SUMMARY OF WATER RESOURCES DATA FOR THE GIRDWOOD-ALYESKA AREA, ALASKA

By Roy L. Glass and Timothy P. Brabets

U. S. GEOLOGICAL SURVEY

Open-File Report 87-678

Prepared in cooperation with the

MUNICIPALITY OF ANCHORAGE

Anchorage, Alaska
1988

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
Water Resources Division
4230 University Drive
Suite 201
Anchorage, Alaska 99508-4664

Copies of this report can be purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center
Box 25425
Denver, Colorado 80225

CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION TABLE

For readers who may prefer to use metric (International System) units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	by	To obtain metric units
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
gallon per minute (gal/min)	0.06308	liter per second (L/s)
degree Fahrenheit (°F)	°C = 5/9 x (°F-32)	degree Celsius (°C)

Other abbreviations in this report are:

mg/L, milligrams per liter
µg/L, micrograms per liter
µS/cm, microsiemens per centimeter at 25 degrees Celsius
cols./100 mL, fecal coliform colonies per 100 milliliters

Sea level:

In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD 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 "Mean Sea Level of 1929."

SUMMARY OF WATER RESOURCES DATA

FOR THE GIRDWOOD-ALYESKA AREA, ALASKA

By Roy L. Glass and Timothy P. Brabets

INTRODUCTION

The town of Girdwood, Alaska is located within the Municipality of Anchorage approximately 40 mi southeast of downtown Anchorage (fig. 1). The Girdwood-Alyeska area, is bounded by Turnagain Arm of Cook Inlet, Chugach State Park, and Chugach National Forest (fig. 2), and is prized for its natural beauty and its recreational opportunities. Rugged mountains surrounding the town are popular areas for alpine and cross-country skiing and hiking.

The Girdwood-Alyeska area is approximately 9.4 mi^2 in size: about 7.3 mi^2 are owned by the Municipality of Anchorage, 0.8 mi^2 are owned by the State of Alaska, and 1.4 mi^2 are owned privately. Much of the municipal land may soon be developed for residential and commercial purposes.

In 1983, Girdwood had 1,070 full-time residents and 1,865 part-time residents (Ott Water Engineers, 1985, p. II-2). On busy weekends during winter about 2,800 ski-lift tickets are sold at Alyeska Ski Resort. Currently three sets of privately owned wells supply most of the water used by area residents and visitors. Outside of water-service areas, such as along the Seward Highway, Alyeska Highway, and Crow Creek Road, residents and businesses rely on privately owned wells or hauling for their water needs.

PURPOSE AND SCOPE

The Municipality of Anchorage and the U.S. Geological Survey have had a long-term cooperatively funded study of the water resources of the Municipality. As part of this study, the Survey was asked to assess and evaluate the sources of water for future needs at Girdwood. To meet that request, existing data on wells and streams were compiled, three test wells were drilled in the Glacier Creek valley, water-quality samples were collected from five wells and three streams, and intermittent discharge measurements were made on Glacier, California, and Virgin Creeks. This report is a compilation and summary of the hydrologic data collected during this study as well as data collected by the U.S. Geological prior to 1985 (U.S. Geological Survey, 1965-86). This report can also be considered a supplement to an earlier report by Zenone (1974).

PHYSICAL SETTING AND CLIMATE

The town lies in a flat, glacially widened valley near the head of Turnagain Arm. The original townsite was near the Seward Highway and Glacier Creek, but was moved about 2 mi upstream after the 1964 earthquake. Bedrock is exposed in the mountains and is chiefly composed of argillite, slate, and graywacke. Unconsolidated glacial and alluvial sediments in the valley overlie the bedrock and are as great as 316 ft thick. The horizontal and vertical distributions of various types of unconsolidated materials are complex because of repeated and interrelated action of glacier ice, melt-water streams, and marine waters of Turnagain Arm. Figure 3 and table 1 (from Zenone, 1974) show the distribution of geologic units at the surface and each unit's property.

Girdwood's climate is characterized by cool, rainy summers and mild, snowy winters. Measurements made from 1955-66 and from 1977-78 at the Alaska Department of Transportation's facility near the Seward and Alyeska Highways, indicate that mean annual precipitation is about 40 in. (which includes both rain and snow) and mean annual temperature is 36.4 °F. Climate conditions have been also measured at Alyeska's ski lodge near the base of the mountains since 1963: mean annual precipitation is about 62 in. and mean annual temperature is 35.7 °F.

Precipitation at Alyeska for 1985 and 1986 was 65.14 in. and 73.29 in. and the mean annual temperatures for 1985 and 1986 were 36.2 and 38.6 °F (National Oceanic and Atmospheric Administration, 1985-87).

SURFACE WATER

Glacier Creek is the major surface-water drainage system of the Girdwood area. Its drainage area is 58.2 mi^2 at the Alaska Railroad bridge where the U.S. Geological Survey operated a stream gaging-station (site 15272550, fig. 2) from August 1965 to September 1978.

On the basis of mean flows, the majority of flow in Glacier Creek occurs in the summer (June, July, and August) due to glacier meltwater, while lowest flows occur in January through March (fig. 4). The average flow is 265 ft^3/s. Fifty percent of the time flow exceeds 150 ft^3/s, and 10 percent of the time flow exceeds 657 ft^3/s (fig. 5). During the period of record, the lowest daily flow recorded was 10 ft^3/s (March 24, 1977). A low-flow frequency curve relates the discharge during a 7-day period to the probability of its occurrence. The low-flow frequency curve for Glacier Creek at Girdwood (fig. 6) shows that a discharge of 13 ft^3/s for a period of 7 days has a probability of occurring once in 10 years. The highest discharge recorded at Glacier Creek was 7,710 ft^3/s (September 15, 1967). Comparing this value with a flood frequency curve (fig. 7) would indicate this to be approximately a 13-year flood.

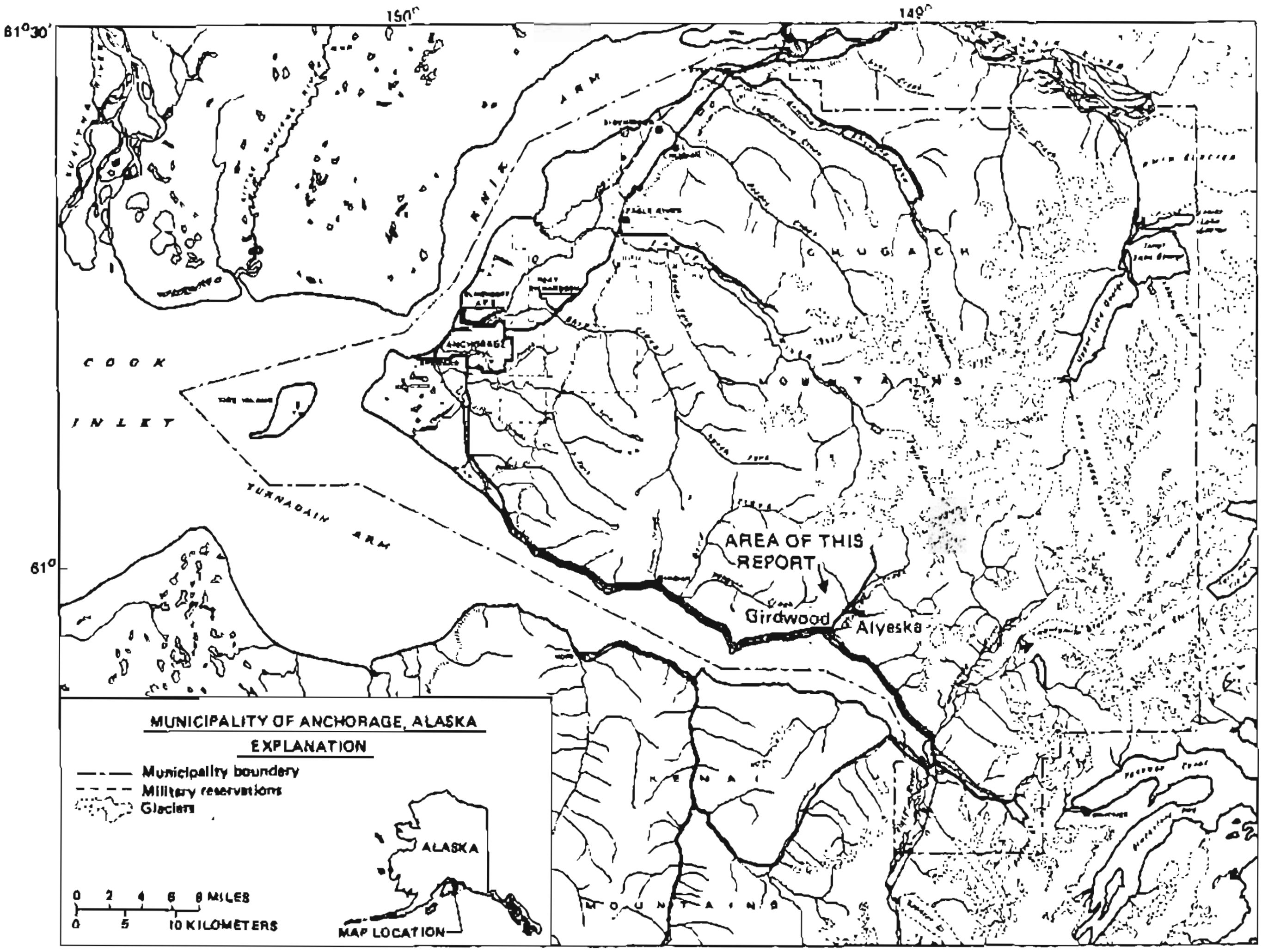


Figure 1.--Location and extent of the Girdwood-Alyeska area, Alaska.

Other major streams in the Girdwood area are California and Virgin Creeks. California Creek drains an area of 6.96 mi^2 at Alyeska Highway and flows into Glacier Creek. This site has been operated as a crest-stage gage since 1967. The highest peak discharge recorded at this site was 600 ft^3/s which would be a 20-year flood when compared to a flood frequency curve (fig. 8).

Virgin Creek drains an area of 3.02 mi^2 above its measuring site and flows into Turnagain Arm. No continuous or partial streamflow records have been kept on this stream. From 1985-87, discharge measurements were made during winter months at Virgin, California, and Glacier Creeks in order to characterize the flow during low or base-flow periods (table 2). Comparing the discharge measurements made at Glacier Creek with the low-flow frequency curve (fig. 6) indicates that the winter periods of 1985-87 had above-average base flow. Measurements made at California and Virgin Creeks indicate that California Creek will have no flow during some winter periods whereas Virgin Creek may have a sustained base flow.

GROUND WATER

Ground water supplies nearly all water demands in the Girdwood area. Data for 105 wells are summarized in tables 3 and 4 and their locations are shown in figure 9.

Most wells along the mountain fronts are completed in bedrock and usually yield water at low rates (less than 3 gal/min). Wells completed in unconsolidated sediments in the central part of the valley generally yield water at rates sufficient for domestic uses. However, the composition and water-bearing properties of unconsolidated sediments vary widely, even locally. Well SA01000219BBCA2 017 (see table 3 for a description of the well-numbering system used in this report) penetrated 315 ft of unconsolidated sediments without encountering suitable saturated porous and permeable materials, whereas nearby wells yield water from sands and gravels 135 to 156 ft below land surface.

