Overview of Environmental and Hydrogeologic Conditions At the Merle K. "Mudhole" Smith Airport Near Cordova, Alaska

By Joseph M. Dorava and James M. Sokup

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

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
cubic meter per second (m^3/s)	35.31	cubic foot per second
cubic meter per second per square kilometer [$(m^3/s)/km^2$]	91.49	cubic foot per second per square mile
liter per second (L/s)	15.85	gallon per minute
liter per day (L/d)	0.2642	gallon per day
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 unit used in this report:

mg/L, milligram per liter

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Abstract

Air service to Cordova, Alaska and the surrounding region is provided by the Merle K. "Mudhole" Smith Airport, 21 kilometers east of the townsite. The Federal Aviation Administration owns or operates support facilities at the airport and wishes to consider the environmental setting and hydrogeologic conditions when evaluating options for remediation of potential contamination at these facilities. The airport is within the Copper River Delta wetlands area and the Chugach National Forest. Silts, sands, and gravels of fluvial origin underlie the airport. Potential flooding may be caused by outbursts of glacier-dammed lakes, glacier icemelt, snowmelt runoff, or precipitation. Surface spills and disposal of hazardous materials in conjunction with precipitation or flooding may adversely affect the quality of ground water. Drinking water at the airport is currently supplied by wells. Alternative drinking-water sources include local rivers and streams, transporting city water from Cordova, or undiscovered aquifers. Each alternative source, however, would likely cost significantly more to develop than using the existing shallow aquifer supply.

INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airway support and navigational facilities throughout Alaska. At many of these sites, fuels and potentially hazardous materials such as solvents, polychlorinated biphenyls, and pesticides may have been used and (or) disposed of. To determine if environmentally hazardous materials have been spilled or disposed 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 at the Merle K. "Mudhole" Smith Airport (previously known as Mile 13 Airport) near Cordova, Alaska. Also presented in this report is a description of the history, socioeconomics, and physical setting of Cordova and the surrounding region.

BACKGROUND

Location

The Merle K. "Mudhole" Smith Airport is in southcentral Alaska at latitude 60°29'37" N., and longitude 145°28'01" W., approximately 260 km east-southeast of Anchorage and 90 km southeast of Valdez. The airport is 21 km east of the Cordova city limits along the Copper River Highway. It is south of the Chugach Mountains, on a outwash plain between two glacial meltwater rivers about 8 km inland from the Gulf of Alaska (fig.1).

Mountainous terrain surrounds the airport to the west, north, and east. The Heney Range is about 12 km to the west, the foothills of the Chugach Mountains are approximately 15 km to the north, and McKinley Peak is 14 km to the east. The FAA facilities are about 14 m above sea level and the highest peaks within 15 km of the airport are less than 1,300 m in elevation. The airport is situated within the Chugach National Forest and the Copper River Delta wetlands area (Prince William Sound Science Center and Copper River Delta Institute, 1991). The Copper River Delta State Critical Habitat Area, an important wetland for shorebirds and migratory waterfowl, is located between the airport and the Gulf of Alaska (fig.1).

