Ground Water and Streamflow in the Nett Lake Indian Reservation, Northern Minnesota, 1995-97

By James F. Ruhl and Gregory A. Payne

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BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

Thomas J. Casadevall, Acting Director

For additional information write to:

District Chief
U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112

Copies of this report can be purchased from:

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Contents

Illustrations

Tables

Tables--Continued

Conversion Factors, Vertical Datum, and Abbreviated Water-Quality Units

Multiply inch-pound unit	By	To obtain metric unit
inch (in)	2.54	centimeter
foot (ft)	0.3048	meter
acre (ac)	0.004047	square kilometer
square mile (mi^2)	259.0	hectare
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
gallon per minute (gal/min)	0.06309	liter per second
foot squared per day (ft^2/d)	0.09290	meter squared per day
degrees Fahrenheit (°F)	°C = (°F - 32)/1.8	degrees Celsius (°C)

Concentrations of chemical constituents in water samples are given in milligrams per liter (mg/L), micrograms per liter (µg/L), and milliequivalents per liter (mEq/L). Milligrams per liter is a unit that expresses the concentration of a chemical constituent in solution as the mass (milligrams) of the constituent per unit volume (liter) of water. One milligram per liter is equivalent to one thousand micrograms per liter. Concentrations of chemical constituents in mg/L and µg/L are reported as dissolved (operationally defined as the amount of a constituent in a water sample that passes through a 0.45-micrometer membrane filter). (Concentrations of phosphorus also are reported as total, which is the amount of the constituent in an unfiltered sample.)

Sea level: In this report, sea level refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)-geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Glossary

The geologic and hydrologic terms pertinent to this report are defined as follows:

Alkalinity: Capacity for neutralizing acid and commonly reported as an equivalent amount of calcium carbonate. This property is attributed mostly to bicarbonate if the pH of the water is less than 9.5.

Aquifer: Geologic or stratigraphic unit that contains sufficient saturated, permeable material to yield usable quantities of water to wells or springs.

Confined aquifer: An aquifer for which the saturated zone is bounded by confining beds such as clay layers; also referred to as a buried aquifer. Water levels in tightly cased wells completed in this type of aquifer rise above the top of the aquifer.

Conglomerate: Coarse grained, sedimentary rock derived from fragments of other rock.

Crystalline bedrock: Igneous or metamorphic bedrock, as opposed to sedimentary bedrock.

Discharge: The volume of water that passes a through a given cross-sectional area at a fixed point within a given period of time.

Dissolved solids: Total amount of mineral constituents dissolved in water.

Granite: Very hard igneous rock composed primarily of quartz and feldspar.

Graywacke: Generally dark colored, hard, poorly-sorted, argillaceous sandstone.

Ground water: Subsurface water in the saturated zone.

Igneous rock: Rock solidified from molten or partly molten material.

Intrusives: Igneous rocks formed within existing rock by the injection of magma into cracks.

Lava: A general term for molten or partially molten volcanic material; rocks formed from solidification of lava include basalts and rhyolites.

Outwash: Sorted and stratified sand and gravel deposited by flowing meltwater from glacier ice.

Maximum Contaminant Level (MCL): A regulatory limit that pertains to the safety of drinking water.

Metamorphic rock: Rock derived from pre-existing rocks by mineralogical, chemical, and structural changes, essentially in the solid state, in response to changes in temperature, pressure, shearing stress, and chemical environment at depth in the earth's crust.

Peat: Unconsolidated, dark colored deposits of organic material; typically present in a water-saturated environment such as a wetland or bog.

pH: A measure of the hydrogen ion activity (concentration) of a solution; equal to the negative logarithm of the concentration of hydrogen ions. A solution with a pH of 7.0 is neutral; a solution with a pH less than 7.0 is acidic; and a solution with a pH greater than 7.0 is basic.

Slate: A compact, fine-grained metamorphic rock typically formed from mud or volcanic ash.

Secondary Maximum Contaminant Level (SMCL): A non-regulatory guideline that pertains to aesthetic properties of drinking water, such as taste, odor, color, and staining potential.

Specific capacity: The yield of a well per unit of drawdown.

Specific conductance: The capacity of water to conduct an electric current. This property generally is proportional to the dissolved solids content in most dilute natural water.

Streamflow: The discharge in a surface stream.

Till: Unsorted and unstratified clay, silt, sand, gravel, pebbles, and boulders of glacial origin.

Transmissivity: A measure of the capacity of an aquifer to transmit water. It is equal to the hydraulic conductivity multiplied by the saturated thickness of the aquifer.

Tuff: Porous rock, typically stratified, formed by consolidation of volcanic ash.

Unconfined aquifer: An aquifer for which the saturated zone is not bounded by confining beds such as clay layers; also referred to as surficial or water-table aquifer. Water levels in wells completed in this type of aquifer rise and decline within the aquifer.

Volatile organic compounds (VOC): Carbon-containing chemicals that readily evaporate at normal air temperature and pressure. These chemicals are contained in commercial products such as gasoline, paints, adhesives, solvents, wood preservatives, pesticides, cosmetics, and refrigerants. High concentrations in drinking water can be toxic to humans.

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Abstract

The Nett Lake Indian Reservation, about 164 square miles in area, is in northern Minnesota. About 300 people live in Nett Lake Community, about 100 people live in Palmquist Community, and a few people live in other parts of the Reservation. Water resources in the Reservation include: (1) ground water in sand and gravel aquifers and bedrock aquifers; (2) Nett Lake; (3) streams in the Nett Lake River watershed; and (4) wetlands that comprise about one-half of the area of the Reservation.

Ground-water sources in the Reservation consist of sand and gravel aquifers and bedrock aquifers. Buried sand and gravel aquifers are important sources of water. Reported yields for wells completed in these aquifers are as much as 60 gallons per minute. Reported yields for wells completed in bedrock aquifers are as much as 34 gallons per minute.

The Reservation is located within the Little Fork River Basin. Streams that flow into and out of Nett Lake are in the Nett Lake River watershed, a subbasin of the Little Fork River Basin. Most of the discharge into Nett Lake is from Lost River and Woodduck Creek; a small amount of discharge into Nett Lake is from several other small streams. Discharge from Nett Lake is to the Nett Lake River.

Ground water in buried sand and gravel aquifers in the vicinity of three community wells and a closed landfill east of Nett Lake Community may have moved from the landfill toward the community wells. Ground water near Nett Lake locally discharged into the lake through underlying peat that ranges in thickness from 3 to 12 feet. Two Palmquist Community wells probably are not hydraulically connected to shallow ground water in the vicinity of a nearby closed landfill. The wells are located more than 2,000 feet away and are completed in a bedrock aquifer overlain by 124-154 feet of clay.

The concentrations of the trace metals iron and manganese exceeded their respective U.S. Environmental Protection Agency Secondary Maximum Contaminant Level limits in water from three and six wells sampled, respectively. All but 3 of 63 VOCs (volatile organic compounds) analyzed for in water from seven wells sampled had concentrations less than the MDL (method detection limit) of 0.2000 μg/L except for di-bromo-chloro-propane, which had a concentration less than the MDL of 1.000 μg/L. The detected VOCs were phenols, benzene, and 1,1-dichloroethane. The sources of these VOCs may have been leachate from nearby closed landfills. Benzene, the only one of the three detected VOCs with an established MCL (Maximum Contaminant Level), had a concentration that was one order of magnitude less than its MCL of 5 μg/L.

The stage-discharge relations for Nett Lake River and Woodduck Creek were usable for estimation of daily mean discharge for each stream. Six discharge measurements made in the Lost River indicate that discharge in this stream could be substantially greater or smaller than concurrent discharge in Woodduck Creek.

Introduction

The Nett Lake Indian Reservation (hereinafter referred to as the Reservation), about 164 mi^2 (105,000 acres) in area, is in northern Minnesota (fig. 1). About 80 percent of the Reservation is in Koochiching County; the remainder is in St. Louis County. About 300 people live in Nett Lake Community and about 100 people live in Palmquist Community; a small number of people live in other parts of the Reservation (Dr. Chris Holm, Reservation Biologist, oral commun., 1997).

The U.S. Geological Survey (USGS) and the Boise Forte Reservation Tribal Council cooperated in a study of the water resources of the Reservation during 1995-97. These resources include: (1) ground water in sand and gravel aquifers and bedrock aquifers; (2) Nett Lake;

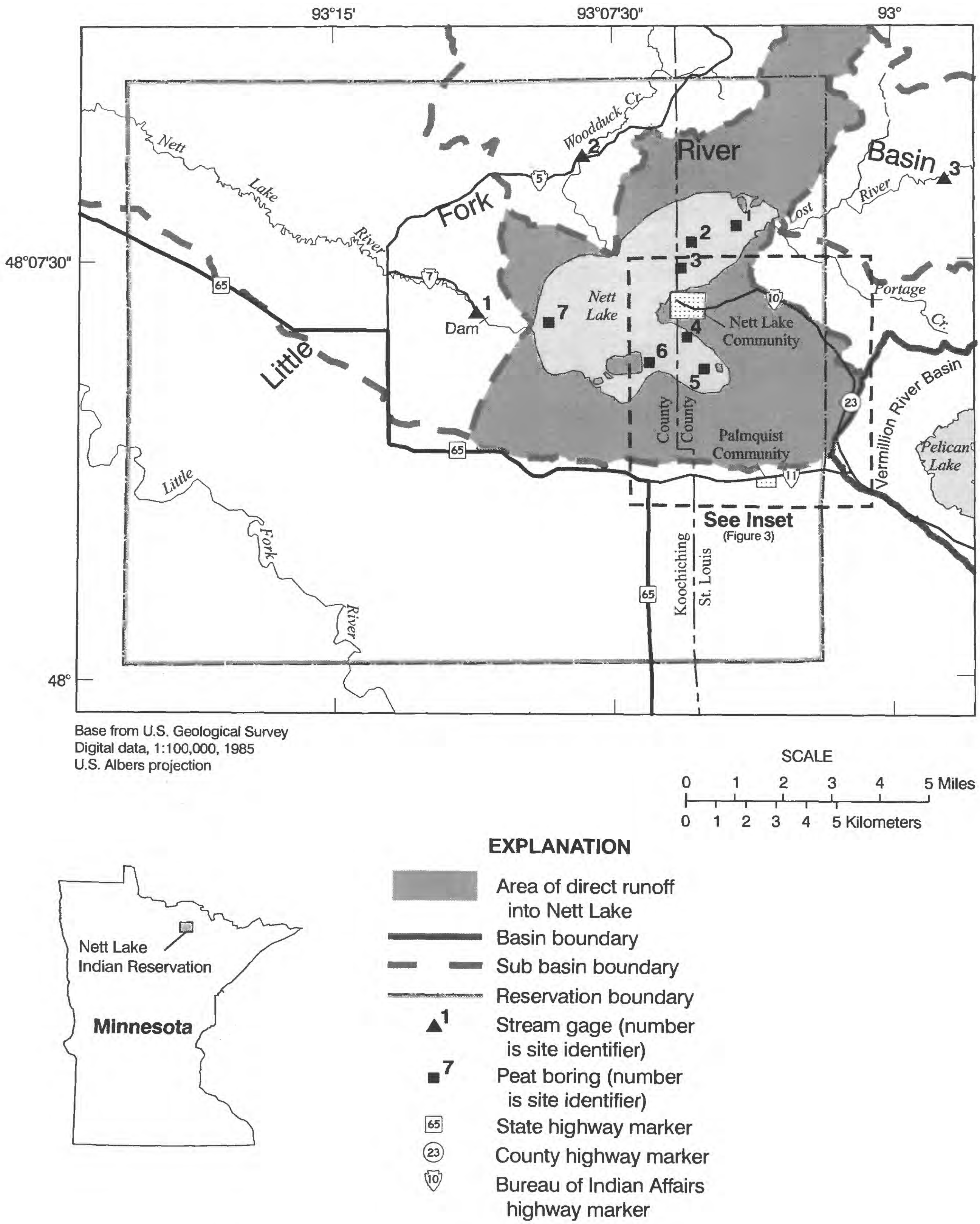

Figure 1. Location of study area and stream gage and peat boring sites, Nett Lake Indian Reservation, northern Minnesota.

