 % (I / E)

J) Hydrometer Reading: 12.5

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 6 (J-K) — .13 % (L / E)

M) Weight of Silt: 35.92 (E - I - L) — .80 % (M / E)

B.H

TEXTURAL ANALYSIS

Batch Designation #2 Gravel 0% Sand 48% Silt 42% Clay 10%

Beaker Number

Temperature 22°

Sample Designation BH-2

Time Set Up 9:05:00

2:32:43

Time to Read Hydrometer 11:37:43

A) Total Sample Weight 44.98

B) Gravel + Envelope 0

C) Gravel Envelope 0

D) Weight of Gravel 0 (B-C) 0 % (D / A)

E) Corrected Sample Weight 44.98 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	24.52
G) Sand Envelope	0	2.72
H) F-G	0	21.80

I) Weight of Sand 21.80 (1-2mm H + <1mm H) .48 % (I / E)

J) Hydrometer Reading 11.0

K) Calgon Hydrometer Reading 6.5

L) Weight of Clay 4.5 (J-K) .10 % (L / E)

M) Weight of Silt .42 (E - I - L) .42 % (M / E)

B67

Texture Analysis 8:00

Batch Designation 1

Beaker Number

Sample Designation B4-12

Gravel 0% Sand 0% Silt 55% Clay 44%

Temperature 22°C

Time to read 8:00:00
2:32:48

Hydrometer 10:32:48

Total Sample Weight 44.99

B Gravel + Envelope 0

C Gravel Envelope 0

D Weight of Gravel B-C 0 — 0 % (D ÷ A)

E Corrected Sample Wt. A-D 44.99

		1-2MM	<1MM
F	Sand + Envelope	0	2.97
G	Sand Envelope	0	2.74
H	F-G	0	.23

I Weight of Sand 1-2MM H + <1MM H .23 — 0 % (I ÷ E)

J Hydrometer Reading 26.5

K Calgon Hydrometer Reading 6.5

L Weight of Clay J-K 20.0 — .44 % (L ÷ E)

M Weight of Silt E- (I + L) 24.76 — .55 % (M ÷ E)

(top)

TEXTURAL ANALYSIS

Batch Designation 2 Gravel 0 Sand 25% Silt 66% Clay 9%

Beaker Number

Temperature 22°

Sample Designation B4-20

Time Set Up 1:49:00
2:32:48

Time to Read Hydrometer 4:21:48

A) Total Sample Weight 45.01

Suspected Shale

B) Gravel + Envelope 2.80

C) Gravel Envelope 2.75

D) Weight of Gravel .05 (B-C) 0 % (D/A)

E) Corrected Sample Weight 45.01 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	2.92	14.10
G) Sand Envelope	2.80	2.77
H) F-G	.12	11.33

I) Weight of Sand 11.45 (1-2mm H + <1mm H) .25 % (I/E)

J) Hydrometer Reading 10.5

K) Calgon Hydrometer Reading 6.5

L) Weight of Clay 4.0 (J-K) .09 % (L/E)

M) Weight of Silt 29.56 (E-I-L) .66 % (M/E)

Texture Analysis 7:55

Batch Designation 1

Beaker Number

Sample Designation C1-2

Gravel 0 Sand 0 Silt 48% Clay 52%

Temperature 22°C

Time to read 7:55:00
2:32:48

Hydrometer 10:27:48

Total Sample Weight 45.02

B Gravel + Envelope 0

Gravel Envelope 0

D Weight of Gravel B-C 0 %
D ÷ A

E Corrected Sample Wt. A-D 45.02

		1-2MM	<1MM	
F	Sand + Envelope	0	2.69	
G	Sand Envelope	0	2.67	
H	F-G	0	.02	
I	Weight of Sand 1-2MM H + <1MM H	.02		0 % I ÷ E
J	Hydrometer Reading	30.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	23.5		.52 % L ÷ E
M	Weight of Silt E- (I + L)			.48 % M ÷ E

TEXTURAL ANALYSIS

70

Batch Designation: 2 — Gravel 0% Sand 1% Silt 62% Clay 37%

Beaker Number: ____ — Temperature: 22°

Sample Designation: C1-8 — Time Set Up: 1:35:00 / 2:32:48

Time to Read Hydrometer: 4:07:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	~~2.75~~ 3.35
G) Sand Envelope	0	2.75
H) F-G	0	0.6

I) Weight of Sand: 0.6 (1-2mm H + <1mm H) — .01 % (I / E)

J) Hydrometer Reading: 23.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 16.5 (J-K) — .37 % (L / E)

M) Weight of Silt: 27.92 (E - I - L) — .62 % (M / E)

TEXTURAL ANALYSIS

71

Batch Designation: 2 — Gravel 0 Sand 3% Silt 79% Clay 18%

Beaker Number:

Temperature: 21°

Sample Designation: C1-17

Time Set Up: 4:13:00 / 2:36:30

Time to Read Hydrometer: 6:49:30

A) Total Sample Weight: 36.18

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 36.18 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	3.96
G) Sand Envelope	0	2.70
H) F-G	0	1.26

I) Weight of Sand: 1.26 (1-2mm H + <1mm H) — .03 % (I / E)

J) Hydrometer Reading: 13.0

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 6.5 (J-K) — .18 % (L / E)

M) Weight of Silt: 28.42 (E - I - L) — .79 % (M / E)

BOT

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation C2-2

Gravel 0 Sand 3% Silt 56% Clay 41%

Temperature 23°C

Time to read 7:20:00 / 2:29:46

Hydrometer 9:49:46

A	Total Sample Weight		45.01
B	Gravel + Envelope	0	
C	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % (D ÷ A)

E	Corrected Sample Wt. A-D			45.01
		1-2MM	<1MM	
F	Sand + Envelope	0	4.02	
G	Sand Envelope	0	2.71	
H	F-G	0	1.31	
I	Weight of Sand 1-2MM H + <1MM H	1.31		.03 % (I ÷ E)
J	Hydrometer Reading	25.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	18.5		.41 % (L ÷ E)
M	Weight of Silt E- (I + L)	25.20		.56 % (M ÷ E)

TEXTURAL ANALYSIS

Batch Designation: 2 — Gravel 0% Sand 1% Silt 72% Clay 27%

Beaker Number:

Sample Designation: C2-6

Temperature: 22°

Time Set Up: 9:10:00

Time to Read Hydrometer: 2:32:48 / 11:42:48

A) Total Sample Weight: 45.02

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 45.02 (A-D)

	1-2mm	<1mm	
F) Sand + Envelope	0	3.23	
G) Sand Envelope	0	2.69	
H) F-G	0	.54	
I) Weight of Sand (1-2mm H + <1mm H)	.54		.01 % (I / E)
J) Hydrometer Reading	18.5		
K) Calgon Hydrometer Reading	6.5		
L) Weight of Clay (J-K)	12		.27 % (L / E)
M) Weight of Silt (E - I - L)	32.48		.72 % (M / E)

organic 0 %

TEXTURAL ANALYSIS

74

Batch Designation: 2 — Gravel 0 % Sand 8 % Silt 74 % Clay 18 %

Beaker Number:

Temperature: 21°

Sample Designation: 0.2-10

Time Set Up: 4:25:00

2:36:30

Time to Read Hydrometer: 7:01:30

A) Total Sample Weight: 44.99

B) Gravel + Envelope: 0

C) Gravel Envelope: 0

D) Weight of Gravel: 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight: 44.99 (A-D)

	1-2mm (shells & wood chips)	<1mm	
F) Sand + Envelope	2.77	6.38	
G) Sand Envelope	2.69	2.61	
H) F-G	.08	3.77	0 %
I) Weight of Sand	3.77 (1-2mm H + <1mm H)		.08 % (I / E)

J) Hydrometer Reading: 14.5

K) Calgon Hydrometer Reading: 6.5

L) Weight of Clay: 8 (J-K) — .18 % (L / E)

M) Weight of Silt: 33.14 (E - I - L) — .74 % (M / E)

TOP

8:20

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation C3-2

Gravel 0 Sand 0 Silt 61% Clay 39%

Temperature 22°C

Time to read 8:20:00
2:32:48

Hydrometer 10:52:48

	Total Sample Weight		45.02
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % D ÷ A

		1-2MM	<1MM	
E	Corrected Sample Wt. A-D			45.02
F	Sand + Envelope	0	2.84	
G	Sand Envelope	0	2.76	
H	F-G	0	.08	
I	Weight of Sand 1-2MM H + <1MM H	.08		0 % I ÷ E
J	Hydrometer Reading	24.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	17.5		.39 % L ÷ E
M	Weight of Silt E- (I + L)	27.44		.61 % M ÷ E

7:40

TOP

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation C3-7

Gravel 0 Sand 0% Silt 57% Clay 42%

Temperature 22°C

Time to read 7:40:00 / 2:32:48

Hydrometer 10:12:48

	Total Sample Weight		45.00
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % (D ÷ A)

E	Corrected Sample Wt. A-D			45.00
		1-2MM	<1MM	
F	Sand + Envelope	0	3.00	
G	Sand Envelope	0	2.81	
H	F-G	0	.19	
I	Weight of Sand 1-2MM H + <1MM H	.19		0 % (I ÷ E)
J	Hydrometer Reading	25.5		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	19.0		.42 % (L ÷ E)
M	Weight of Silt E- (I + L)	25.81		.57 % (M ÷ E)

B24

TEXTURAL ANALYSIS

Batch Designation 2 Gravel 0% Sand 11% Silt 75% Clay 14%

Beaker Number

Temperature 22°

Sample Designation C3-15

Time Set Up 1:55:00
2:32:48

Time to Read Hydrometer 4:37:46

A) Total Sample Weight 45.00g

B) Gravel + Envelope 0

C) Gravel Envelope 0

D) Weight of Gravel 0 (B-C) 0 % (D/A)

E) Corrected Sample Weight 45.00g (A-D)

	1-2mm (shells & organics)	<1mm
F) Sand + Envelope	0 ~~276~~	~~7.51~~
G) Sand Envelope	0 2.73	2.74
H) F-G	0 .13	4.83

H) F-G 0 % (Ia/E)

* Ia .03

I) Weight of Sand 4.83 (1-2mm H + <1mm H) .11 % (I/E)

J) Hydrometer Reading 13.0

K) Calgon Hydrometer Reading 6.5

L) Weight of Clay 6.5 (J-K) .14 % (L/E)

M) Weight of Silt 33.64 (E-I-L-Ia) .75 % (M/E)

Ia = weight of shells & organics

TOP

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation CH-2

Gravel 0% Sand 0% Silt 50% Clay 50%

Temperature 23°C

Time to read 7:05:00 / 2:29:46

Hydrometer 9:34:46

	Total Sample Weight		44.99
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % (D ÷ A)

		1-2MM	<1MM	
E	Corrected Sample Wt. A-D			44.99
F	Sand + Envelope	0	2.98	
G	Sand Envelope	0	2.80	
H	F-G	0	.18	
I	Weight of Sand 1-2MM H + <1MM H	.18		0 % (I ÷ E)
J	Hydrometer Reading	29.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	22.5		.50 % (L ÷ E)
M	Weight of Silt E- (I + L)	22.31		.50 % (M ÷ E)

BH

Texture Analysis

Batch Designation 1

Beaker Number

Sample Designation CH-10

Gravel 0 % Sand .9 % Silt 71 % Clay 28 %

Temperature 23°C

Time to read 7:12:00
2:24:46

Hydrometer 9:41:46

	Total Sample Weight		45.00
B	Gravel + Envelope	0	
	Gravel Envelope	0	
D	Weight of Gravel B-C	0	0 % (D ÷ A)

E	Corrected Sample Wt. A-D			45.00
		1-2MM	<1MM	
F	Sand + Envelope	0	3.05	
G	Sand Envelope	0	2.65	
H	F-G	0	.40	
I	Weight of Sand 1-2MM H + <1MM H	.40		.009 % (I ÷ E)
J	Hydrometer Reading	19.0		
K	Calgon Hydrometer Reading	6.5		
L	Weight of Clay J-K	12.5		.28 % (L ÷ E)
M	Weight of Silt E-I-L	32.1		.71 % (M ÷ E)

(E-I-L)

TEXTURAL ANALYSIS

80

Batch Designation 2 — Gravel 0% Sand 4% Silt 80% Clay 16%

Beaker Number

Temperature 22°

Sample Designation CH-18

Time Set Up 9:45:00

2:32:48

Time to Read Hydrometer 12:17:48

A) Total Sample Weight 45.02

B) Gravel + Envelope 0 (organics)

C) Gravel Envelope 0

D) Weight of Gravel 0 (B-C) — 0 % (D / A)

E) Corrected Sample Weight 45.02 (A-D)

	1-2mm	<1mm
F) Sand + Envelope	0	4.46
G) Sand Envelope	0	2.70
H) F-G	0	1.76

I) Weight of Sand 1.76 (1-2mm H + <1mm H) — .04 % (I / E)

J) Hydrometer Reading 13.5

K) Calgon Hydrometer Reading 6.5

L) Weight of Clay 7 (J-K) — .16 % (L / E)

M) Weight of Silt 36.26 (E - I - L) — .80 % (M / E)

APPENDIX B

Sediment Sample Laboratory Reports

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1987

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A1-1 9CBD 98-103cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.108	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.638		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1988

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: A1-11 9CBD 48-53cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.108	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.574		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00021	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1989

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: A1-21 9CBD 0-3cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: Diane Toft

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0869	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.706		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00025	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1990

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A2-1 9CBD 67-72cm Collected February 1995

Approved by: Diane Fiddle

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.127	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.683		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00047	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1991

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A2-8 9CBD 32-37cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.116	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.733		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00021	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1992

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A2-15 9CBD 0-2cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0491	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.743		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00033	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1993

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: A3-1 9CBC 73.5-78.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: Diane Fitte

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.114	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.653		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1994

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A3-8 9CBC 38.5-43.5cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.119	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.707		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

og Number: 95-R1995

Date Collected:
te Received: 10/10/95
te Code: 388000
Site: UNASSIGNED SAMPLING SITE
ments: A3-16 9CBC 0-3.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
monia as (N)	{ 9090}	0.0454	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.791		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1996

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A4-1 9CBC 95-100cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.130	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.770		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1997

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A4-10 9CBC 50-55cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.126	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.798		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1998

Date Collected: Time Collected: Collected By: Constance Holth
Date Received: 10/10/95 Time Received: 9:35 Project Code: RPI
Site Code: 388000 Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: A4-20 9CBC 0-5cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0524	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.794		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R1999

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: B1-1 9CBD 72.5-77.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.133	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.882		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R2000

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: B1-8 9CBD 37.5-42.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.114	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.615		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R2001

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B1-16 9CBD 0-2.5cm Collected February 1995

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0560	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.622		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R2002

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B2-1 9CBD 73.5-78.5cm Collected February 1995

Approved by: Diane Fitzke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.141	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.982		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	0.00021	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R2003

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: B2-8 9CBD 38.5-43.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.128	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.679		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/15/95

Report Date: 11/15/95

Log Number: 95-R2004

Date Collected:
Date Received: 10/10/95
Site Code: 388000
Site: UNASSIGNED SAMPLING SITE
Comments: B2-16 9CBD 0-3.5cm Collected February 1995

Time Collected:
Time Received: 9:35

Collected By: Constance Holth
Project Code: RPI
Project: MISCELLANEOUS

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0437	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.632		mg/g	15.	11/14/95	14:00	Diane
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2005

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B3-1 9CCA 87-92cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.142	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.655		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00029	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2006

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B3-9 9CCA 47-52cm Collected February 1995

Approved by: Diane Fiala

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.148	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.591		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00038	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2007

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B3-19 9CCA 0-2cm Collected February 1995

Approved by: Diane Fitze

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0477	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.722		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2008

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B4-1 9CCA 99-104cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0841	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.627		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2009

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B4-11 9CCA 49-54cm Collected February 1995

Approved by: Diane Litzke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.106	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.701		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2010

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: B4-21 9CCA 0-4cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0661	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.832		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00080	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2011

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C1-1 9CAC 82.5-87.5cm Collected February 1995

Approved by: Diane Litke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.148	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.676		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00148	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2012

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C1-9 9CAC 42.5-47.5cm Collected February 1995

Approved by: Diane Litzke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.149	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.901		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2013

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C1-18 9CAC 0-2.5cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0540	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.860		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2014

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C2-1 9CAC 50-55cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.109	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.536		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2015

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C2-5 9CAC 30-35cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0899	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.655		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2016

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C2-11 9CAC 0-5cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0452	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.823		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00117	0.00020	mg/g		11/ 3/95	16:30	Diane

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2017

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C3-1 9CAC 77-82cm Collected February 1995

Approved by: Diane Fitzke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.121	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.664		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2018

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C3-8 9CAC 42-47cm Collected February 1995

Approved by: Diane Fitzke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.115	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.674		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2019

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C3-16 9CAC 2-7cm Collected February 1995

Approved by: Diane Fiala

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0264	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.617		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2020

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C4-1 9CAC 90-95cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.116	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.745		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2021

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C4-9 9CAC 50-55cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.127	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.675		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	ND	0.00020	mg/g		11/ 3/95	16:30	Diane

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Original Report Date: 11/14/95

Report Date: 11/14/95

Log Number: 95-R2022

Date Collected:
Time Collected:
Collected By: Constance Holth
Date Received: 10/10/95
Time Received: 9:35
Project Code: RPI
Site Code: 388000
Project: MISCELLANEOUS
Site: UNASSIGNED SAMPLING SITE
Comments: C4-19 9CAC 0-5cm Collected February 1995

Approved by: Diane Little

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia as (N)	{ 9090}	0.0462	0.00010	mg/g	10.	11/ 3/95	16:30	Diane
Phosphate as (P) (Total)	{ 9416}	0.675		mg/g	15.	11/ 9/95	16:00	Dennis
Nitrate + Nitrite (N)	{ 9558}	0.00036	0.00020	mg/g		11/ 3/95	16:30	Diane

APPENDIX C

Piezometer Readings:

Water Levels

pH, electrical conductivity, and temperature table

ELECTRICAL CONDUCTIVITY, pH, AND TEMPERATURE OF GROUNDWATER SAMPLES

(obtained October 28, 1995)

NEST A			
Depth	**Cond.**	**pH**	**Temp.**
1-2 ft.	897	7.64	40.2
2-3 ft.	927	7.95	39.0
4-5 ft.	985	7.72	40.0
6-7 ft.	1056	7.77	39.6

NEST B			
Depth	**Cond.**	**pH**	**Temp.**
1-2 ft.	1180	7.9	40.3
2-3 ft.	1125	7.87	40.5
4-5 ft.	1064	7.91	40.7
6-7 ft.	------	------	------

NEST C			
Depth	**Cond.**	**pH**	**Temp.**
1-2 ft.	1628	8.9	41.7
2-3 ft.	1190	8.14	42.3
4-5 ft.	1153	8.26	41.8
6-7 ft.	960	8.12	41.9

Piezometer Water Levels
(measured on October 28, 1995)

Nest A (mouth)

Piezometer Depth (ft)	Water Level	Water Surface to Top of Riser	Head Relative to Water Surface
1--2	2.54	902.58	900.04
2--3	2.46	902.59	900.13
4--5	2	902.52	900.52
6--7	0.54	900.65	900.1

Nest B (middle)

Piezometer Depth (ft)	Water Level	Water Surface to Top of Riser	Head Relative to Water Surface
1--2	1.82	901.78	899.96
2--3	2.54	902.54	900.08
4--5	2.4	902.69	900.3
6--7	void	902.45	void

Nest C (near the reservoir)

Piezometer Depth (ft)	Water Level	Water Surface to Top of Riser	Head Relative to Water Surface
1--2	2.56	902.65	900.08
2--3	3.23	903.4	900.17
4--5	2.35	902.52	900.17
6--7	2.19	902.64	900.46

APPENDIX D

Discharge Measurement Notes

Precipitation Data

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....

Comp. by .....

Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. .....

Tongue River Ln. West of Ranch Rd.

Date June 1, 1995 Party [illegible]

Width 25 Area 78.25 Vel. 1.14 G.H. ..... Disch. 89.4

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter AA

Date rated ..... for rod, other.

Meter 0.5 ft. above bottom of weight.

Spin before meas. 2 min. after OK

Meas. plots ... % diff. from rating .....

(Wading), cable, ice, boat, upstr., (downstr.) of side

(bridge) 1 feet, (mile), (above) below

gage, and Reservoir

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section Overcast

Flow ..... Weather Cold & Windy ≈ 30°

Other ..... Air .....°F@ .....

Gage ..... Water .....°F@ .....

..... Record removed ..... Intake flushed U .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES ICE COVER

River, at
Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Revolutions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Area	Discharge
0	ICE W @ 1530										
2	2	1.5		.6		5	40	.202	.202	3	.61
4	2	1.7		{		5	45	.262	.263	3.4	.63
6	2	1.5		}		7	41	.392	.272	3.6	1.4
8	1.5	2.3		}		10	42	.539	.538	3.45	1.8
9	1	2.4				15	48	.701	.701	2.4	1.7
10	1	2.7		.8		15	44	.763	.689	2.7	1.9
				.2		15	55	.615			
11	1	2.9		.8		20	53	.637	.728	2.9	2.1
				.2		15	41	.818			
12	1	3.1		.8		20	40	1.11	.945	3.1	3.0
				.2		15	43	.780			
13	1	3.3		.8		25	45	1.23	1.061	3.3	3.5
				.2		20	50	.892			
14	1	3.3		.8		25	41	1.35	1.13	3.3	3.7
				.2		20	49	.916			
15	.75	3.4		.8		30	47	1.41	1.30	2.55	3.3
				.2		25	47	1.18			
15.5	0.5	3.4		.8		30	46	1.44	1.34	1.7	2.3
				.2		25	45	1.23			
16	0.5	3.5		.8		30	43	1.54	1.42	1.75	2.5
				.2		25	43	1.29			
16.5	0.5	3.5		.8		30	43	1.54	1.52	1.75	2.7
				.2		30	44	1.51			
17	0.5	3.5		.8		30	42	1.58	1.62	1.75	2.8
				.2		30	40	1.65			
17.5	0.5	3.5		.8		35	47	1.69	1.66	1.75	2.9
				.2		30	41	1.62			
18	0.5	3.6		.8		30	41	1.62	1.71	1.8	3.1
				.2		40	49	1.8			

			.2	40	48	.84			
19	0.5	3.6	.8	30	42	1.58	1.64	1.8	3.0
			.2	40	52	.70			
19.5	0.5	3.6	.8	30	46	1.44	1.6	1.8	2.7
			.2	40	50	1.76			
20	0.5	3.7	.8	25	43	1.29	1.52	1.85	2.8
			.2	40	50	1.76			
20.5	0.5	3.7	.8	20	42	1.06	1.40	1.85	2.6
			.2	40	51	1.73			
21	.75	3.8	.8	20	45	.989	1.36	2.85	3.9
			.2	40	51	1.73			
22	1	3.9	.8	20	47	.948	1.30	3.9	5.1
			.2	40	53	1.67			
23	1	3.9	.8	20	45	.989	1.34	3.9	5.1
			.2	40	52	1.70			
24	1	4.1	.8	20	40	1.11	1.36	4.1	5.6
			.2	30	41	1.62			
25	1	4.3	.8	25	50	1.11	1.30	4.3	5.8
			.2	30	41	1.62			
26	1	4.6	.8	25	47	1.18	1.36	4.6	6.3
			.2	30	43	1.54			
27	0.5	4.6	.8	25	48	1.16	1.3	2.3	3.0
VEDGE		& REIN @ 6:06pm	.2	30	46	1.44			
								76.25	89.0

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....
Comp. by .....
Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. .....

Tongue River 1 mi. West of Renwick Dam

Date April 15, 19 75 Party Construction Co

Width 25 Area 198.2 Vel. 1.91 G.H. ..... Disch. 379.24

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter AA

Date rated ..... for rod, other.

Meter 0.5 ft. above bottom of weight.

Spin before meas. 2 min. after ok

Meas. plots ... % diff. from rating .....

(Wading,) cable, ice, boat, upstr., (downstr.,) side

(bridge) 1 feet, (mile,) (above,) below

gage, and Reservoir

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section overcast

Flow ..... Weather Cool, slight wind ≈ 45°

Other ..... Air .....°F@ .....

Gage ..... Water .....°F@ .....