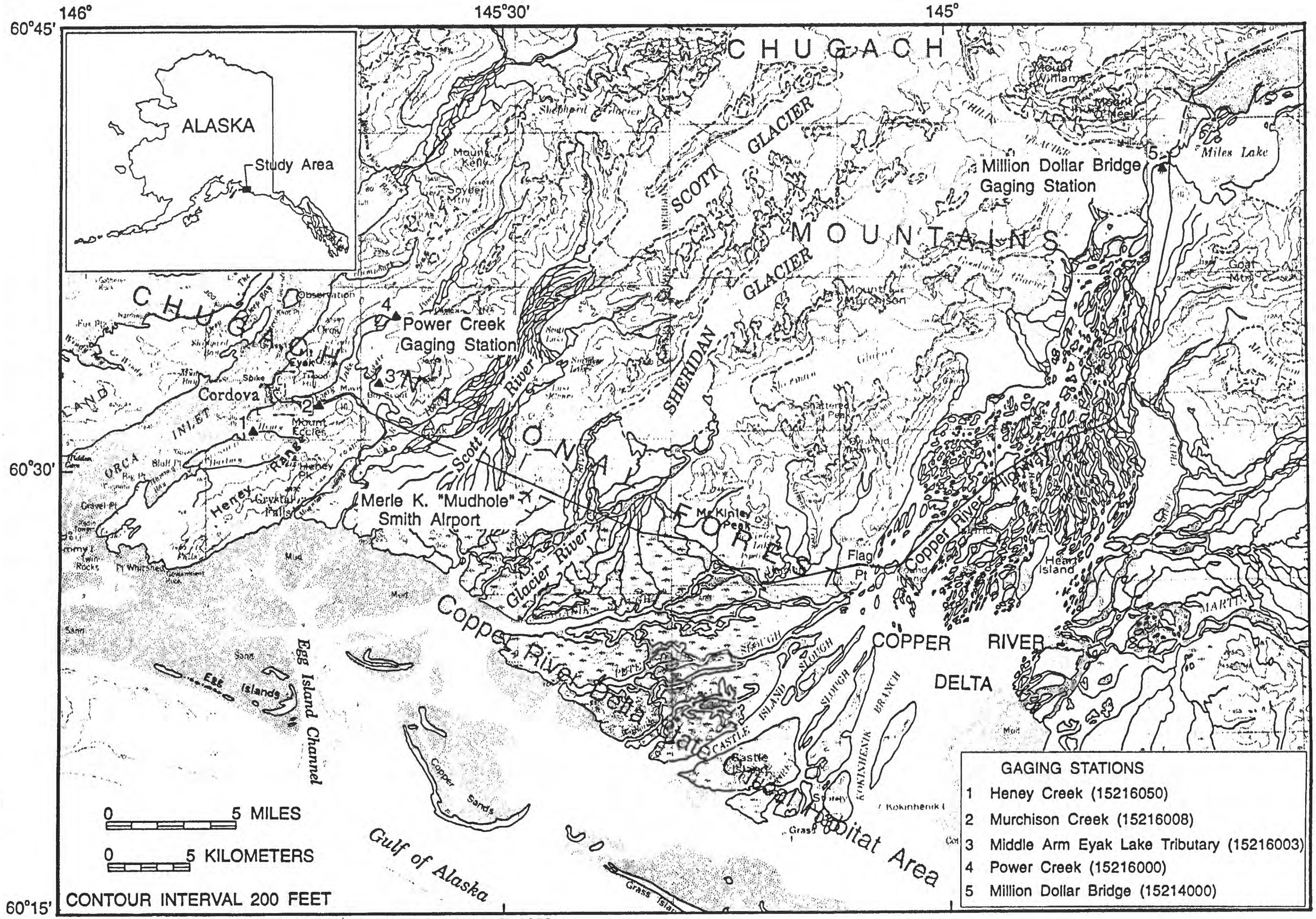
History and Socioeconomics

The city of Cordova began as an extension of Eyak, a fishing village approximately 8 km to the east, which had a population of 200 European and Native Alaskans in 1900 (Ross, 1983). Cordova, which is one of the major deep-water ports for the surrounding mountain-isolated region, grew in importance as a transportation point for Kennecott copper ore from 1912 to 1938 (Overall Economic Development Committee, 1962).

In 1990, Cordova had 2,110 permanent residents, of which 11 percent were Native American (Aleut, American Indian, or Eskimo) (U.S. Bureau of Census, 1991). Major forms of employment in Cordova include fishing, forestry, retail trade, and professional services (Alaska Department of Community and Regional Affairs, 1991). During the peak of the fishing season, fisheries provide roughly 50 percent more jobs than all other forms of employment combined, creating a summertime increase in population of 1,500 to 2,000 people (TRA/Farr Consultants, 1986).

