

RECONNAISSANCE OF THE HYDROLOGY OF SANDSTONE AND LIMESTONE AQUIFERS ALONG THE
NORTHWEST FLANK OF THE LITTLE ROCKY MOUNTAINS, FORT BELKNAP INDIAN RESERVATION,
NORTH-CENTRAL MONTANA

By Steven E. Slagle, U.S. Geological Survey,
and Paul K. Christensen, U.S. Bureau of Indian Affairs

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 93-4193

Prepared in cooperation with the
FORT BELKNAP COMMUNITY COUNCIL and the
U.S. BUREAU OF INDIAN AFFAIRS



Helena, Montana
December 1993

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, Secretary

U.S. Geological Survey

ROBERT M. HIRSCH, Acting Director

For additional information
write to:

District Chief
U.S. Geological Survey
428 Federal Building
Drawer 10076
301 South Park
Helena, MT 59626-0076

Copies of this report may
be purchased from:

U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517
Denver Federal Center
Denver, CO 80225

CONTENTS

	Page
Abstract	1
Introduction	1
Purpose and scope	1
Location and general features of the area	3
Climate	3
Previous investigations	3
System for specifying geographic locations.	3
Quality control	4
Geologic setting.	5
Geologic history.	5
Structure	5
Stratigraphy.	5
Hydrology	8
Eagle Sandstone	8
Water levels.	10
Hydraulic characteristics	12
Water quality	12
Water-supply potential.	12
First Cat Creek sandstone and Third Cat Creek sandstone	12
Water levels.	13
Hydraulic characteristics	13
Water quality	13
Water-supply potential.	13
Mission Canyon and Lodgepole Limestones	13
Water levels.	13
Hydraulic characteristics	15
Water quality	15
Water-supply potential.	15
Summary	16
Selected references	17
Supplemental information.	19

ILLUSTRATIONS

Figure	1. Map showing location of study area.	2
	2. Diagram showing system of specifying location of wells and test holes.	4
	3. Diagrammatic geologic section through the Little Rocky Mountains showing the igneous core and the doming of the sedimentary rocks, Fort Belknap Indian Reservation, north-central Montana	6
	4. Map showing generalized geology and location of wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana.	9
	5. Hydrograph of water-level fluctuations for well E-3 completed in the Virgelle Sandstone Member of the Eagle Sandstone, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana, 1988-90.	10
	6. Map showing altitude of the water surface in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	11
	7-9. Hydrographs of water-level fluctuations for wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana:	
	7. Well C-1 completed in the First Cat Creek sandstone of the Colorado Group, 1988-90	14
	8. Well K-1 completed in the Third Cat Creek sandstone of the Kootenai Formation, 1988-90	14
	9. Well MC-1 completed in the Mission Canyon Limestone, 1989-92	15

TABLES

		Page
Table 1.	Generalized description and water-yielding characteristics of geologic units, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	7
2.	Records of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	20
3.	Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	21
4.	Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	34
5.	Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	40
6.	Specific capacity of monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	54
7.	Aquifer-test data, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	55
8.	Physical properties and dissolved-constituent concentrations of water, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	63
9.	Drinking-water regulations for public water supply	65
10.	Maximum dissolved-solids concentrations for livestock water	65
11.	Results of quality-control analyses of water samples, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana	66

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

<u>Multiply</u>	<u>By</u>	<u>To obtain</u>
acre	4,047	square meter
foot (ft)	0.3048	meter
foot squared per day (ft ² /d)	0.0929	meter squared per day
gallon per minute (gal/min)	0.06309	liter per second
gallon per minute per foot [(gal/min)/ft]	0.207	liter per second per meter
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
square mile (mi ²)	2.59	square kilometer

Temperature can be converted to degrees Celsius (°C) and degrees Fahrenheit (°F) by the equations:

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = 9/5 (^{\circ}\text{C}) + 32$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a 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.

Water-quality units that are abbreviated in this report:

- µg/L micrograms per liter
- µS/cm microsiemens per centimeter at 25 degrees Celsius
- mg/L milligrams per liter

RECONNAISSANCE OF THE HYDROLOGY OF SANDSTONE AND LIMESTONE AQUIFERS
ALONG THE NORTHWEST FLANK OF THE LITTLE ROCKY MOUNTAINS,
FORT BELKNAP INDIAN RESERVATION, NORTH-CENTRAL MONTANA

By Steven E. Slagle and Paul K. Christensen

ABSTRACT

The study area comprises about 55 square miles in the southwestern part of the Fort Belknap Indian Reservation in north-central Montana. The geologic units of interest are the Lodgepole Limestone, a thin-bedded limestone containing some shale and chert; the Mission Canyon Limestone, a massive limestone containing numerous solution cavities; the lower part of the Kootenai Formation composed of sandstone; a sandstone unit at the base of the Colorado Group; and the Virgelle Sandstone Member at the base of the Eagle Sandstone. These units were formed during Early Mississippian through Late Cretaceous time and have been subjected to uplift, folding, and the intrusion of the igneous core of the Little Rocky Mountains. Present dips range from nearly vertical to about 10 degrees.

Thirty-one test holes were drilled and 25 of the holes were completed as monitoring wells. Water-level fluctuations in most aquifers followed a seasonal pattern with the lowest levels occurring in the fall and winter and highest levels in the spring and summer. Seasonal fluctuations ranged from about 0.6 to 21 feet. Specific capacity of wells tested ranged from 0.02 gallon per minute per foot for a well completed in the Eagle Sandstone to 4.6 gallons per minute per foot for a well completed in the Mission Canyon Limestone. Eight aquifer tests indicated transmissivity values of 15 to 1,100 feet squared per day. Dissolved-solids concentration in water collected from 22 wells ranged from 263 to 1,930 milligrams per liter. The least mineralized water was obtained from the Mission Canyon Limestone and the most mineralized from the Eagle Sandstone.

INTRODUCTION

Sandstone and limestone aquifers contained in Cretaceous through Mississippian rocks on the northwestern flank of the Little Rocky Mountains can be a potential source of ground water for domestic and municipal use. Because of a water-supply need in the Hays area, the U.S. Geological Survey, in cooperation with the Fort Belknap Community Council and the U.S. Bureau of Indian Affairs, conducted a reconnaissance appraisal from 1988 to 1991 of the hydrology of the sandstone and limestone aquifers. The results of the study can be used by water-resources managers for planning and development of water supplies in the area.

Purpose and Scope

This report describes the reconnaissance of the hydrology of selected sandstone and limestone aquifers in rocks of Late Cretaceous through Late Mississippian age (table 1) along the northwestern flank of the Little Rocky Mountains (fig. 1). Specifically, the report describes water levels, hydraulic characteristics, water quality, and water-supply potential for five aquifers in the study area.

Thirty-one test holes were drilled to determine the subsurface lithology (tables 2 and 3; tables 2 through 11 are at the back of the report). Of these, 25 were completed as monitoring wells with PVC (polyvinyl chloride) or steel casing and slotted screen or slotted casing. Screened intervals in most wells were sand or gravel packed, and the annulus above the pack was sealed with bentonite slurry and cement. Lithologic logs (table 3) and geophysical logs--natural gamma, spontaneous potential, and resistivity--were recorded for most wells and test holes.

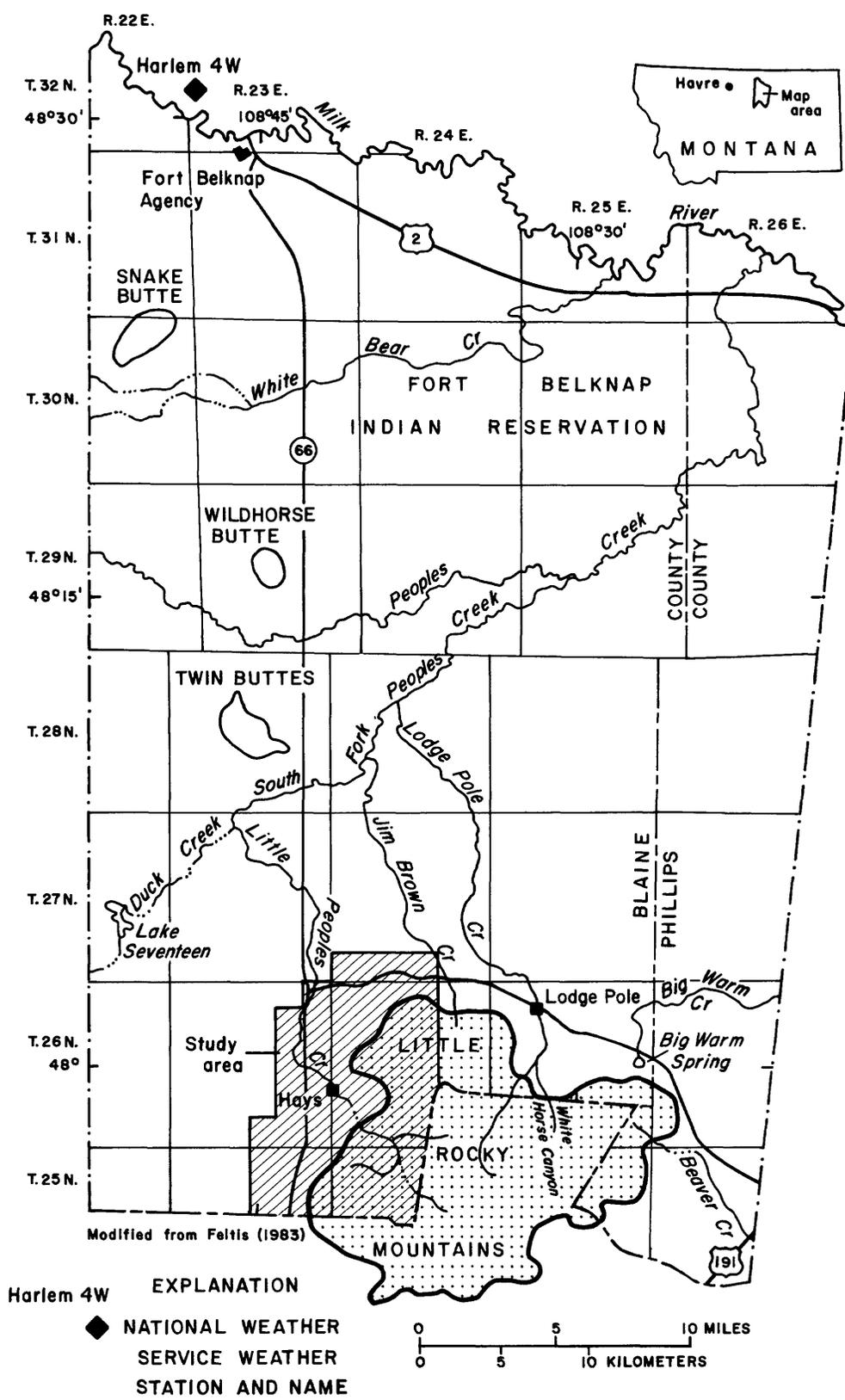


Figure 1.--Location of study area.

Water levels in 24 monitoring wells were measured, generally monthly or bi-monthly (tables 4 and 5). Continuous water-level recorders were installed on three wells. Water levels in seven monitoring wells, selected for inclusion in a state-wide water-level monitoring network, have been measured since the conclusion of this study. Those measurements are included in tables 4 and 5.

Specific-capacity tests were conducted at 16 wells (table 6) and aquifer tests were conducted at 8 locations (table 7). Tests were analyzed using methods developed by Cooper and Jacob (1946).

Water samples were collected from 22 monitoring wells for determination of water quality (table 8). The samples were collected after at least three casing volumes of water were pumped from each well and temperature, specific conductance, and pH remained stable. Concentrations of dissolved oxygen, bicarbonate, alkalinity, sulfide, nitrate (as nitrogen), and ferrous and total iron were determined onsite. Dissolved oxygen was determined onsite by use of a dissolved-oxygen meter. A portable colorimeter was used for onsite analyses for sulfide, nitrate, and iron. Onsite values for bicarbonate and alkalinity were determined by incremental titration. Major-ion and selected trace-element concentrations were determined by the Montana Bureau of Mines and Geology laboratory in Butte, Mont.

Location and General Features of the Area

The study area comprises about 55 mi² in the southwestern part of the Fort Belknap Indian Reservation (fig. 1) in north-central Montana, about 60 mi southeast of Havre. The topography is characterized by hills and valleys that are bounded on the south and east by the Little Rocky Mountains and on the north and west by glaciated plains. The upper reaches of Little Peoples and Jim Brown Creeks drain much of the area.

Climate

The climate in the study area is semiarid, with average annual precipitation ranging from about 16 in. at Hays to between 20 and 22 in. at the higher altitudes of the Little Rocky Mountains (U.S. Soil Conservation Service, 1977). The nearest weather station with complete temperature records is Harlem 4W, located about 40 miles north-northwest of Hays near the northwest corner of the reservation (fig. 1). The mean annual temperature at that location for the base period 1951-80 is 42.0 °F (National Oceanic and Atmospheric Administration, 1982). Minimum mean monthly temperature (10.2 °F) occurs in January and maximum mean monthly temperature (69.2 °F) occurs in July.

Previous Investigations

Previous geologic and hydrologic studies in the Hays-Lodge Pole area either have focused on the plains area of the reservation north of the mountain flank and foothills or have been regional in scope. The area was previously studied by Collier (1918), Alden (1932), Knechtel (1944), Erdmann and Koskinen (1953), Gries (1953), Nordquist (1953), Knechtel (1959), Alverson (1965), Feltis (1983), and Briar and others (1993).

System for Specifying Geographic Locations

A site number is used as the primary identification for wells and test holes referenced in this report. The site number consists of three or four characters. For wells, the first two or three characters denote the aquifer in which the well is completed: (E-), Eagle Sandstone; (C-), Colorado Group; (K-), Kootenai Formation; (MC-), Mission Canyon Limestone; or (L-), Lodgepole Limestone. For test holes, the designation (T-) is used. The next one or two characters denote a sequence number assigned to each site within a site type.

A location number is used to identify the location of wells and test holes. The location number is based on the rectangular system for the subdivision of public lands (fig. 2). The number consists of 14 characters and is assigned according to the location of the site within a given township, range, and section. The first three characters specify the township and its position north (N) of the Montana Base Line. The next three characters specify the range and its position east (E) of the Montana Principal Meridian. The next two characters indicate the section. The next four characters indicate the position of the site within the section. The first letter denotes the quarter section (160-acre tract); the second, the quarter-quarter section (40-acre tract); the third, the quarter-quarter-quarter section (10-acre tract); and the fourth, the quarter-quarter-quarter-quarter section (2.5-acre tract). The subdivisions of the section are numbered A, B, C, and D in a counterclockwise direction beginning in the northeast quadrant. The last two characters form a sequence number based on the order of inventory in that tract. For example, location number 26N23E12DCBB02 (site E-11) represents the second well inventoried in the NW1/4 NW1/4 SW1/4 SE1/4 sec. 12, T. 26 N., R. 23 E.

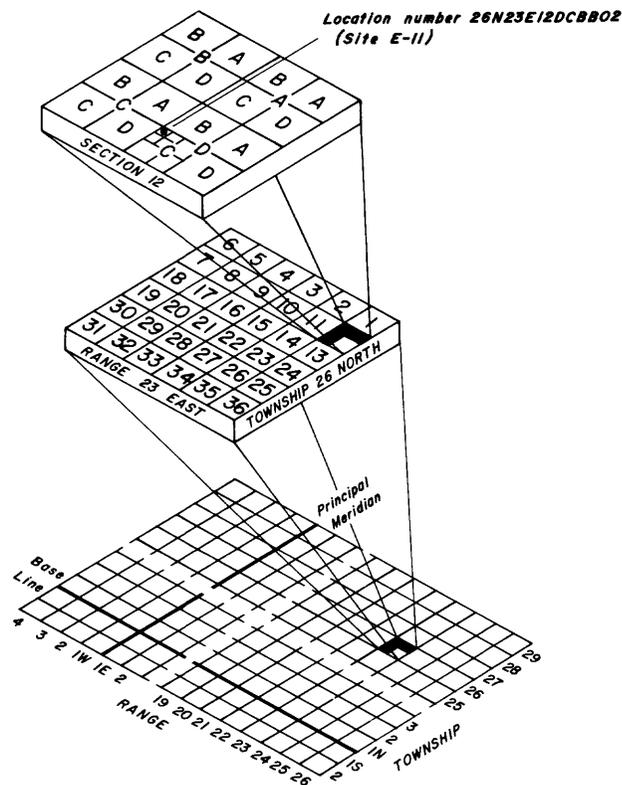


Figure 2.--System of specifying location of wells and test holes.

Quality Control

To assess the accuracy of the analyses of water samples collected during this study, an unidentified duplicate sample was collected for each 10 samples collected or for each sampling trip and sent to the Montana Bureau of Mines and Geology laboratory for analysis. Additionally, for each 20 samples collected, a triplicate sample was collected and sent to the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colo. Results of the quality-control analyses are given in table 11.

GEOLOGIC SETTING

Igneous, metamorphic, and sedimentary rocks, as well as unconsolidated sediments, ranging in age from Proterozoic to Holocene, are exposed in the Little Rocky Mountains and surrounding area. Thickness of the entire sedimentary section is as much as 7,500 ft (Alverson, 1965).

Geologic History

The geologic units of interest in this study were deposited from Early Mississippian through Late Cretaceous time. The Lodgepole and Mission Canyon Limestones were formed during Early to Late Mississippian time. Deposition was interrupted by uplift, folding, and erosion of a large thickness of the Mission Canyon Limestone. The area probably was not submerged during part or all of the Pennsylvanian, Permian, and Triassic Periods, as no sedimentary rocks of these ages occur near the Little Rocky Mountains (Alverson, 1965, p. F43). Resubmergence of the area during Jurassic time resulted in deposition of the Ellis Group on the eroded surface of the Mission Canyon Limestone. Considerable quantities of sediment, probably derived from the ancestral Rocky Mountains being uplifted to the west, were deposited during Cretaceous time. The sequence represents continental deposition of sandstone and siltstone of the Kootenai Formation and Eagle Sandstone and marine deposition of shale forming the intervening Colorado Group. Deposition continued into early Tertiary time, when the sediments were uplifted by intrusion of syenite porphyry. Subsequent erosion of the domed sediments has exposed the igneous core of the Little Rocky Mountains (fig. 3). The Little Rocky Mountains were not overridden by the continental glaciation that covered most of the land surface in the Fort Belknap Reservation.

Structure

The dominant force controlling the geologic structure of the study area was intrusion of the igneous mass that forms the core of the Little Rocky Mountains. This intrusion steeply tilted the previously flat-lying sedimentary rocks (fig. 3). The dips generally are oriented away from the center of the intrusion at angles ranging from nearly vertical near the mountain core to about 10 degrees near Hays.

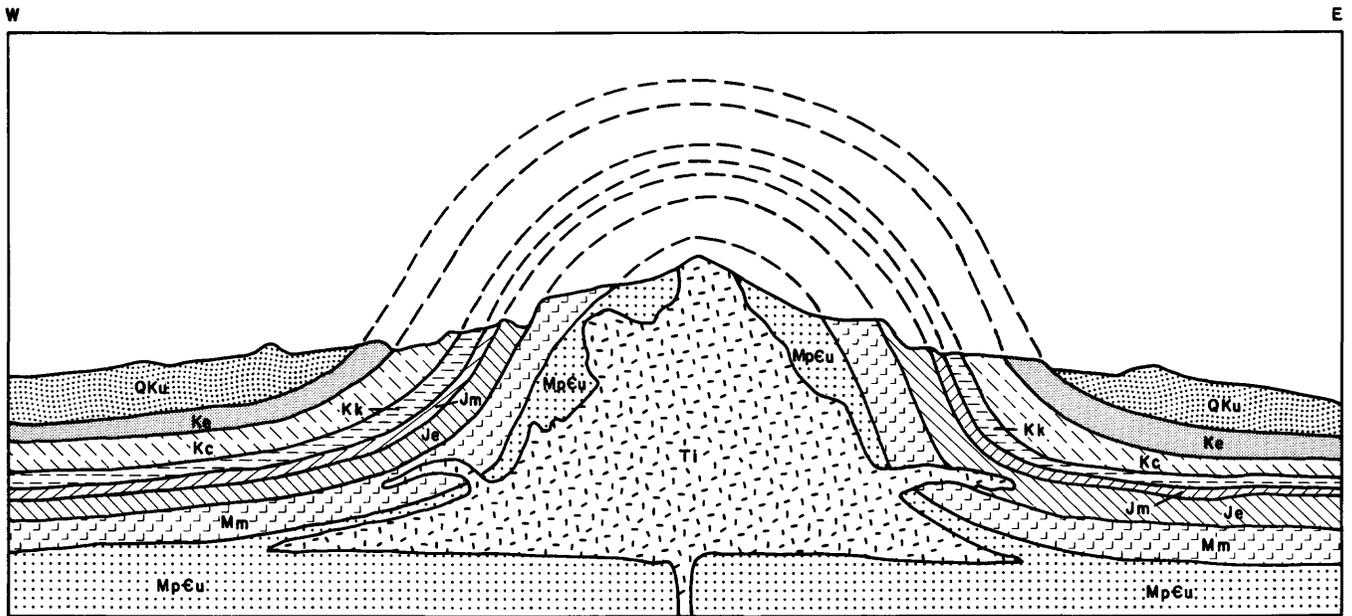
Stratigraphy

The formations considered in this report are part of a sequence of limestone, shale, and sandstone (table 1). Total thickness of this sequence is about 2,800 ft (Alverson, 1965, p. F14).

The Lodgepole Limestone of Early Mississippian age, the lowermost formation studied, is composed of principally dark- to light-gray thin-bedded limestone. In addition, the formation contains some massive limestone, thin partings of shale, and many small chert lenses. The base of the Lodgepole is defined by a thin, black shale (Knechtel, 1959, p. 733). The lower half of the formation is more thinly bedded than the upper. Two zones in the upper half, one more than 100 ft thick, are predominantly red. The upper contact is gradational with the overlying Mission Canyon Limestone.

The Mission Canyon Limestone, of Early and Late Mississippian age, is composed of light-gray to light-brown coarse-grained massive limestone. The lower half of the formation contains nodules and lenses of cherty material, with a few thin-bedded zones near the base (Knechtel, 1959, p. 734). The upper part of the formation contains numerous solution cavities, many of which are filled with clay. Near the periphery of the Little Rocky Mountains, the Mission Canyon Limestone forms a prominent wall. The Mission Canyon Limestone is unconformably overlain by rocks of the Ellis Group.

The Ellis Group, of Middle and Late Jurassic age, is composed of alternating beds of shale, fine-grained sandstone, mudstone, and impure limestone. In the



NOT TO SCALE

Modified from Alverson, 1965, Fig.7

EXPLANATION

	INTRUSIVE ROCKS (Tertiary)		ELLIS GROUP (Jurassic)
	POST-EAGLE SANDSTONE SEDIMENTS, UNDIFFERENTIATED (Quaternary through Cretaceous)		MADISON GROUP (Mississippian)
	EAGLE SANDSTONE (Cretaceous)		PRE-MADISON GROUP ROCKS, UNDIFFERENTIATED (Mississippian through Precambrian)
	COLORADO GROUP (Cretaceous)		HYPOTHETICAL PRE-EROSION POSITION OF SEDIMENTARY ROCKS
	KOOTENAI FORMATION (Cretaceous)		
	MORRISON FORMATION (Jurassic)		

Figure 3.--Diagrammatic geologic section through the Little Rocky Mountains showing the igneous core and the doming of the sedimentary rocks, Fort Belknap Indian Reservation, north-central Montana.

study area, the Ellis Group is represented by the Rierdon Limestone and Swift Formation.

The Morrison Formation, of Late Jurassic age, unconformably overlies the Ellis Group. The Morrison consists primarily of light-gray mudstone and contains a few beds of friable sandstone. Black carbonaceous shale or impure coal commonly composes the uppermost bed.