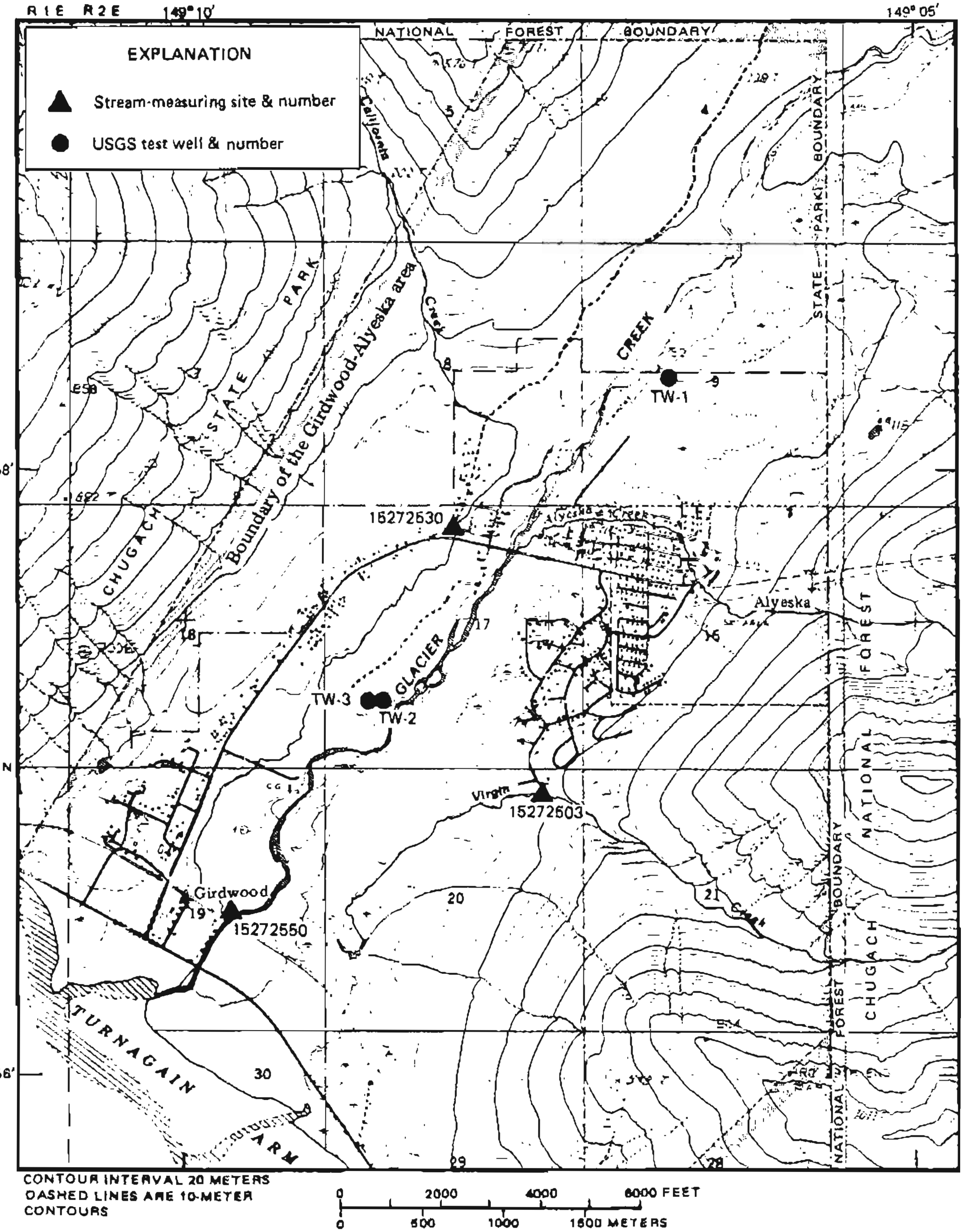


Figure 2.--Location of stream-measuring and test-well sites.

According to Zenone (1974), conditions favorable for ground-water development are present along both the modern and ancient channels of Glacier Creek and its tributaries, and in the alluvium in fan-shaped deposits built up at the foot of the steep mountain slopes of California, Alyeska, and Virgin Creeks. Five public-supply wells completed in the unconsolidated sediments along Glacier Creek and near Alyeska Creek have large yields:

Well number	Section No.	Map No.	Area served	Reported yield (gal/min)
SA01000216BABA1	16	5	Alyeska ski resort and subdivision	325
SA01000216BABA2	16	5	Alyeska ski resort and subdivision	160
SA01000217AABC1	17	5	Alyeska Basin subdivision	344
SA01000208DCDC1	08	2	New Girdwood Townsite	350
SA01000217ABAA2	17	1	New Girdwood Townsite	310

Two wells north of the airport (SA01000209ABCC1 005 and SA01000209ACBA1 004) drilled for Seibu Corporation in 1987 indicate that large yields are available in certain locations north (upstream) of town where coarse-grained saturated sediments are thick. However, sediments near Glacier Creek are not coarse grained everywhere. A third well drilled for Seibu and a well drilled by the U.S. Geological Survey as part of this study encountered chiefly fine-grained materials, mostly silt, that yielded water at low rates. Bedrock was encountered at 56 ft below land surface in test well SA01000209CBDD1 002 (TW-1, fig. 2). The well casing was perforated from 35 to 45 ft below land surface and subsequently yielded only 7 gal/min from an unsorted mixture of silt, coarse sand, and gravel.

Two other test wells drilled by U.S. Geological Survey are about 0.75 mi southwest of town between California and Glacier Creeks (fig. 2). The predominant unconsolidated material penetrated by test well SA01000217CBDD1 010 (TW-2) was silt. However, permeable zones containing sand and gravel (33-100 ft below land surface) yielded up to 15 gal/min through an open-ended casing during drilling. Bedrock was encountered at 173 ft in TW-2. This well was screened in a zone of coarse sand, gravel, and silt (79-100 ft below land surface) and yielded 250 gal/min for 24 hours with 47.6 ft of drawdown. When pumping was stopped, the water level recovered to pre-pumping levels after 26 minutes (fig. 10). Test well SA01000217CBDD2 010 (TW-3) was drilled about 100 ft west of TW-2 to observe water-level changes caused by the pumping of TW-2. Records from a water-level recorder placed on TW-3 show that pumping TW-2 at 250 gal/min for 24 hours caused no water-level declines in TW-3. For the period October 1, 1986 to September 30, 1987, water levels in TW-3 ranged from 3.38 to 6.75 ft below land surface (fig. 11).

WATER QUALITY

A summary of selected water-quality properties and chemical constituents of water from Glacier, California, and Virgin Creeks is shown in table 5. The waters contain relatively low concentrations of dissolved solids (less than 100 mg/L) and their primary cation and anion are calcium and bicarbonate (as indicated by "alkalinity"). Water in Glacier Creek has high concentrations of suspended sediment (as great as 3,760 mg/L) during the summer season due to its content of glacier meltwater (table 6).

Samples of ground water from 10 wells have been analyzed for chemical and physical properties by the Geological Survey (table 7). The waters have a dissolved-solids content ranging from 59 to 170 mg/L. A concentration of less than 500 mg/L is desirable for domestic and most industrial uses (U.S. Environmental Protection Agency, 1977). On the basis of the water's taste and its tendency to stain plumbing fixtures, some wells in the area are reported to yield water that contains undesirable concentrations of iron and manganese. Samples from the two wells serving Alyeska Ski Resort and Alyeska subdivision had high concentrations of iron and manganese (table 7). Concentrations less than 300 µg/L dissolved iron and 50 µg/L dissolved manganese are preferred for most domestic and industrial water uses (U.S. Environmental Protection Agency, 1977). Iron and manganese in higher concentrations precipitate when exposed to air, cause turbidity, stain plumbing fixtures, laundry, and cooking utensils, and also impart noticeable taste and color to foods and drinks.

ADDITIONAL DATA NEEDS

1) Depending on the locations of future residential developments and water-distribution systems, more test wells may be needed to determine the availability of ground water in those areas.

2) If surface waters are to be used as a source for water supply, additional suspended-sediment and turbidity data would be needed to aid designers in determining when treatment practices would need to be altered.

3) If California or Virgin Creeks are to be considered as water-supply sources, additional stream-discharge measurements would be needed to define their low-flow characteristics.

SUMMARY

Streamflows were measured continuously in Glacier Creek, the largest stream in the area, from August 1965 through September 1978. Mean flows were highest in June and July and lowest in January through March. Average stream discharge is 265 ft^3/s, but flows as low as 10 ft^3/s have been observed. Flow in California Creek has ceased during cold winter periods. A sustained base flow was observed in Virgin Creek during 1985-86.

Most of the water used for domestic and commercial/industrial purposes is pumped from wells. Three sets of public-supply wells provide water to Alyeska Ski Resort, residents in Alyeska and Alyeska Basin subdivisions, and residents and businesses near the new townsite of Girdwood.

Near the mountain fronts, wells completed in bedrock generally yield water at low rates (less than 5 gal/min). Large yields (greater than 250 gal/min) can be obtained in areas that are underlain by saturated, coarse-grained sediments, such as in the central part of the valley near Glacier and California Creeks. In some low-lying areas, however, large yields may not be possible because the sediments are chiefly silt and clay.

Waters in Glacier, California, and Virgin Creeks contain relatively low concentrations of dissolved solids. Concentrations of suspended sediment are high in Glacier Creek during summer. Ground water is generally of drinking-water quality except for undesirable concentrations of iron and manganese in some areas.

REFERENCES CITED

National Oceanic and Atmospheric Administration, 1985-87, Climatological data, Alaska: v. 71-72.

Ott Water Engineers, 1985, Girdwood sewer master plan: Anchorage, Alaska, 153 p.

U.S. Environmental Protection Agency, 1977, Quality criteria for water, 1976: Washington D.C., U.S. Government Printing Office, 256 p.

U.S. Geological Survey, 1965-86, Water resources data for Alaska, water years 1965-85: U.S. Geological Survey Water-Data Reports, (published annually).

Zenone, Chester, 1974, Geology and water resources of the Girdwood-Alyeska area, Alaska, U. S. Geological Survey open-file report, 24 p.