Cordova can be reached only by air and by water. Most commonly, residents traveling by automobile use the ferry and the Alaska marine highway system. No roads currently connect Cordova to the interior of Alaska, although more than 75 km of roads exist throughout the Copper River Delta region. At the present time, plans to extend the statewide highway system to Cordova are being evaluated.

In 1941, the airport was built and used as a satellite field by the Army Air Corps (TRA/Farr Consultants, 1986). The airport and its buildings were relinquished 3 years later to the Civil Aeronautics Administration, the predecessor to the FAA. Both the primary and crosswind runways were originally unpaved and were 1,370 m in length. Current landing and take-off areas at the airport are provided by runway 9-27, a 2,286-m-long paved landing strip, and runway 16-34, a 543-m-long unpaved crosswind landing strip (fig. 2). Structures located at the airport include a Coast



Base from U.S. Geological Survey, Cordova, Alaska, 1:250,000, 1959

Figure 1. Location of the Cordova area.

Guard hangar and quarters; FAA flight service station, employee residences, shop, and storage buildings; commercial airline terminals; and a diner (fig. 2). An electric generating site and navigational aid facility (localizer) are near the west end of runway 9-27 and a glide-slope facility is near the southeast end of runway 9-27. An unused non-directional beacon facility is about 2 km east of runway 9-27. A remote communications outlet is on Mount Eyak (fig. 1), 13 km northwest of the FAA station. A detailed account of FAA owned, leased, or transferred properties in the area and a listing of suspected sources of contamination near these facilities can be found in an environmental compliance investigation report of the FAA facilities at the airport (Ecology and Environment, Inc., 1992).

PHYSICAL SETTING

Climate

A maritime climate is present at the Merle K. "Mudhole" Smith Airport, which is approximately 8 km inland from the Gulf of Alaska (Hartman and Johnson, 1984). Climatic data collected at the airport from 1951-87 show moderate temperatures for Cordova and abundant precipitation (Leslie, 1989). The mean annual temperature for the area is 3.5 °C. Mean minimum January temperature is about -9.4 °C and mean maximum August temperature is about 16.3 °C. Mean annual precipitation is about 2,310 mm and mean annual snowfall is 3,090 mm. Most of the precipitation, usually in the form of rain, occurs in September and October (Leslie, 1989). The surrounding mountain terrain helps produce low cloud cover and substantial rain. High seas created by strong winds from the Gulf of Alaska are common in winter. Mean monthly temperature, precipitation, and snowfall are summarized in table 1.

Vegetation

Selkregg (1974) describes the vegetation along the Gulf of Alaska as generally an open forest of evergreen and deciduous trees. Coastal spruce-hemlock forest occurs along the gulf in areas of shallow peat, glacial deposits, and outwash plains (Viereck and Little, 1972). Grasses and herbs in the area consist primarily of lyme grass, bluejoint, lichens, mosses, liverworts, cottongrass, and various other low growing shrubs (Selkregg, 1974).

The upland areas, predominantly to the north, include mature Sitka spruce and western hemlock dominated forest with intermittent black spruce on saturated soils (U.S. Fish and Wildlife Service, 1987). Interspersed north of the airstrip and more dominant to the south are palustrine wetlands characterized by erect, rooted hydrophytic plants and short scrub, principally consisting of members in the alder and willow families (U.S. Fish and Wildlife Service, 1987).

Bedrock Geology

Winkler and Plafker (1981 and 1993) describe the bedrock that underlies the airport as being a widespread, thick, deformed accretionary sequence of flysch and tholeiitic basalt. Estimated bedrock thickness is on the order of 6,000 to 10,000 m. Radiometric data indicate that the bedrock is of late Paleocene or early Eocene age (Plafker and others, 1985). A driller's log from a 52-m deep well at the airport indicated no signs of bedrock material (McCoy and Freethey, 1978).