..... Record removed ..... Intake flushed U .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES ICE COVER

River, at

Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Rev-olu-tions	Time in seconds	VELOCITY		Area	Discharge
								At point	Mean in vertical		
0	LEW @ 2:30pm										
13	7.0	4.3		.8		20	42	1.06	1.81	30.1	54
				.2		5	40	.292			
14	1	4.5		.8		25	42	1.32	.806	4.5	3.6
				.2		5	40	.292			
15	1	4.8		.8		25	41	1.35	.815	4.8	3.9
				.2		5	42	.28			
16	1	5.0		.8		30	43	1.54	1.04	5.0	5.2
				.2		10	42	.539			
17	0.75	5.2		.8		30	42	1.58	.978	3.9	3.8
				.2		7	43	.375			
17.5	0.5	5.4		.8		40	54	1.63	1.15	2.7	3.1
				.2		15	50	.674			
18	0.5	5.3		.8		30	41	1.62	1.16	2.6	3.0
				.2		15	48	.701			
18.5	0.5	5.5		.8		40	45	1.96	1.35	2.8	3.8
				.2		15	45	.747			
19	0.5	5.7		.8		40	48	1.84	1.29	2.8	3.6
				.2		15	45	.747			
19.5	0.5	5.9		.8		40	45	1.96	1.37	3.0	4.1
				.2		15	43	.780			
20	0.5	5.8		.8		40	46	1.92	1.38	2.9	4.0
				.2		15	40	.837			
20.5	0.5	6.0		.8		40	48	1.84	1.45	3.0	4.35
				.2		20	42	1.06			
21	0.5	5.9		.8		40	46	1.92	1.49	2.95	4.39
				.2		20	42	1.06			
21.5	0.5	6.0		.8		40	45	1.96	1.55	3	4.5
				.2		25	49	1.13			

			.2	30	49	1.35				
22.5	0.5	6.2	.8	40	44	2.00				
			.2	30	45	1.47				
23	0.5	6.3	.8	40	40	2.20	1.77	3.15	5.6	
			.2	30	49	1.35				
23.5	0.5	6.3	.8	40	42	2.10				
			.2	30	41	1.62				
24	0.5	6.5	.8	40	40	2.20				
			.2	30	43	1.54				
24.5	0.5	6.6	.8	50	48					
			.2	40	50	1.76				
25	0.5	6.8	.8	50	49	2.24	2.1	3.4	7.1	
			.2	40	45	1.96				
25.5	0.5	7.0	.8	50	47	2.34	2.15	3	7.5	
			.2	40	45	1.96				
26	0.5	7.1	.8	50	45	2.44	2.22	3.55	7.9	
			.2	40	44	2.00				
26.5	0.5	7.0	.8	50	45	2.44	2.32	3.5	8.1	
			.2	40	40	2.20				
27	0.5	7.1	.8	50	47	2.34	2.37	3.55	8.4	
			.2	50	46	2.39				
27.5	0.5	7.1	.8	50	43	2.55	2.50	3.55	8.9	
			.2	50	45	2.44				
28	0.5	7.1	.8	50	43	2.55	2.55	3.55	8.	
			.2	50	43	2.55				
28.5	0.5	7.1	.8	50	42	2.61	2.68	3.7	9.9	
			.2	50	40	2.74				
29	0.5	7.4	.8	50	45	2.44	2.56	3.7	9.5	
			.2	50	41	2.68				
29.5	0.5	7.6	.8	50	42	2.61	2.64	3.8	10	
			.2	50	41	2.68				
30	0.5	7.7	.8	50	43	2.55	2.65	3.85	10.2	
			.2	60	43	2.74				
30.5	0.5	7.7	.8	50	43	2.55	2.58	3.85	9.9	

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Rev-olu-tions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Area	Discharg
				.2		50	42	2.61			
31	0.5	7.8		.8		50	45	2.44	2.5		10.
				.2		50	40	2.74			
31.5	0.5	8.0		.8		50	44	2.50	2.[illegible]	[illegible]	10.
				.2		50	43	2.55			
32	0.5	8.2		.8		50	44	2.50	2.42	4.1	9.9
				.2		50	47	2.34			
32.5	0.5	8.1		.8		50	44	2.50	2.35	4.05	9.5
				.2		40	40	2.20			
33	0.5	8.2		.8		50	43	2.55	2.38	4.1	9.8
				.2		40	40	2.20			
33.5	0.5	8.2		.8		50	45	2.44	2.34	4.1	9.6
				.2		50	49	2.24			
34	0.5	8.3		.8		50	46	2.39	2.19	4.15	9.1
				.2		40	44	2.00			
34.5	0.5	8.2		.8		50	46	2.39	2.12	4.1	8.7
				.2		40	48	1.84			
										198.2	[illegible]

GAGE READINGS

Time

☆ U.S. GOVERNMENT PRINTING OFFICE: 1973-0-508-2

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Rev-olu-tions	Time in seconds	VELOCITY		Area	Discharge
								At point	Mean in vertical		
35	0.5	8.3		.8		50	46	2.39	2.02	4.15	8.4
				.2		30	40	1.65			
35.5	0.5	8.3		.8		50	47	2.34	1.98	4.15	8.2
				.2		30	41	1.62			
36	0.5	8.3		.8		50	46	2.39	1.98	4.15	8.2
				.2		30	42	1.58			
36.5	0.5	8.3		.8		40	40	2.20	1.86	4.15	7.7
				.2		30	45	1.47			
37	0.5	8.3		.8		40	40	2.20	1.86	4.15	7.8
				.2		30	42	1.58			
37.5	0.5	8.4		.8		40	42	2.10	1.85	4.2	7.8
				.2		40	54	1.63			
38	.25	8.4		.8		40	41	2.15	1.9	4.2	8.0
				.2		30	40	1.65			379.3

GAGE READINGS

Time

☆ U.S. Government Printing Office: 1977-0-239-77

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....
Comp. by .....
Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. .....

Tongue River 1 mi. West of Ranch Dam

Date April 30 1975 Party Ustaris, J.

Width 18.5 Area 50.32 Vel. 1.17 G.H. ..... Disch. 59.02

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter AA

Date rated ..... for rod, other.

Meter 0.5 ft. above bottom of weight.

Spin before meas. 1.14 after OK

Meas. plots ... % diff. from rating .....

Wading, cable, ice, boat, upstr. (downstr.) of side

(bridge) 1 feet (mile) (above) below

gage, and Reservoir

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section .....

Flow ..... Weather Sunny but cool ≈ 45°

Other ..... Air .....°F@ .....

Gage ..... Water .....°F@ .....

..... Record removed ..... Intake flushed U L .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES ICE COVER

River, at .....

Creek, near .....

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Revolutions	Time in seconds	VELOCITY		Area	Discharge
								At point	Mean in vertical		
0	2.5	LEW	@	12'45							
5	2.75	1.5		.6		20	44	1.01		4.12	4.16
5.5	.5	1.3				20	43	1.03		.65	.67
6	.5	1.5				20	43	1.03		.75	.77
6.5	.5	1.6				20	40	1.11		.80	.888
7	.5	1.7				20	41	1.08		.85	.918
7.5	.5	1.8				20	42	1.06		.90	.954
8	.5	2.0				20	44	1.01		1.0	1.01
8.5	.5	2.1				20	40	1.11		1.05	1.17
9	.5	2.1				20	41	1.08		1.05	1.13
9.5	.5	2.2				20	42	1.06		1.1	1.17
10	.5	2.3				20	41	1.08		1.15	1.24
10.5	.5	2.3				20	42	1.06		1.15	1.22
11	.5	2.3				20	44	1.01		1.15	1.16
11.5	.5	2.3				20	40	1.11		1.15	1.28
12	.5	2.3				25	46	1.20		1.15	1.38
12.5	.5	2.3				20	40	1.11		1.15	1.28
13	.5	2.3				30	56	1.19		1.15	1.37
13.5	.5	2.3				30	46	1.44		1.15	1.66
14	.5	2.2				25	41	1.35		1.1	1.48
14.5	.5	2.3				30	46	1.44		1.15	1.66
15	.5	2.3				30	47	1.41		1.15	1.62
15.5	.5	2.3				30	47	1.41		1.15	1.62
16	.5	2.3				30	45	1.47		1.15	1.69
16.5	.5	2.4				30	44	1.51		1.2	1.81
17	.5	2.4				30	42	1.58		1.2	1.90
17.5	.5	2.6		.8		30	50	1.33	1.44	1.3	1.87
				.2		30	43	1.54			
18	.5	2.6		.8		30	54	1.23	1.42	1.3	1.85
				.2		30	41	1.62			

				.2	30	44	1.51			
19	.5	2.8		.8	20	44	1.01	1.26	1.4	1.76
				.2	30	44	1.51			
19.5	.5	2.9		.8	20	42	1.06	1.28	1.45	1.86
				.2	30	44	1.51			
20	.5	3.1		.8	20	54	.827	1.16	1.55	1.80
				.2	30	44	1.51			
20.5	.5	3.3		.8	20	54	.827	1.13	1.65	1.86
				.2	30	46	1.44			
21	.5	3.6		.8	20	51	.875	1.09	1.8	1.96
				.2	30	51	1.3			
21.5	.5	3.7		.8	20	50	.892	1.00	1.85	1.85
				.2	30	60	1.11			
22	.5	3.8		.8	20	42	1.06	1.17	1.9	2.2
				.2	30	52	1.28			
22.5	.5	3.7		.8	20	44	1.01	1.0	1.85	1.85
				.2	20	45	.989			
23	.5	3.2		.8	20	40	1.11	1.10	1.6	1.76
				.2	20	41	1.08			
23.5	.5	3.4		.8	20	50	.892	.79	1.7	1.34
V. EDGE		@ REW		.2	20	66	.681			
		@ 2:00 pm							50.32	59.0

9-275-F
(Rev. 10-81)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Meas. No. .....

Comp. by. .....

WATER RESOURCES DIVISION

Sta. No. ..... **DISCHARGE MEASUREMENT NOTES** Checked by .....

Bridge 1 mile East of Kennick Reservoir

Date 5-27 ..., 19 95 ... Party .....

Width 17 Area 23.9 Vel. .98 G. H. ..... Disch. 23.37

Method ..... No. secs. ..... G. H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

Type of meter ..... Date rated ..... Tag checked .....

Meter ..... ft. above bottom of wt. Spin before meas. 1 min. after OK ...

Meas. plots ..... % diff. from ..... rating. Levels obtained .....

GAGE READINGS						WATER QUALITY MEASUREMENTS
Time		Inside	ADR	Graphic	Outside	No .....Yes..... Time .....
.....	.....	.....	.....	.....	.....	Sampies Collected
.....	.....	.....	.....	.....	.....	No .....Yes..... Time .....
.....	.....	.....	.....	.....	.....	Method Used
.....	.....	.....	.....	.....	.....	EDI .....EWI..... Other.....
.....	.....	.....	.....	.....	.....	SEDIMENT SAMPLES
.....	.....	.....	.....	.....	.....	No .....Yes..... Time .....
.....	.....	.....	.....	.....	.....	Method Used
.....	.....	.....	.....	.....	.....	EDI .....EWI..... Other.....
Weighted M.G.H.		.....	.....	.....	.....	BIOLOGICAL SAMPLES
G. H. correction		.....	.....	.....	.....	Yes..... Time .....
Correct M.G.H.		.....	.....	.....	.....	No .....Type .....

Check bar. chain found ..... changed to ..... at ... Reservoir

Wading, cable, ice, boat ... downstr., side bridge ... 1 ... feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow .....

Cross section .....

Control .....

Gage operating ..... Weather .....

Intake/Orifice cleaned ..... Air ..... °C@ ..... Water ..... °C@ .....

Record removed ..... Extreme Indicator: Max. ..... Min. .....

Manometer N_2 Pressure Tank ..... Feed ..... Bbl rate ..... per min.

CSG checked ..... Stick reading .....

Observer .....

HWM ..... outside, in well

Remarks .....

.....

.....

G.H. of zero flow ..... ft. Sheet No. ..... of ..... sheets

River at—

Angle coefficient	Dist. from initial point	Width	Depth	Observation depth	Revolutions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Adjusted for hor. angle or	Area	Discharge
	0	left	edge			0	11.0				
	2	1.25	.6	.6	30	41	.743			.75	.56
⊙	2½	.5	.65	.6	40	44	.916			.325	.30
	3	.5	.85	.6	40	43	.937			.425	.40
	3½	.5	.9	.6	40	48	.842			.45	.38
	4	.5	1	.6	40	45	.896			.5	.45
	4½	.5	1.05	.6	50	49	1.02			.525	.53
	5	.5	1.05	.6	50	48	1.05			.525	.55
	5½	.5	1.15	.6	50	46	1.09			.575	.63
	6	.5	1.2	.6	50	47	1.07			.6	.64
	6½	.5	1.2	.6	50	49	1.02			.6	.61
	7	.5	1.15	.6	40	42	.958			.575	.55
	7½	.5	1.1	.6	40	40	1.00			.55	.55
	8	.5	1.2	.6	40	40	1.00			.6	.6
	8½	.5	1.2	.6	50	46	1.09			.6	.65
	9	.5	1.2	.6	50	47	1.07			.6	.64
	9½	.5	1.2	.6	50	44	1.14			.6	.68
	10	.5	1.2	.6	50	42	1.19			.6	.71
	10½	.5	1.3	.6	50	43	1.16			.65	.75
	11	.5	1.3	.6	50	46	1.09			.65	.71

	12	.5	1.3	.6	50	[illegible]	1.07		.6[illegible]	.76
	12½	.5	1.3	.6	50	43	1.16		.65	.75
	13	.5	1.4	.6	50	42	1.19		.7	.83
	13½	.5	1.4	.6	50	42	1.19		.7	.83
	14	.5	1.45	.6	50	43	1.16		.725	.84
	14½	.5	1.5	.6	50	47	1.07		.75	.80
	15	.5	1.6	.6	40	41	1.22		.8	.98
	15½	.5	1.75	.6	30	43	.710		.87[illegible]	.62
	16	.5	1.85	.6	40	50	.810		.925	.75
	16½	.5	1.9	.6	40	47	.859		.95	.82
	17	.5	2.05	.6	40	44	.918		1.025	.94
	17½	.5	2.1	.6	40	40	1.00		1.05	1.05
	18	.5	2.1	.6	50	47	1.07		1.05	1.12
	18½	.5	2	.6	40	45	1.11		1	1.11
	19	.5	1.85	.6	15	57	.310		.925	.29
	19	.25	1.7	.6	5	53	.120		.425	.05
	[illegible]									
	Right edge of water								23.9	23.37

THIS SIDE

.0 .10 .20 .30 .40 .50 .60 .70 .75

9–275–H
(Rev. 6–71)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....
Comp. by .....
Checked by .....

Sta. No. .....

DISCHARGE MEASUREMENT NOTES

Bridge 1 mi. W. of Res. Res.

Date July 8, 1975 Party .....

Width 1.62 Area 8.03 Vel. .69 G.H. ..... Disch. 5.53

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

Type of meter ..... Date rated ..... for rod, other.

Meter ..... ft. above bottom of wt. Spin before meas. 1 min. after OK

Meas. plots ..... % diff. from ..... rating. (Wading), cable, ice, boat, upstr., (downstr.), side

(bridge) 1 feet (mile), (above), below gage. Levels obtained Reservoir

BASE GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

AUX. GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Check-bar, chain found ..... changed to ..... at .....

Check-bar, chain found ..... changed to ..... at .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section .....

Flow ..... Weather .....

Other ..... Air ..... ° F. @ .....

Gage ..... Water ..... ° F. @ .....

..... Record removed ..... Intake flushed U L .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft. Sheet No. ..... of ..... sheets.

River at—

Angle coefficient	Dist. from initial point	Width	Depth	Observation depth	Revolutions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Adjusted for hor. angle or ----	Area	Discharge
	[illegible]			[illegible]							
LEW	0										
	2	1.25	.65	.6	50	46	1.09			.81	.53
	2.5	.5	.8	.6	25	43	.596			.4	.24
	3	.5	.9	.6	30	43	.716			.45	.32
	3.5	.5	1.1	.6	30	42	.714			.55	.40
	4	.5	1.15	.6	25	44	.568			.55	.31
	4.5	.5	1.2	.6	25	41	.629			.6	.37
	5	.5	1.3	.6	25	40	.657			.65	.41
	5.5	.5	1.4	.6	20	47	.444			.7	.31
	6	.5	1.35	.6	7	42	.191			.67	.13
	6.5	.5	1.5	.6	20	40	.516			.75	.39
	7	.5	1.55	.6	90	42	.958			.77	.74
	7.5	.5	1.5	.6	40	43	.937			.75	.70
⊙	8	.25	1.4	.6	40	48	.842			.35	.30
	[illegible]	Left vertical edge									
										8.03	5.53

.0 .10 .20 .30 .40 .50 .60 .70 .75 1.0

.0 .10 .20 .30 .40 .50 .60 .70 .75

.80 .85 .90 .92 .94 .96 .97

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas No .....
Comp by .....
Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. Bridge 1 mi. W. of Ren. Res.

Date July 30, 1995 Party Constance & Jo

Width 6 Area 3.54 Vel. 0.5 G.H. ..... Disch. 1.77

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS

Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter pygmy

Date rated ..... for rod, other.

Meter ..... ft. above bottom of weight.

Spin before meas. 2 min after OK

Meas. plots ... % diff. from rating .....

(Wading), cable, ice, boat, upstr. (downstr.), side

(bridge) 1 feet, (mile), (above) below

gage, and Reservoir

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section , Scattered clouds

Flow ..... Weather Warm, nice ≈ 60°

Other ..... Air ..... °F@ .....

Gage ..... Water ..... °F@ .....

..... Record removed ..... Intake flushed U L .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES ICE COVER

River, at

Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Revolutions	Time in seconds	VELOCITY		Area	Discharge
								At point	Mean in vertical		
LEW	0										
	1	.25		.3	.6	20	40	.516		.075	.04
	1.5	.5		.3		20	44	.472		.15	.07
	2.0	.5		.3		30	52	.592		.15	.09
	2.5	.5		.3		20	40	.516		.15	.08
	3.0	.5		.3		30	56	.551		.15	.08
	3.5	.5		.4		20	43	.482		.20	.10
	4.0	.5		.4		30	58	.533		.20	.11
	4.5	.5		.5		30	52	.592		.25	.15
	5.0	.5		.75		20	43	.482		.38	.18
	5.5	.5		.95		15	45	.354		.48	.17
	6.0	.5		1.05		30	54	.571		.52	.30
	6.5	.5		1.15		20	44	.472		.58	.27
	7.0	.25		1.0		20	41	.505		.25	.13
										3.54	1.77

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....

Comp. by .....

Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. .....

Date 9-11, 19 95 Party .....

Width 12 Area 13.1 Vel. .83 G.H. ..... Disch. 10.85

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter .....

Date rated ..... for rod, other.

Meter ..... ft. above bottom of weight.

Spin before meas See * after .....

Meas. plots ... % diff. from rating .....

(Wading) cable, ice, boat, upstr., (downstr.) of side

@ bridge 1 feet (mile) (above) (below)

gage, and ROS.

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section .....

Flow ..... Weather .....

Other ..... Air ..... °F@ .....

Gage ..... Water ..... °F@ .....

..... Record removed ..... Intake flushed U L .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

* meter did not spin long (about 10 sec) because it needed oil, we did not have any this time

DISCHARGE MEASUREMENT NOTES ICE COVER

River, at

Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Rev-olu-tions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Area	Discharge
0	REW										
2.5ft	1.5	.4				15	54	.299		.6	.179
3	.5	.4				25	49	.526		.2	.105
3.5	.5	.3				35	48	.739		.15	.111
4	.5	.3				40	49	.826		.15	.124
4.5	.5	.3				46	53	.765		.15	.115
5	.5	.3				30	44	.694		.15	.104
5.5	.5	.3				25	45	.596		.15	.089
6	.5	.4				25	48	.537		.2	.107
6.5	.5	.6				30	46	.665		.3	.199
7	.5	.5				25	42	.610		.4	.244
7.5	.5	.9				30	45	.571		.45	.257
8	.5	1.0				30	40	.761		.5	.380
8.5	.5	1.2				45	45	.896		.6	.538
9	.5	1.3				45	55	.810		.65	.527
9.5	.5	1.5				40	47	.859		.75	.644
10	.5	1.5				46	40	1.00		.75	.75
10.5	.5	1.7				50	42	1.19		.85	1.01
11	.5	1.8				50	40	1.25		.9	1.12
11.5	.5	1.8				45	41	1.09		.9	.981
12	.5	1.7				40	51	.794		.85	.675
12.5	.5	1.8				30	47	.639		.9	.575
13	.5	1.8				46	48	.842		.9	.758
13.5	.5	1.7				50	48	1.05		.85	.892
14	.5	1.6				20	47	.444		.8	.355
14.5	Left vertical Edge									13.1	10.84

9-275a
(Rev. July 1973)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....

Comp. by .....

Checked by .....

DISCHARGE MEASUREMENT NOTES

Sta. No. .....

Tongue River 1 mi. West of Ranch Dam

Date Oct. 8, 1995 Party NC [illegible]

Width 16 Area 29.18 Vel. .79 G.H. ..... Disch. 23.11

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

GAGE READINGS

Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter Pygmy

Date rated ..... for rod, other.

Meter ..... ft. above bottom of weight.

Spin before meas. S.I.S.C. after OK

Meas. plots ... % diff. from rating .....

Wading, cable, ice, boat, (upstr.) downstr., side

(bridge) ..... 1 ..... feet, (mile) (above) below

gage, and [illegible]

Check-bar, found .....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section .....

Flow ..... Weather [illegible]

Other ..... Air ..... °F@ .....

Gage ..... Water ..... °F@ .....

..... Record removed ..... Intake flushed U L .....

Observer .....

.....

Control .....

.....

Remarks [illegible]

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES – ICE COVER

River, at

Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Revolutions	Time in seconds	VELOCITY		Area	Discharge
								At point	Mean in vertical		
0	.5	[illegible]		[illegible]							
1	.75	.4		.6		15	54	.599		.3	.090
[illegible]	.5	.55		[illegible]		[illegible]	[illegible]	.821		[illegible]	[illegible]
2.0	.5	.75		[illegible]		[illegible]	[illegible]	.796		.375	[illegible]
2.5	.5	.85		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	.116
3.0	.5	1.0		[illegible]		20	45	[illegible]		[illegible]	.23
3.5	.5	1.1		[illegible]		20	42	.493		.55	.271
4.0	.5	1.35		[illegible]		25	43	[illegible]		.675	.402
4.5	.5	1.4		[illegible]		30	45	[illegible]		.7	.475
5.0	.5	1.35		[illegible]		[illegible]	[illegible]	.761		.675	.514
5.5	.5	1.4		[illegible]		40	51	.794		.70	.556
6.0	.5	1.4		[illegible]		[illegible]	51	.794		.70	.556
6.5	.5	1.4		[illegible]		30	47	.659		.70	.601
7.0	.5	1.35		[illegible]		40	50	.810		.675	.547
7.5	.5	1.35		[illegible]		[illegible]	53	.765		.675	.516
8.0	.5	1.3		[illegible]		50	[illegible]	.763		.65	.496
8.5	.5	1.3		[illegible]		[illegible]	[illegible]	[illegible]		.65	.547
[illegible]	.5	1.3		[illegible]		[illegible]	[illegible]	.878		.65	.571
[illegible]	.5	1.55		[illegible]		40	46	.836		.775	.648
[illegible]	.5	1.7		[illegible]		[illegible]	[illegible]	.761		.85	.833
[illegible]	.5	1.8		[illegible]		50	50	1.0		.9	.9
[illegible]	.5	1.95		[illegible]		50	[illegible]	1.07		.975	1.04
[illegible]	.5	2.1		[illegible]		50	45	1.11		1.05	1.17
12.0	.5	2.25		[illegible]		50	45	1.11		1.12	1.24
12.5	.5	2.35		[illegible]		[illegible]	50	1.0		1.18	1.18
13.0	.5	2.5		[illegible]		50	51	.956		1.25	1.2
13.5	.5	2.6		.3		30	50	.761	.926	1.3	1.2
				.2		50	46	1.09			
14.0	.5	2.8		.3		30	44	.699	.742	1.4	1.05
				.2		50	[illegible]	.803			
[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

5.0	5	2.1		.2				.5			1.45	1.2(
				.2				.3				
15.5	5	2.2		.2		25	45	.511	.764		1.4	1.07
				..		45	--	.153				
16.0	5	2.1		.9		25	43	.596	.604		1.45	.88
				.2		25	41	.624				
16.5	5	2.8		.8		25	--	.544	.66		1.4	.87
				.2		25	--	.724				
17.0	5	2.9		.8		25	42	.482	.5..		1.7	.76
				.2		25	--	.610				
											29.18	23.1

9-275a
(Rev. June 1971)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Meas. No. .....

Comp. by .....

DISCHARGE MEASUREMENT NOTES

Station No. .....

Dungeness River 1 mile W. of Dungeness R.S. #2

Date 10-29 19 95 Party Constantine, Johnstone

Width 14 Area 18.12 Vel. 1.70 G.H. ..... Disch. 12.72

Method ..... No. rods ..... G.H. change ..... in ..... hrs Susp. .....

Method coef. ..... angle coef. ..... Susp. coef. ..... fc ..... %

GAGE READINGS				
Time		Recorder	Inside	Outside
Weighted M.G.H.				
G.H. correction				
Correct M.G.H.				

Type of meter Price AA #3

Date rated ..... fc ..... adj. coef.

Meter ..... ft. above bottom of weight

Spin before meas ..... after .....

Meas plots ..... % diff. from rating .....

(Wading), cable, ice, boat; upstr., (downstr.), side

(bridge) ..... 1 ..... feet (mile) (above), below

gage, and Reservoir

Check-bar, found ....

changed to ..... at .....

Correct .....

Levels obtained .....

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on following conditions: Cross section .....

Flow ..... Weather Sunny 50's ≈ 30°-35°

Other ..... Air ..... °F @ .....

Gage ..... Water ..... °F @ .....

..... Record removed ..... Intake flushed U .....

Observer .....

.....

Control .....

.....

Remarks .....

.....

.....

G.H. of zero flow ..... ft.

