Environmental Overview and Hydrogeologic Conditions at Aniak, Alaska

By Joseph M. Dorava

U.S. GEOLOGICAL SURVEY

Open-File Report 94-85

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

Anchorage, Alaska
1994

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

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

For additional information write to:

District Chief
U.S. Geological Survey
4230 University Drive, Suite 201
Anchorage, AK 99508-4664

Copies of this report may be purchased from:

U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517
Federal Center
Denver, CO 80225-0425

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
centimeter (cm)	0.3937	inch
meter (m)	0.30481	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
centimeter per second (cm/s)	0.03281	foot per second
liter per second (L/s)	15.85	gallon per minute
liter per day (L/d)	0.2642	gallon per day
cubic meter per second (m^3/s)	35.31	cubic foot per second
degree Celsius (°C)	°F = 1.8 x °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 both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water quality units used in report:

mg/L, milligram per liter
mL, milliliter

Environmental Overview and Hydrogeologic Conditions at Aniak, Alaska

By Joseph M. Dorava

Abstract

The remote Native village of Aniak, on the flood plain of the Kuskokwim River in southwestern Alaska, has long cold winters and short summers that affect both the hydrology of the area and the lifestyle of the residents. Aniak obtains its drinking water from a shallow aquifer in the thick alluvium underlying the village. Surface spills and disposal of hazardous materials combined with annual flooding of the Kuskokwim River may affect the quality of the ground water. Alternative drinking water sources are available but at significantly greater cost than existing supplies. The Federal Aviation Administration owns or operates airport support facilities in Aniak. They wish to consider the subsistence lifestyle of the residents and the quality of the current environment when evaluating options for remediation of environmental contamination near their facilities. This report describes the history, socioeconomics, ground- and surface-water hydrology, geology, climate, vegetation, soils, and flood potential of the areas surrounding the Federal Aviation Administration sites in Aniak.

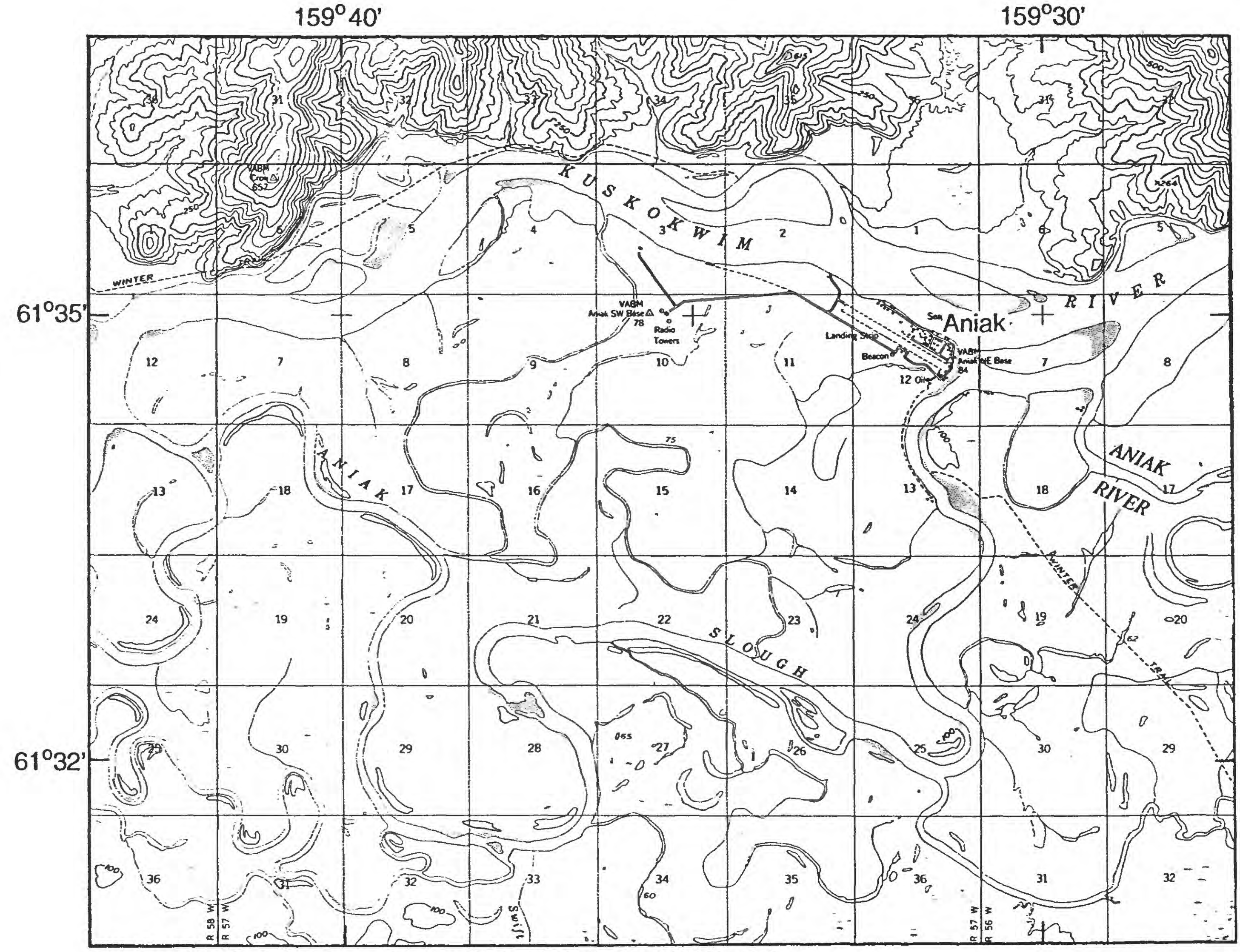
INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airport, 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 of at the sites, the FAA is conducting environmental studies mandated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund Act") and the Resource Conservation and Recovery Act (RCRA). To complete these 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 in cooperation with the FAA, provides such information for the FAA facility and nearby areas at Aniak, Alaska. Also presented in this report is a description of the history, socioeconomics, and physical setting of the Aniak area.

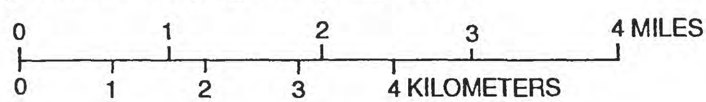
BACKGROUND

Location

Aniak is located in southwestern Alaska (fig. 1) at latitude 61°34'42" N, longitude 159°31'20" W., approximately 145 km northeast of Bethel and approximately 515 km by air west of Anchorage. Aniak is on the south bank of the Kuskokwim River at the upstream end of Aniak Slough, approximately 2 km downstream from the mouth of Aniak River. The location of the village was originally selected by early settlers because they needed water courses for transportation (Oswalt, 1980).



Base from U.S. Geological Survey, Russian Mission(C-2), Alaska, 1:63,360, 1952



CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

Figure 1. Location of Aniak

History

The local area near the Aniak River played an important role in the Alaska gold rush of 1900-01 when prospectors from Nome discovered placer deposits in the headwaters of the Aniak River (Oswalt, 1980). In 1914, the first homestead settlement was established at the current location of Aniak, and a territorial school opened there in 1936. Construction of an airfield was begun in 1936, followed by the erection of the White Alice radio-relay station in 1956. Aniak was officially incorporated on April 4, 1972 as a second class city (Federal Emergency Management Agency, 1990). The airfield provided a transportation link, and the White Alice radio-relay station provided a communications link for the military (Reynolds, 1988). These two projects brought new jobs, people, and growth to Aniak.

In 1939, the population of Aniak was 122; in 1950 it was 142; in 1960 it was 308. In 1970 it dropped to 205, but increased to 355 in 1979, and to 578 by 1991 (Alaska Department of Community and Regional Affairs, written commun., 1993). Native residents of Aniak are shareholders in the Kuskokwim Corporation, an association of 10 middle Kuskokwim River village corporations merged to consolidate ownership and management of lands conveyed to the village corporations in accordance with the Alaska Native Claims Settlement Act (Burns and others, 1975). The Aniak village Native corporation and the Kuskokwim Corporation are also associated with the larger regional Native corporation, the Calista Corporation.

The FAA has had facilities in Aniak since 1940, when they began air navigation support. The FAA facilities in Aniak include navigational aids, living quarters, and a service area located near the southeastern end of the runway. A glide-slope facility and runway lighting are near the northwestern end of the runway, a non-directional beacon facility is near the end of the road about 5 km west of the village (section 3, fig. 1), and a remote communications outlet facility is near the radio towers (section 10, fig. 1). A detailed account of FAA owned, leased, or transferred properties in Aniak and a listing of suspected sources of contamination near these facilities can be found in an environmental compliance investigation report of the FAA facilities in Aniak (Ecology and Environment, Inc., 1992).

Socioeconomics

Aniak is a service and transportation center for area communities and serves as a transfer point for the commercial fishing industry. In 1990, about 70 percent of the population was Native Alaskan (Indian, Eskimo, or Aleut) (U.S. Bureau of Census, 1991). The Native population of Aniak is represented by a five-member traditional council that administers federally sponsored assistance programs (Alaska Dept. of Community and Regional Affairs, 1979). The governmental functions of Aniak are administered by an elected mayor and a seven-member village council.

Aniak (fig. 2) has three schools, approximately 100 single-family homes, a 20-room hotel, movie theater, post office, airport, a small-engine repair shop, 2 stores and a 13-room lodge (Alaska Department of Community and Regional Affairs, 1979). The airport, which consists of a 1.8-km-long gravel runway along the southern edge of the village, serves as the main transportation link to most other communities. No road access is available to Aniak from the rest of Alaska, and the only year-round access is provided by the airport. The Kuskokwim River serves as a transportation corridor for boats and barges during open water and for snowmobiles and dog sleds during

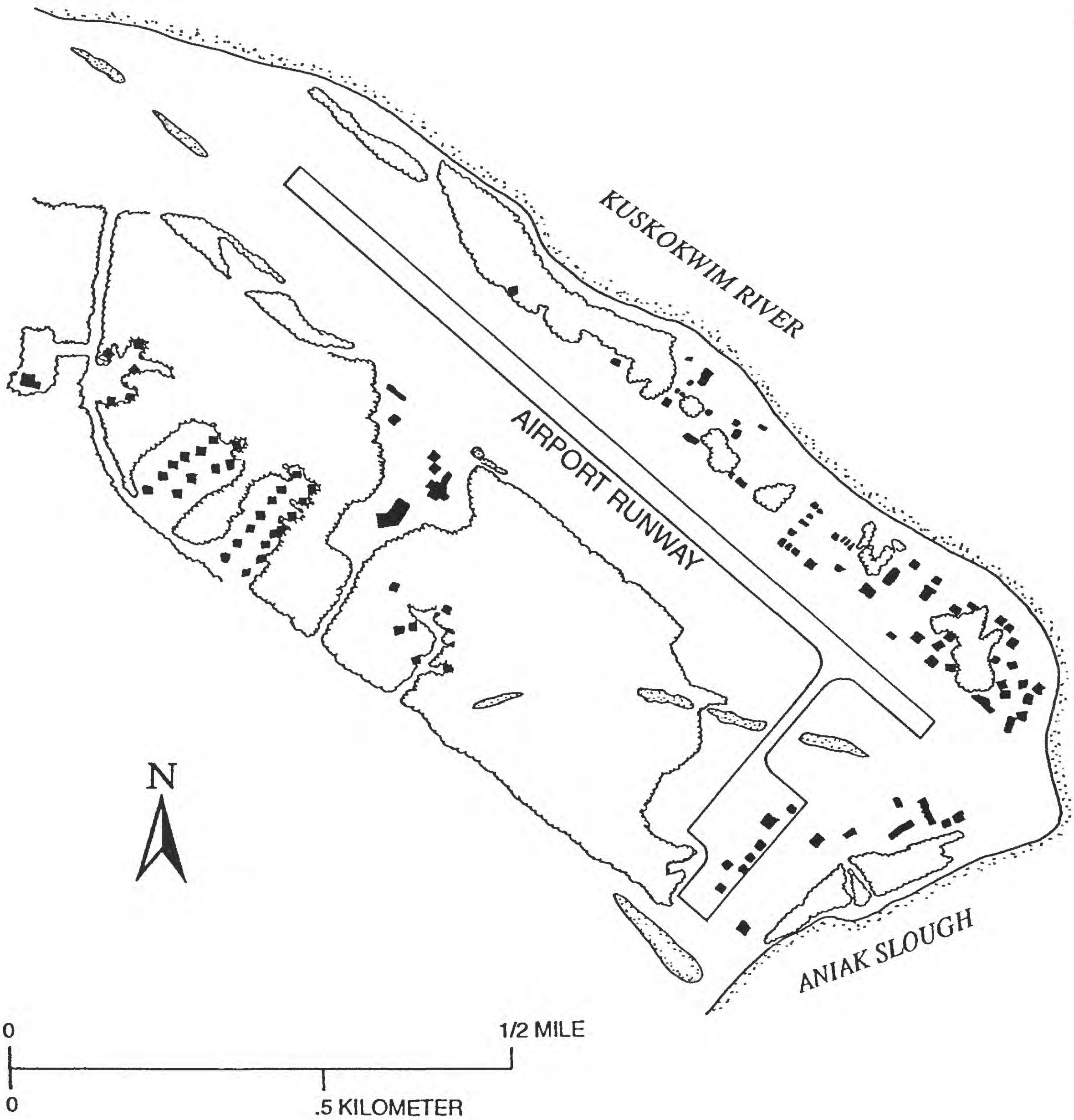


Figure 2. City of Aniak (Alaska Transportation Consultants, 1986).

the winter. Electricity is provided by the privately owned Aniak Power and Light Company, which operates diesel-powered generators and a village-wide power distribution system. No public water supply system exists in Aniak; however, a central sewage collection system built in 1984 (Alaska Department of Environmental Conservation, 1986) and improved in 1990 (Joel Neimeyer, U.S. Public Health Service, written commun., 1993) serves most of the village.

The economy of Aniak is based principally on government and service industry employment (Alaska Department of Community and Regional Affairs, 1979). This limited cash income is supplemented by a subsistence lifestyle in which a family's livelihood is generated from the land. The main source of subsistence food is fish migrating up the Kuskokwim River, such as the five pacific salmon (chinook, coho, sockeye, chum, and pink) (Francisco and others, 1991). This supply is supplemented by the resident fish which include sheefish, whitefish, char, rainbow trout, burbot, Arctic grayling, northern pike, blackfish, and longnose sucker. Other subsistence food sources include waterfowl, furbearers, black bear, brown bear, caribou, and moose which migrate through the local area or live close by. These natural food sources are supplemented by limited vegetable gardening and gathering of seasonal foods such as wild berries and waterfowl eggs. More than 3 million migratory waterfowl annually use the flyways along the Kuskokwim and Yukon Rivers near Aniak (Alaska Planning Group, 1974).

PHYSICAL SETTING

Climate

Aniak is situated on the northeastern border of the Yukon-Kuskokwim Coastal Lowlands south and west of the Kuskokwim Mountains (Wahrhaftig, 1965). The climate of Aniak is transitional between maritime during the summer and continental in the winter (Hartman and Johnson, 1984). Aniak has great diurnal and annual temperature variations. Low precipitation, low cloudiness, and low humidity are typical in the winter; cloudy, humid conditions characterize the summer. Freezing of the Kuskokwim River typically occurs after October (Alaska Department of Community and Regional Affairs, 1979), and May 13 is the average day for break-up computed from 26-years of break-up dates for the Kuskokwim River at Aniak (Federal Emergency Management Agency, 1990). The mean annual temperature is -2.1 °C, but temperatures range from a July mean maximum of 18.3 °C to a January mean minimum of about -22.4 °C (Leslie, 1989). Mean annual precipitation is about 489 mm; approximately 1,425 mm of snow falls annually. Most rainfall occurs in August and September. Mean monthly temperature, precipitation, and snowfall are summarized in table 1.

Vegetation

Vegetation in the Aniak area consists of a closed spruce-hardwood forest along the Kuskokwim River, wet-tundra near sloughs and lakes southeast of Aniak and an alpine tundra on the dry upland slopes north of the village (Viereck and Little, 1972). The forested areas have widely spaced mature white spruce, black spruce, tamarack, white birch, poplar, and cottonwood with an undergrowth of willow and young cottonwood (U.S. Army Corps of Engineers, 1986a, 1986b; Hartman and Johnson, 1984). Tall grasses and some moss form the ground cover (U.S. Army Corps of Engineers, 1986a, 1986b). The alpine tundra areas near Aniak are covered with lichens, mosses, sedges, dwarf birch, lingonberry, crowberry, Labrador tea, and other low growing shrubs (Tolbert and Pollock, 1964).

Table 1. Mean monthly temperature, precipitation, and snowfall for the combined periods 1922-76 and 1985-87, Aniak

[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	-12.7	-8.7	-5.1	2.3	10.9	17.4	18.3	15.6	11.5	2.1	-5.8	-12.7	2.8
	(Record maximum, 33.3 °C, June 1922)												
Mean minimum	-22.4	-19.3	-17.1	-7.9	0.4	6.1	8.1	7.2	2.6	-5.2	-13.9	-21.9	-6.9
	(Record minimum, -52.2 °C, January 1947)												
Mean	-17.7	-14.0	-11.0	-2.8	5.7	11.7	13.2	11.4	7.1	-1.5	-9.8	-17.3	-2.1
Precipitation (mm of moisture)	20.6	22.4	23.9	16.0	25.7	37.3	60.5	117.6	72.4	37.1	27.9	27.4	489
Snowfall (mm)	215.9	226.1	243.8	111.8	27.9	Trace	--	Trace	2.54	101.6	236.2	261.6	1,425

Bedrock Geology

Aniak is located in the Central Kuskokwim Region on the flood plain of the Lower Kuskokwim River (Cady and others, 1955). The broad lowlands around Aniak slope gently upward to the Kuskokwim Mountains on the east and to mountains west of the Aniak River. Bedrock exposures along the Kuskokwim River north of Aniak are defined as the Gemuk Group and consist of andesitic or basaltic flows and volcanic breccia interbedded with siliceous siltstone, graywacke, and small amounts of calcareous conglomerate, and limestone (Cady and others, 1955; Hoare and Coonrad, 1959). The migration of the Kuskokwim River northward beyond these relatively resistant rocks is unlikely (U.S. Army Corps of Engineers, 1986a).

Surficial Geology

Thick deposits of Quaternary sediment overlie most of the bedrock in the Aniak area (Hoare and Coonrad, 1959; Krause, 1984). These deposits consist of three major types: overbank flood deposits, slack water deposits, and bar accretion deposits.

The overbank flood-plain deposits consist of interbedded silt and fine sand that overlie and mask older bar accretion deposits. The overbank flood-plain deposits range from 1 to 10 m thick and occupy most of the well-drained areas of the Kuskokwim River flood plain near Aniak (Krause, 1984). These deposits were emplaced during repeated overbank flood flows and form the high, relatively flat interchannel areas of the flood plain. Permafrost forms in these deposits in shaded areas and along north-facing slopes.

The slack water deposits in sloughs and oxbow lake formations south of Aniak differ from the flood-plain deposits only because they contain a higher proportion of organic matter (Krause, 1984). Slack water deposits overlie bar accretion deposits and underlie or are interbedded with peat. These deposits are formed when overbank flood waters are confined in sloughs or other depressions and sediment settles out.

Bar accretion deposits occupy the banks and bars of the Kuskokwim River adjacent to Aniak (Krause, 1984). These bar accretion deposits consist of interstratified sand and gravel with minor amounts of silt. They are formed by river channel and point bars moving along the Kuskokwim River. Bar accretion deposits along the river are free of permafrost and the low silt content of these deposits should prevent permafrost from forming.