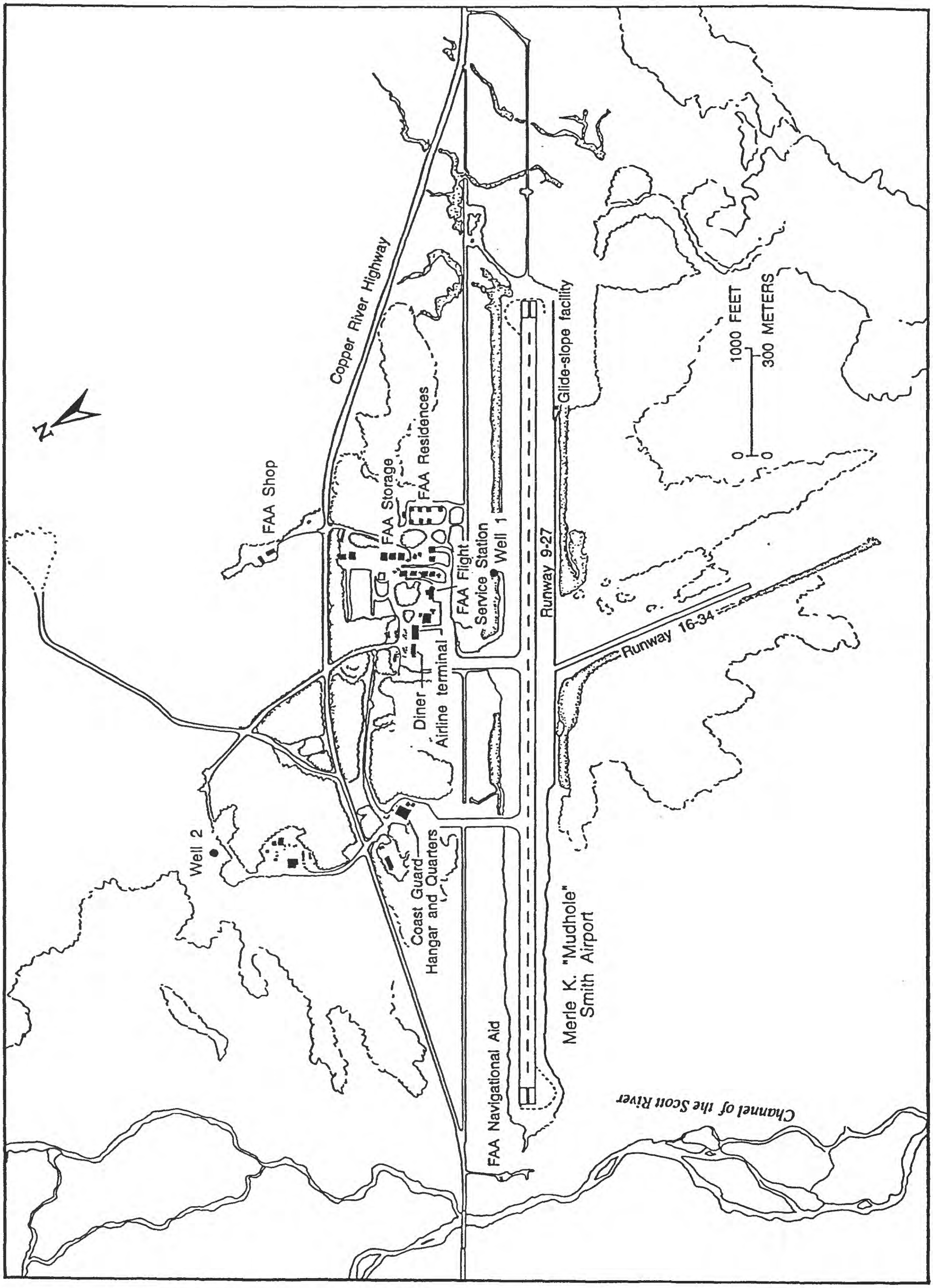


Figure 2. Location of Merle K."Mudhole" Smith Airport and Federal Aviation Administration facilities (from aerial photographs by Aeromap US).

