Overview of Environmental and Hydrogeologic Conditions at Bettles Field, Alaska

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U.S. GEOLOGICAL SURVEY

Open-File Report 95-343

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

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By James R. Cowan

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Anchorage, Alaska
1995

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
centimeter (cm)	0.3937	inch
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
liter (L)	0.2642	gallon
liter per second (L/s)	15.85	gallon per minute
hectare	2.471	acre
cubic meter per second (m^3/s)	35.31	cubic foot per second
degree Celsius (° C)	°F=1.8 (°C)+32	degree Fahrenheit (°F)

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 the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water-quality units used in this report:

Chemical concentration and water temperature are given only in metric units. Chemical concentration in water is given in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the solute mass per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million. Specific conductance is given in microsiemens per centimeter (µS/cm) at 25° C.

Overview of Environmental and Hydrogeologic Conditions at Bettles Field, Alaska

By James R. Cowan

ABSTRACT

The Federal Aviation Administration Bettles Field facility is near the remote community of Evansville on the alluvial plain of the Koyukuk River in north-central Alaska. The area has long, cold winters and short summers. Drinking water is obtained from an alluvial aquifer underlying the facility. Surface spills and disposal of hazardous materials may affect the quality of the ground water. Alternative drinking-water sources are available, but the quantity and quality of these sources are unknown. Floods are not a significant threat at the Federal Aviation Administration facility. The Federal Aviation Administration or its predecessors have operated airway support facilities at Bettles Field since 1949, and is considering the severity of contamination and the current environmental setting when evaluating options for compliance with environmental regulations at these facilities.

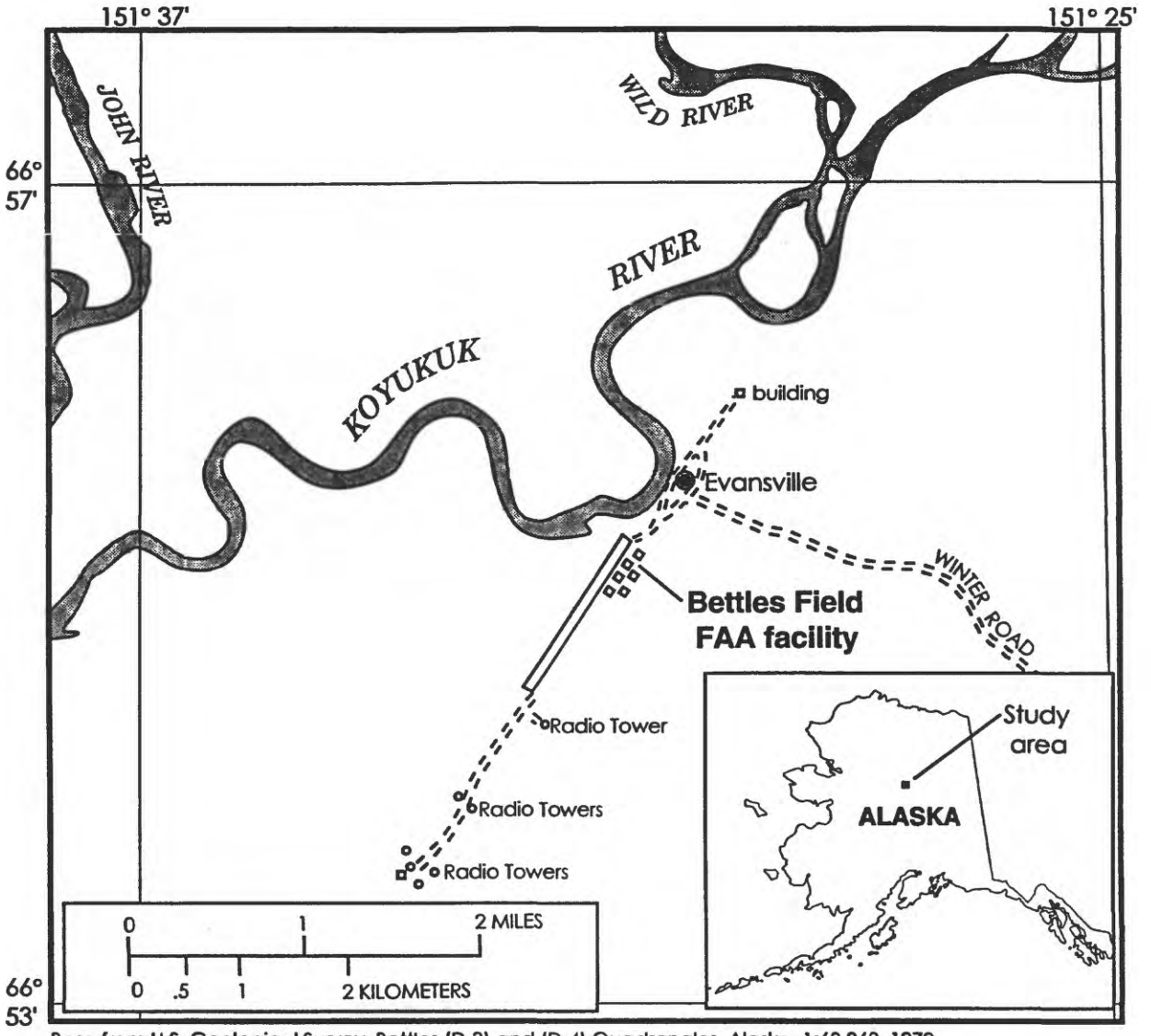
INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airway support and navigational facilities throughout Alaska. At many of these sites, fuels and potentially hazardous materials such as solvents, polychlorinated biphenyls, and pesticides may have been used and (or) disposed of. To determine if environmentally hazardous materials have been spilled or disposed at the sites, the FAA is conducting environmental studies mandated under the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act. To complete these more comprehensive environmental studies, the FAA requires information on the hydrology and geology of areas surrounding the sites. This report, the product of compilation, review, and summary of existing hydrologic and geologic data by the U.S. Geological Survey (USGS), in cooperation with the FAA, provides such information for the Bettles Field FAA facility and nearby areas. Also presented in this report is a description of the history, socioeconomics, and physical setting of the Bettles Field/Evansville area.

BACKGROUND

Location

Bettles Field is in north-central Alaska at approximate lat 66°55' N., long 151°32' W. (fig. 1). The FAA facility is about 290 km northwest of Fairbanks, about 650 km north of Anchorage, and about 40 km north of the Arctic Circle. Bettles Field is on the south bank of the Koyukuk River near the village of Evansville.



Base from U.S. Geological Survey, Bettles (D-3) and (D-4) Quadrangles, Alaska, 1:63,360, 1970

Figure 1. Location of Bettles Field Federal Aviation Administration facility, Alaska.

History and Socioeconomics

In 1899, during the Koyukuk River gold rush, Gordon Bettles opened a trading post at what is now referred to as "Old Bettles." The site was the northern terminus of barge traffic on the Koyukuk River (Orth, 1967). In 1943, the Civil Aeronautics Administration (CAA) (predecessor of the FAA) installed and began operating navigational facilities at the original village of Bettles.

In 1945, the U.S. Navy built Bettles Field southwest of Evansville, approximately 8 km east of the original Bettles FAA facility. Bettles Field was operated by the U.S. Navy as a support base for petroleum exploration on the North Slope of Alaska. In 1949, the CAA transferred its facilities from the original Bettles location to the Bettles Field facility and assumed operational responsibility for the airfield. Employment opportunities associated with construction, operation, and maintenance of the new airfield attracted area residents to Evansville, and the original village of Bettles was largely abandoned. Bettles Field was incorporated as a second-class city in 1985. Evansville remains an unincorporated community (Harding Lawson Associates, 1992). In this report the FAA facilities in the area are referred to as the FAA Bettles Field facility.

Bettles serves as a regional transportation and service center. Access is restricted to air travel during most of the year. During the winter, area residents have access to the State highway system on a 45-km winter trail. The Koyukuk River serves as a regional transportation route during the open-water season and after winter freeze-up (Harding Lawson Associates, 1992).

In 1990, the population of Bettles Field was 36 residents (Alaska Department of Community and Regional Affairs, 1993). Most Native residents live in the neighboring village of Evansville and are members of Native village and regional corporations. The Native population of Evansville is the principal group in the area engaged in subsistence activities such as hunting moose, caribou, and waterfowl. Subsistence activities are concentrated during the summer and autumn seasons (Fison and Associates, 1987).

The FAA Bettles Field facilities include a 1.6-km gravel runway, navigation and communication facilities, and support structures. A detailed description of properties owned, leased, or transferred by the FAA at Bettles Field and a listing of suspected sources of contamination near the facility is in the Environmental Compliance Investigation Report (ECIR) of the FAA facilities at Bettles Field prepared by Harding Lawson Associates (1992).

PHYSICAL SETTING

Climate

Bettles Field is in the continental climate zone (Hartman and Johnson, 1978) and has large diurnal and seasonal temperature variations. Low precipitation, clear skies, and low humidity are typical in the winter; thunderstorms are common in the summer. The mean annual temperature is -5.8°C, but temperatures range from a July mean maximum of 20.5°C to a January mean minimum of -29.1°C. Mean annual precipitation is about 340 mm, and the mean annual snowfall amount is about 1,980 mm. The month of greatest rainfall is August, and snowfall typically is greatest during December (Leslie, 1989). Mean monthly and annual temperature, precipitation, and snowfall are summarized in table 1.