Soils

Two principal soil groups and six less extensive soil groups have been identified and mapped in the Aniak area (Tolbert and Pollock, 1964). The source of these soils has been identified as mostly flood-plain deposits and outwash materials (Rieger and others, 1979). Kuskokwim silt loam, the dominant soil in the uplands north of Aniak, consists of poorly drained silty soils having shallow permafrost tables. Susitna silt loam is the dominant soil on the alluvial plain on which the community is situated. Susitna silt loam consists of a well-drained stratified sandy and silty soil. The upper horizon is generally silt loam and the lower horizons below about 1.5 m are stratified silt loam and very fine sandy loam. The six other soils groups occupy less than 12 percent of the more than 45 km^2 of area mapped and occur away from the village of Aniak mostly on steep slopes or poorly drained lowlands north of the Kuskokwim River (Tolbert and Pollock, 1964).

The vertical permeability of the soils in Aniak was tested by the U.S. Public Health Service to investigate on-site sewage treatment for housing southwest of the airport. Percolation tests indicated a variable percolation rate of between 1 minute and 1 hour per 2.5 cm of percolation or about 0.04 to 0.0007 cm/s (appendix 1). A significant increase in the rate of percolation was observed for tests made at depths greater than about 2.4 m. This increase in percolation was attributed to the presence of numerous well-sorted sand lenses (appendix 1).

Logs of wells drilled at homesites in the housing area southwest of the airport indicate a common sequence of 2 to 3 m of finely laminated, slightly organic fine silt grading to a finely laminated silt containing thin lenses (30 to 60 mm) of well-sorted, fine-grained sand (appendix 1). Test pits were dug to investigate soil characteristics along potential levee alignments north and east of Aniak along the banks of the Kuskokwim River and Aniak Slough. The pits indicated the presence of a thin mat of organic soil, ranging in depth from 0 to 200 mm, overlying a variation of silty sand or sandy silt to a depth of 4 to 5 m (U.S. Army Corps of Engineers, 1986a).

The local area is underlain by a layer of discontinuous permafrost (Ferrians, 1965), and several well drillers' logs indicate the presence of ice or frozen soils at depths of 1 to 6 m (appendix 1; and U.S. Public Health Service, 1983). Seasonal frost commonly penetrates to a depth of about 2 m; however, ground temperatures measured near the airport indicate that soil temperatures at a depth below about 1.5 m were consistently above freezing continuously for more than 10 years (Aitken and Fulwider, 1962).

HYDROLOGY

Surface Water

The village of Aniak is encircled by water. The Kuskokwim River flows from east to west on the northern edge of the village. Aniak Slough carries Kuskokwim River water to the south along the eastern edge of the village and then meanders generally to the west until it reenters the Kuskokwim River approximately 10 km downstream (fig. 1). Numerous abandoned channels between Aniak Slough and the village provide drainage to the south and west away from the village. However, during higher flows or ice-jam flooding, these abandoned channels also provide an access route for water that backs up around the existing dirt berm flood levees on the north and east ends of the village.

The numerous sloughs, oxbow lakes, and abandoned channels indicate rapidly changing channel geometry of the Kuskokwim River near Aniak. Lundell (1983) reported that 6 m of streambank eroded during the 30 years since the original townsite survey in 1952. He conservatively estimated a current 1983 erosion rate of 0.3 m per year near Aniak. In the headwaters reach above Aniak, the Kuskokwim River flows through a narrow valley incised in the Kuskokwim Mountains. In the reach below Aniak, the river spreads out onto a wide alluvial plain. Near the mouth of Aniak River, in the area of transition between these reaches, the gradient of the Kuskokwim River changes from about 0.0006 to about 0.0002 (Lundell, 1983).

Ground Water

The Kuskokwim Mountains east of Aniak consist of ridges trending to the northeast. Surface-water drainage is into the Kuskokwim River, which flows southwest. On a regional scale, this surface drainage direction tends to be duplicated in the ground-water system. In the hills north of Aniak, ground water probably flows in the direction of topographic gradients to the valley bottoms, where it emerges in streams. The lowlands around Aniak also have a net drainage toward the southwest. Local relief in Aniak is gentle: elevation change within the city limits is about 3 to 4 m (U.S. Army Corps of Engineers, 1986a). Depth to the water table varies temporally and spatially in Aniak, but generally ranges from 4 to 8 m (appendix 1). On the basis of topography and a preliminary hydrologic investigation (appendix 1), shallow ground water flows in the same general direction as the Kuskokwim River near Aniak, from northeast to southwest (fig. 3).

Three wells drilled in 1959 to depths of 13.7, 17, and 14.6 m were each pumped at a rate of about 1.9 L/s for 36, 48, and 8 hours respectively. Each had less than 0.2 m of drawdown (appendix 2), which indicates a permeable aquifer. Wells drilled at the new housing site southwest of the runway range in depth from about 13 to 21 m (appendix 1). One 14-m deep, 0.1-m diameter well in lot 30 of the housing site had a 3-m drawdown when pumped for 4.5 hours at a rate of about 0.8 L/s, whereas a drawdown of 0.7 m was measured in another 14-m deep, 0.1-m diameter well at lot 7 when it was pumped for 1.5 hours at a rate of about 1.6 L/s (appendix 1).

The aquifer that supplies Aniak is in thick alluvium between the Kuskokwim River and Aniak Slough. No confining layers other than discontinuous permafrost are evident in the drillers' logs (appendixes 1 and 2). The absence of confining layers in the aquifer means that the water can move without significant interruption vertically and horizontally. The lack of confining layers also indicates that the aquifer is vulnerable to contamination from spills on the land surface.

Ground Water and Surface Water Interaction

Adjacent to the river, shallow ground water flows into and out of the riverbanks as the elevation of water in the river rises and falls. Seasonally, discharge of the river fluctuates from a maximum in late May or early June to a minimum in late April or early May, as shown by the hydrograph (fig. 4) for the Kuskokwim River at Crooked Creek about 80 km upstream. The river also rises during late-summer rainstorms (fig. 4). The water table generally rises and falls in response to these river fluctuations. The water-table fluctuations, however, are attenuated with distance from the river. This flow of water into and out of the aquifer in response to changing stage of the river is termed "bank storage effects" (Linsley and others, 1982) (fig. 5).

The construction of levees along the Kuskokwim River at Aniak may significantly increase the river stage for a flood of a given magnitude. This rise in river stage will increase the ground-water levels near the river. No studies have been done to determine the extent of ground-water/surface-water interactions at Aniak and no continuous records of water-table elevation exist for Aniak. The variations in river stage at Aniak will generally follow the pattern of the discharge hydrograph for the Kuskokwim River at Crooked Creek (fig. 4).

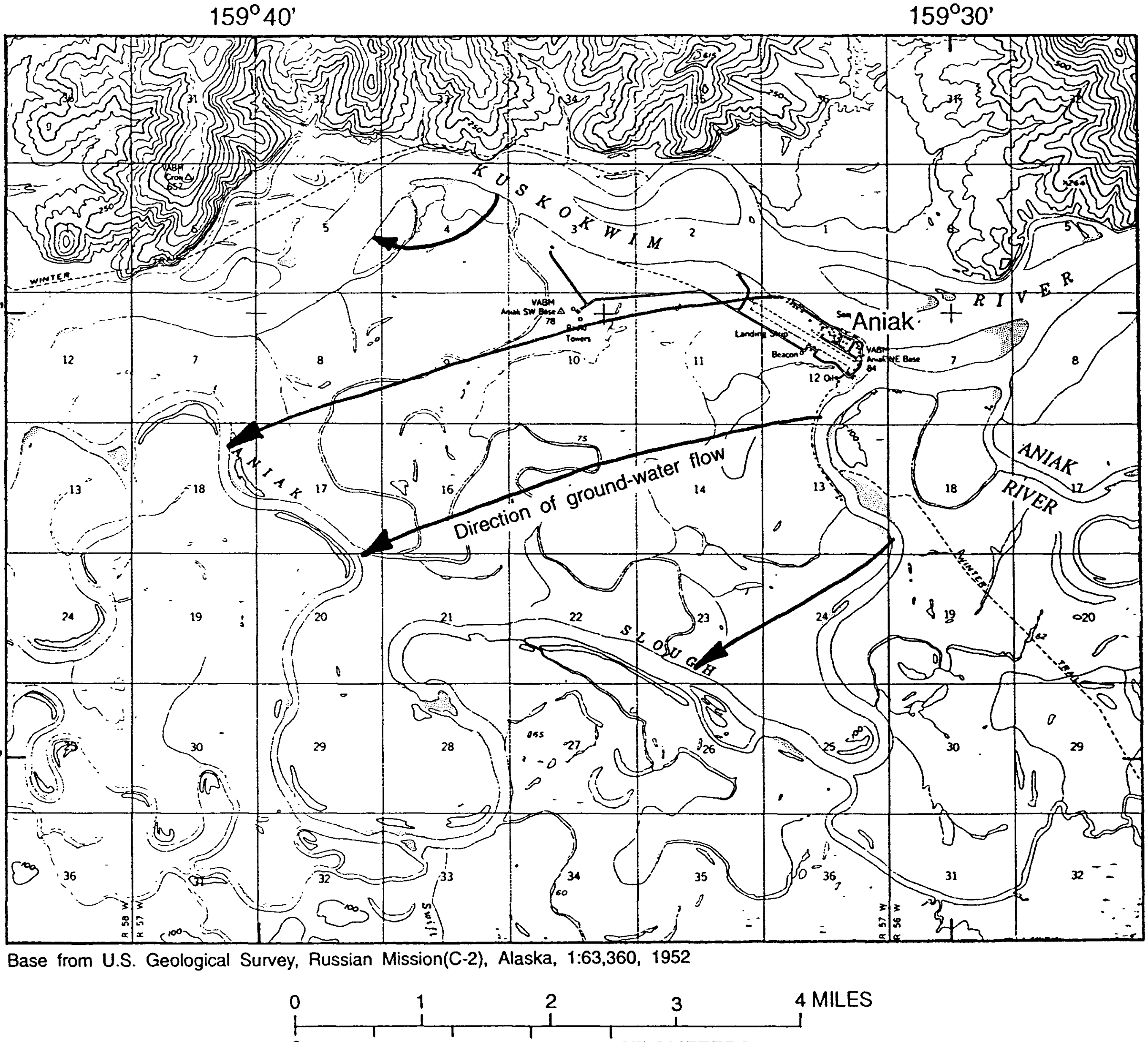


Figure 3. Estimated direction of shallow ground-water flow in Aniak (Scott Wheaton, geologist, U.S Public Health Service, written commun., 1980).

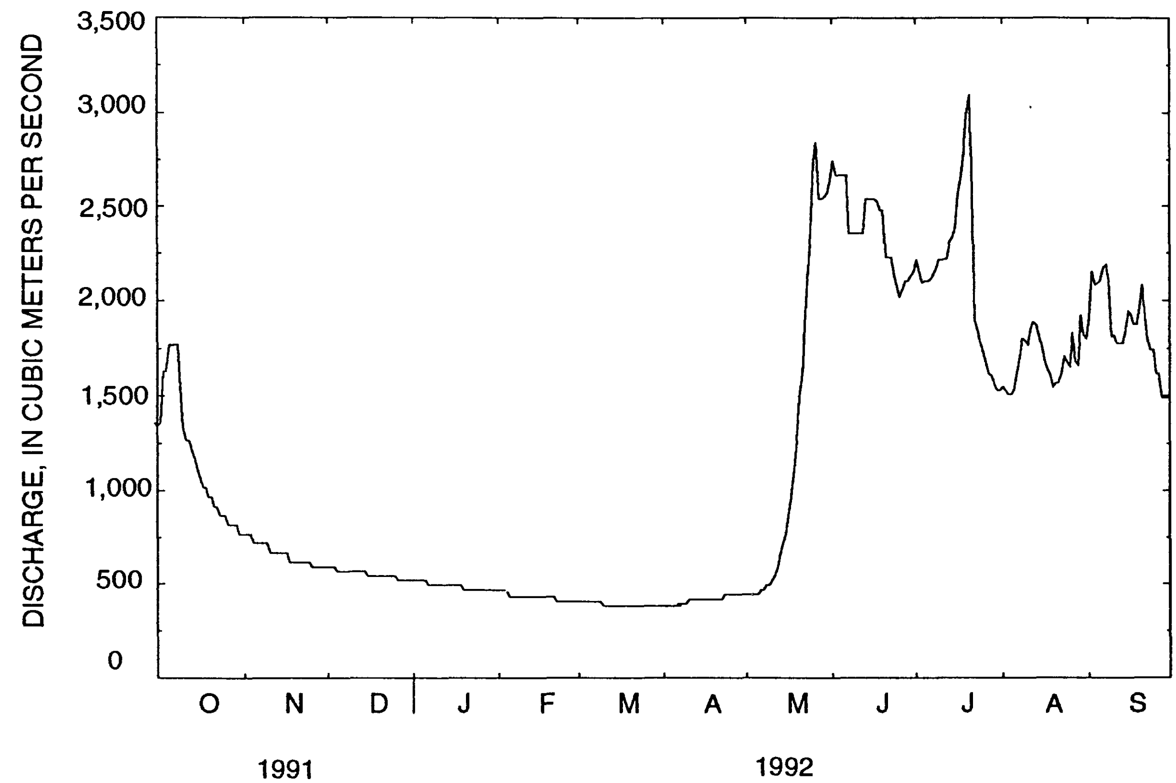


Figure 4. Discharge for the Kuskokwim River at Crooked Creek, 1992 water year.

FLOODS

No continuous streamflow records exist for the Kuskokwim River at Aniak; however, a daily mean discharge record for the period 1951-92 is available for the Kuskokwim River at Crooked Creek. This active stream-gaging station at Crooked Creek records river stage fluctuations that reflect effects from 127,400 km^2 of the 152,400-km^2 Kuskokwim River drainage basin upstream from Aniak. The Crooked Creek gaging station represents more than 83 percent of the basin upstream from Aniak and records from this station have been used to estimate the flood probability at Aniak (Lundell, 1983; U.S. Army Corps of Engineers, 1986a, 1991; Peratrovich, Nottingham, and Drage, Inc., 1989; and Federal Emergency Management Agency, 1990). Flood frequencies calculated for the Kuskokwim River at Crooked Creek are based on records through 1990 (table 2) (Jones and Fahl, 1994).

The flood frequency for the Kuskokwim River at Aniak was determined by first computing the ratio of drainage area at Aniak to the drainage area at Crooked Creek. This ratio was raised to the 0.8 power to obtain a transfer coefficient in a manner similar to previous flood frequency analyses (Lundell,1983; U.S. Army Corps of Engineers, 1986a, 1991; Peratrovich, Nottingham, and Drage, Inc., 1989; and Federal Emergency Management Agency, 1990). This drainage area transfer coefficient of 1.154 is used to increase the peak discharge at Aniak for various recurrence-interval floods at Crooked Creek (table 2). This flood frequency, however, applies only to floods generated by rain and snowmelt runoff and is not applicable to ice-jam floods, which are the primary source of flooding in Aniak.

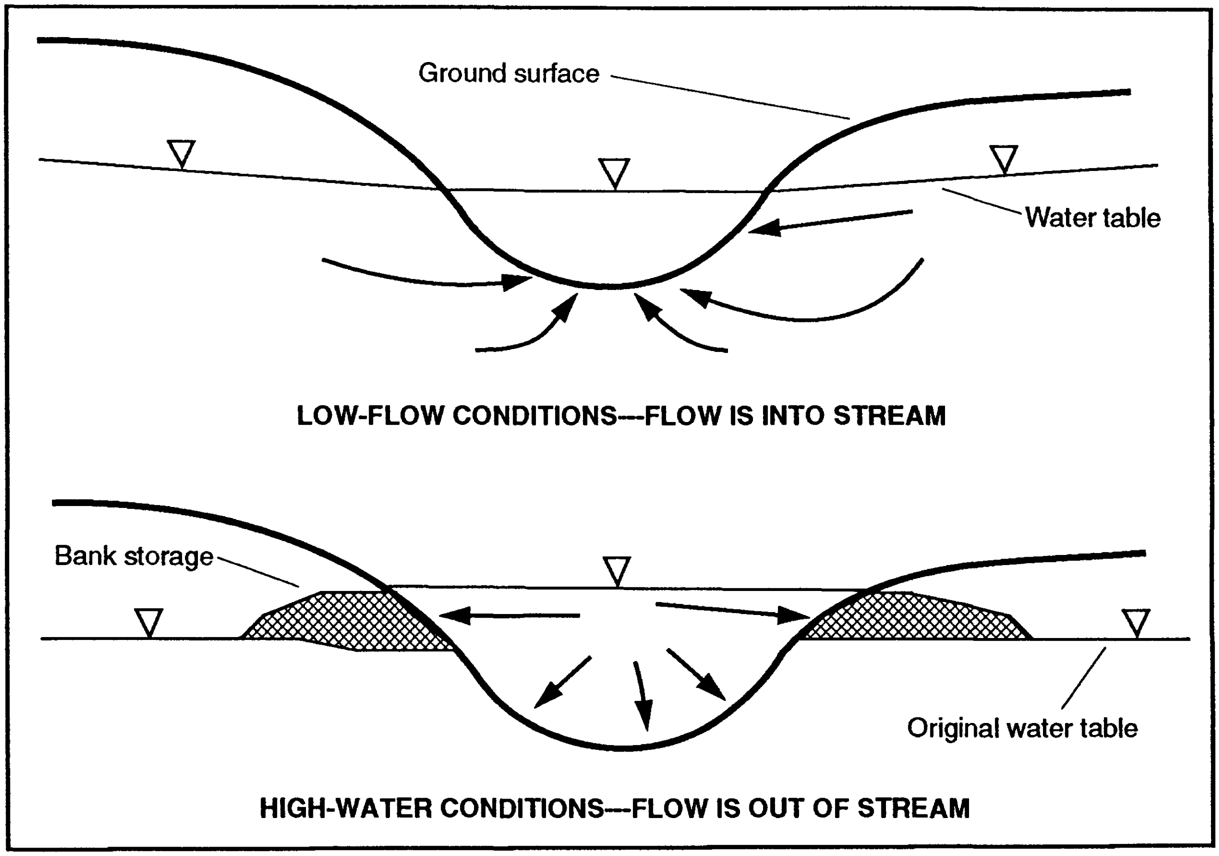


Figure 5. Ground-water/surface-water interactions.

Table 2. Peak discharges of the Kuskokwim River for various recurrence intervals
[Discharge is in cubic meters per second]

Station location	Discharge						
	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
Crooked Creek	4,670	6,290	7,310	8,610	9,540	10,500	12,700
Aniak	5,390	7,260	8,440	9,940	11,000	12,100	14,700

Ice-Jam Floods

Ice-jam flooding occurs when river ice broken during spring thawing is transported downstream, and its downstream movement is blocked in locations where a constriction, a sandbar, or other obstruction such as a sharp meander bend exists. The blockage prevents ice movement and restricts water flow as the ice jam builds in thickness and length. This subsequently slows the water velocity and produces a rise in water level or backwater effect that propagates upstream from the ice jam. When the ice jam releases, a flood wave propagates downstream.

Downstream from Aniak, several features work together to produce frequent ice-jam formations and subsequent backwater floods in the village. These features are a tight meander bend in the Kuskokwim River approximately 6 km downstream from the village, a pointed rock outcrop at the upstream edge of this meander bend, and a large sandbar on the north bank of the river about 3 km downstream from Aniak. An ice jam forms almost annually near Aniak at one of these obstructions.