DISCHARGE MEASUREMENT NOTES—ICE COVER

River, at

Creek, near

Dist. from initial point	Width	Total depth of water	W.S. to bot. ice	Effective depth	Depth of meter below water surface	Rev-olu-tions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Area	Discharge
0	@	LEW									
2ft.	1.25	.5				7	45	.180		.625	.1125
2.5	.5	.6				20	47	.444		.3	.1332
3	.5	.7				25	46	.559		.35	.1957
3.5	.5	.7				30	43	.710		.35	.2485
4	.5	.75				30	40	.716		.375	.2685
4.5	.5	.75				30	43	.710		.375	.2663
5	.5	.7				30	42	.726		.35	.2541
5.5	.5	.7				30	43	.710		.35	.2485
6	.5	.6				30	44	.694		.3	.2082
6.5	.5	.65				30	42	.726		.325	.2359
7	.5	.7				30	42	.726		.35	.2541
7.5	.5	.7				30	47	.652		.35	.2282
8	.5	.8				30	47	.652		.4	.2608
8.5	.5	1.0				30	52	.592		.5	.326
9	.5	1.2				30	43	.710		.6	.426
9.5	.5	1.35				30	41	.743		.675	.5015
10	.5	1.45				40	49	.826		.725	.5989
10.5	.5	1.5				40	50	.810		.75	.6075
11	.5	1.65				30	44	.694		.825	.5725
11.5	.5	1.7				25	41	.624		.85	.5304
12	.5	1.8				30	47	.652		.9	.5868
12.5	.5	2.0				40	51	.794		1	.794
13	.5	2.1				40	46	.878		1.05	.9219
13.5	.5	2.2				40	44	.916		1.1	1.0076
14	.5	2.2				30	42	.726		1.1	.7986
14.5	.5	2.2				25	44	.583		1.1	.6413
15	.5	2.2				25	44	.583		1.1	.6413
15.5	.5	2.1				40	50	.810		1.05	.8505
16	@	RVE									12.7193
									A=	18.12	

Data obtained from internet site: ftp://ftp.ncdc.noaa.gov/pub/data/coop-precip/northdakota.txt

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

321435 CAVALIER 7 NW ND 1963 10 37 17 123 266 801 446 84 75 60 16
156 2091

yrs. Total (inches)

321435 CAVALIER 7 NW ND 1964 27 33 101 286 250 800 240 240 516 40
35 66 2634

321435 CAVALIER 7 NW ND 1965 2 3 59 246 348 259 233 182 451 90 115
54 2042

321435 CAVALIER 7 NW ND 1966 31 52 192 266 126 304 315 335 38 124
36 96 1915

321435 CAVALIER 7 NW ND 1967 113 5 38 297 123 140 186 107 82 102 43
86 1322

321435 CAVALIER 7 NW ND 1968 49 3 79 183 438 135 588 338 248 64 27
25 2177

321435 CAVALIER 7 NW ND 1969 126 79 14 29 110 310 242 135 196 205
15 72 1533

321435 CAVALIER 7 NW ND 1970 53 27 133 357 332 342 170 291 149 82
71 51 2058

321435 CAVALIER 7 NW ND 1971 73 8 167 131 56 561 348 47 66 294 20
19 1790

321435 CAVALIER 7 NW ND 1972 33 65 108 101 184 229 152 280 263 191
18 47 1671

321435 CAVALIER 7 NW ND 1973 0 8 96 43 161 334 316 261 314 244 102
52 1931

321435 CAVALIER 7 NW ND 1974 87 25 50 316 546 104 133 376 96 64 27
58 1882

no record

321435 CAVALIER 7 NW ND 1975 25 21 124 175 179 408 9999 9999 9999 9999
9999 9999 99999

321435 CAVALIER 7 NW ND 1976 9999 9999 9999 149 71 430 425 186 27 12
4 80 99999

321435 CAVALIER 7 NW ND 1977 102 95 33 23 381 9999 262 165 541 76
64 60 99999

321435 CAVALIER 7 NW ND 1978 9 4 6 116 232 65 273 130 329 14 51
48 1277

321435 CAVALIER 7 NW ND 1979 22 71 97 325 263 298 414 537 67 22 33
6 2155

321435 CAVALIER 7 NW ND 1980 38 16 14 0 90 174 412 741 384 186 58
7 2120

CAVALIER 7NW ND 1962 102 97 181 43 756 291 655 211 56 49 86 54

2581

321435 CAVALIER 7 NW ND 1981 14 57 49 81 275 538 156 332 173 298 32 2 2007

321435 CAVALIER 7 NW ND 1982 47 9 92 52 306 308 416 144 227 326 31 88 2046

321435 CAVALIER 7 NW ND 1983 37 12 135 19 91 205 233 129 246 195 54 6 1362

321435 CAVALIER 7 NW ND 1984 11 22 13 244 52 264 227 137 28 403 41 33 1475

321435 CAVALIER 7 NW ND 1985 10 25 40 40 341 301 182 612 191 158 93 4 1997

321435 CAVALIER 7 NW ND 1986 24 23 15 285 168 255 744 91 167 99 266 17 2154

321435 CAVALIER 7 NW ND 1987 21 149 43 0 208 258 525 218 133 30 23 25 1633

321435 CAVALIER 7 NW ND 1988 36 4 30 0 157 109 304 178 114 49 72 48 1101

321435 CAVALIER 7 NW ND 1989 98 5 86 33 209 316 44 137 85 13 49 19 1094

321435 CAVALIER 7 NW ND 1990 23 35 124 150 86 550 322 286 100 10 18 40 1744

321435 CAVALIER 7 NW ND 1991 12 36 27 220 262 401 439 169 333 256 55 47 2257

321435 CAVALIER 7 NW ND 1992 30 50 84 78 246 385 181 144 179 31 83 94 1585

321435 CAVALIER 7 NW ND 1993 23 0 21 16 290 595 846 466 56 62 27 45 2447

321435 CAVALIER 7 NW ND 1994 48 22 36 41 295 309 253 260 156 274 158 52 1904

load requested item for reason: -201

MONTHLY SUMMARIZED STATION AND DIVISIONAL DATA

NORTH DAKOTA
JANUARY 1995

STATION	TEMPERATURE (°F) AVERAGE MAXIMUM	AVERAGE MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	HIGHEST	DATE	LOWEST	DATE	HEATING DEGREE DAYS	COOLING DEGREE DAYS	NO. OF DAYS MAX 90 OR ABOVE	MAX 32 OR BELOW	MIN 32 OR BELOW	MIN 0 OR BELOW	PRECIPITATION (IN) TOTAL	DEPARTURE FROM NORMAL	GREATEST DAY	DATE	SNOW, SLEET TOTAL	MAX. DEPTH ON GROUND	DATE	NO. OF DAYS .10 OR MORE	.50 OR MORE	1.00 OR MORE
NORTH DAKOTA																								
NORTHWEST 01																								
BOWBELLS	14.7	.0	7.4	2.2	38	30	-15	25	1779	0	0	29	31	15	1.42	.90			M	24.1	M	1	0	0
CROSBY	16.0	1.3	8.7	1.3	40	30	-21	4	1741	0	0	28	31	16	.52		.34	16		9.8				
FORTUNA 1 W	14.7	-2.0	6.4	1.6	38	31	-22	4	1812	0	0	29	31	17	.65	.27	.65	17		8.0	M	1	1	0
FOXHOLM 7 N	16.1	1.5	8.8	3.6	35	31	-17	26	1735	0	0	30	31	17	1.06	.54	.39	17	M	8.9	M	3	0	0
KENMARE 1 WSW	15.3M	.4M	7.9M	2.0	42	31	-18	26	1775	0	0	28	29	14	1.55	.95			M	12.3	M	3	0	0
MINOT FAA AIRPORT	16.8	3.4	10.1	1.1	40	30	-14	4	1693	0	0	29	31	13	.79	.03	.50	17		30.5	19	25+	1	1	0
MINOT EXPERIMENT STN	14.3	.6	7.5	.7	39	31	-18	4	1778	0	0	30	31	17	.96	.27	.40	17		13.9	15	18	2	0	0
MOHALL	13.7	-2.0	5.9	1.7	39	31	-19	26	1831	0	0	29	31	20	1.01	.48	.22	18		19.3	17	29+	4	0	0
POWERS LAKE 1 N	13.7	-2.7	5.5	1.0	37	31	-20	5	1841	0	0	30	31	18	.46	.06	.30	16		10.0	14	30+	1	0	0
STANLEY 3 NNW	14.0	-.6	6.7	1.8	38	31	-18	5+	1801	0	0	30	31	18	.60	.07	.23	16		9.5	14	24+	3	0	0
TIOGA 1 E	14.2	-4.4	4.9	.5	38	31	-24	4	1861	0	0	29	31	20	.69	.26	.40	16		10.0	13	30+	1	0	0
WILDROSE	15.5	1.0	7.3	1.8	40	31	-17	4	1785	0	0	29	31	17	.55	.10	.45	16		7.8	11	16	1	0	0
WILLISTON WSO	19.2	1.5	9.4	.5	42	31	-25	4	1719	0	0	27	31	16	.91	.38	.62	16		16.1	13	17	2	1	0
WILLISTON EXP FARM	21.5	3.0	12.3	2.2	44	31	-18	4	1630	0	0	26	31	13	.78	.36	.72	16	M	9.8	13	16	1	1	0
--DIVISIONAL DATA---->			7.8	.9											.85	.34				13.5				
NORTH CENTRAL 02																								
BELCOURT KEYA RADIO	19.4	7.2	6.1	5.9	42	31	-24	5+	1818	0	0	30	31	24	.24	-.29			M	.0	4	18	0	0	0
BOTTINEAU	13.5	2.8	5.4	3.2	37	31	-22	4	1849	0	0	30	31	20	.57	.10	.25	18		11.0	18	19+	3	0	0
DRAKE 9 NE	14.0	1.5	6.3	.4	39	31	-20	5	1817	0	0	30	31	19M	.55		.28	17		13.0	16	30+	2	0	0
GRANVILLE	15.5	1.4	7.1		38	31+	-15	25	1791	0	0	29	31	21	.20	-.30	.20	18		5.0	16	18	1	0	0
LEEDS	14.7	3.2	5.8	2.9	39	31	-20	4	1831	0	0	30	31	23	.37	-.30	.31	18		5.0			1	0	0
MINNEHAUKAN	13.5	2.4	5.6		38	31	-18	5+	1836	0	0	30	31	23	.35		.20	17		5.5	M		2	0	0
ROLLA 3 NW	13.4	-.3	6.6	3.7	42	31	-15	7	1806	0	0	30	31	18	.40	-.09	.23	18	M	11.0	M		2	0	0
RUGBY	12.5	2.4	5.1	.7	38	30	-22	4	1857	0	0	29	31	20	.78	.30	.54	17		8.3	M		2	1	0
TOWNER 2 NE	13.8	3.9	5.0	1.5	40	31	-23	4	1857	0	0	30	31	21	.75	.23	.24	18		9.0	16	30+	3	0	0
UPHAM 3 N	14.4	4.9	4.8	2.8	43	31	-24	5+	1864	0	0	30	31	22	1.04	.52	.51	17		17.7	21	18	3	1	0
VELVA	16.6	.7	8.7	2.4	42	31	-17	25	1739	0	0	30	31	15M	.95	.12	.47	17		14.2	M		3	0	0
WESTHOPE	12.4	2.5	5.0	.5	38	30	-23	4	1858	0	0	29	31	20	1.39	1.00	.68	17		17.6	19	20+	4	1	0
WILLOW CITY	11.9	4.7	3.6	2.2	38	31	-24	4	1900	0	0	30	31	22M	.22		.11	18		12.5	M		1	0	0
--DIVISIONAL DATA---->			5.8	1.4											.61	.12				10.8				
NORTHEAST 03																								
CAVALIER 7 NW	12.8	3.6	4.6	2.7	40	31	-23	9	1871	0	0	30	31	19	.33	-.11	.32	18		4.3	14	30+	1	0	0
DEVILS LAKE KDLR	14.3	.1	7.2	3.3	40	31	-17	4	1788	0	0	30	31	19	.30	-.25	.13	17		M	7	30+	1	0	0
DRAYTON	13.5	1.5	6.0		40	31	-18	23+	1827	0	0	30	31	18	.58		.38	18	M	6.3	11	30+	1	0	0
EDMORE 1 NW	M	M	M													.00				M				
GRAFTON	13.6	.8	7.2	3.1	39	30	-19	23+	1791	0	0	29	31	16	.43	-.17	.28	17		5.1	M		2	0	0
GRAND FORKS FAA AP	16.4	.2	8.3	4.0	40	30	-17	23	1751	0	0	28	31	16	.43	-.29	.30	17		6.0	5	23+	1	0	0
GRAND FORKS UNIV	17.1	3.0	10.1	4.9	42	30	-16	4	1697	0	0	28	31	12	.80	-.06	.80	17		8.0	M		1	0	0
HANSBORO 4 NNE	14.5	4.3M	5.1M	1.3	41	30	-21	4	1857	0	0	29	29	21	.48	-.06	.37	16		4.6	5	27+	1	0	0
LANGDON EXP STATION	12.1	4.1	4.0	5.1	37	31	-23	4	1890	0	0	30	31	21	.56	-.06	.53	18		4.8	14	30+	1	1	0
LARIMORE	15.1	.6	7.3	3.2	39	31	-16	5+	1785	0	0	30	31	19	.15	-.48	.10	10	M	5.3	6	31	1	0	0
MC VILLE	13.0	1.2	5.9	1.1	36	30	-23	4	1832	0	0	29	31	19	.59	-.02	.49	17		7.0	6	17	1	0	0
PARK RIVER	16.4	1.4	8.9	3.2	40	30	-17	4	1737	0	0	29	31	14	.74	-.13	.52	17		6.7	M		1	0	0
PEMBINA	13.3	4.9	4.2	4.6	40	31	-25	9	1888	0	0	30	31	19	.31	-.18	.25	18		5.6	13	30+	1	0	0
PETERSBURG 2 N	12.3	3.4	4.5	2.7	36	31	-20	4	1875	0	0	30	31	22	.35	-.33	.28	18	M	8.0	M		1	0	0
--DIVISIONAL DATA---->			6.4	3.1											.47	-.10				5.8				

SEE REFERENCE NOTES FOLLOWING STATION INDEX

MONTHLY SUMMARIZED STATION AND DIVISIONAL DATA

NORTH DAKOTA
FEBRUARY 1995

STATION	TEMPERATURE (°F)													PRECIPITATION (IN)									
	AVERAGE MAXIMUM	AVERAGE MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	HIGHEST	DATE	LOWEST	DATE	HEATING DEGREE DAYS	COOLING DEGREE DAYS	NO. OF DAYS MAX 90 OR ABOVE	NO. OF DAYS MIN 32 OR BELOW	NO. OF DAYS MIN 0 OR BELOW	TOTAL	DEPARTURE FROM NORMAL	GREATEST DAY	DATE	SNOW, SLEET TOTAL	SNOW, SLEET MAX. DEPTH ON GROUND	SNOW, SLEET DATE	NO. OF DAYS .10 OR MORE	NO. OF DAYS .50 OR MORE	NO. OF DAYS 1.00 OR MORE
NORTH DAKOTA																							
NORTHWEST 01																							
BOWBELLS	24.1	6.9	15.5	4.5	42	22	16	13+	1380	0	0	16	28	.08		.03	10+	M	M		0	0	0
CROSBY	25.7	8.8	17.3	3.2	47	31	15	15	1334	0	0	15	27	.08	-.27	.04	14+	1.3	8	1	0	0	0
FORTUNA 1 W	26.1	6.6	16.4	4.9	45	20	18	15	1360	0	0	15	28	9				M					
FOXHOLM 7 N	24.8	8.9	16.9	5.8	46	22	12	13	1343	0	0	17	27	9				4.5	M		0	0	0
KENMARE 1 WSW	23.7	8.1	15.9	4.3	45	22	13	13+	1371	0	0	18	28	10		.13	2	3.1	M		0	0	0
MINOT FAA AIRPORT	23.3	8.9	16.1	1.3	47	22	11	12	1368	0	0	17	27	9		.15	1	3.4	8	2	0	0	0
MINOT EXPERIMENT STN	23.1	7.5	15.3	2.8	42	22	15	16+	1387	0	0	18	28	10		.11	2	3.0	9	1	0	0	0
MOHALL	22.0	4.2	13.1	3.2	43	22	16	14+	1449	0	0	19	28	13		.12	4	6.7	11	6+	1	0	0
POWERS LAKE 1 N	22.6	2.6	12.6	1.0	41	22	22	15+	1463	0	0	17	28	12		.06	10	2.2	2	0	1	0	0
STANLEY 3 NNW	23.6	6.3	15.0	3.9	42	22	13	14	1396	0	0	17	28	13		.08	08	1.0	M		0	0	0
TIOGA 1 E	24.3	5.1	14.7	3.1	42	22	20	12	1403	0	0	18	28	11		.25	04	1.5	M		0	0	0
WILDROSE	25.8	6.9	16.4	4.7	45	22	11	13	1353	0	0	16	28	11		.09	31	.8	8	1	0	0	0
WILLISTON WSO	29.6	10.2	19.9	3.8	50	23	11	13	1259	0	0	12	28	8		.21	07	2.6	8	1+	1	0	0
WILLISTON EXP FARM	32.7	12.4	22.6	5.4	53	23	13	12	1184	0	0	10	27	7		.21	06	2.6	8	1	1	0	0
--DIVISIONAL DATA-->			16.3	3.1										.25	-.16	.02	26+	.8	M		0	0	0
																		2.8					
NORTH CENTRAL 02																							
BELCOURT KEYA RADIO	24.9M	1.5M	13.2M	7.4	48	22+	22	14	1446	0	0	18	27	12M	.44			2.3	25	M	5.3	4	5	2	0	0
BOTTINEAU	19.8	1.8	10.8	2.5	42	22	20	14	1515	0	0	23	28	11	.41	.01		.12	10		12.0	18	15+	1	0	0
DRAKE 9 NE	22.0	4.1	13.1		43	22	17	14	1450	0	0	19	28	13	.55			.30	10		13.0	20	19+	1	0	0
GRANVILLE	22.9	4.7	13.8	1.0	42	21	19	14	1431	0	0	18	28	12							M	M				
LEEDS	20.5	3.9	12.7	1.9	42	22	20	14	1517	0	0	21	28	15	.19	-.25		.08	25		5.0	M	M	0	0	0
MINNEHAUKAN	19.9	2.6	11.3		42	22	20	16+	1503	0	0	22	28	12	.25			.12	15	M	6.0	M	M	1	0	0
ROLLA 3 NW	20.1	3.2	11.7	3.3	49	22	16	13	1481	0	0	22	28	12	.48	-.03		.16	25		M	M	M	3	0	0
RUGBY	20.3	2.1	11.2	3.9	42	21	20	18	1502	0	0	21	28	12	.28	-.10		.08	14		5.5	M	M	0	0	0
TOWNER 2 NE	21.3	1.3	11.3	1.7	43	22+	21	15	1499	0	0	20	28	14	.36	-.12		.23	5		7.5	19	19+	1	0	0
UPHAM 3 N	21.9	1.9	11.4	3.1	45	22	23	14	1498	0	0	19	28	12	.33	-.08		.07	4		5.5	20	6+	0	0	0
VELVA	26.2	7.2	16.7	4.4	48	22	17	14	1348	0	0	14	27	10M	.25			.25	27		M	M		1	0	0
WESTHOPE	21.0	2.0	11.5	1.5	42	21	22	14+	1495	0	0	19	28	12	.48	-.15		.11	14		6.7	13	18+	2	0	0
WILLOW CITY	19.7	.3	10.0	2.5	42	20	26	14	1587	0	0	21	28	13	.19	-.18		.07	5	M	7.0	M		0	0	0
--DIVISIONAL DATA-->			12.1	1.6										.35	-.06						7.9					
NORTHEAST 03																							
CAVALIER 7 NW	16.8	1.4	7.7	.0	41	23+	19	16+	1600	0	0	23	28	14	.43	-.05		.19	10		11.5	20	28+	2	0	0
DEVILS LAKE KDLR	20.4M	3.5	12.0M	2.2	45	22	16	14	1483	0	0	21	28	12	1.32	-.17		.07	10		M	10	20+	2	0	0
DRAYTON	17.8	1.8	8.0		41	23	22	16	1594		0	23	28	16	1.03			.44	10		13.6	18	19+	3	0	0
EDMORE 1 NW	17.1	3.0	7.1	-1.1	38	22	25	28	1619		0	24	28	16	.58	.26		.17	25		7.1	12	16+	3	0	0
GRAFTON	18.0M	.9	9.5M	-.5	40	22	17	16+	1549		0	24	28	15	.49	.05		.20	25		13.5	M	M	2	0	0
GRAND FORKS FAA AP	M	M	M																		M	M				
GRAND FORKS UNIV	20.9	.8	10.9	-.5	43	22	19	13	1511		0	21	28	16	.66	.18		.21	10	M	11.9	M		2	0	0
HANSBORO 4 NNE	21.8	1.7	11.8	1.5	42	21	21	14	1489		0	19	28	14	.55	.17		.33	24		5.5	9	28+	1	0	0
LANGDON EXP STATION	16.9	2.5	7.2	2.3	40	23	22	28	1615		0	24	28	17	.62	.23		.16	25		12.6	21	19+	3	0	0
LARIMORE	20.7	2.7	11.7	2.0	41	24+	15	28	1490		0	21	28	13M	.40			.21	25		14.0	M		2	0	0
MC VILLE	19.5	1.2	10.4	.8	39	21	19	28+	1527		0	23	28	13	.68	.33		.38	14		7.5	9	14	1	0	0
PARK RIVER	21.3	2.6	12.0	1.1	42	22	14	13+	1481		0	22	28	16	.75	.29		.33	25		12.8	M		3	0	0
PEMBINA	17.6	4.5	6.5	.3	46	23	26	16	1638		0	24	28	19	.55	.17		.25	10		10.0	19	27+	3	0	0
PETERSBURG 2 N	18.2	1.0	8.6	1.2	38	23+	20	28	1578		0	24	28	16	.24	.18		.10	15	M	10.0	M		1	0	0
--DIVISIONAL DATA-->			9.5	.1										.58	-.15						10.8					

SEE REFERENCE NOTES FOLLOWING STATION INDEX

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): 7 NW CAVALIER (River Station, if different)
MONTH: MAR 19 95
STATE: ND
COUNTY: PEMBINA
RIVER:
TIME (Local) OF OBSERVATION: RIVER 0700 TEMP. 0700 PRECIPITATION 0700
STANDARD TIME IN USE: CST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	Snow, ice pellets on ground (ins.) AT Ob
1	1	+22	+20	0	0	20
2	7	+20	7	0	0	20
3	22	7	8	0	0	20
4	8	-20	+20	0	0	20
5	-8	-20	+12	0	0	20
6	1	-12	-2	.05	1	21
7	2	-7	-7	T	T	21
8	4	-19	-16	0	0	21
9	8	-16	0	0	0	21
10	16	6	15	0	0	21
11	34	16	24	0	0	20
12	38	21	35	0	0	18
13	39	33	39	0	0	15
14	39	34	35	0	0	14
15	35	26	26	0	0	13
16	35	24	29	0	0	12
17	39	29	35	.18	0	8
18	48	32	40	0	0	6
19	45	29	30	0	0	5
20	32	29	31	T	0	5
21	40	30	32	0	0	4
22	38	30	31	0	0	4
23	42	31	33	.02	0	3
24	40	33	37	0	0	2
25	54	23	35	0	0	1
26	42	32	32	.18	.25	.25
27	33	32	33	.57	4	2
28	43	24	26	T	T	1
29	30	21	23	0	0	1
30	29	17	19	0	0	1
31	32	18	27	T	T	1
SUM				1.06	5.25	

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

AM NOON PM

DATE	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT AM	TENDENCY	REMARKS (Special observations, etc.)
1											
2											
3											
4											
5											H2O IN SNOW = 3.98" WT = 11' 9 1/2"
6											
7											
8											
9											
10											
11											
12											
13	X										H2O IN SNOW = 3.71" WT = 11' 10"
14											
15											
16											
17											
18											
19											H2O IN SNOW = 1.42"
20											WT = 11' 2 1/4"
21											
22											
23											
24											
25											
26											
27											WT = 10' 7 1/2"
28											
29											
30											
31											
	Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING
DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by tough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: H. L. MC CONNELL

SUBMITTING OFFICE: WSO FARGO

STATION INDEX NO: 32-1435-3

STATION (Climatological) 7 NW CAVALIER (River Station, if different)

MONTH APRIL 19 95

STATE N D

COUNTY PEMBINA

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP 0700 PRECIPITATION 0700

STANDARD TIME IN USE CDST

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)
1	41	22	24	T	T	T
2	38	24	33	0	0	T
3	48	21	21	.10	1	1
4	21	-2	-1	0	0	1
5	22	-1	22	.04	1	1
6	30	16	17	T	T	1
7	34	17	30	0	0	T
8	37	13	14	0	0	T
9	29	14	16	0	0	T
10	38	16	26	0	0	T
11	43	26	30	0	0	T
12	41	29	32	0	0	T
13	51	32	34	0	0	T
14	54	31	34	0	0	T
15	58	32	33	0	0	T
16	41	32	32	T	T	T
17	38	28	31	T	T	T
18	49	31	33	0	0	T
19	48	29	29	0	0	T
20	51	29	33	0	0	T
21	55	32	34	0	0	T
22	47	28	29	0	0	T
23	61	29	36	.23	0	0
24	51	30	30	0	0	0
25	51	29	29	0	0	0
26	47	27	29	0	0	0
27	44	29	29	.01	T	T
28	39	29	32	T	T	0
29	44	32	37	0	0	0
30	55	36	37	0	0	0
31						
SUM				.38	2	

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

DATE	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	RIVER STAGE GAGE READING AT ___ A.M.	RIVER STAGE TENDENCY	REMARKS (Special observations, etc.)
1											
2											
3											WT=10'3"
4											
5											
6											
7											
8											
9											
10											WT=9'11½"
11											
12											
13											
14											
15											
16											
17											WT=9'8⅝"
18											
19											
20											
21											
22		X		X							
23											
24											WT=9'7⅝"
25											
26											
27											
28											
29											
30											
31											
Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds						

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING DATE

OBSERVER HILL McCONNELL

SUPERVISING OFFICE WSO - FARGO

STATION INDEX NO 32-1435-3

128

STATION (Climatological) 7 NW CAVALIER (Hydro. Station, if different) | MONTH MAY | 19 95

STATE ND | COUNTY PEMBINA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE CDST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

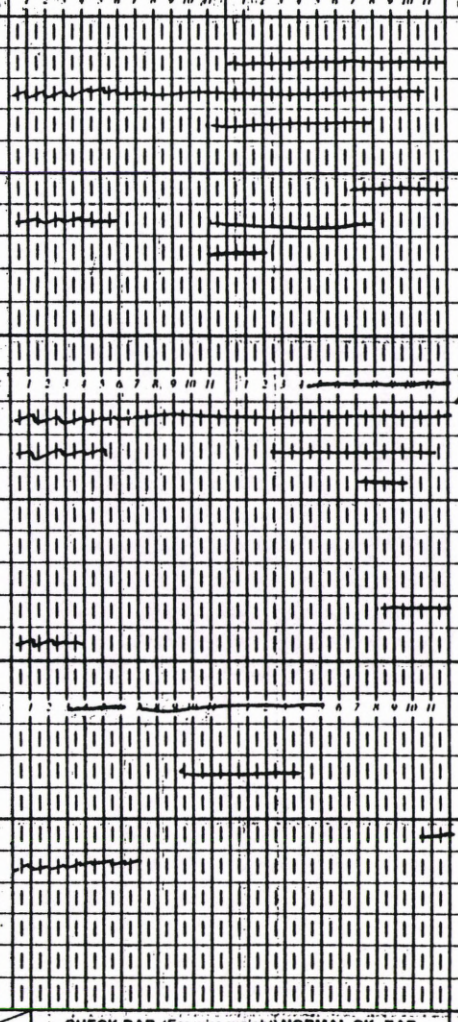
WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN.	PRECIPITATION 24 HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (Ins.)
1	55	36	37	0	0	0
2	55	33	34	0	0	0
3	58	34	43	.07	0	0
4	56	39	41	.04	0	0
5	49	30	30	.10	0	0
6	60	29	37	0	0	0
7	70	35	48	.16	0	0
8	65	48	51	T	0	0
9	60	47	47	.02	0	0
10	63	36	40	0	0	0
11	68	40	51	0	0	0
12	78	41	41	0	0	0
13	46	34	34	.60	0	0
14	44	34	44	T	0	0
15	67	34	35	.06	0	0
16	62	35	42	.01	0	0
17	58	33	39	0	0	0
18	66	39	45	0	0	0
19	74	45	50	0	0	0
20	59	40	41	.14	0	0
21	61	33	42	0	0	0
22	64	42	46	.33	0	0
23	51	36	39	.01	0	0
24	59	37	38	0	0	0
25	57	34	35	T	0	0
26	65	35	39	0	0	0
27	70	37	51	.02	0	0
28	63	50	55	0	0	0
29	74	47	60	0	0	0
30	82	60	64	0	0	0
31	89	63	69	0	0	0
SUM			SUM	1.56	0	

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.