Table 1. Mean monthly and annual temperature, precipitation, and snowfall for the period 1951-87, Bettles Field, Alaska

[Modified from Leslie (1989); °C, degree Celsius; mm, millimeter]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
						Temperature (°C)							
Mean maximum	-15.3	-17.9	-10.2	-0.5	11.4	19.7	20.5	16.8	9.2	-3.8	-14.3	-19.4	-0.7
	(Record maximum 33.9 °C, July 1986)												
Mean minimum	-29.1	-28.1	-23.0	-13.1	0.6	8.1	9.1	6.3	0.1	-11.0	-22.1	-27.8	-10.8
	(Record minimum -56.7 °C, January, 1975)												
Mean	-24.7	-23.1	-16.6	-6.7	6.1	13.9	14.8	11.6	4.6	-7.4	-18.2	-23.6	-5.8
						Precipitation (mm of moisture)							
	18.5	15.7	16.3	14.5	13.2	36.1	49.3	61.0	45.7	29.7	22.1	20.8	Total 342.9
						Snowfall (mm)							
	284.5	226.1	233.7	193.0	27.9	0.0	0.0	2.5	40.6	299.7	315.0	353.1	Total 1976.1

Vegetation

Vegetation in the Bettles Field area consists of closed spruce-hardwood forests, open spruce forests, and treeless bogs (Viereck and Little, 1972). The closed spruce-hardwood forests grow on south-facing slopes near the Koyukuk River and in areas that have well-drained soils. They are characterized by white and black spruce, paper birch, aspen, and balsam poplar. Open, low-growing spruce forests, characterized by widely spaced mature white spruce, black spruce, tamarack, paper birch, balsam poplar, and aspen with willow undergrowth, occur on north-facing slopes and in the river valley lowlands. Treeless bogs contain sedge and grass species and local areas of willows, alders, and birch.

Geology

The FAA Bettles Field facility is near the northeastern margin of the Koyukuk drainage basin, just south of the boundary between the Rocky Mountain System and the Intermontane Plateaus physiographic divisions as identified by Wahrhaftig (1965). The area is separated from the Brooks Range to the north by a major east-trending fault. Bedrock consists of an interbedded volcanic graywacke and mudstone sequence of Late Lower Cretaceous age, which is exposed in the Alatna Hills to the west and the Jack White Range to the east (Patton and Miller, 1973). Depth to bedrock in the vicinity of the FAA facility is unknown.

The facility is near the southern limit of Pleistocene glaciation by Brooks Range glaciers. The surficial geology is characterized by alluvial and glacial-fluvial sediments of Quaternary age in the Koyukuk River Valley and surrounding lowlands (Péwé, 1975). Discontinuous permafrost occurs in the alluvial sediments of the Koyukuk River Valley and may be absent in close proximity to large water bodies (Ferrians, 1965).

Soils at the FAA Bettles Field facility are classified as inceptisols, a soil order that includes immature soils that exhibit only minor modification of the parent material. Permafrost-bearing soils are included in this soil order (Rieger and others, 1979). Lowland soils surrounding the FAA Bettles Field facility are derived from the silty alluvium and loess of the Koyukuk River Valley. A thick, peaty surface mat is present above a 25- to 50-cm-thick saturated active layer. Freezing and thawing of the active layer produces an irregular land surface. Where present, the underlying permafrost is usually ice rich. Similar soils are found on the neighboring uplands but are usually more gravelly and loamy in texture than are their lowland equivalents. In these upland soils, the active layer is generally greater than 100 cm.

HYDROLOGY

Surface Water

The major surface-water feature near the FAA Bettles Field facility is the Koyukuk River. It flows to the west and southwest to its confluence with the Yukon River at the village of Koyukuk, approximately 260 km downstream. Nearby tributaries of the Koyukuk River are the John River and the Wild River (fig. 1). The John River flows into the Koyukuk River about 6 km downstream from the facility. The Wild River joins the Koyukuk River approximately 3 km upstream. An unnamed lake that has a surface area of approximately 60 hectares is about 3 km south-southeast of the FAA facility.

Streamflow data are not available for the Koyukuk River nor for its upstream tributaries near Bettles Field. However, the average annual discharge and low-flow discharge can be estimated using equations developed to characterize the streamflow of rivers and streams in interior Alaska (T. P. Brabets, U.S. Geological Survey, written commun., 1995). These equations use drainage basin area and mean annual precipitation within the drainage basin to estimate streamflow.

The average annual discharge (Q_{AVE}) is calculated using:

$$Q_{AVE} = 0.009(AREA)^{1.064}(PRECIP)^{1.354}$$

Where:

AREA = drainage basin area in square miles

PRECIP = mean annual precipitation within the drainage basin in inches

The area of the Koyukuk River drainage basin above Bettles Field, determined from inspection of the USGS hydrologic unit map for Alaska (U.S. Geological Survey, 1987), is approximately 11,300 km^2 (4,350 mi^2). The mean annual precipitation in the drainage basin, determined by inspection of the map showing mean annual precipitation for Alaska and conterminous basins of Canada (Jones and Fahl, 1994, plate 2), is approximately 66 cm (26 in.). Using these values, the average annual discharge of the Koyukuk River at Bettles Field is estimated to be approximately 160 m^3/s. The standard error of prediction, following conversion from the logarithmic units used in the regression analysis, is 29 percent (Jones and Fahl, 1994).

March is considered to be the period of low streamflow in interior Alaska. The estimated low-flow discharge for an interior Alaska river or stream is calculated by:

$$Q_{MAR} = 0.132(AREA)^{0.977}$$

Using this equation, the average low-flow discharge for the Koyukuk River at Bettles is estimated to be about 13 m^3/s. The paucity of winter streamflow data for interior Alaska rivers and streams, and conversion from logarithmic units result in a standard predictive error for low-flow determination of 92 percent.

Floods

Flood data for the FAA Bettles Field facility are not available. The U.S. Army Corps of Engineers (1993) rates the flood hazard at the neighboring village of Evansville as low, and no flooding of the village has been reported. Consequently, flood protection measures have not been implemented in the area.

The National Weather Service has maintained riverbank river-stage markers at Evansville since July 1969 (Paul Meyer, National Weather Service, oral commun., 1995). Flood stage, which is based on an arbitrary datum, is defined as 10.1 m. On August 28, 1994, heavy rainfall resulted in a record high stage of 7.4 m. This event correlated with record high discharges at three USGS stream-gaging stations in the Koyukuk River drainage basin: stream-gaging station 15564877 on Wiseman Creek at Wiseman, stream-gaging station 15564875 on the Middle Fork of the Koyukuk River near Wiseman (both about 95 km upstream from the FAA Bettles Field facility), and stream-gaging station 15564900 on the Koyukuk River at Hughes (about 140 km downstream from the FAA facility). The resulting floods at these sites were subsequently determined to have a recurrence interval of 100 years or more (B.B. Bigelow, USGS, oral commun., 1995). Consequently, the record high stage observed at Evansville in late August 1994, is considered to be the equivalent of a 100-year flood at the FAA Bettles Field facility. Low areas north of Bettles Field were reportedly inundated during this flood, but floodwater did not reach the FAA facility. Other high stages of about 6.2 m were observed at Evansville during the spring in 1989 and 1993 as the result of snowmelt runoff (Paul Meyer, National Weather Service, oral commun., 1995).

River stage and river discharge have not been correlated for the Koyukuk River near the FAA Bettles Field facility. Consequently, flood magnitude and frequency estimates based upon regression analysis of stream discharge and drainage basin characteristics were not made. The lack of significant flooding at the FAA facilities during the record high-stage 1994 flood indicates that the FAA Bettles Field facility is not subject to flooding during floods with peak stages of 7.4 m or less. Ice-jam floods have not been a significant threat at the FAA facility.

Ground Water

The FAA Bettles Field facility is in the zone of discontinuous permafrost and riverbank sediments along major rivers are often unfrozen because of the warming effect of the river water (Ferrians, 1965; Smith, 1986). The presence of permafrost in alluvium can influence the groundwater flow regime, but definitive permafrost information is lacking for the FAA Bettles Field facility. The well schedule for the Bettles Roadhouse water well (appendix 1) is annotated with conflicting information about the presence of permafrost. This well is adjacent to the FAA Bettles Field facility but is not an FAA-owned well. The well schedules for other wells drilled at the facility make no reference to permafrost or to related drilling problems (appendix 1).

The water-table elevation in wells supplying the FAA Bettles Field facility is reported to fluctuate seasonally and with the stage of the nearby Koyukuk River (Harding Lawson Associates, 1992), approximately 0.5 km north of the facility. Harding Lawson Associates (1992) reports that water-table depth appears to vary from about 4 m to about 12 m below the ground surface and that it is shallowest during late summer. However, in the absence of continuous river-stage and water-table elevation data and of definitive information about the aquifer characteristics, the nature of the local hydrogeologic system and the significance of bank storage effect are difficult to define. Inasmuch as the water table tends to mirror topography, the local water-table surface probably is of very low relief with a northwesterly flow direction. If the water-table elevation fluctuates with river stage, the direction of ground-water flow may shift to the west and southwest following high-stage events. Consequently, ground-water flow direction may be highly variable and a contaminant plume might migrate in an unpredictable manner. This effect might be most pronounced in the upper part of the aquifer if it is relatively thick. The nature of the local ground-water system might be further complicated by impermeable permafrost barriers if permafrost is present in the vicinity of the facility.

DRINKING WATER

Present Drinking-Water Supplies

Drinking water for the FAA Bettles Field facility is obtained from several FAA-owned wells that supply individual structures or groups of buildings. Approximately seven wells have been drilled at the facility since 1962, and at least one is no longer in service (Harding Lawson Associates, 1992). Four wells drilled in 1962 were completed in coarse gravel aquifers at depths of 11 to 12 m. At the time of completion, the water-table depth in the four wells was measured between 5.6 m and 7.2 m below ground level. All four wells yielded more than 2 L/s of water with insignificant drawdown during initial pump tests (Arthur J. Lappi, Federal Aviation Administration, written commun., 1962; appendix 1). A graphical well log for the well at the west end of the powerhouse building (Building 603) was reconstructed for this report from the driller's notes (fig. 2) (Arthur J. Lappi, Federal Aviation Administration, written commun., 1962; appendix 1). A well census table is included in appendix 1. Information about wells drilled since 1962 is not available in the USGS records.