Ice-jam floods are responsible for most of the reported damage to flood-control structures, personal property, and buildings in Aniak (Federal Emergency Management Agency, 1990). Ice-jam floods may cause several times more damage than open-water floods (Beltaos, 1990). Records of flood water elevations in Aniak have been kept since 1960 and major floods have occurred in 1962, 1968, 1972, 1975, and 1976 (Federal Emergency Management Agency, 1990). The frequency of ice-jam floods in the village of Aniak for the period 1960-85 was determined from records kept by individual observers in Aniak, from a National Weather Service River Forecast Center slope-gage located near the upstream end of the levee in Aniak, and from a mixed population flood-frequency investigation by the U.S. Army Corps of Engineers (1991).

Flood Protection Measures

In 1951, the FAA constructed a levee along the upstream edge of the village to protect the airport runway. A flood in 1968 damaged the levee, and the river ice damaged it again in 1971. In 1968, emergency funds were authorized to repair the levee; in 1971 emergency funds were spent to repair, extend, and raise the levee; and in 1978 the U.S. Army Corps of Engineers constructed another levee on the north side of Aniak that was tied to the existing FAA levee (Federal Emergency Management Agency, 1990). During a single year's breakup in 1987, about 1 m of the entire streambank was eroded along the Kuskokwim River adjacent to Aniak and almost 2 m was eroded along a 0.5-km section of the levee (Federal Emergency Management Agency, 1990).

Levee damage, bank erosion, and water inundation have been a constant concern for residents of Aniak (Lundell, 1983; U.S. Army Corps of Engineers, 1986c, 1991; Peratrovich, Nottingham, and Drage, Inc., 1989; and Federal Emergency Management Agency, 1990). Current flood-control measures provide limited protection (U.S. Army Corps of Engineers, 1991). More than $2 million have been expended to address flood damage and control in Aniak (Federal Emergency Management Agency, 1990). The U.S. Army Corps of Engineers (1991) reports that the flood-control protection provided by the present levee system is inadequate and about $20 million of renovation and new construction of a ring dike would be required to protect Aniak residents and their buildings from the 100-year flood.

DRINKING WATER

Present Drinking Water Supplies

No public water-supply system exists in Aniak. Drinking water is typically provided by individual wells (U.S. Public Health Service, 1983). More than half the residents obtain drinking water from shallow wells and no reasonably available alternative sources exist. Thus, the residents of Aniak would be able to petition the U.S. Environmental Protection Agency (USEPA) to have their current drinking water supply designated as a sole source aquifer (U.S. Environmental Protection Agency, 1987). Sole source designation of Aniak's aquifer would authorize the USEPA to review all Federal financially assisted projects planned for the area to determine their potential for contaminating the aquifer (U.S. Environmental Protection Agency, 1987). Individual homesites without wells commonly obtain water from a neighboring well or haul water from the Kuskokwim River. Private wells provide adequate water and average about 9 m deep (U.S. Public Health Service, 1983).

Water-use withdrawals were estimated for Aniak using the 1990 population of 578. Ground--water sources supplied an estimated 51,000 L/d for domestic and commercial users. Surface-water sources supplied an estimated 1,600 L/d for domestic use. In 1990, the total water withdrawn per person in Aniak was 90 L/d. This compares with an average water use per person of 1,960 L/d estimated for all uses for the entire State of Alaska in 1990 (Solley and others, 1993).

When the Kuskokwim River rises above the flood-control levee or flows around the levee into Aniak, it not only damages structures and roads, but also causes contaminants on the surface of the land to mobilize and move into inadequately sealed wells. Concern about the possible contamination of private drinking water wells by surface water has been expressed by residents of a new housing project in Aniak, who found that flood waters were commonly higher than the top of their well casings (Christy Miller, Alaska Department of Community and Regional Affairs, oral commun., 1993). Even when wells are effectively sealed, flood waters may move contaminants such as petroleum products into previously uncontaminated areas, where the contaminants can then infiltrate into the aquifer.

Quality of Present Supply

Information on the quality of Aniak's drinking water is sparse. One 33.5-m deep well near the White Alice Site located south of the runway was sampled periodically during the period 1962-70, and water quality analyses in U.S. Geological Survey files indicate that it could be an acceptable drinking water source. This well water had an iron content consistently less than 1.6 mg/L, a silica content ranging from 10 to 15 mg/L, and a hardness as $CaCO_3$ ranging from 85 to 102 mg/L. The iron content is higher than the 0.30 mg/L secondary maximum contaminant level regulations set by the USEPA (1992) for drinking water, but does not prohibit this water from being utilized for drinking. Silica and hardness may create scale in plumbing or boilers but is generally of little concern to most users.

More than 30 wells with a diameter of 0.1 m were drilled in 1980 at the new housing site. Analyses of samples from these wells indicate an iron content averaging 0.30 mg/L, a silica content ranging from 7 to 20 mg/L, and hardness as $CaCO_3$ ranging from 100 to 200 mg/L (appendix 1).

Alternative Drinking Water Sources

The Kuskokwim River represents a virtually inexhaustible source of drinking water for Aniak. Mean annual flow of the Kuskokwim River at Aniak is estimated to be about 1,400 m^3/s on the basis of a drainage basin unit discharge calculated from the published discharge record at Crooked Creek (U.S. Geological Survey, 1992). This quantity of water in the river adjacent to Aniak is more than 1,000 times the quantity of water used daily by the city of Anchorage, which has an estimated population of 250,000. However, because there is no public water distribution system in Aniak, the cost of the development of the Kuskokwim River as a water supply would be significant, maybe even prohibitive for Aniak.

Quality of Alternative Sources

The quality of the Kuskokwim River water has been monitored at the Crooked Creek gaging station for more than 35 years as part of the U.S. Geological Survey's National Stream-Quality Accounting and Radiochemical Network. The record of water quality indicates that the Kuskokwim River could be utilized as a drinking water source; however, treatment would be required. The number of fecal coliform in the water, especially during the fall season following salmon spawning, has exceeded drinking water regulations. On October 5, 1989, the fecal coliform count was 43 colonies/100 mL of water (U.S. Geological Survey, 1991). The sediment concentration in the water was measured at 316 mg/L on July 16, 1991 (U.S. Geological Survey, 1992). The dissolved iron content has been measured (U.S. Geological Survey, 1992) in concentrations greater than the 0.30 mg/L secondary maximum contaminant level regulations set by the U.S. Environmental Protection Agency (1992) for drinking water.

Another potential source of drinking water for Aniak is the Aniak River, which is approximately 2 km east of the village. This river has an adequate but smaller quantity of water to supply Aniak, in comparison with the Kuskokwim River. From 1955 to 1957, water-quality samples were collected from the Aniak River by the U.S. Geological Survey. Analyses of these samples (appendix 3) indicate that the Aniak River water contains iron concentrations as high as 0.42 mg/L, which is also above the 0.30 mg/L regulation value set by the USEPA. The water had a silica content ranging from 8 to 10 mg/L and a hardness as $CaCO_3$ ranging from 29 to 37 mg/L.

SUMMARY

Aniak's remote location makes it dependent on the airport or the river for transportation. The subsistence lifestyle of the Native residents makes them dependent on a sustainable environment. Frequent ice-jam flooding is hazardous to residents and their property. When the Kuskokwim River rises above the flood control levee or flows around it into Aniak, contaminants on the surface of the land are mobilized and can move into the ground-water drinking supply or directly into inadequately protected wells. The residents of Aniak use a single aquifer for their current drinking water supply. The Kuskokwim and Aniak Rivers represent alternative drinking water supplies, but because there is no public water distribution system in Aniak, the development of these source may be uneconomical.

REFERENCES CITED

Aitken, G.W. and Fulwider, C.W., 1962, Ground temperature observations, Aniak, Alaska: U.S. Army Cold Regions Research and Engineering Laboratory, Corps of Engineers, Technical Report 101, 14, p.

Alaska Department of Community and Regional Affairs, 1979, Aniak: Alaska Department of Community and Regional Affairs Community Map--Aniak, 1 sheet.

Alaska Department of Environmental Conservation, 1986, Sanitation facility improvements--Aniak, Alaska: Village Safe Water Program Final Report, 36 p.

Alaska Planning Group, 1974, Proposed Yukon Delta National Wildlife Refuge: U.S. Department of the Interior Final Environmental Statement, 550 p.

Alaska Transportation Consultants, 1986, Aniak Airport master plan final report: Anchorage, Alaska Department of Transportation and Public Facilities, Division of Planning.

Beltaos, Spyridon, 1990, Breakup jams, *in* Ryan, R.L., and Crissman, R.D., eds., Cold regions hydrology and hydraulics: American Society of Civil Engineers Monograph, p. 485-510.

Burns, A.W., Mitchell, J.C., Nash, R.A., and Wallick, P.K., 1975, Land selection in the Calista Region--A summary of activities during 1973-1974: Anchorage, Calista Corporation, 78 p.

Cady, W.M., Wallace, R.E., Hoare, J.M., and Weber, E.J., 1955, The Central Kuskokwim Region, Alaska: U.S. Geological Survey Professional Paper 268, 132 p.

Ecology and Environment, Inc., 1992, Environmental compliance investigation report, Aniak FAA station, Aniak Alaska: Anchorage [Draft report available from Federal Aviation Administration, Alaskan Region], variously paged.

Federal Emergency Management Agency, 1990, Flood insurance study--City of Aniak, Alaska: Federal Emergency Management Agency report, 19 p.

Ferrians, O.J., Jr., 1965, Permafrost map of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-445, 1 sheet, scale 1:250,000.

Francisco, R.K., Anderson, Cindy, Burkey, Charles, Jr., Coffing, Mike, Hyer, Karen, Molyneaux, D. B., and Utermohle, Charles, 1992, Annual management report for the subsistence and commercial fisheries of the Kuskokwim area, 1991: Alaska Department of Fish and Game Regional Information Report No. 3A92-06, 212 p.

Hartman, C.W., and Johnson, P.R., 1984, Environmental atlas of Alaska: University of Alaska Fairbanks, Institute of Water Resources/Engineering Experiment Station, 95 p.

Hoare, J.M., and Coonrad, W.L., 1959, Geology of the Russian Mission Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Map I-292, scale 1:250,000.

Jones, S.H., and Fahl, C.B., 1994, Magnitude and frequency of floods in Alaska and conterminous basins of Canada: U.S. Geological Survey Water-Resources Investigations Report 93-4179, 122 p., + 2 pl.

Krause, K.J., 1984, Photointerpretive map of morphological flood-plain deposits and material resources, Middle Kuskokwim River from Sleetmute to Kalskag, Alaska: Alaska Division of Geological and Geophysical Surveys Report of Investigations 84-2, 10 p.

Leslie, L.D., 1989, Alaska climate summaries (2d ed.): Alaska Climate Center Technical Note 5, Arctic Environmental Information and Data Center, University of Alaska, Anchorage.

Linsley, R.K., and Franzini, J.B., 1979, Water resources engineering (3rd ed.): McGraw Hill Book Company, 716 p.

Linsley, R.K., Kohler, M.A., and Paulhus, J.L., 1982, Hydrology for engineers (3rd ed.): McGraw Hill Book Company, 508 p.

Lundell, Bob, 1983, Aniak dike extension feasibility study: Polydyne Engineering, 122 p. + appendixes.

Oswalt, W.H., 1980, Historical settlements along the Kuskokwim River, Alaska: Alaska State Library Historical Monograph No. 7, 104 p.

Peratrovich, Nottingham, and Drage, Inc., 1989, Stage frequency analysis--Aniak, Alaska: Anchorage, Peratrovich, Nottingham, and Drage, Inc., variously paged.

Reynolds, G.L., 1988, Historical overview and inventory--White Alice Communications System: U.S. Army Corps of Engineers, Alaska District, 98 p.

Rieger, Samuel, Schoephorster, D.B., and Furbush, C.E., 1979, Exploratory soil survey of Alaska: Soil Conservation Service report, 213 p.

Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 76 p.

Tolbert, J.G., and Pollock, R.S., 1964, Soils of the Aniak area, Alaska: Soil Conservation Service report, 22 p.

U.S. Army Corps of Engineers, 1986a, Flood control, Aniak, Alaska--C. Soils analysis: U.S. Army Corps of Engineers Flood Control Section 205 Reconnaissance Report, 32 p.

_____1986b, Flood control, Aniak, Alaska--E. Environmental considerations: U.S. Army Corps of Engineers Flood Control Section 205 Reconnaissance Report, 5 p.

_____1986c, Flood control, Aniak, Alaska--A. Hydrology and hydraulics analyses: U.S. Army Corps of Engineers Flood Control Section 205 Reconnaissance Report, 65 p.

_____1991, Flood control, Aniak, Alaska: U.S. Army Corps of Engineers Section 205 Technical Report, 44 p.

U.S. Bureau of Census, 1991, Percent distribution Alaska population by sex, race and Hispanic origin--1990 census: Compiled by Alaska Department of Labor, Research and Analysis, 3 p.

U.S. Environmental Protection Agency, 1987, Sole source aquifer designation--Petitioner guidance: U.S. Environmental Protection Agency report, 30 p.

____1992, Drinking water regulations and health advisories: U.S. Environmental Protection Agency report, 11 p.

U.S. Geological Survey, 1991 Water resources data for Alaska, water year 1990: U.S. Geological Survey Water Data Report AK-90-1, 252 p.

_____1992, Water resources data for Alaska, water year 1991: U.S.Geological Survey Water Data Report AK-91-1, 415 p.

U.S. Public Health Service, 1983, Sanitation facilities construction for Aniak, Alaska: Anchorage, U.S. Public Health Service Project No. AN-80-22, Final Report, variously paged.

Viereck, L.A., and Little, E.L. Jr., 1972, Alaska trees and shrubs: U.S. Department of Agriculture Handbook No. 410, 265 p.

Wahrhaftig, Clyde, 1965, Physiographic divisions of Alaska: U.S. Geological Survey Professional Paper 482, 52 p.

APPENDIX 1

U.S. Public Health Service ground-water-quality data, aquifer test data, and soil description for Aniak, Alaska

Hutchison

UNITED STATES GOVERNMENT

memorandum

Alaska Area Native Health Service
Box 7-741, Anchorage, Alaska 99510

DATE: May 16, 1980

REPLY TO ATTN OF: A-EHB

SUBJECT: Aniak Subdivision Soils

TO: Reid Bond

Attached for your information is a report discussing results of a soils exploration program at Aniak conducted May 1-5, 1980, with reference to feasibility of on-site sewage and water supply facilities. The conclusions and recommendations are for general subdivision site conditions. Further field study is scheduled for late May 1980, to more closely define permafrost position at specific construction sites.

Scott Wheaton
Geologist

Attachment

cc: Jim Thode
Valerie Kramer
John Hutchison
John DeLapp
Dan Rogness
Bob Hopp (Drill Yard)

PHS. 1980

ANIAK SUBDIVISION

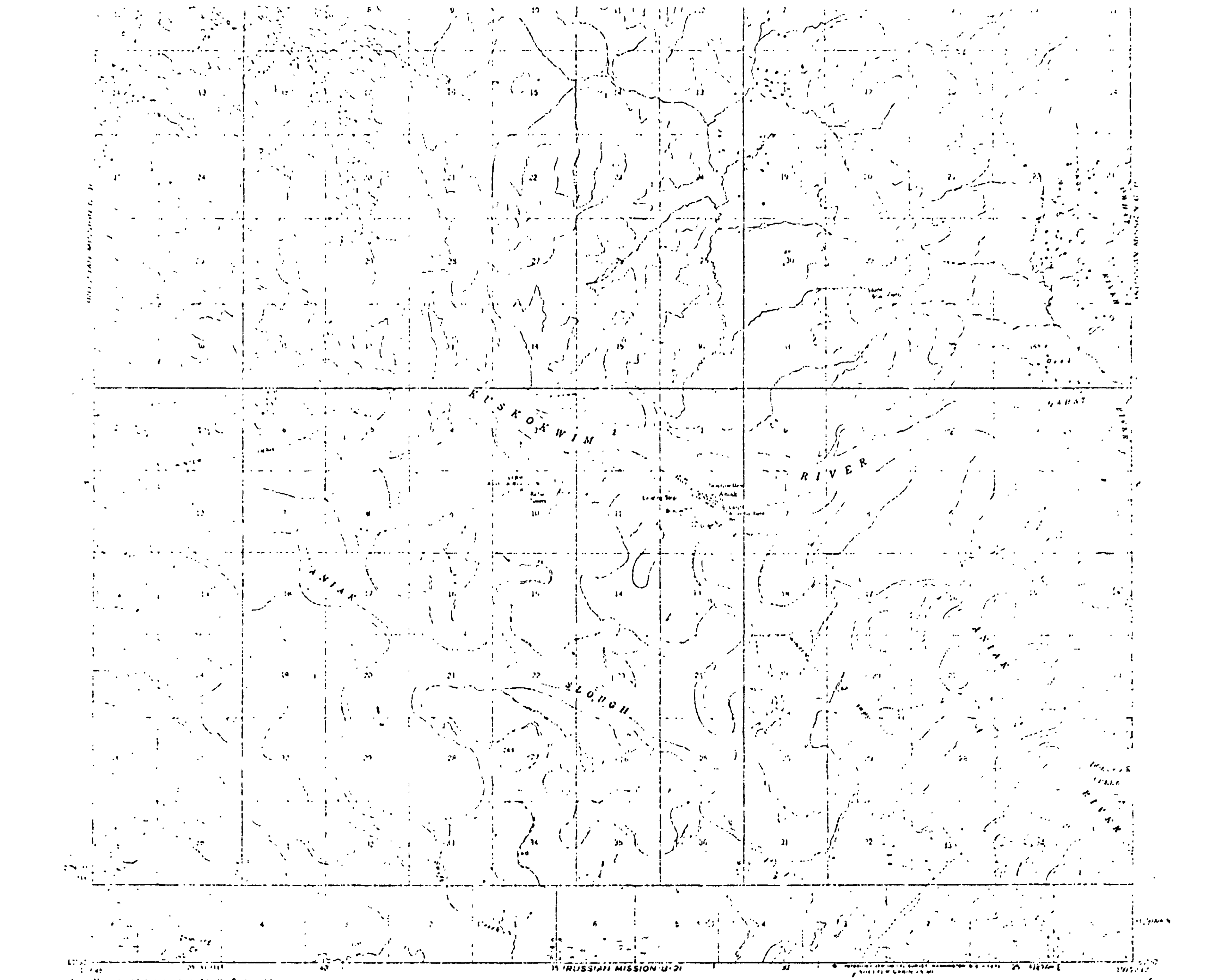
GENERAL SOILS REPORT

MAY 1980

U.S. PUBLIC HEALTH SERVICE
ENVIRONMENTAL HEALTH BRANCH

SUBMITTED BY: Scott Wheaton
Geologist

DATE: May 16, 1980



Mapped, edited, and published by the Geological Survey

SCALE 1:63 360

CONTOUR INTERVAL 100 FEET

FOR SALE BY U.S. GEOLOGICAL SURVEY
FAIRBANKS, ALASKA 99701, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

RUSSIAN MISSION C-2, ALASKA

INTRODUCTION:

A housing subdivision located just southwest of the Aniak airport property boundary is proposed to be served by on-site individual sewer and water facilities. The Environmental Health Branch (EHB) of the U.S. Public Health Service conducted field investigation of the site May 1 through May 5, 1980, through the supervision of Scott Wheaton, Geologist, assisted by Bob Hopp and John Demming, Drillers.