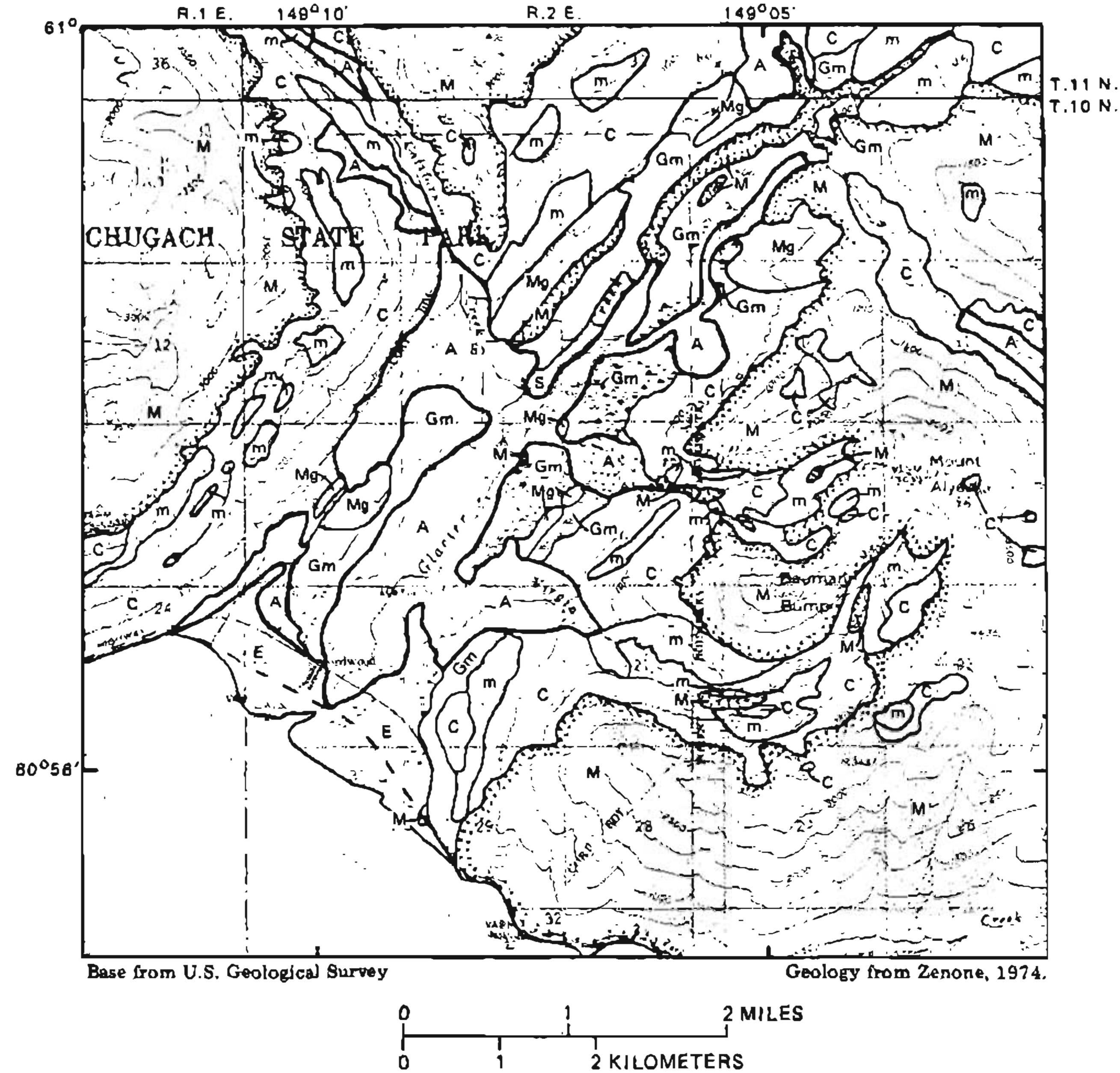


Figure 3.--Geology of the Girdwood-Alyeska area.
(See table 1 for explanation.)

Table 1.–Description of geologic map units and their properties
[See figure 3 for map]

Geologic unit	Topography and/or location	Geologic material	Engineering properties				Ground-water potential
			Foundation conditions	Drainage conditions	Potential as source for construction material	Slope and slope stability (percentage)	
ALLUVIAL DEPOSITS (A)	Low terraces along Glacier Creek; active and former stream channels; small alluvial fans and cones.	Chiefly gravel and sand; minor amounts of silt and a few boulders.	Excellent except near major streams where water table may be very near ground surface.	Good.	Good--the only reliably good source in area.	Flat (<5 percent) to moderately steep (up to 25 percent) slopes. Stable except for erosion at stream banks and on some alluvial fans.	Excellent--most reliable source in the area. Highest well yields (200-500 gal/min) can probably be obtained from material along Glacier Creek; smaller yields (up to 200 gal/min) likely from fan areas of Alyeska, California, and Virgin Creeks.
COLLUVIUM (Slope Deposits) (C)	At base of and on lower parts of steep mountain slopes.	Wide range of grain sizes, approximating a loosely packed diamicton. Rubble, boulders, and cobbles common where slopes very steep or deposit has resulted from landslide.	Poor because of steep slopes.	Fair to good.	Not suitable except locally.	Steep slopes (25-40 percent), not suitable for many types of development. Potentially unstable, subject to landsliding and erosion.	Poor aquifer. Where material is coarse grained, drainage is very rapid on steep slopes, and storage capability is low. Where finer grained material restrains drainage, water-yielding capability is low.
MORAINAL DEPOSITS (m)	Glacial moraines, deposited directly from existing and former glaciers which occupied most of the area.	Chiefly till, commonly composed of diamicton, locally well sorted into gravel, sand, and silt.	Good.	Good.	Poor.	Steep slopes (25-40 percent), not suited to many types of development. Generally stable, except subject to erosion in areas of predominately fine-grained material.	Probably a poor aquifer in this area. Position on mountain slopes suggests these are thin deposits overlying bedrock or colluvium.
MARINE OR GLACIAL DEPOSITS (Mg)	Form small hills or ridges in the flat areas of the valley.	Chiefly diamicton, but may contain moderately well-sorted gravel, sand, and silt	Good.	Good.	Poor.	Gentle to moderate slopes (5-25 percent). Generally stable.	May yield small quantities (5-15 gal/min) of water to wells from better sorted portions.
GLACIAL OR MARINE DIAMICTON (Gm)	Underlies flat, often swampy areas in Glacier Creek valley.	Chiefly diamicton containing high proportion of silt and clay matrix.	Fair to poor	Generally poor.	Unsuitable.	Gentle slopes (5-15 percent. Generally stable.	Poor aquifer because of silt and clay content. Well-log data indicate this unit is underlain by alluvial deposits from which the wells produce water.
SILT AND CLAY (S)	Found in only one area along short reach of Glacier Creek.	Silt and clay of marine origin.	Poor.	Poor.	Unsuitable.	Flat (<5 percent) to gently sloping (up to 15 percent). Fine-grained material subject to erosion.	Not considered a water-bearing unit.
ESTUARINE DEPOSITS (E)	Tidal flats of Turnagain Arm.	Silt and very fine-grained sand.	Very poor.	Very poor.	Unsuitable.	Flat. Subject to continual erosion.	Not considered a water-bearing unit.
BEDROCK (M)	Mountain slopes and ridges which border the valley.	Metamorphic rocks (Valdez Group) of marine origin; Jurassic (?) and Cretaceous age.	Good.	Good--rapid surface runoff.	Poor--not good as riprap due to closely spaced cleavage and jointing.	Steep to very steep (45-100 percent) slopes. Rockfalls and landslides possible.	May yield small quantities (5-15 gal/min) of water locally from fractured and weathered zones.

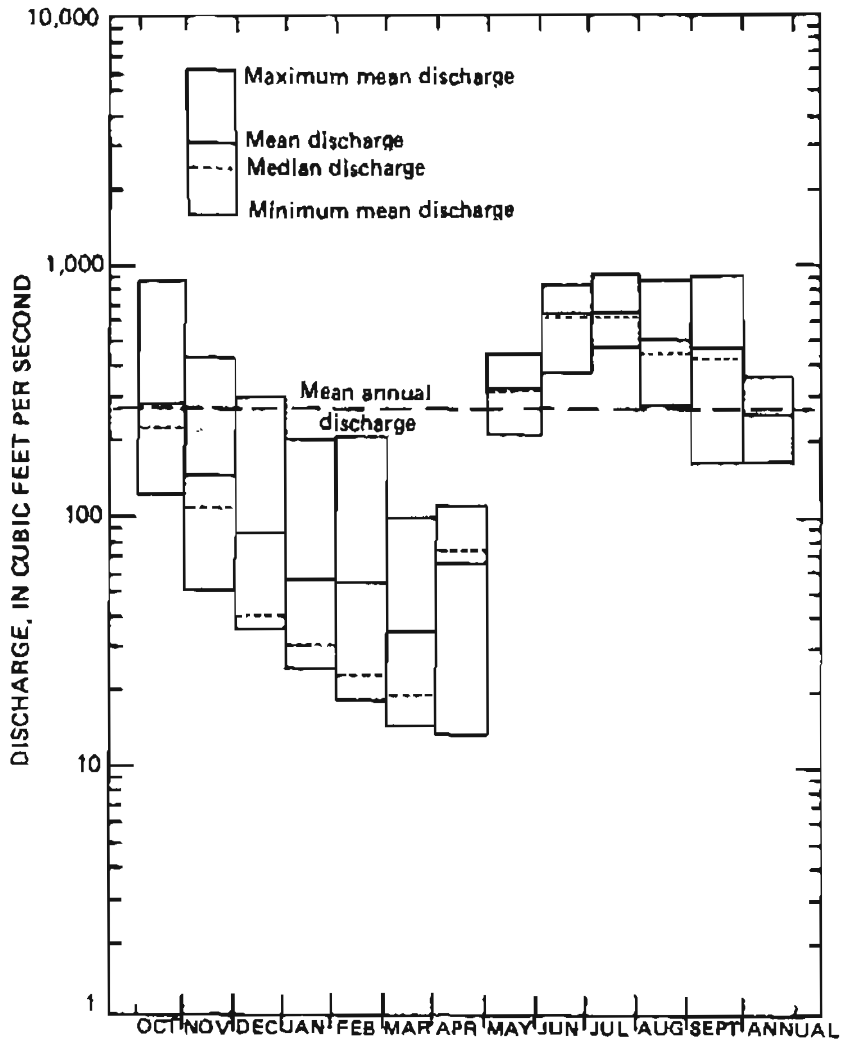


Figure 4.--Monthly streamflow variations for Glacier Creek at Girdwood.

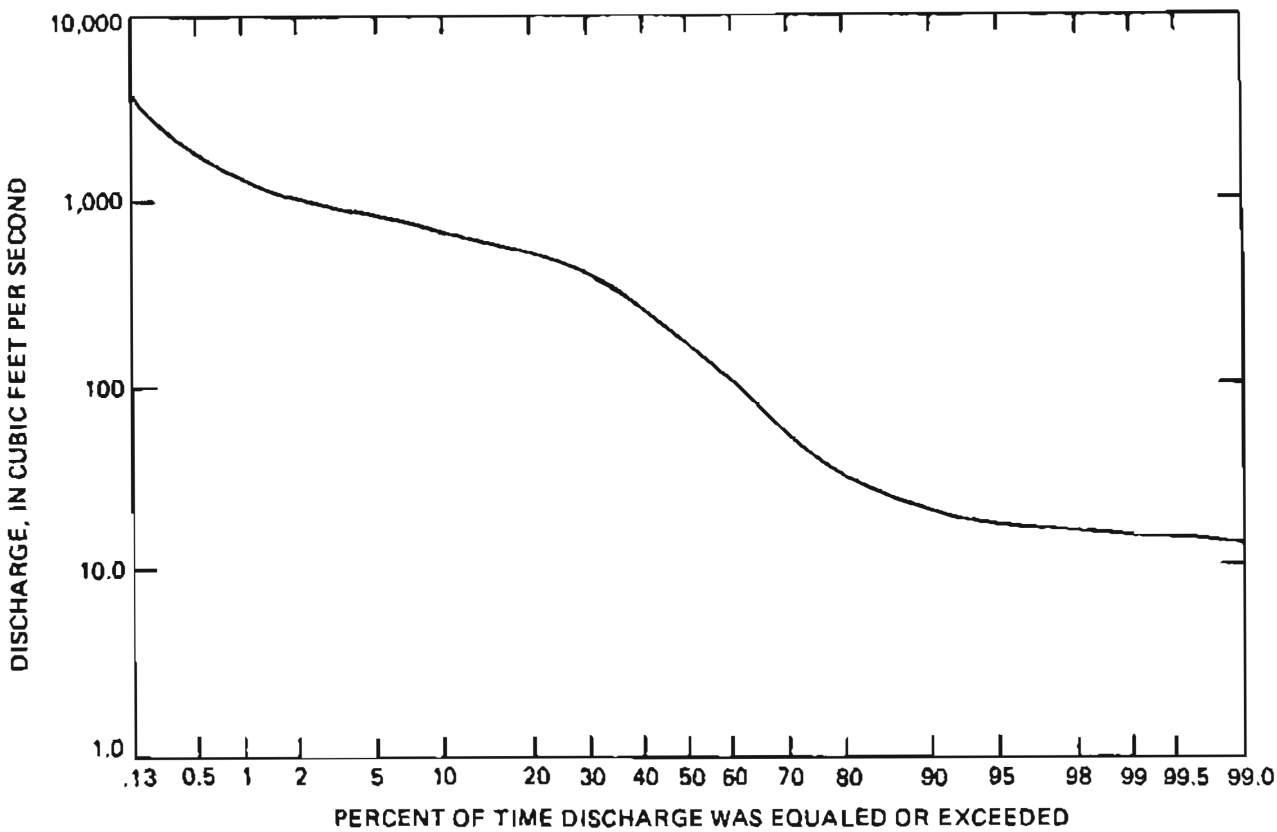


Figure 5.–Flow-duration curve for Glacier Creek at Girdwood.