Quality of Present Supply

The 10.6-m-deep Quarters well (Well census, appendix 1) was drilled and sampled in 1962. The sampled water contained 0.02 mg/L dissolved iron, 9.4 mg/L silica, and hardness as calcium carbonate of 195 mg/L. A copy of the USGS Water Analysis (Lab. No. 7110), with concentrations reported as parts-per-million, is included in appendix 2.

In 1987, aromatic hydrocarbons were detected in water samples from a privately owned well northeast of the FAA Bettles Field facility (Harding Lawson Associates, 1992). Consequently, the FAA, the Alaska Department of Environmental Conservation, and the Alaska Department of Transportation and Public Facilities initiated a multiyear ground-water-monitoring program to determine if the ground water used at the FAA facility was contaminated by petroleum products. Only one water well was found to be contaminated. The contaminated well, situated near the powerhouse, was abandoned in 1990.

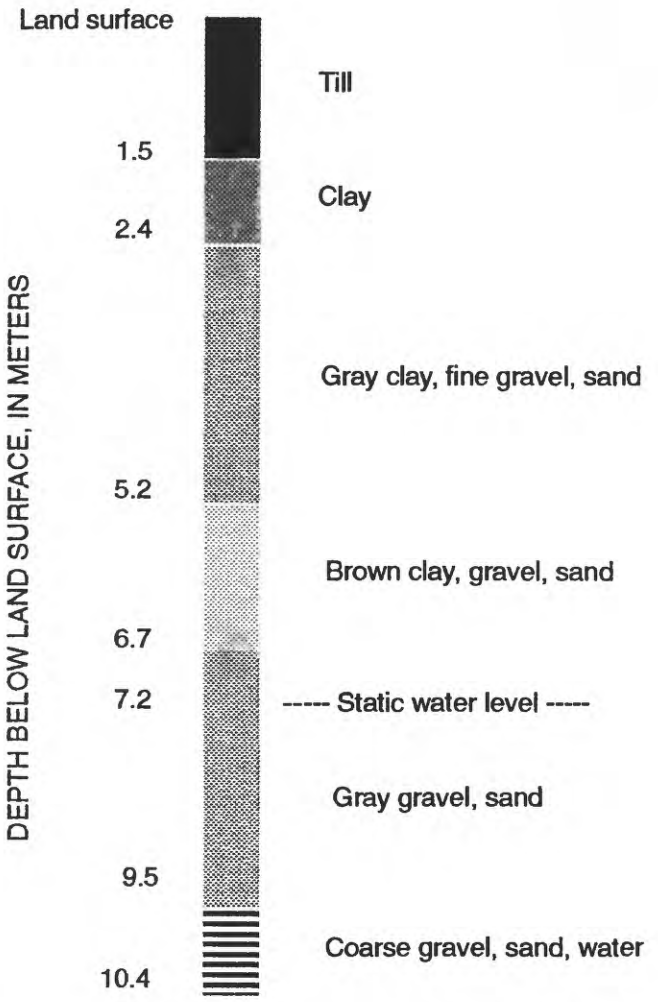


Figure 2. Reconstructed well log for Building 603/Powerhouse. (Land surface datum)

Alternative Drinking-Water Sources

Having an estimated annual average discharge of 160 m^3/s (160,000 L/s), the Koyukuk River represents an abundant potential source of drinking water for the FAA Bettles Field facility. The unnamed lake south of the facility might also be a potential water source if it is deep enough to retain an adequate volume of water beneath the lake ice during the winter. There is no public water-distribution system at the FAA Bettles Field facility or at the neighboring village of Evansville. Use of untapped areas of the alluvial aquifers in the river valley probably represents the best water source should additional or alternative water supplies be required.

Quality of Alternative Sources

The quality of the Middle Fork of the Koyukuk River water was monitored infrequently at USGS stream-gaging station 15564875 near Wiseman during the 1970's. Water-quality analyses available from the USGS records are included in appendix 3. Suspended sediment and dissolved-solids concentrations appear to vary seasonally, being highest during spring runoff. Sampling was too infrequent, and the analyses were too narrow in scope to determine baseline constituent levels and trends. Microbiological analyses were not conducted (U.S.Geological Survey, 1972-75, 1976-79).

SUMMARY

The remote location of the FAA Bettles Field facility makes it dependent on air transportation during most of the year. A winter trail allows overland access during the winter months. The facility's potable water supply is obtained from shallow alluvial aquifers. A ground-water-monitoring program is in place because of concerns about possible aquifer contamination by petroleum products. Flood risk at the facility is low. The Koyukuk River and untapped alluvial aquifers are alternative drinking-water sources, but no distribution system exists to utilize these resources.

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APPENDIX 1

USGS Well Information

FAA Bettles Field Facility

COPY

FEDERAL AVIATION AGENCY

UNITED STATES GOVERNMENT
Memorandum

DATE: September 24, 1962

SUBJECT: Completion of Assignment to Bettles

FROM: Arthur J Lappi. U.E.M.

TO: Chief, Maintenance Engineering Section, AL-813

Quarters Area ($180.42 to develop project to hook up to 4 quarters buildings)

Drilled 8 inch cased well in center of Quarters Area to a depth of 34 ft. 10 in. ground level where coarse gravel and water was encountered.

Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hrs. at a pumping rate of 40 gal. per minute or 2400 gal. per hr. with 3 inch drawdown. Static level 18 ft. 5 in.

This well is centrally located so could be used for fire protection and for domestic water by building pump house over well and ducts run to Quarters 101 distance of 94 ft.; Quarter 102 distance of 25 ft.; Quarters 100 distance of 51 ft.; Quarters 103 a distance of 93 ft. Well would produce 80 to 100 gal. per minute for fire protection without damage to the well.

Depth of well 34 ft. 10 in. ground level. Depth of well top casing, 37 ft. 10 in. Static level ground level 18 ft. 5 in. Static level top of casing 21 ft. 5 in. Drawdown 3 in. while pumping 40 gal. per minute.

Garage Well ($813.42 to supply pump from excess or well purchase)

Drilled 6 in. cased well adjacent to Garage Building on east side to a depth of 37 ft. 10 in. ground level where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hrs. at a pumping rate of 30 gal. per minute or 1800 gal. per hr. with no drawdown. Static level 23 ft. 3 in.

Built concrete duct from well into Garage Building. No pump was installed. Station should budget for 1 H.P. submersible pump, controls, and piping. Pressure tank available at Station.

Depth of well, 37 ft. 10 in. Static level 23 ft. 3 in. No drawdown while test pumping 30 gal. per minute.

Control Building F.S.S.

Drilled 6 in. cased well 36 ft. 4 in. from southwest corner of Control Building to a depth of 37 ft. 8 in. where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hours. and at a pumping rate of 30 gal. per minute with no drawdown.

Depth of well 37 ft. 8 in. Length of drop-pipe and pump 35 ft. Static level 21 ft. Built concrete well pit and 38 ft. of concrete duct from well pit to under floor of Control Building.

Installed 1/2 H.P. Jacuzzi submersible pump, No. 5542 unit No. WMJ 145. Franklin Motor Control CBC 4004x5D volts 1.5 amp. 11.3.

Remodeled pump room under Control Building floor. Installed new pressure tank, air cell, new chlorinator, and all new piping. Installed heating cables on piping in duct and piping under Control Building. Control box and all electrical control for submersible pump installed in pump room under Control Building.

New Powerhouse well

Drilled 6 in. cased well adjacent to power house on west end to depth of 40 ft. where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 20 thousand slot opening. Surged and developed well. Test pumped 48 hrs. at a pumping rate of 30 gal. per minute with no drawdown. Static level 23 ft. 8 in.

Built concrete duct from well to inside of powerhouse. Installed 1/3 H.P. submersible pump, Cat. No. SO 3 B 11, Serial No. 95856 B Volts 115 ph 1 cy 60 R.P.M. 3450 amp 7.8 Max. load 9.2. Installed new pressure tank and all electrical controls, heating cable, and connections for chlorinator, a chlorinator is being ordered by Station. Depth of well 40 ft. Length of drop-pipe and pump 38 ft., static level 23 ft. 8 in.

Quarters 102

Pulled damaged 1 1/4 inch well point and drove new 2 inch well point 5 ft. deeper to try to eliminate shortage of water.

Received very good cooperation during assignment from all Station personnel, especially Station Manager William Nesbit, Acting Station Manager, and Station Foreman Mechanic Russell T. McConnell.

/s/ Arthur J. Lappi, AL-813.42

Attachments - 2

Drill Log
Revised Prints

COPY

Driller 's Log, Powerhouse Well

Depth (feet)	Material	Remarks
1 - 4	Till	Thawed
5 - 7	Clay	Thawed
8 - 16	Grey clay, fine gravel, and sand	Thawed
17 - 21	Brown clay, fine gravel, and sand	Thawed
22 - 23	Grey clay and sand, some water	Thawed
24 - 30	Grey clay and sand	Thawed
31 - 35	Coarse gravel and sand	Water
36 - 40	Coarse gravel and sand	Water

9/24/62 Added to schedule of Powerhouse well.

Well census, FAA Bettles Field facility

Well Name		Description
(Harding Lawson Associates, 1992)	(Arthur J. Lappi, 1962)	
Building 102	Quarters well	Serves buildings 101 and 102.
Building 108	----------	Serves buildings 106 and 110. Well constructed since 1962.
Building 111	----------	Serves building 111. Well constructed since 1962.
Building 400	Control building well	Serves buildings 200 and 400. Originally served only building 400.
Building 603	Powerhouse well	Originally served buildings 200 and 603. Well decommissioned in 1990.
----------	Garage well	Drilled on east side of building 600. Not referenced in HLA ECIR. Status unknown.