Subsurface exploration was conducted using a track-mounted rotary drill equipped with three-inch solid flight auger. Holes were logged from cuttings spun to the surface and from minimally disturbed samples obtained above water table with a 2.5 inch split spoon sampler. Percolation tests were performed on portions of test holes remaining open after removing drilling tools. Three wells were constructed using 15-slot, 30-inch long, 2-inch diameter, galvanized, spiral-wrapped drive well point screens. All three wells were pumped using a deep-well configuration jet pump and water samples were obtained and analyzed. Test hole logs, well logs, and water analyses are attached.

The following report discusses the site geology and soils with relation to construction of on-site sewerage and water supply and includes preliminary conclusions and recommendations for design and construction.

SUMMARY:

The subdivision is located on the floodplain of the lower Kuskokwim and Aniak Rivers. The site is nearly level but incised by several large (15 to 20 foot deep), steep-walled, abandoned channels and more numerous shallow, sinuous depressions trending north-south. In general, the area is very well drained with the exception of the larger abandoned channels. Vegetation consists of widely spaced mature white spruce, white birch and cottonwood with an undergrowth of willow and young cottonwood. Grass and some moss form the ground cover.

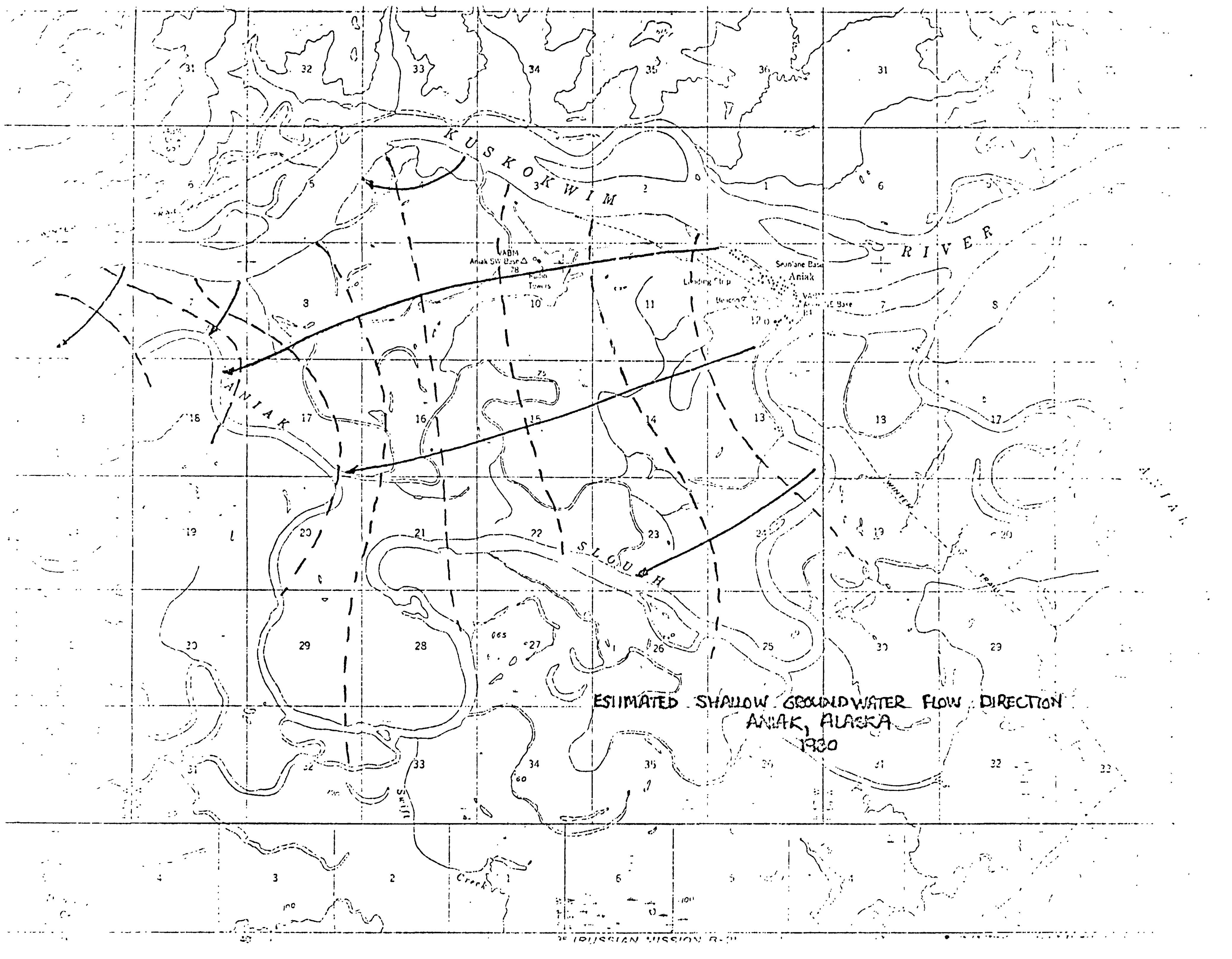
Surficial soils in the Aniak vicinity are composed of stratified sandy silty soils overlying sand and fine gravels at depths of 15 to 25 feet. Drilling at the site revealed a common sequence of 6 to 7.5 feet of finely laminated, slightly organic fine silt grading to a finely laminated silt containing thin lenses (1 to 3 inches) of well-sorted, fine-grain sand. The sand lenses comprised 10 to 30 percent of the total soil volume. Medium-grain, well-sorted sand, gravelly sands, and fine gravels were encountered at depths of 15 to 25 feet.

Water table at the time of drilling was usually encountered at depths of about 21 feet. This is probably a seasonal low - water table levels within 15 feet of the syrface are likely. The shallow groundwater (30 to 40 feet deep) at the subdivision site has a low iron content (less than 0.3 ppm) but is moderately hard and may have a silicon content (7 to 20 ppm) sufficient to cause some hot water scaling problems. Water quality information for deeper groundwater is scanty but data from a nearby 110-foot well does suggest iron content less than 1.5 ppm. Thin gravelly aquifers to depths of at least 100 feet are capable of producing 10 to 100 gallons per minute.

Permafrost was encountered sporadically in the east half of the subdivision. The permanently frozen ground showed no visible ice but was moderately to well bonded and was generally confined to the near surface silty soils. Permafrost table was observed at depths of 3 to 7 feet (seasonal frost penetrates from 1.5 to 5 feet) and extended to depths of 10 to 18 feet. Apparent layered permafrost (permafrost containing taliks - thawed zones - of sandy sediments) was observed in one test hole.

Specific permafrost location cannot be confidently predicted. Though some relict permafrost masses may be present, permafrost underlying the subdivision site is geologically very young and is presently aggrading. The site is underlain by well-drained sediments in a discontinuous permafrost zone so that aggradation is the result of microclimatic differences. Thus permafrost masses there are small, thin and generally isolated. Though specific permafrost location cannot be determined because of its recent microclimatic consequence, general statements can be made. That is: 1) permafrost does not exist beneath the larger abandoned channels; 2) permafrost will not likely exceed a depth of 20 feet; 3) permafrost may be present in isolated masses throughout the subdivision; but, 4) will be encountered more regularly in the eastern half of the subdivision where surficial deposits are likely somewhat older. In any event, to assure a permafrost-free construction site, borehole information would be required at the structure location.

Permeability of the subdivision site surficial sediments is moderate for the soil as a mass but is relatively high in horizons due to the presence of thin, numerous, well-sorted sand lenses. The U.S. Soil Conservation Service estimates a permeability for the top five feet of soil (the Susitna series) of about one to two inches per hour. Percolation tests performed during this field investigation showed percolation rates of about three minutes per inch for all thawed boreholes open for a depth greater than 8 feet. Two thawed test holes with tested depths less than 8 feet had percolation rates at or greater than 60 minutes per inch. It appears that the well-sorted sand lenses which are present at depths greater than about seven feet greatly enhance the seepage rate in the otherwise moderately permeable silty soil.

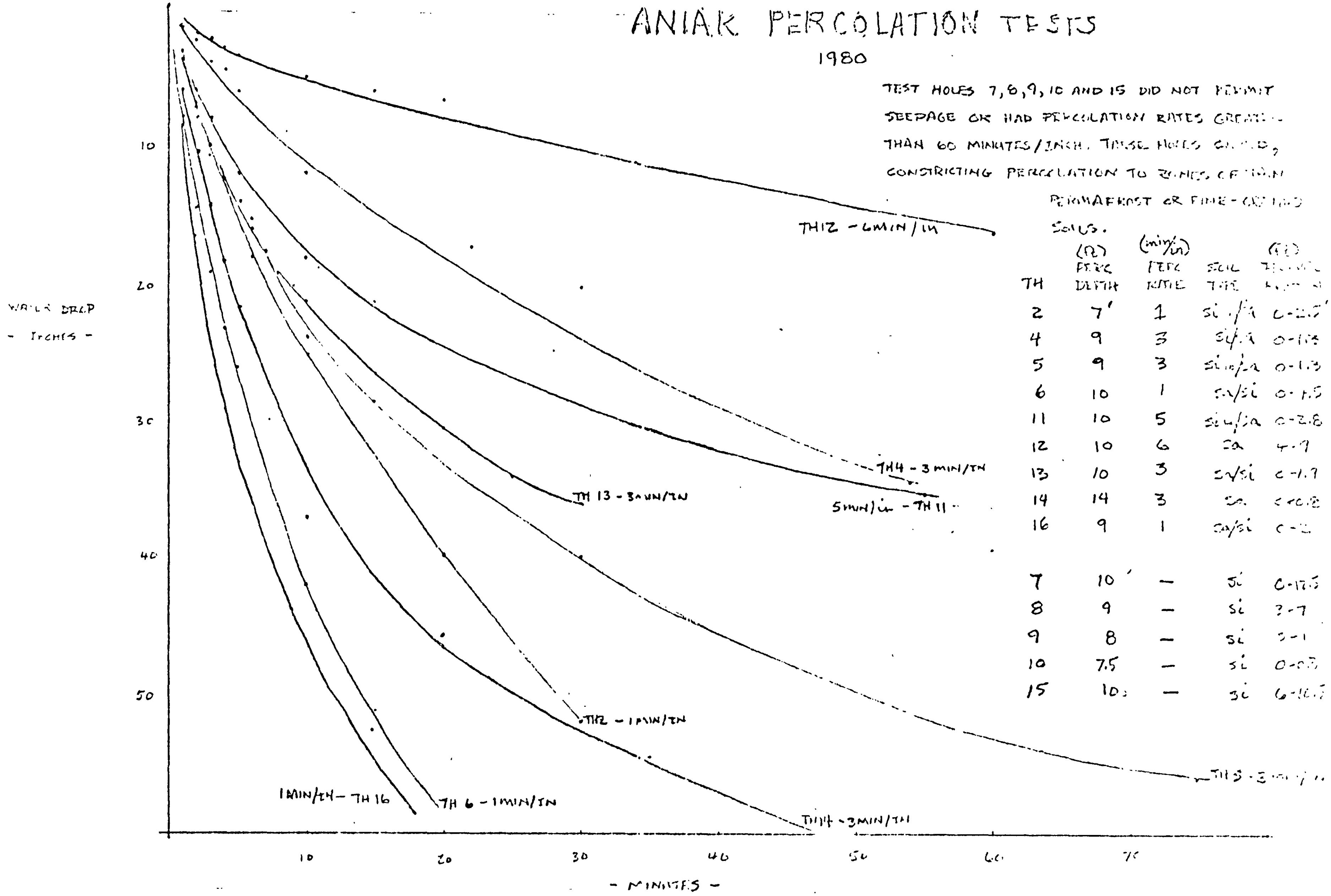

KUSKOKWIM RIVER
ANIAK
SLOUGH
Aniak
Seaplane Base
Landing Strip
Aniak SW Base
Radio Towers
WINTER TRAIL
Swift Creek
ESTIMATED SHALLOW GROUNDWATER FLOW DIRECTION
ANIAK, ALASKA
1990

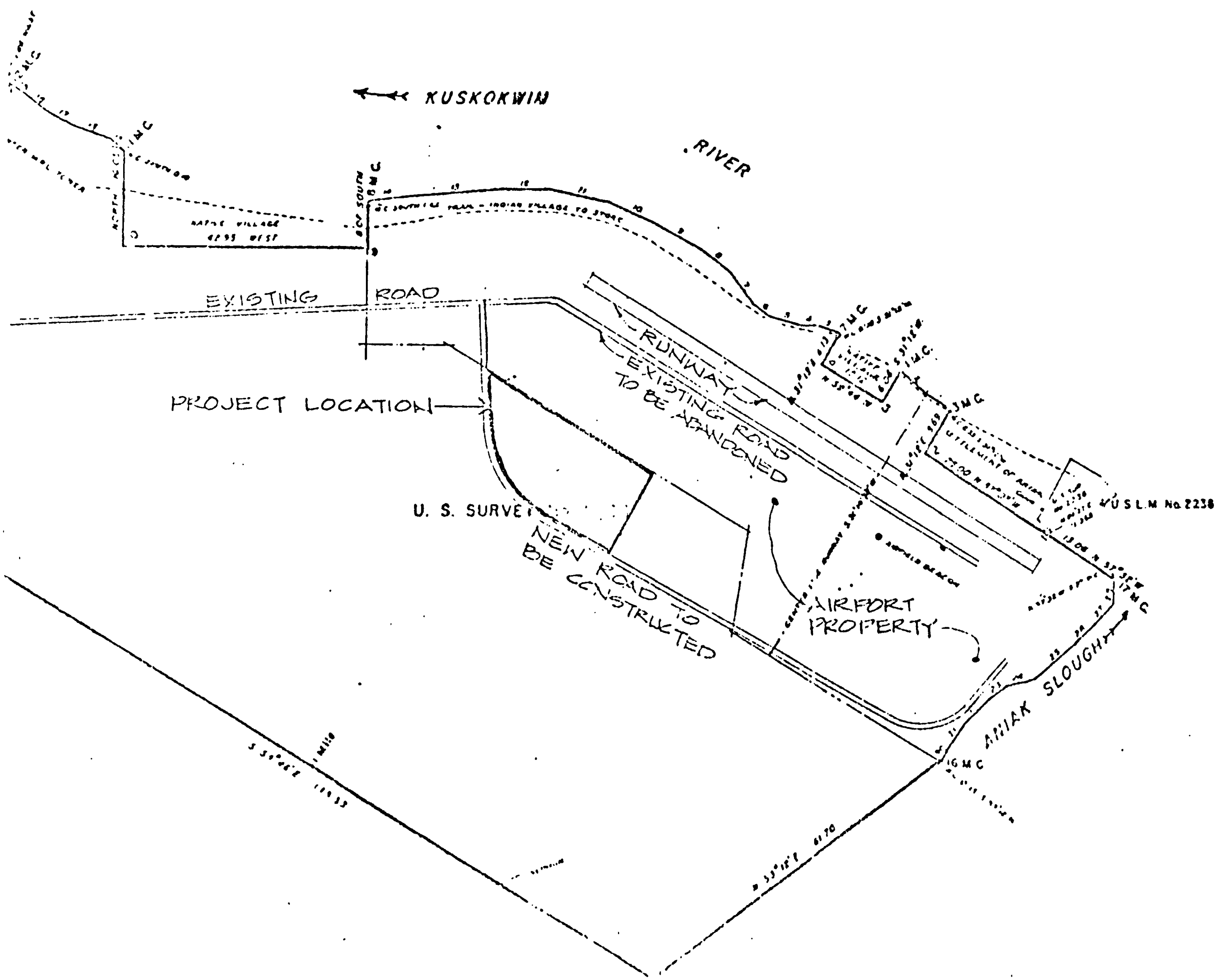
ANIAK PERCOLATION TESTS

1980

TEST HOLES 7, 8, 9, 10 AND 15 DID NOT PERMIT SEEPAGE OR HAD PERCOLATION RATES GREATER THAN 60 MINUTES/INCH. THESE HOLES [illegible], CONSTRICTING PERCOLATION TO ZONES OF [illegible] PERMAFROST OR FINE-[illegible] SOILS.

TH	(ft) PERC DEPTH	(min/in) PERC RATE	SOIL TYPE	(ft) [illegible]
2	7'	1	si/sa	0-2.5'
4	9	3	si/sa	0-1.5
5	9	3	si w/sa	0-1.3
6	10	1	sa/si	0-1.5
11	10	5	si w/sa	0-2.8
12	10	6	sa	4-7
13	10	3	sa/si	0-1.7
14	14	3	sa	[illegible]
16	9	1	sa/si	[illegible]
7	10'	—	si	0-12.5
8	9	—	si	3-7
9	8	—	si	[illegible]
10	7.5	—	si	[illegible]
15	10	—	si	[illegible]





ROSED ANIAK 32 UNIT HOUSING SITE

SITUATED

AT ANIAK, ALASKA
ON THE LEFT BANK OF THE KUSKOKW
AT CONFLUENCE WITH ANIAK SL

AREA 1747.69 ACRES

LATITUDE 61°34'45"N. LONGITUDE
AT CORNER NO. 1

MAGNETIC DECLINATION 21°

SCALE 1 INCH EQUALS 15 CHAINS

SURVEYED BY

F.W.WILLIAMS
ASSOCIATE CADASTRAL ENGINEER,

JUNE 18 – 30,

UNDER AUTHORITY OF

GENERAL LAND OFFICE LETTER
JULY 24, 1942.

AND SPECIAL INSTRUCTIONS DATED SEPT
APPROVED BY THE GENERAL LAND OFFICE
1943.

UNITED STATES DEPARTMENT OF THE
BUREAU OF LAND MANAGEMENT

PUBLIC SURVEY OFFICE
JUNEAU, ALASKA, AUGUST

I HEREBY CERTIFY THAT THIS
SURVEY NO. 2633, ALASKA, IS STRICTL
TO THE FIELD NOTES OF SAID SURVEY
EXAMINED AND APPROVED.

OFFICE

WASHINGTON D. C.,

THE SURVEY REPRESENTED BY THIS
BEEN CORRECTLY EXECUTED
REQUIREMENTS OF LAW
OFFICE, IS HEREBY ACCEPTED.

Permanently frozen soil is not practicably permeable.