The Kootenai Formation of Early Cretaceous age unconformably overlies the Morrison Formation and is divided into two distinct informal units. The lower unit, commonly called the Third Cat Creek sandstone (Reeves, 1927), consists primarily of light-gray locally friable sandstone. The base of the unit is marked by a hard, coarse-grained arkosic sandstone; the top of the unit locally is distinguished by a light-gray dense limestone. The upper unit, commonly called the variegated argillaceous member, is composed of mottled maroon and grayish-green clay and contains a few thin beds of light-gray friable sandstone.

Table 1.--Generalized description and water-yielding characteristics of geologic units, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

Erathem	System	Series	Stratigraphic unit		Lithologic characteristics	Water-yielding characteristics	
Cenozoic	Quaternary	Holocene	Surficial deposits		Unconsolidated gravel, sand, silt, and clay. Includes alluvium, colluvium, and glacial drift.	Can produce usable quantities of water suitable for stock and domestic use where sorted and saturated.	
		Pleistocene					
	Tertiary	Pliocene through Paleocene?					
Mesozoic	Cretaceous	Upper Cretaceous	Montana Group	Post-Eagle Sandstone Rocks	Mostly fine-grained sandstone, siltstone, and shale. Includes Claggett Shale and Judith River Formation in the study area.	Claggett Shale not considered an aquifer. Judith River Formation yields sufficient quantities of water for stock and domestic use. Water quality might be unsuitable for some uses.	
				Eagle Sandstone	Upper Member	Sandstone, siltstone and shale. Upper member mostly shale. Virgelle Sandstone Member interbedded sandstone and shale.	Virgelle Sandstone Member yields moderate quantities of water suitable for stock and domestic use.
					Virgelle Sandstone Member		
		Telegraph Creek Formation		Mostly sandy shale.	Generally not considered an aquifer.		
		Lower Cretaceous		Colorado Group	First Cat Creek sandstone	Mostly dark-gray to bluish-gray shale. First Cat Creek sandstone consists of coarse-grained arkosic sandstone.	First Cat Creek sandstone yields small to moderate quantities of moderately mineralized water to wells.
				Kootenai Formation	Third Cat Creek sandstone	Mostly maroon and grayish-green clay. Third Cat Creek sandstone consists primarily of light-gray sandstone.	Third Cat Creek sandstone yields small to moderate quantities of water suitable for stock and domestic use.
	Jurassic	Upper Jurassic	Ellis Group	Morrison Formation	Primarily light-gray mudstone.	Generally not considered an aquifer.	
				Swift Formation	Alternating layers of shale, sandstone, mudstone, and impure limestone.	Generally not considered an aquifer although may yield small quantities of water to wells.	
				Rierdon Limestone			
	Mississippian	Upper Mississippian	Madison Group	Mission Canyon Limestone	Mission Canyon Limestone consists of massive cavernous limestone. Lodgepole Limestone is composed of thin-bedded limestone with shale partings.	Mission Canyon Limestone can yield large quantities of water suitable for domestic, stock, or municipal supply.	
Lodgepole Limestone							

Modified from Levings and others (1981).

Conformably overlying the Kootenai Formation is the Colorado Group of Early and Late Cretaceous age, a thick sequence of mostly dark-gray to bluish-gray shale. The Colorado Group also contains numerous bentonite beds, particularly in the lower part, as well as some lenticular sandstone and limestone beds. A thick-bedded fine-grained argillaceous sandstone, equivalent to the First Cat Creek sandstone (Reeves, 1927) occurs at the base.

The Montana Group of Late Cretaceous age conformably overlies the Colorado Group. The Telegraph Creek Formation, which is composed mostly of sandy shale, represents a transition zone between shale of the underlying Colorado Group and the sandstone of the overlying Eagle Sandstone.

The Eagle Sandstone of Late Cretaceous age, the uppermost unit investigated for this report, is divided into two members. The lower member, the Virgelle Sandstone Member, contains brown to gray massive sandstone, brownish-gray siltstone, and gray shale. The sandstone commonly is very fine to fine-grained and commonly is cross-bedded. The unnamed upper member is composed primarily of gray shale, but contains many thin beds of siltstone, sandy shale, and friable sandstone.

In addition to the geologic units investigated for this study, several overlying units were penetrated during test drilling. The Claggett Shale of Late Cretaceous age conformably overlies the Eagle Sandstone. The Claggett is composed primarily of dark-gray marine shale and siltstone that weathers to brownish-gray and is not considered to be an aquifer. Several drill holes penetrated unconsolidated surficial materials consisting of alluvium, colluvium, and glacial drift of late Tertiary (?) or Quaternary age. These deposits consist of mixtures of gravel, sand, silt, and clay and can produce usable quantities of water where sorted and saturated.

HYDROLOGY

The location of wells and test holes drilled as part of this study is shown in figure 4. Most of these wells and test holes are located in hills and valleys, north and west of the Little Rocky Mountains. A few are located near the southern terminus of the glaciated plains.

Eagle Sandstone

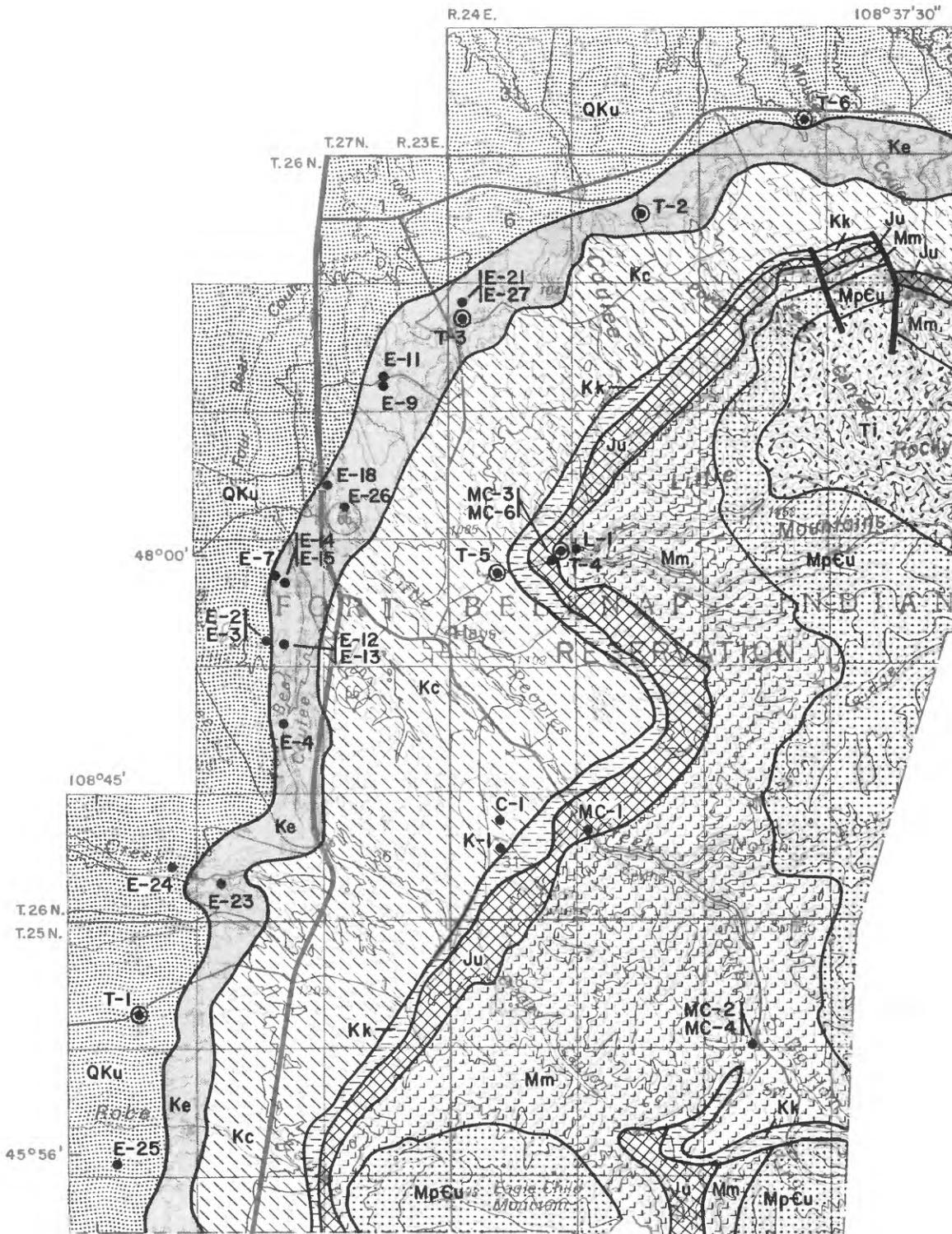
Seventeen wells were drilled and completed in the Virgelle Sandstone Member of the Eagle Sandstone. Three test holes were drilled to the Virgelle.

EXPLANATION FOR FIGURE 4

	INTRUSIVE ROCKS (Tertiary)		MADISON GROUP (Mississippian)
	POST-EAGLE SANDSTONE SEDIMENTS, UNDIFFERENTIATED (Quaternary through Cretaceous)		PRE-MADISON GROUP ROCKS, UNDIFFERENTIATED (Mississippian through Precambrian)
	EAGLE SANDSTONE (Cretaceous)	—	GEOLOGIC CONTACT
	COLORADO GROUP (Cretaceous)	—	FAULT
	KOOTENAI FORMATION (Cretaceous)	E-24 ●	WELL AND NUMBER
	MORRISON FORMATION AND ELLIS GROUP, UNDIFFERENTIATED (Jurassic)	T-5 ⊙	TEST HOLE AND NUMBER

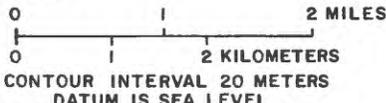
Topographic contours on figure 4 are given in meters. The following table can be used to convert index contours from meters to feet

METERS	FEET
1,000	3,281
1,100	3,609
1,200	3,937
1,300	4,265
1,400	4,593
1,500	4,922
1,600	5,250



Base from U.S. Geological Survey metric quadrangles, Dodson and Zortman, 1984

Geology modified from Knechtel (1959)



To convert to feet, multiply meters by 3.281

Figure 4.--Generalized geology and location of wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana. (Explanation on facing page.)

Water Levels

Water levels in monitoring wells in the Eagle Sandstone ranged from about 36 ft below land surface in well E-11 to about 20 ft above land surface in well E-2 (tables 4 and 5). Water-level fluctuations in individual wells during the study ranged from about 0.6 to about 9 ft. Water levels generally were highest in spring and summer and lowest in fall and winter (fig. 5). Water-surface altitudes in wells (fig. 6) indicate predominantly west to northwest flow, away from the Little Rocky Mountains.

Head differentials in well pairs completed at different depths (E-2, E-3; E-9, E-11; E-14, E-15; E-21, E-27) indicate an upward component of flow in the areas surrounding the mountains. Head differentials range from 0.07 foot per foot of well depth at E-14 and E-15 to 0.24 foot per foot of well depth at E-2 and E-3. Head differential was 0.09 foot per foot of well depth at E-9 and E-11 and 0.20 foot per foot of well depth at E-21 and E-27.

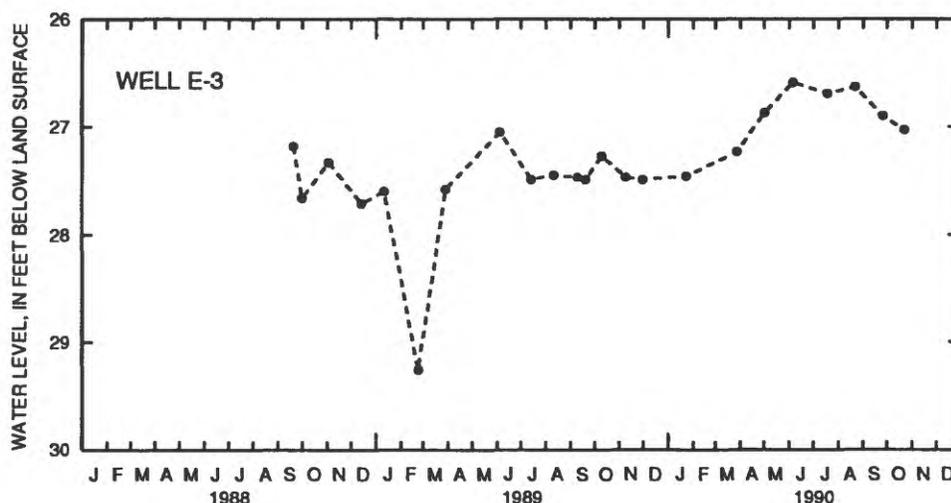


Figure 5.--Water-level fluctuations for well E-3 completed in the Virgelle Sandstone Member of the Eagle Sandstone, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana, 1988-90.

EXPLANATION FOR FIGURE 6

3,695

Kev

- WELL--Number is water-surface altitude, in feet above sea level, August 23, 1990. Abbreviation designates aquifer in which well is completed: Kev, Virgelle Sandstone Member of the Eagle Sandstone; Kfc, First Cat Creek sandstone of Colorado Group; Ktc, Third Cat Creek sandstone of Kootenai Formation; Mmc, Mission Canyon Limestone

Topographic contours on figure 6 are given in meters. The following table can be used to convert index contours from meters to feet

METERS	FEET
1,000	3,281
1,100	3,609
1,200	3,937
1,300	4,265
1,400	4,593
1,500	4,922
1,600	5,250

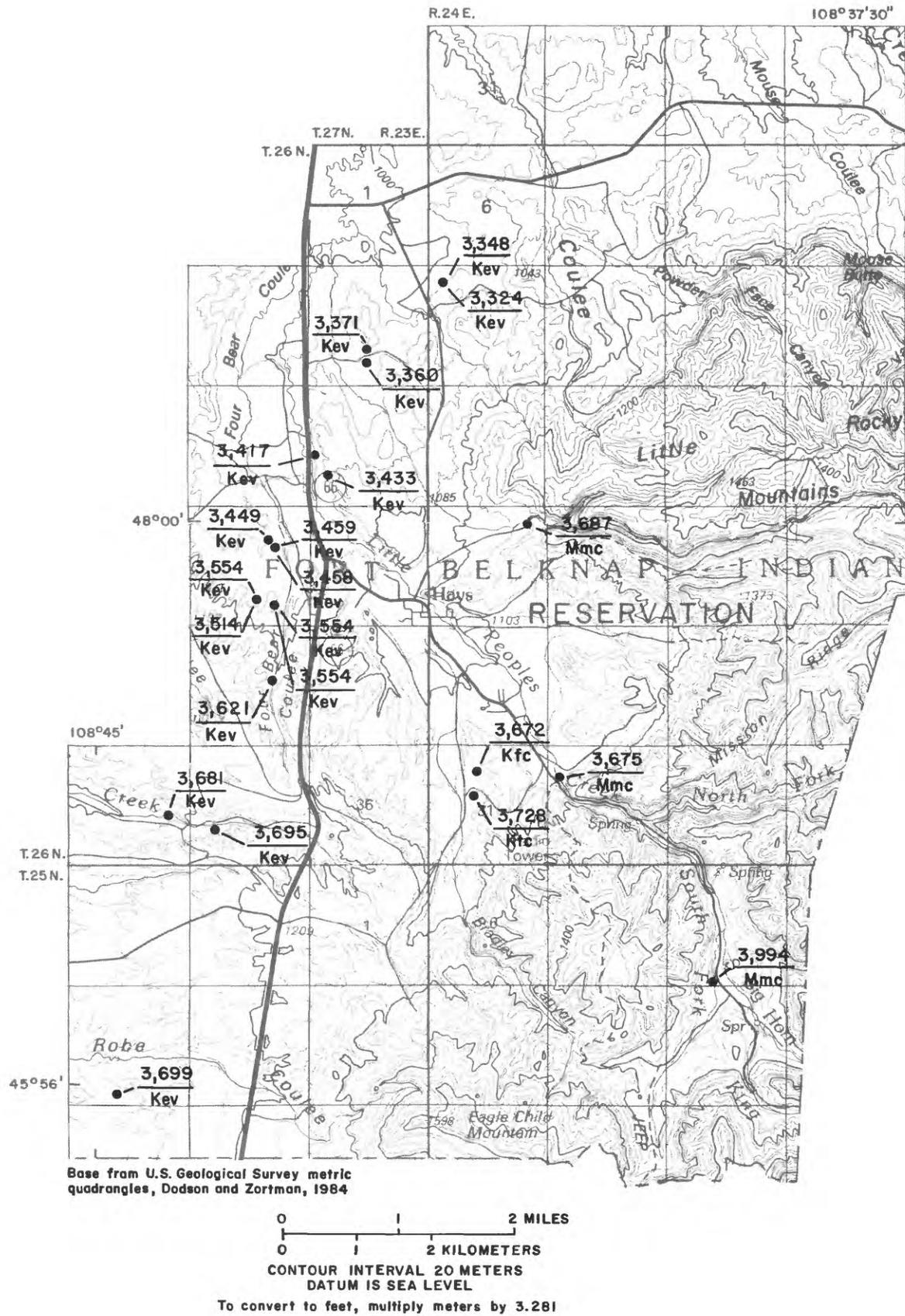


Figure 6.--Altitude of the water surface in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana. (Explanation on facing page.)

Hydraulic Characteristics

Specific capacity of 10 wells completed in the Virgelle Sandstone Member ranged from 0.02 to 0.59 (gal/min)/ft (table 6) and median specific capacity was 0.27 (gal/min)/ft. Aquifer tests conducted at sites E-2, E-12, and E-15 indicated transmissivities of 71, 91, and 56 ft²/d. Drawdown data for the pumped wells (table 7) indicate that boundary conditions began to influence drawdown at about 110 minutes after pumping began at E-12 and at about 60 minutes at E-15.

Water Quality

Samples for water-quality analysis were collected from 15 wells completed in the Virgelle Sandstone Member (table 8). Water from most of these wells was a calcium bicarbonate or magnesium bicarbonate type. The water was a sodium bicarbonate type in well E-2; a sodium sulfate type in wells E-9, E-18, E-21, and E-26; and a magnesium-calcium sulfate type in well E-11. Dissolved-solids concentrations in the Virgelle ranged from 381 to 1,930 mg/L. Dissolved-solids concentrations are largest in the northwestern part of the study area. Data from well pairs completed at different depths indicate that dissolved-solids concentration increases with depth. Comparison of well locations, well depths, and areal geology indicates that larger dissolved-solids concentrations could be the result of increased distance from the recharge area, longer residence time of water in the aquifer, or differences in geochemical conditions.

Water from most wells completed in the Virgelle Sandstone Member did not contain concentrations of fluoride, nitrate, barium, cadmium, chromium, copper, or lead that exceeded Maximum Contaminant Levels (MCL's) established by the U.S. Environmental Protection Agency for public drinking-water supplies (table 9). However, the MCL for lead was exceeded in water from well E-25. Because none of the other 14 water samples contained lead in concentrations exceeding the MCL, the lead concentration in water from well E-25 might have resulted from sample contamination.

Secondary Maximum Contaminant Levels (SMCL's) were exceeded in water from most wells. SMCL's were exceeded for sulfate in 8 wells, dissolved solids in 12 wells, iron in 9 wells, and manganese in 4 wells. Maximum limits for dissolved-solids concentration for livestock watering are listed in table 10. Water from all wells completed in the Eagle Sandstone, including the Virgelle Sandstone Member, is suitable for livestock watering.

Water-Supply Potential

Data collected during this study indicate that wells completed in the Virgelle Sandstone Member probably will produce at least 5 gal/min, which generally is an adequate quantity of water for domestic or stock supply. A possible limiting factor for the usefulness of the water supply is the quality. Large concentrations of some constituents may make the water objectionable to users. For example, large concentrations of dissolved solids or iron can impart an unpleasant taste, and large concentrations of iron or manganese can cause staining of plumbing fixtures.

First Cat Creek Sandstone and Third Cat Creek Sandstone

One well was completed in the First Cat Creek sandstone at the base of the Colorado Group, and one well was completed in the Third Cat Creek sandstone at the base of the underlying Kootenai Formation. One test hole was terminated in the upper part of the Colorado Group and one test hole was drilled through the Kootenai Formation to the underlying Morrison Formation.

Water Levels

The water level in well C-1 (table 4), completed in the First Cat Creek sandstone, declined almost steadily from 23.71 ft below land surface in November 1988 to 24.75 ft below land surface in October 1990 (fig. 7). The water level in well K-1 completed in the Third Cat Creek sandstone fluctuated seasonally from about 4 ft below land surface to nearly 2 ft above land surface during this study. The lowest water levels in well K-1 occurred during winter or early spring and the highest water levels occurred during summer (fig. 8).

Hydraulic Characteristics

Specific capacities of wells C-1 and K-1 were 0.16 and 0.08 (gal/min)/ft (table 6). Aquifer tests were conducted using wells C-1 and K-1. Transmissivity at well C-1, completed in the First Cat Creek sandstone, was 21 ft²/d. Transmissivity at well K-1, completed in the Third Cat Creek sandstone, was 15 ft²/d. Drawdown data for the aquifer tests are given in table 7.

Water Quality

Water samples for chemical analysis were collected from well C-1 and well K-1. Water from well C-1 was a sodium bicarbonate type with a dissolved-solids concentration of 1,160 mg/L, whereas water from well K-1 was a calcium magnesium bicarbonate type with a dissolved-solids concentration of 428 mg/L (table 8).

Water from well C-1 contained concentrations of sulfate and dissolved solids that exceeded SMCL's (table 9). Water from well K-1 contained no analyzed constituent concentrations that exceeded U.S. Environmental Protection Agency MCL's or SMCL's.

Water-Supply Potential

Hydraulic data from well C-1 indicate that the First Cat Creek sandstone is capable of yielding at least 5 gal/min to wells, which generally is considered an adequate quantity of water for domestic or stock use. Hydraulic data from well K-1 indicate that the quantity of water available from the Kootenai Formation might not be sufficient for domestic use. Data from well K-1, the only well completed in the Kootenai Formation in this study, infer that expected yields would be less than 5 gal/min. However, yields of some wells completed in the Eagle Sandstone also indicated an equally small potential that was found to be a minimum, well below the average. Additional exploration of the Kootenai might indicate that the values obtained from well K-1 are minimum values.

Although water from well C-1 contains concentrations of sulfate and dissolved solids that exceed SMCL's (table 9), the values are not uncommon for domestic water supplies in eastern Montana. Water-quality data for well K-1 indicate that the water probably is suitable for domestic and stock use.

Mission Canyon and Lodgepole Limestones

Five wells and one test hole were drilled in the Mission Canyon Limestone. One well was drilled and completed in the Lodgepole Limestone. Well depths range from 130 to 475 ft below land surface (table 2).

Water Levels

Water levels in wells completed in the Mission Canyon and Lodgepole Limestones ranged from about 7 to 45 ft below land surface (table 4). Fluctuations follow a seasonal pattern. Water levels were lowest in the fall and winter and highest in the spring and summer (fig. 9). On the basis of measurements made during this study, water levels in individual wells fluctuated from about 3 to 21 ft.

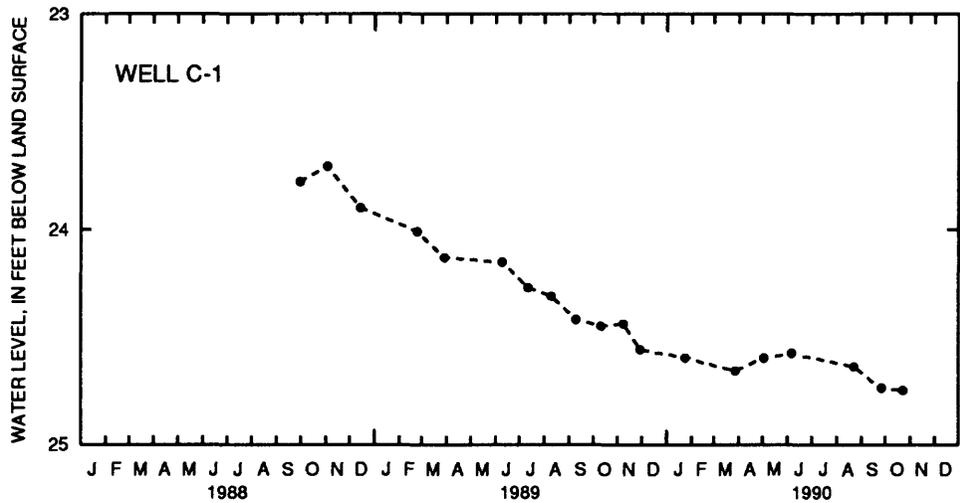


Figure 7.--Water-level fluctuations for well C-1 completed in the First Cat Creek sandstone of the Colorado Group, northwest flank of the Little Rocky Mountains, Fort Belnap Indian Reservation, north-central Montana, 1988-90.