Bettles Roadhouse

9–185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

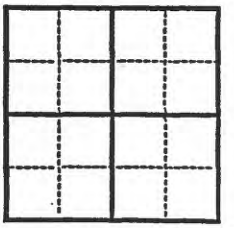
WELL SCHEDULE

Date 7-63, 19__ Field No. ____

Record by Arthur Grantz Office No. ____

Source of data Anderson, Bettles

1. *Location:* State Alaska County Bettles Airfield
   Map ____
   ____ ¼ ____ ¼ sec. ____ T ____ N/S R ____ E/W
2. *Owner:* Bettles Roadhouse Address ____
   Tenant ____ Address ____
   Driller ____ Address ____
3. *Topography* ____
4. *Elevation* ____ ft. above/below ____
5. *Type:* Dug, drilled, driven, bored, jetted ____ 19__
6. *Depth:* Rept. 44 ft. Meas. ____ ft.
7. *Casing:* Diam. ____ in., to ____ in., Type ____
   Depth ____ ft., Finish ____



8. *Chief Aquifer* well entirely in gravel ft. to ____ ft.
   Others ____
9. *Water level* 24 ft. rept./meas. ____ 19__ above/below ____
   ____ which is ____ ft. above/below surface
10. *Pump:* Type ____ Capacity ____ G. M. ____
    Power: Kind ____ Horsepower ____
11. *Yield:* Flow ____ G. M., Pump ____ G. M., Meas., Rept. Est. ____
    Drawdown ____ ft. after ____ hours pumping ____ G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ____
    Adequacy, permanence ____
13. *Quality* ____ Temp ____ °F.
    Taste, odor, color ____ Sample Yes/No ____
    Unfit for ____
14. *Remarks:* (Log, Analyses, etc.) "Spotty pfst in well" but Anderson reports no permafrost. Thermistor cable inst. in vicinity of roadhouse

U. S. GOVERNMENT PRINTING OFFICE 16—62891-1

9–185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE

Date 9/20/63, 19__ Field No. _____

Record by VM Office No. _____

Source of data Phillips Log

1. *Location:* State Alaska County _____

Map _____

__ ¼ __ ¼ sec. __ T __ N/S R __ E/W

2. *Owner:* Faa Address Bethles

Tenant #5 Address _____

Driller Toppi Address _____

3. *Topography* _____

4. *Elevation* _____ ft. above/below _____

5. *Type:* Dug, drilled, driven, bored, jetted 9 19 62

6. *Depth:* Rept. 40 ft. Meas. _____ ft.

7. *Casing:* Diam. 6 in., to _____ in., Type _____

Depth 40 ft., Finish _____

8. *Chief Aquifer* _____ From _____ ft. to _____ ft.

Others _____

9. *Water level* _____ ft. rept. meas. _____ 19__ above/below _____

_____ which is _____ ft. above/below surface

10. *Pump:* Type _____ Capacity _____ G. M. _____

Power: Kind _____ Horsepower _____

11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____

Drawdown _____ ft. after _____ hours pumping _____ G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. _____

Adequacy, permanence _____

13. *Quality* _____ Temp _____ °F.

Taste, odor, color _____ Sample Yes/No 9/20/63

Unfit for _____

14. *Remarks:* (Log/Analyses/etc.) Tilo

_____

_____

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9-185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

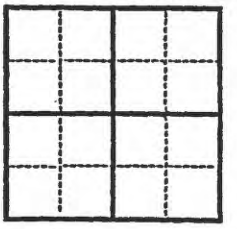
WELL SCHEDULE

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data R.T. McConnell: Memo AJ Lappi to Chief Maint Eng. Section FAA

1. *Location:* State ___ County ___
   Adjacent to west end of powerhouse
   Map ___
   ___ ¼ ___ ¼ sec. ___ T ___ N/S R ___ E/W
2. *Owner:* FAA Address Bettles Field
   Tenant Powerhouse well Address ___
   Driller ___ Address ___
3. *Topography* ___
4. *Elevation* ___ ft. above/below ___
5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___
6. *Depth:* Rept. 40 ft. Meas. ___ ft.
7. *Casing:* Diam. 6 in., to ___ in., Type ___
   Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.
   Others ___
9. *Water level* 23.8 ft. rept./meas. ___ 19___ above/below ___
   ___ which is ___ ft. above/below surface
10. *Pump:* Type ___ Capacity ___ G. M. ___
    Power: Kind ___ Horsepower ___
11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___
    Drawdown 0 ft. after 48 hours pumping 30 G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___
    Adequacy, permanence ___
13. *Quality* ___ Temp ___ °F.
    Taste, odor, color ___ Sample Yes/No ___
    Unfit for ___
14. *Remarks:* (Log, Analyses, etc.) At TD ~~coarse gray gravel and wate~~ encountered.

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~~9-185~~
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

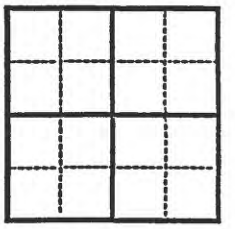
WELL SCHEDULE — Bettles Field

Date 7-63, 19___ Field No. ___

Record by Arthur Grants Office No. ___

Source of data R.T. McConnell: memo A.J. Lappi to Chief Maint Eng. Section FAA

1. *Location:* State 36.4 ft from SW corner Control Bldg.
   Map ___
   ___ ¼ ___ ¼ sec. ___ T ___ N/S R ___ E/W
2. *Owner:* ~~FAA~~ Address ~~Bettles Field~~
   Tenant Control Bldg. F.S.S. Address ___
   Driller ___ Address ___
3. *Topography* ___
4. *Elevation* ___ ft. above/below ___
5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___
6. *Depth:* Rept. 371 8" ft. Meas. ___ ft.
7. *Casing:* Diam. 6 in., to ___ in., Type ___
   Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.
   Others ___
9. *Water level* 23 ft. rept./meas. ___ 19___ above/below ___
   ___ which is ___ ft. above/below surface
10. *Pump:* Type ___ Capacity ___ G. M. ___
    Power: Kind ___ Horsepower ___
11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___
    Drawdown 0 ft. after 48 hours pumping 30 G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___
    Adequacy, permanence ___
13. *Quality* ___ Temp ___ °F.
    Taste, odor, color ___ Sample Yes/No ___
    Unfit for ___
14. *Remarks:* (Log, Analyses, etc.) At TD enc. coarse gray gravel and water

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9–185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

WELL SCHEDULE

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data R.T. McConnell: Memo AJ Lappi to Chief Maint Engrng Sec. FAA

1. *Location:* State ___ County ___

Map ___

___ ¼ ___ ¼ sec. ___ T ___ N/S R ___ E/W

2. *Owner:* FAA Address Bettles Field

Tenant Garage well Address ___

Driller ___ Address ___

3. *Topography* ___

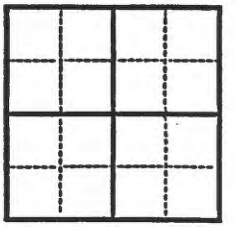
4. *Elevation* ___ ft. above/below ___

5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___

6. *Depth:* Rept. 37' 10" ft. Meas. ___ ft.

7. *Casing:* Diam. 6 in., to ___ in., Type ___

Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.

Others ___

9. *Water level* 23' 3" ft. rept./meas. ___ 19___ above/below ___

___ which is ___ ft. above/below surface

10. *Pump:* Type ___ Capacity ___ G. M. ___

Power: Kind ___ Horsepower ___

11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___

Drawdown 0 ft. after 48 hours pumping 30 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___

Adequacy, permanence ___

13. *Quality* ___ Temp ___ °F.

Taste, odor, color ___ Sample Yes/No ___

Unfit for ___

14. *Remarks:* (Log, Analyses, etc.) At 37' 10" TD enc. coarse gray gravel and water.

___

___

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9-185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE — Bettles Field FAA

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data ~~R. T. McConnell;~~ Memo A. J. Lappi to Chief Chief, Maint. Eng. Sect. FAA

1. *Location:* State ___ County ___

Map ___

___ ¼ ___ ¼ sec. ___ T ___ N/S R ___ E/W

2. *Owner:* FAA Address ___

Tenant Quarters area Address Bettles Field

Driller in center of area Address ___

3. *Topography* ___

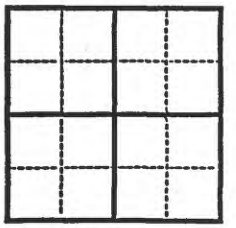
4. *Elevation* ___ ft. above/below ___

5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___

6. *Depth:* Rept. 34' 10" ft. Meas. ___ ft.

7. *Casing:* Diam. 8 in., to ___ in., Type ___

Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.

Others ___

9. *Water level* 18' 5" ft. rept./meas. below lsd 19___ above/below ___

___ which is ___ ft. above/below surface

10. *Pump:* Type ___ Capacity ___ G. M. ___

Power: Kind ___ Horsepower ___

11. *Yield:* Flow ___ G. M., Pump 40 G. M., Meas., Rept. Est. ___

Drawdown 3 inch after 48 hours pumping 40 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___

Adequacy, permanence Prod. 80-100 gpm without damage to well- for fire prot.

13. *Quality* ___ Temp ___ °F.