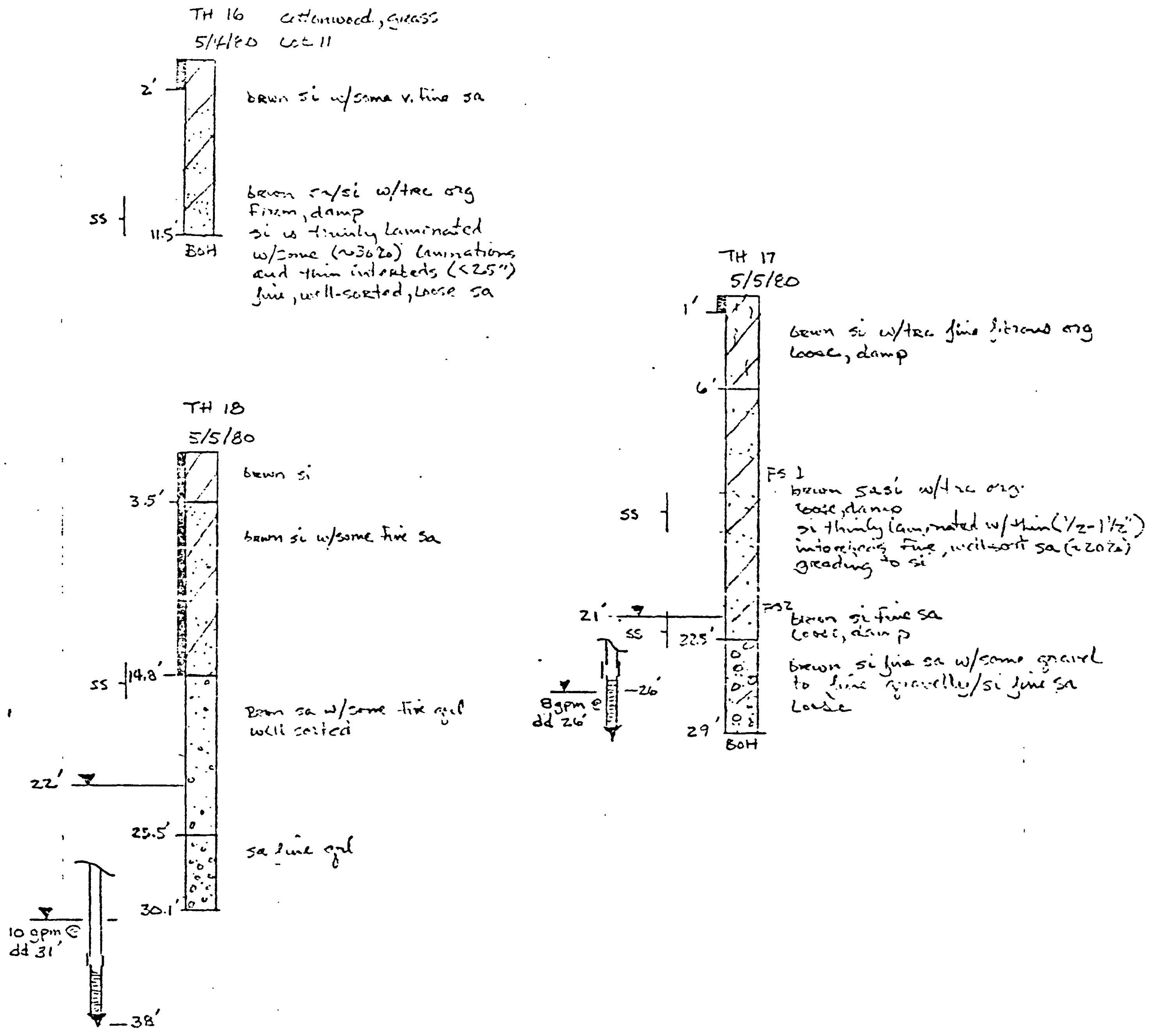
RECOMMENDATIONS:

Shallow wells (35 to 100 feet deep) will produce good quality water at rates of 10 to 100 gallons per minute. If on-site sewerage is constructed, wells should be sanitary sealed to depths of at least 15 feet. If a well penetrates permafrost, means of thawing the well should be provided. Pump intakes should not be placed above a thirty foot depth to assure production of 5 gpm or more - water table level likely varies from depths of 15 to 25 feet.

Drainfields will be operable at the subdivision site if absorption trenches are excavated to depths of seven feet or more and the drain pipe bedded on several feet of gravelly backfill. Because soil structure will be disturbed during construction reducing permeability, a percolation rate of about 20 minutes per inch is recommended for design purposes.

A limited attempt should be made to locate permafrost-free areas for drainfield location. Most lots will have some thawed ground but a few may not be feasible for on-site sewage disposal. Also though thawed zones are located, permafrost may still be encountered during trench excavation. Though permafrost degradation would be rapid, system design should allow a margin for lost seepage efficiency due to come inevitable trench construction in undetected, isolated permafrost masses.

Wider trenches are preferable so that any permafrost entered will not aggrade into the trench. Drain pipe placed five feet beneath a surface not subject to traffic will generally be below seasonal frost.


TH 16 cottonwood, grass
5/4/80
2'
brwn si w/some v. fine sa
brown sa/si w/trc org
Firm, damp
si is thinly laminated
w/some (~30%) laminations
and thin interbeds (<2.5")
fine, well-sorted, loose sa
SS
11.5'
BOH
TH 18
5/5/80
brwn si
3.5'
brwn si w/some fine sa
SS
14.8'
Brwn sa w/some fine grl
well sorted
22'
25.5'
sa fine grl
30.1'
10 gpm @
dd 31'
38'
TH 17
5/5/80
1'
brwn si w/trc fine fibrous org
loose, damp
6'
FS 1
brown sasi w/trc org
loose, damp
si thinly laminated w/thin (1/2-1 1/2")
interbeds fine, wellsort sa (~20%)
grading to si
SS
FS2
21'
brwn si fine sa
loose, damp
SS
22.5'
brwn si fine sa w/some gravel
to fine gravelly/si fine sa
Loose
26'
8 gpm @
dd 26'
29'
BOH

[illegible]

TH 1 [illegible], [illegible], birch, grass
5/1/80 Lot 1

Nb (seasonal)

- humus – roots/si
- dk brown si w/trc to some clay (med. dilatent), wet, loose
- 13′ — brown sa/si, firm, damp; sa in thin lenses, fine to med. grain, well sorted.
- 21.5′ (water level)
- 24′ — grl/sa w/ some to trc. si; grL < ½″, well rded, tabular
- 7.5 gpm @ dd 25.5′ (25′ – 28.3′)
- 31′ — grey sa/grL, med grain
- 35′ BOH

TH 2
5/3/80 Lot 1

Nb

- dk brown w/some sa; wet, loose; sa fine, well-sorted in thin lenses (~1-2″)
- 2.5′
- 6.8′ – 8.8′ SS
- 8.8′ BOH

TH 3 willow, cottonwood, spruce
5/3/80 Lot 2

Nb (seasonal) 1.2′

- brown si w/trc fine sa; loose, wet; sa well-sorted in thin lenses
- 8.6′ — brown v. fine sa/si; loose, damp; sa + si laminated to thinly interbedded (~2″); sa well-sorted
- SS 8.6′ – 10.8′
- 10.8′ BOH

TH 4
5/3/80 Lot 5

Nb 1.3′

- brown si; loose, damp
- 9′ — mottled brn/grey si/ v. fine sa; loose, damp; si (~30%) thinly laminated [illegible]; org defining laminations
- SS 9′ – 11′
- 11′ BOH

TH 5
5/3/8 Lot 6

Nbe 1.3′

- brown si; loose, damp
- 9′ — brown si w/some fine sa; damp, loose; sa in thin lenses
- SS 9′ – 10′
- 10′ – 11′ — sa; loose, damp; med. grain, well-sort
- 11′ BOH

TH 6 cleared trail
5/3/80 Lot 9

Nbe

- brown si
- 2.3′, 3.5′, 4.3′
- SS 3.5′ – 4.5′
- 6′ — v. fine sa; loose, damp, well-sorted
- 8′ — brown si w/some sa (~20%); sa med.-grain, well sorted in thin lenses (½-3″)
- SS 8′ – 12′
- 12′ BOH

TH 7 willow, cottonwood, spruce
5/3/80 Lot 14

Nbe

- brn si w/trc sa
- SS
- Nb
- SS 12.7′
- 12.7′ — brown fine sa w/some si; damp
- 13′ BOH

TH 8 spruce, cottonwood, moss/grass
5/3/80 Lot 16

- Nbe
- 1.7'
- 3' — brown si; wet, loose
- 7.1'
- SS — 9' — brown fine sa/si; firm, damp; sa well-sorted in interbeds 2-3" thick
- BOH

TH 9 willow, spruce, grass
5/4/80 Lot 20

- Nbe tec Vs — 1.1' — brown si; loose, wet
- 8.1'
- SS — 9.5', 10.5' — brown fine sa/si w/tce org.; loose, damp; sa well-sorted, in lenses (3-6"), about 30% volume
- BOH

TH10 birch/spruce, willows, grass
5/4/80 Lot 23

- 0.3' — brown si; loose, wet
- 9'
- SS — 12.5' — brown fine sa/coarse si; loose, damp; si finely laminated w/ amorphous org. defining lams. Fine sa (20%), well-sorted in thin interbeds (½-3")
- BOH

TH 11 willow, alder, birch, grass
5/4/80 Lot 25

- 0.5' — blk org/some si – humus
- 2.8'
- SS — 4', 6' — brown si w/some fine sa; loose, damp; si laminated with thin interbeds (½-2") well-sorted sa (~10%)
- 11.5'
- SS — 14' — brown si w/ some v. fine sa; loose, damp

TH12 willow, spruce, grass/moss
5/4/80 Lot 28

- Nbe 1.2'
- 4' — brown si; loose, wet
- Nbe
- <5% Vs 9.0' 9.2' — Brown sa w/tce woody org. med. grain, well-sort; damp
- Nbe 11.4' — brown si
- SS 13.4' — brown sa
- 15' — brown si sa
- 17.5'
- 19.5' — brown sa; loose, wet to saturated
- BOH

TH 13 cleared trail
5/4/80 Lot 30

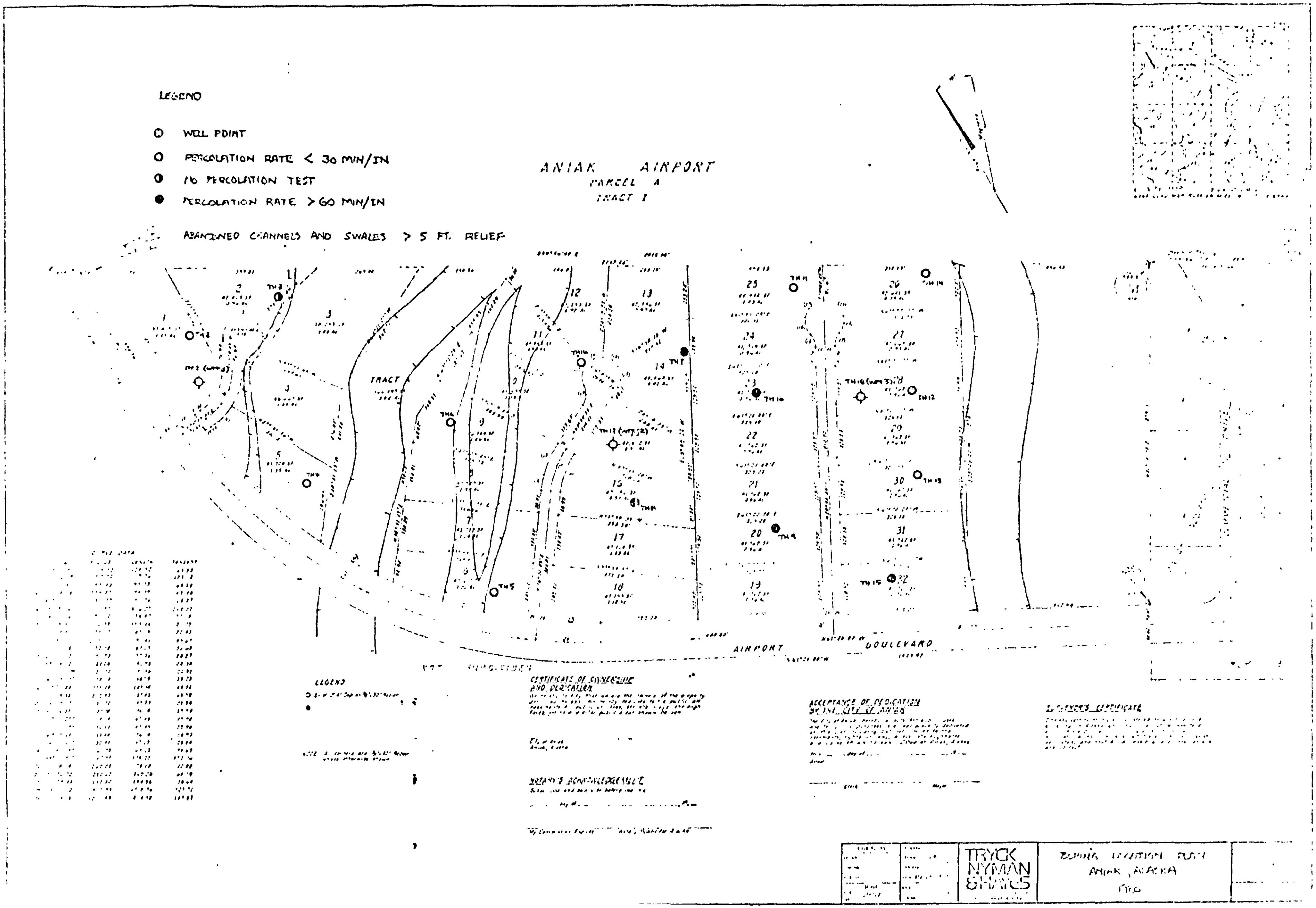
- 1.9' — brown si; loose, wet
- 6' — brown si w/some fine sa; laminated si grades to thin interbeds (½-3") fine, well-sorted sa; loose, wet
- SS — 11'
- BOH

TH 15 birch, willow, grass/moss
5/4/80 Lot 32

- Nbe
- 2' — brown si; loose, wet
- 6'
- Nbf
- SS — [illegible] — brown sa; [illegible], damp
- BOH

TH 14 birch, willow, grass
5/4/80 Lot 26

- 0.8' — brown si w/tce sa; loose, wet
- brown sa/si, loose [illegible] sa ([illegible]) in interbeds (<6")
- SS — 11.1'
- SS — 14' — brown sa; firm, damp, well-sorted; med to fine grain
- BOH


LEGEND
WELL POINT
PERCOLATION RATE < 30 MIN/IN
16 PERCOLATION TEST
PERCOLATION RATE > 60 MIN/IN
ABANDONED CHANNELS AND SWALES > 5 FT. RELIEF
ANIAK AIRPORT
PARCEL A
TRACT I
AIRPORT BOULEVARD
CERTIFICATE OF OWNERSHIP AND DEDICATION
ACCEPTANCE OF DEDICATION
NOTARY'S ACKNOWLEDGEMENT
TRYCK NYMAN & HAYES
ANIAK, ALASKA

ANIAK WELL DATA

WELL #	1	2	3	4
OWNER	USAF (RCA?)	FAA	FAA	FAA
DRILL DATE	DEC 1955	MAY 1959	MAY 1959	JUNE 1959
DEPTH	105 (110?)	56	45	50
SCREEN DEPTH/LENGTH	100-110/10'	51-56/5'	41-45/5'	PERF LAST 6.5'
Ft DRAWDOWN/Q gpm	? / 100	0.5/30	0.5/30	0.5/30
STATIC WATER LEVEL	22	27	27	15
LOG	100-105' grl (much water) below 80'	0-24' muck/ some ice. 24-58 coarse gry sa/grl (water)	AS FOR # 2	0-2' Fill 2-8 Fill, frozen 8-13 muck/some ice 13-31 brown sa/grl 31-50 coarse sa/grl (much water)
WATER QUALITY *				
Fe, ppm	0.1 – 1.2			
Nitrate	2.1 – 5.8			
Hardness	96 – 100			

* OTHER ANIAK WELLS

SOURCE	Fe	NITRATE	Mg	Ca	DATE
HIGH SCHOOL	–	trc	4.8	17.5	1979
PRIVATE WELL (60')	11.4	0	3.9	27.5	1979
State school (40')	0.14	30	7.7	43	1969

ANIAK WELL DATA SUMMARY

1980

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
P.O. BOX 4-1276
Anchorage, Alaska 99509
TELEPHONE (907)-279-4014
274-3364
ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Alaska

DATE COLLECTED 5-5-80 TIME COLLECTED: 1140 Hrs.

SAMPLED BY S. Wheaton SOURCE Well Pt. 1, Lot 1, Screen @ 26-28 ft.

REMARKS Hard Alkaline water, hich Silicon level, will cause scale build up in hot water systems. Will be difficult to remove. Treatment: None. Preservation: None. Color: Clear. Taste: Good. Smell: None. Q @ 7.5 gpm

FOR LAB USE ONLY
RECVD. BY AG LAB # 3677-1
DATE RECEIVED 5-7-80
DATE COMPLETED 5-13-80
DATE REPORTED 5-14-80
SIGNED [signature]

	mg/l		mg/l		mg/l
[ ]Ag, Silver	<0.05	[ ]P, Phosphorous	0.15	[ ]Cyanide	
[ ]Al, Aluminum	<0.05	[ ]Pb, Lead	<0.05	[ ]Sulfate	
[ ]As, Arsenic		[ ]Pt, Platinum		[ ]Phenol	
[ ]Au, Gold		[ ]Sb, Antimony		[ ]Total Dissolved Solids	158
[ ]B, Boron		[ ]Se, Selenium		[ ]Total Volatile Solids	
[ ]Ba, Barium	0.10	[ ]Si, Silicon	7.5	[ ]Suspended Solids	
[ ]Bi, Bismuth		[ ]Sn, Tin		[ ]Volatile Suspended Solids	
[ ]Ca, Calcium	45	[ ]Sr, Strontium		[ ]Hardness as $CaCO_3$	145
[ ]Cd, Cadmium	<0.010	[ ]Ti, Titanium		[ ]Alkalinity as $CaCO_3$	155
[ ]Co, Cobalt		[ ]W, Tungsten		[ ]	
[ ]Cr, Chromium	<0.05	[ ]V, Vanadium		[ ]	
[ ]Cu, Copper	<0.05	[ ]Zn, Zinc		[ ]	
[ ]Fe, Iron	0.14	[ ]Zr, Zirconium		[ ]	
				* * * * * *	
[ ]Hg, Mercury		[ ]Ammonia Nitrogen-N		[ ]mmhos Conductivity	270
[ ]K, Potassium	1.4	[ ]Kjedahl Nitrogen-N		[ ]pH Units	
[ ]Mg, Magnesium	7.7	[ ]Nitrate-N	3.4	[ ]Turbidity NTU	
[ ]Mn, Manganese	<0.05	[ ]Nitrite-N		[ ]Color Units	
[ ]Mo, Molybdenum		[ ]Phosphorus (Ortho)-P		[ ]T. Coliform/100ml	0
[ ]Na, Sodium	1.9	[ ]Chloride		[ ]	
[ ]Ni, Nickel		[ ]Fluoride		[ ]	

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

USTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Well Point 2, Lot 15

ATE COLLECTED 5-5-80 TIME COLLECTED: ---

AMPLED BY Scott Wheaton SOURCE Screen at 27-29 feet

EMARKS 8.5gpm, No treatment or preservative. Hard water with high Silicon, hot water systems will produce scale that is difficult to remove. Color-Clear. Taste-Good. Smell-None.

FOR LAB USE ONLY

RECVD.BY AG LAB # 3678

DATE RECEIVED 5-7-80

DATE COMPLETED 5-9-80

DATE REPORTED 5-9-80

SIGNED

	mg/l		mg/l		mg/l
]Ag,Silver	<0.05	[]P,Phosphorous	<0.05	[]Cyanide	
]Al,Aluminum	0.11	[]Pb,Lead	<0.05	[]Sulfate	
]As,Arsenic	<0.10	[]Pt,Platinum	<0.10	[]Phenol	
]Au,Gold	<0.05	[]Sb,Antimony	<0.05	[]Total Dissolved Solids	
]B,Boron	<0.05	[]Se,Selenium	<0.10	[]Total Volatile Solids	
]Ba,Barium	<0.10	[]Si,Silicon	7.3	[]Suspended Solids	
]Bi,Bismuth	0.27	[]Sn,Tin	<0.05	[]Volatile Suspended Solids	
]Ca,Calcium	56	[]Sr,Strontium	0.22	[]Hardness as $CaCO_3$	175
]Cd,Cadmium	<0.010	[]Ti,Titanium	<0.05	[]Alkalinity as $CaCO_3$	
]Co,Cobalt	<0.05	[]W,Tungsten	<0.05	[]	
]Cr,Chromium	<0.05	[]V,Vanadium	<0.05	[]	
]Cu,Copper	<0.05	[]Zn,Zinc	<0.05	[]	
]Fe,Iron	0.12	[]Zr,Zirconium	<0.05	[]	
				* * * * * *	
]Hg,Mercury	<0.10	[]Ammonia Nitrogen-N		[]mmhos Conductivity	
]K,Potassium	1.5	[]Kjedahl Nitrogen-N		[]pH Units	
]Mg,Magnesium	8.4	[]Nitrate-N		[]Turbidity NTU	
]Mn,Manganese	<0.05	[]Nitrite-N		[]Color Units	
]Mo,Molybdenum	<0.05	[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	
]Na,Sodium	2.5	[]Chloride		[]	
]Ni,Nickel	<0.05	[]Fluoride		[]	

CHEMICAL GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Alaska

DATE COLLECTED 5-6-80 TIME COLLECTED: 0815 Hrs.