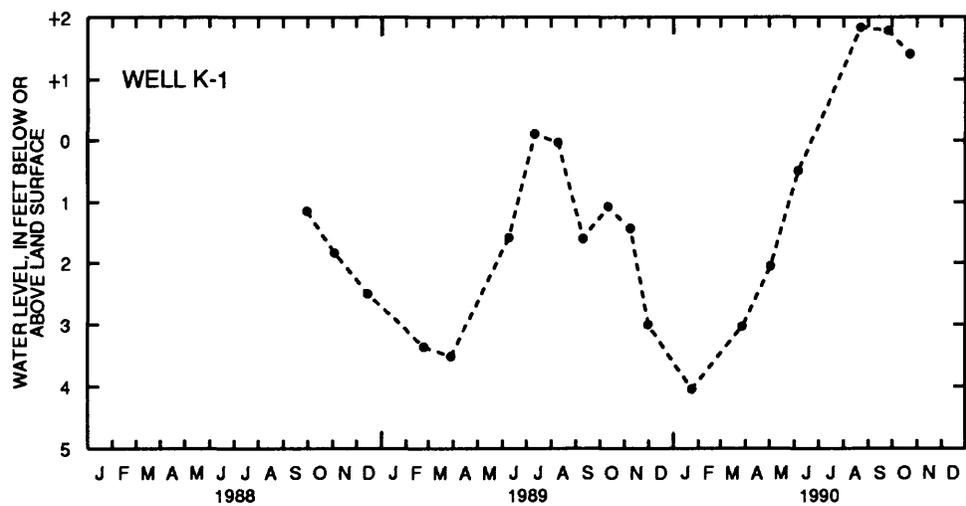


Figure 8.--Water-level fluctuations for well K-1 completed in the Third Cat Creek sandstone of the Kootenai Formation, northwest flank of the Little Rocky Mountains, Fort Belnap Indian Reservation, north-central Montana, 1988-90.

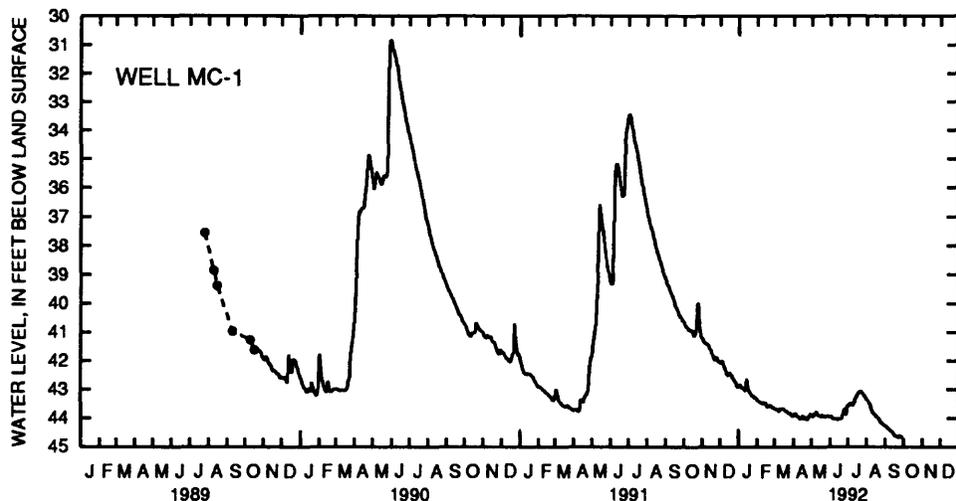


Figure 9.--Water-level fluctuations for well MC-1 completed in the Mission Canyon Limestone, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana, 1989-92.

Hydraulic Characteristics

Specific capacity of four wells completed in the Mission Canyon Limestone ranged from 0.35 to 4.6 (gal/min)/ft (table 6). Median specific capacity was 2.0 (gal/min)/ft. Aquifer tests were conducted at wells MC-1, MC-3, and MC-6. The tests indicated transmissivities of about 1,100 and 1,000 ft^2/d at MC-1 and MC-3, respectively; transmissivity at MC-6 was estimated at about 60 ft^2/d owing to numerous boundary effects. Drawdown data are given in table 7. The effect of nearby Little Peoples Creek contributing water to the aquifer was noted after about 15 minutes of pumping during the test of MC-1.

Water Quality

Water samples for laboratory analysis were collected from four wells completed in the Mission Canyon Limestone and one well completed in the Lodgepole Limestone. Water from the wells completed in the Mission Canyon Limestone was a calcium bicarbonate type. Dissolved-solids concentrations ranged from 263 mg/L in water from well MC-1 to 335 mg/L in water from well MC-2 (table 8). Water from well L-1 completed in the Lodgepole Limestone was a calcium-magnesium bicarbonate type with a dissolved-solids concentration of 392 mg/L (table 8). Concentrations for all constituents analyzed in this study were considerably less than MCL's and SMCL's (table 9).

Water-Supply Potential

Data collected from wells constructed for this study indicate that the Mission Canyon Limestone can supply large quantities of water, at least 66 gal/min, to wells. However, because of the cavernous nature of the upper part of the Mission Canyon Limestone, the possibility of the caverns being filled with clay, and the minimal primary effective porosity of limestone, large quantities of water are dependent on a well intersecting a fracture system or associated open cavern. Thus, the potential for water production can change drastically in short distances and the duration of sustained yield may be limited by the areal extent of the permeable zone. For example, a large diameter well at the location of well MC-2, drilled and cased to a depth of 298 ft, probably would be capable of initially

producing about 100 gal/min of water, whereas well MC-4, located only 75 ft away and drilled to a depth of 371 ft, virtually produces no water. Production of large quantities of water from the Lodgepole Limestone also is dependent on a well intersecting a fracture system. Data indicate the quality of water from the Lodgepole and Mission Canyon Limestones probably is suitable for domestic, municipal, or stock supply (table 10).

SUMMARY

The study area comprises about 55 mi² near Hays, about 60 mi southeast of Havre, in the southwestern part of the Fort Belknap Indian Reservation. The topography is characterized by hills and valleys that are bounded on the south and east by the Little Rocky Mountains, and on the north and west by glaciated plains. Annual precipitation in the area ranges from about 16 in. at Hays to between 20 and 22 in. at the higher altitudes of the Little Rocky Mountains.

The geologic units of interest in this report were formed from Early Mississippian through Late Cretaceous time and consist of the Lodgepole and Mission Canyon Limestones, the Kootenai Formation, the Colorado Group, and the Eagle Sandstone. These rocks have been uplifted and folded by the intrusion of the igneous core of the Little Rocky Mountains. Dips of the uplifted and folded sedimentary rocks generally are oriented away from the center of the intrusion at angles ranging from nearly vertical near the mountain core to about 10 degrees in the Hays area. The mountains were not overridden by continental glaciation that covered most of the Fort Belknap Reservation. The Lodgepole Limestone is principally composed of thin-bedded limestone containing some massive limestone, thin partings of shale, and many small chert lenses. The Mission Canyon Limestone is composed of light-gray to light-brown coarse-grained massive limestone with a few thin-bedded zones near the base. The upper part of the formation contains numerous solution cavities, many of which are filled with clay. The Kootenai Formation can be divided into two distinct informal units. The lower unit, commonly called the Third Cat Creek sandstone, consists primarily of light-gray, locally friable, sandstone. The upper unit is composed of mottled maroon and gray-green clay and contains a few thin beds of light-gray friable sandstone. The Colorado Group consists of mostly dark-gray to bluish-gray shale containing numerous bentonite beds as well as some lenticular sandstone and limestone beds. A thick-bedded arkosic coarse-grained sandstone, equivalent to the First Cat Creek sandstone, is present at the base of the Colorado Group. The Eagle Sandstone is divided into two members. The lower member, the Virgelle Sandstone Member, contains brown to gray massive sandstone, brownish-gray siltstone, and gray shale. The informal upper member is composed primarily of gray shale but contains many thin beds of siltstone, sandy shale, and friable sandstone.

Thirty-one test holes were drilled and 25 of these holes were completed as monitoring wells in the Lodgepole Limestone, Mission Canyon Limestone, Kootenai Formation, Colorado Group, or Eagle Sandstone. Water levels were measured monthly or bimonthly in 24 wells, continuous water-level recorders were operated on three wells, aquifer tests were conducted using 8 wells, and water samples for onsite and laboratory analysis were collected from 22 wells.

During this study, seasonal fluctuation of the water level in wells completed in the Eagle Sandstone ranged from about 0.6 to 9 ft. The highest water level generally occurred in the spring and summer and the lowest level in the fall and winter. Median specific capacity of 0.27 (gal/min)/ft and transmissivities of 71, 91, and 56 ft²/d were determined. Water from most wells was a calcium or magnesium bicarbonate type. Dissolved-solids concentrations ranged from 381 to 1,930 mg/L. Water from most wells completed in the Eagle Sandstone contains concentrations of some constituents--typically sulfate, dissolved solids, iron, and manganese--which exceed established Secondary Maximum Contaminant Levels of the U.S. Environmental Protection Agency.

The water level in a well completed in the First Cat Creek sandstone at the base of the Colorado Group showed a near steady decline throughout the study period. The water level in a well completed in the Third Cat Creek sandstone of the Kootenai Formation fluctuated about 6 ft with the highest levels occurring

during summer and the lows during winter or early spring. Analysis of aquifer test data indicates transmissivity values of 21 ft²/d for the First Cat Creek sandstone and 15 ft²/d for the Third Cat Creek sandstone. Water from well C-1 completed in the First Cat Creek was a sodium bicarbonate type with a dissolved-solids concentration of 1,160 mg/L. Water from well K-1 completed in the Third Cat Creek was a calcium magnesium bicarbonate type with a dissolved-solids concentration of 428 mg/L. Water from the First Cat Creek contained concentrations of sulfate and dissolved solids which exceeded the U.S. Environmental Protection Agency Secondary Maximum Contaminant Levels.

Water-level fluctuations in four wells completed in the Lodgepole and Mission Canyon Limestones followed a seasonal pattern with the lowest levels occurring in the fall and winter and the highest in the spring and summer. Water-level fluctuations in individual wells ranged from about 3 to 21 ft during the study.

Median specific capacity of 2.0 (gal/min)/ft and transmissivity values of 1,100, 1,000, and 60 ft²/d were determined for wells completed in the Mission Canyon Limestone. Water from the wells completed in the Mission Canyon Limestone was a calcium bicarbonate type with dissolved-solids concentrations ranging from 263 to 335 mg/L. Water from the well completed in the Lodgepole Limestone was a calcium-magnesium bicarbonate type with a dissolved-solids concentration of 392 mg/L. Concentrations for all constituents analyzed were less than U.S. Environmental Protection Agency Maximum Contaminant Levels.

SELECTED REFERENCES

- Alden, W.C., 1932, Physiography and glacial geology of eastern Montana and adjacent areas: U.S. Geological Survey Professional Paper 174, 133 p.
- Alverson, D.C., 1965, Geology and hydrology of the Fort Belknap Indian Reservation, Montana: U.S. Geological Survey Water-Supply Paper 1576-F, 59 p.
- Briar, D.W., Christensen, P.K., and Oellermann, D.J., 1993, Hydrology of valley fill and potential for additional ground-water withdrawals along the north flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana: U.S. Geological Survey Water-Resources Investigations Report 92-4162, 86 p.
- Collier, A.J., 1918, Geology of northeastern Montana: U.S. Geological Survey Professional Paper 120-B, p. 17-39.
- Cooper, H.H., Jr., and Jacob, C.E., 1946, A generalized graphical method for evaluating formation constants and summarizing well-field history: American Geophysical Union Transactions, v. 27, no. 4, p. 526-534.
- Erdmann, C.E., and Koskinen, V.K., 1953, Preliminary structure contour map of Blaine, northern Chouteau and Hill Counties and adjoining areas, Montana: U.S. Geological Survey, scale 1:250,000, 1 sheet.
- Feltis, R.D., 1980, Dissolved-solids and ratio maps of water in the Madison Group, Montana: Montana Bureau of Mines and Geology Hydrogeologic Map 3, scale 1:1,000,000, 3 sheets.
- _____, 1983, Ground-water resources of the Fort Belknap Indian Reservation, north-central Montana: Montana Bureau of Mines and Geology Memoir 53, 36 p.
- Gill, J.R., and Cobban, W.A., 1973, Stratigraphy and geologic history of the Montana Group and equivalent rocks, Montana, Wyoming, and North and South Dakota: U.S. Geological Survey Professional Paper 776, 37 p.
- Gries, J.P., 1953, Upper Cretaceous stratigraphy of the Little Rocky Mountain area, in Parker, J.M., ed., Billings Geological Society Guidebook, 4th Annual Field Conference, Little Rocky Mountains--Montana and southwestern Saskatchewan, 1953, p. 102-105.

- Knechtel, M.M., 1944, Oil and gas possibilities of the plains adjacent to the Little Rocky Mountains, Montana: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 4, scale 1:48,000, 1 sheet.
- _____, 1959, Stratigraphy of the Little Rocky Mountains and encircling foothills, Montana: U.S. Geological Survey Bulletin 1072-N, p. 723-752.
- Levings, J.F., Levings, G.W., Feltis, R.D., Hotchkiss, W.R., and Lee, R.W., 1981, Selective annotated bibliography of geology and ground-water resources for the Montana part of the Northern Great Plains Regional Aquifer System Analysis: U.S. Geological Survey Water-Resources Investigations Open-File Report 81-401, 91 p.
- McKee, J.E., and Wolf, H.W., 1971, Water quality criteria (2d ed): California State Water Quality Control Board Publication 3-A, 548 p.
- National Oceanic and Atmospheric Administration, 1982, Monthly normals of temperature, precipitation, and heating and cooling degree days 1951-80, Montana: Asheville, N.C., National Climatic Data Center, 24 p.
- Nordquist, J.W., 1953, Mississippian stratigraphy of northern Montana, in Parker, J.M., ed., Billings Geological Society Guidebook, 4th Annual Field Conference, Little Rocky Mountains, Montana and southwestern Saskatchewan, 1953, p. 68-82.
- Reeves, Frank, 1927, Geology of the Cat Creek and Devils Basin oil fields and adjacent areas in Montana: U.S. Geological Survey Bulletin 786-B, p. 39-95.
- U.S. Environmental Protection Agency, 1991a, Maximum Contaminant Levels (section 141.62 of subpart G of part 141, National Revised Primary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1991, p. 673.
- _____, 1991b, Secondary Maximum Contaminant Levels (section 143.3 of part 143, National Secondary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1991, p. 759.
- _____, 1992a, Lead and copper action levels (section 141.80 of subpart I of part 141, Control of Lead and Copper): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1992, p. 704.
- _____, 1992b, Maximum Contaminant Levels (section 141.62 of subpart G of part 141, National Revised Primary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1992, p. 687.
- U.S. Soil Conservation Service, 1977, Average annual precipitation in Montana based on 1941-1970 base period: Bozeman, Mont., U.S. Department of Agriculture, 13 p.
- Weed, W.H., and Pirsson, L.V., 1896, The geology of the Little Rocky Mountains: Journal of Geology, v. 4, p. 399-428.

SUPPLEMENTAL INFORMATION

Table 2.--Records of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Site number and location number--numbering systems described in text. Altitude of land surface--in feet above sea level; determined by levels from nearest bench mark (reported to tenths) or determined from USGS 7 1/2-minute topographic map (reported to whole number). Depth drilled--in feet below land surface. Depth of well--in feet below land surface. Top of open interval--in feet below land surface. Bottom of open interval--in feet below land surface.

Geologic unit--Kev, Virgelle Sandstone Member of Eagle Sandstone; Kcg, Colorado Group; Kfc, First Cat Creek sandstone of Colorado Group; Ktc, Third Cat Creek sandstone of Kootenai Formation; Mmc, Mission Canyon Limestone; Ml, Lodgepole Limestone. --, not applicable]

Site number	Location number	Date drilled	Altitude of land surface (feet)	Depth drilled (feet)	Depth of well (feet)	Diameter of casing (inches)	Top of open interval (feet)	Bottom of open interval (feet)	Geologic unit
C-1	26N24E31BADCO1	09-10-88	3,696.3	175	174	2	99 139	119 159	Kfc
E-2	26N23E23DCBA01	09-13-88	3,538.7	415	414	2	317	337	Kev
E-3	26N23E23DCBA02	09-14-88	3,540.2	225	224	2	203	213	Kev
E-4	26N23E26ACDC01	09-14-88	3,634.3	145	144	2	122	132	Kev
E-7	26N23E23ACAB01	09-15-88	3,473.7	304	303	2	282	292	Kev
E-9	26N23E12DCBB01	09-17-88	3,391.3	95	94	2	73	83	Kev
E-11	26N23E12DCBB02	09-20-88	3,407.5	215	214	2	193	203	Kev
E-12	26N23E23DCAD01	08-01-89	3,574.8	330	300	4	235	285	Kev
E-13	26N23E23DCAD02	08-02-89	3,571.2	300	299	2	229	279	Kev
E-14	26N23E23ACAD01	08-12-89	3,477.1	220	220	2	150	210	Kev
E-15	26N23E23ACAD02	08-14-89	3,477.4	244	244	4	164	224	Kev
E-18	26N23E13CBBC01	08-24-89	3,418.5	269	269	2	240	260	Kev
E-21	26N24E07BBDB02	09-08-89	3,350.4	280	280	2	240	260	Kev
E-23	26N23E35CBDA01	09-10-89	3,718.5	120	119	2	79	99	Kev
E-24	26N23E34DABD01	09-10-89	3,671.9	130	130	2	90	110	Kev
E-25	25N23E10CDD01	09-11-89	3,705.2	290	290	2	240	270	Kev
E-26	26N23E13CBDD01	09-12-89	3,465.7	265	258	2	218	258	Kev
E-27	26N24E07BBDB01	09-13-89	3,347.5	160	160	2	85	140	Kev
K-1	26N24E31BDDC01	09-09-88	3,725.7	235	226	2	165	195	Ktc
L-1	26N24E20BBBC01	08-26-91	3,750	475	475	4	355	395	Ml
MC-1	26N24E32BCBA01	09-20-89	3,713.1	300	140	8;5	120	137	Mmc
MC-2	25N24E04CDDD01	07-27-89	4,013.6	298	298	2	272	292	Mmc
MC-3	26N24E19ACA01	09-19-89	3,703.4	130	125	8;5	105	115	Mmc
MC-4	25N24E04CDDD02	09-07-89	4,015.2	371	371	6	280	371	Mmc
MC-6	26N24E19ACA02	08-30-91	3,700	278	278	6	125	278	Mmc
T-1	25N23E03DACC01	09-09-89	3,800	340	--	--	--	--	Kcg
T-2	26N24E05ACCC01	09-19-88	3,392.7	235	--	--	--	--	Kev
T-3	26N24E07BCAB01	08-17-89	3,380	165	--	--	--	--	Kev
T-4	26N24E19ACB01	08-28-91	3,710	180	--	--	--	--	Mmc
T-5	26N24E19BDAB01	07-17-89	3,620	490	--	--	--	--	Ktc
T-6	27N24E33DACD01	08-27-89	3,280	260	--	--	--	--	Kev

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Abbreviations: ft, foot; gal/min, gallons per minute; in., inch; Sch., Schedule; PVC, polyvinyl chloride; NAT. GAMMA, natural gamma; RES, resistivity; SP, spontaneous potential]

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> C-1		
<u>Date drilled:</u> 09/10/88		
<u>Bottom of well:</u> 174 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 99-119 ft and 139-159 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 94 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Colluvium:</u>		
Clay, brown, pebbly, cobbly.....	16	16
<u>Colorado Group:</u>		
Shale, dark-gray, with numerous very thin bentonite partings.....	60	76
<u>First Cat Creek sandstone:</u>		
Siltstone, dark-gray.....	13	89
Sandstone, gray, very fine grained, friable, argillaceous (?); water.....	8	97
Siltstone, dark-gray, sandy.....	4	101
Sandstone, gray, very fine grained, argillaceous in part; water.....	21	122
Siltstone, dark-gray, sandy.....	13	135
Sandstone, gray, very fine to fine-grained, argillaceous in part; water.....	29	164
<u>Kootenai Formation:</u>		
Clay, mottled maroon and greenish gray.....	11	175
 <u>Site number:</u> E-2		
<u>Date drilled:</u> 09/13/88		
<u>Bottom of well:</u> 414 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 317-337 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 278 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES, SP		
<u>Claggett Shale:</u>		
Shale, brown.....	12	12
Shale, dark-gray, with few light-gray bentonite beds.....	132	144
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	28	172
Siltstone, brownish-gray, sandy.....	15	187
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, argillaceous at 191-192 and 204-205 ft, friable; water.....	60	247
Shale and siltstone, brownish-gray, sandy.....	19	266
Shale, brownish-gray, sandy.....	11	277
Siltstone, brownish-gray, sandy.....	25	302
Sandstone, gray, very fine to fine-grained, friable; argillaceous at 312-314 and at 318-319 ft; indurated at 304, 320-323, and 334-337 ft; water.....	48	350
Sandstone, brownish-gray, argillaceous.....	11	361
<u>Telegraph Creek Formation:</u>		
Shale and siltstone, brownish-gray, sandy.....	14	375
Shale, brownish-gray.....	20	395
Siltstone, brownish-gray, sandy.....	20	415

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-3		
<u>Date drilled:</u> 09/14/88		
<u>Bottom of well:</u> 224 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 203-213 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 196 ft		
<u>Geophysical logs available:</u> None		
<u>Claggett Shale:</u>		
Shale, brown.....	12	12
Shale, dark-gray, with few light-gray bentonite beds.....	132	144
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	28	172
Siltstone, brownish-gray, sandy.....	15	187
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, argillaceous at 191-192 and 204-205 ft, friable; water.....	38	225
Note: Adjacent to site E-2.		
<u>Site number:</u> E-4		
<u>Date drilled:</u> 09/14/88		
<u>Bottom of well:</u> 144 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 122-132 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 111 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES, SP		
<u>Alluvium:</u>		
Clay, brown, sandy.....	5	5
<u>Eagle Sandstone:</u>		
Sandstone, brown, very fine to fine-grained, friable; no water.....	39	44
Sandy siltstone and argillaceous sandstone, brownish-gray.....	4	48
Shale, brownish-gray, sandy.....	25	73
Sandstone, brownish-gray, argillaceous.....	3	76
Siltstone, brownish-gray, sandy.....	21	97
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; indurated intervals at 97, 116-119 and 130-132 ft.....	48	145
<u>Site number:</u> E-7		
<u>Date drilled:</u> 09/15/88		
<u>Bottom of well:</u> 303 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 282-292 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 262 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES, SP		
<u>Claggett Shale:</u>		
Shale, dark-gray, with light-gray bentonite beds; brown near land surface.....	211	211
Shale, brownish-gray, sandy.....	26	237
<u>Eagle Sandstone:</u>		
Siltstone, brownish-gray, sandy.....	16	253
Sandstone, brownish-gray, argillaceous.....	3	256
Shale, brownish-gray, sandy.....	2	258
Siltstone, brownish-gray, sandy.....	5	263