Taste, odor, color ___ Sample Yes/No ___

Unfit for ___

14. *Remarks:* (Log, Analyses, etc.) coarse gravel enc. with water at 34' 10" TD

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9-125
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE

Date 4/27, 1962 Field No. _____

Record by RMW Office No. Btl-1

Source of data Dec-48 Demand List

1: *Location:* State Alaska County Central

Map _____

_____ ¼ _____ ¼ sec. _____ T _____ N S R _____ E W

2. *Owner:* FAA Address Bettles

Tenant _____ Address _____

Driller _____ Address _____

3. *Topography* _____

4. *Elevation* _____ ft. above below _____

5. *Type:* Dug, drilled, driven, bored, jetted _____ 19____

6. *Depth:* Rept. 20 ft. Meas. _____ ft.

7. *Casing:* Diam. _____ in., to _____ in., Type _____

Depth _____ ft., Finish _____

8. *Chief Aquifer* _____ From _____ ft. to _____ ft.

Others _____

9. *Water level* _____ ft. rept. meas. _____ 19____ above below _____

_____ which is _____ ft. above below surface

10. *Pump:* Type _____ Capacity _____ G. M. _____

Power: Kind _____ Horsepower _____

11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____

Drawdown _____ ft. after _____ hours pumping _____ G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. Station

Adequacy, permanence _____

13. *Quality* good - 175/hardness Temp _____ °F.

Taste, odor, color _____ Sample Yes No _____

Unfit for _____

14. *Remarks:* (Log, Analyses, etc.) CAA list

_____

_____

U. S. GOVERNMENT PRINTING OFFICE 16—62801-1

APPENDIX 1

USGS Well Information

FAA Bettles Field Facility

COPY

FEDERAL AVIATION AGENCY

UNITED STATES GOVERNMENT

Memorandum

DATE: September 24, 1962

SUBJECT: Completion of Assignment to Bettles

FROM: Arthur J Lappi. U.E.M.

TO: Chief, Maintenance Engineering Section, AL-813

Quarters Area ($180.42 to develop project to hook up to 4 quarters buildings)

Drilled 8 inch cased well in center of Quarters Area to a depth of 34 ft. 10 in. ground level where coarse gravel and water was encountered.

Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hrs. at a pumping rate of 40 gal. per minute or 2400 gal. per hr. with 3 inch drawdown. Static level 18 ft. 5 in.

This well is centrally located so could be used for fire protection and for domestic water by building pump house over well and ducts run to Quarters 101 distance of 94 ft.; Quarter 102 distance of 25 ft.; Quarters 100 distance of 51 ft.; Quarters 103 a distance of 93 ft. Well would produce 80 to 100 gal. per minute for fire protection without damage to the well.

Depth of well 34 ft. 10 in. ground level. Depth of well top casing, 37 ft. 10 in. Static level ground level 18 ft. 5 in. Static level top of casing 21 ft. 5 in. Drawdown 3 in. while pumping 40 gal. per minute.

Garage Well ($813.42 to supply pump from excess or well purchase)

Drilled 6 in. cased well adjacent to Garage Building on east side to a depth of 37 ft. 10 in. ground level where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hrs. at a pumping rate of 30 gal. per minute or 1800 gal. per hr. with no drawdown. Static level 23 ft. 3 in.

Built concrete duct from well into Garage Building. No pump was installed. Station should budget for 1 H.P. submersible pump, controls, and piping. Pressure tank available at Station.

Depth of well, 37 ft. 10 in. Static level 23 ft. 3 in. No drawdown while test pumping 30 gal. per minute.

Control Building F.S.S.

Drilled 6 in. cased well 36 ft. 4 in. from southwest corner of Control Building to a depth of 37 ft. 8 in. where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 30 thousand slot opening. Surged and developed well. Test pumped for 48 hours. and at a pumping rate of 30 gal. per minute with no drawdown.

Depth of well 37 ft. 8 in. Length of drop-pipe and pump 35 ft. Static level 21 ft. Built concrete well pit and 38 ft. of concrete duct from well pit to under floor of Control Building.

Installed 1/2 H.P. Jacuzzi submersible pump, No. 5542 unit No. WMJ 145. Franklin Motor Control CBC 4004x5D volts 1.5 amp. 11.3.

Remodeled pump room under Control Building floor. Installed new pressure tank, air cell, new chlorinator, and all new piping. Installed heating cables on piping in duct and piping under Control Building. Control box and all electrical control for submersible pump installed in pump room under Control Building.

New Powerhouse well

Drilled 6 in. cased well adjacent to power house on west end to depth of 40 ft. where coarse grey gravel and water was encountered. Installed 5 ft. length Johnson Everdur well screen with 20 thousand slot opening. Surged and developed well. Test pumped 48 hrs. at a pumping rate of 30 gal. per minute with no drawdown. Static level 23 ft. 8 in.

Built concrete duct from well to inside of powerhouse. Installed 1/3 H.P. submersible pump, Cat. No. SO 3 B 11, Serial No. 95856 B Volts 115 ph 1 cy 60 R.P.M. 3450 amp 7.8 Max. load 9.2. Installed new pressure tank and all electrical controls, heating cable, and connections for chlorinator, a chlorinator is being ordered by Station. Depth of well 40 ft. Length of drop-pipe and pump 38 ft., static level 23 ft. 8 in.

Quarters 102

Pulled damaged 1 1/4 inch well point and drove new 2 inch well point 5 ft. deeper to try to eliminate shortage of water.

Received very good cooperation during assignment from all Station personnel, especially Station Manager William Nesbit, Acting Station Manager, and Station Foreman Mechanic Russell T. McConnell.

/s/ Arthur J. Lappi, AL-813.42

Attachments - 2

Drill Log
Revised Prints

COPY

Driller 's Log, Powerhouse Well

Depth (feet)	Material	Remarks
1 - 4	Till	Thawed
5 - 7	Clay	Thawed
8 - 16	Grey clay, fine gravel, and sand	Thawed
17 - 21	Brown clay, fine gravel, and sand	Thawed
22 - 23	Grey clay and sand, some water	Thawed
24 - 30	Grey clay and sand	Thawed
31 - 35	Coarse gravel and sand	Water
36 - 40	Coarse gravel and sand	Water

9/24/62 Added to schedule of Powerhouse well.

Well census, FAA Bettles Field facility

Well Name		Description
(Harding Lawson Associates, 1992)	(Arthur J. Lappi, 1962)	
Building 102	Quarters well	Serves buildings 101 and 102.
Building 108	----------	Serves buildings 106 and 110. Well constructed since 1962.
Building 111	----------	Serves building 111. Well constructed since 1962.
Building 400	Control building well	Serves buildings 200 and 400. Originally served only building 400.
Building 603	Powerhouse well	Originally served buildings 200 and 603. Well decommissioned in 1990.
----------	Garage well	Drilled on east side of building 600. Not referenced in HLA ECIR. Status unknown.

Bettles Roadhouse

9–185
(October 1950)

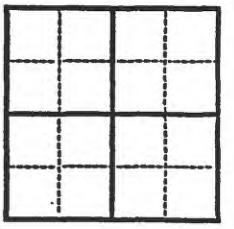
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

WELL SCHEDULE

Date 7-63, 19__ Field No. _____
Record by Arthur Grantz Office No. _____
Source of data Anderson, Bettles

1. *Location:* State Alaska County Bettles Airfield
Map _____
____ ¼ ____ ¼ sec. ____ T ____ N/S R ____ E/W
2. *Owner:* Bettles Roadhouse Address _____
Tenant _____ Address _____
Driller _____ Address _____
3. *Topography* _____
4. *Elevation* _____ ft. above/below _____
5. *Type:* Dug, drilled, driven, bored, jetted ____ 19____
6. *Depth:* Rept. 44 ft. Meas. _____ ft.
7. *Casing:* Diam. ____ in., to ____ in., Type ____
Depth ____ ft., Finish _____



8. *Chief Aquifer* well entirely in gravel ft. to _____ ft.
Others _____
9. *Water level* 24 ft. rept./meas. _____ 19____ above/below _____
_____ which is _____ ft. above/below surface
10. *Pump:* Type _____ Capacity _____ G. M. _____
Power: Kind _____ Horsepower _____
11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____
Drawdown _____ ft. after _____ hours pumping _____ G. M.
12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. _____
Adequacy, permanence _____
13. *Quality* _____ Temp _____ °F.
Taste, odor, color _____ Sample Yes/No _____
Unfit for _____
14. *Remarks:* (Log, Analyses, etc.) "Spotty pfst in well" but Anderson reports no permafrost. Thermistor cable inst. in vicinity of roadhouse

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9–185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE

Date 9/20/63, 19__ Field No. _____

Record by VM Office No. _____

Source of data Phillips Log

1. *Location:* State Alaska County _____

Map _____

_____ ¼ _____ ¼ sec. _____ T _____ N S R _____ E W

2. *Owner:* Fee Address Bottles

Tenant #5 Address _____

Driller Foppe Address _____

3. *Topography* _____

4. *Elevation* _____ ft. above below _____

5. *Type:* Dug, drilled, driven, bored, jetted 9 19 62

6. *Depth:* Rept. 40 ft. Meas. _____ ft.

7. *Casing:* Diam. 6 in., to _____ in., Type _____

Depth 40 ft., Finish _____

8. *Chief Aquifer* _____ From _____ ft. to _____ ft.

Others _____

9. *Water level* _____ ft. rept. meas. _____ 19__ above below _____

_____ which is _____ ft. above below surface

10. *Pump:* Type _____ Capacity _____ G. M. _____

Power: Kind _____ Horsepower _____

11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____

12. Drawdown _____ ft. after _____ hours pumping _____ G. M.

13. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. _____

Adequacy, permanence _____

14. *Quality* _____ Temp _____ °F.