SAMPLED BY S. Wheaton SOURCE Well Pt.3, Lot 23, screen 36-38 ft.

REMARKS Hard, Alkaline water, high Silicon level, will cause scale build up in hot water systems, will be difficult to remove. Treatment: None. Preservation: None. Color: Clear. Taste: good. Smell: None. Q @ 10 gpm

FOR LAB USE ONLY

RECVD.BY AG LAB # 3677-

DATE RECEIVED 5-7-80

DATE COMPLETED 5-13-80

DATE REPORTED 5-14-80

SIGNED Archie L. [illegible]

	mg/l		mg/l		mg/l
[]Ag, Silver	<0.05	[]P, Phosphorous	0.07	[]Cyanide	
[]Al, Aluminum	<0.05	[]Pb, Lead	<0.05	[]Sulfate	
[]As, Arsenic	<0.10	[]Pt, Platinum	<0.10	[]Phenol	
[]Au, Gold	<0.05	[]Sb, Antimony	<0.05	[]Total Dissolved Solids	157
[]B, Boron	<0.05	[]Se, Selenium	<0.10	[]Total Volatile Solids	
[]Ba, Barium	0.11	[]Si, Silicon	7.0	[]Suspended Solids	
[]Bi, Bismuth	0.23	[]Sn, Tin	<0.05	[]Volatile Suspended Solids	
[]Ca, Calcium	34	[]Sr, Strontium	0.17	[]Hardness as $CaCO_3$	114
[]Cd, Cadmium	<0.010	[]Ti, Titanium	<0.05	[]Alkalinity as $CaCO_3$	135
[]Co, Cobalt	<0.05	[]W, Tungsten	<0.05	[]	
[]Cr, Chromium	<0.05	[]V, Vanadium	<0.05	[]	
[]Cu, Copper	<0.05	[]Zn, Zinc	<0.05	[]	
[]Fe, Iron	0.10	[]Zr, Zirconium	<0.05	[]	
[]Hg, Mercury	<0.10	[]Ammonia Nitrogen-N		[]mmhos Conductivity	230
[]K, Potassium	1.4	[]Kjedahl Nitrogen-N		[]pH Units	
[]Mg, Magnesium	6.9	[]Nitrate-N	2.0	[]Turbidity NTU	
[]Mn, Manganese	<0.05	[]Nitrite-N		[]Color Units	
[]Mo, Molybdenum	<0.05	[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	0
[]Na, Sodium	2.5	[]Chloride		[]	
[]Ni, Nickel	<0.05	[]Fluoride		[]	

AQUIFER TEST FIELD DATA SHEET

Page ___

cject No. ______________ Proj t Name ______________ Well # ______

cation of Well Amak Lot #30

pth of Well 46 T.O.C. ft. Length of Casing 40 ft. Pumped Well / Observation W

Observation Well, Dist. to Pumped Well 25'2" ft. Top of Casing to Static L

te Drilling Completed 9-12-80 Driller Mark Anderson Date Tested 9-12-8

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 125 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Draw @ Reco
	1	35'	9'-10"		1	25-6"	9-6
	2	35'	9'-10"		2	25-2"	9'-1
	3	35'	9-10"		3		
	4	35'	9-10"		4		
	5	35'	9-10"		5		
	6	35'	9-10"		6		
	7	35'	9-10"		7		
	8	35'	9-10"		8		
	9	35'	9-10"		9		
	10	35'	9-10"		10		
	11	35'	9-10"		11		
	12	35'	9-10"		12		
	15	35'	9-10"		15		
	20	35'	9-10"		20		
	25	35'	9-10"		25		
	30	35'	9-10"		30		
	40	35'	9'-10"		40		
	50	35'	9-10"		50		
	60	35'	9'-10"		60		
	80				80		
	100	Well remained constant			100		
	140	for production & drawdown			140		
	180 (3 hrs.)	for total test pump			180 (3 hrs.)		
	240 (4 hrs.)	of 4.5 hrs.			240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU C HEALTH SERVICE, DIVISION OF INDIA HEALTH

LOCATION Aniak Lot #31 DATE STARTED 9-11-80

DATE COMPLETED 9-12-80 DRILLER Mark Anderson B Hopp

TOTAL DEPTH OF WELL 46 T.O.C FT. CASING INSTALLED 40-0 DIAMETER 1 1/4"

GROUT 20' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 25'-1 T.O.C HRS. PUMPED 2.5 @ 25 GPM DRAWDOWN 7-0"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0 - 1-6"		topsoil
1-6" - 12'		frozen silt
12 - 18'		Brown fine sand
18 - 22'		Coarse sand w/ H_2O
22' - 41'		water formation

SOIL DATA TO 15 FT.

FEET THAWED 1'6"

BOTTOM OF FROST & MATERIAL 12' silt

SEASONAL OR PERMA FROST perma frost

WATER DATA FIELD TEST

TASTE Good

APPEARANCE FRESH Clear

AFTER 24 HOURS Clear

IRON

CHLORIDES

TDS

PUMP TEST 25'-1" STATIC LEVEL

PUMPING LEVEL 32'-1 @ 25 GPM

AFTER 2.5 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH

TIDES no OR FROST no

static level may change w/ river level

DEVELOP PROCEDURE surge pumping & test pump

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

AQUIFER TEST FIELD DATA SHEET

Page____

roject No.______________ Proj t Name______________________ ____ Well # ______

ocation of Well Amak Lot 31

epth of Well 46TOC ft. Length of Casing 40 ft. Pumped Well / Observation

Observation Well, Dist. to Pumped Well 25-1 ft. Top of Casing to Static

ate Drilling Completed 9-11-80 Driller Mark Anderson Date Tested 9-12-80

lock ime	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Draw @ Reco
	1	31-10"	6'-9"		1	25'-1"	7'
	2	32'-1"	7'		2		
	3	32'-1"	7'		3		
	4	32-1"	7'		4		
	5	32-1"	7'		5		
	6	32-1"	7'		6		
	7	32-1"	7'		7		
	8	32-1"	7'		8		
	9	32'-1"	7'		9		
	10	32'-1"	7'		10		
	11	32'-1"	7'		11		
	12	32'-1"	7'		12		
	15	32-1"	7'		15		
	20	32'-1"	7'		20		
	25				25		
	30	Well remained at this			30		
	40	level constantly for			40		
	50	the total test pump			50		
	60	time of 2.5 hrs			60		
	80				80		
	100	Water was clear in			100		
	140	the first 10 min of			140		
	180 (3 hrs.)	pumping.			180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PUE : HEALTH SERVICE, DIVISION OF INDIA EALTH

LOCATION Quick Lot #32 DATE STARTED 9-27-80

DATE COMPLETED 9-27-80 DRILLER Bob Hopp & John Hemmung

TOTAL DEPTH OF WELL 46-0" TOC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 20' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5'-11"

STATIC WATER LEVEL 25'-2" TOC HRS. PUMPED 1 @ 25 GPM DRAWDOWN 7-0"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1"		muskeg
1-2		silt
2-9		frozen silt
9-13		silt
13'-17'		Brown fine sand
17-22		Brown coarse sand w/ H_2O
22-26		frozen material
26-41		water formation

SOIL DATA TO 15 FT.

FEET THAWED 2

BOTTOM OF FROST & MATERIAL 9' silt

SEASONAL OR PERMA FROST perma frost

WATER DATA FIELD TEST

TASTE Good

APPEARANCE FRESH Clear

AFTER 24 HOURS

IRON

CHLORIDES

TDS

PUMP TEST 25'-2" STATIC LEVEL

PUMPING LEVEL 32'-2" @ 25 GPM

AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH

TIDES no OR FROST no

static level may change w/ river level

DEVELOP PROCEDURE test pump & surge pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

AQUIFER TEST FIELD DATA SHEET

Page ___

Project No. ____ Project Name ANIAK ____ Well # ____

Location of Well Aniak Lot #32

Depth of Well 46' TOC ft. Length of Casing 40 ft. Pumped Well / Observation W

If Observation Well, Dist. to Pumped Well 25'-2" ft. Top of Casing to Static L

Date Drilling Completed 9-27-80 Driller Bob Hopp Date Tested 9-27-80

Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm ~~or~~ Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ — Recovery
	1	32'-2"	7'		1	25-2"	7
	2	32-2"	7'		2		
	3	32-2"	7'		3		
	4	32-2"	7'		4		
	5	32-2"	7'		5		
	6	32-2"	7'		6		
	7	32'-2"	7'		7		
	8	32'-2"	7'		8		
	9	32-2"	7'		9		
	10	32'-2"	7'		10		
	11	32'-2"	7'		11		
	12	32'-2"	7'		12		
	15	32-2"	7'		15		
	20				20		
	25				25		
	30	32'-2"	7'		30		
	40	32-2"	7'		40		
	50				50		
	60	32'-2"	7'		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907)-279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Well Point 2, Lot 15

DATE COLLECTED 5-5-80 TIME COLLECTED: ---

SAMPLED BY Scott Wheaton SOURCE Screen at 27-29 feet

REMARKS 8.5gpm, No treatment or preservative. Hard water with high Silicon, hot water systems will produce scale that is difficult to remove. Color-Clear. Taste-Good. Smell-None.

FOR LAB USE ONLY
RECVD.BY AG LAB # 3678
DATE RECEIVED 5-7-80
DATE COMPLETED 5-9-80
DATE REPORTED 5-9-80
SIGNED [signature]

	mg/l		mg/l		mg/l
[]Ag,Silver	<0.05	[]P,Phosphorous	<0.05	[]Cyanide	
[]Al,Aluminum	0.11	[]Pb,Lead	<0.05	[]Sulfate	
[]As,Arsenic	<0.10	[]Pt,Platinum	<0.10	[]Phenol	
[]Au,Gold	<0.05	[]Sb,Antimony	<0.05	[]Total Dissolved Solids	
[]B,Boron	<0.05	[]Se,Selenium	<0.10	[]Total Volatile Solids	
[]Ba,Barium	<0.10	[]Si,Silicon	7.3	[]Suspended Solids	
[]Bi,Bismuth	0.27	[]Sn,Tin	<0.05	[]Volatile Suspended Solids	
[]Ca,Calcium	56	[]Sr,Strontium	0.22	[]Hardness as $CaCO_3$	175
[]Cd,Cadmium	<0.010	[]Ti,Titanium	<0.05	[]Alkalinity as $CaCO_3$	
[]Co,Cobalt	<0.05	[]W,Tungsten	<0.05	[]	
[]Cr,Chromium	<0.05	[]V,Vanadium	<0.05	[]	
[]Cu,Copper	<0.05	[]Zn,Zinc	<0.05	[]	
[]Fe,Iron	0.12	[]Zr,Zirconium	<0.05	[]	
				* * * * * *	
[]Hg,Mercury	<0.10	[]Ammonia Nitrogen-N		[]mmhos Conductivity	
[]K,Potassium	1.5	[]Kjedahl Nitrogen-N		[]pH Units	
[]Mg,Magnesium	8.4	[]Nitrate-N		[]Turbidity NTU	
[]Mn,Manganese	<0.05	[]Nitrite-N		[]Color Units	
[]Mo,Molybdenum	<0.05	[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	
[]Na,Sodium	2.5	[]Chloride		[]	
[]Ni,Nickel	<0.05	[]Fluoride		[]	

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907)-279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Alaska

DATE COLLECTED 5-5-80 TIME COLLECTED: 1140 Hrs.

SAMPLED BY S. Wheaton SOURCE Well Pt. 1, Lot 1, Screen @ 26-28 ft.

REMARKS Hard Alkaline water, high Silicon level, will cause scale build up in hot water systems. Will be difficult to remove. Treatment: None. Preservation: None. Color: Clear. Taste: Good. Smell: None. Q @ 7.5 gpm

FOR LAB USE ONLY

RECVD. BY AG LAB # 3677-1

DATE RECEIVED 5-7-80

DATE COMPLETED 5-13-80

DATE REPORTED 5-14-80

SIGNED Archie L. Green

	mg/l		mg/l		mg/l
[]Ag, Silver	<0.05	[]P, Phosphorous	0.15	[]Cyanide	
[]Al, Aluminum	<0.05	[]Pb, Lead	<0.05	[]Sulfate	
[]As, Arsenic		[]Pt, Platinum		[]Phenol	
[]Au, Gold		[]Sb, Antimony		[]Total Dissolved Solids	158
[]B, Boron		[]Se, Selenium		[]Total Volatile Solids	
[]Ba, Barium	0.10	[]Si, Silicon	7.5	[]Suspended Solids	
[]Bi, Bismuth		[]Sn, Tin		[]Volatile Suspended Solids	
[]Ca, Calcium	45	[]Sr, Strontium		[]Hardness as $CaCO_3$	145
[]Cd, Cadmium	<0.010	[]Ti, Titanium		[]Alkalinity as $CaCO_3$	155
[]Co, Cobalt		[]W, Tungsten		[]	
[]Cr, Chromium	<0.05	[]V, Vanadium		[]	
[]Cu, Copper	<0.05	[]Zn, Zinc		[]	
[]Fe, Iron	0.14	[]Zr, Zirconium		[]	
[]Hg, Mercury		[]Ammonia Nitrogen-N		[]mmhos Conductivity	270
[]K, Potassium	1.4	[]Kjedahl Nitrogen-N		[]pH Units	
[]Mg, Magnesium	7.7	[]Nitrate-N	3.4	[]Turbidity NTU	
[]Mn, Manganese	<0.05	[]Nitrite-N		[]Color Units	
[]Mo, Molybdenum		[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	0
[]Na, Sodium	1.9	[]Chloride		[]	
[]Ni, Nickel		[]Fluoride		[]	

CHEMICAL - GEOLOGICAL LABORATORIES OF ALASKA, INC

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907)-279-4014
274-3364

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

CUSTOMER Alaska Area Native Health Service SAMPLE LOCATION: Aniak, Alaska

DATE COLLECTED 5-6-80 TIME COLLECTED: 0815 Hrs.

SAMPLED BY S. Wheaton SOURCE Well Pt.3, Lot 28, screen 36-38 ft.

REMARKS Hard, Alkaline water, high Silicon level, will cause scale build up in hot water systems, will be difficult to remove. Treatment: None. Preservation: None. Color: Clear. Taste: good. Smell: None. Q @ 10 gpm

FOR LAB USE ONLY
RECVD.BY AG LAB # 3677-2
DATE RECEIVED 5-7-80
DATE COMPLETED 5-13-80
DATE REPORTED 5-14-80
SIGNED Archie L. Green

	mg/l		mg/l		mg/l
[]Ag, Silver	<0.05	[]P, Phosphorous	0.07	[]Cyanide	
[]Al, Aluminum	<0.05	[]Pb, Lead	<0.05	[]Sulfate	
[]As, Arsenic	<0.10	[]Pt, Platinum	<0.10	[]Phenol	
[]Au, Gold	<0.05	[]Sb, Antimony	<0.05	[]Total Dissolved Solids	157
[]B, Boron	<0.05	[]Se, Selenium	<0.10	[]Total Volatile Solids	
[]Ba, Barium	0.11	[]Si, Silicon	7.0	[]Suspended Solids	
[]Bi, Bismuth	0.23	[]Sn, Tin	<0.05	[]Volatile Suspended Solids	
[]Ca, Calcium	34	[]Sr, Strontium	0.17	[]Hardness as $CaCO_3$	114
[]Cd, Cadmium	<0.010	[]Ti, Titanium	<0.05	[]Alkalinity as $CaCO_3$	135
[]Co, Cobalt	<0.05	[]W, Tungsten	<0.05	[]	
[]Cr, Chromium	<0.05	[]V, Vanadium	<0.05	[]	
[]Cu, Copper	<0.05	[]Zn, Zinc	<0.05	[]	
[]Fe, Iron	0.10	[]Zr, Zirconium	<0.05	[]	
				* * * * * *	
[]Hg, Mercury	<0.10	[]Ammonia Nitrogen-N		[]mmhos Conductivity	230
[]K, Potassium	1.4	[]Kjedahl Nitrogen-N		[]pH Units	
[]Mg, Magnesium	6.9	[]Nitrate-N	2.0	[]Turbidity NTU	
[]Mn, Manganese	<0.05	[]Nitrite-N		[]Color Units	
[]Mo, Molybdenum	<0.05	[]Phosphorus (Ortho)-P		[]T.Coliform/100ml	0
[]Na, Sodium	2.5	[]Chloride		[]	
[]Ni, Nickel	<0.03	[]Fluoride		[]	

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

LOCATION Aniak DATE STARTED May 5, 1980

DATE COMPLETED May 5, 1980 DRILLER Bob Hopp

TOTAL DEPTH OF WELL T.O.C. 40'8" FT. CASING INSTALLED 40'-8" DIAMETER 2"

GROUT 0 SCREEN SIZE 15 slot MFG. ______ LENGTH 30"

STATIC WATER LEVEL 22 HRS. PUMPED 4 @ 10 GPM DRAWDOWN ______

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'-10"		Frozen Brown silt - fine + uniform
1-10" - 3'6"		Brown silt fine + uniform
3'-6" - 8'-4"		Frozen Brown silt - fine with some Brown sand
8'-4" - 14'-9"		Frozen Brown silt - with some Brown sand
14'-9" - 16' sample taken w/split spoon		thawed Brown sand w/some 1/4" smooth rocks
16' - 25'-6"		Uniform Brown sand - fine w/water
25'-6 - 27'-6"		fine gravel w/water
27'-6" - 30'-2"		gravel w/ water

SOIL DATA TO 15 FT.

FEET THAWED 0

BOTTOM OF FROST & MATERIAL 15

SEASONAL OR PERMA FROST PermaFrost

WATER DATA FIELD TEST

TASTE Good

APPEARANCE FRESH Clear

AFTER 24 HOURS Clear

IRON ______

CHLORIDES ______

TDS ______

PUMP TEST 22' - STATIC LEVEL

PUMPING LEVEL ______ @ 10 GPM

AFTER 4 HRS.

HIGHEST RECOMMENDED PUMP RATE 10 GPM

WILL STATIC LEVEL CHANGE WITH TIDES No OR FROST Possible

DEVELOP PROCEDURE test pump w/jet pump

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW Bob Hopp + John Demming

Well was augered to depth of 30'-2". 2" sand point was then driven to 38' ground level

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

LOCATION Aniak DATE STARTED May 5, 1980

DATE COMPLETED May 5, 1980 DRILLER Bob Hopp

TOTAL DEPTH OF WELL T.O.C. 40'-8" FT. CASING INSTALLED 40'-8" DIAMETER 2"

GROUT 0 SCREEN SIZE 15 slot MFG. ______ LENGTH 30"

STATIC WATER LEVEL 22 HRS. PUMPED 4 @ 10 GPM DRAWDOWN ______

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'-10"		Frozen Brown silt - fine + uniform
1-10" - 3'6"		Brown silt fine + uniform
3'-6" - 8'-4"		Frozen Brown silt - fine with some Brown sand
8'-4" - 14'-9"		Frozen Brown silt - with some Brown sand
14'-9" - 16' sample taken w/ split spoon		Thawed Brown sand w/ some 1/4" smooth rocks
16' - 25'-6"		Uniform Brown sand - fine w/ water
25'-6 - 27'-6"		fine gravel w/ water
27'-6" - 30'-2"		gravel w/ water

SOIL DATA TO 15 FT.