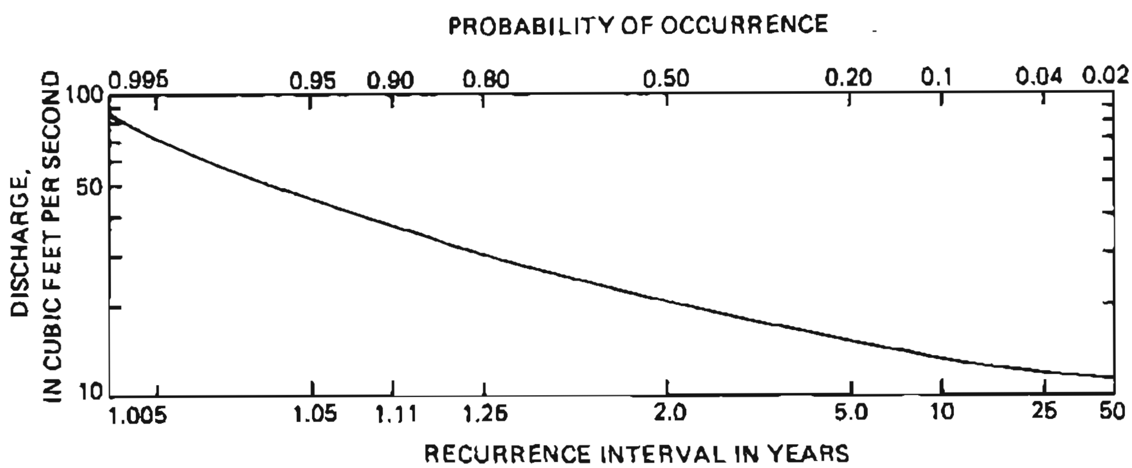


Figure 6.--Seven-day low-flow frequency curve for Glacier Creek at Girdwood.

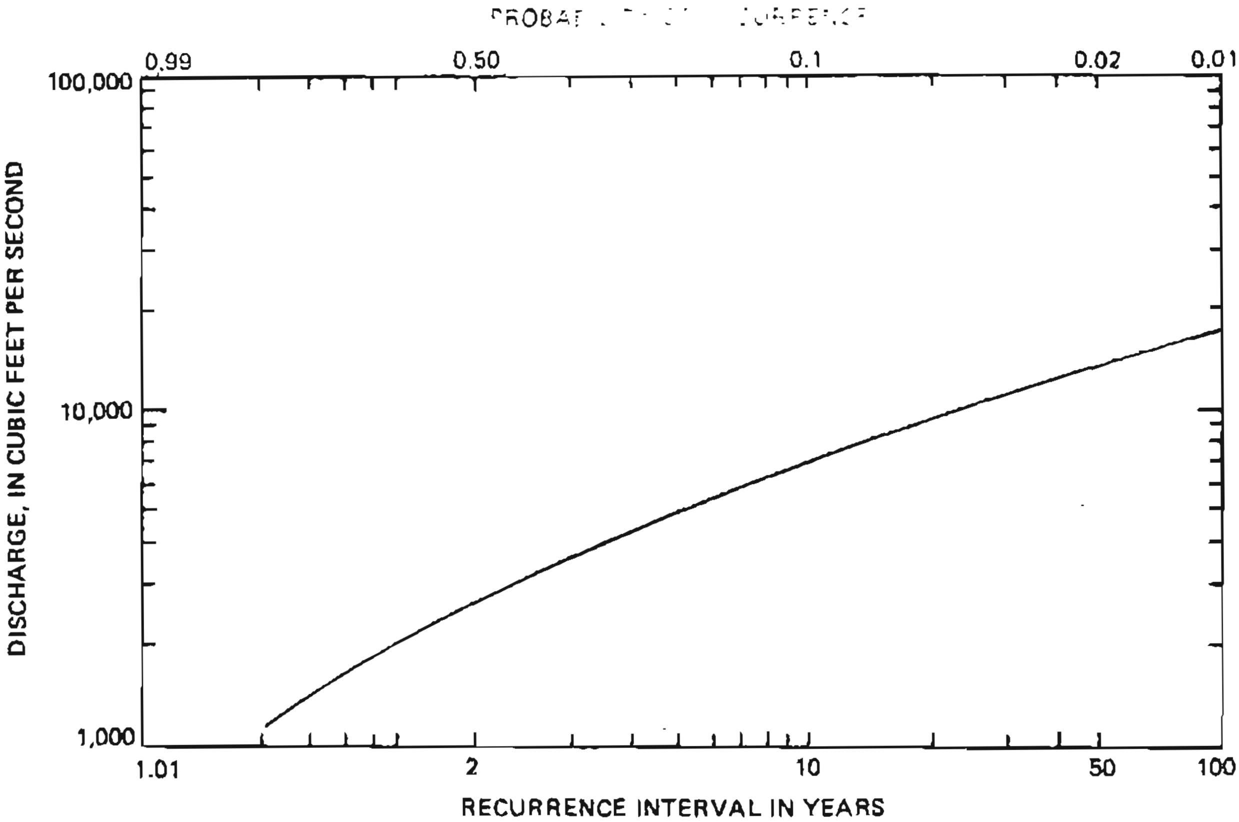


Figure 7.--Flood frequency curve for Glacier Creek at Girdwood.

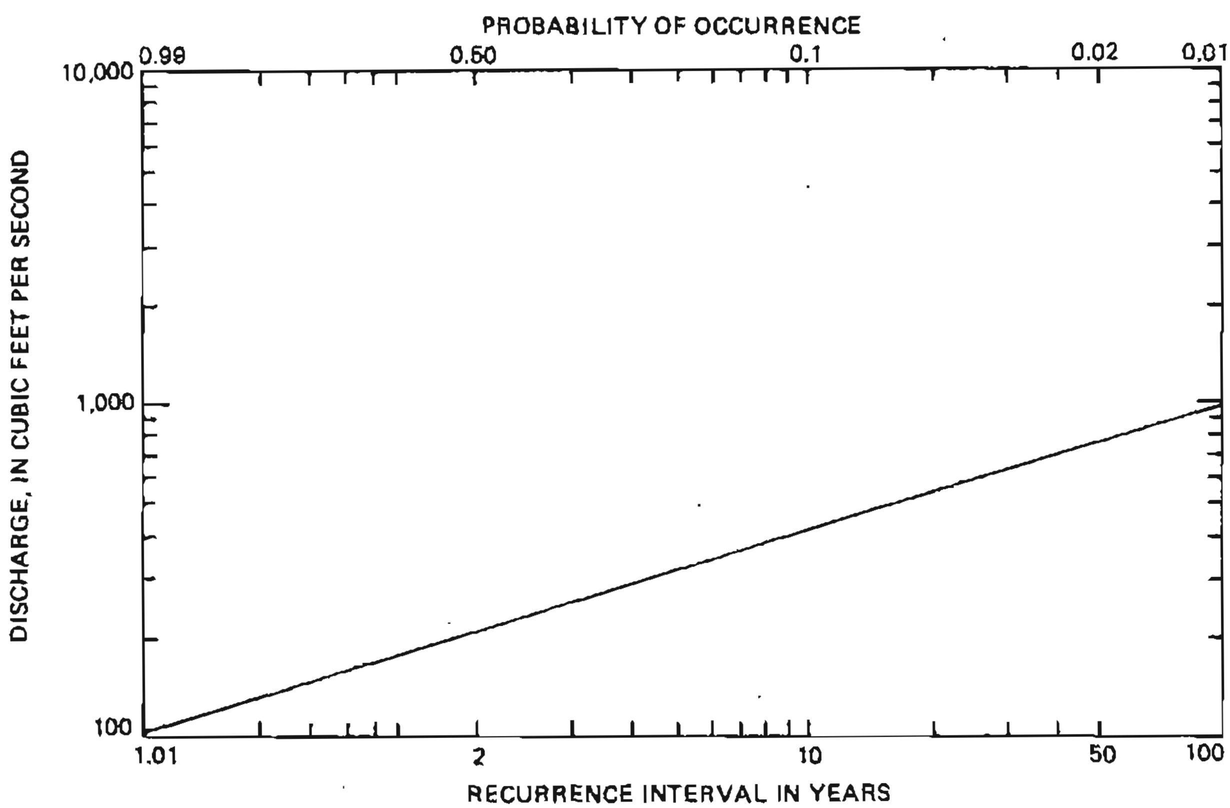


Figure 8.--Flood frequency curve for California Creek at Girdwood.