Taste, odor, color _____ Sample Yes No 9/20/63

Unfit for _____

15. *Remarks:* (Log) Analyses, etc.) Yes

_____

_____

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9-185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

WELL SCHEDULE

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data R.T. McConnell: Memo AJ Lappi to Chief Maint Eng. Section FAA

1. *Location:* State ___ County Adjacent to west end of powerhouse

Map ___

___ ¼ ___ ¼ sec. ___ T ___ N S R ___ E W

2. *Owner:* FAA Address Bettles Field

Tenant Powerhouse well Address ___

Driller ___ Address ___

3. *Topography* ___

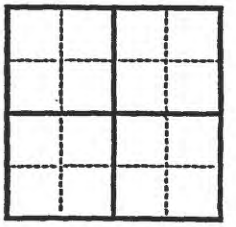
4. *Elevation* ___ ft. above below ___

5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___

6. *Depth:* Rept. 40 ft. Meas. ___ ft.

7. *Casing:* Diam. 6 in., to ___ in., Type ___

Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.

Others ___

9. *Water level* 23.8 ft. rept. meas. ___ 19___ above below ___

___ which is ___ ft. above below surface

10. *Pump:* Type ___ Capacity ___ G. M. ___

Power: Kind ___ Horsepower ___

11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___

Drawdown 0 ft. after 48 hours pumping 30 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___

Adequacy, permanence ___

13. *Quality* ___ Temp ___ °F.

Taste, odor, color ___ Sample Yes No ___

Unfit for ___

14. *Remarks:* (Log, Analyses, etc.) At TD coarse gray gravel and wate encountered.

___

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(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE — Bettles Field

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data R.T. McConnell: memo A.J. Lappi to Chief Maint Eng. Section FAA

1. *Location:* State 36.4 ft from SW corner Control Bldg.

   Map ___

   ___ ¼ ___ ¼ sec. ___ T ___ N S R ___ E W

2. *Owner:* FAA Address Bettles Field

   Tenant Control Bldg. F.S.S. Address ___

   Driller ___ Address ___

3. *Topography* ___

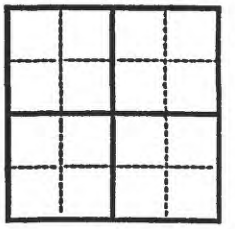
4. *Elevation* ___ ft. above below ___

5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___

6. *Depth:* Rept. 371 8" ft. Meas. ___ ft.

7. *Casing:* Diam. 6 in., to ___ in., Type ___

   Depth ___ ft., Finish ___



8. *Chief Aquifer* ___ From ___ ft. to ___ ft.

   Others ___

9. *Water level* 22 ft. rept. meas. ___ 19___ above below ___

   ___ which is ___ ft. above below surface

10. *Pump:* Type ___ Capacity ___ G. M. ___

    Power: Kind ___ Horsepower ___

11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___

    Drawdown 0 ft. after 48 hours pumping 30 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___

    Adequacy, permanence ___

13. *Quality* ___ Temp ___ °F.

    Taste, odor, color ___ Sample Yes No ___

    Unfit for ___

14. *Remarks:* (Log, Analyses, etc.) At TD enc. coarse gray gravel and water

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9-185
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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Bettles Field

WELL SCHEDULE

Date 7-63, 19___ Field No. ___

Record by Arthur Grantz Office No. ___

Source of data R.T. McConnell: Memo AJ Lappi to Chief Maint Engrng Sec. FAA

1. *Location:* State ___ County ___

Map ___

___ ¼ ___ ¼ sec. ___ T ___ N S R ___ E W

2. *Owner:* FAA Address Bettles Field

Tenant Garage well Address ___

Driller ___ Address ___

3. *Topography* ___

4. *Elevation* ___ ft. above below ___

5. *Type:* Dug, drilled, driven, bored, jetted ___ 19___

6. *Depth:* Rept. 37' 10" ft. Meas. ___ ft.

7. *Casing:* Diam. 6 in., to ___ in., Type ___

Depth ___ ft., Finish ___

8. *Chief Aquifer* ___ From ___ ft. to ___ ft.

Others ___

9. *Water level* 23' 3" ft. rept. meas. ___ 19___ above below ___

___ which is ___ ft. above below surface

10. *Pump:* Type ___ Capacity ___ G. M. ___

Power: Kind ___ Horsepower ___

11. *Yield:* Flow ___ G. M., Pump 30 G. M., Meas., Rept. Est. ___

Drawdown 0 ft. after 48 hours pumping 30 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ___

Adequacy, permanence ___

13. *Quality* ___ Temp ___ °F.

Taste, odor, color ___ Sample Yes No ___

Unfit for ___

14. *Remarks:* (Log, Analyses, etc.) At 37' 10" TD enc. coarse gray gravel and water.

U. S. GOVERNMENT PRINTING OFFICE 16—62801-1

9-185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE — Bettles Field FAA

Date 7-63, 19__ Field No. ____

Record by Arthur Grants Office No. ____

Source of data R.T. McConnell; Memo A. J. Lappi to Chief Chief, Maint. Eng. Sect. FAA

1. *Location:* State ____ County ____

Map ____

____ ¼ ____ ¼ sec. ____ T ____ N/S R ____ E/W

2. *Owner:* FAA Address ____

Tenant Quarters area Address Bettles Field

Driller in center of area Address ____

3. *Topography* ____

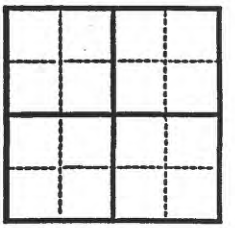
4. *Elevation* ____ ft. above/below ____

5. *Type:* Dug, drilled, driven, bored, jetted ____ 19__

6. *Depth:* Rept. 34' 10" ft. Meas. ____ ft.

7. *Casing:* Diam. 8 in., to ____ in., Type ____

Depth ____ ft., Finish ____



8. *Chief Aquifer* ____ From ____ ft. to ____ ft.

Others ____

9. *Water level* 18' 5" ft. rept. meas. below lsd 19__ above/below ____

____ which is ____ ft. above/below surface

10. *Pump:* Type ____ Capacity ____ G. M. ____

Power: Kind ____ Horsepower ____

11. *Yield:* Flow ____ G. M., Pump 40 G. M., Meas., Rept. Est. ____

Drawdown 3 inch after 48 hours pumping 40 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. ____

Adequacy, permanence Prod. 80-100 gpm without damage to

13. *Quality* well- for fire prot. Temp ____ °F.

Taste, odor, color ____ Sample Yes/No ____

Unfit for ____

14. *Remarks:* (Log, Analyses, etc.) coarse gravel enc. with water at 34' 10" TD

U. S. GOVERNMENT PRINTING OFFICE 16—62801-1

9-125
(October 1959)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE

Date 4/27, 1962 Field No. _____

Record by RMW Office No. Btl-1

Source of data Dec. 48 demand list

1: *Location:* State Alaska County Central

Map _____

_____ ¼ _____ ¼ sec. _____ T _____ N S R _____ E W

2. *Owner:* FAA Address Battles

Tenant _____ Address _____

Driller _____ Address _____

3. *Topography* _____

4. *Elevation* _____ ft. above below _____

5. *Type:* Dug, drilled, driven, bored, jetted _____ 19__

6. *Depth:* Rept. 20 ft. Meas. _____ ft.

7. *Casing:* Diam. _____ in., to _____ in., Type _____

Depth _____ ft., Finish _____

8. *Chief Aquifer* _____ From _____ ft. to _____ ft.

Others _____

9. *Water level* _____ ft. rept. meas. _____ 19__ above below _____

_____ which is _____ ft. above below surface

10. *Pump:* Type _____ Capacity _____ G. M. _____

Power: Kind _____ Horsepower _____

11. *Yield:* Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____

Drawdown _____ ft. after _____ hours pumping _____ G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. Station

Adequacy, permanence _____

13. *Quality* good - 175' hardness Temp _____ °F.

Taste, odor, color _____ Sample Yes No _____

Unfit for _____

14. *Remarks:* (Log, (Analyses), etc.) CAA list

_____

_____

U. S. GOVERNMENT PRINTING OFFICE 16—62861-1

APPENDIX 2

Ground-Water-Quality Data,

FAA Bettles Field Facility

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

2GW 4

KP

Location FAA @ Yukon @ Bettles, Alaska County
Source Depth (ft) Diam (in.)
Cased to (ft) Date drilled Point of coll. @ Housing area new well
Owner
Treatment Use
WBF WL Yield
Temp (°F) Appear. when coll.
Collected Before July 20, 1962 By
Remarks

	ppm	epm		ppm	epm
Silica (SiO_2)	9.4		Bicarbonate (HCO_3)	231	3.79
Aluminum (Al)			Carbonate (CO_3)		
Iron (Fe) (dis)	0.02		Carbon Dioxide (CO_2)	6	
Manganese (Mn)	2.1		Sulfate (SO_4)	7.0	0.15
			Chloride (Cl)	1.0	0.03
			Fluoride (F)	0.0	0.00
Calcium (Ca)	65	3.26			
Magnesium (Mg)	7.8	0.64	Nitrate (NO_3)	0.2	0.00
Sodium (Na)	0.9	0.04			
Potassium (K)	0.4	0.01			
Total		3.95	Total		3.97

	ppm		
		Specific conductance (micromhos at 25° C)	349
Dissolved solids:			
Calculated	206	pH	7.8
Residue on evaporation at 180°C			
		Color	5
Hardness as $CaCO_3$	195		
Noncarbonate	6		
Total Alkalinity as $CaCO_3$	189		