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-7--Continued		
<u>Virgelle Sandstone Member:</u>		
Sandstone, brownish-gray, argillaceous.....	7	270
Sandstone, gray, very fine to fine-grained, friable; indurated at base of interval; argillaceous at 297-299 ft; water.....	34	304
 <u>Site number:</u> E-9		
<u>Date drilled:</u> 09/17/88		
<u>Bottom of well:</u> 94 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 73-83 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 61 ft		
<u>Geophysical logs available:</u> RES, SP		
<u>Eagle Sandstone:</u>		
Shale and siltstone, brown, sandy.....	35	35
Siltstone, brownish-gray, sandy.....	17	52
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	43	95
 <u>Site number:</u> E-11		
<u>Date drilled:</u> 09/20/88		
<u>Bottom of well:</u> 214 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 193-203 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 184 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Colluvium:</u>		
Clay, brown, with some small, black chalcedonic, rounded pebbles.....	5	5
<u>Eagle Sandstone:</u>		
Shale, brown, gray below 20 ft, sandy.....	39	44
Siltstone, brown, sandy,.....	24	68
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	52	120
Sandy siltstone and argillaceous sandstone, brownish-gray.....	16	136
Shale, brownish-gray, sandy.....	22	158
Siltstone, brownish-gray, sandy.....	12	170
Sandstone, gray, very fine to fine-grained, friable; indurated at 206 and 210-213 ft.....	45	215
 <u>Site number:</u> E-12		
<u>Date drilled:</u> 08/01/89		
<u>Bottom of well:</u> 300 ft		
<u>Casing:</u> 4-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 235-285 ft		
<u>Screen type:</u> 4-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 225 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Claggett Shale:</u>		
Shale, brown, gray below 35 ft, with few light-gray bentonite beds.....	75	75
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	28	103
Siltstone, brownish-gray, sandy.....	15	118

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-12--Continued		
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	44	162
Sandstone, gray, very fine to fine-grained, friable; with brownish gray argillaceous sandstone.....	12	174
Argillaceous sandstone and sandy siltstone, brownish-gray.....	9	183
Siltstone, brownish-gray, sandy.....	16	199
Shale, brownish-gray, sandy.....	13	212
Siltstone, brownish-gray, sandy.....	23	235
Sandstone, gray, very fine to fine-grained, friable; indurated at 254-256 and 265-269 ft; water.....	47	282
Sandstone, brownish-gray, argillaceous.....	11	293
<u>Telegraph Creek Formation:</u>		
Shale and siltstone, brownish-gray, sandy.....	37	330
 <u>Site number:</u> E-13		
<u>Date drilled:</u> 08/02/89		
<u>Bottom of well:</u> 299 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 229-279 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> less than 230 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Claggett Shale:</u>		
Shale, gray, with beds of light-gray bentonite; brown shale near surface.....	66	66
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	28	94
Siltstone, brownish-gray, sandy.....	16	110
<u>Virgelle Sandstone Member:</u>		
Sandstone, brownish-gray, argillaceous.....	6	116
Shale and siltstone, brownish-gray, sandy.....	4	120
Sandstone, brownish-gray, argillaceous.....	3	123
Sandstone, gray, very fine to fine-grained, friable; argillaceous at 152-154, 158-161, and 164-166 ft; water.....	47	170
Siltstone, brownish-gray, sandy.....	19	189
Shale, brownish-gray, sandy.....	13	202
Siltstone, brownish-gray, sandy.....	23	225
Sandstone, gray, very fine to fine-grained, friable, indurated at 266-270 ft; water..	47	272
Sandstone, brownish-gray, argillaceous.....	12	284
<u>Telegraph Creek Formation:</u>		
Siltstone, brownish-gray, sandy.....	16	300
 <u>Site number:</u> E-14		
<u>Date drilled:</u> 08/12/89		
<u>Bottom of well:</u> 220 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 150-210 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 143 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Alluvium:</u>		
Clay, silty, brown.....	21	21
Gravel and sand, brown; no water.....	2	23
<u>Claggett Shale:</u>		
Shale, dark-gray, with few light-gray bentonite beds.....	84	107
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	27	134
Siltstone, brownish-gray, sandy.....	16	150

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness penetrated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-14--Continued		
Virgelle Sandstone Member:		
Sandstone, gray, very fine to fine-grained, friable; water.....	7	157
Argillaceous sandstone, and sandy siltstone, brownish-gray.....	6	163
Sandstone, gray, very fine to fine-grained, friable, some indurated beds; water.....	44	207
Argillaceous sandstone and sandy siltstone, brownish-gray.....	13	220
<u>Site number:</u> E-15		
<u>Date drilled:</u> 08/14/89		
<u>Bottom of well:</u> 244 ft		
<u>Casing:</u> 4-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 164-224 ft		
<u>Screen type:</u> 4-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 149 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Alluvium:</u>		
Gravel and sand; no water.....	10	10
Sand, silty, brown.....	4	14
Gravel and sand, no water.....	5	19
<u>Claggett Shale:</u>		
Shale, dark-gray, with light-gray bentonite beds.....	91	110
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	38	148
Siltstone, brownish-gray, sandy.....	17	165
Virgelle Sandstone Member:		
Sandstone, brownish-gray, argillaceous; brownish-gray sandy siltstone bed at 173-174 ft.....	12	177
Sandstone, gray, very fine to fine-grained, friable, some indurated beds; water.....	45	222
Argillaceous sandstone and sandy siltstone, brownish-gray.....	11	233
<u>Telegraph Creek Formation:</u>		
Siltstone, brownish-gray, sandy.....	9	242
Shale, brownish-gray, sandy.....	2	244
<u>Site number:</u> E-18		
<u>Date drilled:</u> 08/24/89		
<u>Bottom of well:</u> 269 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 240-260 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 232 ft		
<u>Geophysical logs available:</u> RES		
<u>Alluvium:</u>		
Gravel and sand, no water.....	10	10
Clay, brown, silty, sandy.....	4	14
Gravel and sand, water.....	12	26
<u>Claggett Shale:</u>		
Shale, dark-gray, with light-gray bentonite beds; black pebbles near base.....	158	184
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, silty, sandy.....	21	205
Siltstone, brownish-gray, silty, sandy.....	23	228
Virgelle Sandstone Member:		
Argillaceous sandstone and sandy siltstone, brownish-gray.....	4	232
Siltstone, brownish-gray, sandy.....	9	241
Sandstone, gray, very fine to fine-grained, friable; indurated at 267-269 ft; water..	28	269

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-21		
<u>Date drilled:</u> 09/08/89		
<u>Bottom of well:</u> 280 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe; uppermost 21 ft is 2-in. steel pipe		
<u>Screened interval:</u> 240-260 ft		
<u>Screen type:</u> 2-in. Sch. 80 and 40 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 230 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Glacial drift:</u>		
Clay, brown, silty, sandy, pebbly; lots of shale chips.....	23	23
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	29	52
Siltstone, brownish-gray, sandy.....	23	75
Sandstone, gray, very fine to fine-grained, argillaceous.....	5	80
Sandstone, gray, very fine to fine-grained, friable, indurated at 124-125 ft; water..	45	125
Sandstone and brownish-gray argillaceous sandstone.....	21	146
Siltstone, brownish-gray, sandy.....	33	179
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	45	224
Sandstone, brownish-gray, argillaceous.....	9	233
<u>Telegraph Creek Formation:</u>		
Siltstone, brownish-gray, sandy.....	26	259
Shale, brownish-gray, sandy.....	21	280
<u>Site number:</u> E-23		
<u>Date drilled:</u> 09/10/89		
<u>Bottom of well:</u> 119 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 79-99 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 70 ft		
<u>Geophysical logs available:</u> None		
<u>Colluvium:</u>		
Sand, brown, clayey, silty, pebbly.....	30	30
<u>Eagle Sandstone:</u>		
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, argillaceous in part, friable; water.....	70	100
<u>Telegraph Creek Formation:</u>		
Siltstone and shale, brownish-gray, sandy.....	20	120
<u>Site number:</u> E-24		
<u>Date drilled:</u> 09/10/89		
<u>Bottom of well:</u> 130 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe; uppermost 21 ft is 2-in. steel pipe		
<u>Screened interval:</u> 90-110 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 50 ft		
<u>Geophysical logs available:</u> None		
<u>Colluvium and alluvium:</u>		
Gravel, sand, silt and clay, brown; water at base of interval.....	26	26
<u>Eagle Sandstone:</u>		
<u>Virgelle Sandstone Member:</u>		
Siltstone and shale, brownish-gray, sandy.....	24	50
Sandstone, yellow, brown, and gray, very fine to fine-grained, friable; water.....	68	118
Siltstone and shale, brownish-gray, sandy.....	12	130

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-25		
<u>Date drilled:</u> 09/11/89		
<u>Bottom of well:</u> 290 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 240-270 ft		
<u>Screen type:</u> 2-in. Sch. 40 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 223 ft		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Colluvium:</u>		
Gravel, sand, silt and clay, brown.....	1	1
<u>Claggett Shale:</u>		
Shale, dark-gray, with few light-gray bentonite beds; brown near land surface.....	169	170
<u>Eagle Sandstone:</u>		
Shale and siltstone, brownish-gray, sandy.....	52	222
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine grained, friable; water.....	53	275
Siltstone and shale, brownish-gray, sandy.....	15	290
<u>Site number:</u> E-26		
<u>Date drilled:</u> 09/12/89		
<u>Bottom of well:</u> 258 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe; uppermost 21 ft is 2-in. steel pipe		
<u>Screened interval:</u> 218-258 ft		
<u>Screen type:</u> 2-in. Sch. 40 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> 190 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Claggett Shale:</u>		
Shale, brown.....	30	30
Shale, dark-gray.....	40	70
<u>Eagle Sandstone:</u>		
Shale, brownish-gray, sandy.....	22	92
Siltstone, brownish-gray, sandy.....	19	111
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	2	113
Sandstone, brownish-gray, argillaceous.....	3	116
Sandstone, gray, very fine to fine-grained, friable; water.....	52	168
Argillaceous sandstone and sandy siltstone, brownish-gray.....	20	188
Shale, brownish-gray, sandy.....	17	205
Siltstone, brownish-gray, sandy.....	19	224
Sandstone, gray, very fine to fine-grained, friable; indurated at 224-226 and at 263-265 ft; water.....	41	265
<u>Site number:</u> E-27		
<u>Date drilled:</u> 09/13/89		
<u>Bottom of well:</u> 160 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 85-140 ft		
<u>Screen type:</u> 2-in. Sch. 80 and 40 PVC 20 slot		
<u>Approximate depth to top of gravel pack:</u> above top of screen; exact depth unknown		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Glacial drift:</u>		
Clay, brown, silty, sandy, pebbly; abundant shale chips.....	25	25
<u>Eagle Sandstone:</u>		
Shale and siltstone, brownish-gray, sandy.....	57	82

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> E-27--Continued		
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, friable; water.....	48	130
Sandstone and brownish-gray argillaceous sandstone.....	18	148
Siltstone, brownish-gray, sandy.....	7	155
Shale and siltstone, brownish-gray, sandy.....	5	160
<u>Site number:</u> K-1		
<u>Date drilled:</u> 09/09/88		
<u>Bottom of well:</u> 226 ft		
<u>Casing:</u> 2-in. Sch. 80 PVC pipe		
<u>Screened interval:</u> 165-195 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot screen		
<u>Approximate depth to top of gravel pack:</u> 118 ft		
<u>Geophysical logs available:</u> RES, SP		
<u>Colluvium:</u>		
Clay, brown, silty, sandy, pebbly, cobbly, poorly sorted.....	15	15
<u>Kootenai Formation:</u>		
Clay, mottled maroon and greenish-gray, silty, sandy.....	5	20
Sandstone, greenish-gray, argillaceous; no water.....	13	33
Clay, gray.....	11	44
Clay, mottled gray and maroon.....	31	75
Clay, gray.....	15	90
Clay, gray and maroon.....	15	105
Clay, black, carbonaceous.....	2	107
Clay, gray and maroon.....	23	130
Clay, gray; thin sandstone or limestone beds at 151 and 156 ft.....	39	169
<u>Third Cat Creek sandstone:</u>		
Limestone, light-gray, dense.....	2	171
Sandstone, light-gray, coarse-grained; water.....	33	204
<u>Morrison Formation:</u>		
Coal, black.....	1	205
Mudstone, light-gray and gray.....	30	235
<u>Site number:</u> L-1		
<u>Date drilled:</u> 08/26/91		
<u>Bottom of well:</u> 475 ft		
<u>Casing:</u> 4-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 355-395 ft		
<u>Screen type:</u> 4-in. Sch. 40 PVC 30 slot		
<u>Approximate depth to top of gravel pack:</u> None		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Alluvium and colluvium:</u>		
Gravel, sand, and silt.....	24	24
<u>Lodgepole Limestone:</u>		
Limestone, dark-gray, fine-textured.....	116	140
Limestone, light-gray, coarse-textured.....	20	160
Limestone, dark-gray, fine-textured.....	15	175
Limestone, dark-gray, coarse-textured; contains brachiopods and crinoids.....	5	180
Limestone, dark-gray, fine-textured.....	20	200
Limestone, light-tan, coarse-textured.....	10	210
Limestone, dark-gray, fine-textured.....	25	235
Limestone, tan, coarse-textured; contains some fine-textured limestone.....	5	240
Limestone, dark-gray, fine-textured.....	20	260
Limestone, light-gray, fine-textured.....	10	270
Limestone, dark-gray, fine-textured.....	145	415
Shale, tan and grayish-green.....	25	440
Dolomite, tan and grayish-green.....	35	475

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> MC-1		
<u>Date drilled:</u> 09/20/89		
<u>Bottom of well:</u> 140 ft		
<u>Casing:</u> 8-in. steel casing from land surface to 48 ft; 5-in. PVC casing from land surface to 140 ft, with end cap at bottom of casing		
<u>Slotted interval:</u> 120-137 ft		
<u>Slot description:</u> Horizontal 0.12 in. wide, about 4 in. long, and staggered 4 to 5 in. apart on opposite sides of PVC casing		
<u>Approximate depth to top of gravel pack:</u> 40 ft		
<u>Geophysical logs available:</u> CALIPER, NAT. GAMMA, RES, SP		
<u>Alluvium:</u>		
Gravel, coarse, angular, broken pieces, sandy; no water.....	32	32
<u>Rierdon Limestone:</u>		
Shale, weathered, yellowish-brown, and greenish-gray with some thin limestone beds...	7	39
<u>Mission Canyon Limestone:</u>		
Limestone, white, pink, light-gray, and light-brown, iron-stained in part, hard; fractured limestone, soft limestone, and cavity fill at 91-97, 124-136, 141-146, and 236-251 ft; major water-producing zones at 130-135 and 243-250 ft, more than 100 gal/min.....	261	300
<u>Site number:</u> MC-2		
<u>Date drilled:</u> 07/27/89		
<u>Bottom of well:</u> 298 ft		
<u>Casing:</u> 2-in. Sch. 40 PVC pipe		
<u>Screened interval:</u> 272-292 ft		
<u>Screen type:</u> 2-in. Sch. 80 PVC 20 slot screen		
<u>Approximate depth to top of gravel pack:</u> 247 ft		
<u>Geophysical logs available:</u> NAT. GAMMA, RES, SP		
<u>Alluvium:</u>		
Gravel, coarse, angular, broken pieces; brown clay beds at 13-15 and 17-18 ft.....	27	27
<u>Swift Formation:</u>		
Shale, gray, calcareous, silty in part; with thin layer of light-gray siltstone (volcanic ash ?) at base.....	27	54
<u>Rierdon Limestone:</u>		
Limestone, argillaceous, gray; and calcareous gray shale; fractured or cavernous at 54-60 ft, water.....	168	222
Shale, gray and greenish-gray, silty with several thin beds of gray and brown limestone.....	21	243
<u>Mission Canyon Limestone:</u>		
Limestone, hard, light-brown and light-gray; fractured limestone or cavity fill at 272-280 ft, water.....	55	298
<u>Site number:</u> MC-3		
<u>Date drilled:</u> 09/19/89		
<u>Bottom of well:</u> 125 ft		
<u>Casing:</u> 8-in. steel casing from land surface to 57 ft; 5-in. PVC casing from land surface to 125 ft		
<u>Slotted interval:</u> 105-115 ft		
<u>Screen type:</u> Casing slotted 0.12 in.; slots about 4 to 5 in. long and vertical, distributed around the casing		
<u>Approximate depth to top of gravel pack:</u> Above slotted casing; exact depth unknown		
<u>Geophysical logs available:</u> None		
<u>Colluvium:</u>		
Gravel, sand, silt, and clay, brown.....	30	30
Boulder.....	1	31

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> MC-3--Continued		
<u>Rierdon Limestone:</u>		
Limy shale and argillaceous limestone, yellowish-brown, yellowish-gray, greenish-gray, weathered.....	25	56
Lost-circulation zone; cavernous or fractured with yellowish-brown partly cemented fill; no water.....	3	59
Limestone(?), hard, no samples.....	2	61
Shale, greenish-gray, with some brown limestone.....	4	65
Limestone, gray.....	5	70
Shale, gray, silty.....	7	77
<u>Mission Canyon Limestone:</u>		
Limestone, light-brown, light-gray, pink, and white, hard; water at and below 95 ft; cavity at 110-111 ft which produced about 100 or more gal/min, cavity fill is reddish-brown.....	53	130
<u>Site number:</u> MC-4		
<u>Date drilled:</u> 09/07/89		
<u>Bottom of well:</u> 371 ft		
<u>Casing:</u> 6-in. steel to 280 ft		
<u>Screened interval:</u> Open hole 4 3/4-in. diameter below 280 ft		
<u>Screen type:</u> None		
<u>Approximate depth to top of gravel pack:</u> None		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Alluvium:</u>		
Gravel, coarse, angular, broken pieces; with some brown clay beds.....	23	23
<u>Swift Formation:</u>		
Shale, gray, calcareous, silty in part.....	88	111
<u>Rierdon Limestone:</u>		
Limestone, argillaceous, gray; and calcareous gray shale.....	143	254
Shale, greenish-gray, with several thin beds of gray limestone.....	17	271
<u>Mission Canyon Limestone:</u>		
Limestone, hard, light-brown and light-gray; gray clay at 331-335 and 337-342 ft; no water.....	100	371
<u>Site number:</u> MC-6		
<u>Date drilled:</u> 08/30/91		
<u>Bottom of well:</u> 278 ft		
<u>Casing:</u> 6-in. Sch. 40 PVC		
<u>Screened interval:</u> 125-185 ft		
<u>Screen type:</u> 6-in. Sch. 40 PVC 50 slot		
<u>Uncased interval:</u> 185-278 ft		
<u>Approximate depth to top of gravel pack:</u> None		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Colluvium:</u>		
Gravel, sand, silt, and clay.....	30	30
<u>Rierdon Limestone:</u>		
Shale, greenish-gray.....	20	50
Limestone, brown.....	10	60
Shale, greenish-gray.....	9	69
<u>Mission Canyon Limestone:</u>		
Limestone, tan and black, fine-textured.....	11	80
Limestone, tan, fine-textured, some iron-oxide stain.....	40	120
Limestone, tan, fine-textured, some manganese-oxide stain.....	30	150
Limestone, light-gray, fine-textured, some manganese-oxide stain; contains some calcite crystals.....	40	190
Limestone, white, coarse-textured; contains brown coarse-textured, shaly limestone...	50	240
Limestone, white, coarse-textured.....	20	260
Limestone, tan, fine-textured.....	18	278

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> T-1		
<u>Date drilled:</u> 09/09/89		
<u>Geophysical logs available:</u> NAT. GAMMA, RES		
<u>Alluvium:</u>		
Gravel and sand; no water.....	1	1
Clay, brown, silty, sandy.....	8	9
<u>Telegraph Creek Formation (?):</u>		
Shale, mottled, gray, brown.....	9	18
Shale, gray.....	11	29
Siltstone and shale, brownish-gray, sandy.....	206	235
<u>Colorado Group (?):</u>		
Shale, gray; bentonite bed at about 240 ft and calcareous concretion at 301 ft.....	105	340
<u>Site number:</u> T-2		
<u>Date drilled:</u> 09/19/88		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Eagle Sandstone:</u>		
Shale and siltstone, brown, sandy.....	25	25
<u>Virgelle Sandstone Member:</u>		
Sandstone, brown, very fine to fine-grained, friable, indurated at 29-30, 42-44, and 71-72 ft; no water.....	59	84
Sandstone, brownish-gray, argillaceous.....	13	97
Shale and siltstone, brownish-gray, sandy.....	25	122
Sandstone, brownish-gray, argillaceous.....	5	127
Shale and siltstone, brownish-gray, sandy.....	2	129
Sandstone, gray, very fine to fine-grained, friable; indurated at 170-173 and at 195 ft; no water.....	71	200
Sandstone, brownish-gray, argillaceous.....	4	204
<u>Telegraph Creek Formation:</u>		
Shale and siltstone, brownish-gray, sandy.....	18	222
Sandstone, gray, argillaceous.....	13	235
<u>Site number:</u> T-3		
<u>Date drilled:</u> 08/17/89		
<u>Geophysical logs available:</u> NAT. GAMMA		
<u>Colluvium (?):</u>		
Sand, fine, brown.....	10	10
<u>Eagle Sandstone:</u>		
<u>Virgelle Sandstone Member:</u>		
Sandstone, gray, very fine to fine-grained, indurated.....	2	12
Shale and siltstone, brown, sandy.....	49	61
Sandstone, brown, gray, very fine to fine-grained, friable, indurated at 97-98 ft; water.....	54	115
Sandy shale, sandy siltstone, and argillaceous sandstone, brownish-gray; indurated sandstone at 125-128 ft.....	50	165

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
<u>Site number:</u> T-4		
<u>Date drilled:</u> 08/28/91		
<u>Geophysical logs available:</u> None		
<u>Mission Canyon Limestone:</u>		
Limestone, light-tan, coarse-textured; contains some crinoid fragments.....	10	10
Limestone, light-tan, coarse-textured; contains calcite and red clay filling solution cavities.....	10	20
Limestone, light-tan, coarse-textured, contains some chert, crinoids, and brachiopods; red clay filling solution cavities.....	10	30
Limestone, tan, fine-textured.....	10	40
Limestone, white, coarse-textured; contains some gray fine-textured limestone.....	30	70
Limestone, gray, fine-textured.....	70	140
Limestone, gray, fine-textured, red argillaceous limestone, and red limy shale; contains some coarse-textured limestone, crinoids, and brachiopods.....	20	160
Limestone, gray, fine-textured.....	20	180
<u>Site number:</u> T-5		
<u>Date drilled:</u> 07/17/89		
<u>Geophysical logs available:</u> None		
<u>Alluvium:</u>		
Gravel and sand; water at 37 ft.....	53	53
<u>Colorado Group:</u>		
Shale, gray and dark-gray; light-brown bentonite bed near 65 ft.....	78	131
Shale, siltstone, and argillaceous sandstone, gray and light-gray.....	75	206
<u>Kootenai Formation:</u>		
Clay, mottled greenish-gray, gray, and maroon.....	38	244
Sandstone, light-gray, very fine to fine-grained, indurated.....	13	257
Clay, mottled brown and grayish-brown.....	27	284
Clay, mottled maroon, greenish-gray, and gray.....	23	307
Clay, gray.....	13	320
Clay, mottled maroon and gray.....	51	371
<u>Third Cat Creek sandstone:</u>		
Sandstone(?), indurated.....	2	373
Clay, gray.....	47	420
Clay, black, carbonaceous.....	10	430
Sandstone, gray, coarse-grained; water.....	46	476
<u>Morrison Formation:</u>		
Mudstone, gray.....	14	490
<u>Site number:</u> T-6		
<u>Date drilled:</u> 08/27/89		
<u>Geophysical logs available:</u> NAT. GAMMA, RES, SP		
<u>Glacial drift:</u>		
Clay, brown, silty, sandy, pebbly (till); gray below about 30 ft.....	36	36
<u>Eagle Sandstone:</u>		
Siltstone, brownish-gray, sandy.....	35	71
Shale, brownish-gray, sandy.....	13	84
Sandstone, gray, very fine to fine-grained, indurated; no water.....	3	87
Siltstone, brownish-gray, sandy.....	4	91
Shale, brownish-gray, sandy.....	25	116
Sandstone, gray, argillaceous.....	6	122
Shale, brownish-gray, sandy.....	9	131
Argillaceous sandstone and sandy siltstone, brownish-gray.....	23	154
Siltstone, brownish-gray, sandy.....	6	160
Shale, brownish-gray, sandy.....	24	184