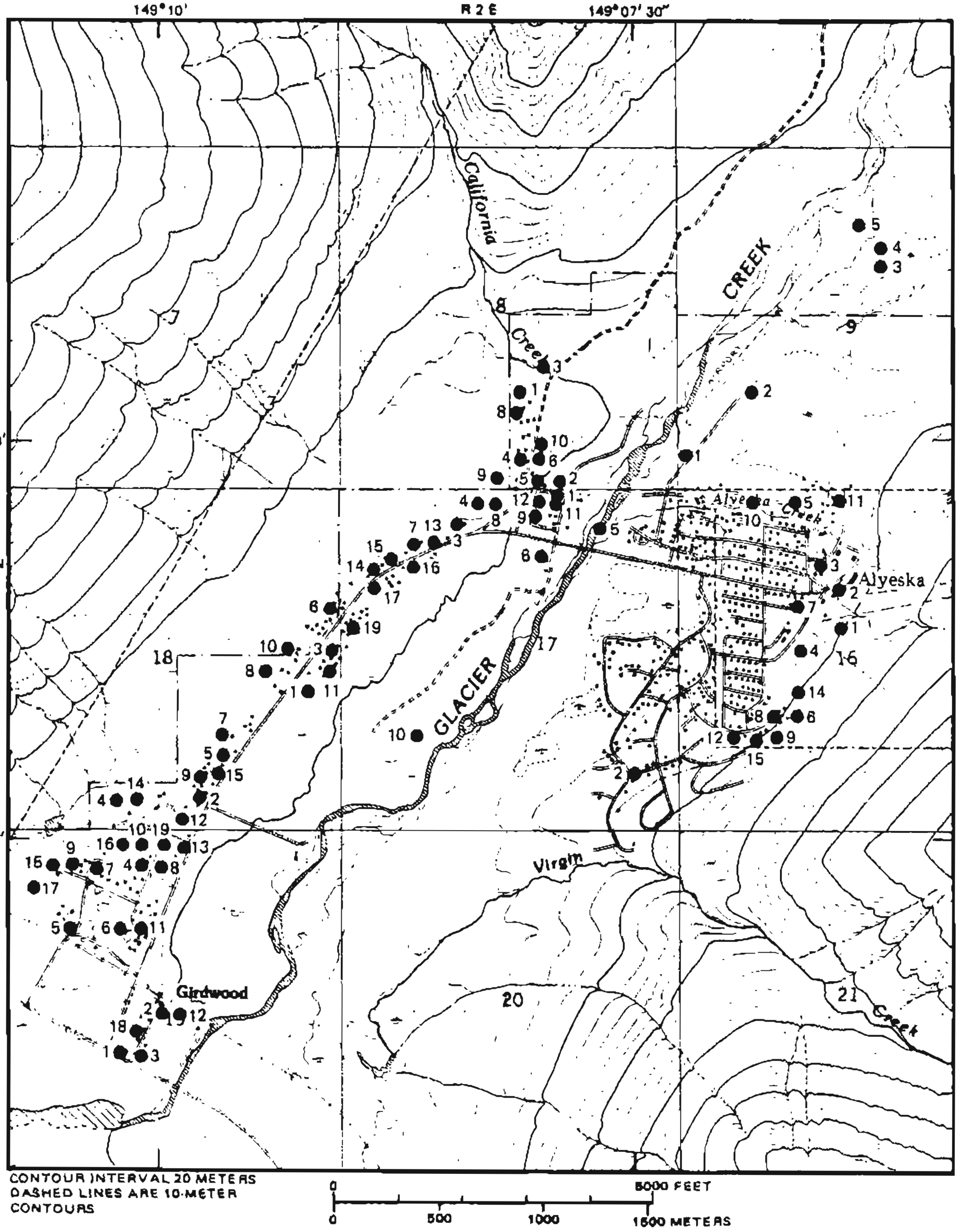


Figure 9.--Well locations in the Girdwood-Alyeska area.

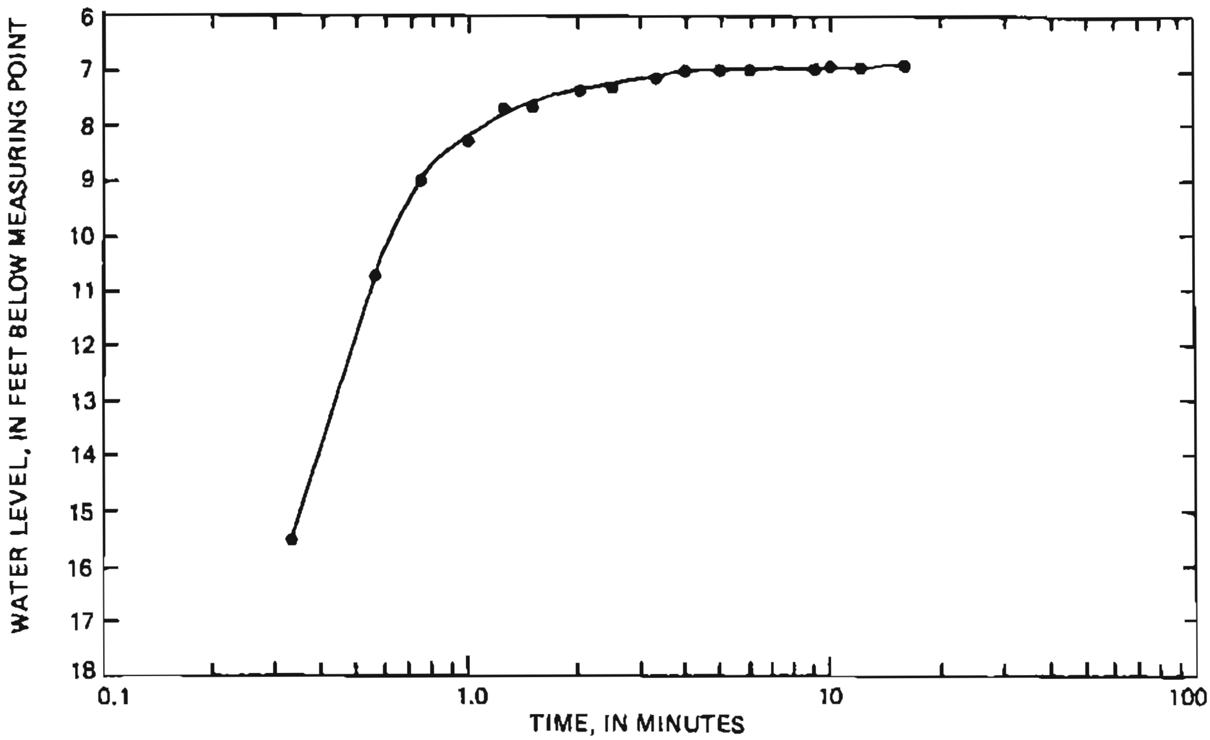


Figure 10.– Water-level recovery versus time for well SA01000217CBDD1-010 (TW-2).

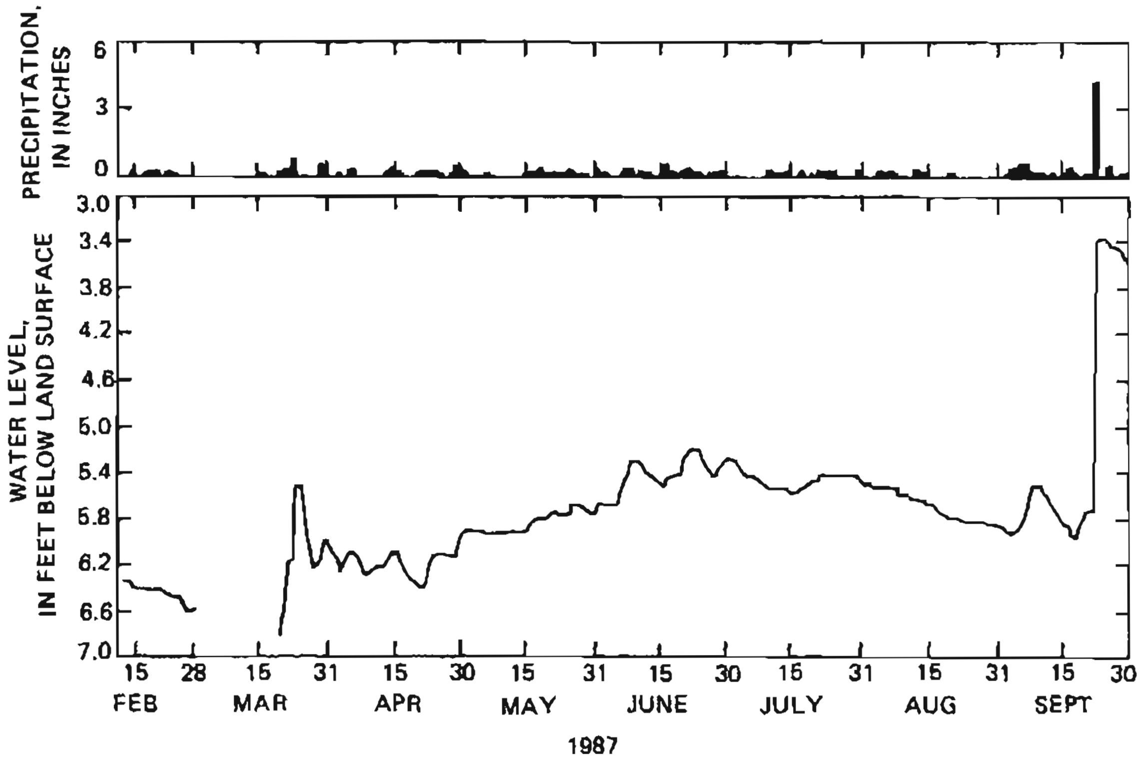


Figure 11.–Hydrograph of water level in well SA01000217CBDD2-010 (TW-3) and precipitation at the Girdwood waste-water treatment plant. (Precipitation data from National Weather Service, written commun., 1987.)

Table 2.--Stream-discharge measurements of California Creek, Glacier Creek, and Virgin Creek, 1985-87

[Data in cubic feet per second; see fig. 2 for site locations]

Date	California Creek at Girdwood (15272530)	Glacier Creek at Girdwood (15272550)	Virgin Creek at Girdwood (15272503)
04-16-85	0.0	23.5	3.6
05-22-85	16.2	214	10.0
06-13-85	35.9	—	31.1
02-25-86	0.76	44	3.0
02-04-87	4.9	92.3	3.8
03-11-87	.4	39.2	3.4
04-07-87	4.4	83.4	4.6

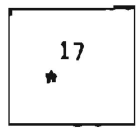
EXPLANATION OF HEADINGS FOR TABLE 3

LOCAL NUMBER: The well-numbering system used in this report is the Alaska Water Resources Division's local well-numbering system and is based on the rectangular subdivision of public lands. The first two letters indicate the well's position in reference to a base and meridian (first letter) and the quadrant formed by the intersection of the base line and the principal meridian (second letter), lettered counter-clockwise from the northeast corner:

B	A
C	D

In this report, all wells are in the Seward base and meridian (S) and in its northeastern quadrant (A). The first three digits indicate the township in which the well is located, the next three digits the range, and the last two digits the section. For example, a well numbered SA01000217CBDD1 is located in township 10 north, range 2 east, section 17. Letters following the section number indicate further subdivision. The first letter indicates which quarter of the section the well is located, the second letter indicates where in that quarter the well is located, and so forth to the fourth section subdivision. Like the quadrants formed by the base and meridian, each succeeding subdivision is lettered counter-clockwise from the northeast corner. Well SA0100001217CBDD1 is thus located in the southwest quarter (C) of section 17. Further definition of its location shows that it is in the southeast quarter (D) of the southeast quarter (D) of the northwest quarter (B) of the southwest quarter (C) of section 17.

T. 10 N.



R. 2 E.

SA01000217CBDD1 010

MAP NUMBER: Map number refers to the sequential listing of wells within a square-mile section (see figure 9 for well locations). All wells within a fourth-order quarter section (the smallest subdivision) have the same map number and are plotted in figure 9 at the center of its fourth-order quarter section. For example, well SA01000217CBDD1 010 was the tenth well recorded in section 17 and is identified in figure 9 with the number 10.

OWNER: Person, business, or agency responsible for the well at the time the well information was reported or collected.

DATE DRILLED: Date driller recorded the well log, usually when the last test was made or well reached final depth.

ALTITUDE: Altitude of land surface at well. Altitudes were determined from topographic maps that have either 100-foot or 20-meter (65.6 ft) contour intervals. Altitudes are in feet above sea level.

HOLE DEPTH: Depth drilled, in feet, as reported by driller or owner.

WELL DEPTH: Depth of well, in feet, as reported by the driller or owner. It is the distance from land surface to the bottom of the well casing or screen if the well was completed in unconsolidated sediments, or to the depth drilled if the well is completed in bedrock. Most domestic wells in this area are completed with open-ended casings that are 6 inches in diameter.

DEPTH TO BEDROCK: Depth to bedrock, in feet below land surface.

WATER LEVEL DEPTH: Depth to water, in feet below land surface, in the completed well. Negative values indicate a water level above land surface. Most entries were reported by drillers or owners and have not been field checked. All water levels are assumed to be a static water surface, that is, a natural level not influenced by any recent withdrawal of water from the well.