(3) streams in the Nett Lake River watershed; and (4) wetlands that comprise about one-half the area of the Reservation. The study provides information to tribal officials for effective management of these resources and improved understanding of the hydrology of the area.

Concerns of tribal officials about the Reservation's water resources include: (1) potential ground-water contamination from two closed landfills—one each near Nett Lake and Palmquist Communities; (2) occasional dewatering of aquifers that supply community wells (Dr. Chris Holm, Reservation Biologist, oral commun., 1997); and (3) maintenance of the depth and quality of Nett Lake to optimize production of wild rice—an important food resource in the diet, culture, and economy of the Reservation—and to provide a suitable staging area for migratory waterfowl.

Purpose and Scope

The purposes of this report are to describe: (1) hydrogeologic conditions and ground-water quality in the communities of Nett Lake and Palmquist; and (2) streamflow in the Nett Lake River watershed. Hydrogeologic conditions are described mainly in terms of: (1) water-bearing characteristics of the sand and gravel aquifers and bedrock aquifers; (2) local flow directions of shallow ground water near the two closed landfills; and (3) local ground-water interaction with Nett Lake. Ground-water quality is described on the basis of chemical analyses of water from wells completed in the sand and gravel aquifers and bedrock aquifers. Streamflow is described on the basis of direct measurements of discharge and estimates of daily mean discharge derived from stage and discharge records.

Data analyzed and presented in this report were compiled from: (1) geologic logs of glacial sediments and bedrock recorded for six monitoring wells, five community wells, and three test holes; (2) lakebed borings at seven sites in Nett Lake; (3) water-level measurements for six monitoring wells and three community wells; (4) the specific capacity of a Nett Lake Community well; (5) water-quality analyses of samples from six monitoring wells and two community wells; and (6) stage and discharge measurements from the Nett Lake River, Lost River, and Woodduck Creek.

Previous Investigations

Information about the ground-water resources of the Reservation is available from a report by Norvitch (1963) that describes the geologic setting and hydrogeologic characteristics of the aquifers and the quality of the ground water. Information about the hydrologic balance of Nett Lake is available from an engineering study of water-level control of Nett Lake (TKDA and Associates, Incorporated, written communication, 1988). A general appraisal of the water resources of the Little Fork River Basin, which includes the study area, has been published as a hydrologic atlas (Helgesen and others, 1976).

Environmental and Hydrologic Setting

The climate is continental; the normal monthly (30-year average) temperature ranges from about 0° F during January to about 66° F during July (Baker and others, 1985). The normal annual (30-year average) total precipitation is about 27 inches (Baker and Kuehnast, 1978). About 20 percent of the total precipitation is in the form of snow (Helgesen and others, 1976).

The principal geologic materials in the Reservation are: (1) Proterozoic-age, igneous and metamorphic bedrock, consisting of Vermilion Granite (generally light-colored intrusives) and the Knife Lake Group (slates, graywackes, tuffs, lavas, and conglomerate); (2) Pleistocene-age, unconsolidated glacial sediments, consisting of morainal till, lake clay and lake sand, and, in scattered areas, outwash sand and gravel; and (3) Holocene-age (post-glacial), unconsolidated sediments that consist of alluvial sand and gravel along the Little Fork River, and peat within wetlands and bed sediments of Nett Lake (Norvitch and others, 1963).

The areal extent of exposed bedrock, major glacial features, and post-glacial alluvium and peat are shown in figure 2. The mapped glacial features include: (1) a ground moraine of St. Louis sublobe origin that mostly consists of buff- to gray-colored, calcareous till with carbonate rock fragments; (2) an end moraine of Rainy lobe origin that mostly consists of gray till with associated outwash; (3) lake and beach sand originally deposited in the littoral zone of Glacial Lake Agassiz; and (4) outwash sand and gravel believed to be of Rainy lobe origin (Norvitch and others, 1963).

The sources of ground water in the Reservation are sand and gravel aquifers and bedrock aquifers. The sand and gravel aquifers are composed of surficial (unconfined) and buried (confined) alluvium, lake and beach sand, and outwash. Most surficial sand and gravel aquifers occur in outwash; most buried sand and gravel aquifers occur as lenses of sand and gravel within end

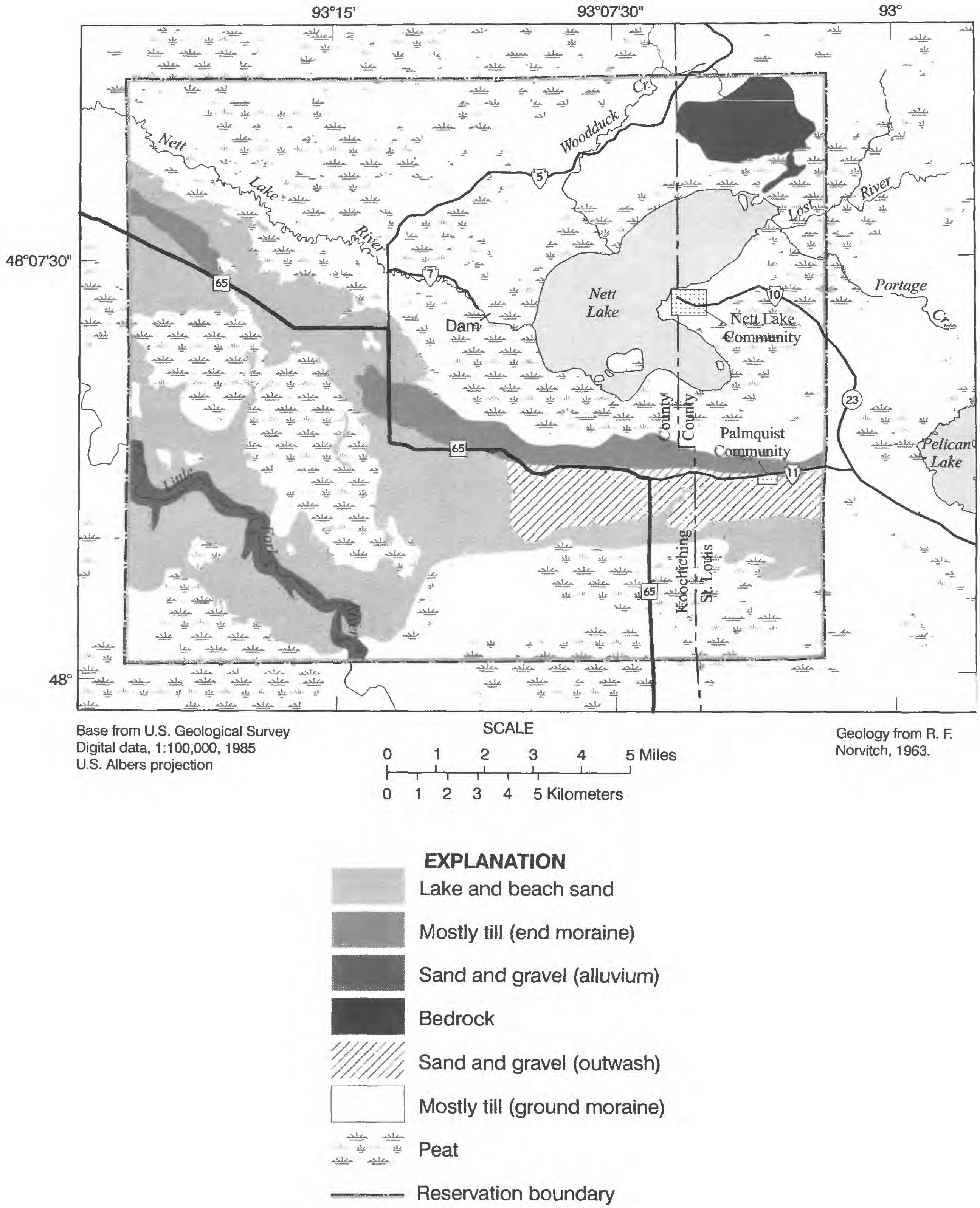

Figure 2. Surficial geologic features, Nett Lake Indian Reservation, northern Minnesota. (Only peat mapped outside Reservation boundary)

and ground moraines. The bedrock aquifers are composed of fractured zones of the bedrock.

The buried sand and gravel aquifers are water-supply sources near Nett Lake Community. The report by Norvitch (1963) and results of test drilling for water-supply wells indicate that the buried sand and gravel aquifers are small and discontinuous. The productivity of the bedrock aquifers is limited by the density of fractures. Exposed surfaces of bedrock in the northeast part of the Reservation are not fractured (Norvitch, 1963).

The Reservation is located within the Little Fork River Basin (fig. 1). Surface-water drainage from about the southwestern 40 percent of the Reservation flows out the Little Fork River toward the northwest; surface-water drainage from the remainder of the Reservation flows out the Nett Lake River toward the northwest. Streams that flow into and out of Nett Lake are in the Nett Lake River watershed, a subbasin of the Little Fork River Basin. Most of the streamflow into Nett Lake is from Lost River and Woodduck Creek; a small amount of streamflow into Nett Lake is from several other small streams. All streamflow from Nett Lake is to the Nett Lake River.

Streamflow in the Reservation is sustained during periods of low flow by ground-water discharge and drainage from lakes (Helgesen and others, 1976). High streamflow is regulated by the storage and release of water from wetlands and lakes. High streamflow accompanies or immediately follows spring snowmelt, but may also result from high-intensity rainfall.

The principal ions in the ground water are calcium, magnesium, and bicarbonate (Helgesen and others, 1976). Areal variations in the concentrations of these ions is attributable to differences in mineralogic composition of the glacial sediments and bedrock; ground-water residence time; and chemical composition of the recharge. The quality of the ground water for household use may be lowered because of the hardness and concentrations of iron and manganese that exceed 300 μg/L and 50 μg/L, respectively. Problems associated with the lowered water quality include unpleasant tastes and odors, staining of fixtures, and buildup of deposits in sinks and bathtubs.

Methods of Investigation

Six monitoring wells (MW) installed by the USGS, five community wells (CW) installed by the Reservation, and three test holes (TH) drilled by the USGS, were used in the collection of hydrogeologic and water-quality data (fig. 3). These wells were completed in sand and gravel aquifers except CW4 and CW5, which were completed in bedrock.

Detailed descriptions of the construction methods for the monitoring wells are described by Menheer and Brigham (1997). The boreholes were drilled with a hollow-stem rotary hydraulic auger drill rig. The casings are flush-threaded, 2-inch inside-diameter, PVC (polyvinyl chloride). The screens are 5-ft-long (except for MW5, which is 10-ft-long), flush-threaded, machine slotted (0.010-slot) PVC. The boreholes around the screens were backfilled with washed, medium to coarse sand. Bentonite grout was pumped into the annular space above the sand packs to within 3-4 ft of land surface. A 7-ft-long protective steel casing was cemented in place around each well head to divert surface drainage.

Water levels in MW1-MW6 and in CW1-CW3 were measured with an electric tape. The reference point elevations (above sea level) for MW1-MW4 were surveyed to within 0.01 foot from established benchmarks. The reference point elevations for MW5 and MW6 and the community wells were estimated to within 5 feet from USGS topographic maps.

Seven borings through lakebed peat into underlying lake clay were done during winter in Nett Lake (fig. 1). The borings were done by hand-driving, from the ice surface, 6- to12-ft lengths of 1.25-inch inside-diameter steel pipe with a 6-inch drive-point screen through the peat and into a few inches of the underlying clay. Thicknesses of the peat were determined from these borings.