Lab. No. Col 7110 Field No. Project

APPENDIX 3

Surface-Water-Quality Data,

USGS Stream-Gaging Station 15564875

Middle Fork of the Koyukuk River near Wiseman, Alaska

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN--Continued

TEMPERATURE (°C) OF WATER, JUNE TO SEPTEMBER 1971

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	---	---	---	---	---	---	---	---	13.5	12.0	---	---
2	---	---	---	---	---	---	---	---	13.0	12.5	---	---
3	---	---	---	---	---	---	---	---	14.0	12.5	---	---
4	---	---	---	---	---	---	---	---	14.5	12.5	---	---
5	---	---	---	---	---	---	---	---	14.0	11.0	---	---
6	---	---	---	---	---	---	---	---	14.5	12.0	---	---
7	---	---	---	---	---	---	---	---	13.0	12.5	---	---
8	---	---	---	---	---	---	---	---	14.0	12.0	---	---
9	---	---	---	---	---	---	---	---	13.0	12.5	---	---
10	---	---	---	---	---	---	---	---	13.5	12.5	---	---
11	---	---	---	---	---	---	---	---	14.5	12.0	---	---
12	---	---	---	---	---	---	---	---	14.0	12.0	---	---
13	---	---	---	---	7.0	5.5	---	---	14.5	12.0	---	---
14	---	---	---	---	7.5	6.0	---	---	14.0	12.5	---	---
15	---	---	---	---	6.5	5.0	---	---	14.0	12.0	---	---
16	---	---	---	---	6.5	4.5	---	---	14.5	11.5	---	---
17	---	---	---	---	6.0	4.5	---	---	14.0	12.0	---	---
18	---	---	---	---	6.0	3.0	---	---	13.0	12.0	---	---
19	---	---	---	---	5.5	4.0	---	---	13.0	12.0	---	---
20	---	---	---	---	5.0	3.0	---	---	13.0	12.5	---	---
21	---	---	---	---	6.0	3.5	---	---	13.5	12.5	---	---
22	---	---	---	---	6.0	3.5	---	---	13.0	12.0	---	---
23	---	---	---	---	5.5	3.5	---	---	13.5	12.0	---	---
24	---	---	---	---	5.0	3.5	---	---	13.0	12.0	---	---
25	---	---	---	---	6.0	4.5	---	---	13.5	12.0	---	---
26	---	---	---	---	5.0	4.0	---	---	---	---	---	---
27	---	---	---	---	---	---	14.0	12.5	---	---	---	---
28	---	---	---	---	---	---	13.5	13.0	---	---	---	---
29	---	---	---	---	---	---	14.0	13.0	---	---	---	---
30	---	---	---	---	---	---	13.5	12.5	---	---	---	---
31	---	---	---	---	---	---	13.0	12.5	---	---	---	---
MONTH	---	---	---	---	---	---	---	---	14.5	11.0	---	---

SUSPENDED SEDIMENT ANALYSES, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DATE	TIME	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	DISCHARGE (CFS)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)	SUS. SED. FALL DIAM. % FINER THAN .002 MM	SUS. SED. FALL DIAM. % FINER THAN .004 MM
JUNE 11...	1700	---	193	4600	575	7140	18	28
JULY 27...	1100	12.5	382	1240	10	33	---	---
SEP. 09...	0815	3.0	428	465	10	13	---	---

DATE	SUS. SED. FALL DIAM. % FINER THAN .008 MM	SUS. SED. FALL DIAM. % FINER THAN .016 MM	SUS. SED. FALL DIAM. % FINER THAN .031 MM	SUS. SED. FALL DIAM. % FINER THAN .062 MM	SUS. SED. FALL DIAM. % FINER THAN .125 MM	SUS. SED. FALL DIAM. % FINER THAN .250 MM	SUS. SED. FALL DIAM. % FINER THAN .500 MM
JUNE 11...	37	41	57	73	88	99	100
JULY 27...	---	---	---	---	---	---	---
SEP. 09...	---	---	---	---	---	---	---

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN

LOCATION.--Lat 67°26'35", long 150°03'40", temperature recorder on left bank, 0.8 mile upstream from Minnie Creek, 2.8 miles downstream from Hammond River, and 1.6 miles north of Wiseman.

DRAINAGE AREA.--1,426 sq mi.

PERIOD OF RECORD.--Chemical analyses: August 1970 to September 1971 (partial-record station).
Water temperatures: June to September 1971.
Sediment records: September 1970 to September 1971 (partial-record station).

EXTREMES, 1971.--Water temperatures: Maximum, not determined; minimum, freezing point on many days during winter months.

REMARKS.--No temperature records available for June 27 to July 26 and Aug. 26 to Sept. 30, well was dry.

WATER QUALITY DATA, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DATE	DIS-CHARGE (CFS)	SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	SULFATE (SO4) (MG/L)	CHLO-RIDE (CL) (MG/L)
OCT.										
02...	186	3.4	50	46	26	3.3	.7	176	79	1.0
NOV.										
13...	--	3.9	0	55	26	3.5	.7	208	81	.8
APR.										
16...	5.0	4.6	0	61	26	3.4	.5	231	72	1.0
SEP.										
09...	465	3.5	--	52	20	2.5	.6	163	63	.8

DATE	DIS-SOLVED FLUO-RIDE (F) (MG/L)	NITRATE (NO3) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPECI-FIC COND-UCTANCE (MICRO-MHOS)	PH (UNITS)	COLOR (PLAT-INUM-COBALT UNITS)	TEMP-ERATURE (DEG C)
OCT.									
02...	.2	1.1	247	222	78	420	8.1	0	.0
NOV.									
13...	.1	.1	273	244	73	458	8.2	0	.0
APR.									
16...	.1	.5	283	259	70	476	7.9	0	2.0
SEP.									
09...	.2	1.8	232	212	65	411	8.3	0	3.0

ALASKA WEST OF LONGITUDE 141°

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN

LOCATION (revised).--Lat 67°25'54", long 150°04'55", in NE¼ sec.18, T.30 N., R.11 W., temperature recorder at gaging station on left bank, 1.0 mile upstream from Minnie Creek, 2.6 miles downstream from Hammond River, and 1.6 miles north of Wiseman.

DRAINAGE AREA.--1,426 sq mi.

PERIOD OF RECORD.--Chemical analyses: Water years 1970-72 (partial-record station).
Water temperatures: June 1971 to September 1972.
Sediment records: Water years 1970-72 (partial-record station).

EXTREMES, 1972.--Water temperatures: Maximum, not determined; minimum, freezing point on most days during winter months.

REMARKS.--No temperature records available for Oct. 1 to May 20 and Aug. 14 to Sept. 30, well was dry.

WATER QUALITY DATA, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DATE	TIME	DIS-CHARGE (CFS)	DIS-SOLVED SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	DIS-SOLVED IRON (FE) (UG/L)	TOTAL MAN-GANESE (MN) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)
MAR.											
15...	1430	--	3.0	--	90	--	10	34	30	3.9	.5
AUG.											
13...	1300	443	3.0	30	--	0	--	57	21	3.4	.6

DATE	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	AMMONIA NITRO-GEN (N) (MG/L)	ORGANIC NITRO-GEN (N) (MG/L)	TOTAL PHOS-PHORUS (P) (MG/L)
MAR.											
15...	161	0	81	1.0	.1	.16	.00	--	.15	.09	.00
AUG.											
13...	189	0	72	.8	.0	--	--	.00	--	--	--

DATE	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	COLOR (PLAT-INUM-COBALT UNITS)	TUR-BID-ITY (JTU)	DIS-SOLVED OXYGEN (MG/L)
MAR.										
15...	.00	233	209	77	†320	†7.6	--	0	0	† 6.8
AUG.										
13...	.00	251	230	74	428	7.5	12.5	5	--	--

† Field data

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN—Continued

WATER TEMPERATURE (°C) MAY TO SEPTEMBER 1972

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	---	---	---	---	14.0	13.5	16.5	12.5	14.5	12.5	---	---
2	---	---	---	---	14.0	13.5	15.5	13.0	15.0	12.5	---	---
3	---	---	---	---	14.5	11.5	15.5	13.5	16.0	13.0	---	---
4	---	---	---	---	14.0	12.0	16.5	13.0	16.0	13.0	---	---
5	---	---	---	---	13.5	11.5	18.5	14.0	14.5	12.5	---	---
6	---	---	---	---	14.0	11.0	18.0	14.0	14.0	12.5	---	---
7	---	---	---	---	13.5	11.5	19.0	15.0	12.5	12.0	---	---
8	---	---	---	---	14.0	10.5	17.5	15.0	13.5	12.5	---	---
9	---	---	---	---	13.5	11.0	18.5	13.5	13.5	12.5	---	---
10	---	---	---	---	13.0	12.5	18.5	14.0	13.0	12.5	---	---
11	---	---	---	---	13.5	10.0	18.0	14.5	14.0	12.0	---	---
12	---	---	---	---	12.5	10.0	18.0	15.0	13.5	12.0	---	---
13	---	---	---	---	12.0	9.5	15.5	13.0	13.5	12.5	---	---
14	---	---	---	---	13.5	10.5	18.0	13.5	---	---	---	---
15	---	---	---	---	13.5	11.0	17.0	13.5	---	---	---	---
16	---	---	---	---	14.0	11.0	15.5	13.5	---	---	---	---
17	---	---	---	---	15.0	12.0	13.0	11.5	---	---	---	---
18	---	---	---	---	15.0	12.5	12.5	11.5	---	---	---	---
19	---	---	---	---	13.5	12.0	12.5	12.0	---	---	---	---
20	---	---	---	---	13.0	11.5	13.0	12.0	---	---	---	---
21	---	---	14.5	13.0	13.5	12.0	14.5	12.5	---	---	---	---
22	---	---	14.5	12.5	13.5	11.5	14.5	12.5	---	---	---	---
23	---	---	14.5	12.0	13.0	12.0	15.0	12.5	---	---	---	---
24	---	---	14.5	12.0	13.0	11.5	15.5	12.5	---	---	---	---
25	---	---	14.5	11.5	13.5	12.0	14.5	12.5	---	---	---	---
26	---	---	14.5	11.0	13.5	12.0	15.5	12.5	---	---	---	---
27	---	---	13.5	11.5	14.0	12.0	15.0	12.5	---	---	---	---
28	---	---	13.5	13.0	13.5	12.5	14.0	13.0	---	---	---	---
29	---	---	13.5	11.5	13.0	12.0	14.5	12.5	---	---	---	---
30	---	---	14.0	12.0	14.5	12.5	14.0	12.5	---	---	---	---
31	---	---	13.5	11.5			13.0	12.0				
MONTH	---	---	---	---	15.0	9.5	19.0	11.5	---	---	---	---

SUSPENDED SEDIMENT ANALYSES, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DATE	TIME	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	DISCHARGE (CFS)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)
AUG. 13...	1300	12.5	428	443	2	2.4

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June to August 1971, May to August 1972, July to September 1976.