WATER LEVEL DATE: Date when water level was measured.

YIELD: The rate, in gallons per minute, that that water has been withdrawn from the well during a short test period. Usually this testing is accomplished by the well driller by pumping or bailing for 0.25 to 2 hours. Caution: this entry often does not reflect the long-term capacity of the well to supply water and commonly either overestimates or underestimates the full potential of the aquifer at that location.

Table 3.– Summary of data for wells

[bdrk, bedrock; gal/min, gallons per minute; --, no data]

Local number	Map number	Owner	Date drilled	Altitude (feet)	Depth (in feet): Hole	Depth (in feet): Well	Depth (in feet): To bdrk	Water level: Depth (feet)	Water level: Date	Yield (gal/min)
SECTION 8										
SA01000208CDDD1	009	CROW CREEK LODGE	03-11-75	140	100	100	--	41	03-11-75	6
SA01000208DBCA1	003	KNAPP EDITH	01-01-58	170	73	73	--	10	01-01-58	10
SA01000208DBCA2	003	BAKER JOHN R	01-17-84	160	100	100	--	70	01-17-84	30
SA01000208DBCC1	001	BURSIEL ROBERT	--	150	70	70	--	10	01-01-65	15
SA01000208DBCC2	001	BURSIEL ROBERT	05-18-78	150	59	58.5	--	20	05-18-78	15
SA01000208DCBB1	008	FEHLE TONY	06-30-72	150	65	63	--	45	06-30-72	20
SA01000208DCBD1	010	MEAGHER GEORGE	10-24-66	160	63	63	--	30	02-01-73	30
SA01000208DCCA1	006	CONRAD DON	01-01-72	130	38	38	--	--	--	20
SA01000208DCCA2	006	GUNDERSON DAVE	01-01-72	130	28	28	--	16	01-01-72	12
SA01000208DCCB1	004	DOUBLE MSKY BAR	01-01-62	150	48	48	--	--	--	--
SA01000208DCCD1	005	WILLIAMS IVAN E		125	41	41	--	15	01-01-58	30
SA01000208DCDC1	002	GIRDWOOD CITY OF	01-01-65	150	101	79	98	9.5	01-01-68	350
SECTION 9										
SA01000209ABCC1	005	SEIBU ALASKA INC	03-13-87	230	61	61	58	17.4	03-13-87	50
SA01000209ACBA1	004	SEIBU ALASKA INC	03-25-87	164	88	88	83	11	03-25-87	579
SA01000209ACBD1	003	SEIBU ALASKA INC	03-10-87	164	43	43	33	2	03-10-87	--
SA01000209CBDD1	002	AK DOT (TW-1)	09-22-86	140	66	56	56	21.2	09-25-86	7
SA01000209CCCB1	001	KING EARL	07-31-68	180	29	29	--	5	07-31-68	200
SA01000209CCCB2	001	KING EARL	07-29-68	180	32	29.5	--	9	07-29-68	12
SECTION 16										
SA01000216BAAA1	011	BICKEL ROGER & JOAN	10-02-81	280	105	105	95	0	10-02-81	11
SA01000216BABA1	005	ALYESKA CORP	10-16-65	270	70	53	66	--	--	325
SA01000216BABA2	005	ALYESKA UTILITIES	07-30-82	250	54	44	--	11	07-30-82	160
SA01000216BADC1	003	ALYESKA CORP	01-01-66	280	48	48	--	--	--	--
SA01000216BBAA1	010	DEBAKER B & RICE K	08-17-79	225	98	98	38	--	--	--
SA01000216BDAA1	002	ALYESKA CORP	01-01-67	350	100	100	--	--	--	--
SA01000216BDBD1	007	JACOBS LOCKE	--	300	90	90	--	--	--	--
SA01000216BDCD1	004	RASMUSON ELMER E	10-13-69	290	80	80	65	26	10-13-69	20
SA01000216BDDA1	001	ALYESKA CORP	01-01-62	350	138	138	2	68	01-01-68	--
SA01000216CABD1	014	CARESS WARREN H	07-25-85	330	148	148	35	--	--	35
SA01000216CACA1	006	MCCOY GEORGE	08-22-84	450	110	110	30	Flowing	08-22-84	30
SA01000216CACB1	008	SAFAR YVAN	08-13-79	375	58	58	35	--	--	0.5
SA01000216CACB2	008	CREWS JR PAUL	08-13-79	375	58	58	26	-2	08-13-79	0.5
SA01000216CACB3	008	SCHULTZ DONALD C	08-16-79	375	58	58	13	-5	08-16-79	10
SA01000216CACB4	008	SAFAR YVAN	08-14-79	390	78	78	38	25	08-14-79	0.5
SA01000216CACB5	008	KUNG PETER	11-04-83	300	98	98	30	36	11-04-83	1
SA01000216CACB6	008	KNOUS WARD	08-10-79	375	88	88	27	-2	08-10-79	0.5
SA01000216CACC1	009	MILLER DOYLE	05-07-84	330	106	106	18	--	--	6
SA01000216CBDC1	012	SEARS DAVID	05-18-81	300	101	101	67	58	05-18-81	6.5
SA01000216CBDD1	015	JOHNSON BOB	05-09-84	300	248	248	18	30	05-09-84	1
SECTION 17										
SA01000217AABC1	005	CHERRIER&KING	03-29-78	115	76.5	76.5	--	3.5	03-29-78	344
SA01000217ABAA1	001	POST OFFCE STORE	--	110	45	45	--	--	--	--
SA01000217ABAA2	001	GLACIER VALLEY WATER	10-09-81	110	91	72.7	--	10.3	10-09-81	310
SA01000217ABAB1	011	HARPER WILLIAM LEE	08-15-84	100	50	50	--	-1	08-15-84	20
SA01000217ABAB2	011	BRODIN RALPH	09-20-82	100	55	55	--	--	--	40
SA01000217ABBA1	012	ROSIES OF GIRDWOOD A	02-08-83	100	60	60	--	15	02-08-83	30
SA01000217ABBD1	009	FONTAINE CLARK	05-05-80	100	40	38.5	--	7	05-05-80	15
SA01000217ABBD2	009	JANSSEN CONTRACTING	10-17-84	100	60	60	--	8	10-17-84	40
SA01000217ABCD1	006	GIRDWOOD FIRE STATIO	10-05-81	120	39	38.5	--	9	10-05-81	25
SA01000217BAAA1	008	BORDIN RALPH	12-21-82	150	59	59	--	40	12-21-82	20
SA01000217BAAB1	004	DUQUETTE NORMAN	05-17-79	130	62	61.8	--	35	05-17-79	15
SA01000217BABD1	003	PRINGLE STEVE	10-19-77	120	58	58	--	--	--	10
SA01000217BACB1	013	DUQUETTE NORMAN	10-11-84	100	59	58.6	--	33	10-11-84	15
SA01000217BBCD1	014	SPIRO PAUL	10-11-84	100	59	58.6	--	46	10-11-84	10
SA01000217BBDA1	007	BERGSTRAND JAY	05-19-78	130	56	56	--	--	--	10
SA01000217BBDC1	015	MCPHERSON STUART	08-21-80	100	61	57	--	32	08-21-80	12
SA01000217BBDD1	016	JEWELL ALAN	07-25-80	100	56	56	--	28	07-25-80	25
SA01000217BCBA1	017	HINTON NICHOLAS C	05-10-84	100	47	47	--	32	05-10-84	30
SA01000217BCCB1	019	HARMON JERRY	03-12-75	140	70	70	--	45	03-12-75	10
SA01000217BCCB2	019	ROWE BILL	09-07-74	140	46	45	--	25	09-07-74	6
SA01000217CBDD1	010	ANCH MUNIC (TW-2)	09-18-86	30	205	103	173	5.4	09-19-86	250
SA01000217CBDD2	010	ANCH MUNIC (TW-3)	09-05-86	30	80	80	--	5.9	09-19-86	--
SA01000217DBAC1	002	INLET CO	01-01-71	290	600	600	28	28	01-01-77	10

Table 3.-- Summary of data for wells -- Continued

Local number	Map number	Owner	Date drilled	Altitude (feet)	Depth (in feet) Hole	Well	To bdrk	Water level Depth (feet)	Date	Yield (gal/min)
SECTION 18										
SA01000218ADAD1	006	DAVIS RAYMOND A	07-12-71	150	90	88	—	55	07-12-71	30
SA01000218ADAD2	006	DAVIS RAYMOND A	03-14-75	150	100	89	—	—	—	—
SA01000218ADAD3	006	MEINEL GENE	07-31-80	150	73	73	—	18	07-31-80	5
SA01000218ADCD1	010	CRICK RICHARD&CRUSEY	10-13-73	100	107	107	—	82	10-13-73	30
SA01000218ADDD1	003	MOUSEL JON	04-07-83	50	57	57	—	38	04-07-83	15
SA01000218ADDD2	003	GIEL	10-21-77	100	73	72.6	—	35	10-21-77	—
SA01000218ADDD3	003	TOMCO MICHAEL S	08-21-79	100	79	78.7	—	—	—	20
SA01000218CDCA1	004	PRINCE JESSE	09-19-69	105	152	152	—	80	09-19-69	10
SA01000218CDDB1	014	WESTBERG WAYNE	10-16-79	100	160	159	—	80	10-16-79	50
SA01000218DAAA1	011	VANDENBURG JACK	09-19-74	100	56	56	—	35	09-19-74	5
SA01000218DAAC1	001	BROCKWAY DANA	05-31-83	50	80	78.7	—	39	05-31-83	5
SA01000218DABB1	008	DUNN IRENE	09-06-71	150	97	97	—	85	09-06-71	6
SA01000218DBDC1	007	EGLOFF WERNER	07-02-72	110	52	52	—	35	07-02-72	8
SA01000218DCAB1	005	ALLEN JOEL C	—	100	47	47	—	30	01-01-58	15
SA01000218DCAC1	015	HILL DAVID	07-03-85	100	62	62	—	42	07-03-85	20
SA01000218DCBD1	009	BROWN CHARLES	—	100	57	57	—	35	12-01-72	3
SA01000218DCBD2	009	PARRY RICHARD	07-26-85	100	69	68	—	58	07-26-85	7
SA01000218DCCA1	012	RESSEL JOSEF	12-06-78	90	165	165	—	56	12-06-78	30
SA01000218DCCA2	012	CHEIFER ARLENE	08-21-79	70	156	154	—	—	—	20
SA01000218DCCC1	002	JOHNSON R W	01-01-66	100	86	86	—	—	—	—
SECTION 19										
SA01000219ABBB1	013	SEARS DAVID W	04-18-79	100	48	48	—	6	04-18-79	15
SA01000219BAAA1	019	HART KEITH	09-01-59	90	72	72	—	60	09-01-59	3
SA01000219BAAB1	010	BETZ PRESTON	01-01-64	100	138	138	—	—	—	—
SA01000219BAAC1	004	ANCHORAGE DHHS 81	01-31-85	50	20.5	20.5	—	1.4	04-22-85	—
SA01000219BAAC2	004	HUGHES JOHN	07-01-84	100	93	93	—	79	07-01-84	12
SA01000219BAAD1	008	HIBBS J V	01-01-58	90	89	89	—	20	01-01-58	17
SA01000219BABA1	016	HASTREITER HERMANN	12-16-72	90	163	162	—	55	12-16-72	50
SA01000219BABC1	007	WILLOUGHBY CHRIS	08-22-83	60	101	98.3	—	—	—	2.5
SA01000219BBAC1	015	FLETCHER JOHN	07-15-79	50	240	240	—	27	07-15-79	6
SA01000219BBAD1	009	YANAGAWA CARL	10-10-84	60	316	315.5	—	10	10-10-84	25
SA01000219BBCA1	017	SCHWARTZ BILL	06-22-82	50	142	142	—	32	06-22-82	5
SA01000219BBCA2	017	SWARTZ BILL	11-01-84	50	346	331	315	20	03-02-85	1
SA01000219BCAA1	005	ADH GIRDWOOD	07-01-67	50	50	50	—	—	—	—
SA01000219BDAB1	011	SPROAT WILLIAM L	—	70	71	71	—	10	01-01-58	15
SA01000219BDBA1	006	GIRDWOOD ELEM SCH	01-01-65	50	88	88	—	63	01-01-65	—
SA01000219CAAA1	002	DANICH HOUSE	01-01-52	50	46	46	—	35	01-01-68	—
SA01000219CAAA2	002	DOLAN KEN	12-21-82	50	39	38.5	—	4	12-21-82	50
SA01000219CAAC1	018	HARRISON MARK	08-09-84	15	53	53	—	1	08-09-84	20
SA01000219CACA1	001	J DANICH TEXACO	03-07-66	35	46.5	46.5	—	1	03-07-66	40
SA01000219CACA2	001	TRAUTNER JOHN	11-09-78	35	119	119	—	10	11-09-78	100
SA01000219CADB1	003	DANICH JOE	01-01-50	25	46	46	—	1	01-01-50	—
SA01000219CADB2	003	HAYWORTH GENE	01-01-49	25	35	35	—	0.7	01-01-49	—
SA01000219DBBB1	012	KELLY GLENN	—	30	45	45	—	—	—	40
SA01000219DBBB2	012	MURPHY DENIS	09-04-86	15	40	39	—	-0.5	09-04-86	35