Table 3.--Lithologic logs of monitoring wells and test holes, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Description	Thick- ness pene- trated (ft)	Bottom of interval below land surface (ft)
Site number: T-6--Continued		
Virgelle Sandstone Member:		
Sandstone, gray, very fine to fine-grained, friable; water.....	4	188
Argillaceous sandstone and sandy siltstone, brownish-gray.....	7	195
Shale, brownish-gray, sandy.....	5	200
Sandstone, gray, very fine to fine-grained, argillaceous, indurated; water (?).....	49	249
Telegraph Creek Formation:		
Shale, brownish-gray, sandy.....	11	260

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Water level--in feet below or above (+) land surface.
M, method of measurement--G, pressure gage; S, steel tape]

C-1 (First Cat Creek sandstone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 30, 1988	23.78 S	AUG 10, 1989	24.31 S	MAY 02, 1990	24.60 S
NOV 03	23.71 S	SEP 10	24.42 S	JUN 06	24.58 S
DEC 14	23.90 S	OCT 11	24.45 S	AUG 23	24.64 S
FEB 23, 1989	24.01 S	NOV 08	24.44 S	SEP 26	24.74 S
MAR 29	24.13 S	29	24.56 S	OCT 23	24.75 S
JUN 09	24.15 S	JAN 24, 1990	24.60 S		
JUL 12	24.27 S	MAR 28	24.66 S		
HIGHEST	23.71	NOV 03, 1988			
LOWEST	24.75	OCT 23, 1990			

E-2 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 21, 1988	+18.95 G	JUL 14, 1989	+19.12 G	MAY 02, 1990	+15.86 G
OCT 01	+18.58 G	AUG 10	+16.41 G	JUN 06	+17.30 G
NOV 03	+19.86 G	11	+18.70 G	JUL 19	+15.45 G
FEB 22, 1989	+19.79 G	SEP 20	+19.40 G	AUG 23	+15.10 G
MAR 29	+18.64 G	OCT 10	+19.41 G	SEP 26	+16.03 G
JUN 05	+17.94 G	MAR 28, 1990	+11.71 G	OCT 23	+15.91 G
HIGHEST	+19.86	NOV 03, 1988			
LOWEST	+11.71	MAR 28, 1990			

E-3 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 20, 1988	27.18 S	JUL 14, 1989	27.49 S	MAR 28, 1990	27.23 S
OCT 01	27.66 S	AUG 11	27.45 S	MAY 02	26.87 S
NOV 03	27.33 S	SEP 10	27.47 S	JUN 06	26.59 S
DEC 14	27.71 S	20	27.49 S	JUL 19	26.69 S
JAN 11, 1989	27.60 S	OCT 10	27.27 S	AUG 23	26.63 S
FEB 23	29.26 S	NOV 09	27.47 S	SEP 26	26.90 S
MAR 29	27.58 S	30	27.49 S	OCT 23	27.03 S
JUN 05	27.05 S	JAN 24, 1990	27.46 S		
HIGHEST	26.59	JUN 06, 1990			
LOWEST	29.26	FEB 23, 1989			

E-4 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 02, 1988	13.45 S	AUG 11, 1989	13.24 S	MAY 02, 1990	13.14 S
NOV 03	13.16 S	SEP 10	13.27 S	JUN 06	13.16 S
DEC 14	13.75 S	20	13.39 S	JUL 19	13.14 S
JAN 11, 1989	13.55 S	OCT 11	13.11 S	AUG 23	12.97 S
FEB 23	13.20 S	NOV 09	13.24 S	SEP 26	13.20 S
MAR 29	13.44 S	30	13.27 S	OCT 23	13.19 S
JUN 06	13.07 S	JAN 24, 1990	13.33 S		
JUL 14	13.23 S	MAR 28	13.26 S		
HIGHEST	12.97	AUG 23, 1990			
LOWEST	13.75	DEC 14, 1988			

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-7 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 02, 1988	28.82 S	SEP 10, 1989	25.34 S	MAY 02, 1990	25.73 S
NOV 03	28.33 S	21	25.23 S	JUN 06	24.12 S
DEC 14	28.55 S	22	25.63 S	JUL 19	24.47 S
FEB 23, 1989	28.16 S	OCT 11	25.18 S	AUG 23	24.57 S
MAR 29	27.96 S	NOV 09	25.19 S	SEP 26	24.75 S
JUN 07	27.36 S	30	25.24 S	OCT 23	24.80 S
JUL 14	27.17 S	JAN 24, 1990	25.32 S		
AUG 11	26.54 S	MAR 28	25.14 S		
HIGHEST	24.12 JUN 06, 1990				
LOWEST	28.82 OCT 02, 1988				

E-9 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 02, 1988	31.13 S	JUL 12, 1989	32.42 S	MAR 28, 1990	31.23 S
NOV 03	31.08 S	AUG 11	31.17 S	MAY 02	31.23 S
DEC 14	31.34 S	SEP 10	31.20 S	JUN 06	31.22 S
JAN 12, 1989	31.20 S	OCT 11	31.15 S	JUL 18	31.18 S
FEB 22	31.04 S	NOV 08	31.09 S	AUG 23	31.13 S
MAR 30	31.25 S	29	31.37 S	SEP 26	31.29 S
JUN 08	31.11 S	JAN 23, 1990	30.97 S	OCT 23	31.30 S
HIGHEST	30.97 JAN 23, 1990				
LOWEST	32.42 JUL 12, 1989				

E-11 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 04, 1988	35.68 S	JUL 12, 1989	35.70 S	MAR 28, 1990	35.69 S
NOV 03	35.49 S	AUG 11	35.78 S	MAY 02	35.86 S
DEC 14	35.84 S	SEP 10	35.84 S	JUN 06	35.87 S
JAN 12, 1989	35.77 S	OCT 11	35.76 S	JUL 18	35.94 S
FEB 22	35.68 S	NOV 08	35.73 S	AUG 23	36.01 S
MAR 30	35.83 S	29	35.99 S	SEP 26	36.21 S
JUN 08	35.65 S	JAN 23, 1990	35.78 S	OCT 23	36.15 S
HIGHEST	35.49 NOV 03, 1988				
LOWEST	36.21 SEP 26, 1990				

E-12 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
AUG 02, 1989	21.18 S	NOV 30, 1989	20.75 S	OCT 23, 1990	20.31 S
10	19.24 S	JAN 24, 1990	20.75 S	DEC 13	20.69 S
11	19.46 S	MAR 28	21.42 S	FEB 12, 1991	20.60 S
23	19.41 S	MAY 02	19.53 S	FEB 20, 1992	20.65 S
SEP 10	19.59 S	JUN 06	19.58 S	MAR 31	20.50 S
20	19.86 S	JUL 19	19.83 S	APR 01	20.50 S
OCT 11	19.53 S	AUG 23	20.41 S	SEP 14	23.07 S
NOV 09	20.46 S	SEP 26	20.29 S	MAR 23, 1993	22.38 S
HIGHEST	19.24 AUG 10, 1989				
LOWEST	23.07 SEP 14, 1992				

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-13 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
AUG 10, 1989	16.29 S	NOV 09, 1989	17.16 S	JUN 16, 1990	16.77 S
11	16.44 S	30	17.48 S	JUL 19	16.73 S
23	16.20 S	JAN 24, 1990	17.43 S	AUG 23	17.25 S
SEP 10	16.36 S	MAR 28	18.23 S	SEP 26	17.13 S
20	16.60 S	MAY 02	16.44 S	OCT 23	17.16 S
OCT 11	16.32 S	JUN 06	16.44 S		
HIGHEST	16.20	AUG 23, 1989			
LOWEST	18.23	MAR 28, 1990			

E-14 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
AUG 23, 1989	18.99 S	NOV 09, 1989	18.82 S	JUN 16, 1990	17.86 S
SEP 10	18.79 S	30	18.82 S	JUL 19	17.98 S
21	18.77 S	JAN 24, 1990	18.99 S	AUG 23	17.94 S
22	19.37 S	MAR 28	18.69 S	SEP 26	18.09 S
OCT 11	18.74 S	MAY 02	18.33 S	OCT 23	18.17 S
HIGHEST	17.86	JUN 16, 1990			
LOWEST	19.37	SEP 22, 1989			

E-15 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
AUG 15, 1989	23.80 S	JAN 24, 1990	20.64 S	FEB 12, 1991	19.89 S
23	20.75 S	MAR 28	20.39 S	20	20.60 S
SEP 10	20.46 S	MAY 02	20.02 S	APR 01	21.06 S
21	18.46 S	JUN 06	19.56 S	MAR 31, 1992	21.06 S
22	21.16 S	AUG 23	19.62 S	SEP 14	21.49 S
OCT 11	20.38 S	SEP 26	19.75 S	MAR 23, 1993	21.79 S
NOV 09	20.49 S	OCT 23	19.88 S		
30	20.37 S	DEC 13	19.80 S		
HIGHEST	18.46	SEP 21, 1989			
LOWEST	23.80	AUG 15, 1989			

E-18 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 10, 1989	0.82 S	JAN 24, 1990	0.65 S	AUG 23, 1990	1.03 S
OCT 10	.54 S	MAR 28	.69 S	SEP 26	.91 S
NOV 08	.89 S	MAY 02	.51 S	OCT 23	.83 S
09	.65 S	JUN 06	+.35 S		
30	.78 S	15	.07 S		
HIGHEST	+0.35	JUN 06, 1990			
LOWEST	1.03	AUG 23, 1990			

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-21 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 10, 1989	2.80 S	JAN 24, 1990	2.68 S	JUN 14, 1990	1.73 S
OCT 10	2.62 S	MAR 28	2.30 S	AUG 23	2.29 S
NOV 08	2.68 S	MAY 02	1.90 S	SEP 26	2.55 S
29	2.69 S	JUN 06	1.74 S	OCT 23	2.40 S
HIGHEST	1.73	JUN 14, 1990			
LOWEST	2.80	SEP 10, 1989			

E-23 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 10, 1989	24.05 S	MAR 28, 1990	23.27 S	AUG 23, 1990	23.17 S
NOV 09	24.49 S	MAY 02	21.47 S	SEP 26	23.91 S
29	24.75 S	JUN 06	20.80 S	OCT 23	24.16 S
JAN 24, 1990	24.83 S	15	21.11 S		
HIGHEST	20.80	JUN 06, 1990			
LOWEST	24.83	JAN 24, 1990			

E-24 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 10, 1989	+8.66 G	MAR 28, 1990	+8.66 G	AUG 23, 1990	+8.89 G
NOV 09	+10.53 G	MAY 02	+11.37 G	SEP 26	+10.27 G
29	+9.58 G	JUN 06	+11.66 G	OCT 23	+9.58 G
HIGHEST	+11.66	JUN 06, 1990			
LOWEST	+8.66	OCT 10, 1989; MAR 28, 1990			

E-25 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 13, 1989	14.74 S	MAR 28, 1990	7.34 S	AUG 23, 1990	5.94 S
OCT 10	7.32 S	MAY 02	6.72 S	SEP 26	6.25 S
NOV 08	7.20 S	JUN 06	6.34 S	OCT 23	6.40 S
29	7.52 S	12	6.17 S		
JAN 23, 1990	7.12 S	13	6.73 S		
HIGHEST	5.94	AUG 23, 1990			
LOWEST	14.74	SEP 13, 1989			

E-26 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 13, 1989	32.40 S	JAN 23, 1990	32.12 S	JUN 14, 1990	31.95 S
OCT 10	32.05 S	MAR 28	32.21 S	AUG 23	32.19 S
NOV 08	32.12 S	MAY 02	32.04 S	SEP 26	32.39 S
29	32.30 S	JUN 06	31.83 S	OCT 23	32.32 S
HIGHEST	31.83	JUN 06, 1990			
LOWEST	32.40	SEP 13, 1989			

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-27 (Virgelle Sandstone Member)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
OCT 10, 1989	24.01 S	MAR 28, 1990	24.13 S	AUG 23, 1990	24.00 S
NOV 08	24.03 S	MAY 02	23.95 S	SEP 26	24.20 S
	24.39 S	JUN 06	23.79 S	OCT 23	24.26 S
JAN 23, 1990	23.79 S	14	23.90 S		
HIGHEST	23.79	JAN 23, 1990; JUN 06, 1990			
LOWEST	24.39	NOV 29, 1989			

K-1 (Third Cat Creek sandstone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
SEP 30, 1988	1.15 S	AUG 10, 1989	0.03 S	MAY 02, 1990	2.05 S
NOV 03	1.83 S	SEP 10	1.60 S	JUN 06	.49 S
DEC 14	2.50 S	OCT 11	1.07 S	AUG 23	+1.84 S
FEB 23, 1989	3.36 S	NOV 08	1.43 S	SEP 26	+1.79 S
MAR 29	3.51 S	30	3.00 S	OCT 23	+1.41 S
JUN 09	1.58 S	JAN 24, 1990	4.04 S		
JUL 12	+1.11 S	MAR 28	3.03 S		
HIGHEST	+1.84	AUG 23, 1990			
LOWEST	4.04	JAN 24, 1990			

L-1 (Lodgepole Limestone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
NOV 05, 1991	8.48 S	FEB 18, 1992	22.19 S	APR 01, 1992	13.79 S
HIGHEST	8.48	NOV 05, 1991			
LOWEST	22.19	FEB 18, 1992			

MC-1 (Mission Canyon Limestone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
JUL 26, 1989	37.54 S	MAY 02, 1990	36.04 S	JUN 24, 1991	34.84 S
AUG 10	38.85 S	JUN 06	31.29 S	AUG 30	39.06 S
AUG 15	39.38 S	JUL 17	35.73 S	NOV 05	41.24 S
SEP 10	40.97 S	18	35.88 S	FEB 18, 1992	44.70 S
OCT 10	41.27 S	AUG 23	38.35 S	MAR 31	43.90 S
17	41.62 S	SEP 26	40.53 S	APR 01	43.90 S
NOV 08	42.03 S	OCT 23	40.84 S	MAY 28	43.91 S
29	42.63 S	DEC 13	41.99 S	SEP 14	45.58 S
JAN 24, 1990	43.12 S	FEB 12, 1991	43.05 S	MAR 24, 1993	46.30 S
FEB 21	43.14 S	APR 04	43.70 S		
MAR 28	41.34 S	MAY 21	37.60 S		
HIGHEST	31.29	JUN 06, 1990			
LOWEST	46.30	MAR 24, 1993			

Table 4.--Water levels in monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

MC-2 (Mission Canyon Limestone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
JUL 28, 1989	17.78 S	FEB 22, 1990	21.35 S	APR 04, 1991	21.18 S
AUG 10	19.24 S	MAR 28	11.13 S	MAY 21	14.17 S
SEP 07	20.95 S	MAY 02	9.67 S	JUN 26	7.07 S
10	20.53 S	JUN 06	8.40 S	AUG 30	19.60 S
OCT 10	21.16 S	13	10.36 S	NOV 05	20.78 S
NOV 08	21.67 S	AUG 23	19.63 S	FEB 18, 1992	22.49 S
29	20.34 S	SEP 26	21.24 S	APR 01	21.48 S
JAN 24, 1990	20.66 S	OCT 23	21.79 S	MAY 28	22.49 S

HIGHEST 7.07 JUN 26, 1991
 LOWEST 22.49 FEB 18, 1992; MAY 28, 1992

MC-3 (Mission Canyon Limestone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
AUG 26, 1989	33.75 S	MAY 02, 1990	29.38 S	JUN 25, 1991	24.83 S
SEP 10	32.25 S	JUN 06	15.63 S	AUG 30	26.13 S
OCT 11	33.50 S	JUL 18	13.35 S	NOV 05	31.20 S
18	33.83 S	19	14.48 S	FEB 18, 1992	34.36 S
NOV 08	34.10 S	AUG 23	16.87 S	APR 01	34.52 S
29	34.32 S	SEP 26	24.74 S	MAY 28	34.79 S
JAN 23, 1990	34.39 S	OCT 23	28.27 S	SEP 14	34.89 S
FEB 21	34.67 S	APR 04, 1991	33.99 S		
MAR 28	32.19 S	MAY 21	32.48 S		

HIGHEST 13.35 JUL 18, 1990
 LOWEST 34.89 SEP 14, 1992

MC-6 (Mission Canyon Limestone)

DATE	WATER LEVEL M	DATE	WATER LEVEL M	DATE	WATER LEVEL M
NOV 05, 1991	29.46 S	FEB 18, 1992	32.01 S	APR 01, 1992	32.39 S

HIGHEST 29.46 NOV 05, 1991
 LOWEST 32.39 APR 01, 1992

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Water level--in feet below land surface; ---, no data]

E-12 (Virgelle Sandstone Member)

WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---	---	---
6	---	---	---	---	---	---	---	---	---	---	---	---
7	---	---	---	---	---	---	---	---	---	---	---	---
8	---	---	---	---	---	---	---	---	---	---	---	---
9	---	---	---	---	---	---	---	---	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---	---	---
11	---	---	---	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	---	---	---	---	---
13	---	---	---	---	---	---	---	---	---	---	---	---
14	---	---	---	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---
18	---	---	---	---	---	---	---	---	---	---	---	---
19	---	---	---	---	---	---	---	---	---	---	---	---
20	---	---	---	---	---	---	---	---	---	---	---	---
21	---	---	---	---	---	---	---	---	---	---	---	---
22	---	---	---	---	---	---	---	---	---	---	---	---
23	---	---	---	---	---	---	---	---	---	---	---	---
24	---	---	---	---	---	---	---	---	---	---	---	20.89
25	---	---	---	---	---	---	---	---	---	---	---	20.49
26	---	---	---	---	---	---	---	---	---	---	---	20.21
27	---	---	---	---	---	---	---	---	---	---	---	20.02
28	---	---	---	---	---	---	---	---	---	---	---	19.96
29	---	---	---	---	---	---	---	---	---	---	---	19.88
30	---	---	---	---	---	---	---	---	---	---	---	19.72
31	---	---	---	---	---	---	---	---	---	---	---	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-12 (Continued)

DAY	WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19.67	19.54	20.78	20.57	20.55	20.62	20.14	19.59	19.42	19.97	20.16	20.23
2	19.74	19.75	20.76	20.62	20.58	20.58	20.05	19.55	19.49	19.96	20.19	20.21
3	19.74	20.00	20.66	20.69	20.57	20.56	19.97	19.61	19.57	19.94	20.26	20.21
4	19.62	20.02	20.60	20.69	20.61	20.76	19.99	19.64	19.51	20.04	20.32	20.26
5	19.57	20.09	20.61	20.66	20.60	20.95	19.97	19.64	19.47	20.05	20.37	20.22
6	19.63	20.21	20.68	20.68	20.59	21.06	19.88	19.53	19.53	19.96	20.35	20.22
7	19.64	20.20	20.66	20.67	20.55	21.02	19.82	19.46	19.66	19.99	20.32	20.22
8	19.60	20.23	20.61	20.70	20.59	21.07	19.71	19.51	19.77	20.05	20.36	20.20
9	19.61	20.34	20.65	20.72	20.57	21.07	19.79	19.59	19.83	20.04	20.40	20.21
10	19.53	20.38	20.75	20.78	20.61	21.00	19.86	19.54	19.81	19.98	20.42	20.21
11	19.45	20.42	20.72	20.91	20.57	21.06	19.82	19.52	19.77	19.95	20.43	20.18
12	19.47	20.41	20.67	20.81	20.68	21.12	19.70	19.51	19.75	19.91	20.44	20.17
13	19.51	20.40	20.69	20.67	20.68	21.14	19.66	19.52	19.83	19.85	20.40	20.19
14	19.52	20.45	20.69	20.70	20.58	21.16	19.62	19.52	19.96	19.80	20.39	20.25
15	19.54	20.58	20.72	20.73	20.56	21.26	19.63	19.47	19.94	19.77	20.34	20.21
16	19.59	20.59	20.69	20.73	20.54	21.30	19.66	19.52	19.92	19.71	20.33	20.17
17	19.63	20.52	20.67	20.78	20.57	21.32	19.66	19.54	19.96	19.73	20.37	20.19
18	19.62	20.54	20.68	20.78	20.68	21.32	19.56	19.49	19.97	19.78	20.41	20.24
19	19.56	20.53	20.70	20.73	20.62	21.29	19.57	19.45	19.97	19.84	20.44	20.23
20	19.48	20.61	20.77	20.70	20.57	21.33	19.61	19.46	20.00	20.03	20.47	20.25
21	19.40	20.62	20.86	20.69	20.65	21.35	19.60	19.50	20.01	20.15	20.44	20.29
22	19.42	20.62	20.79	20.65	20.67	21.41	19.53	19.56	20.01	20.18	20.42	20.32
23	19.48	20.60	20.75	20.66	20.73	21.44	19.46	19.52	19.95	20.16	20.39	20.27
24	19.47	20.47	20.79	20.62	20.68	21.37	19.48	19.44	19.96	20.14	20.31	20.18
25	19.44	20.47	20.75	20.48	20.68	21.37	19.51	19.38	20.01	20.15	20.25	20.17
26	19.42	20.51	20.71	20.57	20.75	21.32	19.51	19.42	19.99	20.16	20.25	20.20
27	19.40	20.59	20.67	20.50	20.74	21.36	19.55	19.48	19.95	20.18	20.26	20.27
28	19.46	20.68	20.69	20.43	20.65	21.32	19.48	19.48	19.96	20.25	20.24	20.30
29	19.53	20.70	20.70	20.54	---	20.80	19.53	19.43	19.99	20.30	20.22	20.26
30	19.50	20.72	20.69	20.56	---	20.36	19.56	19.42	20.01	20.29	20.19	20.20
31	19.50	---	20.72	20.58	---	20.17	---	19.42	---	20.21	20.19	---
MEAN	19.54	20.39	20.71	20.66	20.62	21.07	19.70	19.51	19.83	20.02	20.33	20.22
MAX	19.74	20.72	20.86	20.91	20.75	21.44	20.14	19.64	20.01	20.30	20.47	20.32
MIN	19.40	19.54	20.60	20.43	20.54	20.17	19.46	19.38	19.42	19.71	20.16	20.17

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-12 (Continued)

WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991												
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20.14	20.65	20.79	20.82	20.72	20.61	20.84	20.82	20.75	20.42	20.59	20.76
2	20.14	20.77	20.83	20.88	20.72	20.65	20.79	20.84	20.82	20.47	20.58	20.76
3	20.09	20.75	20.82	20.82	20.79	20.62	20.81	20.85	20.83	20.54	20.59	20.70
4	20.13	20.66	20.73	20.71	20.79	20.57	20.82	20.83	20.81	20.58	20.64	20.64
5	20.13	20.70	20.81	20.68	20.85	20.53	20.80	20.84	20.82	20.51	20.61	20.61
6	20.18	20.74	20.85	20.70	20.85	20.64	20.78	20.87	20.88	20.46	20.55	20.62
7	20.28	20.65	20.79	20.73	20.81	20.73	20.73	20.82	20.85	20.46	20.56	20.70
8	20.30	20.65	20.78	20.73	20.83	20.72	20.76	20.77	20.62	20.56	20.58	20.72
9	20.30	20.67	20.78	20.70	20.82	20.76	20.82	20.74	20.40	20.57	20.62	20.67
10	20.22	20.70	20.74	20.72	20.78	20.71	20.87	20.70	20.31	20.52	20.62	20.67
11	20.17	20.75	20.76	20.70	20.78	20.70	20.79	20.75	20.30	20.49	20.59	20.64
12	20.20	20.74	20.80	20.64	20.78	20.77	20.77	20.81	20.21	20.53	20.59	20.60
13	20.15	20.66	20.73	20.66	20.79	20.78	20.86	20.72	20.12	20.58	20.63	20.67
14	20.11	20.69	20.70	20.69	20.79	20.77	20.86	20.64	20.13	20.57	20.65	20.71
15	20.15	20.81	20.67	20.78	20.79	20.74	20.77	20.68	20.22	20.52	20.62	20.75
16	20.16	20.81	20.69	20.78	20.66	20.75	20.74	20.77	20.32	20.49	20.63	20.79
17	20.19	20.74	20.59	20.75	20.65	20.81	20.78	20.82	20.38	20.52	20.62	20.74
18	20.23	20.70	20.70	20.71	20.71	20.80	20.81	20.82	20.41	20.51	20.65	20.65
19	20.17	20.63	20.82	20.76	20.75	20.74	20.82	20.81	20.47	20.51	20.66	20.63
20	20.18	20.60	20.84	20.82	20.69	20.64	20.84	20.80	20.49	20.51	20.62	20.71
21	20.26	20.62	20.78	20.71	20.74	20.67	20.83	20.81	20.47	20.51	20.60	20.70
22	20.20	20.69	20.73	20.71	20.83	20.73	20.78	20.77	20.46	20.53	20.61	20.74
23	20.28	20.63	20.71	20.72	20.81	20.79	20.77	20.80	20.43	20.62	20.65	20.73
24	20.47	20.64	20.78	20.82	20.83	20.83	20.73	20.83	20.41	20.67	20.65	20.70
25	20.48	20.67	20.74	20.79	20.84	20.75	20.70	20.87	20.41	20.65	20.61	20.68
26	20.59	20.67	20.62	20.69	20.87	20.73	20.69	20.82	20.38	20.59	20.62	20.64
27	20.63	20.74	20.67	20.68	20.75	20.73	20.68	20.82	20.40	20.54	20.63	20.65
28	20.59	20.79	20.79	20.77	20.61	20.74	20.66	20.85	20.44	20.58	20.61	20.73
29	20.62	20.73	20.73	20.72	---	20.78	20.65	20.85	20.46	20.60	20.57	20.63
30	20.60	20.78	20.71	20.70	---	20.83	20.74	20.83	20.45	20.60	20.63	20.64
31	20.57	---	20.76	20.73	---	20.86	---	20.73	---	20.56	20.66	---
MEAN	20.29	20.70	20.75	20.74	20.77	20.73	20.78	20.80	20.48	20.54	20.61	20.69
MAX	20.63	20.81	20.85	20.88	20.87	20.86	20.87	20.87	20.88	20.67	20.66	20.79
MIN	20.09	20.60	20.59	20.64	20.61	20.53	20.65	20.64	20.12	20.42	20.55	20.60

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-12 (Continued)

WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20.65	20.71	20.69	20.70	20.65	20.53	20.60	20.61	21.26	23.85	24.28	24.28
2	20.72	20.63	20.59	20.67	20.64	20.53	20.52	20.65	21.24	23.91	24.26	24.29
3	20.73	20.59	20.59	20.63	20.73	20.55	20.50	20.65	21.27	23.95	24.23	24.27
4	20.70	20.60	20.66	20.60	20.80	20.53	20.50	20.60	21.29	23.96	24.24	24.25
5	20.64	20.60	20.62	20.57	20.71	20.53	20.53	20.57	21.32	23.97	24.22	24.31
6	20.65	20.60	20.55	20.60	20.67	20.53	20.59	20.56	21.32	23.99	24.21	24.31
7	20.74	20.62	20.50	20.60	20.69	20.53	20.57	20.48	21.34	24.04	24.23	24.23
8	20.73	20.62	20.53	20.66	20.67	20.57	20.56	20.34	21.35	24.06	24.30	24.25
9	20.70	20.57	20.61	20.71	20.59	20.62	20.50	20.40	21.35	24.08	24.38	24.18
10	20.65	20.58	20.62	20.69	20.59	20.60	20.58	20.45	21.38	24.05	24.40	23.31
11	20.66	20.63	20.58	20.62	20.67	20.57	20.62	20.58	21.30	24.04	24.38	22.63
12	20.71	20.58	20.58	20.59	20.67	20.57	20.56	20.60	21.05	24.04	24.33	22.77
13	20.64	20.52	20.55	20.65	20.61	20.59	20.56	20.55	20.92	24.05	24.30	---
14	20.53	20.51	20.63	20.64	20.57	20.62	20.59	20.54	21.34	24.12	24.31	---
15	20.55	20.58	20.74	20.70	20.56	20.59	20.57	20.58	21.46	24.17	24.31	---
16	20.73	20.61	20.75	20.69	20.56	20.54	20.51	20.61	21.51	24.19	24.32	22.58
17	20.73	20.51	20.76	20.67	20.55	20.54	20.50	20.60	21.64	24.19	24.33	22.37
18	20.68	20.44	20.72	20.74	20.61	20.55	20.55	20.57	21.72	24.22	24.32	22.49
19	20.56	20.51	20.61	20.70	20.61	20.58	20.61	20.54	21.73	24.23	24.32	22.39
20	20.52	20.59	20.65	20.67	20.59	20.58	20.55	20.64	21.77	24.19	24.35	22.42
21	20.64	20.58	20.72	20.65	20.60	20.57	20.51	20.73	21.84	24.18	24.32	22.28
22	20.62	20.65	20.65	20.61	20.58	20.57	20.54	20.80	21.97	24.16	24.37	21.87
23	20.58	20.76	20.66	20.62	20.59	20.53	20.65	20.84	22.46	24.18	24.42	21.57
24	20.59	20.74	20.70	20.60	20.64	20.54	20.69	20.90	23.12	24.24	24.44	21.34
25	20.59	20.66	20.66	20.62	20.68	20.59	20.63	20.84	23.41	24.25	24.42	21.23
26	20.71	20.58	20.66	20.65	20.69	20.59	20.55	20.81	23.55	24.23	24.36	21.32
27	20.72	20.56	20.68	20.65	20.68	20.52	20.56	20.84	23.69	24.26	24.35	21.99
28	20.75	20.61	20.65	20.66	20.64	20.47	20.56	20.87	23.74	24.25	24.37	23.13
29	20.67	20.57	20.60	20.66	20.59	20.56	20.45	21.00	23.71	24.26	24.37	23.56
30	20.78	20.61	20.59	20.70	---	20.65	20.48	21.16	23.75	24.26	24.34	23.78
31	20.78	---	20.65	20.70	---	20.66	---	21.26	---	24.25	24.29	---
MEAN	20.67	20.60	20.64	20.65	20.64	20.56	20.56	20.68	21.96	24.12	24.32	---
MAX	20.78	20.76	20.76	20.74	20.80	20.66	20.69	21.26	23.75	24.26	24.44	---
MIN	20.52	20.44	20.50	20.57	20.55	20.47	20.45	20.34	20.92	23.85	24.21	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-12 (Continued)

WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993												
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23.87	23.78	21.74	23.86	22.95	23.06	---	---	---	---	---	---
2	23.92	23.81	21.58	23.75	22.93	23.07	---	---	---	---	---	---
3	23.89	23.92	21.45	23.80	23.07	23.11	---	---	---	---	---	---
4	23.88	24.00	21.39	23.86	23.09	23.13	---	---	---	---	---	---
5	24.01	23.92	21.26	23.93	23.10	23.12	---	---	---	---	---	---
6	24.08	23.94	21.11	23.91	23.07	23.12	---	---	---	---	---	---
7	24.10	23.91	21.06	23.89	23.05	23.07	---	---	---	---	---	---
8	24.03	23.86	20.98	23.86	23.04	23.04	---	---	---	---	---	---
9	23.97	23.88	20.92	24.02	23.00	22.99	---	---	---	---	---	---
10	24.05	23.96	20.98	23.95	23.09	23.06	---	---	---	---	---	---
11	24.07	23.98	20.91	23.86	23.12	23.09	---	---	---	---	---	---
12	24.13	24.03	21.03	23.85	23.06	23.12	---	---	---	---	---	---
13	24.03	24.05	21.18	23.81	23.06	23.03	---	---	---	---	---	---
14	24.10	24.03	21.22	23.56	23.09	22.90	---	---	---	---	---	---
15	24.14	23.89	21.82	23.50	23.15	22.84	---	---	---	---	---	---
16	24.17	23.12	22.65	23.40	23.18	22.96	---	---	---	---	---	---
17	24.17	22.49	22.99	23.41	23.19	23.05	---	---	---	---	---	---
18	24.16	22.15	23.18	23.38	23.12	22.94	---	---	---	---	---	---
19	24.06	21.93	23.32	23.37	23.06	22.97	---	---	---	---	---	---
20	24.09	21.71	23.41	23.34	22.98	23.05	---	---	---	---	---	---
21	24.08	21.68	23.47	23.32	22.98	23.02	---	---	---	---	---	---
22	24.13	21.84	23.56	23.39	23.03	22.80	---	---	---	---	---	---
23	24.25	22.20	23.73	23.42	23.07	---	---	---	---	---	---	---
24	24.23	22.48	23.68	23.36	23.11	---	---	---	---	---	---	---
25	24.16	22.66	23.77	23.14	23.07	---	---	---	---	---	---	---
26	24.08	22.83	23.70	23.07	23.08	---	---	---	---	---	---	---
27	23.41	22.90	23.68	23.01	23.10	---	---	---	---	---	---	---
28	22.75	22.86	23.82	23.05	23.07	---	---	---	---	---	---	---
29	23.01	22.86	23.84	23.03	---	---	---	---	---	---	---	---
30	23.42	22.23	23.87	23.02	---	---	---	---	---	---	---	---
31	23.63	---	23.90	22.99	---	---	---	---	---	---	---	---
MEAN	23.94	23.16	22.43	23.52	23.07	---	---	---	---	---	---	---
MAX	24.25	24.05	23.90	24.02	23.19	---	---	---	---	---	---	---
MIN	22.75	21.68	20.91	22.99	22.93	---	---	---	---	---	---	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-15 (Virgelle Sandstone Member)

WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	---	---	20.43
2	---	---	---	---	---	---	---	---	---	---	---	20.42
3	---	---	---	---	---	---	---	---	---	---	---	20.42
4	---	---	---	---	---	---	---	---	---	---	---	20.45
5	---	---	---	---	---	---	---	---	---	---	---	20.41
6	---	---	---	---	---	---	---	---	---	---	---	20.42
7	---	---	---	---	---	---	---	---	---	---	---	20.41
8	---	---	---	---	---	---	---	---	---	---	---	20.47
9	---	---	---	---	---	---	---	---	---	---	---	20.44
10	---	---	---	---	---	---	---	---	---	---	---	20.48
11	---	---	---	---	---	---	---	---	---	---	---	20.46
12	---	---	---	---	---	---	---	---	---	---	---	20.42
13	---	---	---	---	---	---	---	---	---	---	---	20.39
14	---	---	---	---	---	---	---	---	---	---	---	20.36
15	---	---	---	---	---	---	---	---	---	---	---	20.32
16	---	---	---	---	---	---	---	---	---	---	21.05	20.27
17	---	---	---	---	---	---	---	---	---	---	21.04	20.33
18	---	---	---	---	---	---	---	---	---	---	21.04	20.38
19	---	---	---	---	---	---	---	---	---	---	21.04	20.45
20	---	---	---	---	---	---	---	---	---	---	21.04	20.46
21	---	---	---	---	---	---	---	---	---	---	21.05	---
22	---	---	---	---	---	---	---	---	---	---	20.85	---
23	---	---	---	---	---	---	---	---	---	---	20.78	---
24	---	---	---	---	---	---	---	---	---	---	20.71	22.81
25	---	---	---	---	---	---	---	---	---	---	20.61	21.92
26	---	---	---	---	---	---	---	---	---	---	20.60	21.46
27	---	---	---	---	---	---	---	---	---	---	20.59	21.22
28	---	---	---	---	---	---	---	---	---	---	20.54	21.08
29	---	---	---	---	---	---	---	---	---	---	20.53	20.91
30	---	---	---	---	---	---	---	---	---	---	20.46	20.75
31	---	---	---	---	---	---	---	---	---	---	20.41	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-15 (Continued)

WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20.74	20.57	20.57	20.46	20.63	20.84	20.29	20.03	19.54	19.52	19.56	19.69
2	20.76	20.48	20.56	20.46	20.67	20.82	20.27	20.04	19.60	19.57	19.59	19.67
3	20.68	20.40	20.52	20.52	20.64	20.73	20.34	20.06	19.60	19.64	19.64	19.70
4	20.57	20.37	20.46	20.53	20.68	20.69	20.34	20.07	19.54	19.66	19.68	19.72
5	20.54	20.38	20.46	20.51	20.66	20.63	20.31	20.01	19.53	19.65	19.68	19.69
6	20.58	20.38	20.52	20.52	20.70	20.59	20.35	19.91	19.52	19.65	19.63	19.70
7	20.56	20.40	20.51	20.48	20.70	20.58	20.37	19.88	19.52	19.65	19.61	19.71
8	20.51	20.43	20.46	20.44	20.70	20.60	20.31	19.93	19.56	19.66	19.64	19.70
9	20.47	20.44	20.49	20.45	20.67	20.61	20.28	19.94	19.56	19.66	19.67	19.71
10	20.40	20.48	20.59	20.57	20.69	20.53	20.19	19.89	19.50	19.66	19.69	19.71
11	20.38	20.48	20.56	20.69	20.69	20.52	20.22	19.87	19.45	19.65	19.70	19.69
12	20.43	20.47	20.50	20.62	20.70	20.50	20.33	19.85	19.45	19.65	19.69	19.69
13	20.45	20.46	20.50	20.52	20.70	20.40	20.31	19.86	19.46	19.65	19.67	19.74
14	20.48	20.51	20.50	20.55	20.71	20.41	20.22	19.82	19.46	19.65	19.64	19.78
15	20.52	20.58	20.52	20.58	20.71	20.43	20.18	19.80	19.49	19.65	19.62	19.74
16	20.55	20.53	20.51	20.59	20.71	20.42	20.14	19.83	19.59	19.65	19.62	19.71
17	20.57	20.46	20.48	20.64	20.70	20.41	20.15	19.81	19.63	19.65	19.65	19.74
18	20.52	20.44	20.49	20.65	20.69	20.47	20.18	19.76	19.58	19.65	19.69	19.77
19	20.46	20.48	20.51	20.62	20.70	20.50	20.18	19.74	19.56	19.65	19.72	19.77
20	20.40	20.49	20.59	20.59	20.71	20.51	20.08	19.75	19.57	19.67	19.72	19.79
21	20.36	20.52	20.65	20.58	20.71	20.49	20.07	19.78	19.57	19.67	19.70	19.82
22	20.42	20.56	20.57	20.55	20.70	20.45	20.11	19.79	19.54	19.62	19.68	19.84
23	20.45	20.44	20.54	20.56	20.72	20.46	20.11	19.74	19.49	19.55	19.67	19.78
24	20.43	20.37	20.57	20.63	20.77	20.47	20.06	19.65	19.50	19.52	19.66	19.72
25	20.44	20.41	20.54	20.64	20.79	20.53	20.00	19.60	19.54	19.54	19.66	19.72
26	20.42	20.47	20.51	20.63	20.85	20.53	20.00	19.63	19.52	19.56	19.68	19.75
27	20.43	20.55	20.47	20.54	20.80	20.45	20.03	19.66	19.49	19.59	19.69	19.80
28	20.51	20.58	20.50	20.61	20.78	20.42	20.03	19.62	19.50	19.65	19.69	19.82
29	20.56	20.58	20.54	20.57	---	20.37	20.06	19.59	19.53	19.68	19.67	19.78
30	20.50	20.58	20.54	20.52	---	20.38	20.01	19.57	19.54	19.65	19.65	19.74
31	20.53	---	20.56	20.60	---	20.35	---	19.54	---	19.59	19.67	---
MEAN	20.50	20.48	20.53	20.56	20.71	20.52	20.18	19.81	19.53	19.63	19.66	19.74
MAX	20.76	20.58	20.65	20.69	20.85	20.84	20.37	20.07	19.63	19.68	19.72	19.84
MIN	20.36	20.37	20.46	20.44	20.63	20.35	20.00	19.54	19.45	19.52	19.56	19.67

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-15 (Continued)

WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19.65	19.81	19.83	19.84	19.93	19.94	20.09	20.31	20.25	20.08	20.41	20.59
2	19.65	19.91	19.83	19.84	19.92	19.94	20.09	20.34	20.32	20.20	20.42	20.62
3	19.68	19.90	19.84	19.84	19.97	19.90	20.09	20.35	20.34	20.32	20.46	20.62
4	19.68	19.82	19.81	19.84	20.00	19.86	20.04	20.36	20.32	20.28	20.44	20.61
5	19.73	19.82	19.81	19.84	20.02	19.91	20.13	20.36	20.34	20.23	20.40	20.58
6	19.81	19.86	19.84	19.84	20.05	20.01	20.17	20.39	20.39	20.23	20.39	20.56
7	19.83	19.81	19.84	19.84	20.02	20.04	20.14	20.36	20.39	20.32	20.42	20.57
8	19.82	19.78	19.84	19.84	20.03	20.06	20.18	20.32	20.35	20.32	20.47	20.61
9	19.75	19.79	19.84	19.84	20.04	20.05	20.23	20.31	20.31	20.28	20.49	20.62
10	19.72	19.81	19.83	19.84	20.02	20.01	20.26	20.30	20.32	20.25	20.49	20.62
11	19.75	19.85	19.83	19.84	19.98	20.04	20.22	20.32	20.37	20.28	20.49	20.62
12	19.71	19.83	19.84	19.83	19.94	20.08	20.20	20.37	20.34	20.33	20.49	20.60
13	19.68	19.77	19.83	19.83	19.99	20.09	20.26	20.31	20.29	20.33	20.50	20.57
14	19.71	19.77	19.83	19.84	20.05	20.07	20.27	20.30	20.31	20.28	20.49	20.61
15	19.73	19.83	19.82	19.89	19.97	20.06	20.19	20.30	20.33	20.27	20.49	20.63
16	19.75	19.83	19.83	19.95	19.90	20.08	20.17	20.32	20.33	20.29	20.50	20.69
17	19.78	19.81	19.79	19.94	19.93	20.09	20.21	20.36	20.36	20.28	20.52	20.74
18	19.73	19.77	19.82	19.91	19.99	20.09	20.24	20.36	20.37	20.29	20.55	20.69
19	19.74	19.72	19.93	19.92	19.99	20.04	20.25	20.34	20.40	20.30	20.51	20.61
20	19.82	19.68	19.95	19.95	19.98	20.02	20.28	20.32	20.41	20.30	20.50	20.59
21	19.78	19.69	19.94	19.91	20.05	20.06	20.27	20.32	20.34	20.32	20.51	20.61
22	19.78	19.73	19.92	19.90	20.07	20.09	20.24	20.30	20.13	20.40	20.54	20.61
23	19.86	19.71	19.89	19.91	20.07	20.09	20.23	20.31	20.21	20.45	20.55	20.61
24	19.86	19.71	19.91	19.93	20.09	20.09	20.21	20.33	20.21	20.43	20.52	20.62
25	19.80	19.74	19.92	19.95	20.09	20.09	20.19	20.36	20.22	20.39	20.53	20.66
26	19.84	19.73	19.84	19.90	20.05	20.09	20.18	20.32	20.23	20.34	20.54	20.65
27	19.85	19.78	19.84	19.87	19.95	20.09	20.19	20.31	20.24	20.37	20.53	20.63
28	19.80	19.83	19.91	19.91	19.90	20.09	20.17	20.35	20.24	20.40	20.50	20.61
29	19.81	19.79	19.91	19.92	---	20.09	20.16	20.36	20.22	20.40	20.57	20.61
30	19.79	19.79	19.90	19.90	---	20.09	20.25	20.33	20.17	20.38	20.62	20.62
31	19.75	---	19.87	19.92	---	20.09	---	20.25	---	20.41	20.58	---
MEAN	19.76	19.79	19.86	19.88	20.00	20.04	20.19	20.33	20.30	20.31	20.50	20.62
MAX	19.86	19.91	19.95	19.95	20.09	20.09	20.28	20.39	20.41	20.45	20.62	20.74
MIN	19.65	19.68	19.79	19.83	19.90	19.86	20.04	20.25	20.13	20.08	20.39	20.56

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-15 (Continued)

WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20.61	20.83	20.79	---	---	---	---	---	---	---	---	---
2	20.64	20.77	20.84	---	---	---	---	---	---	---	---	---
3	20.71	20.68	20.81	---	---	---	---	---	---	---	---	---
4	20.73	20.62	20.79	---	---	---	---	---	---	---	---	---
5	20.71	20.64	20.76	---	---	---	---	---	---	---	---	---
6	20.65	20.70	20.74	---	---	---	---	---	---	---	---	---
7	20.67	20.68	20.78	---	---	---	---	---	---	---	---	---
8	20.74	20.68	20.82	---	---	---	---	---	---	---	---	---
9	20.75	20.70	20.84	---	---	---	---	---	---	---	---	---
10	20.72	20.70	20.82	---	---	---	---	---	---	---	---	---
11	20.67	20.68	20.77	---	---	---	---	---	---	---	---	---
12	20.61	20.65	20.81	---	---	---	---	---	---	---	---	---
13	20.61	20.68	20.86	---	---	---	---	---	---	---	---	21.50
14	20.61	20.75	20.86	---	---	---	---	---	---	---	---	21.54
15	20.59	20.76	20.86	---	---	---	---	---	---	---	---	21.47
16	20.58	20.67	20.86	---	---	---	---	---	---	---	---	21.49
17	20.61	20.65	20.84	---	---	---	---	---	---	---	---	21.54
18	20.61	20.76	20.83	---	---	---	---	---	---	---	---	21.47
19	20.61	20.80	20.85	---	---	---	---	---	---	---	---	21.43
20	20.59	20.79	20.86	---	---	---	---	---	---	---	---	21.42
21	20.58	20.84	---	---	---	---	---	---	---	---	---	21.43
22	20.69	20.87	---	---	---	---	---	---	---	---	---	21.48
23	20.67	20.84	---	---	---	---	---	---	---	---	---	21.44
24	20.66	20.77	---	---	---	---	---	---	---	---	---	21.43
25	20.66	20.75	---	---	---	---	---	---	---	---	---	21.51
26	20.67	20.79	---	---	---	---	---	---	---	---	---	21.52
27	20.76	20.78	---	---	---	---	---	---	---	---	---	21.55
28	20.79	20.82	---	---	---	---	---	---	---	---	---	21.55
29	20.80	20.85	---	---	---	---	---	---	---	---	---	21.56
30	20.73	20.80	---	---	---	---	---	---	---	---	---	21.54
31	20.81	---	---	---	---	---	---	---	---	---	---	---
MEAN	20.67	20.74	---	---	---	---	---	---	---	---	---	---
MAX	20.81	20.87	---	---	---	---	---	---	---	---	---	---
MIN	20.58	20.62	---	---	---	---	---	---	---	---	---	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

E-15 (Continued)