DATE	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1											WT = 9'5"
2											
3											
4											
5											
6											
7											
8											WT = 9' 3 4
9											
10											
11											
12	X			X							
13				X							
14											
15											WT = 9' 1 1/2
16											
17											
18											
19											
20											
21											
22				X							WT = 8' 11 1/2
23											
24											
25											
26											
27											
28											
29											WT = 8' 11"
30											
31											
	Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds					

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

OBSERVER H. L. McCORMELL

SUPERVISING OFFICE WSO ~~FARGO~~ ND

STATION INDEX NO 32-1435-3

STATION (City or Airport) [redacted] AIRPORT [redacted] MONTH June [redacted]

FORM [redacted] (7-89) [redacted]

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE	COUNTY	RIVER
N D	PEMBINA	

TIME (local) OF OBSERVATION RIVER	TEMP.	PRECIPITATION	STANDARD TIME IN USE
	0700	0700	CDST

TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F: 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION: 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE: CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	87	58	60	0	0	0											WT = 8 1/2"
2	85	54	61	0	0	0											
3	84	55	64	0	0	0											
4	84	57	66	.01	0	0											
5	88	60	62	0	0	0											
6	84	62	62	0	0	0				X							
7	84	44	45	.33	0	0				X							
8	70	38	39	T	0	0											
9	64	39	47	0	0	0											
10	71	47	49	0	0	0											
11	72	42	47	0	0	0											
12	76	47	53	0	0	0											WT = 9 1/4"
13	82	53	62	0	0	0											
14	82	59	61	0	0	0											
15	91	61	66	0	0	0											
16	94	65	71	0	0	0											
17	93	70	72	0	0	0											
18	98	71	75	0	0	0											
19	94	62	81	0	0	0											WT = 9 5/4"
20	91	65	69	0	0	0				X							
21	94	62	63	.17	0	0				X							
22	80	63	66	.16	0	0				X							
23	84	63	64	0	0	0											
24	74	57	58	.20	0	0											
25	62	57	58	.01	0	0											
26	71	58	59	0	0	0											WT = 9 7/2"
27	74	58	61	T	0	0											
28	79	60	67	0	0	0											
29	80	58	59	0	0	0											
30	61	50	52	.07	0	0											
31																	
Mo.			SUM	95			Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds					

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. 1 2 3 4 5 6 7 8 9 10 11 NOON 1 2 3 4 5 6 7 8 9 10 11 P.M.

WEATHER (Calendar Day): Mark 'X' for all types occurring each day.

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire weight) NORMAL CK. BAR

READING	DATE
H.L. McC	
FARGO	

OBSERVER H.L. McCONNELL

SUPERVISING OFFICE WSO FARGO

STATION INDEX NO. 32-1435-3

[redacted] JULY 19[redacted]

STATE: ND | COUNTY: PEMBINA | RIVER:

TIME (local) OF OBSERVATION: RIVER 0700 | TEMP 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE: CST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

(7-89) [redacted]

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN	PM AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, hail, sleet and tenths	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	PRECIPITATION Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT A M	TENDENCY	REMARKS (Special observations, etc.)
1	60	45	48	0	0	0												
2	71	47	51	0	0	0												
3	71	51	57	.15	0	0		X										WT=9'10"
4	75	56	57	0	0	0												
5	71	54	55	.25	0	0												
6	59	52	55	2.26	0	0												
7	72	53	54	0	0	0												
8	62	54	60	.02	0	0		X										
9	77	57	63	0	0	0												
10	84	57	66	0	0	0												WT=9'10 3/4"
11	82	65	68	0	0	0					X							
12	87	66	72	.01	0	0												
13	89	65	66	.29	0	0					X							
14	89	63	63	0	0	0												
15	79	58	61	0	0	0					X							
16	80	60	62	.31	0	0					X							
17	66	59	62	.94	0	0					X							WT=10'1 1/4"
18	73	55	57	.13	0	0												
19	76	57	60	.23	0	0												
20	71	57	58	.09	0	0												
21	77	58	62	T	0	0												
22	80	54	55	.03	0	0												
23	75	55	60	0	0	0												
24	61	59	60	T	0	0												WT=10'1"
25	71	51	57	0	0	0												
26	72	51	56	.07	0	0												
27	78	56	65	0	0	0												
28	82	59	62	0	0	0												
29	77	51	53	0	0	0												
30	80	53	70	0	0	0					X							
31	82	51	52	T	0	0												WT=10'3 3/4"
SUM				4.78														

CHECK BAR (For wire-weight) NORMAL CR. BAR

	Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER H.L. McCONNELL

SUPERVISING OFFICE WSO FARGO

STATION INDEX NO. 32-1435-3

131

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION: CAVALIER
MONTH: AUG 19 95
STATE: ND
COUNTY: PEMBINA
RIVER:
TIME (local) OF OBSERVATION RIVER: CDST
TEMP.: 0700
PRECIPITATION: 0700
STANDARD TIME IN USE: CDST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	REMARKS (Special observations, etc.)
1	72	51	54	0	0	0							
2	80	54	58	0	0	0							
3	85	52	53	T	0	0							
4	75	51	56	0	0	0							
5	78	53	53	0	0	0							
6	83	53	64	0	0	0							
7	81	64	66	0	0	0	X						WT=10'6¾"
8	87	66	71	0	0	0				X			
9	83	53	56	T	0	0							
10	80	48	52	0	0	0							
11	76	49	50	0	0	0							
12	76	50	56	0	0	0							
13	78	53	55	0	0	0				X			
14	78	54	59	.44	0	0							WT=10'10¼"
15	77	52	53	0	0	0							
16	87	52	63	0	0	0	X						
17	82	63	70	0	0	0	X						
18	89	69	69	.02	0	0				X			
19	76	52	54	2.30	0	0				X			
20	78	53	54	0	0	0							
21	81	53	54	0	0	0							WT=11'2"
22	76	54	62	.04	0	0							
23	89	52	53	0	0	0							
24	73	53	62	0	0	0							
25	65	57	58	.04	0	0	X						
26	78	54	57	0	0	0							
27	75	56	59	0	0	0							
28	69	56	56	.19	0	0							WT=11'1½"
29	72	49	50	0	0	0							
30	82	50	69	T	0	0							
31	76	49	49	0	0	0							
SUM				3.03									

CHECK BAR (For wire weight) NORMAL CK. BAR
READING | DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: H.L. McCONNELL
SUPERVISING OFFICE: WSO-FARGO
STATION INDEX NO. 32-1435-3

132

[redacted] 7 NW CAVALIER [redacted] SEPT [redacted]

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

(7-89)

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE: ND | COUNTY: PEMBINA | RIVER:

TIME (local) OF OBSERVATION: TEMP. 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE: CDST

TYPE OF RIVER GAGE: | ELEVATION OF RIVER GAGE ZERO: Ft. | FLOOD STAGE: Ft. | NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24 HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	RIVER STAGE Condition	Gage reading at A.M.	Tendency	REMARKS (Special observations, etc.)
1	74	49	52	0	0	0										
2	60	52	56	0	0	0										
3	78	47	49	0	0	0										
4	84	49	58	0	0	0										WT=11'5 3/4"
5	86	52	52	0	0	0				X						
6	77	52	61	1.74	0	0				X						
7	62	38	38	.43	0	0										
8	55	38	41	0	0	0										
9	64	41	43	0	0	0										
10	63	43	47	0	0	0										
11	74	47	52	0	0	0										WT=11'3 1/2"
12	77	52	61	0	0	0										
13	83	55	56	0	0	0										
14	73	36	36	0	0	0										
15	70	36	53	0	0	0										
16	76	51	51	0	0	0										
17	61	35	36	0	0	0										
18	64	36	43	0	0	0				X						WT=11'5 1/4"
19	47	36	38	.16	0	0										
20	48	31	32	T	0	0										
21	49	32	34	.07	0	0										
22	44	28	29	T	0	0										
23	50	27	28	0	0	0										
24	59	27	46	0	0	0										
25	64	46	48	0	0	0										WT=11'4 3/4"
26	71	42	43	0	0	0										
27	69	43	49	0	0	0										
28	79	48	54	.04	0	0				X						
29	80	49	51	0	0	0										
30	69	47	47	T	0	0										
31																
SUM				2.44												

CHECK BAR (For wire-weight) NORMAL CK. BAR | READING | DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage
C. Upper surface of smooth ice
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice
H. Pool stage.

OBSERVER: H.L. McCONNELL

SUPERVISING OFFICE: WSO FARGO

STATION INDEX NO. 32-1435-3

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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

WS FORM B-91 (7-89)

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION: CAVALIER
MONTH: OCT 19 75
STATE: ND
COUNTY: PEMBINA
RIVER:
TIME (local) OF OBSERVATION RIVER — TEMP. 0700 PRECIPITATION 0700
STANDARD TIME IN USE: CDST
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO Ft.
FLOOD STAGE Ft.
NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ AM	TENDENCY	REMARKS (Special observations, etc.)
1	57	40	40	0	0	0											
2	62	37	40	0	0	0											WT = 11' 7 3/4"
3	51	39	46	.63	0	0											
4	52	38	39	.15	0	0											
5	49	36	45	.08	0	0	X										
6	49	40	40	.05	0	0											
7	45	33	33	0	0	0											
8	50	33	35	0	0	0											
9	53	34	37	0	0	0											WT = 11' 5 3/4"
10	54	36	41	0	0	0											
11	69	40	52	0	0	0											
12	76	45	45	0	0	0											
13	66	44	46	0	0	0											
14	46	34	36	.40	0	0											
15	43	29	29	0	0	0											
16	51	29	33	0	0	0											WT = 11' 5 1/2"
17	56	32	47	0	0	0											
18	52	32	34	0	0	0											
19	41	34	40	.21	0	0											
20	40	33	33	.31	0	0											
21	41	25	26	0	0	0											
22	39	24	31	0	0	0											
23	45	30	35	0	0	0											WT = 11' 4 3/4"
24	43	26	27	0	0	0											
25	54	25	35	0	0	0											
26	51	28	32	0	0	0											
27	50	32	36	.02	0	0											
28	49	33	36	0	0	0											
29	41	29	29	.08	T	T											
30	36	24	25	T	T	T											
31	38	25	30	0	0	T											
SUM			SUM	1.93	T												

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING
DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: H.L. McCONNELL
SUPERVISING OFFICE: WSO - FARGO
STATION INDEX NO. 32 · 1435 - 3

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APPENDIX E

NDSHD Water Quality Laboratory Reports

1995
1994
1993

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 4/ 6/95 Report Date: 4/ 6/95

Log Number: 95-R125

Date Collected: 3/20/95 Time Collected: Collected By: Melvin Askew
Date Received: 3/22/95 Time Received: 11:15 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick Dam
Comments:

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	18.3	0.1	mg/L	7.5	4/ 5/95	9:18	Carol
Magnesium (Mg)	{ 1212}	7.9	0.1	mg/L	9.8	4/ 5/95	9:18	Carol
Potassium (K)	{ 1219}	6.0	1.0	mg/L	5.1	4/ 5/95	9:18	Carol
Calcium (Ca)	{ 1220}	32.4	0.030	mg/L	7.2	4/ 5/95	9:18	Carol
Manganese (Mn)	{ 1225}	0.754	0.002	mg/L	3.7	4/ 5/95	9:18	Carol
Iron (Fe)	{ 1226}	3.63	0.007	mg/L	7.4	4/ 5/95	9:18	Carol
Chloride	{ 5217}	3.5	3.0	mg/L	2.9	3/22/95	14:00	Dennis
Ammonia (N)	{ 3085}	0.156	0.010	mg/L	7.8	3/24/95	11:00	Dennis
	{ 9305}	7.82				3/22/95	14:47 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		3/22/95	14:47	Diane
Bicarbonate (HCO3)	{ 9315}	87.	1.	mg/L	5.1	3/22/95	14:47	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		3/22/95	14:47	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	73.	1.	mg/L	5.1	3/22/95	14:47	Diane
Conductivity	{ 9330}	312.	1.00	umhos/cm	1.8	3/22/95	14:00	Diane
Phosphate (Total) (P)	{ 9415}	0.018	0.018	mg/L	9.8	3/24/95	16:00	Dennis
Sulfate as (SO4)	{ 9449}	54.	3.	mg/L	15.	3/22/95	11:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	4.79	0.005	mg/L	9.2	3/24/95	11:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.14	0.061	mg/L	12.	3/24/95	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	114.		mg/L				
Suspended Solids (Total)	{ 9850}	126.	2.	mg/L	5.0	3/27/95	9:00 *	Sujit
Cation Sum	{ 9905}	3.222		me/L				
Anion Sum	{ 9910}	3.047		me/L				
Difference	{ 9915}	0.175		me/L				
Percent Difference	{ 9920}	2.80		%				
Percent Sodium	{ 9925}	24.6		%				
Sodium Adsorption Ratio	{ 9930}	0.75						
Dissolved Solids(C)-Total	{ 9935}	177.		mg/L				

* = Incomplete [24 Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 4/ 5/95

Report Date: 4/ 5/95

Number: 95-R197

Date Collected: 3/27/95
Time Collected: 10:20
Collected by: Brent Nelson
Date Received: 3/28/95
Time Received: 11:06
Project Code: RAPSRRA
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.163	0.010	mg/L	7.6	3/29/95	14:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.462	0.018	mg/L	9.8	4/ 4/95	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.66	0.005	mg/L	3.2	3/29/95	14:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.871	0.061	mg/L	10.	4/ 4/95	10:00	Dennis
Suspended Solids (Total)	{ 3650}	234.	2.	mg/L	5.0	4/ 3/95	9:10	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 4/ 7/95 Report Date: 4/ 7/95

Lab Number: 95-R213

Date Collected: 3/30/95 Time Collected: 7:45 Collected By: Mel Asrew
Date Received: 3/31/95 Time Received: 11:05 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	(9085)	0.109	0.010	mg/L	7.0	4/ 5/95	10:00	Dennis
Phosphate (Total) (P)	(9415)	0.248	0.010	mg/L	3.0	4/ 4/95	10:00	Dennis
Nitrate + Nitrite (N) Tot	(9557)	0.00	0.005	mg/L	0.0	4/ 5/95	10:00	Dennis
Nitrogen (Total Kjeldahl)	(9878)	0.991	0.001	mg/L	10.	4/ 4/95	10:00	Dennis
Suspended Solids (Total)	(9850)	25.	1.	mg/L	5.0	4/ 6/95	11:00	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 4/27/95

Report Date: 4/27/95

Log Number: 95-R254

Date Collected: 4/ 4/95
Time Collected: 17:00
Collected By: Mel Askew
Date Received: 4/ 6/95
Time Received: 11:22
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.097	0.010	mg/L	7.8	4/ 7/95	10:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.437	0.018	mg/L	9.8	4/12/95	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	2.45	0.005	mg/L	8.2	4/ 7/95	15:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.902	0.061	mg/L	13.	4/12/95	10:00	Dennis
Suspended Solids (Total)	{ 9850}	300.	2.	mg/L	5.0	4/10/95	11:30	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 4/27/95

Report Date: 4/27/95

Log Number: 95-R281

Date Collected: 4/ 9/95
Time Collected: 14:50
Collected By: Mel Askew
Date Received: 4/11/95
Time Received: 11:20
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.139	0.010	mg/L	7.8	4/25/95	13:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.351	0.018	mg/L	9.8	4/19/95	13:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	3.27	0.005	mg/L	8.2	4/25/95	13:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.30	0.061	mg/L	13.	4/19/95	13:00	Dennis
Suspended Solids (Total)	{ 9850}	251.	2.	mg/L	5.0	4/13/95	8:00	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 8/95

Report Date: 5/ 9/95

Log Number: 95-R317

Date Collected: 4/12/95
Time Collected: 19:00
Collected By: Mel Askew
Date Received: 4/17/95
Time Received: 10:20
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.107	0.010	mg/L	7.8	5/ 5/95	16:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.397	0.018	mg/L	9.8	5/ 1/95	14:50	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	2.99	0.005	mg/L	8.2	5/ 5/95	16:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.421	0.061	mg/L	13.	5/ 1/95	14:50	Dennis
Suspended Solids (Total)	{ 9850}	209.	2.	mg/L	5.0	4/19/95	8:30	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 1/95

Report Date: 5/ 1/95

Number: 95-R341

Date Collected: 4/16/95
Time Collected: 19:10
Collected By: Mel Askew
Date Received: 4/18/95
Time Received: 11:14
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.099	0.010	mg/L	7.3	4/25/95	12:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.438	0.018	mg/L	9.8	4/28/95	9:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.91	0.005	mg/L	3.2	4/25/95	12:00	Dennis
Suspended Solids (Total)	{ 9850}	125.	2.	mg/L	5.0	4/20/95	8:30	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 1/95

Report Date: 5/ 1/95

Number: 95-R388

Date Collected: 4/19/95
Time Collected: 13:27
Collected By: Mel Askew
Date Received: 4/21/95
Time Received: 11:40
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	ND	0.010	mg/L		4/25/95	14:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.073	0.018	mg/L	9.3	4/28/95	9:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.81	0.005	mg/L	8.2	4/25/95	14:00	Dennis
Suspended Solids (Total)	{ 9350}	21.	2.	mg/L	5.0	4/26/95	8:00	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 8/95

Report Date: 5/ 8/95

Log Number: 95-R431

Date Collected: 4/24/95
Time Collected: 19:00
Collected By: Mel Askes
Date Received: 4/26/95
Time Received: 15:31
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Gores

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.129	0.010	mg/L	7.8	5/ 5/95	16:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.280	0.018	mg/L	9.8	4/28/95	9:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.19	0.005	mg/L	8.2	5/ 5/95	16:00	Dennis
Suspended Solids (Total)	{ 9850}	27.	2.	mg/L	5.0	4/28/95	8:00	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 8/95

Report Date: 5/ 8/95

Log Number: 95-R458

Date Collected: 4/26/95
Time Collected: 18:45
Collected By: Mel Askew
Date Received: 4/28/95
Time Received: 14:42
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Gores

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.026	0.010	mg/L	7.8	5/ 5/95	16:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.296	0.018	mg/L	9.8	5/ 4/95	11:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.10	0.005	mg/L	8.2	5/ 5/95	16:00	Dennis
Suspended Solids (Total)	{ 9850}	14.	2.	mg/L	5.0	5/ 2/95	8:30	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 6/95

Report Date: 6/ 6/95

Lab Number: 95-R481

Date Collected: 4/30/95
Time Collected: 15:00
Collected By: MEL ASKEW
Date Received: 5/ 3/95
Time Received: 9:00
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A. Dyke

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/ 8/95	11:30	Dennis
Phosphorus (Total) (P)	{ 9415}	0.208	0.018	mg/L	9.8	5/31/95	13:00 *	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.886	0.005	mg/L	8.2	5/ 8/95	11:30	Dennis
Suspended Solids (Total)	{ 9850}	106.	2.	mg/L	5.0	5/ 4/95	9:00	Sujit

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 6/95

Report Date: 6/ 6/95

I Number: 95-R524

Date Collected: 5/ 8/95 Time Collected: 7:55 Collected By: Mel Askew
Date Received: 5/ 9/95 Time Received: 11:09 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.078	0.010	mg/L	7.8	5/16/95	16:00	Dennis
Phosphorus (Total) (P)	{ 9415}	0.170	0.018	mg/L	9.8	5/31/95	13:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.470	0.005	mg/L	8.2	5/16/95	16:00	Dennis
Suspended Solids (Total)	{ 9850}	72.	2.	mg/L	5.0	5/11/95	8:30	Sujit

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/14/95

Report Date: 6/14/95

I Number: 95-R606

Date Collected: 5/15/95 Time Collected: 8:15 Collected By: Mel Askew
Date Received: 5/16/95 Time Received: 11:24 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.039	0.010	mg/L	7.8	5/25/95	16:30	Dennis
Phosphorus (Total) (P)	{ 9415}	0.117	0.018	mg/L	9.8	5/25/95	14:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.231	0.005	mg/L	8.2	5/25/95	16:30	Dennis
Suspended Solids (Total)	{ 9850}	63.	2.	mg/L	5.0	5/19/95	10:00	Robert

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 9/95

Report Date: 6/ 9/95

Number: 95-R693

Date Collected: 5/24/95
Time Collected: 19:00
Collected By: Mel Askew
Date Received: 5/26/95
Time Received: 10:23
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dianne A Gross

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.040	0.010	mg/L	7.8	6/ 2/95	11:30	Diane
Phosphorus (Total) (P)	{ 9415}	0.066	0.018	mg/L	9.8	6/ 9/95	11:06	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.058	0.005	mg/L	8.2	6/ 2/95	11:30	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	0.789	0.061	mg/L	13.	6/ 9/95	11:06	Diane
Suspended Solids (Total)	{ 9850}	10.	2.	mg/L	5.0	5/30/95	2:00	Robert

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

iginal Report Date: 6/27/95

Report Date: 6/27/95

I Number: 95-R913

te Collected: 6/14/95 Time Collected: 19:50 Collected By: Mel Askew
Date Received: 6/16/95 Time Received: 11:08 Project Code: RNPSRRR
ite Code: 380111 Pembina County Project: RENWICK WATERSHED
te: Tongue River 1 Mile W of Renwick
omments:

Approved by: Dennis A Jones

Inorganic

alyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.080	0.010	mg/L	7.8	6/26/95	11:30	Dennis
osphorus (Total) (P)	{ 9415}	0.295	0.018	mg/L	9.8	6/27/95	8:53	Diane
trate + Nitrite (N) Tot	{ 9557}	0.168	0.005	mg/L	8.2	6/26/95	11:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.525	0.061	mg/L	13.	6/27/95	8:53	Diane
spended Solids (Total)	{ 9850}	14.	2.	mg/L	5.0	6/19/95	9:00	Robert

North Dakota Department of Health
Chemistry Division

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iginal Report Date: 8/ 1/95

Report Date: 8/ 1/95

L Number: 95-R1379

te Collected: 7/19/95
Date Received: 7/21/95
te Code: 380111
te: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 19:10
Time Received: 13:26
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Dennis A Jones

Inorganic

alyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
mmonia (N)	{ 9085}	0.017	0.010	mg/L	7.8	7/26/95	15:30	Dennis
osphorus (Total) (P)	{ 9415}	0.231	0.018	mg/L	9.8	7/31/95	11:00	Dennis
trate + Nitrite (N) Tot	{ 9557}	0.241	0.005	mg/L	8.2	7/26/95	15:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.890	0.061	mg/L	13.	7/31/95	11:00	Dennis
spended Solids (Total)	{ 9850}	29.	2.	mg/L	5.0	7/24/95	8:15	Robert

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Original Report Date: 8/28/95 Report Date: 8/28/95