Ground-water samples were collected for chemical analyses from MW1-MW6 and from CW3 and CW4. Prior to collection of these samples, water was pumped for about 20 to 40 minutes to remove at least three well casing volumes of water. CW3 and CW4 had permanently installed, submersible pumps. MW1-MW6 were pumped with a portable, positive displacement Keck pump. During the pumping period the water was monitored to determine temperature, pH, specific conductance, and dissolved oxygen concentration. These measurements were made with a Hydrolab sonde calibrated at the start of each sampling day. When these properties stabilized, the water from the well was assumed to represent the water in the aquifer, and a sample was collected. Detailed descriptions of the procedures used to collect, treat, and store the samples are described by Fishman and

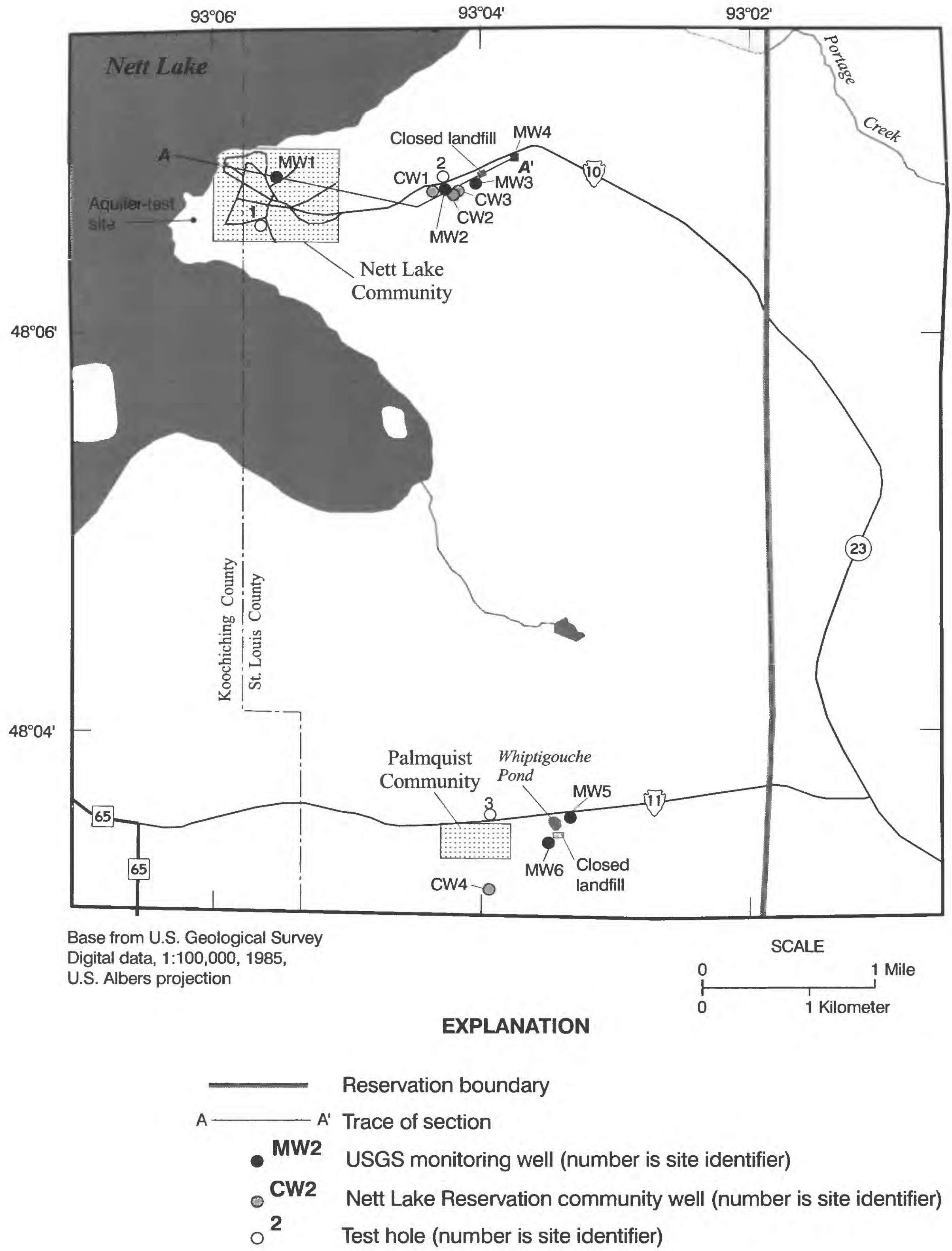

Figure 3. Locations of wells, test holes, closed landfills, trace of section, and aquifer-test site, Nett Lake Indian Reservation, northern Minnesota.

Friedman (1989) and Koterba and others (1995). Chemical analyses of the samples were done at the USGS National Water Quality Laboratory in Arvada, Colorado.

Ions, nutrients, and 21 trace metals were analyzed in water sampled once from MW2, MW4, MW5, MW6, and CW4, and in water sampled twice from MW3 and CW3. Only nutrients were analyzed in water sampled once from MW1. A total of 63 VOCs were analyzed in water sampled once from MW2, MW4, MW5, MW6, and CW4, in water sampled twice from CW3, and in water sampled three times from MW3.

A blank water sample was analyzed for the same ions and trace metals and for some of the same VOCs (benzene, toluene, ethyl-benzene, xylene, meta/para-xylene, and tertiary-butyl-methyl-ether) as water from the wells sampled (environmental water samples) to verify quality of data. The blank water sample was collected under similar conditions and with similar equipment as the environmental water samples to determine if contamination occurred between samples. These quality-assurance analyses indicated that the reported concentrations of constituents analyzed in this study, except possibly fluoride, were not affected by contamination between sample sites.

Detectable concentrations of fluoride (0.2 mg/L), calcium (0.06 mg/L), copper (60 μg/L), silver (1 μg/L), and toluene (0.144 μg/L) were reported for the blank water sample. Fluoride and calcium were the only two of these constituents that were present above the MDL (method detection limit—the minimum concentration that can be reliably cited) in water from the wells sampled. The concentrations of calcium in water from the wells sampled were about two orders of magnitude greater than that reported for the blank water sample. The concentration of fluoride in water from three wells sampled, however, was the same as that reported for the blank water sample.

Stream-discharge data were collected from the Nett Lake River, Lost River, and Woodduck Creek (fig. 1). Stream-gage sites on the Nett Lake River and Woodduck Creek were instrumented for collection of continuous stage data during the open-water part of the year. The site on Lost River was equipped with a staff gage for manual readings of stage. Current meters were used to measure discharge at 4- to 6-week intervals at all gage sites. Stage-discharge relations were developed for the gage sites on Nett Lake River and Woodduck Creek by procedures described in Rantz (1982). Daily mean discharges for these streams were computed from recorded stage and their respective stage-discharge relations using methods described in Kennedy (1983).

Acknowledgments

We are grateful to Dr. Chris Holm, Boise Forte Reservation Biologist, and other members of the Boise Forte Reservation Tribal Council, for the administrative and field support given to the study. This support included assistance in the location of and access to monitoring-well and stream-gage sites and community wells, and assistance in the lakebed borings that were done in Nett Lake.

Ground water in the Communities of Nett Lake and Palmquist

Evaluation of ground water in the Nett Lake Indian Reservation focused on the communities of Nett Lake and Palmquist. Residents of the Reservation use ground water from aquifers in or near these communities for their source of water supply. Closed landfills near these communities are potential sources of ground-water contamination.

Hydrogeology

Till that consists predominantly of clay with some fine to coarse sand is present in and around the community of Nett Lake (table 1, back of the report). These sediments are not aquifers except in a few locations where water-bearing layers of sand and gravel are buried within the till. Nett Lake Community wells are completed in these sand and gravel aquifers. Reported yields for CW1, CW2, and CW3 were about 12, 36, and 60 gal/min, respectively (Dr. Chris Holm, Reservation Biologist, oral commun., 1997).

Water-level elevations in MW2, MW3, MW4, CW1, CW2, and CW3 near the closed landfill east of Nett Lake Community indicate a moderate hydraulic gradient of about 12 ft per mile from MW3, located along the edge of the closed landfill, to MW2, located near the three community wells (fig. 4). The gradient, which may have been influenced by ground-water withdrawals from the community wells, suggests the potential for local ground water to have moved through shallow glacial sediments from the closed landfill toward the community wells. The rate of the ground-water movement would have been dependent on the degree of interconnection of sand and gravel lenses within the till.

The transmissivity of a buried sand and gravel aquifer, estimated by the method of Theis and others

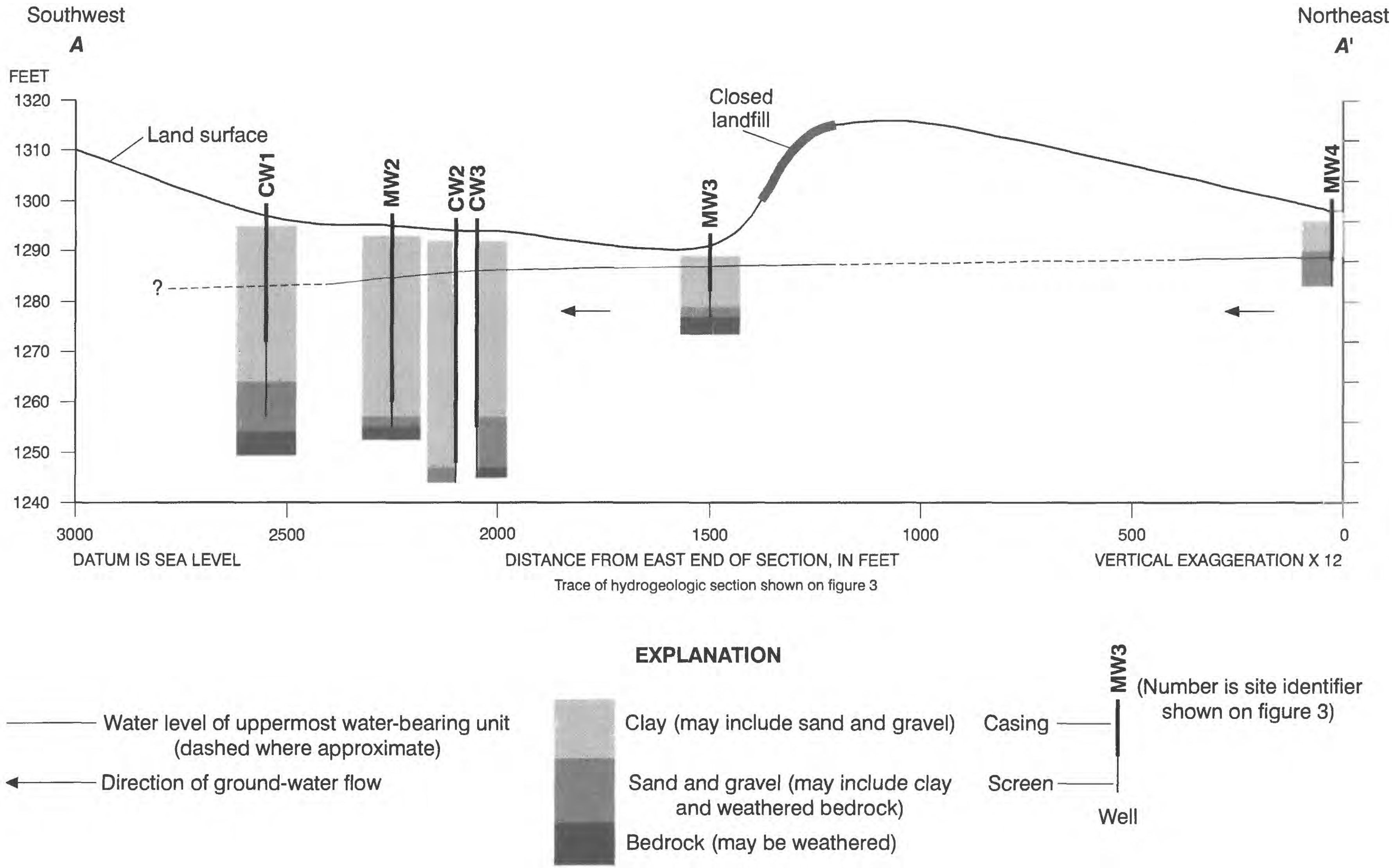

Figure 4. Water levels, ground-water flow, and lithologic descriptions of drill cuttings along trace A-A' for wells near Nett Lake Community, Nett Lake Indian Reservation, northern Minnesota, August 1997.

(1963) from the specific capacity for CW3, was about 1,600 ft^2/d. The transmissivity of a buried sand and gravel aquifer, estimated from an aquifer test west of Nett Lake Community (fig. 1), was about 800 ft^2/d (Norvitch, 1963). These estimated transmissivities are in the low part of the range (1,000 to 16,000 ft^2/d) reported for other buried sand and gravel aquifers in western Minnesota (Delin, 1986). The estimated transmissivities indicate that these aquifers may not supply a sufficient amount of water to support large capacity wells.