Table 4. -- Lithologic data for selected wells

Depth below land surface in feet	Lithologic description
Well SA01000208CDDD1 009 Crow Creek Lodge	
[Log by M-W Drilling]	
0-2	Ice
2-5	Gravel, small
5-11	Gravel, clayey
11-18	Clay
18-19	Water gravel
19-24	Clay and gravel
24-47	Silty gravel
47-70	Wet gravel
70-98	Hardpan
98-100	Water gravel, slightly sandy
Well SA01000208DBCA2 003 John Baker	
[Log by Jay Williams Drilling Co.]	
0-8	Sand and gravel
8-76	Hardpan
76-94	Sand and gravel
94-100	Gravel and water
Well SA01000208DBCC2 001 Bob Bursiel	
[Log by M-W Drilling]	
0-1	Organics
1-3	Damp gravel
3-13	Blue clay
13-23	Silty hardpan
23-41	Silty cobbles
41-52	Loose gravel
52-59	Sandy water gravel
Well SA01000208DCDB1 002 City of Girdwood/Glacier Valley Water Assoc.	
[Log by U.S. Corps of Engineers]	
0-4	Sandy gravel
4-31	Sand, silty and gravelly
31-33	Sand, silty
33-57	Sand, gravelly
57-58	Sand, silty and gravelly
58-63	Sand, silty
63-66.5	Sand, gravelly
66.5-68.5	Sand, clayey and gravelly
68.5-76	Sand, gravelly, with water
76-98	Sand, silty and gravelly, large boulders 91-97 ft
98-101	Bedrock, shaley sandstone
Well SA01000209ABBC1 005 Seibu Alaska, Inc.	
[Log by M-W Drilling]	
0-12	Gray silty gravel
12-43	Gray silty gravel with some water, 10 gal/min
43-58	Brown silty gravel with some water, 10 gal/min
58-61	Gray bedrock
Well SA01000209ACBD1 003 Seibu Alaska, Inc.	
[Log by M-W Drilling]	
0-8	Gray silty gravel
8-16	Gray silty gravel with some water
16-26	Brown sandy gravel with some water
26-33	Gray sandy gravel with some water, 10-15 gal/min
33-43	Gray bedrock, 0.5-1 gal/min
Well SA01000209ACBA1 004 Seibu Alaska, Inc.	
[Log by M-W Drilling]	
0-6	Gray silty gravel
6-14	Organics
14-28	Gray silt with gravel, wet
28-46	Gray gravel with water, 20+ gal/min
46-53	Gray silty gravel with water, 25+ gal/min
53-78	Gray sandy gravel with water, 25+ gal/min
78-83	Gray silty gravel with some water
83-88	Gray bedrock

Table 4.–Lithologic data for selected wells -- Continued

Well SA01000209CBDD1 002 Alaska Department of Transportation
[Well drilled by U.S. Geological Survey, log by U.S. Geological Survey]

Depth below land surface in feet	Lithologic description
0-10	Clayey silt, trace sand, gray, moist
10-46	Silt, coarse sand, and gravel, saturated at 27 ft Yield estimated to be 3 gal/min at 32 ft Yield estimated to be 5 gal/min at 38 ft
46-56	Gravelly silt, dark gray, yields less than 1 gal/min
56-66	Bedrock

Well SA01000209CCCB1 001 Earl King
[Log by Clemenson Drilling]

Depth below land surface in feet	Lithologic description
0-1	Dirt
1-3	Gravel
3-15	Hard till and boulders
15-17	Gravel with water
17-18	Brown till
18-22	Gravel with water
22-23	Till
23-29	Till, hard

Well SA01000209CCCB2 001 Earl King
[Log by Clemenson Drilling]

Depth below land surface in feet	Lithologic description
0-1	Gravel
1-4	Peat
4-8	Silt
8-12	Gravel with water
12-17	Silt, sand, and clay
17	Laminated sand and gravel with boulders, clay, and water
17-25	Gravel with water
25-27	Soft brown clay with water
27-29.5	Boulders with water

Well SA01000216BABA1 005 Alyeska Corporation
[Log by J. Morgan and Dickerson-Oswald and Associates]

Depth below land surface in feet	Lithologic description
0-10	Brown muck and blue clay
10-12	Blue clay
12-33	Blue clay and gravel
33-34	Loose gravel and clay, water
34-39	Rocks and gravel, water
39-43	Blue clay
43-45	Fine sand and gravel, water
45-47	Fine sand and gravel with clay, water
47-49	Rocks and gravel, water flows at surface
49-51	Fine and coarse sand, water, 20 gal/min
51-53(?)	Fine and coarse sand, some rock, water
53(?)-59.5	Clay, gravel, and sand
59.5-66	Blue clay, very little gravel
66-70	Black shale, bedrock

Well SA01000216BABA2 005 Alyeska Utilities
[Log by M-W Drilling]

Depth below land surface in feet	Lithologic description
0-2	Organics
2-10	Sandy clay, brown
10-23	Clay with some gravel, gray
23-25	Gravel with some clay
25-34	Gravel with clay, water seepage
34-43	Small gravel with sand and water
43-54	Gray clay with gravel

Well SA01000216BADC1 003 Alyeska Corporation
[Log by Penn-Jersey Drilling]

Depth below land surface in feet	Lithologic description
0-2	Muskeg
2-4	Gravel
4-14	Blue clay
14-48	Gravel

Table 4.--Lithologic data for selected wells -- Continued

Depth below land surface in feet	Lithologic description
Well SA01000216BDCD1 004 Elmer Rasmuson	
[Log by Swafford Drilling]	
0-18	Sand and gravel, brown
18-25	Blue gray clay gravel
25-34	Sand and gravel, brown
34-43	Sand and gravel with water
43-47	Clay and gravel, blue grav
47-55	Sand and gravel,with water
55-65	Clay, sand, and gravel
65-75	Shale, soft
75-80	Bedrock
Well SA01000217AABC1 005 Cherrier and King	
[Log by Frontier Drilling]	
0-76.5	Large gravel
Well SA01000217ABAA2 001 Glacier Valley Water Association	
[Log by M-W Drilling]	
0-8	Loose gravel
8-79	Water gravel
79-91	Silty hardpan
Well SA01000217ABBA1 012 Rosies of Girdwood	
[Log by Rampart Drilling Works]	
0-12	Silty sandy fine gravel
12-28	Coarse gravel
28-42	Fine silty gravel with several small boulders
42-51	Water-producing gravel with 30 percent silty clay
51-60	Gravel with lesser amounts of silt than above
Well SA01000217BAAB1 004 Norman Duquette	
[Log by M-W Drilling]	
0-3	Fill
3-27	Silty gravel
27-38	Sandy gravel
38-41	Wet gravel
41-56	Hardpan
56-62	Water gravel
Well SA01000217CBDD1 010 Municipality of Anchorage	
[Drilled by U.S. Geological Survey, log by U.S. Geological Survey]	
0-18	Gravelly silt, dark gray, moist saturated at 12 ft
18-29	Sand and gravel, trace silt, yields 5-10 gal/min
29-33	Gray silt
33-100	Sand, gravel, and silt Yields about 15 gal/min at 55 ft Yields about 15 gal/min at 77 ft Yields about 10 gal/min at 98 ft
100-110	Silt, sand, and gravel
110-115	Silt and sand, trace gravel
115-120	Silt and sand, dark gray Yields about 3 gal/min at 118 ft
120-140	Silt, trace clay
140-173	Silt and clay, sticky Yields virtually no water
173-177	Bedrock, hard
177-190	Bedrock, soft, collapses into hole when water is pumped Yields about 3 gal/min
190-205	Bedrock, hard
Well SA01000217CBDD2 010 Municipality of Anchorage	
[Log by M-W Drilling]	
0-13	Gravel
13-15	Silty sand, wet
15-27	Sandy gravel, wet
27-29	Sandy silt, wet
29-33	Grey sandy gravel, wet
33-48	Brown sandy gravel and water, estimated 20 gal/min
48-78	Grey sandy gravel and water, estimated 50-60 gal/min

Table 4.--Lithologic data for selected wells -- Continued

Depth below land surface in feet	Lithologic description
Well SA01000218ADAD3 006 Gene Meinel	
[Log by M-W Drilling]	
0-7	Organic
7-51	Silty gray clay with gravel
51-54	Boulder
54-66	Silty gray clay with gravel
66-73	Brown clay and gravel
73-73.3	Sandy gravel and water
Well SA01000218ADAC1 010 Joe Crusey and Richard Crick	
[Log by M-W Drilling]	
0-2	Gravel fill
2-6	Organics
6-45	Clayey gravel till
45-50	Blue clay
50-51	Boulder
51-92	Blue clay
92-94	Coarse sand, wet
94-103	Coarse gravel, wet
103-107	Coarse gravel, slightly sandy, good waterbearing
Well SA01000218CDDB1 014 Wayne Westberg	
[Log by M-W Drilling]	
0-1	Gravel fill
1-3	Organics
3-78	Silty gravel, occasional cobbles
78-113	Clayey gravel
113-148	Gravelly hardpan
148-160	Sandy gravel, waterbearing
Well SA01000218DCBD2 009 Richard Parry	
[Log by M-W Drilling]	
0-63	Brown silty gravel, damp
63-69	Sand and gravel, water
Well SA01000218DCCA1 012 Josef Ressel	
[Log by M-W Drilling]	
0-1	Organics
1-29	Silty gravel
29-55	Loose sandy gravel
55-76	Hardpan
76-80	Wet gravel
80-118	Gray clay
118-145	Heaving sand
145-163	Hardpan
163-165	Water gravel
SA01000219BAAC1 004 Municipality of Anchorage, Department of Health and Human Services, well No. 81	
[Log by Denali Drilling]	
0-3	Peat
3-7	Silty gravelly sand, saturated, gravels to 1 inch, gray-brown
7-20.5	Sandy silt, blue-gray, random small gravels, slightly plastic, drier with depth
Well SA01000219BAAC2 004 John Hughes	
[Log by Foss Drilling]	
0-5	Peat
5-25	Sand and gravel, blue-gray
25-80	Sand and gravel, green, hard
80-93	Sand and gravel, with water
Well SA01000219BABA1 016 Herman Hastreiter	
[Log by M-W Drilling]	
0-25	Silty boulder gravel
25-41	Silty gravel
41-80	Sandy silt, occasional cobble
80-103	Sandy gravel and cobbles
103-120	Silty gravel, wet
120-156	Silty gravel, wet
156-162	Water gravel