Number: 95-R1634

Date Collected: 8/16/95 Time Collected: 11:00 Collected By: Mel Askew
Date Received: 8/18/95 Time Received: 11:59 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.010	0.010	mg/L	7.8	8/25/95	13:30	Dennis
Phosphorus (Total) (P)	{ 9415}	0.198	0.018	mg/L	9.8	8/25/95	13:00	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.139	0.005	mg/L	8.2	8/25/95	13:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.598	0.061	mg/L	13.	8/25/95	13:00	Diane
Suspended Solids (Total)	{ 9850}	5.	2.	mg/L	5.0	8/18/95	13:30	Carol

North Dakota Department of Health
Chemistry Division

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Original Report Date: 10/ 4/95

Report Date: 10/ 4/95

Log Number: 95-R1928

Date Collected: 9/19/95
Date Received: 9/21/95
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 16:45
Time Received: 12:17
Pembina County

Collected By: Mel Askev
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Diane Little
Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	(9085)	ND	0.010	mg/L		9/29/95	15:10	Diane
Phosphorus (Total) (P)	(9415)	0.246	0.018	mg/L	9.8	10/ 3/95	16:20	Diane
Nitrate + Nitrite (N) Tot	(9557)	0.130	0.005	mg/L	8.2	9/29/95	15:10	Diane
Nitrogen (Total Kjeldahl)	(9575)	0.524	0.061	mg/L	13.	10/ 3/95	16:20	Diane
Suspended Solids (Total)	(9850)	10.	2.	mg/L	5.0	9/25/95	10:00	Carol

ND = Not Detected

North Dakota Department of Health
Chemistry Division

Page: 1

Original Report Date: 11/ 7/95

Report Date: 11/ 7/95

Log Number: 95-R2067

Date Collected: 10/18/95
Time Collected: 11:35
Collected By: Mel Askew
Date Received: 10/20/95
Time Received: 10:42
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Dennis A Jones

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Ammonia (N)	{ 9085}	0.037	0.010	mg/L	7.8	10/27/95	13:30	Diane
Phosphorus (Total) (P)	{ 9415}	0.120	0.018	mg/L	9.8	11/ 3/95	16:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.217	0.005	mg/L	8.2	10/27/95	13:30	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	0.670	0.061	mg/L	13.	11/ 3/95	16:30	Dennis
Suspended Solids (Total)	{ 9850}	5.	2.	mg/L	5.0	10/20/95	12:10	Carol

North Dakota State partment of Health
and Consolidated Laboratories
4/ 8/94
Pembina County

Log Number: 94-R99 Type: 2

Date Collected: 3/25/94 Date Received: 3/29/94
Time Collected: 8:45 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	23.4	0.1	mg/L	7.5	4/ 7/94	10:36	Mike
Magnesium (Mg)	{ 1212}	11.8	0.1	mg/L	9.8	4/ 7/94	10:36	Mike
Potassium (K)	{ 1219}	7.1	1.0	mg/L	5.1	4/ 7/94	10:36	Mike
Calcium (Ca)	{ 1220}	45.8	0.030	mg/L	7.2	4/ 7/94	10:36	Mike
Manganese (Mn)	{ 1225}	0.420	0.002	mg/L	6.7	4/ 7/94	10:36	Mike
Iron (Fe)	{ 1226}	0.697	0.007	mg/L	7.4	4/ 7/94	10:36	Mike
Chloride	{ 5217}	12.8	3.0	mg/L	3.9	4/ 5/94	15:00	Dennis
Ammonia (N)	{ 9085}	0.099	0.010	mg/L	7.8	3/31/94	11:00	Dennis
pH	{ 9305}	7.45				3/29/94	16:08 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		3/29/94	16:08	Diane
Bicarbonate (HCO3)	{ 9315}	142.	1.	mg/L	5.1	3/29/94	16:08	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		3/29/94	16:08	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	116.	1.	mg/L	5.1	3/29/94	16:08	Diane
Conductivity	{ 9330}	472.	1.00	umhos/cm	1.2	3/29/94	16:10	Diane
Phosphate (Total) (P)	{ 9415}	0.449	0.020	mg/L	9.8	3/30/94	16:30	Dennis
Sulfate as (SO4)	{ 9440}	101.	3.	mg/L	15.	4/ 5/94	15:00	Dennis
trate + Nitrite (N) Tot	{ 9557}	4.83	0.005	mg/L	8.2	3/31/94	11:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	2.19	0.180	mg/L	13.	3/30/94	16:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	163.		mg/L				
Suspended Solids (Total)	{ 9850}	60.	2.	mg/L	5.0	3/29/94	14:00	Mike
Cation Sum	{ 9905}	4.464		me/L				
Anion Sum	{ 9910}	4.885		me/L				
Difference	{ 9915}	-0.421		me/L				
Percent Difference	{ 9920}	-4.50		%				
Percent Sodium	{ 9925}	23.7		%				
Sodium Adsorption Ratio	{ 9930}	0.80						
Dissolved Solids(C)-Total	{ 9935}	274.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

Per. Mike Born Chemist

North Dakota State Department of Health
and Consolidated Laboratories
4/14/94
Pembina County

Log Number: 94-R111 Type: 2

Date Collected: 3/29/94 Date Received: 3/31/94
Time Collected: 10:45 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	32.4	0.1	mg/L	7.5	4/11/94	8:15	Mike
Magnesium (Mg)	{ 1212}	17.7	0.1	mg/L	9.8	4/11/94	8:15	Mike
Potassium (K)	{ 1219}	8.8	1.0	mg/L	5.1	4/11/94	8:15	Mike
Calcium (Ca)	{ 1220}	68.6	0.030	mg/L	7.2	4/11/94	8:15	Mike
Manganese (Mn)	{ 1225}	0.262	0.002	mg/L	6.7	4/ 7/94	10:36	Mike
Iron (Fe)	{ 1226}	0.399	0.007	mg/L	7.4	4/ 7/94	10:36	Mike
Chloride	{ 5217}	13.9	3.0	mg/L	3.9	4/ 5/94	16:15	Dennis
Ammonia (N)	{ 9085}	0.119	0.010	mg/L	7.8	4/ 7/94	15:00	Dennis
pH	{ 9305}	7.72				3/31/94	14:47 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		3/31/94	14:47	Diane
Bicarbonate (HCO3)	{ 9315}	178.	1.	mg/L	5.1	3/31/94	14:47	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		3/31/94	14:47	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	146.	1.	mg/L	5.1	3/31/94	14:47	Diane
Conductivity	{ 9330}	567.	1.00	umhos/cm	1.2	3/31/94	14:00	Diane
Phosphate (Total) (P)	{ 9415}	0.179	0.020	mg/L	9.8	4/13/94	14:45	Diane
Sulfate as (SO4)	{ 9440}	124.	3.	mg/L	15.	4/ 5/94	16:15	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	5.54	0.005	mg/L	8.2	4/ 7/94	15:00	Dennis
trogen (Total Kjeldahl)	{ 9575}	0.720	0.180	mg/L	13.	4/13/94	14:45	Diane
Hardness Total (as CaCO3)	{ 9840}	244.		mg/L				
~~Suspended Solids (Total)~~	~~{ 9850}~~	~~38.~~	~~2.~~	~~mg/L~~	5.0	4/ 4/94	14:00	Carol
Cation Sum	{ 9905}	6.527		me/L				
Anion Sum	{ 9910}	5.985		me/L				
Difference	{ 9915}	0.541		me/L				
Percent Difference	{ 9920}	4.33		%				
Percent Sodium	{ 9925}	22.3		%				
Sodium Adsorption Ratio	{ 9930}	0.90						
Dissolved Solids(C)-Total	{ 9935}	355.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

Per. Mike Bom Chemist

X

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

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Original Report Date: 5/ 4/94

Report Date: 5/ 4/94

Log Number: 94-R122

Date Collected: 4/ 4/94
Date Received: 4/ 5/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 15:35
Time Received: 11:00
Pembina County

Collected By: Mel Askev
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	29.2	0.1	mg/L	7.5	5/ 4/94	9:15	Mike
Magnesium (Mg)	(1212)	13.1	0.1	mg/L	9.8	5/ 4/94	9:15	Mike
Potassium (K)	(1219)	6.4	1.0	mg/L	5.1	5/ 4/94	9:15	Mike
Calcium (Ca)	(1220)	53.8	0.030	mg/L	7.2	5/ 4/94	9:15	Mike
Manganese (Mn)	(1225)	4.54	0.002	mg/L	6.7	5/ 2/94	9:36	Mike
Iron (Fe)	(1226)	19.5	0.007	mg/L	7.4	5/ 2/94	9:36	Mike
Chloride	(5217)	10.3	3.0	mg/L	3.9	4/ 5/94	16:15	Dennis
monia (N)	(9085)	0.091	0.010	mg/L	7.8	4/ 7/94	15:00	Dennis
pH	(9305)	7.45				4/ 5/94	16:17 *	Diane
Carbonate (CO3)	(9310)	ND	1.	mg/L		4/ 5/94	16:17	Diane
Bicarbonate (HCO3)	(9315)	152.	1.	mg/L	5.1	4/ 5/94	16:17	Diane
Hydroxide (OH)	(9320)	ND	1.	mg/L		4/ 5/94	16:17	Diane
Alkalinity (CaCO3)(Total)	(9325)	124.	1.	mg/L	5.1	4/ 5/94	16:17	Diane
Conductivity	(9330)	448.	1.00	umhos/cm	1.2	4/ 5/94	16:00	Diane
Phosphate (Total) (P)	(9415)	ND	0.020	mg/L		4/13/94	14:45	Diane
Sulfate as (SO4)	(9440)	84.	3.	mg/L	15.	4/ 5/94	16:15	Dennis
Nitrate + Nitrite (N) Tot	(9557)	5.05	0.005	mg/L	8.2	4/ 7/94	15:00	Dennis
Nitrogen (Total Kjeldahl)	(9575)	ND	0.180	mg/L		4/13/94	14:45	Diane
Hardness Total (as CaCO3)	(9840)	188.		mg/L				
Suspended Solids (Total)	(9850)	1050.	2.	mg/L	5.0	4/ 6/94	15:00	Carol
Cation Sum	(9905)	5.206		me/L				
Anion Sum	(9910)	4.624		me/L				
Difference	(9915)	0.582		me/L				
Percent Difference	(9920)	5.92		%				
Percent Sodium	(9925)	25.1		%				
Sodium Adsorption Ratio	(9930)	0.92						
Dissolved Solids(C)-Total	(9935)	274.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

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Original Report Date: 5/ 4/94

Report Date: 5/ 4/94

Log Number: 94-R138

Date Collected: 4/ 5/94
Time Collected: 15:50
Collected By: Mel Askev
Date Received: 4/ 7/94
Time Received: 11:00
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	24.8	0.1	mg/L	7.5	5/ 2/94	9:36	Mike
Magnesium (Mg)	(1212)	14.1	0.1	mg/L	9.8	5/ 2/94	9:36	Mike
Potassium (K)	(1219)	8.2	1.0	mg/L	5.1	5/ 2/94	9:36	Mike
Calcium (Ca)	(1220)	58.2	0.030	mg/L	7.2	5/ 2/94	9:36	Mike
Manganese (Mn)	(1225)	1.66	0.002	mg/L	6.7	5/ 2/94	9:36	Mike
Iron (Fe)	(1226)	6.37	0.007	mg/L	7.4	5/ 2/94	9:36	Mike
Chloride	(5217)	12.4	3.0	mg/L	3.9	4/19/94	14:30	Dennis
Ammonia (N)	(9085)	0.077	0.010	mg/L	7.8	4/ 7/94	15:00	Dennis
pH	(9305)	7.61				4/ 7/94	16:55 *	Diane
Carbonate (CO3)	(9310)	ND	1.	mg/L		4/ 7/94	16:55	Diane
Bicarbonate (HCO3)	(9315)	146.	1.	mg/L	5.1	4/ 7/94	16:55	Diane
Hydroxide (OH)	(9320)	ND	1.	mg/L		4/ 7/94	16:55	Diane
Alkalinity (CaCO3)(Total)	(9325)	120.	1.	mg/L	5.1	4/ 7/94	16:55	Diane
Conductivity	(9330)	532.	1.00	umhos/cm	1.2	4/ 7/94	16:40	Diane
Phosphate (Total) (P)	(9415)	0.391	0.018	mg/L	9.8	4/13/94	14:45	Diane
Sulfate as (SO4)	(9440)	147.	3.	mg/L	15.	4/19/94	14:30	Dennis
Nitrate + Nitrite (N) Tot	(9557)	3.97	0.005	mg/L	8.2	4/ 7/94	15:00	Dennis
Nitrogen (Total Kjeldahl)	(9575)	0.700	0.180	mg/L	13.	4/13/94	14:45	Diane
Hardness Total (as CaCO3)	(9840)	204.		mg/L				
Suspended Solids (Total)	(9850)	400.	2.	mg/L	5.0	4/ 8/94	9:30	Carol
Cation Sum	(9905)	5.363		me/L				
Anion Sum	(9910)	5.897		me/L				
Difference	(9915)	-0.534		me/L				
Percent Difference	(9920)	-4.74		%				
Percent Sodium	(9925)	20.9		%				
Sodium Adsorption Ratio	(9930)	0.76						
Dissolved Solids(C)-Total	(9935)	339.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 4/94

Report Date: 5/ 4/94

Log Number: 94-R151

Date Collected: 4/ 7/94 Time Collected: 7:10 Collected By: Mel Askev
Date Received: 4/ 8/94 Time Received: 11:00 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	31.6	0.1	mg/L	7.5	5/ 2/94	16:35	Mike
Magnesium (Mg)	(1212)	20.9	0.1	mg/L	9.8	5/ 2/94	16:35	Mike
Potassium (K)	(1219)	11.7	1.0	mg/L	5.1	5/ 2/94	16:35	Mike
Calcium (Ca)	(1220)	80.8	0.030	mg/L	7.2	5/ 2/94	16:35	Mike
Manganese (Mn)	(1225)	3.57	0.002	mg/L	6.7	5/ 2/94	16:35	Mike
Iron (Fe)	(1226)	13.6	0.007	mg/L	7.4	5/ 2/94	16:35	Mike
Chloride	(5217)	14.2	3.0	mg/L	3.9	4/19/94	15:00	Dennis
monia (N)	(9085)	0.233	0.010	mg/L	7.8	4/18/94	11:00	Dennis
pH	(9305)	7.61				4/ 8/94	15:42 *	Diane
Carbonate (CO3)	(9310)	ND	1.	mg/L		4/ 8/94	15:42	Diane
Bicarbonate (HCO3)	(9315)	144.	1.	mg/L	5.1	4/ 8/94	15:42	Diane
Hydroxide (OH)	(9320)	ND	1.	mg/L		4/ 8/94	15:42	Diane
Alkalinity (CaCO3)(Total)	(9325)	118.	1.	mg/L	5.1	4/ 8/94	15:42	Diane
Conductivity	(9330)	603.	1.00	umhos/cm	1.2	4/ 8/94	14:20	Diane
Phosphate (Total) (P)	(9415)	0.736	0.018	mg/L	9.8	4/21/94	15:00	Dennis
Sulfate as (SO4)	(9440)	216.	3.	mg/L	15.	4/19/94	15:00	Dennis
Nitrate + Nitrite (N) Tot	(9557)	4.90	0.005	mg/L	8.2	4/18/94	11:00	Dennis
Nitrogen (Total Kjeldahl)	(9575)	1.91	0.061	mg/L	13.	4/21/94	15:00	Dennis
Hardness Total (as CaCO3)	(9840)	288.		mg/L				
Suspended Solids (Total)	(9850)	960.	2.	mg/L	5.0	4/12/94	14:15	Carol
Cation Sum	(9905)	7.440		me/L				
Anion Sum	(9910)	7.353		me/L				
Difference	(9915)	0.088		me/L				
Percent Difference	(9920)	0.59		%				
Percent Sodium	(9925)	19.2		%				
Sodium Adsorption Ratio	(9930)	0.81						
Dissolved Solids(C)-Total	(9935)	448.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

X

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 4/94

Report Date: 5/ 4/94

Log Number: 94-R171

Date Collected: 4/11/94 Time Collected: 16:10 Collected By: Deb Sperle
Date Received: 4/13/94 Time Received: 11:00 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom
Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	33.9	0.1	mg/L	7.5	5/ 4/94	9:15	Mike
Magnesium (Mg)	(1212)	19.2	0.1	mg/L	9.8	5/ 4/94	9:15	Mike
Potassium (K)	(1219)	10.2	1.0	mg/L	5.1	5/ 4/94	9:15	Mike
Calcium (Ca)	(1220)	71.9	0.030	mg/L	7.2	5/ 4/94	9:15	Mike
Manganese (Mn)	(1225)	0.910	0.002	mg/L	6.7	5/ 2/94	16:35	Mike
Iron (Fe)	(1226)	0.897	0.007	mg/L	7.4	5/ 2/94	16:35	Mike
Chloride	(5217)	13.4	3.0	mg/L	3.9	4/19/94	15:00	Dennis
Ammonia (N)	(9085)	0.118	0.010	mg/L	7.8	4/18/94	12:00	Dennis
pH	(9305)	7.62				4/13/94	14:12 *	Diane
Carbonate (CO3)	(9310)	ND	1.	mg/L		4/13/94	14:12	Diane
Bicarbonate (HCO3)	(9315)	154.	1.	mg/L	5.1	4/13/94	14:12	Diane
Hydroxide (OH)	(9320)	ND	1.	mg/L		4/13/94	14:12	Diane
Alkalinity (CaCO3)(Total)	(9325)	126.	1.	mg/L	5.1	4/13/94	14:12	Diane
Conductivity	(9330)	604.	1.00	umhos/cm	1.2	4/13/94	15:00	Diane
Phosphate (Total) (P)	(9415)	0.452	0.018	mg/L	9.8	4/22/94	16:30	Dennis
Sulfate as (SO4)	(9440)	198.	3.	mg/L	15.	4/19/94	15:00	Dennis
Nitrate + Nitrite (N) Tot	(9557)	1.84	0.005	mg/L	8.2	4/18/94	12:00	Dennis
Nitrogen (Total Kjeldahl)	(9575)	1.66	0.061	mg/L	13.	4/22/94	16:30	Dennis
Hardness Total (as CaCO3)	(9840)	259.		mg/L				
Suspended Solids (Total)	(9850)	340.	2.	mg/L	5.0	4/14/94	10:00	Carol
Cation Sum	(9905)	6.917		me/L				
Anion Sum	(9910)	7.119		me/L				
Difference	(9915)	-0.203		me/L				
Percent Difference	(9920)	-1.44		%				
Percent Sodium	(9925)	22.1		%				
Sodium Adsorption Ratio	(9930)	0.92						
Dissolved Solids(C)-Total	(9935)	424.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/ 4/94

Report Date: 5/ 4/94

Log Number: 94-R203

Date Collected: 4/14/94
Time Collected: 7:25
Collected By: Mel Askev
Date Received: 4/15/94
Time Received: 11:00
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	33.5	0.1	mg/L	7.5	5/ 4/94	9:15	Mike
Magnesium (Mg)	(1212)	18.9	0.1	mg/L	9.8	5/ 4/94	9:15	Mike
Potassium (K)	(1219)	8.9	1.0	mg/L	5.1	5/ 4/94	9:15	Mike
Calcium (Ca)	(1220)	71.5	0.030	mg/L	7.2	5/ 4/94	9:15	Mike
Manganese (Mn)	(1225)	0.961	0.002	mg/L	6.7	5/ 2/94	16:35	Mike
Iron (Fe)	(1226)	2.22	0.007	mg/L	7.4	5/ 2/94	16:35	Mike
Chloride	(5217)	13.0	3.0	mg/L	3.9	4/19/94	16:30	Dennis
Ammonia (N)	(9085)	ND	0.010	mg/L		4/18/94	15:00	Dennis
pH	(9305)	7.80				4/15/94	16:48 *	Diane
Carbonate (CO3)	(9310)	ND	1.	mg/L		4/15/94	16:48	Diane
Bicarbonate (HCO3)	(9315)	180.	1.	mg/L	5.1	4/15/94	16:48	Diane
Hydroxide (OH)	(9320)	ND	1.	mg/L		4/15/94	16:48	Diane
Alkalinity (CaCO3)(Total)	(9325)	147.	1.	mg/L	5.1	4/15/94	16:48	Diane
Conductivity	(9330)	626.	1.00	umhos/cm	1.2	4/15/94	13:00	Diane
Phosphate (Total) (P)	(9415)	0.328	0.018	mg/L	9.8	4/28/94	9:30	Dennis
Sulfate as (SO4)	(9440)	182.	3.	mg/L	15.	4/19/94	16:30	Dennis
Nitrate + Nitrite (N) Tot	(9557)	1.56	0.005	mg/L	8.2	4/18/94	15:00	Dennis
Nitrogen (Total Kjeldahl)	(9575)	1.29	0.061	mg/L	13.	4/28/94	9:30	Dennis
Hardness Total (as CaCO3)	(9840)	257.		mg/L				
Suspended Solids (Total)	(9850)	245.	2.	mg/L	5.0	4/19/94	15:00	Carol
Cation Sum	(9905)	6.821		me/L				
Anion Sum	(9910)	7.201		me/L				
Difference	(9915)	-0.380		me/L				
Percent Difference	(9920)	-2.71		%				
Percent Sodium	(9925)	22.0		%				
Sodium Adsorption Ratio	(9930)	0.91						
Dissolved Solids(C)-Total	(9935)	418.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

X

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/16/94

Report Date: 5/16/94

Log Number: 94-R252

Date Collected: 4/19/94
Date Received: 4/25/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 16:10
Time Received: 11:00
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	32.8	0.1	mg/L	7.5	5/13/94	9:30	Mike
Magnesium (Mg)	{ 1212}	17.8	0.1	mg/L	9.8	5/13/94	9:30	Mike
Potassium (K)	{ 1219}	7.2	1.0	mg/L	5.1	5/13/94	9:30	Mike
Calcium (Ca)	{ 1220}	66.0	0.030	mg/L	7.2	5/13/94	9:30	Mike
Manganese (Mn)	{ 1225}	0.379	0.002	mg/L	6.7	5/13/94	9:30	Mike
Iron (Fe)	{ 1226}	0.830	0.007	mg/L	7.4	5/13/94	9:30	Mike
Chloride	{ 5217}	12.8	3.0	mg/L	3.9	5/ 5/94	12:45	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/ 6/94	12:00	Dennis
pH	{ 9305}	7.94				4/25/94	12:40 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		4/25/94	12:40	Diane
Bicarbonate (HCO3)	{ 9315}	228.	1.	mg/L	5.1	4/25/94	12:40	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		4/25/94	12:40	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	187.	1.	mg/L	5.1	4/25/94	12:40	Diane
Conductivity	{ 9330}	663.	1.00	umhos/cm	1.2	4/25/94	15:00	Diane
Phosphate (Total) (P)	{ 9415}	0.248	0.018	mg/L	9.8	5/ 9/94	16:00	Dennis
Sulfate as (SO4)	{ 9440}	142.	3.	mg/L	15.	5/ 5/94	12:45	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.07	0.005	mg/L	8.2	5/ 6/94	12:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.928	0.061	mg/L	13.	5/ 9/94	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	238.		mg/L				
Suspended Solids (Total)	{ 9850}	88.	2.	mg/L	5.0	4/25/94	11:45	Carol
Cation Sum	{ 9905}	6.381		me/L				
Anion Sum	{ 9910}	7.149		me/L				
Difference	{ 9915}	-0.767		me/L				
Percent Difference	{ 9920}	-5.67		%				
Percent Sodium	{ 9925}	23.0		%				
Sodium Adsorption Ratio	{ 9930}	0.92						
Dissolved Solids(C)-Total	{ 9935}	393.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

X

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/16/94

Report Date: 5/16/94

Log Number: 94-R253

Date Collected: 4/23/94
Date Received: 4/27/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 16:05
Time Received: 11:00
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	35.9	0.1	mg/L	7.5	5/13/94	9:30	Mike
Magnesium (Mg)	{ 1212}	20.0	0.1	mg/L	9.8	5/13/94	9:30	Mike
Potassium (K)	{ 1219}	7.5	1.0	mg/L	5.1	5/13/94	9:30	Mike
Calcium (Ca)	{ 1220}	76.3	0.030	mg/L	7.2	5/13/94	9:30	Mike
Manganese (Mn)	{ 1225}	0.277	0.002	mg/L	6.7	5/13/94	9:30	Mike
Iron (Fe)	{ 1226}	0.589	0.007	mg/L	7.4	5/13/94	9:30	Mike
Chloride	{ 5217}	14.0	3.0	mg/L	3.9	5/ 5/94	12:45	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/ 6/94	12:00	Dennis
pH	{ 9305}	8.04				4/27/94	14:48 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		4/27/94	14:48	Diane
Bicarbonate (HCO3)	{ 9315}	262.	1.	mg/L	5.1	4/27/94	14:48	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		4/27/94	14:48	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	215.	1.	mg/L	5.1	4/27/94	14:48	Diane
Conductivity	{ 9330}	695.	1.00	umhos/cm	1.2	4/27/94	13:40	Diane
Phosphate (Total) (P)	{ 9415}	0.232	0.018	mg/L	9.8	5/ 9/94	16:00	Dennis
Sulfate as (SO4)	{ 9440}	142.	3.	mg/L	15.	5/ 5/94	12:45	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.828	0.005	mg/L	8.2	5/ 6/94	12:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.960	0.061	mg/L	13.	5/ 9/94	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	273.		mg/L				
Suspended Solids (Total)	{ 9850}	58.	2.	mg/L	5.0	4/28/94	11:45	Carol
Cation Sum	{ 9905}	7.221		me/L				
Anion Sum	{ 9910}	7.740		me/L				
Difference	{ 9915}	-0.519		me/L				
Percent Difference	{ 9920}	-3.47		%				
Percent Sodium	{ 9925}	22.2		%				
Sodium Adsorption Ratio	{ 9930}	0.94						
Dissolved Solids(C)-Total	{ 9935}	427.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 5/24/94