The water-level elevation in MW1 near the shore of Nett Lake was about 9-11 ft higher than the lake (fig. 5), which indicated that shallow ground water locally discharged into the lake through underlying peat. The thickness of the peat, determined from lakebed borings, ranges from 3 to 12 feet (table 1, back of the report). Tightly compacted, gray lake clay underlies the peat. The steep hydraulic gradient (about 25-35 ft per mile) between MW1 and Nett Lake may indicate that the low permeability of the peat and underlying clay restricts ground-water discharge into the lake.

The two Palmquist Community wells (CW4 and CW5) are completed in the bedrock aquifer. The reported yields for CW4 and CW5 were 34 gal/min and 26 gal/min, respectively. These community wells probably are not hydraulically connected to shallow ground water in the vicinity of the closed landfill east of the community because the wells are located more than 2,000 feet away and the bedrock is overlain by 124-154 feet of clay. Water-level elevations were about 7-13 ft higher in MW6 than MW5 (fig. 5), which suggests that local ground-water movement in the shallow glacial sediments near the closed landfill was not toward the community wells.

Ground-Water Quality

The diagrams in figure 6 show that water from the wells sampled was of the calcium magnesium bicarbonate type. The sizes of the diagrams are relative to major-ion concentration (Hem, 1985). The sizes of the diagrams were similar except for MW5 and CW4, which were slightly smaller, thus indicating that water from these two wells had a smaller major-ion concentration than water from the other wells sampled.

The pH of water from eight wells sampled ranged from 6.1 to 7.7 (table 2, back of the report). These pH values were within the range of 6.0 to 8.5 that is typical of most ground water in the United States (Hem, 1985), and also were within the SMCL range of 6.5 to 8.5 established by the USEPA (U.S. Environmental Protection Agency) (1996) except for field measurements of 6.4 and 6.1 for MW1 and CW3, respectively. The concentrations of sulfate, chloride, and fluoride in water from seven wells sampled also were less than their USEPA (1966) SMCL limits (250, 250, and 2.0 mg/L, respectively).

The concentrations of nitrate (as nitrogen) in water from eight wells sampled were less than the MCL of 10 mg/L for drinking water established by the USEPA (1996). These concentrations were less than what generally is considered a natural background of 3.0 mg/L in ground water (Madison and Brunett, 1984).

The concentrations of 21 trace metals in water from seven wells sampled were present in minute concentrations that generally were less than 1,000 µg/L (table 3, back of the report). These concentrations are typical of most natural ground water (Hem, 1985). Natural sources of trace metals include leachate from soil and decayed plant material, solutes from minerals in glacial sediments and igneous and metamorphic rocks, and precipitation.

The concentrations of 10 trace metals with established MCLs in water from the seven wells sampled were within their respective regulatory limits. The 10 trace metals and their USEPA (1996) MCLs are antimony (6 µg/L), arsenic (50 µg/L), barium (2,000 µg/L), beryllium (4 µg/L), cadmium (5 µg/L), chromium (100 µg/L), lead (15 µg/L), mercury (2 µg/L), nickel (100 µg/L), and selenium (50 µg/L). The concentrations of two of five trace metals with established SMCLs, however, exceeded their respective guidelines in water from six of the seven wells sampled (MW2, MW3, MW4, MW5, CW3, and CW4). The five trace metals and their USEPA (1996) SMCLs are iron (300 µg/L), manganese (50 µg/L), copper (1,000 µg/L), silver (100 µg/L), and zinc (5,000 µg/L). Concentrations of iron ranged from 590 to 1,400 µg/L in water sampled from MW2, CW3, and CW4. Potential sources of the iron include dissolution of igneous and metamorphic rock minerals such as pyroxenes, amphiboles, biotite, and magnetite, and in the case of water sampled from CW3 and CW4, corrosion of the steel well casings. Concentrations of manganese ranged from 55 to 1,500 µg/L in water from MW2, MW3, MW4, MW5, CW3, and CW4. Potential sources of the manganese include dissolution of igneous and metamorphic rock minerals, such as pyroxenes and amphiboles, and possibly decay of plant material.

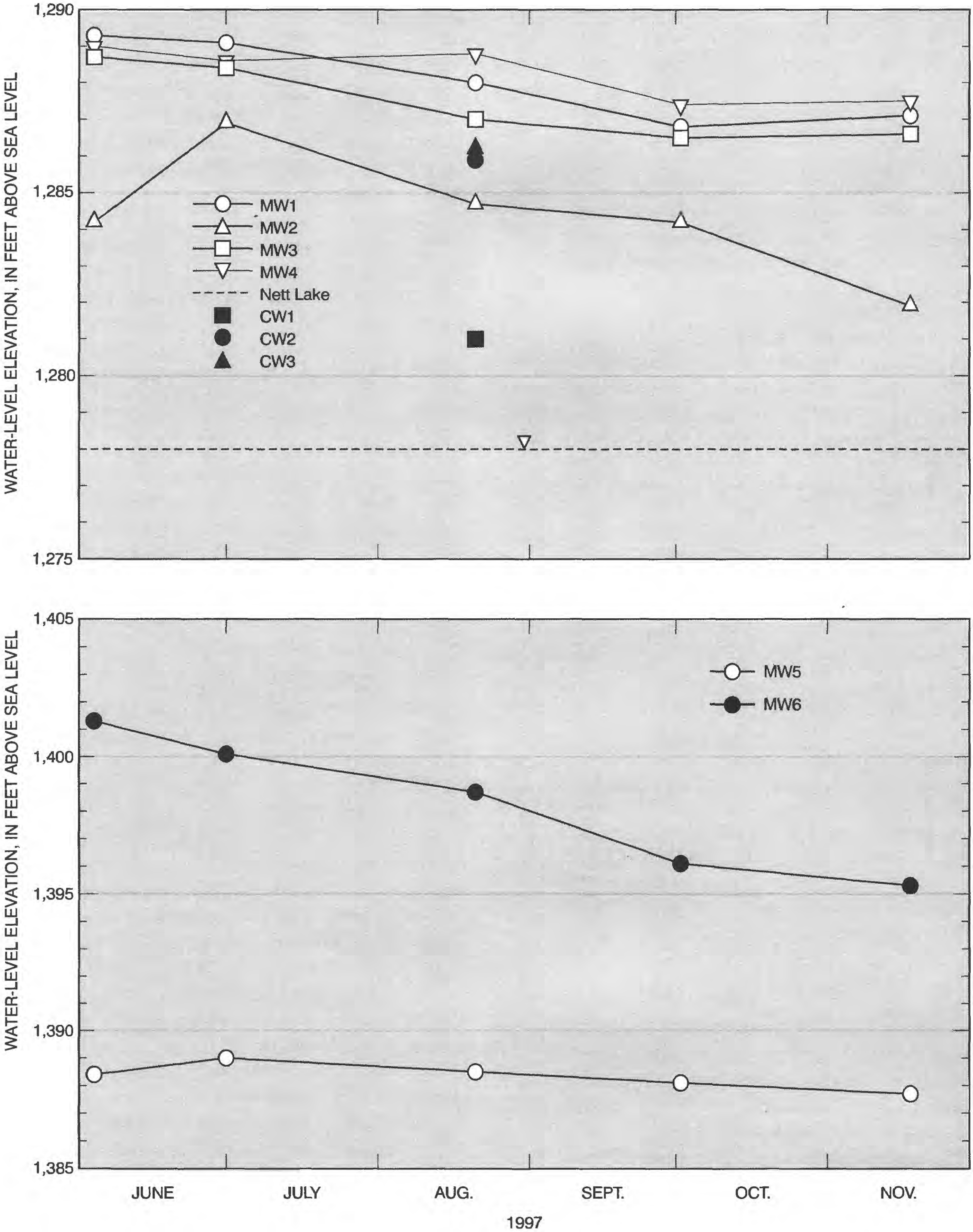

Figure 5. Water-level elevations in six monitoring wells and three community wells, Nett Lake Indian Reservation, northern Minnesota.

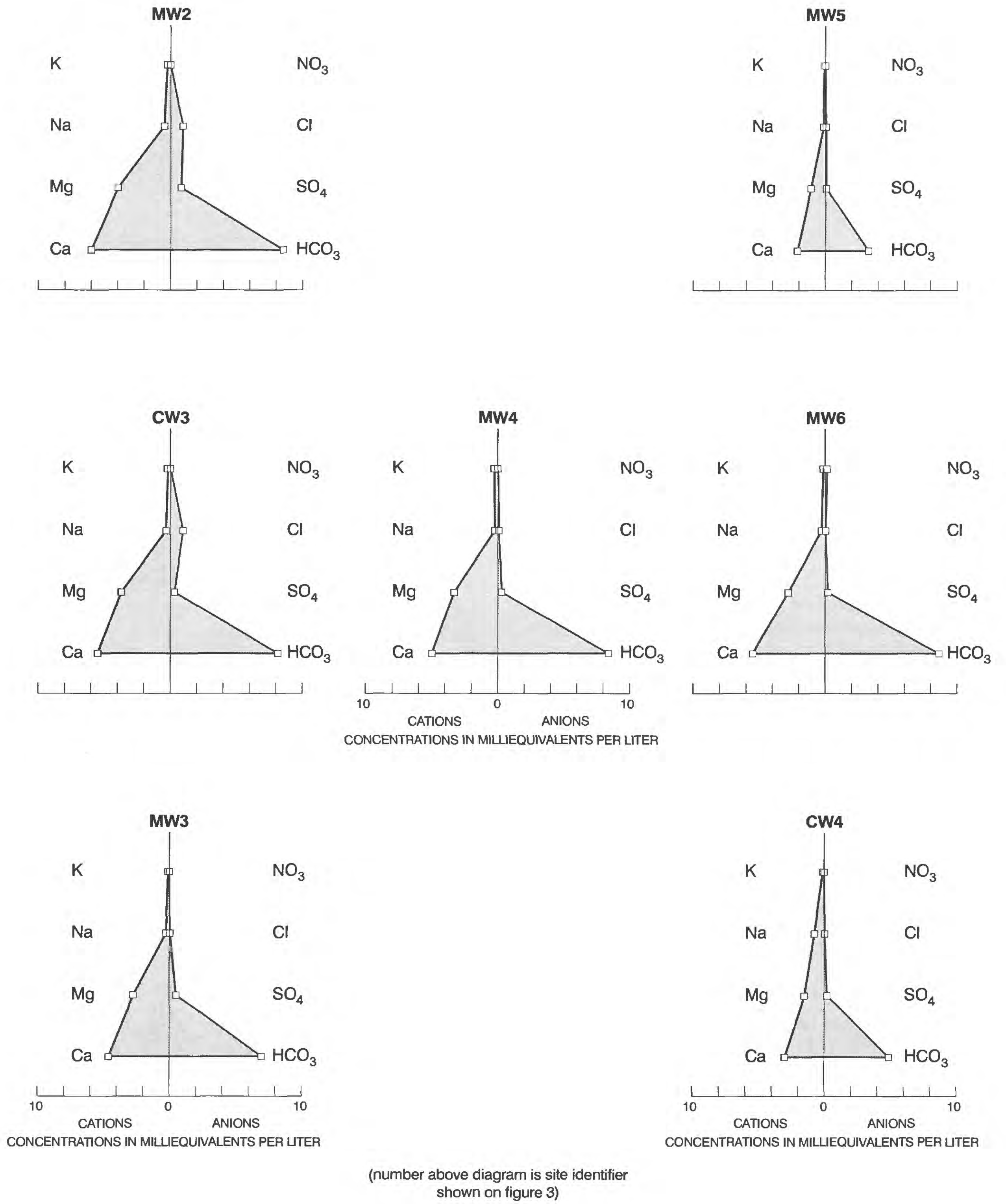

Figure 6. Major-ion composition of water samples from wells completed in sand and gravel aquifers and bedrock aquifers, Nett Lake Indian Reservation, northern Minnesota, 1995-96.

All but 3 of 63 VOCs analyzed in water from seven wells sampled had concentrations less than the MDL. The MDL for all of the VOCs analyzed in this study was 0.200 µg/L except for an MDL of 1.00 µg/L for di-bromo-chloro-propane and phenols. The detected VOCs were phenols, which ranged in concentration from 2 to 3 µg/L in water sampled from MW2, CW3, and MW3; benzene, which had a concentration of 0.500 µg/L in water sampled from MW6; and 1,1-dichloroethane, which had a concentration of 0.300 µg/L in water sampled from MW3 (table 4, back of the report).