Table 4.--Lithologic data for selected wells -- Continued

Depth below land surface in feet	Lithologic description
Well SA01000219BBAD1 009 Carl Yanagawa [Log by M-W Drilling]	
1-2	Gravel fill
2-4	Organics
4-15	Sand and gravel, wet
15-26	Silty hardpan
26-28	Silty gravel, wet
28-93	Silty gravelly hardpan
93-213	Gravelly hardpan
213-238	Loose gravelly silt
238-279	Silty gravelly hardpan
279-308	Silty sand, wet
308-316	Waterbearing gravel
Well SA01000219BBCA2 017 Bill Swartz [Log by Vern's Drilling]	
0-5	Brown sand
5-19	Gray silt
19-50	Cemented gravels with cobbles
50-55	Silt
55-62	Cemenced gravel with silt
62-150	Cemented gravel, water seepage from 62-68 ft and 133-147 ft
150-160	Cemented silty gravel, seepage from 159-160 ft
160-170	Silty gravel
170-230	Cemented silty gravel, seepage from 175-185 ft
230-241	Silt
241-285	Silt, little gravel
285-315	Cemented silty gravel
315-317	Quartz-type rock
317-346	Gray-black rock, water
Well SA01000219CACA2 001 John Trautner [Log by M-W Drilling]	
0-15	Fill
15-21	Wet peat, gravelly
21-37	Clay
37-59	Water gravel
59-64	Wet silty sand
64-89	Silty hardpan
89-101	Wet gravel
101-104	Hardpan
104-119	Sandy water gravel

Table 5. -- Water-quality data for Glacier Creek, California Creek, and Virgin Creek

[ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter]

Stream and station number		Date	Time	Streamflow, instantaneous (ft³/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature water (deg C)	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)
Glacier Creek	15272550	05-03-56	--	--	96	7.20	--	15	1.0	1.6	0.70
		07-04-56	--	--	74	7.30	--	9.9	1.7	2.4	0.20
		10-31-66	1200	--	139	7.40	--	21	1.8	1.9	0.0
		05-04-67	1400	728	103	7.50	3.5	16	1.9	2.2	0.30
		01-04-68	1000	70	127	7.30	0.0	21	2.1	2.5	0.20
		03-29-68	1430	60	135	8.00	0.5	21	1.9	2.4	0.50
		06-06-68	1500	416	100	7.40	6.5	16	1.6	1.5	0.20
		08-04-68	1630	439	80	7.70	11.0	12	1.5	1.1	0.30
		12-03-68	1045	36	156	7.50	0.0	20	2.4	2.8	0.50
		04-01-69	1330	33	146	7.70	1.0	21	2.6	3.7	1.0
		03-05-70	1415	66	115	7.40	1.5	16	2.4	2.5	0.30
		06-10-70	1320	588	88	7.80	7.5	12	2.0	1.4	0.30
		07-22-70	1030	486	90	7.80	5.5	14	2.0	1.4	0.10
		08-31-70	1400	411	98	7.60	7.0	15	1.6	1.5	0.10
		10-15-70	1430	118	131	7.70	1.5	19	2.3	2.4	0.20
		11-01-70	1030	1080	68	7.30	2.0	10	1.2	1.3	0.30
		11-26-71	1430	42	133	7.70	0.0	21	2.1	2.5	0.20
		03-22-72	1000	14	147	7.70	0.0	23	2.4	2.8	0.30
		06-13-85	1440	--	90	7.50	6.5	13	1.5	1.4	0.20
California Creek	15272530	11-26-71	1100	--	125	7.70	0.0	18	2.7	3.4	0.20
		06-13-85	1315	36	80	7.60	4.5	12	1.8	1.3	0.20
Virgin Creek	15272503	06-13-85	1145	31	55	7.40	3.0	9.0	0.40	0.80	0.20

Stream	Date	Alkalinity field (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus, ortho, dissolved (mg/L as P)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)
Glacier Creek	05-03-56	34	7.2	1.2	0.0	4.2	53	--	--	--	--
	07-04-56	30	6.0	0.80	0.10	6.5	46	--	--	--	--
	10-31-66	41	14	1.8	0.10	4.3	71	--	--	--	--
	05-04-67	38	10	0.70	0.40	4.4	62	--	--	--	--
	01-04-68	48	15	0.70	1.0	4.6	77	--	--	--	--
	03-29-68	49	15	1.1	0.0	4.5	78	--	--	--	--
	06-06-68	38	9.8	0.70	0.0	3.6	57	--	--	--	--
	08-04-68	29	9.8	0.80	0.0	2.2	45	--	--	--	--
	12-03-68	49	16	1.2	0.0	5.2	79	--	--	--	--
	04-01-69	54	16	2.8	0.10	4.0	85	--	--	--	--
	03-05-70	38	17	1.8	0.20	4.1	68	--	--	--	--
	06-10-70	34	6.1	0.40	0.0	3.7	47	--	--	--	--
	07-22-70	36	7.5	0.70	0.10	3.9	52	--	--	--	--
	08-31-70	31	13	1.8	0.0	4.1	56	--	--	--	--
	10-15-70	45	14	1.8	0.20	3.7	71	--	--	30	70
	11-01-70	23	5.3	0.80	0.20	3.3	39	--	--	70	30
	11-26-71	49	13	2.0	0.10	4.2	76	--	--	0	20
	03-22-72	54	14	3.1	0.10	5.8	85	--	--	20	30
	06-13-85	--	8.1	0.70	<0.10	3.6	47	0.250	<0.010	21	4
California Creek	11-26-71	48	8.8	3.5	0.10	5.0	72	--	--	10	40
	06-13-85	--	5.6	0.70	<0.10	4.2	44	0.360	<0.010	17	2
Virgin Creek	06-13-85	--	4.9	0.20	<0.10	3.7	30	0.160	<0.010	14	3

Table 6.--Suspended-sediment data for Glacier Creek at Girdwood

Date	Discharge (ft^3/s)	Suspended sediment (mg/L)	Date	Discharge (ft^3/s)	Suspended sediment (mg/L)
06-08-66	723	103	01-23-69	24	2
07-19-66	523	147	04-01-69	33	5
08-11-66	490	350	05-27-69	1,230	354
08-21-66	2,900	3,760	08-27-69	163	16
08-22-66	1,150	645	10-08-69	1,570	900
09-26-66	1,190	902	10-11-69	2,760	1,880
11-12-66	110	8	12-17-69	208	19
01-20-67	30	8	03-05-70	66	1
04-17-67	20	6	04-14-70	95	4
05-04-67	228	26	06-10-70	588	19
09-19-67	1,540	1,360	07-22-70	486	4
10-12-67	173	9	08-31-70	411	14
11-13-67	126	10	10-15-70	118	2
			11-01-70	1,080	538
03-29-68	60	10	12-01-70	54	4
06-06-68	416	14			
07-02-68	863	66	02-08-71	40	4
08-04-68	439	88	04-20-71	41	6
10-03-68	343	28	05-26-71	237	7
12-03-68	36	7			

Table 7. – Major chemical constituents and physical characteristics of water from selected wells

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; cols./100 mL, fecal coliform colonies per 100 milliliters]

Local number		Date of sample	Water level, depth below land surface (feet)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (mg/L as $CaCO_3$)	Hardness, noncarbonate (mg/L as $CaCO_3$)	Fecal coliform bacteria (cols./100 mL)
SA01000208DCBC1	004	08-09-66	--	184	7.80	6.5	--	--	--
		01-26-68	--	195	7.70	--	95	13	--
SA01000208DCDB1	002	08-18-66	--	121	7.50	8.5	47	1	--
		01-26-68	--	128	7.30	3.0	52	6	--
SA01000216BABA1	013	06-13-85	--	242	7.40	6.0	140	16	<1
SA01000216BABD1	005	06-13-85	--	292	7.40	5.0	150	12	<1
SA01000216BADC1	003	01-26-68	--	184	7.90	--	81	0	--
SA01000217AABC1	005	06-11-85	--	160	--	4.0	58	11	<1
SA01000217CBDD1	010	10-15-86	4.00	165	--	4.0	83	12	<1
SA01000219BAAC1	004	04-22-85	1.44	80	5.60	2.5	--	--	<1
		08-22-85	1.75	98	6.00	4.0	--	--	<1
		06-20-86	2.34	99	6.30	2.5	--	--	<1
		08-28-86	1.75	130	6.10	5.0	--	--	<1
SA01000219BDBB1	006	07-22-66	--	213	7.80	10.0	100	2	--
SA01000219BDDD1	002	04-11-53	--	146	6.70	--	73	7	--

Local number		Date of sample	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity lab (mg/L as $CaCO_3$)	Sulfate dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)
SA01000208DCBC1	004	01-26-68	34	2.4	3.0	.40	--	4.5	6.7	.10	6.5	110
SA01000208DCDB1	002	08-18-66	16	1.7	3.0	.20	--	5.3	.70	.00	4.3	59
		01-26-68	17	2.4	3.8	.10	--	11	3.9	.00	4.6	71
SA01000216BABA1	013	06-13-85	46	5.6	9.0	.70	122	6.5	4.9	<.10	13	160
SA01000216BABD1	005	06-13-85	51	4.6	4.9	.40	135	6.8	5.8	<.10	14	170
SA01000216BADC1	003	01-26-68	28	2.8	7.2	.20	--	8.2	.40	.10	9.5	110
SA01000217AABC1	005	06-11-85	20	2.0	9.0	1.4	47	10	12	<.10	5.0	88
SA01000217CBDD1	010	10-15-86	29	2.5	4.2	.70	69	9.3	3.8	<.10	5.4	97
SA01000219BAAC1	004	06-20-86	--	--	--	--	--	--	1.6	--	--	--
		08-28-86	--	--	--	--	--	--	1.6	--	--	--
SA01000219BDBB1	006	07-22-66	36	2.4	3.0	1.2	--	5.8	3.9	.00	7.0	120
SA01000219BDDD1	002	04-11-53	24	3.2	2.3	.80	--	10	3.0	--	7.1	90

Local number		Date of sample	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus, ortho, dissolved (mg/L as P)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)
SA01000216BABA1	013	06-13-85	<.10	<.010	2,900	1,600
SA01000216BABD1	005	06-13-85	.43	<.010	320	2,400
SA01000217AABC1	005	06-11-85	.32	<.010	<3	<1
SA01000217CBDD1	010	10-15-86	.37	<.010	16	2
SA01000219BAAC1	004	04-22-85	<.10	<.010	--	--
		08-22-85	<.10	<.010	--	--
		06-20-86	<.10	<.010	--	--
		08-28-86	<.10	<.010	--	--