Report Date: 5/24/94

Log Number: 94-R269

Date Collected: 4/28/94
Date Received: 5/ 2/94
Site Code: ~~389999~~ 380111
Site: Field Duplicate
Comments: Tongue River W of Renwick

Time Collected: 7:30
Time Received: 11:00

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	34.1	0.1	mg/L	7.5	5/23/94	16:43	Mike
Magnesium (Mg)	{ 1212}	21.7	0.1	mg/L	9.8	5/23/94	16:43	Mike
Potassium (K)	{ 1219}	6.9	1.0	mg/L	5.1	5/23/94	16:43	Mike
Calcium (Ca)	{ 1220}	82.2	0.030	mg/L	7.2	5/23/94	16:43	Mike
Manganese (Mn)	{ 1225}	0.222	0.002	mg/L	6.7	5/23/94	16:43	Mike
Iron (Fe)	{ 1226}	0.749	0.007	mg/L	7.4	5/23/94	16:43	Mike
Chloride	{ 5217}	14.8	3.0	mg/L	3.9	5/ 5/94	13:45	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/ 6/94	13:30	Dennis
pH	{ 9305}	7.89				5/ 2/94	12:07 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		5/ 2/94	12:07	Diane
Bicarbonate (HCO3)	{ 9315}	266.	1.	mg/L	5.1	5/ 2/94	12:07	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		5/ 2/94	12:07	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	218.	1.	mg/L	5.1	5/ 2/94	12:07	Diane
Conductivity	{ 9330}	690.	1.00	umhos/cm	1.2	5/ 2/94	11:30	Diane
Phosphate (Total) (P)	{ 9415}	0.180	0.018	mg/L	9.8	5/10/94	16:00	Dennis
Sulfate as (SO4)	{ 9440}	143.	3.	mg/L	15.	5/ 5/94	13:45	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.559	0.005	mg/L	8.2	5/ 6/94	13:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.736	0.061	mg/L	13.	5/10/94	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	295.		mg/L				
Suspended Solids (Total)	{ 9850}	30.	2.	mg/L	5.0	5/ 3/94	15:00	Carol
Cation Sum	{ 9905}	7.562		me/L				
Anion Sum	{ 9910}	7.849		me/L				
Difference	{ 9915}	-0.286		me/L				
Percent Difference	{ 9920}	-1.86		%				
Percent Sodium	{ 9925}	20.0		%				
Sodium Adsorption Ratio	{ 9930}	0.86						
Dissolved Solids(C)-Total	{ 9935}	436.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

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Original Report Date: 5/26/94

Report Date: 5/26/94

Log Number: 94-R301

Date Collected: 5/ 4/94
Time Collected: 13:30
Collected By: Mel Askew
Date Received: 5/ 9/94
Time Received: 11:00
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	33.9	0.1	mg/L	7.5	5/23/94	16:43	Mike
Magnesium (Mg)	{ 1212}	21.6	0.1	mg/L	9.8	5/23/94	16:43	Mike
Potassium (K)	{ 1219}	6.5	1.0	mg/L	5.1	5/23/94	16:43	Mike
Calcium (Ca)	{ 1220}	85.0	0.030	mg/L	7.2	5/23/94	16:43	Mike
Manganese (Mn)	{ 1225}	0.112	0.002	mg/L	6.7	5/23/94	16:43	Mike
Iron (Fe)	{ 1226}	0.268	0.007	mg/L	7.4	5/23/94	16:43	Mike
Chloride	{ 5217}	12.6	3.0	mg/L	3.9	5/11/94	16:00	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/13/94	16:00	Dennis
pH	{ 9305}	8.14				5/10/94	10:05 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		5/10/94	10:05	Hugh
Bicarbonate (HCO3)	{ 9315}	283.	1.	mg/L	5.1	5/10/94	10:05	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		5/10/94	10:05	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	232.	1.	mg/L	5.1	5/10/94	10:05	Hugh
Conductivity	{ 9330}	703.	1.00	umhos/cm	1.2	5/ 9/94	11:56	Hugh
Phosphate (Total) (P)	{ 9415}	0.192	0.018	mg/L	9.8	5/25/94	11:00	Dennis
Sulfate as (SO4)	{ 9440}	154.	3.	mg/L	15.	5/11/94	16:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.140	0.005	mg/L	8.2	5/13/94	16:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.416	0.061	mg/L	13.	5/25/94	11:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	301.		mg/L				
Suspended Solids (Total)	{ 9850}	10.	2.	mg/L	5.0	5/10/94	9:30	Carol
Cation Sum	{ 9905}	7.675		me/L				
Anion Sum	{ 9910}	8.295		me/L				
Difference	{ 9915}	-0.619		me/L				
Percent Difference	{ 9920}	-3.88		%				
Percent Sodium	{ 9925}	19.6		%				
Sodium Adsorption Ratio	{ 9930}	0.85						
Dissolved Solids(C)-Total	{ 9935}	455.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 3/94

Report Date: 6/ 6/94

Log Number: 94-R314

Date Collected: 5/11/94
Time Collected: 16:00
Collected By: Mel Askew
Date Received: 5/13/94
Time Received: 11:00
Project Code: RMPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	43.1	0.1	mg/L	7.5	6/ 3/94	9:28	Mike
Magnesium (Mg)	{ 1212}	24.0	0.1	mg/L	9.8	6/ 3/94	9:28	Mike
Potassium (K)	{ 1219}	10.1	1.0	mg/L	5.1	6/ 3/94	9:28	Mike
Calcium (Ca)	{ 1220}	101.	0.030	mg/L	7.2	6/ 3/94	9:28	Mike
Manganese (Mn)	{ 1225}	0.128	0.002	mg/L	6.7	6/ 2/94	11:38	Mike
Iron (Fe)	{ 1226}	0.152	0.007	mg/L	7.4	6/ 2/94	11:38	Mike
Chloride	{ 5217}	15.4	3.0	mg/L	3.9	5/18/94	10:00	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/13/94	16:00	Dennis
pH	{ 9305}	8.28				5/13/94	13:31 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		5/13/94	13:31	Hugh
Bicarbonate (HCO3)	{ 9315}	291.	1.	mg/L	5.1	5/13/94	13:31	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		5/13/94	13:31	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	238.	1.	mg/L	5.1	5/13/94	13:31	Hugh
Conductivity	{ 9330}	74.9	1.00	umhos/cm	1.2	5/13/94	13:25	Hugh
Phosphate (Total) (P)	{ 9415}	0.132	0.018	mg/L	9.8	5/25/94	11:00	Dennis
Sulfate as (SO4)	{ 9440}	178.	3.	mg/L	15.	5/18/94	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	ND	0.005	mg/L		5/13/94	16:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.476	0.061	mg/L	13.	5/25/94	11:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	351.		mg/L				
Suspended Solids (Total)	{ 9850}	11.	2.	mg/L	5.0	5/13/94	14:00	Carol
Cation Sum	{ 9905}	9.166		me/L				
Anion Sum	{ 9910}	9.005		me/L				
Difference	{ 9915}	0.161		me/L				
Percent Difference	{ 9920}	0.89		%				
Percent Sodium	{ 9925}	21.0		%				
Sodium Adsorption Ratio	{ 9930}	1.00						
Dissolved Solids(C)-Total	{ 9935}	517.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 2/94

Report Date: 6/ 2/94

Log Number: 94-R325

Date Collected: 5/19/94
Date Received: 5/20/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 8:10
Time Received: 11:00
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Boyn

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	35.4	0.1	mg/L	7.5	6/ 1/94	16:12	Mike
Magnesium (Mg)	{ 1212}	22.4	0.1	mg/L	9.8	6/ 1/94	16:12	Mike
Potassium (K)	{ 1219}	7.6	1.0	mg/L	5.1	6/ 1/94	16:12	Mike
Calcium (Ca)	{ 1220}	87.3	0.030	mg/L	7.2	6/ 1/94	16:12	Mike
Manganese (Mn)	{ 1225}	0.182	0.002	mg/L	6.7	6/ 1/94	16:12	Mike
Iron (Fe)	{ 1226}	0.437	0.007	mg/L	7.4	6/ 1/94	16:12	Mike
Chloride	{ 5217}	15.1	3.0	mg/L	3.9	5/24/94	13:30	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		5/27/94	15:30	Dennis
pH	{ 9305}	8.10				5/20/94	15:21 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		5/20/94	15:21	Hugh
Bicarbonate (HCO3)	{ 9315}	301.	1.	mg/L	5.1	5/20/94	15:21	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		5/20/94	15:21	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	247.	1.	mg/L	5.1	5/20/94	15:21	Hugh
Conductivity	{ 9330}	719.	1.00	umhos/cm	1.2	5/20/94	12:00	Diane
Phosphate (Total) (P)	{ 9415}	0.193	0.018	mg/L	9.8	5/26/94	16:00	Dennis
Sulfate as (SO4)	{ 9440}	165.	3.	mg/L	15.	5/24/94	13:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.028	0.005	mg/L	8.2	5/27/94	15:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	ND	0.061	mg/L		5/26/94	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	310.		mg/L				
Suspended Solids (Total)	{ 9850}	20.	2.	mg/L	5.0	5/24/94	13:15	Christine
Cation Sum	{ 9905}	7.950		me/L				
Anion Sum	{ 9910}	8.889		me/L				
Difference	{ 9915}	-0.940		me/L				
Percent Difference	{ 9920}	-5.58		%				
Percent Sodium	{ 9925}	19.8		%				
Sodium Adsorption Ratio	{ 9930}	0.87						
Dissolved Solids(C)-Total	{ 9935}	483.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Page: 1

Original Report Date: 6/ 9/94

Report Date: 6/ 9/94

Log Number: 94-R358

Date Collected: 5/25/94
Time Collected: 10:25
Collected By: Mel Askew
Date Received: 5/31/94
Time Received: 11:16
Project Code: RNPSRRR
Site Code: 380111
Pembina County
Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bom

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	34.7	0.1	mg/L	7.5	6/ 2/94	11:38	Mike
Magnesium (Mg)	{ 1212}	21.3	0.1	mg/L	9.8	6/ 2/94	11:38	Mike
Potassium (K)	{ 1219}	6.6	1.0	mg/L	5.1	6/ 2/94	11:38	Mike
Calcium (Ca)	{ 1220}	86.9	0.030	mg/L	7.2	6/ 2/94	11:38	Mike
Manganese (Mn)	{ 1225}	0.207	0.002	mg/L	6.7	6/ 2/94	11:38	Mike
Iron (Fe)	{ 1226}	0.377	0.007	mg/L	7.4	6/ 2/94	11:38	Mike
Chloride	{ 5217}	16.2	3.0	mg/L	3.9	6/ 7/94	12:45	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		6/ 6/94	10:00	Dennis
pH	{ 9305}	7.89				5/31/94	12:04 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		5/31/94	12:04	Hugh
Bicarbonate (HCO3)	{ 9315}	304.	1.	mg/L	5.1	5/31/94	12:04	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		5/31/94	12:04	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	249.	1.	mg/L	5.1	5/31/94	12:04	Hugh
Conductivity	{ 9330}	756.	1.00	umhos/cm	1.2	5/31/94	12:00	Hugh
Phosphate (Total) (P)	{ 9415}	0.172	0.018	mg/L	9.8	6/ 3/94	12:30	Dennis
Sulfate as (SO4)	{ 9440}	138.	3.	mg/L	15.	6/ 7/94	12:45	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.101	0.005	mg/L	8.2	6/ 6/94	10:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.444	0.061	mg/L	13.	6/ 3/94	12:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	305.		mg/L				
Suspended Solids (Total)	{ 9850}	26.	2.	mg/L	5.0	5/31/94	15:00	Carol
Cation Sum	{ 9905}	7.783		me/L				
Anion Sum	{ 9910}	8.407		me/L				
Difference	{ 9915}	-0.624		me/L				
Percent Difference	{ 9920}	-3.86		%				
Percent Sodium	{ 9925}	19.8		%				
Sodium Adsorption Ratio	{ 9930}	0.86						
Dissolved Solids(C)-Total	{ 9935}	455.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Original Report Date: 7/12/94 Report Date: 7/12/94

Log Number: 94-R424

Date Collected: 6/15/94 Time Collected: 7:50 Collected By: Mel Askew
Date Received: 6/16/94 Time Received: 11:00 Project Code: RNPSRRR
Site Code: 380111 Pembina County Project: RENWICK WATERSHED
Site: Tongue River 1 Mile W of Renwick
Comments:

Approved by: Mike Bon

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	35.4	0.1	mg/L	7.5	7/11/94	14:04	Mike
Magnesium (Mg)	{ 1212}	20.7	0.1	mg/L	9.8	7/11/94	14:04	Mike
Potassium (K)	{ 1219}	6.9	1.0	mg/L	5.1	7/11/94	14:04	Mike
Calcium (Ca)	{ 1220}	81.1	0.030	mg/L	7.2	7/11/94	14:04	Mike
Manganese (Mn)	{ 1225}	0.366	0.002	mg/L	6.7	7/11/94	14:04	Mike
Iron (Fe)	{ 1226}	0.479	0.007	mg/L	7.4	7/11/94	14:04	Mike
Chloride	{ 5217}	12.0	3.0	mg/L	3.9	6/16/94	13:30	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		6/17/94	17:00	Dennis
pH	{ 9305}	8.10				6/16/94	13:03 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		6/16/94	13:03	Hugh
Bicarbonate (HCO3)	{ 9315}	300.	1.	mg/L	5.1	6/16/94	13:03	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		6/16/94	13:03	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	246.	1.	mg/L	5.1	6/16/94	13:03	Hugh
Conductivity	{ 9330}	594.	1.00	umhos/cm	1.2	6/16/94	15:00	Hugh
Phosphate (Total) (P)	{ 9415}	0.216	0.018	mg/L	9.8	6/20/94	16:30	Dennis
Sulfate as (SO4)	{ 9440}	117.	3.	mg/L	15.	6/16/94	13:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.116	0.005	mg/L	8.2	6/17/94	17:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.560	0.061	mg/L	13.	6/20/94	16:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	288.		mg/L				
Suspended Solids (Total)	{ 9850}	49.	2.	mg/L	5.0	6/20/94	14:30	Christine
Cation Sum	{ 9905}	7.481		me/L				
Anion Sum	{ 9910}	7.786		me/L				
Difference	{ 9915}	-0.304		me/L				
Percent Difference	{ 9920}	-1.99		%				
Percent Sodium	{ 9925}	21.0		%				
Sodium Adsorption Ratio	{ 9930}	0.91						
Dissolved Solids(C)-Total	{ 9935}	423.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

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Original Report Date: 7/12/94

Report Date: 7/12/94

Log Number: 94-R605

Date Collected: 6/28/94
Date Received: 6/29/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected:
Time Received: 11:00
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Born

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	34.4	0.1	mg/L	7.5	7/11/94	14:04	Mike
Magnesium (Mg)	{ 1212}	21.4	0.1	mg/L	9.8	7/11/94	14:04	Mike
Potassium (K)	{ 1213}	6.4	1.0	mg/L	5.1	7/11/94	14:04	Mike
Calcium (Ca)	{ 1220}	78.6	0.030	mg/L	7.2	7/11/94	14:04	Mike
Manganese (Mn)	{ 1225}	0.385	0.002	mg/L	6.7	7/11/94	14:04	Mike
Iron (Fe)	{ 1226}	0.392	0.007	mg/L	7.4	7/11/94	14:04	Mike
Chloride	{ 5217}	12.2	3.0	mg/L	3.9	6/30/94	12:00	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		7/ 5/94	12:00	Dennis
pH	{ 9305}	8.17				6/29/94	15:48 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		6/29/94	15:48	Hugh
Bicarbonate (HCO3)	{ 9315}	294.	1.	mg/L	5.1	6/29/94	15:48	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		6/29/94	15:48	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	241.	1.	mg/L	5.1	6/29/94	15:48	Hugh
Conductivity	{ 9330}	678.	1.00	umhos/cm	1.2	6/29/94	15:00	Hugh
Phosphate (Total) (P)	{ 9415}	0.260	0.018	mg/L	9.8	7/ 7/94	13:30	Dennis
Sulfate as (SO4)	{ 9440}	115.	3.	mg/L	15.	6/30/94	12:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.134	0.005	mg/L	8.2	7/ 5/94	12:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.536	0.061	mg/L	13.	7/ 7/94	13:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	285.		mg/L				
Suspended Solids (Total)	{ 9850}	56.	2.	mg/L	5.0	6/30/94	14:00	Carol
Cation Sum	{ 9905}	7.358		me/L				
Anion Sum	{ 9910}	7.651		me/L				
Difference	{ 9915}	-0.293		me/L				
Percent Difference	{ 9920}	-1.95		%				
Percent Sodium	{ 9925}	20.7		%				
Sodium Adsorption Ratio	{ 9930}	0.89						
Dissolved Solids(C)-Total	{ 9935}	415.		mg/L				

* - Exceeded EPA Holding Time

ND - Not Detected

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Original Report Date: 8/17/94

Log Number: 94-R743

Date Collected: 7/19/94
Date Received: 7/20/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 8:00
Time Received: 11:00
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	(1211)	30.2	0.1	mg/L	7.5	8/15/94	16:35	Mike
Magnesium (Mg)	(1212)	20.2	0.1	mg/L	3.8	8/15/94	16:35	Mike
Potassium (K)	(1213)	5.5	1.0	mg/L	5.1	8/15/94	16:35	Mike
Calcium (Ca)	(1220)	87.6	0.030	mg/L	3.2	8/15/94	16:35	Mike
Manganese (Mn)	(1225)	0.816	0.002	mg/L	6.7	8/15/94	16:35	Mike
Iron (Fe)	(1226)	0.203	0.007	mg/L	7.4	8/15/94	16:35	Mike
Chloride	(5217)	11.5	3.0	mg/L	3.8	7/28/94	14:30	Dennis
Ammonia (N)	(9095)	0.031	0.010	mg/L	7.9	7/22/94	14:30	Dennis
pH	(9300)	8.18				7/20/94	14:53 *	Hugh
Carbonate (CO3)	(9310)	ND	1.	mg/L		7/20/94	14:53	Hugh
Bicarbonate (HCO3)	(9315)	295.	1.	mg/L	5.1	7/20/94	14:53	Hugh
Hydroxide (OH)	(9320)	ND	1.	mg/L		7/20/94	14:53	Hugh
Alkalinity (CaCO3)(Total)	(9325)	242.	1.	mg/L	5.1	7/20/94	14:53	Hugh
Conductivity	(9330)	697.	1.00	umhos/cm	1.2	7/20/94	16:00	Hugh
Phosphate (Total) (P)	(9418)	0.284	0.018	mg/L	9.8	8/ 2/94	11:30	Dennis
Sulfate as (SO4)	(9440)	91.	3.	mg/L	15.	7/26/94	14:30	Dennis
Nitrate + Nitrite (N) Tot	(9557)	0.405	0.005	mg/L	8.2	7/22/94	14:30	Dennis
Nitrogen (Total Kjeldahl)	(9575)	0.500	0.061	mg/L	10.	8/ 2/94	11:30	Dennis
Hardness Total (as CaCO3)	(9340)	352.		mg/L				
Suspended Solids (Total)	(9530)	21.	2.	mg/L	5.0	7/21/94	10:15	Christine
Cation Sum	(9905)	6.506		me/L				
Anion Sum	(9910)	7.148		me/L				
Difference	(9915)	-0.645		me/L				
Percent Difference	(9920)	-4.72		%				
Percent Sodium	(9925)	20.6		%				
Sodium Adsorption Ratio	(9930)	0.83						
Dissolved Solids(C)-Total	(9935)	378.		mg/L				

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

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Original Report Date: 9/ 6/94

Report Date: 9/ 6/94

Log Number: 94-R1009

Date Collected: 8/24/94
Date Received: 8/25/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 8:00
Time Received: 11:09
Pembina County

Collected By: Mel Askew
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: Mike Born

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	45.1	0.1	mg/L	7.5	9/ 2/94	8:59	Mike
Magnesium (Mg)	{ 1212}	25.1	0.1	mg/L	9.8	9/ 2/94	8:59	Mike
Potassium (K)	{ 1219}	9.1	1.0	mg/L	5.1	9/ 2/94	8:59	Mike
Calcium (Ca)	{ 1220}	87.6	0.030	mg/L	7.2	9/ 2/94	8:59	Mike
Manganese (Mn)	{ 1225}	0.295	0.002	mg/L	6.7	9/ 1/94	16:59	Mike
Iron (Fe)	{ 1226}	0.186	0.007	mg/L	7.4	9/ 1/94	16:59	Mike
Chloride	{ 5217}	15.3	3.0	mg/L	3.9	8/31/94	11:00	Dennis
Ammonia (N)	{ 9085}	0.173	0.010	mg/L	7.8	8/26/94	14:00	Dennis
pH	{ 9305}	8.03				8/25/94	13:32 *	Hugh
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		8/25/94	13:32	Hugh
Bicarbonate (HCO3)	{ 9315}	287.	1.	mg/L	5.1	8/25/94	13:32	Hugh
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		8/25/94	13:32	Hugh
Alkalinity (CaCO3)(Total)	{ 9325}	235.	1.	mg/L	5.1	8/25/94	13:32	Hugh
Conductivity	{ 9330}	734.	1.00	umhos/cm	1.2	8/25/94	16:20	Hugh
Phosphate (Total) (P)	{ 9415}	0.263	0.018	mg/L	9.8	8/30/94	10:00	Dennis
Sulfate as (SO4)	{ 9440}	135.	3.	mg/L	15.	8/31/94	11:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.328	0.005	mg/L	8.2	8/26/94	14:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.768	0.061	mg/L	13.	8/30/94	10:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	322.		mg/L				
Suspended Solids (Total)	{ 9850}	21.	2.	mg/L	5.0	8/25/94	14:15	Carol
Cation Sum	{ 9905}	8.648		me/L				
Anion Sum	{ 9910}	8.041		me/L				
Difference	{ 9915}	0.607		me/L				
Percent Difference	{ 9920}	3.64		%				
Percent Sodium	{ 9925}	23.2		%				
Sodium Adsorption Ratio	{ 9930}	1.09						
Dissolved Solids(C)-Total	{ 9935}	461.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

North Dakota State Department of Health
and Consolidated Laboratories
4/21/93
Pembina County

Log Number: 93-R247 Type: 2

Date Collected: 4/ 7/93 Date Received: 4/ 8/93
Time Collected: 7:30 Time Received: 14:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	27.2	mg/l	2.6	mg/l	4/20/93	9:04	Mike
Magnesium (Mg)	{ 1212}	10.1	mg/l	1.0	mg/l	4/20/93	9:04	Mike
Potassium (K)	{ 1219}	5.61	mg/l	0.376	mg/l	4/20/93	9:04	Mike
Calcium (Ca)	{ 1220}	41.8	mg/l	3.85	mg/l	4/20/93	9:04	Mike
Manganese (Mn)	{ 1225}	1.76	mg/l	0.127	mg/l	4/20/93	9:04	Mike
Iron (Fe)	{ 1226}	3.17	mg/l	0.282	mg/l	4/20/93	9:04	Mike
Chloride	{ 5217}	13.1	mg/l	1.6	mg/l	4/15/93	10:00	Dennis
Ammonia (N)	{ 9085}	0.195	mg/l	0.015	mg/l	4/16/93	10:30	Dennis
pH	{ 9305}	7.63				4/ 8/93	15:03 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/ 8/93	15:03	Diane
Bicarbonate (HCO3)	{ 9315}	123.	mg/l	10.	mg/l	4/ 8/93	15:03	Diane
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/ 8/93	15:03	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	101.	mg/l	10.	mg/l	4/ 8/93	15:03	Diane
Conductivity	{ 9330}	355.9	umhos/cm		umhos/cm	4/ 8/93	16:30	Dennis
Phosphate (Total) (P)	{ 9415}	0.655	mg/l	0.056	mg/l	4/13/93	9:30	Dennis
Sulfate as (SO4)	{ 9440}	90.	mg/l	9.	mg/l	4/15/93	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	3.38	mg/l	0.238	mg/l	4/13/93	16:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	2.61	mg/l	0.336	mg/l	4/13/93	9:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	146.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	340.	mg/l	17.	mg/l	4/13/93	12:00	Carol
Cation Sum	{ 9905}	4.531	me/l		me/l			
Anion Sum	{ 9910}	4.260	me/l		me/l			
Difference	{ 9915}	0.271	me/l		me/l			
Percent Difference	{ 9920}	3.08	%		%			
Percent Sodium	{ 9925}	28.7	%		%			
Sodium Adsorption Ratio	{ 9930}	0.98						
Dissolved Solids(C)-Total	{ 9935}	248.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. Mike Boyn Chemist

North Dakota State Department of Health
and Consolidated Laboratories
4/23/93
Pembina County