Phenols are aromatic (six-carbon ring compounds) alcohols that are produced both naturally by plants and synthetically in the manufacture of a wide range of products, such as adhesives and antiseptics (McMurry, 1984). Benzene, the simplest member of aromatic compounds, is produced synthetically in the manufacture of petroleum products, solvents, plastics, and pharmaceuticals. 1,1-Dichloroethane is a two-carbon compound member of the alkane series of hydrocarbons with two attached chlorine atoms. 1,1-Dichloroethane is present in solvents, paints, paint removers, gasoline, and degreasing agents (Verschueren, 1983).

Possible sources of VOCs in water from the wells sampled may include leachate from nearby closed landfills. These chemicals are frequently detected in ground water downgradient from landfills (Andrews, 1996). MW3 and MW6 are particularly vulnerable to contamination from the landfills because of their proximity (less than 50 feet) and shallow screen depths (9-14 feet for MW3; 34-39 feet for MW6). Leachate from the landfills may not have been the source of the phenols because these substances occur naturally in ground water.

MCLs have been established for 19 of the 63 VOCs analyzed in this study. Benzene, the only one of the three detected VOCs with an established MCL, had a concentration that was one order of magnitude less than its MCL of 5 µg/L (U.S. Environmental Protection Agency, 1996). Of the remaining 18 VOCs that had concentrations below the MDL, the MDL was less than the MCL except for di-bromo-chloro-propane, which had an MCL of 0.200 µg/L (table 5, back of the report). All but one of the 19 VOCs, therefore, were present at concentrations that did not exceed their respective regulatory limits. Exceedance of the MCL by di-bromo-chloro-propane could not be determined from the results of this study.

Streamflow in the Nett Lake River Watershed

Stage-discharge relations at the Nett Lake River and Woodduck Creek gages were affected by periodic scour and fill of the channel bed and temporary accumulations of debris in the channels. Daily mean discharge for Nett Lake River and Woodduck Creek are listed in tables 6 and 7 at the back of the report. A hydrograph of daily mean discharges is shown in figure 7. Daily mean discharge for Lost River was not determined because dam building by beavers combined with vegetation and debris in the channel resulted in a highly-variable, indeterminate relation between stage and discharge.

Drainage areas for the Nett Lake River and Woodduck Creek at the gage sites are 128 and 31.8 mi^2, respectively. The drainage area for Lost River at the gage site, which is about 4 miles upstream from its mouth, is 24.0 mi^2. The drainage area for Lost River does not include drainage from Portage Creek, which enters Lost River downstream of the Lost River gage site (fig. 1).

Six current-meter discharge measurements were made on the Lost River (table 8, back of the report). These measurements were compared with concurrent daily discharge records for Woodduck Creek and Nett Lake River. This comparison showed that discharge in Woodduck Creek was substantially greater than discharge in Lost River on two of the six days. On those days, July 30, 1996 and August 27, 1996, discharges in Woodduck Creek were, respectively, 8.7 and 5.4 times greater than discharges in Lost River. These results were unexpected because the drainage area at the gage site for Woodduck Creek (31.8 mi^2) is only about 1.3 times larger than that for Lost River (24.0 mi^2). In contrast, on February 12, 1996, and on March 13, 1996, discharges in Lost River were about 3.8 times greater than discharges in Woodduck Creek. Results of two other measurements, made on June 19, 1996, and on November 13, 1996, show that the ratios of discharge in Woodduck Creek to Lost River were about 1:1 and 1.4:1, respectively, values that are similar to the ratio of the drainage areas.

The discharge measurements in Lost River, although few, indicate that the discharge in this river relative to discharge in Woodduck Creek can be variable. The commonly used assumption that discharge magnitudes in two streams that have adjacent or nearby catchments will be approximately proportional to their respective drainage areas may not apply to these watersheds. Current-meter discharge measurements may be needed to adequately determine discharge, particularly in Lost River.

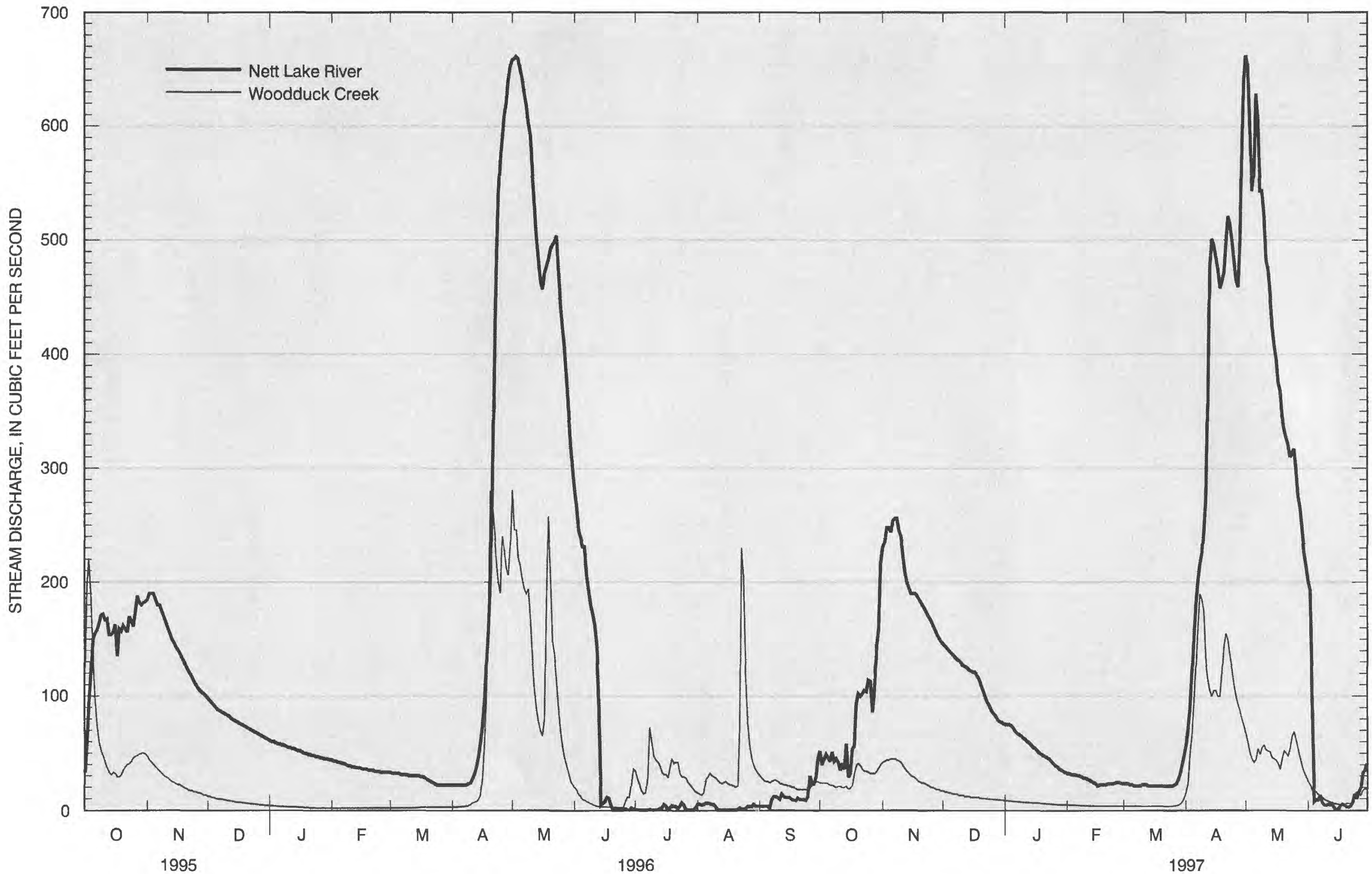

Figure 7. Daily mean stream discharge for Nett Lake River and Woodduck Creek, near Nett Lake Community, Nett Lake Indian Reservation, northern Minnesota.

Summary

The Nett Lake Indian Reservation extends over about a 164 mi^2 area in northern Minnesota. About 300 people live in Nett Lake Community, about 100 people live in Palmquist Community, and a few people live in other parts of the Reservation. Water resources in the Reservation include: (1) ground water in sand and gravel aquifers and bedrock aquifers; (2) Nett Lake; (3) streams in the Nett Lake River watershed; and (4) wetlands that extend over about one-half the Reservation.

Aquifers in the Reservation consist of sand and gravel and bedrock.The buried sand and gravel aquifers are important sources of water near Nett Lake Community, where reported yields for wells completed in these aquifers are as much as 60 gal/min. Reported yields for wells completed in the bedrock aquifers are as much as 34 gal/min.

The Reservation is within the Little Fork River Basin. Streams that flow into and out of Nett Lake are in the Nett Lake River watershed, a subbasin of the Little Fork River Basin. Most of the streamflow into Nett Lake is from Lost River and Woodduck Creek; a small amount of streamflow into Nett Lake is from several other small streams. All streamflow from Nett Lake is to the Nett Lake River.

Water-level elevations in three monitoring wells that are located east of Nett Lake Community and completed in sand and gravel aquifers buried in till indicate a moderate hydraulic gradient of about 12 ft per mile from a closed landfill toward three community wells. The hydraulic gradient may have been influenced by ground-water withdrawals from the community wells, which also are completed in sand and gravel aquifers buried in till. Potential movement of ground water from the closed landfill toward the community wells would be dependent on the degree of interconnection between sand and gravel lenses within the till.

The water-level elevation in a monitoring well near the shore of Nett Lake indicates ground water discharge into the lake through underlying peat. The thickness of the peat, determined from lakebed borings, is from 3 to 12 feet. The peat and underlying, tightly compacted, gray lake clay, because of their low permeability, may restrict ground-water discharge into the lake.

Two Palmquist Community wells probably are not hydraulically connected to the ground water in shallow glacial sediments in the vicinity of a closed landfill east of the community. The wells are located more than 2,000 feet away and are completed in a bedrock aquifer that underlies 124-154 feet of clay. Water-level elevations in two monitoring wells near the closed landfill suggest that local ground-water movement in the shallow glacial sediments was not toward the community wells.

The concentrations of iron and manganese in water from three and six wells sampled, respectively, exceeded their respective SMCL limits. All but 3 of 63 VOCs (volatile organic compounds) analyzed in water from seven wells sampled had concentrations less than the MDL (method detection limit) of 0.200 µg/L except for di-bromo-chloro-propane, which had a concentration less than its MDL of 1.000 µg/L. The detected VOCs were phenols, benzene, and 1,1-dichloroethane. The sources of VOCs in water from the wells sampled may have been leachate from nearby closed landfills. Benzene, the only one of the three detected VOCs with an established MCL, had a concentration that was one order of magnitude less than its MCL of 5 µg/L.

The drainage areas at gage sites on the Nett Lake River and Woodduck Creek are 128 and 31.8 mi^2, respectively. The drainage area of the gage site on Lost River, which is about 4 miles upstream from its mouth, is 24.0 mi^2. This area does not include drainage from Portage Creek, which enters Lost River downstream of the Lost River gage.

Daily mean discharge was determined for the Nett Lake River and Woodduck Creek using continuous-stage recorders and stage-discharge relations. Stage-discharge relations for these streams were affected by channel scour and fill and temporary accumulation of channel debris. A usable stage-discharge relation could not be developed for the Lost River, primarily because beaver dams prevented the determination of daily mean discharge.

Streamflow in the Lost River, based on the results of six discharge measurements, was highly variable relative to flow in Woodduck Creek. Four of the six measurements showed that discharge in Lost River can be substantially greater or smaller than concurrent discharge in Woodduck Creek.