FEET THAWED 0

BOTTOM OF FROST & MATERIAL 15

SEASONAL OR PERMA FROST Permafrost

WATER DATA FIELD TEST

TASTE Good

APPEARANCE FRESH Clear

AFTER 24 HOURS Clear

IRON ______

CHLORIDES ______

TDS ______

PUMP TEST 22' - STATIC LEVEL

PUMPING LEVEL ______ @ 10 GPM

AFTER 4 HRS.

HIGHEST RECOMMENDED PUMP RATE 10 GPM

WILL STATIC LEVEL CHANGE WITH TIDES No OR FROST Possible

DEVELOP PROCEDURE test pump w/ jet pump

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW Bob Hopp + John Demming

Well was augered to depth of 30'-2" a 2" sand point was then driven to 38' ground level

U.S. PU C HEALTH SERVICE, DIVISION OF INDIA IEALTH

LOCATION Unek R Lot #1 DATE STARTED Oct 4 1980

DATE COMPLETED Oct 4 1980 DRILLER Mark Anderson Bob Hogg

TOTAL DEPTH OF WELL 46 7.0c FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 20 SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 25-6" HRS. PUMPED 1.5 @ 25 GPM DRAWDOWN 7-3"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1		Mucky
1-14		silt
14-16		Brown silty sand
16-20		Brown fine sand
20-23		Coarse sand & H_2O
23-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL silt
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE good
APPEARANCE FRESH clear
AFTER 24 HOURS clear
IRON
CHLORIDES
TDS

PUMP TEST 25-6" STATIC LEVEL
PUMPING LEVEL 32-9" @ 25 GPM
AFTER 1.5 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH
TIDES No OR FROST No
Static level may be affected by the river level

DEVELOP PROCEDURE surge pumping & test pumping

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW ______

oject No. ______________ Project Name ______________ ______ Well # ______

cation of Well Quick Lot #1

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 25-6" ft. Top of Casing to Static Le

te Drilling Completed 10-4-80 Driller M Anderson & B Hopp Date Tested 10-4-80

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ or Recov
	1	32-8"	7-2"		1	25-6"	7-3"
	2	32-8"	7-2"		2		
	3	32'-9"	7'-3"		3		
	4	32'-9"	7'-3"		4		
	5	32'-9"	7'-3"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	32-9"	7-3"		10		
	11	"	"		11		
	12	"	"		12		
	15	"	"		15		
	20	32-9"	7-3"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	32-9"	7-3"		60		
	80	"	"		80		
	~~100~~ 90	32-9	7-3"		100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PL C HEALTH SERVICE, DIVISION OF INDI/ IEALTH

LOCATION Anik Lot 2 DATE STARTED Oct 5, 1980

DATE COMPLETED Oct 5 1980 DRILLER Bob Hoge M Anderson

TOTAL DEPTH OF WELL 46 TC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 20 ft. SCREEN SIZE 15 slot MFG Johnson LENGTH 5-11

STATIC WATER LEVEL 25-8 HRS. PUMPED 1.5 @ 25 GPM DRAWDOWN 5-1

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-13		silty sand
13-16		Brown fine sand
16-21		Wet silt
21-23		Coarse sand & H_2O
23-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL fine sand
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 25-8" STATIC LEVEL
PUMPING LEVEL 30-9" @ 25 GPM
AFTER 1.5 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH
TIDES No OR FROST No
static level may be affected by river level

DEVELOP PROCEDURE Surge Pumping & test pumping

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW ______

Page ___ o

oject No. ______________ Project Name ______________ ________ Well # ______

cation of Well Amick Lot #2

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 25'-8" ft. Top of Casing to Static Le

te Drilling Completed 10-5-80 Driller B Hopp + M Anderson Date Tested 10-5-80

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm ~~or~~ Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ ~~or~~ Recov
	1	30'-9"	5'-1"		1 25'-8"	~~30-9"~~	5'-1"
	2	30'-9"	5'-1"		2		
	3	30'-9"	5'-1"		3		
	4	30'-9"	5'-1"		4		
	5	30'-9"	5'-1"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	30'-9"	5'-1"		10		
	11	"	"		11		
	12	"	"		12		
	15	"	"		15		
	20	"	"		20		
	25	"	"		25		
	30	30'-9"	5'-1"		30		
	40	"	"		40		
	50	"	"		50		
	60	"	"		60		
	80	"	"		80		
	100	30'-9"	5'-1"		100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible] C HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION Aniak Lot 4 DATE STARTED Oct 5 1980

DATE COMPLETED Oct 5 1980 DRILLER Bob Hogg M Anderson

TOTAL DEPTH OF WELL 46 TOC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 21 23 SCREEN SIZE 15 slot MFG. Johnson LENGTH 6'

STATIC WATER LEVEL 25-6" HRS. PUMPED 2 @ 25 GPM DRAWDOWN 6-2

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-14		silty sand
14-19		Brown fine sand
19-23		Wet silty sand
23-41		Water formation

SOIL DATA TO 15 FT.

FEET THAWED 15

BOTTOM OF FROST & MATERIAL fine sand

SEASONAL OR PERMA FROST Seasonal

WATER DATA FIELD TEST

TASTE Good

APPEARANCE FRESH Clear

AFTER 24 HOURS Clear

IRON

CHLORIDES

TDS

PUMP TEST 25-6 STATIC LEVEL

PUMPING LEVEL 31-8 @ 25 GPM

AFTER 2 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH TIDES No OR FROST No

static level may change with river level

DEVELOP PROCEDURE surge pumping & test pumping

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW ______

oject No. ______ Project Name ______ ______ Well # ______

ication of Well [illegible] Lot #4

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 25'-6" ft. Top of Casing to Static Le

ate Drilling Completed 10-5-80 Driller [illegible] Date Tested 10-5-80

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm ~~or~~ Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ ~~or~~ Recov
	1	31'-8"	6'-2"		1	25'-6"	6'-2
	2	31'-8"	6'-2"		2		
	3	31'-8"	6'-2"		3		
	4	31'-8"	6'-2"		4		
	5	31'-8"	6'-2"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	31'-8"	6'-2"		10		
	11	"	"		11		
	12	"	"		12		
	15	31'-8"	6'-2"		15		
	20	31'-8"	6'-2"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	31'-8"	6'-2"		60		
	80	"	"		80		
	100	"	"		100		
	140	31'-8"	6'-2"		140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PL :C HEALTH SERVICE, DIVISION OF INDI. HEALTH

LOCATION Amik Lot #5 DATE STARTED Oct 4, 1980

DATE COMPLETED Oct 4, 1980 DRILLER Bob Hopp + M Anderson

TOTAL DEPTH OF WELL 46 TOC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 20' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5'-11"

STATIC WATER LEVEL 25-8" HRS. PUMPED 1 @ 35 GPM DRAWDOWN 5'-6"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-14'		fine sand
14-19'		silty sand
19'-23'		wet silty sand
23'-41'		water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL sand
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 25'8" STATIC LEVEL
PUMPING LEVEL 31'-2" @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES: no OR FROST no

DEVELOP PROCEDURE surge pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

ojcct No.______________ Project Name______________ ______ Well # ______

cation of Well Arick Lot #5

pth of Well 46 TOC ft. Length of Casing 41 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 25'8" ft. Top of Casing to Static Le

te Drilling Completed 10-4-80 Driller [illegible] Date Tested 10-4-80

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ or Recov
	1	31'-2"	5-6"		1	25'8"	5'-6"
	2	31'-2"	5'-6"		2		
	3	31'-2"	5'-6"		3		
	4	31'-2"	5'-6"		4		
	5	31-2"	5-6"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	31-2"	5'-6"		10		
	11	"	"		11		
	12	"	"		12		
	15	31-2"	5'-6"		15		
	20	"	"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	31-2"	5'-6"		50		
	60	31-2"	5-6"		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible] C HEALTH SERVICE, DIVISION OF INDIA[illegible] IEALTH

LOCATION Aniak Lot 6 DATE STARTED 10-2-80

DATE COMPLETED 10-2-80 DRILLER Mark Robinson & B. Hopp

TOTAL DEPTH OF WELL 41 TD FT. CASING INSTALLED 41 DIAMETER 4"

GROUT 20 SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 26-6" HRS. PUMPED 1 @ 25 GPM DRAWDOWN 7-2"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'		Muskeg
1-13'		silt
13-17		Brown fine sand
17-22		Sand, coarse w/H_2O
22-41		water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL silt
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 26-6" STATIC LEVEL
PUMPING LEVEL 33-4" @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES no OR FROST no
static level may be affected by river level

DEVELOP PROCEDURE surge pumping

ESTIMATED MAN HOURS FOR DRILLING ____ HOURS FOR TOTAL JOB ____

CREW ____

oject No. ______________ Project Name ______________ ________ Well # ______

cation of Well Aniak Lot #6

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 26-6" ft. Top of Casing to Static Le

te Drilling Completed 10-2-86 Driller B. Lloyd + M. Anderson Date Tested 10-2-86

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ or Recov
	1	33'-7"	7'-1"		1	26'-6"	7-2"
	2	33'-8"	7'-1"		2		
	3	33'-8"	7'-1"		3		
	4	33-8"	7'-1"		4		
	5	33'-8"	7'-1"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	33-8"	7'-1"		10		
	11	"	"		11		
	12	"	"		12		
	15	33-8"	7-1"		15		
	20	"	"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	33-8"	7-1"		60		
	80				80		
	100	Water clouded & threw			100		
	140	sand the first time			140		
	180 (3 hrs.)	surge pumping - then			180 (3 hrs.)		
	240 (4 hrs.)	stayed clear			240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible]C HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION Aniak Lot #7 DATE STARTED 10-2-80

DATE COMPLETED 10-2-80 DRILLER Mark Anderson & Bob Hoggs

TOTAL DEPTH OF WELL 46-0 T.O.C. FT. CASING INSTALLED 46 DIAMETER 4"

GROUT 20 SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 27 HRS. PUMPED 1.5 @ 25 GPM DRAWDOWN 2-3"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'		Muskeg & Topsoil
1-5		silt
5-8		frozen silt
8-13		silty sand
13-18		Brown fine sand
18-23		
23-41		water formation.

SOIL DATA TO 15 FT.
FEET THAWED 5
BOTTOM OF FROST & MATERIAL 3' silt
SEASONAL OR PERMA FROST perma

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH clear
AFTER 24 HOURS clear
IRON
CHLORIDES
TDS

PUMP TEST 27 STATIC LEVEL
PUMPING LEVEL 29.3 @ 25 GPM
AFTER 1.5 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES OR FROST
static water level may be affected by water level in river

DEVELOP PROCEDURE surge pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

oject No. ____________ Project Name ____________ ________ Well # ________

cation of Well ANIAK LOT #7

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 27'-0 ft. Top of Casing to Static Le

te Drilling Completed 11-2-80 Driller [illegible] Date Tested 10-2-8

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm ~~or~~ Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ ~~or~~ Recov
	1	29'-2"	2'-2"		1		
	2	29'-2"	2'-2"		2		
	3	29'-2"	2'-2"		3		
	4	29'-2"	2'-2"		4		
	5	29'-2"	2'-2"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	29-2"	2'-2"		10		
	11	"	"		11		
	12	"	"		12		
	15	"	"		15		
	20	29'-2"	2'-2"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	29'-2"	2'-2"		60		
	80	"	"		80		
	100	29-2	2'-2"		100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible]C HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION Aniak Lot 8 DATE STARTED Oct 1-1980

DATE COMPLETED Oct 1-1980 DRILLER Mark Anderson B Hopp

TOTAL DEPTH OF WELL 46-TOC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 20 SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11

STATIC WATER LEVEL 27-2 HRS. PUMPED 1 @ 25 GPM DRAWDOWN 4-7"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-8		silty sand
8-13		fine sand
13-17		Brown fine sand
17-21		Coarse sand & water
21-23		silt & rocks
23-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15'
BOTTOM OF FROST & MATERIAL sand
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 27-2 STATIC LEVEL
PUMPING LEVEL 31-9" TOC @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES No OR FROST No

Static water may change w/ river level

DEVELOP PROCEDURE Surge pumping

ESTIMATED MAN HOURS FOR DRILLING ____ HOURS FOR TOTAL JOB ____

CREW ____

Project No. ______ Project Name ______ ______ Well # ______

Location of Well Cruck Lot #3

Depth of Well 41 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 27'-2" ft. Top of Casing to Static Le

Date Drilling Completed 11-1-80 Driller [illegible] Date Tested 11-1-8[illegible]

Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm ~~or~~ Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ ~~or~~ Recov
	1	31-8½"	4-6½"		1	27-2"	4-7"
	2	31'-9"	4'-7"		2		
	3	31'-9"	4-7"		3		
	4	31'-9"	4'-7"		4		
	5	31-9"	4'-7"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	31-9"	4-7"		10		
	11	"	"		11		
	12	"	"		12		
	15	"	"		15		
	20	31-9"	4-7"		20		
	25	31-9"	4-7"		25		
	30	"	"		30		
	40	"	"		40		
	50	31'-9"	4'-7"		50		
	60	31'-9"	4-7"		60		
	80				80		
	100	water cleared in 12			100		
	140	min. clouded up			140		
	130 (3 hrs.)	while since pumping			180 (3 hrs.)		
	240 (4 hrs.)	but finally stayed			240 (4 hrs.)		
	300	clear with steady			300		
	360	pumping			360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible]IC HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION Aniak Lot 9 DATE STARTED 10-1-80

DATE COMPLETED 10-1-80 DRILLER Mark Anderson & B Hays

TOTAL DEPTH OF WELL 41 TOC FT. CASING INSTALLED 40' DIAMETER 4"

GROUT 20' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11'

STATIC WATER LEVEL 27-8 HRS. PUMPED 1 @ 25 GPM DRAWDOWN 1-8" recovered 1 min

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-13		silt
13-16		Brown fine sand
16-19		Coarse sand & H_2O
19-21		silt
21-23		silt & rock
23-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15'
BOTTOM OF FROST & MATERIAL sand
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 27-8" STATIC LEVEL
PUMPING LEVEL 29-4 @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES No OR FROST No
Static level may change with river level

DEVELOP PROCEDURE surge pumping & test pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

oject No. ______________ Project Name ______________ ______ Well # ______

cation of Well Annik Lot #9

pth of Well 46 TOC ft. Length of Casing 40 ft. Pumped Well / Observation We

Observation Well, Dist. to Pumped Well 27'-8" ft. Top of Casing to Static Le

te Drilling Completed 10-1-80 Driller M Anderson Date Tested 11-1-80

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawd @ or Recov
	1	29'-4	1'-8"		1	27'-8"	1'-8"
	2	29'-4"	1'-8"		2		
	3	29'-4"	1'-8"		3		
	4	29'-4"	1'-8"		4		
	5	29'-4"	1'-8"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	29'-4"	1'-8"		10		
	11	"	"		11		
	12	"	"		12		
	15	29'-4"	1'-8"		15		
	20	"	"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	29'-4"	1'-8"		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible]IC HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION Aniak Lot #16 DATE STARTED 9-30-80

DATE COMPLETED 10-1-80 DRILLER Mark Anderson Rod Hopp

TOTAL DEPTH OF WELL 41 TOC FT. CASING INSTALLED 40 DIAMETER 4"

GROUT 21' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-1/2"

STATIC WATER LEVEL 28-2 HRS. PUMPED 1.5 @ 15 GPM DRAWDOWN 11-2"

Recovery 1 min 28-6
2 min 28-2

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1		Muskeg
1-13		silt
13-17		Brown fine sand
17-21		Coarse sand & H_2O
21-23		silt & rocks
23-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL 13 silt
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 28'-2" STATIC LEVEL
PUMPING LEVEL 39-4" @ 15 GPM
AFTER 1.5 HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES no OR FROST no
static level may be affected by river level

DEVELOP PROCEDURE Test pump & surge pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

AQUIFER TEST FIELD DATA SHEET Page ___

oject No. ______________ Proj t Name ______________________ ____ Well # ______

cation of Well *Amuk Lot #10*

pth of Well *46 TOC* ft. Length of Casing *40* ft. Pumped Well / Observation W

Observation Well, Dist. to Pumped Well *28'2"* ft. Top of Casing to Static L

te Drilling Completed *10-1-80* Driller *M Anderson B Hopp* Date Tested *9-30-80*

ock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ *25* gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Draw @ Reco
	1	*39-4"*	*11-2"*		1	*28'-6"*	*11'-4*
	2	*39-4"*	*11'-2" at 15 GPM*		2	*28'-2"*	*11'-2*
	3	*39-4"*	*11'-2"*		3		
	4	*39-4"*	*11'-2"*		4		
	5	*39-4*	*11-2"*		5		
	6	*"*	*"*		6		
	7	*"*	*"*		7		
	8	*"*	*"*		8		
	9	*"*	*"*		9		
	10	*39'-4"*	[illegible]		10		
	11	*39-4"*	*11'-2"*		11		
	12	*39'4"*	*11-2"*		12		
	15	*"*	*"*		15		
	20	*"*	*"*		20		
	25	*"*	*"*		25		
	30	*"*	*"*		30		
	40	*"*	*"*		40		
	50	*"*	*"*		50		
	60	*39'-4"*	*11'-2"*		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PUBLIC HEALTH SERVICE, DIVISION OF INDIAN HEALTH

LOCATION Aniak Lot #11 DATE STARTED 9-30-80

DATE COMPLETED 9-30-80 DRILLER Mark Anderson Bob Hayes

TOTAL DEPTH OF WELL 46-2" T.O.C. FT. CASING INSTALLED 40-3" DIAMETER 4"

GROUT 20' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 27-6" HRS. PUMPED 1 @ 25 GPM DRAWDOWN 1-10"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'		Musky
1-14'		silt
14-18		Brown fine sand
18-21		Coarse sand & water
21-26		silt & rocks
26-41		water formation

SOIL DATA TO 15 FT.
FEET THAWED 15
BOTTOM OF FROST & MATERIAL [illegible]
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH Clear
AFTER 24 HOURS Clear
IRON
CHLORIDES
TDS

PUMP TEST 27-6" STATIC LEVEL
PUMPING LEVEL 29-4" @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH
TIDES no OR FROST no

DEVELOP PROCEDURE Surge pumping & Test pumping

ESTIMATED MAN HOURS FOR DRILLING ______ HOURS FOR TOTAL JOB ______

CREW ______

AQUIFER TEST FIELD DATA SHEET

Page___

roject No.________________ Proj t Name______________________________ Well # ______

ocation of Well Amik Lot 11

epth of Well _____ft. Length of Casing _____ft. Pumped Well / Observation W

f Observation Well, Dist. to Pumped Well 27'6" ft. Top of Casing to Static L

ate Drilling Completed 9-30-80 Driller M. Anderson + B. Hopp Date Tested 9-30-80

lock me	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Draw @ — o Reco
	1	29-4"	1'-10"		1	27'6"	1'-10
	2	29'-4"	1'-10"		2		
	3	29'-4"	1'-10"		3		
	4	29-4"	1'-10"		4		
	5	29'-4"	1'-10"		5		
	6	29-4"	1'-10"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	"	"		10		
	11	"	"		11		
	12	"	"		12		
	15	29-4"	1'-10"		15		
	20	"	"		20		
	25	"	"		25		
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	29-4"	1'-10"		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PU[illegible]C HEALTH SERVICE, DIVISION OF INDI[illegible] HEALTH

LOCATION *Aniak Lot 12* DATE STARTED *9-27-80*

DATE COMPLETED *9-30-80* DRILLER *Mark Anderson & B. Hoff*

TOTAL DEPTH OF WELL *46-1 T.C.C.* FT. CASING INSTALLED *40-1"* DIAMETER *4"*

GROUT *20'* SCREEN SIZE *15 slot* MFG. *Johnson* LENGTH *5-11"*

STATIC WATER LEVEL *27' T.O.C.* HRS. PUMPED *1* @ *25* GPM DRAWDOWN *6-8"* *T.O.C.*

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'		*silt*
1-9'		*frozen silt*
9-13		*Brown fine sand*
13-16		*silt*
16-22		*coarse sand w/ H_2O*
22-26		*silt + gravel up to 2" size*
26-41		*Water formation*

SOIL DATA TO 15 FT.
FEET THAWED *1'*
BOTTOM OF FROST & MATERIAL *9' silt*
SEASONAL OR PERMA FROST *perma frost*

WATER DATA FIELD TEST
TASTE *Good*
APPEARANCE FRESH *Clear*
AFTER 24 HOURS *Clear*
IRON
CHLORIDES
TDS

PUMP TEST *27'* STATIC LEVEL
PUMPING LEVEL *33'-8"* @ *25* GPM
AFTER *1* HRS.