INSTRUMENTATION.--Temperature recorder occasionally operated since June 13, 1971.

REMARKS.--Temperature recorder started July 26. River is ice covered from October to May.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: Maximum recorded, 19.0°C July 7, 1972; minimum, 0.0°C on many days during winter periods.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum recorded, 15.5°C Aug. 6; minimum, 0.0°C during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	TIME	INSTANTANEOUS DISCHARGE (CFS)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	BICARBONATE (HCO3) (MG/L)	CARBON DIOXIDE (CO2) (MG/L)
JUN 18...	1300	5770	200	8.0	8.0	92	1.5

TEMPERATURE (DEG. C) OF WATER, JULY TO SEPTEMBER 1976,

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1							---	---	14.5	11.0	10.5	8.0
2							---	---	15.0	11.0	9.5	8.0
3							---	---	15.0	11.0	8.5	6.5
4							---	---	14.5	11.0	6.5	3.5
5							---	---	15.0	11.0	3.5	2.0
6							---	---	15.5	11.5	5.5	2.0
7							---	---	14.5	12.0	5.5	4.0
8							---	---	13.5	10.0	5.5	4.0
9							---	---	11.0	9.5	6.5	4.0
10							---	---	12.0	10.0	6.0	5.0
11							---	---	12.5	9.0	---	---
12							---	---	14.0	10.0	---	---
13							---	---	13.0	11.0	---	---
14							---	---	13.0	9.5	---	---
15							---	---	12.5	10.0	---	---
16							---	---	11.5	9.0	---	---
17							---	---	11.0	9.5	---	---
18							---	---	12.0	8.0	---	---
19							---	---	11.0	8.0	---	---
20							---	---	12.0	8.0	---	---
21							---	---	11.0	8.0	---	---
22							---	---	10.0	7.0	---	---
23							---	---	11.5	8.5	---	---
24							---	---	12.0	8.0	---	---
25							---	---	13.0	9.5	---	---
26							---	---	13.0	9.5	---	---
27							12.5	10.0	12.5	8.5	---	---
28							12.5	10.0	11.0	7.5	---	---
29							12.5	10.0	11.0	8.5	---	---
30							12.0	10.0	10.5	7.0	---	---
31							13.5	8.5	11.0	8.0	---	---
MONTH							---	---	15.5	7.0	---	---

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June to August 1971, May to August 1972, July to September 1976, May to September 1977.

INSTRUMENTATION.--Temperature recorder occasionally operated since June 13, 1971.

REMARKS.--Temperature recorder started May 17. River is ice covered from October to May.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: Maximum, 20.0°C July 30 to Aug. 1, 1977; minimum, 0.0°C on many days during winter periods.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum, 20.0°C July 30 to Aug. 1, 1977; minimum, 0.0°C during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

DATE	TIME	INSTANTANEOUS DISCHARGE (CFS)	COLOR (PLATINUM-COBALT UNITS)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)	SUS. SED. FALL DIAM. % FINER THAN .002 MM	SUS. SED. FALL DIAM. % FINER THAN .004 MM	SUS. SED. FALL DIAM. % FINER THAN .008 MM
MAY 20...	1320	8110	70	722	15800	4	12	20

DATE	SUS. SED. FALL DIAM. % FINER THAN .016 MM	SUS. SED. FALL DIAM. % FINER THAN .031 MM	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM	SUS. SED. SIEVE DIAM. % FINER THAN .125 MM	SUS. SED. SIEVE DIAM. % FINER THAN .250 MM	SUS. SED. SIEVE DIAM. % FINER THAN .500 MM	SUS. SED. SIEVE DIAM. % FINER THAN 1.00 MM
MAY 20...	33	49	66	82	95	99	100

TEMPERATURE (DEG. C) OF WATER, MAY TO SEPTEMBER 1977

DAY	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
1			---	---	8.0	6.0	16.0	13.0	20.0	16.0	10.5	7.5
2			---	---	7.5	5.5	15.0	12.5	18.5	16.0	10.5	7.0
3			---	---	7.5	5.5	13.5	12.0	18.5	15.0	10.5	7.0
4			---	---	8.0	5.5	13.0	11.0	18.5	14.0	10.0	7.5
5			---	---	8.0	6.0	12.5	10.5	17.0	15.5	9.5	7.5
6			---	---	9.0	5.5	15.5	11.0	16.5	13.5	8.5	7.5
7			---	---	9.0	6.0	16.0	12.5	17.0	12.5	9.5	6.5
8			---	---	10.5	5.5	17.0	13.5	16.5	14.0	9.5	8.0
9			---	---	10.5	7.0	16.5	15.0	18.5	14.5	9.5	8.0
10			---	---	12.0	7.0	17.5	14.0	19.0	16.5	8.5	6.0
11			---	---	11.5	7.0	19.0	15.0	17.0	15.5	8.0	6.5
12			---	---	12.5	7.5	19.0	16.0	16.5	10.5	8.5	7.0
13			---	---	12.5	8.5	18.0	15.0	15.5	13.0	7.5	6.0
14			---	---	10.5	8.0	17.5	14.5	16.0	11.5	7.0	6.0
15			---	---	12.5	7.5	17.5	14.0	15.0	13.5	7.0	6.5
16			---	---	12.5	10.0	18.0	14.0	14.0	11.5	6.5	5.0
17			7.5	6.5	12.0	9.0	18.0	14.5	14.5	12.0	5.5	4.0
18			8.0	5.0	12.5	9.0	17.0	15.0	14.5	13.5	6.0	4.5
19			8.5	5.0	12.5	8.5	17.0	13.5	15.0	13.0	5.5	4.0
20			8.5	7.0	11.0	7.0	17.5	14.5	14.0	11.0	5.0	4.0
21			8.5	7.0	12.0	8.0	17.5	14.0	15.0	12.0	4.5	2.0
22			9.0	7.0	13.0	9.5	16.5	15.0	15.0	13.0	3.0	1.0
23			9.0	7.0	13.0	9.5	17.0	13.0	14.0	11.5	2.0	.5
24			9.0	6.5	11.0	9.0	18.0	13.0	13.5	11.5	3.0	1.0
25			9.0	5.5	11.0	8.5	17.5	14.5	12.0	10.5	4.0	3.0
26			8.5	5.5	13.5	9.5	16.5	14.0	11.0	9.0	4.0	2.5
27			8.5	5.0	14.0	10.5	18.0	14.0	9.0	6.0	3.0	1.0
28			8.0	5.5	14.0	10.5	19.5	15.0	9.0	6.0	2.5	1.0
29			8.5	6.0	14.0	10.5	19.5	15.5	9.0	6.5	3.0	2.0
30			7.5	5.0	14.5	11.0	20.0	15.5	10.0	8.5	2.0	1.0
31			7.0	6.0	---	---	20.0	16.5	11.5	8.0	---	---
MONTH			9.0	5.0	14.5	5.5	20.0	10.5	20.0	6.0	10.5	.5

15564875 MIDDLE FORK KOYUKUK RIVER NEAR WISEMAN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1970 to September 1978 (discontinued).

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June to August 1971, May to August 1972, July to September 1976, May to October 1977, May to September 1978.

INSTRUMENTATION.--Temperature recorder occasionally operated since June 13, 1971.

REMARKS.--Temperature record Oct. 1-5 and May 26 to Sept. 26. River is ice covered from October to May.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: Maximum recorded, 20.0°C July 30 to Aug. 1, 1977; minimum, 0.0°C on many days during winter periods.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum recorded, 17.0°C July 13, 14; minimum, 0.0°C during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)
MAR 16...	1200	3.1	470	7.3	2.0	235	0

QUALITATIVE AND ASSOCIATED QUANTITATIVE ANALYSES OF BIOLOGICAL DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977
BENTHIC INVERTEBRATE ANALYSES, AUGUST 1977 TO SEPTEMBER 1977

DATE	SEP 16,77
TIME	1645
TOTAL COUNT	294
DIVERSITY: PHYLUM	0.0
.CLASS	0.0
..ORDER	1.6
...FAMILY	2.1
....GENUS	2.4
....GENUS-INSECTA	2.4

ORGANISM	COUNT
ARTHROPODA (ARTHROPODS)	
.INSECTA	
..DIPTERA	
...CHIRONOMIDAE	
....CONCHAPELOPIA	7
....CRICOTOPUS	31
....EUKIEFFERIELLA	2
....HETEROTRISSOCLADIUS	2
....MICROPSECTRA	15
..EPHEMEROPTERA	
...BAETIDAE	
....UNKNOWN GENUS	1
...EPHEMERELLIDAE	
....EPHEMERELLA	1
...HEPTAGENIIDAE	
....RHITHROGENA	89
..PLECOPTERA	
...CAPNIIDAE	
....CAPNIA	86
...PERLODIDAE	
....ISOPERLA	56
..TRICHOPTERA	
...HYDROPSYCHIDAE	
....ARCTOPSYCHE	1
...LIMNEPHILIDAE	
....ONOCOSMOECUS	3
LENGTH OF EXPOSURE	15 MIN
SAMPLING METHOD	DIP NET