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Supplemental Information

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96

[BLS, below land surface; ft, feet; USGS, United States Geological Survey; --, no data]

MW1 (USGS monitoring well)
Reference point elevation (at top of PVC well casing): 1,290.34 feet above sea level
Screen interval depth: 21 - 26 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Clay with fine sand	2-24	22	Gray	Hard
Fine sand with clay	24-26	2	Gray	Moderately hard

CW1 (Nett Lake Reservation well—locally known as Nett Lake Community well 2)
Reference point elevation (at top of steel well casing): 1,299 feet above sea level
Screen interval depth: 25 - 40 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Clay	2-23	21	--	--
Sand	23-25	2	Gray	--
Clay with silt	25-33	8	Gray	--
Sand	33-43	10	Gray	--
Bedrock	43	--	--	Hard

MW2 (USGS monitoring well)
Reference point elevation (at top of PVC well casing): 1,297.41 feet above sea level
Screen interval depth: 35 - 40 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Clay with sand and gravel	2-38	36	Gray	Hard
Coarse sand and gravel with clay	38-40	2	Gray	Moderately hard
Bedrock	40	--	--	Very hard

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

CW2 (Nett Lake Reservation well—locally known as Nett Lake Community well 3)
Reference point elevation (at top of steel well casing): 1,296 feet above sea level
Screen interval depth: 46 - 50 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	--
Clay with fine sand	2-47	45	Gray	--
Sand with weathered bedrock	47-50	3	Gray	--

CW3 (Nett Lake Reservation well—locally known as Nett Lake Community well 4)
Reference point elevation (at top of steel well casing): 1,296 feet above sea level
Screen interval depth: 39 - 49 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	--
Clay with fine sand	2-37	35	Gray	--
Fine sand with clay	37-47	10	Gray	--
Bedrock	47	--	--	--

MW3 (USGS monitoring well)
Reference point elevation (at top of PVC well casing): 1,292.86 feet above sea level
Screen interval depth: 9 - 14 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Clay with sand and gravel	2-12	10	Gray	Hard
Sand and gravel	12-14	2	Gray	Moderately hard
Bedrock	14	--	--	Very hard

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

MW4 (USGS monitoring well)
Reference point elevation (at top of PVC well casing) altitude: 1,299.88 feet above sea level
Screen interval depth: 10 - 15 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness of material
Top soil	0-2	2	Black	Soft
Clay with sand and gravel	2-8	6	Gray	Hard
Coarse sand and gravel with clay	8-15	7	Gray	Moderately hard

MW5 (USGS monitoring well)
Reference point elevation (at top of PVC well casing): 1,412 feet above sea level
Screen interval depth: 29 - 39 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Fine to medium sand with clay	2-9	7	Brown	Moderately hard
Clay with sand	7-39	32	Brown	Hard

MW6 (USGS monitoring well)
Reference point elevation (at top of PVC well casing): 1,417 feet above sea level
Screen interval depth: 34 - 39 feet BLS

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Soft
Clay	2-37	35	Brown	Moderately hard
Clay with sand	37-39	2	Brown	Moderately hard

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

CW4 (Nett Lake Reservation Community well—llocally known as Palmquist Community well 1)
(Reference point elevation not estimated)
Open-hole interval depth BLS: 167 - 177 feet

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	--
Clay	2-156	154	Gray	Soft
Bedrock	156-168	12	--	Hard
Bedrock with shale	168-173	5	--	Very hard
Bedrock	173-177	4	--	Very hard

CW5 (Nett Lake Reservation Community well—llocally known as Palmquist Community well 2)
(Reference point elevation not estimated)
Open-hole interval depth BLS: 162 - 169 feet

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	--
Sand	2-21	19	Brown	--
Clay	21-145	124	Gray	--
Bedrock	145-169	24	--	Very hard

Test hole 1

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Hard
Clay	2-5	3	Brown	Very hard

Test hole 2

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Hard
Clay	2-13	11	Gray	Hard
Bedrock	13	--	--	Very hard

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Test hole 3

Geologic log	Depth (ft)	Thickness (ft)	Color	Hardness
Top soil	0-2	2	Black	Moderately hard
Sand	2-52	50	Brown	Moderately hard
Clay with sand	52-60	8	Brown	Hard

Nett Lake peat boring 1

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-7	7	Black	Soft
Clay	7	--	Gray	Hard

Nett Lake peat boring 2

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-12	12	Black	Soft
Clay	12	--	Gray	Hard

Nett Lake peat boring 3

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-9	9	Black	Soft
Clay	9	--	Gray	Hard

Table 1. Geologic logs of six monitoring wells, five community wells, three test holes, and seven lakebed borings in Nett Lake, Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Nett Lake peat boring 4

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-3	3	Black	Soft
Clay	3	--	Gray	Hard

Nett Lake peat boring 5

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-8	8	Black	Soft
Clay	8	--	Gray	Hard

Nett Lake peat boring 6

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-7	7	Black	Soft
Clay	7	--	Gray	Hard

Nett Lake peat boring 7

Geologic log	Depth[1] (ft)	Thickness (ft)	Color	Hardness
Peat	0-6	6	Black	Soft
Clay	6	--	Gray	Hard

[1] Depth below lakebed surface

Table 2. Physical and chemical properties, major and minor ions, and nutrients in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96

[all concentrations are in milligrams per liter; µS/cm, microsiemens per centimeter; °C, degree Celsius; --, no data; <, less than]

Site identifier shown on figure 3	Site identification number	Date	Water temperature, field (°C)	Specific conductance, field (µS/cm)	Oxygen, dissolved, field (as O)	pH, field (standard units)	pH, lab (standard units)	Alkalinity, total, field (mg/L as $CaCO_3$)	Calcium, dissolved (as Ca)	Magnesium, dissolved (as Mg)	Sodium, dissolved (as Na)
MW1	480647093053201	08-27-96	10.0	623	0.2	6.4	--	307	--	--	--
MW2	480600093043001	12-05-95	5.0	1010	.2	6.9	7.1	428	120	48	11
CW3	480644093042901	12-05-95	5.5	914	9.8	6.9	7.0	407	110	45	7.2
		08-27-96	7.5	920	14.5	6.1	6.9	440	110	46	7.7
MW3	480647093041201	12-06-95	5.5	691	.2	6.8	7.2	349	92	33	5.9
		08-27-96	8.5	665	.4	6.5	7.0	340	89	33	4.5
		10-31-96	7.0	667	.4	6.9	--	--	--	--	--
MW4	480654093035001	12-06-95	6.0	812	.7	6.8	7.1	420	100	40	4.9
MW5	480331093032401	12-07-95	--	309	--	7.3	7.5	164	42	13	3.0
MW6	480323093032701	12-07-95	5.5	819	.7	6.9	7.4	432	110	34	6.2
CW4	480327093034501	12-05-95	6.5	497	.1	7.6	7.7	244	60	18	17

Table 2. Physical and chemical properties, major and minor ions, and nutrients, in water samples fromwells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Site identifier shown on figure 3	Site identification number	Date	Potassium, dissolved (as K)	Bicarbonate, dissolved (as HCO_3)	Carbonate, dissolved (as CO_3)	Chloride, dissolved (as Cl)	Sulfate, dissolved (as SO_4)	Fluoride, dissolved (as F)	Nitrogen, ammonia, dissolved (as N)	Nitrogen, nitrite, dissolved (as N)	Nitrogen, ammonia + organic, dissolved (as N)
MW1	480647093053201	08-27-96	--	375	0	--	--	--	0.030	<0.010	<0.20
MW2	480600093043001	12-05-95	9.6	522	0	33	40	<0.10	.070	<.010	--
CW3	480644093042901	12-05-95	8.1	497	0	34	15	<.10	.030	<.010	--
		08-27-96	7.7	537	--	38	17	.20	.040	<.010	<.20
MW3	480647093041201	12-06-95	4.1	426	0	1.4	25	<.10	<.015	<.010	--
		08-27-96	2.9	415	--	1.3	24	.20	.020	<.010	<.20
		10-31-96	--	--	--	--	--	--	--	--	--
MW4	480654093035001	12-06-95	11	512	0	3.3	14	<.10	<.015	<.010	--
MW5	480331093032401	12-07-95	3.0	200	0	1.3	4.1	<.10	<.015	.030	--
MW6	480323093032701	12-07-95	6.0	527	0	1.5	10	.10	<.015	.020	--
CW4	480327093034501	12-05-95	4.3	298	0	1.0	11	.20	<.290	<.010	--

Table 2. Physical and chemical properties, major and minor ions, and nutrients, in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Site identifier shown on figure 3	Site identification number	Date	Nitrogen, nitrite + nitrate, dissolved (as N)	Phosphorus, total (as P)	Phosphorus, dissolved (as P)	Phosphorus, ortho, dissolved (as P)
MW1	480647093053201	08-27-96	<0.050	--	--	<0.010
MW2	480600093043001	12-05-95	<.050	<0.010	<0.010	<.010
CW3	480644093042901	12-05-95	<.050	<.010	.010	<.010
		08-27-96	<.050	--	--	<.010
MW3	480647093041201	12-06-95	<.050	<.010	<.010	.010
		08-27-96	<.050	--	--	.020
		10-31-96	--	--	--	--
MW4	480654093035001	12-06-95	<.050	<.010	<.010	<.010
MW5	480331093032401	12-07-95	.190	.200	<.010	.020
MW6	480323093032701	12-07-95	1.90	.060	<.010	<.010
CW4	480327093034501	12-05-95	<.050	.010	.020	.020

Table 3. Trace metals in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96

[all concentrations are in micrograms per liter; <, less than]

Site identifier shown on figure 3	Site identification number	Date	Antimony, dissolved (as Sb)	Arsenic, dissolved (as As)	Barium, dissolved (as Ba)	Berylium, dissolved (as Be)	Boron, dissolved (as B)	Cadmium, dissolved, (as Cd)	Chromium, dissolved (as Cr)	Cobalt, dissolved (as Co)
MW2	480600093043001	12-05-95	<1.0	2	200	<0.50	40	<1.0	<5.0	<3.0
CW3	480644093042901	12-05-95	<1.0	<1	250	<.50	20	<1.0	<5.0	<3.0
		08-27-96	<1.0	1	260	<.50	33	<1.0	<5.0	<3.0
MW3	480647093041201	12-06-95	<1.0	<1	94	<.50	50	<1.0	<5.0	<3.0
		08-27-96	<1.0	<1	110	<.50	54	<1.0	<5.0	<3.0
MW4	480654093035001	12-06-95	<1.0	<1	330	<.50	20	<1.0	<5.0	15
MW5	480331093032401	12-07-95	<1.0	<1	42	<.50	<10	<1.0	<5.0	<3.0
MW6	480323093032701	12-07-95	<1.0	<1	130	<.50	20	<1.0	<5.0	<3.0
CW4	480327093034501	12-05-95	2.0	18	100	<.50	110	<1.0	<5.0	<3.0

Table 3. Trace metals in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Site identifier shown on figure 3	Site identification number	Date	Copper, dissolved (as Cu)	Iron, dissolved (as Fe)	Lead, dissolved (as Pb)	Lithium, dissolved (as Li)	Manganese, dissolved (as Mn)	Mercury, dissolved (as Hg)	Molybdenum, dissolved (as Mo)	Nickel, dissolved (as Ni)
MW2	480600093043001	12-05-95	<10	1,400	<10	41	220	<0.1	<10	10
CW3	480644093042901	12-05-95	<10	750	<10	34	61	<.1	<10	<10
		08-27-96	<10	590	<10	35	55	<.1	<10	<10
MW3	480647093041201	12-06-95	<10	34	<10	11	370	<.1	<10	<10
		08-27-96	<10	68	<10	11	190	<.1	<10	<10
MW4	480654093035001	12-06-95	<10	8.0	<10	47	1,500	<.1	<10	30
MW5	480331093032401	12-07-95	<10	<3.0	<10	<4	300	<.1	<10	<10
MW6	480323093032701	12-07-95	<10	<3.0	<10	20	33	<.1	<10	<10
CW4	480327093034501	12-05-95	<10	690	<10	24	190	<.1	<10	<10

Table 3. Trace metals in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

Site identifier shown on figure 3	Site identification number	Date	Selenium, dissolved (as Se)	Silver, dissolved (as Ag)	Strontium, dissolved (as Sr)	Vanadium, dissolved (as V)	Zinc, dissolved (as Zn)
MW2	480600093043001	12-05-95	<1	<1.0	240	<6	<3.0
CW3	480644093042901	12-05-95	<1	<1.0	190	<6	7.0
		08-27-96	<1	<1.0	190	<6	18
MW3	480647093041201	12-06-95	<1	<1.0	130	<6	<3.0
		08-27-96	<1	<1.0	110	<6	<3.0
MW4	480654093035001	12-06-95	<1	<1.0	130	<6	<3.0
MW5	480331093032401	12-07-95	<1	<1.0	41	<6	4.0
MW6	480323093032701	12-07-95	<1	<1.0	110	<6	<3.0
CW4	480327093034501	12-05-95	<1	<1.0	350	<6	53