HIGHEST RECOMMENDED PUMP RATE
WILL STATIC LEVEL CHANGE WITH
TIDES *No* OR FROST *No*
Static level may change with river level

DEVELOP PROCEDURE *Test pumping + surge pumping*

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

AQUIFER TEST FIELD DATA SHEET

Page -

Project No. ______ Project Name ______ Well # ______

Location of Well Aniak Lot #12

Depth of Well 46-1 TOC ft. Length of Casing 40-1" ft. Pumped Well / Observation

If Observation Well, Dist. to Pumped Well 27' ft. Top of Casing to Static

Date Drilling Completed 9-29-80 Driller MAnderson & BHopp Date Tested 9-29-80

Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ — Recovery
	1	33'-8"	6'-8"		1	27	6'-8
	2	33-8"	6'-8"		2		
	3	33-8"	6'-8"		3		
	4	33'-8"	6'-8"		4		
	5	33-8"	6-8"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	"	"		10		
	11	"	"		11		
	12	"	"		12		
	15	33-8"	6-8"		15		
	20	"	"		20		
	25	"	"		25		
	30	"	"		30		
	40	33'-8"	6-8"		40		
	50	"	"		50		
	60	33-8"	6-8"		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

U.S. PL C HEALTH SERVICE, DIVISION OF INDI HEALTH

LOCATION Quick Lot 13 DATE STARTED 9-30-80

DATE COMPLETED 9-30-80 DRILLER Bob Hopp & M Anderson

TOTAL DEPTH OF WELL 46-0 FT. CASING INSTALLED T.C.C. 40-11 DIAMETER 4"

GROUT 21' SCREEN SIZE 15 slot MFG. Johnson LENGTH 5-11"

STATIC WATER LEVEL 27' HRS. PUMPED 1 @ 25 GPM DRAWDOWN 6-4"

DEPTH	HOLE DIAMETER / CASING DIAMETER	FORMATION
0-1'		mucky silt
1-13'		
13'-18'		Brown silty sand fine
18-21		Coarse sand & H_2O
21-24'		silt & rocks
24-41		Water formation

SOIL DATA TO 15 FT.
FEET THAWED 15'
BOTTOM OF FROST & MATERIAL silt
SEASONAL OR PERMA FROST seasonal

WATER DATA FIELD TEST
TASTE Good
APPEARANCE FRESH clear
AFTER 24 HOURS clear
IRON
CHLORIDES
TDS

PUMP TEST 27' " STATIC LEVEL
PUMPING LEVEL 33'4 @ 25 GPM
AFTER 1 HRS.

HIGHEST RECOMMENDED PUMP RATE

WILL STATIC LEVEL CHANGE WITH
TIDES No OR FROST No

static level may be affected by river level.

DEVELOP PROCEDURE surge pumping & test pumping

ESTIMATED MAN HOURS FOR DRILLING HOURS FOR TOTAL JOB

CREW

AQUIFER TEST FIELD DATA SHEET

Page____

roject No.______________ Project Name______________________ Well # ______

ocation of Well Anak Lot 13

epth of Well 46 TOC ft. Length of Casing 40- ft. Pumped Well / Observation

f Observation Well, Dist. to Pumped Well 27-0" ft. Top of Casing to Static

ate Drilling Completed 9-30-80 Driller [illegible] Date Tested 9-30-8

lock ime	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Drawdown @ 25 gpm or Recovery	Clock Time	Elapsed Time Since Pumping Started/Stopped	Depth to Water From TOC	Dra @ — Rec
	1	33'-4"	6'-4"		1	27-0	6'-4
	2	33'-4"	6'-4"		2		
	3	33'-4"	6-4"		3		
	4	33'-4"	6'-4"		4		
	5	33-4	6'-4"		5		
	6	"	"		6		
	7	"	"		7		
	8	"	"		8		
	9	"	"		9		
	10	"	"		10		
	11	"	"		11		
	12	"	"		12		
	15	33'-4"	6'-4"		15		
	20	33'-4"	6'-4"		20		
	25	"	"		25	/	
	30	"	"		30		
	40	"	"		40		
	50	"	"		50		
	60	33'-4"	6'-4"		60		
	80				80		
	100				100		
	140				140		
	180 (3 hrs.)				180 (3 hrs.)		
	240 (4 hrs.)				240 (4 hrs.)		
	300				300		
	360				360		
	420				420		
	480				480		
	540				540		
	600				600		

APPENDIX 2

U.S. Geological Survey well drillers' logs, aquifer tests,

and ground-water-quality data for Aniak, Alaska

Chief, Plant Maintenance Branch, AN-675 June 6, 1959

Arthur J. Lappi: Fixed Industrial Equipment Mechanic Leader

Completion of Well Drilling Assignment at Aniak:

Drilled three cased wells, one at Mark 11 Utility Building, one at Utility Building at housing area and one at Control Building Site

Mark 11 Utility Building Well

Ani-9

(1) Drilled 6 inch cased well, 5 ft. length welded well casing to a depth of 45 ft.
(2) Installed 5 ft. length Johnson Everdur well screen, with 35 thousand slot opening. Well screen exsposed 4 ft. below end of casing.
(3) Surged and devloped well. Test pumped well fro 36 hrs. at a rate of 30 gal. per minute or 1800 gal. per hr. with 6 inch drawdown.
(4) Water samples taken and water found to be same as well inside of Mark 11 Utility building. Very hard water turns coffee black. ← old one?
(5) Static level 27ft. Depth of well 45 ft.

Utility Building Well Housing Area.

Ani-4

(1) Drilled six inch cased well behind Utility Building to depth of 56 ft.
(2) Installed five ft. Johnson Everdur well screen with 35 thousand slot opening.
(3) Surged and developed well for eight hrs.
(4) Test pumped well 48 hrs. at a rate of 30 gal. per minute or 1800 gal. per hr. with a 6 inch drawdown.
(5) Water samples taken and water found to be very good, does not turn coffee black.
(6) Static level 27ft. Depth of well ground level 56 ft. Depth of well top of casing 58 ft.
(7) Fire pump could be installed in well due to unlimited amount of water and small drawdown. Suggest dragline from McGrath be shipped to Aniak and with conjunction of other work lined up for machine a 8ft. diameter caison be installed for fire protection.

Control Building Well

Sealed Ani-5

(1) Drilled six inch cased well on radio maintenance side of control building, four feet out from outside wall and in line with center of wall to a depth of 47 ft 10 in.
(2) Surged and developed well
(3) Test pumped well 8hrs. at a rate of 30 gal per minute or 1800 gal. per hr. with 6 inch drawdown.
(4) Water samples taken and by local tests found wter to be very good.
(5) Perforated casing 18 inch. from bottom of casing. Depth to bottom of well from top of casing 49 ft. 10 inches.
(6) Static level 15 ft. Water table high due to spring brake-up of ice and river high.

..ak ..e..is

Well drilling rig loaded on Alaska River Navigation barge and shipped to McGrath May 30, 1959

Received very good cooperation during our assignment from all station personnel, especially the Station Manager and Station Mechanic and has been a pleasure working with them.

Drill Logs

Ani-8

Mark 11 Utility Building Well

1-25	Muck some rock at 15 ft	Thawed
26	Broke throu to course gravel and water	
	Lots of red rocks and red water	Thawed
27-50	Course gravel and sand Red Rocks Lots of water	

Ani-4

Utility Building Housing Area

1-24	Muck some rocks	Thawed
25	Course grey sand gravel Water	Thawed
26-58	Course grey sand gravel Lots of water	

Ani-5

Control Building Well

1-2	Fill dirt	Thawed
2-7	Fill dirt Seasonal frost	Frozen
8-18	Muck some rocks	Thawed
19-31	Brown sand and gravel	Thawed
32-50	Course sand and gravel Water at 32ft. Lots of water.	

Arthur J. Lappi

Arthur J. Lappi, AN 675

Ackd. made

.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	13456					
Date of collection	5-1-70					
Silica (SiO_2)	14					
Iron (Fe) (total)	.36					
Manganese (Mn)	.17					
Calcium (Ca)	27					
Magnesium (Mg)	5.5					
Sodium (Na)	2.8					
Potassium (K)	1.0					
Bicarbonate (HCO_3)	102					
Carbonate (CO_3)	00					
Sulfate (SO_4)	9.0					
Chloride (Cl)	.7					
Fluoride (F)	.3					
Nitrate (NO_3)	2.1					
Dissolved solids						
Calculated	112					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	90					
Noncarbonate hardness as $CaCO_3$	6					
Alkalinity as $CaCO_3$	84					
Specific conductance (micromhos at 25°C)	191					
pH	7.0					
Color	0					

GPO : 1965 O—772-789

13456 – White Alice Site at Aniak – Well #1, coll. by Colliver, clear appearance, collected from boiler room.

HCX 5 17 - Aniak

1970

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	13113					
Date of collection	10-24-69					
Silica (SiO_2)	14					
Iron (Fe)	.14					
Manganese (Mn)	.19					
Calcium (Ca)	25					
Magnesium (Mg)	5.3					
Sodium (Na)	2.6					
Potassium (K)	1.0					
Bicarbonate (HCO_3)	103					
Carbonate (CO_3)	00					
Sulfate (SO_4)	6.6					
Chloride (Cl)	0.7					
Fluoride (F)	0.1					
Nitrate (NO_3)	3.3					
Dissolved solids						
Calculated	115					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	91					
Noncarbonate hardness as $CaCO_3$	7					
Alkalinity as $CaCO_3$	84					
Specific conductance (micromhos at 25°C)	186					
pH	7.4					
Color	0					

13113 - RCA Site (Fed.El.), Aniak, Well #1, coll. at bathroom by H. Colliver, clear appearance.

Aniak RCA

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

9-268 q ~~(parts per million)~~ (milligrams per liter)

Laboratory Number	11822					
Date of collection	Rec. 9-24-62					
Silica (SiO_2)	13					
Iron (Fe)	.42					
Manganese (Mn)	.16					
Aluminum (Al)	2.4					
Carbon Dioxide (CO_2)	16					
Calcium (Ca)	23					
Magnesium (Mg)	5.8					
Sodium (Na)	2.6					
Potassium (K)	.8					
Bicarbonate (HCO_3)	103					
Carbonate (CO_3)	0					
Sulfate (SO_4)	11					
Chloride (Cl)	1.4					
Fluoride (F)	.3					
Nitrate (NO_3)	2.9					
Dissolved solids						
Calculated	117					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	92					
Noncarbonate hardness as $CaCO_3$	8					
Alkalinity as $CaCO_3$	84					
Specific conductance (micromhos at 25°C)	182					
pH	7.0					
Color	10					

11822-28-1829 - Aniak well #1, domestic use, drilled in 1957, 110 feet deep

Ar‾ak RCA site

U.S. DEPARTMENT OF THE INTERIC
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	10417					
Date of collection	8/7/67					
Silica (SiO_2)	15					
Iron (Fe)	1.52					
Manganese (Mn) qualitative	0.1					
Carbon Dioxide (CO_2)	7.1					
Calcium (Ca)	32					
Magnesium (Mg)	5.6					
Sodium (Na)	2.9					
Potassium (K)	1.6					
Bicarbonate (HCO_3)	112					
Carbonate (CO_3)	0					
Sulfate (SO_4)	14					
Chloride (Cl)	1.4					
Fluoride (F)	0.3					
Nitrate (NO_3)	5.8					
Dissolved solids						
Calculated	135					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	102					
Noncarbonate hardness as $CaCO_3$	10					
Alkalinity as $CaCO_3$	92					
Specific conductance (micromhos at 25°C)	202					
pH	7.4					
Color	10					

10417-Aniak well #1 owned by RCA, depth 110, water-bearing formation unkown collected from pump house by F. Lindholm, appearance clear use domestic.

U.S. DEPARTMENT OF THE INTERIO.
GEOLOGICAL SURVEY 8769

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	8769					
Date of collection	2/16/66					
Silica (SiO_2)	14					
Iron (Fe)	0.10					
Manganese (Mn)	0.00					
Calcium (Ca)	27					
Magnesium (Mg)	7.2					
Sodium (Na)	3.1					
Potassium (K)	1.3					
Bicarbonate (HCO_3)	113					
Carbonate (CO_3)	0					
Sulfate (SO_4)	5.8					
Chloride (Cl)	2.5					
Fluoride (F)	0.1					
Nitrate (NO_3)	4.8					
Carbon Dioxide	18					
Dissolved solids						
Calculated	122					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	97					
Noncarbonate hardness as $CaCO_3$	4					
Alkalinity as $CaCO_3$	93					
Specific conductance (micromhos at 25°C)	203					
pH	7.0					
Color	5					

8769 - RCA Aniak Boiler Room Tap . Drilled well, 110 ft. GM Pump
Collected by K. Gordon

RCA Site - Anaik

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	9601					
Date of collection	9-3-66					
Silica (SiO_2)	15					
Iron (Fe)	0.04					
Manganese (Mn)	0.02					
Carbon Dioxide (CO_2)	14					
Calcium (Ca)	28					
Magnesium (Mg)	5.8					
Sodium (Na)	2.3					
Potassium (K)	1.2					
Bicarbonate (HCO_3)	110					
Carbonate (CO_3)	0.0					
Sulfate (SO_4)	7.2					
Chloride (Cl)	0.7					
Fluoride (F)	0.1					
Nitrate (NO_3)	4.2					
Dissolved solids						
Calculated	119					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	94					
Noncarbonate hardness as $CaCO_3$	4					
Alkalinity as $CaCO_3$	90					
Specific conductance (micromhos at 25°C)	202					
pH	7.1					
Color	5					

9601 - RCA Site, Anaik, Alaska Collected from drilled well by F. Lindholm.

RCA Service
Ardak, Alaska

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	8069					
Date of collection	May 20, 1964					
Silica (SiO_2)	10					
Iron (Fe) (dis)	0.07					
Iron (FE) (Total)	0.16					
Manganese (Mn)	0.05					
Calcium (Ca)	20					
Magnesium (Mg)	10					
Sodium (Na)	2.9					
Potassium (K)	0.1					
Bicarbonate (HCO_3)	94					
Carbonate (CO_3)	0					
Sulfate (SO_4)	12					
Chloride (Cl)	2.8					
Fluoride (F)	0.1					
Nitrate (NO_3)	2.9					
Carbon Dioxide (CO_2)	9.4					
Dissolved solids						
Calculated	107					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	91					
Noncarbonate hardness as $CaCO_3$	14					
Alkalinity as $CaCO_3$	77					
Specific conductance (micromhos at 25°C)	188					
pH	7.2					
Color	4					

8069 - RCA @ Ardak, Alaska. Samp. Pt. @ Kitchen Tap. Clear @ Collection.
Collected by J. G. Tuckerman.

S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Number	7456					
Date of collection	March 13, 1963					
Silica (SiO_2)	12					
Iron (Fe) (dis)	0.03					
Iron (Fe) (total)	0.12					
Manganese (Mn)	0.08					
Calcium (Ca)	20					
Magnesium (Mg)	9.0					
Sodium (Na)	2.3					
Potassium (K)	1.0					
Bicarbonate (HCO_3)	94					
Carbonate (CO_3)						
Sulfate (SO_4)	9.0					
Chloride (Cl)	3.0					
Fluoride (F)	0.1					
Nitrate (NO_3)	0.0					
Carbon Dioxide (CO_2)	12					
Dissolved solids						
Calculated	102					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	86					
Noncarbonate hardness as $CaCO_3$	9					
Alkalinity as $CaCO_3$	77					
Specific conductance (micromhos at 25°C)	175					
pH	7.1					
Color	0					

7456 - RCA - Aniak, Alaska. Samp. Pt. - @ Storage Tank.

U. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

9-268 q

Laboratory Numbers	7381					
Date of collection	Dec. 1, 1962					
Silica (SiO_2)	14					
Iron (Fe) (dis)	0.02					
Manganese (Mn)	0.01					
Calcium (Ca)	26					
Magnesium (Mg)	4.6					
Sodium (Na)	2.9					
Potassium (K)	0.9					
Bicarbonate (HCO_3)	94					
Carbonate (CO_3)						
Sulfate (SO_4)	11					
Chloride (Cl)	2.0					
Fluoride (F)	0.1					
Nitrate (NO_3)	1.7					
Carbon Dioxide (CO_2)	1					
Dissolved solids Calculated	109					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	85					
Noncarbonate hardness as $CaCO_3$	8					
Alkalinity as $CaCO_3$	77					
Specific conductance (micromhos at 25°C)	170					
pH	8.2					
Color	0					

7381 - RCA - Aniak, Alaska. Clear @ Collection.

APPENDIX 3

U.S. Geological Survey water-quality data for the Aniak River

USGS Station No. 613415159302000 - ANIAK RIVER AT ANIAK AK

WATER-QUALITY DATA

WATER YEAR OCTOBER 1955 TO SEPTEMBER 1956

DATE	COLOR (PLAT-INUM-COBALT UNITS) (00080)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) (00405)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	CAR-BONATE WATER WH FET FIELD MG/L AS CO3 (00445)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)
JUN 28...	10	68	7.6	1.3	26	32	0	0.020	29

DATE	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)	SODIUM PERCENT (00932)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
JUN 28...	3	7.5	2.4	2.0	0.2	13	0.30	0.50

DATE	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3) (71851)	MANGA-NESE (UG/L AS MN) (71883)	IRON (UG/L AS FE) (71885)
JUN 28...	6.2	0.10	8.2	43	0.06	0.10	0	0

WATER YEAR OCTOBER 1956 TO SEPTEMBER 1957

DATE	COLOR (PLAT-INUM-COBALT UNITS) (00080)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) (00405)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	CAR-BONATE WATER WH FET FIELD MG/L AS CO3 (00445)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)
APR									
04...	5	97	6.9	8.9	36	44	0	0.140	37

DATE	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)	SODIUM PERCENT (00932)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
APR								
04...	1	9.9	3.1	4.9	0.3	22	0.90	1.0

DATE	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3) (71851)	MANGA-NESE (UG/L AS MN) (71883)	IRON (UG/L AS FE) (71885)
APR								
04...	8.0	0.10	10	60	0.08	0.60	0	420