Log Number: 93-R261 Type: 2

Date Collected: 4/12/93 Date Received: 4/14/93
Time Collected: 16:25 Time Received: 16:20
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	28.6	mg/l	2.7	mg/l	4/22/93	9:18	Mike
Magnesium (Mg)	{ 1212}	13.5	mg/l	1.1	mg/l	4/22/93	9:18	Mike
Potassium (K)	{ 1219}	5.73	mg/l	0.384	mg/l	4/22/93	9:18	Mike
Calcium (Ca)	{ 1220}	51.9	mg/l	4.79	mg/l	4/22/93	9:18	Mike
Manganese (Mn)	{ 1225}	0.263	mg/l	0.019	mg/l	4/22/93	9:18	Mike
Iron (Fe)	{ 1226}	0.727	mg/l	0.065	mg/l	4/22/93	9:18	Mike
Chloride	{ 5217}	13.6	mg/l	1.7	mg/l	4/15/93	10:30	Dennis
Ammonia (N)	{ 9085}	0.169	mg/l	0.013	mg/l	4/16/93	12:30	Dennis
pH	{ 9305}	7.79				4/14/93	16:27 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/14/93	16:27	Diane
Bicarbonate (HCO3)	{ 9315}	182.	mg/l	10.	mg/l	4/14/93	16:27	Diane
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/14/93	16:27	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	149.	mg/l	10.	mg/l	4/14/93	16:27	Diane
Conductivity	{ 9330}	538.5	umhos/cm		umhos/cm	4/14/93	16:30	Diane
Phosphate (Total) (P)	{ 9415}	0.257	mg/l	0.022	mg/l	4/19/93	16:00	Dennis
Sulfate as (SO4)	{ 9440}	115.	mg/l	12.	mg/l	4/15/93	10:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.300	mg/l	0.021	mg/l	4/20/93	16:45	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.17	mg/l	0.151	mg/l	4/19/93	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	185.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	38.	mg/l	5.	mg/l	4/15/93	11:15	Carol
Cation Sum	{ 9905}	5.162	me/l		me/l			
Anion Sum	{ 9910}	5.763	me/l		me/l			
Difference	{ 9915}	-0.600	me/l		me/l			
Percent Difference	{ 9920}	-5.50	%		%			
Percent Sodium	{ 9925}	25.0	%		%			
Sodium Adsorption Ratio	{ 9930}	0.91						
Dissolved Solids(C)-Total	{ 9935}	318.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health and Consolidated Laboratories
Chemistry Division

Original Report Date: 9/ 5/94

Report Date: 10/ 5/94

Log Number: 94-R1068

Date Collected: 9/22/94
Date Received: 9/22/94
Site Code: 380111
Site: Tongue River 1 Mile W of Renwick
Comments:

Time Collected: 15:45
Time Received: 11:38
Pembina County

Collected By: Brent Nelson
Project Code: RNPSRRR
Project: RENWICK WATERSHED

Approved by: _____

Inorganic

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	28.8	0.1	mg/L	7.5	9/29/94	17:00	Mike
Magnesium (Mg)	{ 1212}	20.7	0.1	mg/L	9.3	9/29/94	17:00	Mike
Potassium (K)	{ 1213}	6.2	1.0	mg/L	5.1	9/29/94	17:00	Mike
Calcium (Ca)	{ 1220}	73.5	0.030	mg/L	7.2	9/29/94	17:00	Mike
Manganese (Mn)	{ 1225}	0.235	0.002	mg/L	6.7	9/29/94	17:00	Mike
Iron (Fe)	{ 1226}	0.143	0.007	mg/L	7.4	9/29/94	17:00	Mike
Chloride	{ 5217}	13.4	3.0	mg/L	3.3	9/27/94	12:30	Dennis
Ammonia (N)	{ 9085}	ND	0.010	mg/L		9/29/94	11:00	Dennis
pH	{ 9305}	8.20				9/23/94	9:20 *	Dennis
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		9/23/94	9:20	Dennis
Bicarbonate (HCO3)	{ 9315}	332.	1.	mg/L	5.1	9/23/94	9:20	Dennis
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		9/23/94	9:20	Dennis
Alkalinity (CaCO3)(Total)	{ 9325}	272.	1.	mg/L	5.1	9/23/94	9:20	Dennis
Conductivity	{ 9330}	661.	1.00	umhos/cm	1.2	9/22/94	14:00	Diane
Phosphate (Total) (P)	{ 9415}	0.192	0.018	mg/L	9.8	10/ 4/94	12:00	Dennis
Sulfate as (SO4)	{ 9440}	74.	3.	mg/L	15.	9/27/94	12:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.020	0.005	mg/L	8.2	9/29/94	11:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.559	0.061	mg/L	13.	10/ 4/94	12:00	Dennis
Hardness Total (as CaCO3)	{ 9340}	269.		mg/L				
Suspended Solids (Total)	{ 9850}	10.	2.	mg/L	5.0	9/22/94	15:00	Carol
Cation Sum	{ 9905}	6.796		me/L				
Anion Sum	{ 9910}	7.454		me/L				
Difference	{ 9915}	-0.657		me/L				
Percent Difference	{ 9920}	-4.61		%				
Percent Sodium	{ 9925}	18.8		%				
Sodium Adsorption Ratio	{ 9930}	0.76						
Dissolved Solids(C)-Total	{ 9935}	382.		mg/L				

* - Exceeded EPA Holding Time

ND - Not Detected

North Dakota State Department of Health
and Consolidated Laboratories
./26/93
Pembina County

Log Number: 93-R211 Type: 2

Date Collected: 4/ 1/93
Time Collected: 7:20
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Date Received: 4/ 5/93
Time Received: 8:30

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	35.6	mg/l	3.4	mg/l	4/23/93	9:19	Mike
Magnesium (Mg)	{ 1212}	16.0	mg/l	1.3	mg/l	4/23/93	9:19	Mike
Potassium (K)	{ 1219}	7.05	mg/l	0.472	mg/l	4/23/93	9:19	Mike
Calcium (Ca)	{ 1220}	61.6	mg/l	5.68	mg/l	4/23/93	9:19	Mike
Manganese (Mn)	{ 1225}	0.108	mg/l	0.008	mg/l	4/12/93	11:49	Mike
Iron (Fe)	{ 1226}	0.183	mg/l	0.016	mg/l	4/12/93	11:49	Mike
Chloride	{ 5217}	14.6	mg/l	1.8	mg/l	4/ 7/93	12:00	Dennis
Ammonia (N)	{ 9085}	0.476	mg/l	0.037	mg/l	4/ 8/93	10:30	Dennis
pH	{ 9305}	7.85				4/ 5/93	9:17 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/ 5/93	9:17	Diane
Bicarbonate (HCO3)	{ 9315}	187.	mg/l	10.	mg/l	4/ 5/93	9:17	Diane
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/ 5/93	9:17	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	153.	mg/l	10.	mg/l	4/ 5/93	9:17	Diane
Conductivity	{ 9330}	547.8	umhos/cm		umhos/cm	4/ 5/93	9:30	Diane
Phosphate (Total) (P)	{ 9415}	0.250	mg/l	0.021	mg/l	4/ 7/93	15:00	Dennis
Sulfate as (SO4)	{ 9440}	106.	mg/l	11.	mg/l	4/ 7/93	12:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.18	mg/l	0.083	mg/l	4/ 6/93	11:00	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.11	mg/l	0.143	mg/l	4/ 7/93	15:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	220.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	14.	mg/l	5.	mg/l	4/ 5/93	14:30	Carol
Cation Sum	{ 9905}	6.174	me/l		me/l			
Anion Sum	{ 9910}	5.685	me/l		me/l			
Difference	{ 9915}	0.489	me/l		me/l			
Percent Difference	{ 9920}	4.13	%		%			
Percent Sodium	{ 9925}	26.0	%		%			
Sodium Adsorption Ratio	{ 9930}	1.04						
Dissolved Solids(C)-Total	{ 9935}	333.	mg/l		mg/l			

* Exceeded EPA ...

Completed Dec 15, 1993

Mike Bom Chemist

North Dakota State Department of Health
and Consoli ted Laboratories
4/28/93
Pembina County

Log Number: 93-R241 Type: 2

Date Collected: 4/ 5/93 Date Received: 4/ 8/93
Time Collected: 16:20 Time Received: 11:10
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	33.6	mg/l	3.2	mg/l	4/20/93	9:04	Mike
Magnesium (Mg)	{ 1212}	10.1	mg/l	1.0	mg/l	4/20/93	9:04	Mike
Potassium (K)	{ 1219}	6.46	mg/l	0.433	mg/l	4/20/93	9:04	Mike
Calcium (Ca)	{ 1220}	40.1	mg/l	3.70	mg/l	4/20/93	9:04	Mike
Manganese (Mn)	{ 1225}	1.37	mg/l	0.099	mg/l	4/20/93	9:04	Mike
Iron (Fe)	{ 1226}	2.46	mg/l	0.219	mg/l	4/20/93	9:04	Mike
Chloride	{ 5217}	16.5	mg/l	2.1	mg/l	4/15/93	10:00	Dennis
Ammonia (N)	{ 9085}	0.290	mg/l	0.023	mg/l	4/16/93	10:30	Dennis
pH	{ 9305}	7.67				4/ 8/93	13:14 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/ 8/93	13:14	Diane
Bicarbonate (HCO3)	{ 9315}	111.	mg/l	10.	mg/l	4/ 8/93	13:14	Diane
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/ 8/93	13:14	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	91.	mg/l	10.	mg/l	4/ 8/93	13:14	Diane
Conductivity	{ 9330}	424.5	umhos/cm		umhos/cm	4/ 8/93	13:20	Diane
Phosphate (Total) (P)	{ 9415}	0.757	mg/l	0.065	mg/l	4/27/93	16:30	Diane
Sulfate as (SO4)	{ 9440}	102.	mg/l	11.	mg/l	4/15/93	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	preserved with HNO3						
Nitrogen (Total Kjeldahl)	{ 9575}	1.05	mg/l	0.135	mg/l	4/27/93	16:30	Diane
Hardness Total (as CaCO3)	{ 9840}	142.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	250.	mg/l	12.	mg/l	4/ 8/93	14:00	Carol
Cation Sum	{ 9905}	4.692	me/l		me/l			
Anion Sum	{ 9910}	4.409	me/l		me/l			
Difference	{ 9915}	0.282	me/l		me/l			
Percent Difference	{ 9920}	3.10	%		%			
Percent Sodium	{ 9925}	33.9	%		%			
Sodium Adsorption Ratio	{ 9930}	1.23						
Dissolved Solids(C)-Total	{ 9935}	263.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

and Consolidated Laboratories

4/26/93

Pembina County

Log Number: 93-R295 Type: 2

Date Collected: 4/14/93
Time Collected: 16:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Date Received: 4/16/93
Time Received: 15:35

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	32.3	mg/l	3.1	mg/l	4/22/93	9:18	Mike
Magnesium (Mg)	{ 1212}	16.1	mg/l	1.3	mg/l	4/22/93	9:18	Mike
Potassium (K)	{ 1219}	6.35	mg/l	0.426	mg/l	4/22/93	9:18	Mike
Calcium (Ca)	{ 1220}	61.0	mg/l	5.62	mg/l	4/22/93	9:18	Mike
Manganese (Mn)	{ 1225}	0.286	mg/l	0.021	mg/l	4/22/93	9:18	Mike
Iron (Fe)	{ 1226}	0.495	mg/l	0.044	mg/l	4/22/93	9:18	Mike
Chloride	{ 5217}	13.4	mg/l	1.7	mg/l	4/21/93	14:30	Dennis
Ammonia (N)	{ 9085}	0.074	mg/l	0.006	mg/l	4/23/93	10:30	Diane
pH	{ 9305}	7.98				4/16/93	13:53 *	Dennis
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/16/93	13:53	Dennis
Bicarbonate (HCO3)	{ 9315}	190.	mg/l	10.	mg/l	4/16/93	13:53	Dennis
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/16/93	13:53	Dennis
Alkalinity (CaCO3)(Total)	{ 9325}	156.	mg/l	10.	mg/l	4/16/93	13:53	Dennis
Conductivity	{ 9330}	588.3	umhos/cm		umhos/cm	4/19/93	14:00	Diane
Phosphate (Total) (P)	{ 9415}	0.242	mg/l	0.021	mg/l	4/19/93	16:00	Dennis
Sulfate as (SO4)	{ 9440}	116.	mg/l	12.	mg/l	4/21/93	14:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.65	mg/l	0.116	mg/l	4/21/93	10:40	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.894	mg/l	0.115	mg/l	4/19/93	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	219.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	38.	mg/l	5.	mg/l	4/19/93	11:00	Carol
Cation Sum	{ 9905}	5.995	me/l		me/l			
Anion Sum	{ 9910}	5.909	me/l		me/l			
Difference	{ 9915}	0.086	me/l		me/l			
Percent Difference	{ 9920}	0.72	%		%			
Percent Sodium	{ 9925}	24.2	%		%			
Sodium Adsorption Ratio	{ 9930}	0.95						
Dissolved Solids(C)-Total	{ 9935}	339.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
4/30/93
Pembina County

Log Number: 93-R303 Type: 2

Date Collected: 4/20/93 Date Received: 4/21/93
Time Collected: 7:25 Time Received: 14:50
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	13.8	mg/L	2.5	mg/L	4/29/93	9:06	Mike
Magnesium (Mg)	{ 1212}	14.5	mg/L	1.1	mg/L	4/29/93	9:06	Mike
Potassium (K)	{ 1219}	2.29	mg/L	0.300	mg/L	4/29/93	9:06	Mike
Calcium (Ca)	{ 1220}	66.8	mg/L	6.16	mg/L	4/29/93	9:06	Mike
Manganese (Mn)	{ 1225}	0.642	mg/L	0.046	mg/L	4/29/93	9:06	Mike
Iron (Fe)	{ 1226}	0.910	mg/L	0.081	mg/L	4/29/93	9:06	Mike
Chloride	{ 5217}	7.4	mg/L	0.9	mg/L	4/28/93	10:30	Dennis
Ammonia (N)	{ 9085}	0.270	mg/L	0.021	mg/L	4/23/93	10:30	Diane
pH	{ 9305}	7.94				4/21/93	15:19 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/L	10.	mg/L	4/21/93	15:19	Diane
Bicarbonate (HCO3)	{ 9315}	296.	mg/L	10.	mg/L	4/21/93	15:19	Diane
Hydroxide (OH)	{ 9320}	0.	mg/L	1.	mg/L	4/21/93	15:19	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	242.	mg/L	10.	mg/L	4/21/93	15:19	Diane
Conductivity	{ 9330}	530.1	umhos/cm		umhos/cm	4/21/93	16:00	Diane
Phosphate (Total) (P)	{ 9415}	0.172	mg/L	0.015	mg/L	4/27/93	16:30	Diane
Sulfate as (SO4)	{ 9440}	43.	mg/L	4.	mg/L	4/28/93	10:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.270	mg/L	0.019	mg/L	4/22/93	14:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.11	mg/L	0.143	mg/L	4/27/93	16:30	Diane
Hardness Total (as CaCO3)	{ 9840}	227.	mg/L		mg/L			
Suspended Solids (Total)	{ 9850}	50.	mg/L	5.	mg/L	4/22/93	10:30	Carol
Cation Sum	{ 9905}	5.300	me/L		me/L			
Anion Sum	{ 9910}	5.957	me/L		me/L			
Difference	{ 9915}	-0.657	me/L		me/L			
Percent Difference	{ 9920}	-5.83	%		%			
Percent Sodium	{ 9925}	11.6	%		%			
Sodium Adsorption Ratio	{ 9930}	0.40						
Dissolved Solids(C)-Total	{ 9935}	294.	mg/L		mg/L			

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
5/ 3/93
Pembina County

Log Number: 93-R320 Type: 2

Date Collected: 4/22/93 Date Received: 4/23/93
Time Collected: 8:00 Time Received: 10:50
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	33.4	mg/l	3.2	mg/l	4/29/93	9:06	Mike
Magnesium (Mg)	{ 1212}	15.0	mg/l	1.2	mg/l	4/29/93	9:06	Mike
Potassium (K)	{ 1219}	6.05	mg/l	0.405	mg/l	4/29/93	9:06	Mike
Calcium (Ca)	{ 1220}	58.1	mg/l	5.36	mg/l	4/29/93	9:06	Mike
Manganese (Mn)	{ 1225}	0.303	mg/l	0.022	mg/l	4/29/93	9:06	Mike
Iron (Fe)	{ 1226}	0.571	mg/l	0.051	mg/l	4/29/93	9:06	Mike
Chloride	{ 5217}	13.1	mg/l	1.6	mg/l	4/28/93	11:30	Dennis
Ammonia (N)	{ 9085}	0.033	mg/l	0.003	mg/l	4/30/93	11:00	Diane
pH	{ 9305}	7.86				4/23/93	14:13 *	Diane
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	4/23/93	14:13	Diane
Bicarbonate (HCO3)	{ 9315}	188.	mg/l	10.	mg/l	4/23/93	14:13	Diane
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	4/23/93	14:13	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	154.	mg/l	10.	mg/l	4/23/93	14:13	Diane
Conductivity	{ 9330}	572.5	umhos/cm		umhos/cm	4/23/93	14:20	Diane
Phosphate (Total) (P)	{ 9415}	0.231	mg/l	0.020	mg/l	4/27/93	16:30	Diane
Sulfate as (SO4)	{ 9440}	126.	mg/l	13.	mg/l	4/28/93	11:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	1.01	mg/l	0.071	mg/l	4/28/93	9:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.23	mg/l	0.158	mg/l	4/27/93	16:30	Diane
Hardness Total (as CaCO3)	{ 9840}	207.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	58.	mg/l	5.	mg/l	4/26/93	10:30	Carol
Cation Sum	{ 9905}	5.801	me/l		me/l			
Anion Sum	{ 9910}	6.076	me/l		me/l			
Difference	{ 9915}	-0.275	me/l		me/l			
Percent Difference	{ 9920}	-2.32	%		%			
Percent Sodium	{ 9925}	25.9	%		%			
Sodium Adsorption Ratio	{ 9930}	1.01						
Dissolved Solids(C)-Total	{ 9935}	344.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
5/13/93
Pembina County

Log Number: 93-R353 Type: 2

Date Collected: 4/30/93 Date Received: 5/ 3/93
Time Collected: 8:15 Time Received: 10:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result		Uncertainty		Date	Time	Analyst
Sodium (Na)	{ 1211}	36.1	mg/l	2.7	mg/l	5/12/93	11:20	Mike
Magnesium (Mg)	{ 1212}	18.0	mg/l	1.8	mg/l	5/12/93	11:20	Mike
Potassium (K)	{ 1219}	6.80	mg/l	1.00	mg/l	5/12/93	11:20	Mike
Calcium (Ca)	{ 1220}	73.0	mg/l	5.23	mg/l	5/12/93	11:20	Mike
Manganese (Mn)	{ 1225}	0.174	mg/l	0.012	mg/l	5/12/93	11:20	Mike
Iron (Fe)	{ 1226}	0.226	mg/l	0.017	mg/l	5/12/93	11:20	Mike
Chloride	{ 5217}	15.0	mg/l	3.0	mg/l	5/ 6/93	14:35	Diane
Ammonia (N)	{ 9085}	0.030	mg/l	0.010	mg/l	5/ 7/93	12:30	Diane
pH	{ 9305}	7.92				5/ 3/93	11:54 *	Dennis
Carbonate (CO3)	{ 9310}	0.	mg/l	10.	mg/l	5/ 3/93	11:54	Dennis
Bicarbonate (HCO3)	{ 9315}	237.	mg/l	12.	mg/l	5/ 3/93	11:54	Dennis
Hydroxide (OH)	{ 9320}	0.	mg/l	1.	mg/l	5/ 3/93	11:54	Dennis
Alkalinity (CaCO3)(Total)	{ 9325}	194.	mg/l	10.	mg/l	5/ 3/93	11:54	Dennis
Conductivity	{ 9330}	674.0	umhos/cm		umhos/cm	5/ 3/93	14:00	Dennis
Phosphate (Total) (P)	{ 9415}	0.167	mg/l	0.020	mg/l	5/11/93	15:45	Dennis
Sulfate as (SO4)	{ 9440}	145.	mg/l	22.	mg/l	5/ 6/93	14:35	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.000	mg/l	0.005	mg/l	5/ 4/93	14:30	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	0.526	mg/l	0.180	mg/l	5/11/93	15:45	Dennis
Hardness Total (as CaCO3)	{ 9840}	257.	mg/l		mg/l			
Suspended Solids (Total)	{ 9850}	20.	mg/l	5.	mg/l	5/ 4/93	14:45	Carol
Cation Sum	{ 9905}	6.906	me/l		me/l			
Anion Sum	{ 9910}	7.329	me/l		me/l			
Difference	{ 9915}	-0.423	me/l		me/l			
Percent Difference	{ 9920}	-2.97	%		%			
Percent Sodium	{ 9925}	23.3	%		%			
Sodium Adsorption Ratio	{ 9930}	0.98						
Dissolved Solids(C)-Total	{ 9935}	411.	mg/l		mg/l			

* Exceeded EPA Holding Time

Per. _____ Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/ 2/93
Pembina County

Log Number: 93-R366 Type: 2

Date Collected: 5/ 5/93 Date Received: 5/ 7/93
Time Collected: 17:10 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	40.6	0.1	mg/L	7.5	6/ 1/93	12:00	Carol
Magnesium (Mg)	{ 1212}	21.5	0.1	mg/L	9.8	6/ 1/93	12:00	Carol
Potassium (K)	{ 1219}	7.45	1.00	mg/L	5.1	6/ 1/93	12:00	Carol
Calcium (Ca)	{ 1220}	84.2	0.030	mg/L	7.2	6/ 1/93	12:00	Carol
Manganese (Mn)	{ 1225}	0.123	0.002	mg/L	6.7	6/ 1/93	12:00	Carol
Iron (Fe)	{ 1226}	0.334	0.007	mg/L	7.4	6/ 1/93	12:00	Carol
Chloride	{ 5217}	15.6	3.0	mg/L	3.9	5/19/93	9:30	Dennis
Depth	{ 9050}	12.8		Meters		5/ 5/93	17:10	
Ammonia (N)	{ 9085}	0.000	0.010	mg/L	7.8	5/ 7/93	12:30	Diane
pH	{ 9305}	8.11				5/ 7/93	15:10 *	Diane
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	5/ 7/93	15:10	Diane
Bicarbonate (HCO3)	{ 9315}	258.	10.	mg/L	5.1	5/ 7/93	15:10	Diane
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	5/ 7/93	15:10	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	211.	10.	mg/L	5.1	5/ 7/93	15:10	Diane
Conductivity	{ 9330}	700.	1.00	umhos/cm	1.2	5/ 7/93	15:00	Diane
Phosphate (Total) (P)	{ 9415}	0.137	0.020	mg/L	9.8	5/11/93	15:45	Dennis
Sulfate as (SO4)	{ 9440}	144.	3.	mg/L	15.	5/19/93	9:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.000	0.005	mg/L	8.2	5/11/93	12:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.354	0.180	mg/L	13.	5/11/93	15:45	Dennis
Hardness Total (as CaCO3)	{ 9840}	299.		mg/L				
Suspended Solids (Total)	{ 9850}	10.	4.	mg/L	5.0	5/ 7/93	12:00	Carol
Cation Sum	{ 9905}	7.966		me/L				
Anion Sum	{ 9910}	7.669		me/L				
Difference	{ 9915}	0.297		me/L				
Percent Difference	{ 9920}	1.90		%				
Percent Sodium	{ 9925}	22.7		%				
Sodium Adsorption Ratio	{ 9930}	1.02						
Dissolved Solids(C)-Total	{ 9935}	440.		mg/L				

* Exceeded EPA Holding Time

Per. Ken Kary Chemist

North Dakota State Department of Health
and Consolidated Laboratories
5/20/93
Pembina County

Log Number: 93-R375 Type: 2

Date Collected: 5/11/93 Date Received: 5/12/93
Time Collected: 7:20 Time Received: 11:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	35.8	0.1	mg/L	7.5	5/18/93	10:45	Mike
Magnesium (Mg)	{ 1212}	15.2	0.1	mg/L	9.8	5/18/93	10:45	Mike
Potassium (K)	{ 1219}	6.65	1.00	mg/L	5.1	5/18/93	10:45	Mike
Calcium (Ca)	{ 1220}	63.4	0.030	mg/L	7.2	5/18/93	10:45	Mike
Manganese (Mn)	{ 1225}	0.867	0.002	mg/L	6.7	5/18/93	10:45	Mike
Iron (Fe)	{ 1226}	1.48	0.007	mg/L	7.4	5/18/93	10:45	Mike
Chloride	{ 5217}	15.1	3.0	mg/L	3.9	5/19/93	9:30	Dennis
Ammonia (N)	{ 9085}	0.008	0.010	mg/L	7.8	5/14/93	10:30	Dennis
pH	{ 9305}	7.83				5/13/93	16:28 *	Diane
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	5/13/93	16:28	Diane
Bicarbonate (HCO3)	{ 9315}	205.	10.	mg/L	5.1	5/13/93	16:28	Diane
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	5/13/93	16:28	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	168.	10.	mg/L	5.1	5/13/93	16:28	Diane
Conductivity	{ 9330}	634.8		umhos/cm		5/12/93	16:30	Diane
Phosphate (Total) (P)	{ 9415}	0.323	0.020	mg/L	9.8	5/18/93	10:30	Dennis
Sulfate as (SO4)	{ 9440}	140.	3.	mg/L	15.	5/19/93	9:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.000	0.005	mg/L	8.2	5/13/93	15:00	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	1.40	0.180	mg/L	13.	5/18/93	10:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	221.		mg/L				
Suspended Solids (Total)	{ 9850}	180.	5.	mg/L	5.0	5/14/93	12:00	Carol
Cation Sum	{ 9905}	6.282		me/L				
Anion Sum	{ 9910}	6.703		me/L				
Difference	{ 9915}	-0.421		me/L				
Percent Difference	{ 9920}	-3.24		%				
Percent Sodium	{ 9925}	26.0		%				
Sodium Adsorption Ratio	{ 9930}	1.05						
Dissolved Solids(C)-Total	{ 9935}	377.		mg/L				