Table 4. Volatile organic compounds in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96

[all concentrations are in micrograms per liter; <, less than; --, no data]

Site identifier shown on figure 1	Site identification number	Date	Phenols	Benzene	1,1-Di-chloro-ethane
MW2	480600093043001	12-05-95	3	<0.200	--
CW3	480644093042901	12-05-95	<1	<.200	--
		08-27-96	2	<.200	<0.200
MW3	480647093041201	12-06-95	<1	<.200	--
		08-27-96	3	<.200	.300
		10-31-96	--	<.200	.300
MW4	480654093035001	12-06-95	<1	<.200	--
MW5	480331093032401	12-07-95	<1	<.200	--
MW6	480323093032701	12-07-95	<1	0.500	--
CW4	480327093034501	12-05-95	<1	<.200	--

Table 5. Volatile organic compounds not detected in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96

[VOC, volatile organic compound; MCL, Maximum Contaminant Level; --, no MCL; *, VOC analyzed in sample water from MW2, MW3, MW4, MW5, MW6, CW3, and CW4; **, VOC analyzed in sample water from CW3 and MW3]

VOC	MCL (µg/L)
Tertiary-butyl-methyl-ether *	--
Ethyl-benzene *	700
Meta/para-xylene *	--
Toluene *	1,000
Meta/Para-Xylene *	--
Xylene *	1,000
Di-bromo-methane **	--
Di-chloro-bromo-methane **	--
Carbon-tetra-chloride **	5
1,2-Di-chloro-ethane **	5
Bromoform **	--
Chloro-di-bromo-methane **	--
Chloroform **	--
Chloro-benzene **	--
Chloro-ethane **	--
Methyl-bromide **	--
Methyl-chloride **	--
Methylene-chloride **	--
Tetra-chloro-ethylene **	5
Tri-chloro-fluoro-methane **	--
1,1-Di-chloro-ethylene **	700
1,1,1-Tri-chloro-ethane **	200
1,1,2-Tri-chloro-ethane **	5
1,1,2,2-Tetra-chloro-ethane **	--
0-Di-chloro-benzene **	600
1,2-Di-chloro-propane **	5
1,2-Trans-di-chloro-ethene **	100
1,3-Trans-di-chloro-propene **	--
1,3-Cis-di-chloro-propene **	--
1,2,4-Tri-chloro-benzene **	70
1,3-Di-chloro-benzene **	--
1,4-Di-chloro-benzene **	75
Di-chloro-di-fluoro-methane **	--

Table 5. Volatile organic compounds not detected in water samples from wells in the Nett Lake Indian Reservation, northern Minnesota, 1995-96—continued

VOC	MCL (μg/L)
Napthalene **	--
1,1-Di-chloro-propene **	--
2,2-Di-chloro-propane **	--
1,3-Di-chloro-propane **	--
1,2,4-Tri-methyl-benzene **	--
Isopropyl-benzene **	--
N-Propyl-benzene **	--
1,3,5-Tri-methyl-benzene **	--
0-Chloro-toluene **	--
P-Chloro-toluene **	--
Bromo-chloro-methane **	--
N-Butyl-benzene **	--
Secondary-butyl-benzene **	--
Tertiary-butyl-benzene **	--
P-Iso-propyl-toluene **	--
1,2,3-Tri-chloro-propane **	--
1,1,1,2-Tetra-chloro-ethane **	--
1,2,3-Tri-chloro-benzene **	--
1,2-Di-bromo-ethane **	--
1,1,3-Freon **	--
Bromo-benzene **	--
Di-bromo-chloro-propane **	0.200
Tri-chloro-ethylene **	5
1,2-Cis-di-chloro-ethylene **	70
Hexa-chloro-butadiene **	--
Styrene **	--
Vinyl chloride **	2

Table 6. Discharge for the Nett Lake River near Nett Lake Community, and summary statistics of the discharge, during the 1996 and 1997 water years (October 1, 1995 - September 30, 1997), Nett Lake Indian Reservation, northern Minnesota

[e, estimated; max, maximum; min, minimum; ac-ft, acre feet; cfs, cubit feet per second; cfsm, cubic feet per second per square mile; in., inches; WY, water year]

Discharge, cubit feet per second, water year October 1995 to September 1996, daily mean values

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	e185	e98	e61	e44	e33	e22	658	281	.44	5.2	3.7
2	60	e190	e96	e60	e43	e32	e22	659	266	.38	5.1	3.3
3	94	e190	e94	e60	e43	e32	e22	661	245	.11	4.3	3.3
4	121	e190	e92	e59	e42	e32	e22	659	239	.09	5.0	3.4
5	150	e185	e90	e58	e42	e32	e22	650	231	.06	6.0	3.5
6	155	e180	e88	e58	e41	e31	e22	641	231	.00	5.9	1.5
7	158	e180	e87	e57	e41	e31	e22	628	206	.04	5.7	9.0
8	164	e175	e86	e57	e40	e31	e22	618	193	.56	5.0	12
9	171	e170	e85	e56	e39	e31	e23	602	180	.14	4.8	12
10	172	e165	e84	e55	e39	e30	e24	592	172	.09	3.0	11
11	167	e160	e83	e55	e38	e30	e28	559	162	.19	.06	9.4
12	168	e155	e82	e54	e38	e30	e32	531	144	.42	.01	14
13	154	e150	e80	e54	e37	e30	e38	502	90	1.3	.00	12
14	154	e147	e79	e53	e37	e30	e47	484	4.3	1.5	.00	11
15	156	e143	e78	e52	e37	e30	e60	464	6.1	4.6	.00	11
16	163	e140	e77	e52	e36	e29	e74	457	7.5	3.4	.00	11
17	135	e137	e76	e51	e36	e29	e95	471	11	.15	.00	9.4
18	159	e133	e75	e50	e36	e28	e130	477	10	1.6	.00	8.7
19	157	e130	e74	e50	e35	e27	e160	483	3.8	3.6	.00	8.6
20	162	e127	e73	e49	e35	e26	e200	492	.01	3.3	.00	11
21	159	e123	e72	e49	e35	e25	e280	496	.00	3.1	.28	9.5
22	156	e120	e71	e48	e34	e24	e380	499	.00	1.4	1.8	9.4
23	170	e117	e70	e48	e34	e23	e480	504	.00	3.3	.88	9.5
24	166	e113	e69	e47	e34	e22	e540	473	.00	6.4	.46	8.8
25	161	e110	e68	e47	e33	e22	e570	445	.00	4.5	1.5	12
26	174	e107	e67	e46	e33	e22	e590	424	1.1	.44	3.0	30
27	188	e105	e66	e46	e33	e22	e610	405	.49	.05	2.9	23
28	182	e103	e65	e45	e33	e22	e620	378	.16	.03	3.0	23
29	180	e102	e64	e45	e33	e22	e640	351	1.9	.07	4.9	29
30	182	e100	e63	e45	---	e22	652	321	1.2	.09	3.7	45
31	e183	---	e62	e44	---	e22	---	301	---	2.3	3.6	---
TOTAL	4754	4332	2414	1611	1081	852	6449	15885	2687.56	43.65	76.09	368.0
MEAN	153	144	77.9	52.0	37.3	27.5	215	512	89.6	1.41	2.45	12.3
MAX	188	190	98	61	44	33	652	661	281	6.4	6.0	45
MIN	33	100	62	44	33	22	22	301	.00	.00	.00	1.5
AC-FT	9430	8590	4790	3200	2140	1690	12790	31510	5330	87	151	730
CFSM	1.20	1.13	.61	.41	.29	.21	1.68	4.00	.70	.01	.02	.10
IN.	1.38	1.26	.70	.47	.31	.25	1.87	4.62	.78	.01	.02	.11

Statistics of monthly mean data for water years 1996-1996, by water year

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	153	144	77.9	52.0	37.3	27.5	215	512	89.6	1.41	2.45	12.3
MAX	153	144	77.9	52.0	37.3	27.5	215	512	89.6	1.41	2.45	12.3
(WY)	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996
MIN	153	144	77.9	52.0	37.3	27.5	215	512	89.6	1.41	2.45	12.3
(WY)	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996

SUMMARY STATISTICS	FOR 1996 WATER YEAR		
ANNUAL TOTAL	40553.30	cfs	
ANNUAL MEAN	111	cfs	
HIGHEST DAILY MEAN	661	cfs	May 3
LOWEST DAILY MEAN	.00	cfs	Jun 21
ANNUAL SEVEN-DAY MINIMUM	.00	cfs	Aug 13
INSTANTANEOUS PEAK FLOW	663	cfs	May 1
INSTANTANEOUS PEAK STAGE	5.08	ft	May 1
ANNUAL RUNOFF	80440	ac-ft	
ANNUAL RUNOFF	.87	cfsm	
ANNUAL RUNOFF	11.79	in.	
10 PERCENT EXCEEDS	379	cfs	
50 PERCENT EXCEEDS	45	cfs	
90 PERCENT EXCEEDS	.48	cfs	

Table 6. Discharge for the Nett Lake River near Nett Lake Community, and summary statistics of the discharge, during the 1996 and 1997 water years (October 1, 1995 - September 30, 1997), Nett Lake Indian Reservation, northeastern Minnesota—continued

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	52	e230	e146	e75	e32	e23	e57	662	201	---	---	---
2	40	e235	e144	e75	e32	e23	71	653	193	---	---	---
3	45	248	e142	e75	e31	e23	e90	595	96	---	---	---
4	49	248	e140	e74	e31	e22	e120	543	7.4	---	---	---
5	46	244	e138	e72	e31	e22	e150	559	9.2	---	---	---
6	43	254	e136	e69	e30	e21	e180	628	9.1	---	---	---
7	51	256	e134	e67	e30	e21	e200	605	13	---	---	---
8	43	256	e132	e66	e29	e21	e215	543	6.7	---	---	---
9	45	e245	e131	e65	e28	e21	e225	543	4.6	---	---	---
10	42	e240	e129	e63	e28	e22	e245	522	4.2	---	---	---
11	35	e225	e127	e62	e27	e22	e275	482	5.3	---	---	---
12	41	e209	e126	e60	e26	e22	e360	474	4.6	---	---	---
13	36	e200	e125	e59	e25	e21	478	453	5.4	---	---	---
14	58	e195	e123	e57	e24	e21	501	425	2.1	---	---	---
15	29	e190	e122	e55	e23	e21	495	408	.54	---	---	---
16	32	e190	e121	e54	e21	e21	485	396	1.2	---	---	---
17	54	e190	121	e52	e22	e21	474	375	3.8	---	---	---
18	56	e188	e118	e50	e22	e21	458	368	5.4	---	---	---
19	93	e185	e115	e49	e22	e21	464	345	4.4	---	---	---
20	102	e182	e110	e48	e22	e21	472	334	3.0	---	---	---
21	100	e179	e105	e47	e23	e21	498	327	2.6	---	---	---
22	102	e176	e100	e46	e23	e21	521	321	3.7	---	---	---
23	105	e172	e95	e45	e23	e21	514	310	6.6	---	---	---
24	104	e169	e92	e43	e23	e21	500	313	14	---	---	---
25	114	e166	e88	e41	24	e21	482	317	10	---	---	---
26	113	e162	e85	e39	e24	e22	465	298	15	---	---	---
27	86	e158	e83	e38	e24	e23	459	275	20	---	---	---
28	105	e154	e80	e36	e23	e27	499	265	33	---	---	---
29	144	e151	e78	e35	---	e32	586	246	35	---	---	---
30	159	e148	e77	e34	---	e40	640	226	41	---	---	---
31	e215	---	e76	e33	---	e48	---	214	---	---	---	---
TOTAL	2339	6045	3539	1684	723	728	11179	13025	760.84	---	---	---
MEAN	75.5	202	114	54.3	25.8	23.5	373	420	25.4	---	---	---
MAX	215	256	146	75	32	48	640	662	201	---	---	---
MIN	29	148	76	33	21	21	57	214	.54	---	---	---
AC-FT	4640	11990	7020	3340	1430	1440	22170	25840	1510	---	---	---
CFSM	.59	1.57	.89	.42	.20	.18	2.91	3.28	.20	---	---	---
IN.	.68	1.76	1.03	.49	.21	.21	3.25	3.79	.22	---	---	---