DAY	WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21.53	21.42	21.67	21.74	21.81	21.81	---	---	---	---	---	---
2	21.49	21.42	21.61	21.71	21.79	21.81	---	---	---	---	---	---
3	21.46	21.42	21.66	21.68	21.78	21.81	---	---	---	---	---	---
4	21.54	21.42	21.62	21.78	21.76	21.81	---	---	---	---	---	---
5	21.56	21.42	21.60	21.75	21.74	21.81	---	---	---	---	---	---
6	21.55	21.43	21.67	21.68	21.80	21.81	---	---	---	---	---	---
7	21.51	21.46	21.66	21.75	21.80	21.81	---	---	---	---	---	---
8	21.44	21.43	21.66	21.77	21.77	21.81	---	---	---	---	---	---
9	21.50	21.47	21.60	21.74	21.77	21.81	---	---	---	---	---	---
10	21.52	21.55	21.60	21.68	21.77	21.80	---	---	---	---	---	---
11	21.54	21.57	21.59	21.68	21.77	21.76	---	---	---	---	---	---
12	21.46	21.62	21.60	21.72	21.80	21.71	---	---	---	---	---	---
13	21.51	21.64	21.65	21.73	21.81	21.79	---	---	---	---	---	---
14	21.54	21.62	21.62	21.71	21.81	21.80	---	---	---	---	---	---
15	21.56	21.60	21.66	21.68	21.81	21.76	---	---	---	---	---	---
16	21.55	21.59	21.66	21.68	21.79	21.79	---	---	---	---	---	---
17	21.54	21.59	21.60	21.73	21.75	21.81	---	---	---	---	---	---
18	21.46	21.59	21.62	21.79	21.69	21.81	---	---	---	---	---	---
19	21.47	21.59	21.66	21.79	21.68	21.81	---	---	---	---	---	---
20	21.47	21.60	21.67	21.76	21.74	21.79	---	---	---	---	---	---
21	21.50	21.59	21.67	21.78	21.80	21.79	---	---	---	---	---	---
22	21.56	21.63	21.76	21.78	21.80	21.79	---	---	---	---	---	---
23	21.59	21.64	21.74	21.80	21.77	---	---	---	---	---	---	---
24	21.55	21.65	21.75	21.81	21.79	---	---	---	---	---	---	---
25	21.55	21.68	21.78	21.81	21.80	---	---	---	---	---	---	---
26	21.54	21.68	21.74	21.81	21.78	---	---	---	---	---	---	---
27	21.55	21.74	21.71	21.81	21.79	---	---	---	---	---	---	---
28	21.51	21.69	21.63	21.80	21.79	---	---	---	---	---	---	---
29	21.43	21.68	21.64	21.77	---	---	---	---	---	---	---	---
30	21.42	21.68	21.68	21.80	---	---	---	---	---	---	---	---
31	21.42	---	21.75	21.81	---	---	---	---	---	---	---	---
MEAN	21.51	21.57	21.66	21.75	21.78	---	---	---	---	---	---	---
MAX	21.59	21.74	21.78	21.81	21.81	---	---	---	---	---	---	---
MIN	21.42	21.42	21.59	21.68	21.68	---	---	---	---	---	---	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

MC-1 (Mission Canyon Limestone)

WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	41.94	42.56	42.58	42.22	42.99	40.45	35.84	30.89	34.16	37.25	39.38
2	---	41.99	42.60	42.61	41.77	43.00	39.98	36.05	31.04	34.22	37.36	39.42
3	---	41.96	42.63	42.68	41.99	43.01	39.40	36.03	31.15	34.34	37.47	39.49
4	---	41.90	42.61	42.76	42.23	43.00	38.74	35.94	31.18	34.50	37.57	39.54
5	---	41.86	42.59	42.82	42.45	43.01	38.09	35.74	31.25	34.60	37.65	39.56
6	---	41.87	42.57	42.88	42.60	43.05	37.51	35.54	31.33	34.68	37.72	39.61
7	---	41.90	42.60	42.93	42.71	43.06	37.15	35.46	31.42	34.81	37.79	39.66
8	---	41.97	42.65	42.95	42.80	43.03	36.87	35.52	31.55	34.94	37.88	39.70
9	---	42.05	42.68	42.99	42.90	43.02	36.79	35.60	31.66	35.03	37.97	39.76
10	---	42.09	42.74	43.02	42.96	43.04	36.82	35.61	31.72	35.15	38.04	39.80
11	---	42.11	42.78	43.06	43.02	43.04	36.79	35.66	31.78	35.27	38.11	39.84
12	---	42.13	42.26	43.12	43.06	43.03	36.71	35.73	31.90	35.34	38.16	39.87
13	---	42.17	41.81	43.08	43.13	43.05	36.71	35.81	32.13	35.41	38.22	39.94
14	---	42.21	41.98	43.00	43.04	43.05	36.70	35.86	32.34	35.50	38.28	40.00
15	---	42.27	42.14	42.99	42.83	43.05	36.71	35.88	32.43	35.59	38.33	40.03
16	---	42.35	42.29	42.99	42.73	43.04	36.67	35.88	32.52	35.67	38.40	40.07
17	---	42.36	42.38	43.04	42.78	43.05	36.52	35.79	32.65	---	38.48	40.13
18	41.66	42.34	42.44	43.10	42.91	43.03	36.25	35.65	32.79	---	38.56	40.18
19	41.61	42.33	42.31	42.94	43.06	43.02	36.08	35.59	32.91	35.95	38.64	40.22
20	41.59	42.35	41.97	42.76	43.11	42.95	35.84	35.58	33.03	36.07	38.69	40.28
21	41.57	42.37	41.94	42.81	43.10	42.83	35.53	35.61	33.14	36.19	38.73	40.35
22	41.57	42.41	42.07	42.90	43.09	42.68	35.20	35.64	33.23	36.30	38.79	40.40
23	41.61	42.47	41.98	42.97	43.05	42.65	34.94	35.62	33.32	36.38	38.86	40.41
24	41.64	42.45	41.98	43.09	43.03	42.56	34.85	35.58	33.49	36.47	38.92	40.42
25	41.63	42.43	42.09	43.14	43.02	41.91	34.95	35.34	33.62	36.57	38.98	40.46
26	41.66	42.46	42.17	43.14	42.98	41.68	35.07	34.53	33.70	36.69	39.05	40.52
27	41.68	42.51	42.24	43.22	43.00	41.50	35.23	32.82	33.78	36.82	39.11	40.59
28	41.71	42.58	42.30	43.23	43.01	41.38	35.31	31.28	33.89	36.95	39.16	40.64
29	41.81	42.62	42.38	43.19	---	41.19	35.48	30.89	34.01	37.07	39.21	40.66
30	41.88	42.59	42.46	43.09	---	40.97	35.66	30.84	34.09	37.14	39.25	40.70
31	41.89	---	42.53	42.95	---	40.76	---	30.83	---	37.18	39.32	---
MEAN	---	42.23	42.35	42.97	42.81	42.60	36.63	34.96	32.46	---	38.39	40.05
MAX	---	42.62	42.78	43.23	43.13	43.06	40.45	36.05	34.09	---	39.32	40.70
MIN	---	41.86	41.81	42.58	41.77	40.76	34.85	30.83	30.89	---	37.25	39.38

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

MC-1 (Continued)

WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40.74	41.04	41.65	41.91	42.92	43.25	43.74	41.85	39.26	33.51	36.77	39.16
2	40.74	41.13	41.70	42.01	42.91	43.06	43.72	41.70	39.31	33.47	36.90	39.27
3	40.80	41.17	41.74	42.09	42.91	43.01	43.72	41.46	39.32	33.46	36.99	39.32
4	40.85	41.18	41.69	42.16	42.93	43.07	43.71	41.28	39.32	33.47	37.05	39.36
5	40.91	41.21	41.71	42.25	42.95	43.16	43.71	41.13	39.22	33.56	37.16	39.38
6	40.99	41.21	41.79	42.32	42.98	43.29	43.70	40.99	38.46	33.73	37.25	39.42
7	41.05	41.13	41.83	42.37	42.99	43.37	43.74	40.86	37.26	33.86	37.33	39.47
8	41.10	41.11	41.87	42.43	43.01	43.43	43.77	40.53	36.00	33.97	37.37	39.56
9	41.11	41.14	41.91	42.45	43.04	43.46	43.78	40.05	35.43	34.07	37.42	39.62
10	41.12	41.15	41.93	42.47	43.05	43.47	43.76	39.56	35.23	34.22	37.50	39.65
11	41.17	41.18	41.93	42.50	43.05	43.51	43.60	39.04	35.17	34.38	37.60	39.70
12	41.12	41.19	41.95	42.48	43.05	43.54	43.42	38.20	35.20	34.50	37.69	39.75
13	41.04	41.16	41.99	42.45	43.10	43.56	43.37	36.96	35.27	34.59	37.76	39.79
14	41.04	41.18	42.01	42.45	43.15	43.57	43.38	36.58	35.38	34.67	37.85	39.87
15	41.04	41.27	42.03	42.46	43.15	43.57	43.42	36.71	35.52	34.80	37.95	39.94
16	41.04	41.33	42.03	42.48	43.15	43.59	43.45	36.92	35.68	34.91	38.05	40.02
17	41.04	41.34	42.02	42.48	43.17	43.61	43.44	37.11	35.85	35.03	38.14	40.10
18	41.04	41.36	41.94	42.47	43.21	43.61	43.38	37.23	35.99	35.16	38.19	40.14
19	40.84	41.37	41.82	42.49	43.22	43.59	43.32	37.36	36.13	35.29	38.25	40.15
20	40.68	41.39	41.75	42.53	43.23	43.56	43.26	37.47	36.28	35.40	38.32	40.19
21	40.71	41.46	41.75	42.54	43.27	43.56	43.22	37.63	36.31	35.58	38.39	40.27
22	40.76	41.56	41.12	42.56	43.29	43.58	43.19	37.84	36.28	35.74	38.46	40.32
23	40.80	41.59	40.71	42.59	43.30	43.62	43.16	38.06	36.27	35.85	38.51	40.39
24	40.85	41.64	41.10	42.64	43.34	43.64	43.12	38.19	36.16	35.92	38.58	40.43
25	40.88	41.71	41.36	42.70	43.38	43.64	43.04	38.37	34.91	35.99	38.65	40.45
26	40.91	41.75	41.49	42.72	43.40	43.65	42.71	38.56	34.35	36.10	38.72	40.48
27	40.95	41.79	41.60	42.74	43.36	43.68	42.34	38.71	34.12	36.23	38.78	40.50
28	40.95	41.75	41.75	42.80	43.34	43.70	42.11	38.82	33.96	36.34	38.91	40.54
29	40.97	41.64	41.83	42.84	---	43.71	41.95	38.88	33.84	36.44	39.02	40.62
30	40.98	41.61	41.78	42.87	---	43.74	41.89	39.02	33.65	36.56	39.06	40.61
31	40.98	---	41.79	42.90	---	43.75	---	39.17	---	36.66	39.09	---
MEAN	40.94	41.36	41.73	42.49	43.14	43.50	43.27	38.91	36.17	34.95	37.99	39.95
MAX	41.17	41.79	42.03	42.90	43.40	43.75	43.78	41.85	39.32	36.66	39.09	40.62
MIN	40.68	41.04	40.71	41.91	42.91	43.01	41.89	36.58	33.65	33.46	36.77	39.16

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

MC-1 (Continued)

WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40.62	41.20	42.06	42.90	43.36	43.68	43.91	43.91	43.94	43.57	43.35	44.28
2	40.66	41.21	42.10	42.85	43.40	43.69	43.87	43.95	43.93	43.57	43.37	44.28
3	40.73	41.25	42.07	42.84	43.41	43.69	43.85	43.95	43.95	43.55	43.38	44.29
4	40.78	41.32	42.03	42.85	43.42	43.70	43.84	43.93	43.97	43.51	43.42	44.30
5	40.82	41.37	42.01	42.87	43.44	43.71	43.86	43.91	44.00	43.49	43.48	44.35
6	40.82	41.38	42.04	42.93	43.47	43.71	43.91	43.87	44.02	43.50	43.51	44.38
7	40.84	41.38	42.13	42.97	43.47	43.74	43.93	43.84	44.02	43.54	43.57	44.38
8	40.91	41.39	42.20	42.97	43.46	43.77	43.95	43.83	44.02	43.56	43.64	44.40
9	40.93	41.43	42.24	42.97	43.48	43.75	43.95	43.79	44.02	43.55	43.72	44.43
10	40.93	41.44	42.29	42.97	43.50	43.70	43.98	43.80	44.02	43.51	43.78	44.44
11	40.92	41.44	42.34	43.01	43.50	43.67	44.01	43.87	44.02	43.47	43.82	44.45
12	40.94	41.45	42.43	43.04	43.48	43.67	44.02	43.92	44.02	43.43	43.84	44.45
13	40.97	41.51	42.51	43.07	43.47	43.67	44.02	43.92	44.02	43.37	43.86	---
14	40.96	41.58	42.51	42.80	43.47	43.66	44.01	43.91	44.04	43.32	43.88	---
15	40.93	41.60	42.50	42.64	43.49	43.67	43.99	43.91	44.05	43.28	43.89	---
16	40.97	41.60	42.48	42.84	43.55	43.69	43.94	43.94	44.02	43.25	43.93	44.59
17	41.08	41.68	42.43	42.94	43.61	43.71	43.91	43.94	44.02	43.19	43.95	44.62
18	41.12	41.77	42.44	43.02	43.62	43.74	43.97	43.92	44.02	43.15	43.96	44.62
19	41.14	41.80	42.50	43.08	43.61	43.76	44.02	43.89	44.02	43.12	43.98	44.64
20	41.11	41.84	42.50	43.10	43.60	43.77	44.02	43.89	44.02	43.11	44.00	44.64
21	41.06	41.93	42.53	43.14	43.57	43.78	43.98	43.93	43.99	43.09	44.01	44.64
22	41.00	41.98	42.59	43.17	43.55	43.79	43.99	43.96	43.87	43.07	44.05	44.67
23	40.76	41.96	42.62	43.20	43.56	43.82	44.03	43.95	43.81	43.07	44.10	44.66
24	40.05	41.90	42.65	43.23	43.59	43.84	44.05	43.95	43.75	43.10	44.14	44.62
25	40.01	41.87	42.69	43.24	43.61	43.84	44.03	43.96	43.73	43.13	44.16	44.61
26	40.00	41.91	42.72	43.25	43.63	43.83	43.97	43.92	43.68	43.14	44.18	44.63
27	40.23	41.94	42.74	43.26	43.64	43.85	43.94	43.93	43.71	43.18	44.19	44.64
28	40.82	42.00	42.78	43.29	43.65	43.89	43.91	43.93	43.91	43.21	44.21	44.68
29	40.86	42.06	42.85	43.31	43.66	43.91	43.86	43.93	43.63	43.23	44.24	44.66
30	41.09	42.04	42.91	43.30	---	43.93	43.85	43.96	43.56	43.27	44.26	44.66
31	41.20	---	42.94	43.31	---	43.94	---	43.97	---	43.30	44.26	---
MEAN	40.81	41.64	42.45	43.04	43.53	43.76	43.95	43.91	43.93	43.32	43.88	---
MAX	41.20	42.06	42.94	43.31	43.66	43.94	44.05	43.97	44.05	43.57	44.26	---
MIN	40.00	41.20	42.01	42.64	43.36	43.66	43.84	43.79	43.56	43.07	43.35	---

Table 5.--Water levels in wells with recorders, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

MC-1 (Continued)

WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993												
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	44.66	44.86	44.98	45.03	45.07	45.04	---	---	---	---	---	---
2	44.64	44.89	45.03	45.03	45.08	45.04	---	---	---	---	---	---
3	44.61	44.95	44.93	45.03	45.11	45.04	---	---	---	---	---	---
4	44.56	44.99	44.94	45.06	45.13	45.04	---	---	---	---	---	---
5	44.60	45.00	44.85	45.11	45.13	45.03	---	---	---	---	---	---
6	44.62	45.02	44.81	45.17	45.11	44.99	---	---	---	---	---	---
7	44.64	45.02	44.78	45.19	45.11	44.98	---	---	---	---	---	---
8	44.64	45.02	44.85	45.18	45.11	44.94	---	---	---	---	---	---
9	44.63	45.02	44.91	45.22	45.10	44.93	---	---	---	---	---	---
10	44.66	45.05	45.00	45.23	45.14	44.93	---	---	---	---	---	---
11	44.67	45.07	45.03	45.23	45.11	44.93	---	---	---	---	---	---
12	44.69	45.12	45.09	45.28	44.84	44.94	---	---	---	---	---	---
13	44.67	45.15	45.14	45.32	44.81	44.93	---	---	---	---	---	---
14	44.71	45.15	45.12	45.36	44.89	44.90	---	---	---	---	---	---
15	44.74	45.15	45.09	45.37	44.97	44.90	---	---	---	---	---	---
16	44.78	45.14	45.13	45.35	44.91	44.88	---	---	---	---	---	---
17	44.79	45.13	45.14	45.32	44.70	44.73	---	---	---	---	---	---
18	44.81	45.13	45.12	45.29	44.28	44.41	---	---	---	---	---	---
19	44.81	45.13	45.09	45.24	44.17	44.45	---	---	---	---	---	---
20	44.79	45.13	45.04	45.19	44.31	44.55	---	---	---	---	---	---
21	44.79	45.16	44.78	45.17	44.46	44.55	---	---	---	---	---	---
22	44.79	45.16	44.86	45.18	44.59	44.47	---	---	---	---	---	---
23	44.83	45.19	45.00	45.18	44.71	---	---	---	---	---	---	---
24	44.84	45.23	44.98	45.17	44.81	---	---	---	---	---	---	---
25	44.83	45.22	45.06	45.09	44.88	---	---	---	---	---	---	---
26	44.81	45.07	45.09	45.06	44.96	---	---	---	---	---	---	---
27	44.81	44.81	45.12	45.02	45.01	---	---	---	---	---	---	---
28	44.84	44.81	45.20	45.02	45.02	---	---	---	---	---	---	---
29	44.84	44.92	45.18	45.05	---	---	---	---	---	---	---	---
30	44.84	44.94	45.08	45.07	---	---	---	---	---	---	---	---
31	44.83	---	45.03	45.07	---	---	---	---	---	---	---	---
MEAN	44.73	45.05	45.01	45.17	44.88	---	---	---	---	---	---	---
MAX	44.84	45.23	45.20	45.37	45.14	---	---	---	---	---	---	---
MIN	44.56	44.81	44.78	45.02	44.17	---	---	---	---	---	---	---

Table 6.--Specific capacity of monitoring wells, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Geologic unit: Kev, Virgelle Sandstone Member of Eagle Sandstone; Kfc, First Cat Creek sandstone of Colorado Group; Ktc, Third Cat Creek sandstone of Kootenai Formation; Mmc, Mission Canyon Limestone]

Site number	Discharge (gallons per minute)	Drawdown (feet)	Specific capacity (gallons per minute per foot)	Geologic unit
C-1	1.42	9.16	0.16	Kfc
E-12	22.2	37.47	.59	Kev
E-13	1.46	3.80	.38	Kev
E-14	1.40	4.32	.32	Kev
E-15	16.0	60.75	.26	Kev
E-18	1.48	5.63	.26	Kev
E-21	1.50	20.81	.07	Kev
E-23	1.46	2.61	.56	Kev
E-25	1.30	64.27	.02	Kev
E-26	1.28	11.47	.11	Kev
E-27	1.36	4.91	.28	Kev
K-1	1.45	17.85	.08	Ktc
MC-1	62.0	13.38	4.6	Mmc
MC-2	1.42	3.24	.44	Mmc
MC-3	66.0	18.19	3.6	Mmc
MC-6	30.4	87.54	.35	Mmc

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana

[--, no data or not applicable]

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>C-1 Test¹</u>					
<u>Pumped well C-1</u>					
06-09-89	--	0	0.96	0	--
		.5	3.43	2.47	--
		1.0	5.00	4.04	1.36
		1.5	5.56	4.60	--
		2.0	6.12	5.16	--
		2.5	6.39	5.43	--
		3.0	6.58	5.62	--
		3.5	6.76	5.80	--
		4.0	6.81	5.85	--
		4.5	6.86	5.90	--
		5.0	6.93	5.97	1.40
		6.0	7.05	6.09	--
		7.0	7.19	6.23	--
		8.0	7.33	6.37	--
		9.0	7.45	6.49	--
		10	7.54	6.58	1.40
		12	7.72	6.76	--
		14	7.87	6.91	--
		15	--	--	1.43
		16	8.01	7.05	--
		18	8.15	7.19	--
		20	8.25	7.29	1.43
		25	8.47	7.51	1.41
		30	8.67	7.71	1.43
		35	8.85	7.89	--
		40	8.99	8.03	1.43
		45	9.12	8.16	--
		50	9.23	8.27	1.43
		60	9.44	8.48	1.43
		70	9.65	8.69	1.41
		80	9.82	8.86	1.41
		90	9.99	9.03	1.41
		98	--	--	1.41
		99.5	10.12	9.16	--
<u>E-2 Test²</u>					
<u>Flowing well E-2</u>					
06-07-89	0950	0	+16.20	--	--
		.23	--	--	8.57
		.75	--	--	8.00
		1.3	--	--	7.50
		1.8	--	--	7.06
		2.3	--	--	7.06
		2.8	--	--	7.06
		3.3	--	--	6.67
		3.8	--	--	6.67
		4.3	--	--	6.32
		4.8	--	--	6.32
		5.3	--	--	6.32
		6.3	--	--	6.32
		7.3	--	--	6.32
		8.3	--	--	6.32
		9.3	--	--	6.32
		10	--	--	6.32
		12	--	--	6.00
		14	--	--	6.00
		16	--	--	6.00
		18	--	--	6.00
		20	--	--	5.85
		25	--	--	5.71