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/ 7/93
Pembina County

Log Number: 93-R399 Type: 2

Date Collected: 5/12/93 Date Received: 5/14/93
Time Collected: 19:10 Time Received: 10:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Galen Briese
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	36.3	0.1	mg/L	7.5	6/ 3/93	9:50	Carol
Magnesium (Mg)	{ 1212}	15.7	0.1	mg/L	9.8	6/ 3/93	9:50	Carol
Potassium (K)	{ 1219}	7.59	1.00	mg/L	5.1	6/ 3/93	9:50	Carol
Calcium (Ca)	{ 1220}	61.0	0.030	mg/L	7.2	6/ 3/93	9:50	Carol
Manganese (Mn)	{ 1225}	0.494	0.002	mg/L	6.7	6/ 3/93	9:50	Carol
Iron (Fe)	{ 1226}	1.75	0.007	mg/L	7.4	6/ 3/93	9:50	Carol
Chloride	{ 5217}	15.1	3.0	mg/L	3.9	5/19/93	10:00	Dennis
Ammonia (N)	{ 9085}	0.026	0.010	mg/L	7.8	5/21/93	10:30	Dennis
pH	{ 9305}	7.92				5/14/93	15:30 *	Diane
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	5/14/93	15:30	Diane
Bicarbonate (HCO3)	{ 9315}	197.	10.	mg/L	5.1	5/14/93	15:30	Diane
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	5/14/93	15:30	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	161.	10.	mg/L	5.1	5/14/93	15:30	Diane
Conductivity	{ 9330}	614.	1.00	umhos/cm	1.2	5/14/93	14:30	Diane
Phosphate (Total) (P)	{ 9415}	0.245	0.020	mg/L	9.8	5/18/93	10:30	Dennis
Sulfate as (SO4)	{ 9440}	147.	3.	mg/L	15.	5/19/93	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.078	0.005	mg/L	8.2	5/20/93	13:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.889	0.100	mg/L	13.	5/18/93	10:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	217.		mg/L				
Suspended Solids (Total)	{ 9850}	81.	4.	mg/L	5.0	5/17/93	14:00	Jennifer
Cation Sum	{ 9905}	6.235		me/L				
Anion Sum	{ 9910}	6.717		me/L				
Difference	{ 9915}	-0.482		me/L				
Percent Difference	{ 9920}	-3.72		%				
Percent Sodium	{ 9925}	26.6		%				
Sodium Adsorption Ratio	{ 9930}	1.07						
Dissolved Solids(C)-Total	{ 9935}	380.		mg/L				

* Exceeded EPA Holding Time

Per. Ken Kay Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/10/93
Pembina County

Log Number: 93-R420 Type: 2

Date Collected: 5/19/93 Date Received: 5/21/93
Time Collected: 7:55 Time Received: 10:50
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	48.7	0.1	mg/l	7.5	6/ 9/93	11:26	Carol
Magnesium (Mg)	{ 1212}	21.4	0.1	mg/l	9.8	6/ 9/93	11:26	Carol
Potassium (K)	{ 1219}	8.20	1.00	mg/l	5.1	6/ 9/93	11:26	Carol
Calcium (Ca)	{ 1220}	84.4	0.030	mg/l	7.2	6/ 9/93	11:26	Carol
Manganese (Mn)	{ 1225}	0.227	0.002	mg/l	6.7	6/ 4/93	15:41	Carol
Iron (Fe)	{ 1226}	0.958	0.007	mg/l	7.4	6/ 4/93	15:41	Carol
Chloride	{ 5217}	15.2	3.0	mg/l	3.9	5/24/93	13:30	Diane
Ammonia (N)	{ 9085}	2.15	0.010	mg/l	7.8	5/28/93	11:30	Diane
pH	{ 9305}	8.02				5/21/93	12:48 *	Dennis
Carbonate (CO3)	{ 9310}	0.	10.	mg/l	5.1	5/21/93	12:48	Dennis
Bicarbonate (HCO3)	{ 9315}	241.	10.	mg/l	5.1	5/21/93	12:48	Dennis
Hydroxide (OH)	{ 9320}	0.	1.	mg/l	5.1	5/21/93	12:48	Dennis
Alkalinity (CaCO3)(Total)	{ 9325}	197.	10.	mg/l	5.1	5/21/93	12:48	Dennis
Conductivity	{ 9330}	697.	1.00	umhos/cm	1.2	5/21/93	13:10	Diane
Phosphate (Total) (P)	{ 9415}	0.181	0.020	mg/l	9.8	5/25/93	14:25	Diane
Sulfate as (SO4)	{ 9440}	146.	3.	mg/l	15.	5/24/93	13:30	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.015	0.005	mg/l	8.2	5/26/93	12:00	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	0.672	0.180	mg/l	13.	5/25/93	14:25	Diane
Hardness Total (as CaCO3)	{ 9840}	299.		mg/l				
Suspended Solids (Total)	{ 9850}	25.	4.	mg/l	5.0	5/25/93	10:30	Jennifer
Cation Sum	{ 9905}	8.501		me/l				
Anion Sum	{ 9910}	7.421		me/l				
Difference	{ 9915}	1.081		me/l				
Percent Difference	{ 9920}	6.79		%				
Percent Sodium	{ 9925}	26.1		%				
Sodium Adsorption Ratio	{ 9930}	1.22						
Dissolved Solids(C)-Total	{ 9935}	443.		mg/l				

* Exceeded EPA Holding Time

Per. Ken Kary Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/ 8/93
Pembina County

Log Number: 93-R430 Type: 2

Date Collected: 5/27/93 Date Received: 5/28/93
Time Collected: 16:30 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	40.2	0.1	mg/L	7.5	6/ 4/93	12:22	Carol
Magnesium (Mg)	{ 1212}	21.1	0.1	mg/L	9.8	6/ 4/93	12:22	Carol
Potassium (K)	{ 1219}	6.90	1.00	mg/L	5.1	6/ 4/93	12:22	Carol
Calcium (Ca)	{ 1220}	84.4	0.030	mg/L	7.2	6/ 4/93	12:22	Carol
Manganese (Mn)	{ 1225}	0.282	0.002	mg/L	6.7	6/ 4/93	12:22	Carol
Iron (Fe)	{ 1226}	0.370	0.007	mg/L	7.4	6/ 4/93	12:22	Carol
Chloride	{ 5217}	13.9	3.0	mg/L	3.9	6/ 2/93	14:20	Diane
Ammonia (N)	{ 9085}	0.371	0.010	mg/L	7.8	5/28/93	11:30	Diane
pH	{ 9305}	8.05				5/28/93	11:33	Carol
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	5/28/93	11:33	Carol
Bicarbonate (HCO3)	{ 9315}	278.	10.	mg/L	5.1	5/28/93	11:33	Carol
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	5/28/93	11:33	Carol
Alkalinity (CaCO3)(Total)	{ 9325}	228.	10.	mg/L	5.1	5/28/93	11:33	Carol
Conductivity	{ 9330}	760.	1.00	umhos/cm	1.2	5/28/93	14:15	Steve P
Phosphate (Total) (P)	{ 9415}	0.183	0.020	mg/L	9.8	6/ 1/93	15:15	Diane
Sulfate as (SO4)	{ 9440}	152.	3.	mg/L	15.	6/ 2/93	14:20	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.041	0.005	mg/L	8.2	6/ 3/93	13:05	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	1.31	0.180	mg/L	13.	6/ 1/93	15:15	Diane
Hardness Total (as CaCO3)	{ 9840}	298.		mg/L				
Suspended Solids (Total)	{ 9850}	23.	4.	mg/L	5.0	5/28/93	11:30	Jennifer
Cation Sum	{ 9905}	7.947		me/L				
Anion Sum	{ 9910}	8.116		me/L				
Difference	{ 9915}	-0.169		me/L				
Percent Difference	{ 9920}	-1.05		%				
Percent Sodium	{ 9925}	22.6		%				
Sodium Adsorption Ratio	{ 9930}	1.01						
Dissolved Solids(C)-Total	{ 9935}	455.		mg/L				

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/22/93
Pembina County

Log Number: 93-R433 Type: 2

Date Collected: 6/ 2/93 Date Received: 6/ 4/93
Time Collected: 15:45 Time Received: 10:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	39.8	0.1	mg/L	7.5	6/21/93	9:42	Mike
Magnesium (Mg)	{ 1212}	21.2	0.1	mg/L	9.8	6/21/93	9:42	Mike
Potassium (K)	{ 1219}	7.4	1.0	mg/L	5.1	6/21/93	9:42	Mike
Calcium (Ca)	{ 1220}	83.4	0.030	mg/L	7.2	6/21/93	9:42	Mike
Manganese (Mn)	{ 1225}	0.187	0.002	mg/L	6.7	6/21/93	9:42	Mike
Iron (Fe)	{ 1226}	0.305	0.007	mg/L	7.4	6/21/93	9:42	Mike
Chloride	{ 5217}	15.4	3.0	mg/L	3.9	6/ 7/93	11:10	Diane
Ammonia (N)	{ 9085}	0.047	0.010	mg/L	7.8	6/10/93	15:50	Diane
pH	{ 9305}	8.13				6/ 4/93	17:17 *	Steve P
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	6/ 4/93	17:17	Steve P
Bicarbonate (HCO3)	{ 9315}	300.	10.	mg/L	5.1	6/ 4/93	17:17	Steve P
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	6/ 4/93	17:17	Steve P
Alkalinity (CaCO3)(Total)	{ 9325}	246.	10.	mg/L	5.1	6/ 4/93	17:17	Steve P
Conductivity	{ 9330}	754.	1.00	umhos/cm	1.2	6/ 4/93	13:30	Steve P
Phosphate (Total) (P)	{ 9415}	0.175	0.020	mg/L	9.8	6/17/93	15:55	Diane
Sulfate as (SO4)	{ 9440}	143.	3.	mg/L	15.	6/ 7/93	11:10	Diane
Nitrate + Nitrite (N) Tot	{ 9557}	0.029	0.005	mg/L	8.2	6/ 9/93	15:15	Diane
Nitrogen (Total Kjeldahl)	{ 9575}	0.452	0.180	mg/L	13.	6/17/93	15:55	Diane
Hardness Total (as CaCO3)	{ 9840}	296.		mg/L				
Suspended Solids (Total)	{ 9850}	12.	4.	mg/L	5.0	6/ 4/93	13:50	Jennifer
Cation Sum	{ 9905}	7.872		me/L				
Anion Sum	{ 9910}	8.331		me/L				
Difference	{ 9915}	-0.459		me/L				
Percent Difference	{ 9920}	-2.83		%				
Percent Sodium	{ 9925}	22.6		%				
Sodium Adsorption Ratio	{ 9930}	1.01						
Dissolved Solids(C)-Total	{ 9935}	458.		mg/L				

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
6/28/93
Pembina County

Log Number: 93-R470 Type: 2

Date Collected: 6/11/93 Date Received: 6/16/93
Time Collected: 15:15 Time Received: 10:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	46.2	0.1	mg/L	7.5	6/22/93	13:29	Mike
Magnesium (Mg)	{ 1212}	19.5	0.1	mg/L	9.8	6/22/93	13:29	Mike
Potassium (K)	{ 1219}	7.5	1.0	mg/L	5.1	6/22/93	13:29	Mike
Calcium (Ca)	{ 1220}	77.1	0.030	mg/L	7.2	6/22/93	13:29	Mike
Manganese (Mn)	{ 1225}	0.746	0.002	mg/L	6.7	6/22/93	13:29	Mike
Iron (Fe)	{ 1226}	2.73	0.007	mg/L	7.4	6/22/93	13:29	Mike
Chloride	{ 5217}	16.3	3.0	mg/L	3.9	6/22/93	10:00	Dennis
Ammonia (N)	{ 9085}	0.056	0.010	mg/L	7.8	6/25/93	12:30	Dennis
pH	{ 9305}	7.93				6/16/93	14:46 *	Steve P
Carbonate (CO3)	{ 9310}	0.	10.	mg/L	5.1	6/16/93	14:46	Steve P
Bicarbonate (HCO3)	{ 9315}	220.	10.	mg/L	5.1	6/16/93	14:46	Steve P
Hydroxide (OH)	{ 9320}	0.	1.	mg/L	5.1	6/16/93	14:46	Steve P
Alkalinity (CaCO3)(Total)	{ 9325}	180.	10.	mg/L	5.1	6/16/93	14:46	Steve P
Conductivity	{ 9330}	662.	1.00	umhos/cm	1.2	6/16/93	15:15	Steve P
Phosphate (Total) (P)	{ 9415}	0.384	0.020	mg/L	9.8	6/17/93	15:55	Diane
Sulfate as (SO4)	{ 9440}	140.	3.	mg/L	15.	6/22/93	10:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.244	0.005	mg/L	8.2	6/24/93	14:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	1.49	0.180	mg/L	13.	6/17/93	15:55	Diane
Hardness Total (as CaCO3)	{ 9840}	273.		mg/L				
Suspended Solids (Total)	{ 9850}	130.	2.	mg/L	5.0	6/17/93	11:00	Carol
Cation Sum	{ 9905}	7.846		me/L				
Anion Sum	{ 9910}	6.982		me/L				
Difference	{ 9915}	0.864		me/L				
Percent Difference	{ 9920}	5.83		%				
Percent Sodium	{ 9925}	26.8		%				
Sodium Adsorption Ratio	{ 9930}	1.22						
Dissolved Solids(C)-Total	{ 9935}	415.		mg/L				

* Exceeded EPA Holding Time

Per. Mike Bom Chemist

North Dakota State Department of Health
and Consolidated Laboratories
11/16/93
Pembina County

Log Number: 93-R722 Type: 2

Date Collected: 7/26/93
Time Collected: 10:10
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Date Received: 7/28/93
Time Received: 11:00

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	22.8	0.1	mg/L	7.5	8/11/93	9:57	Mike
Magnesium (Mg)	{ 1212}	14.9	0.1	mg/L	9.8	8/11/93	9:57	Mike
Potassium (K)	{ 1219}	12.9	1.0	mg/L	5.1	8/11/93	9:57	Mike
Calcium (Ca)	{ 1220}	60.4	0.030	mg/L	7.2	8/11/93	9:57	Mike
Manganese (Mn)	{ 1225}	1.59	0.002	mg/L	6.7	8/11/93	9:57	Mike
Iron (Fe)	{ 1226}	13.8	0.007	mg/L	7.4	8/11/93	9:57	Mike
Chloride	{ 5217}	8.8	3.0	mg/L	3.9	8/ 3/93	16:00	Dennis
Ammonia (N)	{ 9085}	0.145	0.010	mg/L	7.8	7/29/93	11:45	Dennis
pH	{ 9305}	7.51				7/28/93	11:59 *	Steve P
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		7/28/93	11:59	Steve P
Bicarbonate (HCO3)	{ 9315}	191.	1.	mg/L	5.1	7/28/93	11:59	Steve P
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		7/28/93	11:59	Steve P
Alkalinity (CaCO3)(Total)	{ 9325}	156.	1.	mg/L	5.1	7/28/93	11:59	Steve P
Conductivity	{ 9330}	437.	1.00	umhos/cm	1.2	7/28/93	11:30	Steve P
Phosphate (Total) (P)	{ 9415}	0.952	0.020	mg/L	9.8	7/30/93	15:30	Dennis
Sulfate as (SO4)	{ 9440}	92.	3.	mg/L	15.	8/ 3/93	16:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.067	0.005	mg/L	8.2	7/28/93	14:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	3.16	0.180	mg/L	13.	7/30/93	10:30	Dennis
Hardness Total (as CaCO3)	{ 9840}	212.		mg/L				
Suspended Solids (Total)	{ 9850}	550.	2.	mg/L	5.0	7/29/93	11:00	Carol
Cation Sum	{ 9905}	5.573		me/L				
Anion Sum	{ 9910}	5.388		me/L				
Difference	{ 9915}	0.185		me/L				
Percent Difference	{ 9920}	1.69		%				
Percent Sodium	{ 9925}	18.9		%				
Sodium Adsorption Ratio	{ 9930}	0.68						
Dissolved Solids(C)-Total	{ 9935}	308.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

Per. Mike Born Chemist

North Dakota State Department of Health
and Consolidated Laboratories
11/16/93
Pembina County

Log Number: 93-R810 Type: 2

Date Collected: 8/ 6/93 Date Received: 8/12/93
Time Collected: 16:00 Time Received: 11:30
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	22.6	0.1	mg/l	7.5	8/16/93	12:59	Mike
Magnesium (Mg)	{ 1212}	13.9	0.1	mg/l	9.8	8/16/93	12:59	Mike
Potassium (K)	{ 1219}	6.8	1.0	mg/l	5.1	8/16/93	12:59	Mike
Calcium (Ca)	{ 1220}	46.2	0.030	mg/l	7.2	8/16/93	12:59	Mike
Manganese (Mn)	{ 1225}	1.09	0.002	mg/l	6.7	8/16/93	12:59	Mike
Iron (Fe)	{ 1226}	3.69	0.007	mg/l	7.4	8/16/93	12:59	Mike
Chloride	{ 5217}	7.2	3.0	mg/l	3.9	8/16/93	14:30	Dennis
Ammonia (N)	{ 9085}	0.044	0.010	mg/l	7.8	8/13/93	14:00	Dennis
pH	{ 9305}	7.82				8/12/93	13:50 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/l		8/12/93	13:50	Diane
Bicarbonate (HCO3)	{ 9315}	196.	1.	mg/l	5.1	8/12/93	13:50	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/l		8/12/93	13:50	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	161.	1.	mg/l	5.1	8/12/93	13:50	Diane
Conductivity	{ 9330}	456.	1.00	umhos/cm	1.2	8/12/93	16:30	Diane
Phosphate (Total) (P)	{ 9415}	0.362	0.020	mg/l	9.8	8/17/93	16:00	Dennis
Sulfate as (SO4)	{ 9440}	60.	3.	mg/l	15.	8/16/93	14:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.147	0.005	mg/l	8.2	8/19/93	8:45	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	2.10	0.180	mg/l	13.	8/17/93	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	173.		mg/l				
Suspended Solids (Total)	{ 9850}	171.	2.	mg/l	5.0	8/13/93	11:25	Jennifer
Cation Sum	{ 9905}	4.615		me/l				
Anion Sum	{ 9910}	4.758		me/l				
Difference	{ 9915}	-0.143		me/l				
Percent Difference	{ 9920}	-1.52		%				
Percent Sodium	{ 9925}	22.1		%				
Sodium Adsorption Ratio	{ 9930}	0.75						
Dissolved Solids(C)-Total	{ 9935}	255.		mg/l				

* Exceeded EPA Holding Time

ND = Not Detected

Per. _____ Chemist

North Dakota State Department of Health
and Consolidated Laboratories
11/16/93
Pembina County

Log Number: 93-R940 Type: 2

Date Collected: 9/15/93 Date Received: 9/17/93
Time Collected: 13:30 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	33.5	0.1	mg/l	7.5	9/24/93	10:37	Carol
Magnesium (Mg)	{ 1212}	20.4	0.1	mg/l	9.8	9/24/93	10:37	Carol
Potassium (K)	{ 1219}	7.0	1.0	mg/l	5.1	9/24/93	10:37	Carol
Calcium (Ca)	{ 1220}	76.6	0.030	mg/l	7.2	9/24/93	10:37	Carol
Manganese (Mn)	{ 1225}	0.279	0.002	mg/l	6.7	9/24/93	10:37	Carol
Iron (Fe)	{ 1226}	0.553	0.007	mg/l	7.4	9/24/93	10:37	Carol
Chloride	{ 5217}	11.0	3.0	mg/l	3.9	9/20/93	13:30	Dennis
Ammonia (N)	{ 9085}	0.123	0.010	mg/l	7.8	9/24/93	14:45	Dennis
pH	{ 9305}	7.99				9/17/93	14:43 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/l		9/17/93	14:43	Diane
Bicarbonate (HCO3)	{ 9315}	294.	1.	mg/l	5.1	9/17/93	14:43	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/l		9/17/93	14:43	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	241.	1.	mg/l	5.1	9/17/93	14:43	Diane
Conductivity	{ 9330}	642.	1.00	umhos/cm	1.2	9/17/93	14:30	Diane
Phosphate (Total) (P)	{ 9415}	0.275	0.020	mg/l	9.8	9/21/93	9:15	Dennis
Sulfate as (SO4)	{ 9440}	91.	3.	mg/l	15.	9/20/93	13:30	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.173	0.005	mg/l	8.2	9/22/93	11:45	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.948	0.180	mg/l	13.	9/21/93	9:15	Dennis
Hardness Total (as CaCO3)	{ 9840}	275.		mg/l				
Suspended Solids (Total)	{ 9850}	22.	2.	mg/l	5.0	9/20/93	14:00	Carol
Cation Sum	{ 9905}	7.152		me/l				
Anion Sum	{ 9910}	7.118		me/l				
Difference	{ 9915}	0.034		me/l				
Percent Difference	{ 9920}	0.24		%				
Percent Sodium	{ 9925}	20.8		%				
Sodium Adsorption Ratio	{ 9930}	0.88						
Dissolved Solids(C)-Total	{ 9935}	386.		mg/l				

* Exceeded EPA Holding Time

ND = Not Detected

Per. _____ Chemist

North Dakota State Department of Health
and Consolidated Laboratories
11/15/93
Pembina County

Log Number: 93-R1054 Type: 2

Date Collected: 10/29/93 Date Received: 11/ 2/93
Time Collected: 14:00 Time Received: 11:00
Site: 380111 Tongue River
1 Mile W of Renwick
Collected by: Mel Askew
Comments:

Analyte		Result	Detect Level	Units	1 SD (%)	Date	Time	Analyst
Sodium (Na)	{ 1211}	25.5	0.1	mg/L	7.5	11/ 9/93	8:52	Mike
Magnesium (Mg)	{ 1212}	21.2	0.1	mg/L	9.8	11/ 9/93	8:52	Mike
Potassium (K)	{ 1219}	5.6	1.0	mg/L	5.1	11/ 9/93	8:52	Mike
Calcium (Ca)	{ 1220}	83.3	0.030	mg/L	7.2	11/ 9/93	8:52	Mike
Manganese (Mn)	{ 1225}	0.220	0.002	mg/L	6.7	11/ 9/93	8:52	Mike
Iron (Fe)	{ 1226}	0.218	0.007	mg/L	7.4	11/ 9/93	8:52	Mike
Chloride	{ 5217}	7.8	3.0	mg/L	3.9	11/12/93	11:00	Dennis
Ammonia (N)	{ 9085}	0.019	0.010	mg/L	7.8	11/ 5/93	13:30	Dennis
pH	{ 9305}	8.12				11/ 2/93	16:05 *	Diane
Carbonate (CO3)	{ 9310}	ND	1.	mg/L		11/ 2/93	16:05	Diane
Bicarbonate (HCO3)	{ 9315}	325.	1.	mg/L	5.1	11/ 2/93	16:05	Diane
Hydroxide (OH)	{ 9320}	ND	1.	mg/L		11/ 2/93	16:05	Diane
Alkalinity (CaCO3)(Total)	{ 9325}	266.	1.	mg/L	5.1	11/ 2/93	16:05	Diane
Conductivity	{ 9330}	545.	1.00	umhos/cm	1.2	11/ 2/93	16:10	Diane
Phosphate (Total) (P)	{ 9415}	0.110	0.020	mg/L	9.8	11/ 5/93	16:00	Dennis
Sulfate as (SO4)	{ 9440}	29.	3.	mg/L	15.	11/12/93	11:00	Dennis
Nitrate + Nitrite (N) Tot	{ 9557}	0.161	0.005	mg/L	8.2	11/ 9/93	9:30	Dennis
Nitrogen (Total Kjeldahl)	{ 9575}	0.686	0.180	mg/L	13.	11/ 5/93	16:00	Dennis
Hardness Total (as CaCO3)	{ 9840}	295.		mg/L				
Suspended Solids (Total)	{ 9850}	5.	2.	mg/L	5.0	11/ 2/93	13:45	Carol
Cation Sum	{ 9905}	7.169		me/L				
Anion Sum	{ 9910}	6.244		me/L				
Difference	{ 9915}	0.925		me/L				
Percent Difference	{ 9920}	6.90		%				
Percent Sodium	{ 9925}	15.7		%				
Sodium Adsorption Ratio	{ 9930}	0.64						
Dissolved Solids(C)-Total	{ 9935}	334.		mg/L				

* Exceeded EPA Holding Time

ND = Not Detected

Per. Mike Boon Chemist

REFERENCES

Buchanan, T. J., and Somers, W. P., 1973. Discharge Measurements at Gaging Stations: United States Geological Society Techniques of Water-Resources Investigation, Book 3, Ch. A8, Washington ,.D.C., United States Government Printing Office, p. 1,9.

Cherry, J. A., and Lee, D. R., 1978. A Field Exercise on Groundwater Flow sing Seepage Meters and Mini-Piezometers: Journal of Geological Education, v.27, p. 7.

Drever, J. I., 1988. The Geochemistry of Natural Waters, 2nd ed. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. p. 310.

Kent, D. M., 1994. Applied Wetlands Science and Technology. CRC Press Inc. Boca Raton, Florida p. 1, 5, 86.

Korom, S. F., 1992. Natural Denitrification in the Saturated Zone: A Review, Water Resources Research , v. 28, no. 6, p. 1658.

Korom, S. F., 1996. Oral Communication (January 30).

Payne, W. J., 1981. Denitrification. John Wiley, New York. p. 7.

Tarnocai, C. 1979. Canadian Wetland Registry. In Rubec, D.D.A. and F.C. Pollett (eds.) Proceedings of a Workshop on Canadian Wetlands Environment. Canada Land Directorate, Ecological Land Classification Series, No. 12. Pp. 9-38

U. S. Department of Agriculture Soil Conservation Service, 1992. Renwick Dam Reservoir Sedimentation Study Report, p. 1-3.

U. S. Department of Agriculture Soil Conservation Service and Resource Conservation and Development Council, 1991. Red River RC & D 1991 319 Proposal, p. 4.