Table 7. Discharge for Woodduck Creek near Nett Lake Community, and summary statistics of the discharge, during the 1996 and 1997 water years (October 1, 1995 - September 30, 1997), Nett Lake Indian Reservation, northern Minnesota

[e, estimated; max, maximum; min, minimum; ac-ft, acre feet; cfs, cubic feet per second; cfsm, cubic feet per second per square mile; in., inches; WY, water year]

Discharge, cubic feet per second, water year October 1995 to September 1996, daily mean values

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	119	e47	e12	e3.8	e1.8	e1.8	e2.7	281	20	34	15	30
2	196	e44	e12	e3.7	e1.8	e1.8	e2.7	246	18	27	14	28
3	221	e42	e11	e3.5	e1.8	e1.8	e2.8	246	14	22	13	26
4	187	e40	e11	e3.4	e1.8	e1.8	e2.8	222	12	17	15	25
5	137	e38	e10	e3.3	e1.8	e1.8	e2.9	214	9.4	14	27	25
6	99	e36	e9.8	e3.2	e1.8	e1.8	e3.0	202	8.7	15	29	24
7	75	e34	e9.7	e3.1	e1.8	e1.8	e3.2	194	7.6	28	32	25
8	60	e32	e9.4	e3.0	e1.8	e1.8	e3.5	190	6.7	72	30	26
9	52	e30	e9.0	e2.9	e1.8	e1.8	e4.0	194	5.8	59	29	26
10	48	e29	e8.7	e2.8	e1.8	e1.8	e5.0	169	4.9	47	28	25
11	42	e28	e8.3	e2.7	e1.8	e1.8	e6.4	132	4.0	44	26	23
12	37	e26	e8.0	e2.6	e1.8	e1.8	e7.0	106	3.6	42	24	23
13	33	e25	e7.8	e2.5	e1.8	e1.9	e7.6	90	3.1	39	23	22
14	31	e24	e7.4	e2.5	e1.8	e2.0	e9.4	78	2.8	33	24	22
15	33	e23	e7.0	e2.4	e1.8	e2.1	e13	70	2.8	31	25	21
16	32	e22	e6.8	e2.3	e1.8	e2.3	e30	65	2.9	31	23	21
17	29	e22	e6.6	e2.3	e1.8	e2.4	e60	79	2.8	28	22	20
18	29	e21	e6.4	e2.2	e1.8	e2.5	e100	175	2.6	37	22	20
19	31	e20	e6.2	e2.1	e1.8	e2.6	e170	258	2.5	45	21	19
20	35	e19	e6.0	e2.1	e1.8	e2.7	e280	210	2.4	41	20	18
21	38	e18	e5.8	e2.0	e1.8	e2.7	e270	149	2.2	42	21	18
22	40	e17	e5.6	e2.0	e1.8	e2.7	e250	136	2.1	42	76	18
23	41	e17	e5.4	e2.0	e1.8	e2.7	e220	115	1.9	32	230	18
24	e43	e16	e5.2	e1.9	e1.8	e2.7	e200	91	1.9	29	204	18
25	e46	e16	e5.0	e1.9	e1.8	e2.7	e190	70	1.8	29	119	18
26	e47	e15	e4.8	e1.9	e1.8	e2.7	e240	56	6.8	28	76	19
27	e48	e15	e4.6	e1.9	e1.8	e2.7	e230	46	11	24	56	22
28	e49	e14	e4.4	e1.9	e1.8	e2.7	213	39	11	22	45	25
29	e50	e13	e4.3	e1.9	e1.8	e2.7	206	32	22	20	39	25
30	e50	e13	e4.1	e1.9	---	e2.7	232	25	36	18	35	25
31	e49	---	e3.9	e1.9	---	e2.7	---	22	---	16	32	---
TOTAL	2027	756	226.2	77.6	52.2	69.8	2967.0	4202	233.3	1008	1395	675
MEAN	65.4	25.2	7.30	2.50	1.80	2.25	98.9	136	7.78	32.5	45.0	22.5
MAX	221	47	12	3.8	1.8	2.7	280	281	36	72	230	30
MIN	29	13	3.9	1.9	1.8	1.8	2.7	22	1.8	14	13	18
AC-FT	4020	1500	449	154	104	138	5890	8330	463	2000	2770	1340
CFSM	2.06	.79	.23	.08	.06	.07	3.11	4.26	.24	1.02	1.42	.71
IN.	2.37	.88	.26	.09	.06	.08	3.47	4.92	.27	1.18	1.63	.79

Statistics of monthly mean data for water years 1996-1996, by water year

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	65.4	25.2	7.30	2.50	1.80	2.25	98.9	136	7.78	32.5	45.0	22.5
MAX	65.4	25.2	7.30	2.50	1.80	2.25	98.9	136	7.78	32.5	45.0	22.5
(WY)	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996
MIN	65.4	25.2	7.30	2.50	1.80	2.25	98.9	136	7.78	32.5	45.0	22.5
(WY)	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996

SUMMARY STATISTICS	FOR 1996 WATER YEAR		
ANNUAL TOTAL	13689.1	cfs	
ANNUAL MEAN	37.4	cfs	
HIGHEST DAILY MEAN	281	cfs	May 1
LOWEST DAILY MEAN	1.8	cfs	Feb 1
ANNUAL SEVEN-DAY MINIMUM	1.8	cfs	Feb 1
INSTANTANEOUS PEAK FLOW	322	cfs	May 1
INSTANTANEOUS PEAK STAGE	11.52	ft	Apr 20
INSTANTANEOUS LOW FLOW	1.7	cfs	Jun 25
ANNUAL RUNOFF (AC-FT)	27150	ac-ft	
ANNUAL RUNOFF (CFSM)	1.18	cfsm	
ANNUAL RUNOFF (INCHES)	16.01	in.	
10 PERCENT EXCEEDS	116	cfs	
50 PERCENT EXCEEDS	18	cfs	
90 PERCENT EXCEEDS	1.8	cfs	

Table 7. Discharge for Woodduck Creek near Nett Lake Community, and summary statistics of the discharge, during the 1996 and 1997 water years (October 1, 1995 - September 30, 1997), Nett Lake Indian Reservation, northeastern Minnesota—continued

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	e42	e17	e8.3	e4.5	e3.4	e15	67	25	---	---	---
2	24	e43	e16	e8.1	e4.4	e3.4	e25	59	22	---	---	---
3	24	e44	e16	e7.9	e4.3	e3.4	e50	50	18	---	---	---
4	24	e44	e15	e7.7	e4.2	e3.4	e66	45	16	---	---	---
5	23	e45	e15	e7.5	e4.2	e3.4	e94	42	16	---	---	---
6	22	e45	e14	e7.3	e4.1	e3.4	e125	45	14	---	---	---
7	22	e45	e14	e7.1	e4.0	e3.4	e160	54	13	---	---	---
8	21	e44	e14	e7.0	e3.9	e3.4	e190	49	11	---	---	---
9	20	e43	e13	e6.8	e3.9	e3.4	e185	55	9.5	---	---	---
10	21	e42	e13	e6.7	e3.8	e3.4	e175	57	8.5	---	---	---
11	21	e39	e13	e6.6	e3.8	e3.4	e130	53	7.7	---	---	---
12	20	e36	e12	e6.5	e3.7	e3.4	e115	52	7.1	---	---	---
13	20	e34	e12	e6.4	e3.6	e3.4	e105	51	6.2	---	---	---
14	21	e32	e12	e6.3	e3.6	e3.4	e100	46	5.6	---	---	---
15	19	e30	e11	e6.2	e3.5	e3.4	e105	45	5.5	---	---	---
16	19	e29	e11	e6.1	e3.5	e3.4	e105	44	5.2	---	---	---
17	22	e28	e11	e6.0	e3.4	e3.4	e100	41	4.9	---	---	---
18	32	e26	e11	e5.9	e3.4	e3.4	e100	36	5.5	---	---	---
19	39	e25	e11	e5.8	e3.4	e3.4	120	45	4.8	---	---	---
20	41	e24	e10	e5.7	e3.4	e3.4	145	52	6.0	---	---	---
21	39	e24	e10	e5.6	e3.4	e3.4	155	50	5.9	---	---	---
22	36	e23	e9.9	e5.5	e3.4	e3.4	149	48	5.6	---	---	---
23	34	e22	e9.7	e5.4	e3.4	e3.4	135	54	6.3	---	---	---
24	34	e21	e9.5	e5.3	e3.4	e3.5	124	65	12	---	---	---
25	33	e20	e9.4	e5.2	e3.4	e3.6	111	69	16	---	---	---
26	32	e20	e9.3	e5.0	e3.4	e3.8	100	62	16	---	---	---
27	32	e19	e9.2	e4.9	e3.4	e4.0	93	54	13	---	---	---
28	32	e18	e9.0	e4.8	e3.4	e4.5	87	46	17	---	---	---
29	34	e18	e8.8	e4.7	---	e5.5	80	39	19	---	---	---
30	e37	e17	e8.6	e4.7	---	e7.0	74	33	18	---	---	---
31	e40	---	e8.5	e4.6	---	e10	---	29	---	---	---	---
TOTAL	862	942	362.9	191.6	103.8	120.1	3318	1537	340.3	---	---	---
MEAN	27.8	31.4	11.7	6.18	3.71	3.87	111	49.6	11.3	---	---	---
MAX	41	45	17	8.3	4.5	10	190	69	25	---	---	---
MIN	19	17	8.5	4.6	3.4	3.4	15	29	4.8	---	---	---
AC-FT	1710	1870	720	380	206	238	6580	3050	675	---	---	---
CFSM	.87	.99	.37	.19	.12	.12	3.48	1.56	.36	---	---	---
IN.	1.01	1.10	.42	.22	.12	.14	3.88	1.80	.40	---	---	---

Statistics of monthly mean data for water years 1996-1996, by water year

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	46.6	28.3	9.50	4.34	2.74	3.06	105	92.6	9.56	32.5	45.0	22.5
MAX	65.4	31.4	11.7	6.18	3.71	3.87	111	136	11.3	32.5	45.0	22.5
(WY)	1996	1997	1997	1997	1997	1997	1997	1996	1997	1996	1996	1996
MIN	27.8	25.2	7.30	2.50	1.80	2.25	98.9	49.6	7.78	32.5	45.0	22.5
(WY)	1997	1996	1996	1996	1996	1996	1996	1997	1996	1996	1996	1996

SUMMARY STATISTICS	FOR 1996 CALENDAR YEAR			WATER YEARS 1996 - 1997		
ANNUAL TOTAL	12846.8	cfs				
ANNUAL MEAN	35.1	cfs		37.4	cfs	
HIGHEST ANNUAL MEAN				37.4	cfs	1996
LOWEST ANNUAL MEAN				37.4	cfs	1996
HIGHEST DAILY MEAN	281	cfs	May 1	281	cfs	May 1 1996
LOWEST DAILY MEAN	1.8	cfs	Feb 1			
ANNUAL SEVEN-DAY MINIMUM	1.8	cfs	Feb 1	1.8	cfs	Feb 1 1996
INSTANTANEOUS PEAK FLOW				322	cfs	May 1 1996
INSTANTANEOUS PEAK STAGE				11.52	ft	Apr 20 1996
ANNUAL RUNOFF	25480	ac-ft		27100	ac-ft	
ANNUAL RUNOFF	1.10	ac-ft		1.18	ac-ft	
ANNUAL RUNOFF	15.03	in		15.98	in	
10 PERCENT EXCEEDS	82	cfs		91	cfs	
50 PERCENT EXCEEDS	19	cfs		16	cfs	
90 PERCENT EXCEEDS	1.8	cfs		2.3	cfs	

Table 8. Instantaneous streamflow in Lost River, and daily mean streamflow in Woodduck Creek and Nett Lake River, near Nett Lake Community, Nett Lake Indian Reservation, northern Minnesota

[ft^3/s, cubic feet per second]

Date	Lost River near Nett Lake (ft^3/s)	Woodduck Creek near Nett Lake (ft^3/s)	Nett Lake River near Nett Lake (ft^3/s)
February 12, 1996	6.92	1.8	38
March 13, 1996	6.99	1.8	30
June 19, 1996	2.58	2.5	3.8
July 30, 1996	2.07	18	0.09
August 27, 1996	10.4	56	2.9
November 13, 1996	23.7	34	200

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