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>E-2 Test--Continued</u>					
<u>Flowing well E-2--Continued</u>					
		30	--	--	5.71
		35	--	--	5.58
		40	--	--	5.45
		50	--	--	5.45
		60	--	--	5.33
		80	--	--	5.22
		100	--	--	5.22
		120	--	--	5.00
		140	--	--	5.00
		160	--	--	5.00
		170	--	--	5.00
<u>E-12 Test¹</u>					
<u>Pumped well E-12</u>					
09-20-89	0836	--	21.86	--	--
	1020	0	21.86	0	--
		3.0	36.80	14.94	--
		6.0	43.70	21.84	--
		9.0	54.06	32.20	22.2
		10.5	59.20	37.34	--
		12	60.10	38.24	--
		14	60.59	38.73	--
		16	60.96	39.10	--
		18	61.30	39.44	--
		20	61.60	39.74	--
		22	61.91	40.04	--
		24	62.20	40.34	--
		26	62.56	40.70	--
		28	62.83	40.97	--
		30	63.20	41.34	--
		35	63.60	41.74	--
		37	63.93	42.07	--
		40	64.15	42.29	--
		45	64.96	43.10	--
		50	64.97	43.11	--
		55	65.45	43.59	--
		60	65.72	43.86	--
		65	66.30	44.44	--
		67	66.36	44.50	--
		70	66.39	44.53	--
		75	66.77	44.91	--
		81	66.86	45.00	--
		90	67.33	45.47	--
		100	67.99	46.03	--
		120	68.63	46.77	--
		140	69.34	47.48	--
		161	69.59	47.73	--
		168	70.20	48.34	--
		180	71.06	49.20	--
		200	71.59	49.73	--
		220	71.86	50.00	--
		240	72.35	50.49	--
		260	72.65	50.79	--
		280	72.39	50.53	--
		281	72.69	50.83	--
		286	72.78	50.92	--
		300	72.98	51.12	--
		350	73.65	51.79	--
		360	73.92	52.06	--
		400	74.20	52.34	--
		402	74.35	52.49	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>E-12 Test</u> --Continued					
<u>Pumped well E-12</u> --Continued					
		407	74.86	53.00	--
		450	75.10	53.24	--
		500	75.91	54.05	--
		550	76.33	54.47	--
		600	77.04	55.18	--
		650	77.10	55.24	--
		655	77.13	55.27	--
		700	77.46	55.60	--
		725	78.00	56.14	--
		750	78.06	56.20	--
		760	78.24	56.38	--
		800	78.36	56.50	--
09-21-89		900	78.69	56.83	--
		920	79.10	57.24	--
		1,000	79.68	57.82	--
		1,100	80.06	58.20	--
		1,200	80.62	58.76	--
		1,400	81.11	59.25	22.2
		1,440	81.19	59.33	--
<u>E-15 Test</u> ¹					
<u>Pumped well E-15</u>					
09-21-89	1500	--	22.46	--	--
	1555	--	22.40	--	--
09-22-89	0845	--	23.16	--	--
	0900	--	23.15	--	--
	0910	0	23.15	0	--
		1.0	26.90	3.75	16.0
		2.0	32.80	9.65	--
		7.0	56.00	32.85	--
		9.0	57.50	34.35	--
		12	58.68	35.53	--
		14	59.29	36.14	--
		16	59.82	36.67	--
		18	60.33	37.18	--
		20	60.72	37.57	--
		22	61.28	38.13	--
		24	61.80	38.65	--
		26	62.03	38.88	--
		28	62.35	39.20	--
		30	62.59	39.44	--
		35	63.32	40.17	--
		40	63.91	40.76	--
		45	64.62	41.47	--
		50	65.05	41.90	--
		55	65.84	42.69	--
		60	66.25	43.10	--
		66	66.67	43.52	--
		71	67.19	44.04	--
		75	67.40	44.25	--
		80	67.96	44.81	--
		90	68.62	45.47	--
		100	69.34	46.19	--
		110	69.97	46.82	--
		120	70.56	47.41	--
		130	70.81	47.66	--
		140	71.59	48.44	--
		164	72.86	49.71	--
		170	73.11	49.96	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>E-15 Test</u> --Continued					
<u>Pumped well E-15</u> --Continued					
		180	73.59	50.44	--
		200	74.54	51.39	--
		220	75.19	52.04	--
		246	75.91	52.76	--
		260	76.55	53.40	--
		285	77.50	54.35	--
		300	77.96	54.81	--
		350	79.29	56.14	--
		402	80.60	57.45	--
		453	81.79	58.64	--
		500	83.15	60.00	--
<u>K-1 Test</u> ¹					
<u>Pumped well K-1</u>					
06-09-89	--	0	1.16	0	--
		.5	5.15	3.99	--
		1.0	8.90	7.74	1.41
		1.5	10.87	9.71	--
		2.0	12.73	11.57	--
		2.5	13.95	12.79	--
		3.0	14.81	13.65	--
		3.5	15.37	14.21	--
		4.0	15.78	14.62	--
		4.5	16.10	14.94	--
		5.0	16.19	15.03	1.52
		6.0	16.35	15.19	--
		7.0	16.77	15.61	--
		8.0	17.15	15.99	--
		9.0	17.34	16.18	--
		10	16.60	15.44	1.46
		12	16.15	14.99	--
		14	16.35	15.19	--
		15	--	--	1.48
		16	16.62	15.46	--
		18	16.79	15.63	--
		20	16.90	15.74	1.46
		25	16.99	15.83	1.46
		30	16.96	15.80	1.43
		35	17.14	15.98	1.43
		40	17.31	16.15	1.43
		45	17.62	16.46	--
		50	17.94	16.78	1.43
		55	18.11	16.95	--
		60	18.33	17.17	1.46
		70	18.66	17.50	1.46
		80	18.90	17.74	1.46
		90	19.04	17.88	1.45
		98	--	--	1.45
		99.5	19.01	17.85	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>MC-1 Test¹</u>					
<u>Pumped well MC-1</u>					
07-17-90	1208	0	35.73	0	--
		.33	41.70	5.97	60.8
		.50	42.15	6.42	--
		1.0	46.01	10.28	--
		1.5	46.40	10.67	--
		2.0	46.35	10.62	--
		2.5	46.41	10.68	--
		3.0	46.54	10.81	60.8
		3.5	46.64	10.91	--
		4.0	46.77	11.04	--
		4.5	46.88	11.15	--
		5.0	46.95	11.22	--
		6.0	47.10	11.37	--
		7.0	47.23	11.50	--
		8.0	47.37	11.64	--
		9.0	47.45	11.72	--
		11	47.62	11.89	--
		12	47.68	11.95	--
		14	47.80	12.07	--
		16	47.90	12.17	--
		18	47.86	12.13	--
		20	48.00	12.27	--
		25	48.04	12.31	61.0
		30	48.16	12.43	--
		35	48.24	12.51	--
		40	48.61	12.88	63.0
		45	48.47	12.74	62.0
		50	48.52	12.79	62.0
		55	48.57	12.84	62.0
		60	48.62	12.89	62.0
		70	48.64	12.91	62.0
		80	48.70	12.97	62.0
		90	48.76	13.03	62.0
		100	48.80	13.07	62.0
		110	48.81	13.08	62.0
		120	48.86	13.13	62.0
		140	49.00	13.27	62.0
		160	48.91	13.18	61.0
		180	49.00	13.27	62.0
		200	49.04	13.31	62.0
		220	49.09	13.36	62.0
		240	49.11	13.38	62.0
<u>MC-3 Test¹</u>					
<u>Pumped well MC-3</u>					
07-18-90	0840	--	13.35	--	--
	0930	0	13.36	0	--
		.33	22.86	9.50	65.7
		.50	23.45	10.09	--
		.87	23.14	9.78	--
		1.0	22.75	9.39	--
		1.5	22.80	9.44	--
		2.0	22.96	9.60	--
		2.5	23.09	9.73	--
		3.0	23.20	9.84	--
		3.5	23.30	9.94	--
		4.0	23.35	9.99	66.0
		4.5	23.43	10.07	--
		5.0	23.51	10.15	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>MC-3 Test--Continued</u>					
<u>Pumped well MC-3--Continued</u>					
		6.0	23.64	10.28	--
		7.0	23.74	10.38	--
		8.0	23.85	10.49	--
		9.0	23.92	10.56	--
		10	24.03	10.67	--
		12	24.15	10.79	--
		14	24.35	10.99	66.0
		16	24.47	11.11	--
		18	24.62	11.26	--
		20	24.79	11.43	66.0
		25	25.03	11.67	--
		30	25.28	11.92	66.0
		35	25.51	12.15	--
		40	25.74	12.38	66.0
		45	25.94	12.58	66.0
		50	26.37	13.01	66.0
		55	26.56	13.20	--
		60	26.73	13.37	66.0
		70	27.11	13.75	66.0
		80	27.39	14.03	66.0
		90	27.69	14.33	66.0
		100	27.84	14.48	65.0
		110	28.15	14.79	66.0
		120	28.32	14.96	66.0
		140	28.68	15.32	66.0
		160	29.07	15.71	66.0
		180	29.48	16.12	66.0
		200	29.90	16.54	--
		220	30.25	16.89	66.0
		240	30.55	17.19	--
<u>MC-6 Test¹</u>					
<u>Pumped well MC-6</u>					
11-19-91	1500	--	32.83	--	--
11-20-91	0840	--	32.80	--	--
	0920	0	32.80	0	30.4
		1.0	--	--	--
		2.0	62.80	30.00	30.4
		3.0	71.20	38.40	--
		4.0	74.28	41.48	--
		5.0	86.85	54.05	--
		6.0	88.88	56.08	--
		7.0	91.50	58.70	--
		8.0	93.90	61.10	--
		10	98.55	65.75	--
		12	101.67	68.87	--
		14	95.26	62.46	--
		16	96.33	63.53	--
		18	97.79	64.99	--
		20	99.22	66.42	30.4
		22	100.27	67.47	--
		25	101.20	68.40	--
		34	104.47	71.67	--
		40	105.68	72.88	--
		47	106.38	73.58	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>MC-6 Test--Continued</u>					
<u>Pumped well MC-6--Continued</u>					
		50	106.65	73.85	--
		55	108.96	76.16	--
		60	108.65	75.85	30.4
		65	109.69	76.89	--
		70	108.10	75.30	--
		75	108.30	75.50	--
		80	108.90	76.10	--
		90	108.35	75.55	--
		100	109.73	76.93	30.4
		110	111.79	78.99	--
		120	113.35	80.55	--
		140	114.55	81.75	--
		160	115.22	82.42	--
		180	116.06	83.26	--
		200	116.00	83.20	--
		220	115.97	83.17	30.4
		240	115.84	83.04	--
		260	115.02	82.22	--
		280	116.82	84.02	--
		300	116.28	83.48	--
		346	³ 115.15	82.35	--
		360	116.30	83.50	30.4
		390	117.13	84.33	--
		420	117.03	84.23	--
		450	118.96	86.16	30.4
		480	121.35	88.55	29.4
		510	121.50	88.70	29.4
		540	120.34	87.54	29.4
 <u>Observation well MC-3</u> (35 ft from well MC-6)					
11-20-91	0840	--	33.55	--	--
	0920	0	33.55	0	--
		1.0	34.03	.48	--
		2.0	34.20	.65	--
		3.0	34.40	.85	--
		4.0	34.42	.87	--
		5.0	34.50	.95	--
		6.0	34.58	1.03	--
		7.0	34.65	1.10	--
		8.0	34.72	1.17	--
		10	34.81	1.26	--
		12	34.91	1.36	--
		14	35.00	1.45	--
		16	35.07	1.52	--
		18	35.15	1.60	--
		20	35.21	1.66	--
		22	35.27	1.72	--
		25	35.35	1.80	--
		30	35.49	1.94	--
		35	35.63	2.08	--
		40	35.74	2.19	--
		45	35.85	2.30	--
		50	35.97	2.42	--
		55	36.06	2.51	--
		60	36.17	2.62	--
		65	36.28	2.73	--

Table 7.--Aquifer-test data, northwest flank of the Little Rocky Mountains,
Fort Belknap Indian Reservation, north-central Montana--Continued

Date	Hour	Time after start of test (minutes)	Depth to water below or above (+) measuring point	Drawdown (feet)	Discharge (gallons per minute)
<u>MC-6 Test--Continued</u>					
<u>Observation well MC-3--Continued</u>					
		70	36.33	2.78	--
		75	36.39	2.84	--
		80	36.44	2.89	--
		90	36.52	2.97	--
		100	36.61	3.06	--
		110	36.71	3.16	--
		120	36.80	3.25	--
		140	36.98	3.43	--
		160	37.16	3.61	--
		180	37.32	3.77	--
		200	37.50	3.95	--
		220	37.63	4.08	--
		240	37.81	4.26	--
		265	38.00	4.45	--
		280	38.15	4.60	--
		300	38.35	4.80	--
		340	¹ 38.35	4.80	--
		360	38.58	5.03	--
		390	38.85	5.30	--
		420	39.08	5.53	--
		450	39.25	5.70	--
		480	39.45	5.90	--
		510	39.66	6.11	--
		540	39.88	6.33	--

¹Constant-discharge test (Cooper and Jacob, 1946).

²Constant-drawdown test (Cooper and Jacob, 1946).

³Pump off for 5 minutes to repair valve (310-315 minutes).

Table 8.--Physical properties and dissolved-constituent concentrations of water, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Analyses by Montana Bureau of Mines and Geology. Geologic unit--Kev, Virgelle Sandstone Member of Eagle Sandstone; Kfc, First Cat Creek sandstone of Colorado Group; Ktc, Third Cat Creek sandstone of Kootenai Formation; Mmc, Mission Canyon Limestone; Ml, Lodgepole Limestone. Abbreviations: °C, degrees Celsius; mg/L, milligrams per liter; fet, fixed-endpoint titration; fld, field (onsite) measurement; lab, laboratory; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C. Symbols: <, less than detection limit for analytical method used; --, no data; ND, not detected]

Site number	Geologic unit	Date	Specific conductance, fld (µS/cm)	pH, fld (standard units)	Temperature, water (°C)	Dissolved oxygen, fld (mg/L)	Hardness, total (mg/L as CaCO ₃)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium-adsorption ratio	Potassium, dissolved (mg/L as K)
C-1	Kfc	10-03-88	1,850	--	10.0	--	22	5.2	2.2	440	40	2.4
E-2	Kev	10-01-88	1,340	--	10.5	0.2	90	16	12	290	13	2.1
E-3	Kev	10-01-88	1,060	--	10.5	--	490	93	62	60	1	3.4
E-4	Kev	10-02-88	--	--	--	4.7	350	64	47	20	.5	2.7
E-7	Kev	10-03-88	775	--	10.0	.1	350	63	46	38	.9	2.7
E-9	Kev	10-02-88	1,280	--	10.5	.2	78	16	9.3	240	12	1.5
E-11	Kev	10-02-88	1,480	--	10.5	--	540	96	74	140	3	3.4
E-13	Kev	06-16-90	863	7.3	10.0	--	380	71	50	42	.9	2.6
E-14	Kev	06-16-90	845	7.2	10.0	.5	410	76	52	27	.6	2.4
E-18	Kev	06-15-90	1,710	8.9	10.5	.6	8	2.5	.49	370	56	.74
E-21	Kev	06-14-90	2,750	7.2	10.0	.8	530	96	71	460	9	3.1
E-23	Kev	06-15-90	1,480	7.1	9.5	.7	600	120	71	100	2	4.9
E-24	Kev	06-15-90	815	7.4	9.0	.6	230	52	24	94	3	2.1
E-25	Kev	06-13-90	668	7.6	9.5	--	170	22	29	76	3	3.1
E-26	Kev	06-14-90	1,560	8.4	10.0	--	20	4.6	2.2	340	33	1.4
E-27	Kev	06-14-90	2,100	7.1	10.5	.9	920	120	150	160	2	4.4
K-1	Ktc	10-03-88	710	--	9.5	3.5	370	82	39	13	.3	6.2
L-1	Ml	11-21-91	658	7.3	8.0	--	350	73	42	4.5	.1	5.0
MC-1	Mmc	07-17-90	455	7.4	10.0	8.1	250	69	18	3.0	.1	1.4
MC-2	Mmc	06-13-90	580	7.2	9.5	--	300	82	22	6.7	.2	2.2
MC-3	Mmc	07-18-90	468	7.2	9.0	8.1	260	65	24	1.3	.03	1.1
MC-6	Mmc	11-20-91	545	7.5	9.0	6.9	310	82	26	1.3	.03	.80

Site number	Bicarbonate, fet-fld (mg/L as HCO ₃)	Bicarbonate, fet-lab (mg/L as HCO ₃)	Carbonate, fet-fld (mg/L as CO ₃)	Alkalinity (mg/L as CaCO ₃)	Sulfide, dissolved, fld (mg/L as S)	Sulfate, dissolved (mg/L as SO ₄)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Bromide, dissolved (mg/L as Br)	Silica, dissolved (mg/L as SiO ₂)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrate, dissolved (mg/L as N)
C-1	--	710	3	--	--	350	4.4	1.2	<0.10	8.3	1,160	0.11
E-2	--	500	0	--	0.02	290	3.0	.2	<.10	8.5	865	.22
E-3	--	410	0	--	.02	270	4.0	.5	<.10	14	706	.19
E-4	--	310	0	--	ND	120	2.9	1.0	<.10	--	416	.92
E-7	--	370	0	--	.02	120	2.5	.4	<.10	14	473	.57
E-9	--	360	0	--	ND	230	7.7	.2	<.10	9.4	696	.09
E-11	--	420	0	--	ND	500	4.5	.6	<.10	13	1,050	.31
E-13	340	330	0	280	ND	190	2.0	.3	--	15	541	<.06
E-14	370	370	0	300	--	150	2.6	.3	--	13	512	.06
E-18	350	430	0	370	--	440	14	.3	--	8.8	1,100	<.06
E-21	590	590	0	480	ND	1,000	6.4	.4	--	12	1,930	<.06
E-23	380	270	0	320	ND	490	5.5	.3	--	12	948	<.06
E-24	330	340	0	270	--	140	5.6	.4	--	13	503	<.06
E-25	330	320	0	270	.07	73	4.3	.4	--	14	381	<.06
E-26	340	380	0	640	.20	410	5.1	.3	--	9.7	965	<.06
E-27	460	470	0	380	--	850	5.6	.1	--	12	1,530	.55
K-1	--	330	0	--	.06	110	1.9	.8	<.10	6.9	428	.74
L-1	--	320	0	270	.03	99	1.4	.9	<.10	6.3	392	<.03
MC-1	270	250	0	220	--	35	.60	.3	<.10	12	263	.14
MC-2	280	290	0	230	.02	71	.90	.3	<.10	9.6	335	.01
MC-3	--	300	0	240	--	21	.30	.2	<.10	9.2	268	.10
MC-6	--	310	0	260	--	54	.80	.1	<.10	8.2	328	.07

Table 8.--Physical properties and dissolved-constituent concentrations of water, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana--Continued

Site number	Phosphorus, dissolved (mg/L as P)	Phosphorus, ortho, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, total, fld (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Iron, ferrous, fld (µg/L as Fe)
C-1	<0.10	<0.10	<30	--	1,900	<2	<2	<2	--	7	--
E-2	<.10	<.10	<30	--	1,100	<2	<2	<2	ND	15	10
E-3	<.10	<.10	<30	--	--	<2	<2	<2	2,000	960	1,800
E-4	<.10	<.10	<30	--	160	<2	<2	<2	ND	11	ND
E-7	<2.0	<.10	<30	--	170	<2	<2	<2	920	120	800
E-9	<.10	<.10	<30	--	200	<2	<2	<2	480	260	250
E-11	<.10	<.10	<30	--	380	<2	<2	<2	1,200	700	900
E-13	<.10	--	<40	<10	230	<5	<5	<4	510	590	500
E-14	<.10	--	<40	16	100	<5	<5	<4	1,100	1,100	600
E-18	<.10	<.10	<40	<10	150	<5	<5	<4	70	5	ND
E-21	<.10	<.10	<40	<10	990	<5	<5	<4	1,200	1,100	900
E-23	<.10	--	<40	<10	520	<5	<5	<4	600	550	470
E-24	<.10	<.10	<40	<10	230	<5	<5	<4	400	480	--
E-25	.16	<.10	<40	17	250	<5	<5	<4	490	390	470
E-26	<.10	<.10	<40	<10	250	<5	<5	<4	150	7	0
E-27	<.10	<.10	<40	<10	360	<5	<5	<4	1,900	310	700
K-1	<.10	<.10	<30	--	140	<2	<2	<2	200	18	100
L-1	<.10	<.05	<100	24	<100	<6	<6	<5	140	56	--
MC-1	<.10	<.10	<40	55	<40	<5	<5	<4	--	17	--
MC-2	<.10	<.10	<40	25	70	<5	<5	<4	200	150	80
MC-3	<.10	--	<40	44	<40	<5	<5	<4	--	<4	--
MC-6	<.10	<.05	<100	80	<100	<6	<6	6	ND	3	--

Site number	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)	Strontium, dissolved (µg/L as Sr)	Titanium, dissolved (µg/L as Ti)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Zirconium, dissolved (µg/L as Zr)
C-1	--	150	6	<20	<10	<2.0	150	<1	<1	6	<4
E-2	--	100	7	<20	<10	<2.0	360	<1	<1	12	<4
E-3	--	86	120	<20	<16	<2.0	950	2	1	610	<4
E-4	--	20	7	<20	<10	<2.0	540	<1	<1	560	<4
E-7	--	56	52	<20	<10	<2.0	990	<1	<1	560	<4
E-9	--	31	7	<20	<10	<2.0	160	<1	<1	4	<4
E-11	--	110	45	<20	<10	<2.0	1,400	<1	<1	390	<4
E-13	<50	43	24	<40	<20	<4.0	770	4	<4	<6	<6
E-14	<50	43	47	<40	<20	<4.0	640	4	<4	<6	<6
E-18	<50	58	14	<40	<20	<4.0	80	<4	<4	<6	<6
E-21	<50	170	13	<40	<20	<4.0	1,000	7	<4	10	<6
E-23	<50	130	26	<40	<20	<4.0	1,600	5	<4	<6	<6
E-24	<50	27	61	<40	<20	<4.0	360	<4	<4	<6	<6
E-25	74	100	31	<40	<20	<4.0	480	<4	<4	<6	<6
E-26	<50	70	7	<40	<20	<4.0	110	<4	<4	<6	<6
E-27	<50	180	59	<40	<20	<4.0	1,500	5	<4	7	<6
K-1	--	53	35	<20	<10	<2.0	830	1	<1	3	<4
L-1	<50	35	4	<40	<20	<6.0	710	<8	<8	6	<8
MC-1	--	5	4	<40	<20	<4.0	310	9	<4	<6	<6
MC-2	<50	8	34	<40	<20	<4.0	320	7	<4	<6	<6
MC-3	--	<4	<2	<40	<20	<4.0	180	<4	<4	<6	<6
MC-6	<50	<6	2	<40	<20	<6.0	320	<3	<8	14	<8

Table 9.--Drinking-water regulations for public water supply¹
 [MCL, Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant Level; mg/L, milligrams per liter; µg/L, micrograms per liter; --, no regulation available or not applicable]

Water-quality characteristic	Maximum concentration or value for indicated regulation		
	National Primary Drinking-Water Regulation ² (MCL or action level)	National Secondary Drinking-Water Regulation ³ (SMCL)	Equivalent trace-element concentration ⁴ for MCL, SMCL, or action level (µg/L)
<u>Physical property (standard units)</u>			
pH	--	6.5-8.5	--
<u>Common constituents (mg/L)</u>			
Dissolved solids	--	500	--
Chloride	--	250	--
Fluoride	4.0	2.0	--
Nitrate (as N)	10	--	--
Sulfate	--	250	--
<u>Trace elements (mg/L)</u>			
Barium ⁵	2.0	--	2,000
Cadmium	.005	--	5
Chromium	.1	--	100
Copper ⁶	1.3	--	1,300
Iron	--	.3	300
Lead ⁶	.015	--	15
Manganese	--	.05	50
Silver	--	.1	100
Zinc	--	5.0	5,000

¹Listed only for properties, common constituents, and trace elements analyzed in this report.

²U.S. Environmental Protection Agency (1991a), except as indicated.

³U.S. Environmental Protection Agency (1991b), except as indicated.

⁴The U.S. Geological Survey reports trace-element concentrations in micrograms per liter.

⁵U.S. Environmental Protection Agency (1992b).

⁶U.S. Environmental Protection Agency (1992a).

Table 10.--Maximum dissolved-solids concentrations for livestock water¹

Livestock	Dissolved-solids concentration, in milligrams per liter	Livestock	Dissolved-solids concentration, in milligrams per liter
Poultry	2,860	Cattle (dairy)	7,150
Swine	4,290	Cattle (beef)	10,000
Horses	6,435	Sheep (adult)	12,900

¹From McKee and Wolf (1971, p. 112).

Table 11.--Results of quality-control analyses of water samples, northwest flank of the Little Rocky Mountains, Fort Belknap Indian Reservation, north-central Montana

[Abbreviations: °C, degrees Celsius; mg/L, milligrams per liter; fet, fixed-endpoint titration; fld, field (onsite) measurement; lab, laboratory; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 °C; MBMG, Montana Bureau of Mines and Geology; USGS, U.S. Geological Survey.
 Symbols: <, less than detection limit for analytical method used; --, no data.
 Geologic unit--Kev, Virgelle Sandstone Member of Eagle Sandstone; Mmc, Mission Canyon Limestone]

Site number	Geologic unit	Date	Specific conductance (µS/cm)	pH (standard units)	Temperature, water (°C)	Hardness, total (mg/L as CaCO ₃)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)
E-21	Kev	06-14-90	2,750	7.2	10.0	530	97	71	450	8	3.2
			2,750	7.2	10.0	530	97	69	460	9	3.4
MC-1	Mmc	07-17-90	455	7.4	10.0	250	68	19	2.9	.1	1.4

Site number	Bicarbonate, fet-fld (mg/L as HCO ₃)	Bicarbonate, fet-lab (mg/L as HCO ₃)	Carbonate, fet-fld (mg/L as CO ₃)	Alkalinity (mg/L as CaCO ₃)	Sulfate, dissolved (mg/L as SO ₄)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Bromide, dissolved (mg/L as Br)	Silica, dissolved (mg/L as SiO ₂)	Solids, sum of constituents, dissolved (mg/L)
E-21	590	590	0	480	1,000	6.7	0.4	<0.1	13	1,930
	590	--	--	486	970	10	.5	--	12	1,920
MC-1	270	263	0	220	34	.60	.3	<.1	11	268

Site number	Nitrogen, nitrate, dissolved (mg/L as N)	Aluminum, dissolved (µg/L as Al)	Barium, dissolved (µg/L as Ba)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium, dissolved (µg/L as Li)
E-21	<0.06	<40	<10	1,030	<5	<5	<4	1,100	<50	178
	--	--	5	1,400	5	<20	<30	1,100	30	180
MC-1	.14	<40	54	<40	<5	<5	<4	5	--	5

Site number	Manganese, dissolved (µg/L as Mn)	Molybdenum, dissolved (µg/L as Mo)	Nickel, dissolved (µg/L as Ni)	Silver, dissolved (µg/L as Ag)	Strontium, dissolved (µg/L as Sr)	Titanium, dissolved (µg/L as Ti)	Vanadium, dissolved (µg/L as V)	Zinc, dissolved (µg/L as Zn)	Zirconium, dissolved (µg/L as Zr)	Laboratory
E-21	12	<40	<20	<4.0	1,010	<4	<4	<6	<6	MBMG
	18	<30	<30	<3.0	1,000	--	<18	<9	--	USGS
MC-1	2	<40	<20	<4.0	306	<4	<4	<6	<6	MBMG