Table 1. Mean monthly temperature, precipitation, and snowfall for the period 1951 to 1987, Cordova

[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	-0.8	1.4	3.2	6.6	10.9	14.3	16.2	16.3	13.4	8.1	2.9	-0.1	7.7
	(Record maximum, 30.0 °C, July 1979)												
Mean minimum	-9.4	-7.5	-6.2	-2.1	2.1	5.9	8.2	7.4	4.4	0.2	-4.7	-7.8	-0.8
	(Record minimum, -34.4 °C, January 1972)												
Mean	-5.1	-3.0	-1.5	2.3	6.5	10.1	12.2	11.9	8.9	4.2	-0.9	-3.9	3.5
Precipitation (mm of moisture)	154.7	160.8	135.1	135.4	148.3	129.3	162.3	221.0	328.2	322.8	212.6	202.4	2312.7
Snowfall (mm)	490.2	561.3	624.8	355.6	30.5	0.0	0.0	0.0	0.0	88.9	284.5	657.9	3096.3

Two concealed faults, the Eyak and Cordova Faults, are located 12 and 20 km northwest of the airport respectively (Winkler and Plafker, 1981 and 1993). These faults run nearly parallel to each other and trend from the southwest to the northeast. The 1964 earthquake, which had an epicenter approximately 140 km northwest of the airport, raised the entire Copper River Delta between 1.8 and 3.4 m above the previous mean sea level (Thilenius, 1990). Evidence of vertical displacement is found in modifications of shoreline morphology and an approximate 2-m increase in the elevation of survey monuments in the Copper River Delta region. Potential hazards exist in coastal areas from seismically generated tsunamis (fast moving sea waves) that may result from future earthquakes.

Surficial Geology and Soils

Coastal lowlands, consisting of alluvial, glacial, and marine deposits lie between the Chugach Mountains to the north of the airport and the Gulf of Alaska to the south. Surficial deposits in the airport area are of Holocene age. They are predominantly alluvium deposited by nonglacial streams, and outwash deposited by glacial meltwater (Winkler and Plafker, 1981 and 1993). The sediment load carried by coastal rivers in the Cordova region is high and seaward of their mouths: sedimentation rates are as rapid as 64 m per 1,000 years (Molnia, 1979). The near-shore deposits on the Copper River Delta are up to 180 m thick (Reimnitz, 1966). In the Cordova region, the maritime climate precludes the formation of permafrost (Ferrians, 1965).

According to Rieger and others (1979), sediments in the Copper River Delta consist predominantly of waterlaid silts and clays. Flood-plain areas consist mainly of alluvial silts and fine sands bordering dunes of eolian sand. Shallow depressions and low-lying areas throughout the delta consist mainly of peat, intermixed with decreasing quantities of muck and silt.

The thickness, lithologic composition, and layering of unconsolidated materials near the airport are not well known. A driller's log from a 52-m deep well at the airport indicated that below 3 m and above approximately 20 m depth, silt, sand, and gravel are interlaced with organic material (McCoy and Freethey, 1978).

HYDROLOGY

Surface Water

Surface-water drainages near the Merle K. "Mudhole" Smith Airport, generally originate in the Chugach Mountains to the north and flow southward over the outwash plains to the Gulf of Alaska. Streams in the local area are dominated by rainfall-runoff and have rapid and frequent variations in flow and stage. This is demonstrated by the hydrograph for Power Creek near Cordova, where rainfall peaks in August and September are narrow and closely spaced (fig. 3).

Four streams between the city of Cordova and the airport are monitored by USGS gaging stations: No. 15216000, Power Creek; No. 15216003, Middle Arm Eyak Lake Tributary; No. 15216008, Murchison Creek; and No.15216050, Heney Creek at canyon mouth (fig. 1). These streams drain basins having areas that range from about 1 km^2 to more than 660 km^2 and have an average mean annual runoff of about 11.4 $(m^3/s)/km^2$.

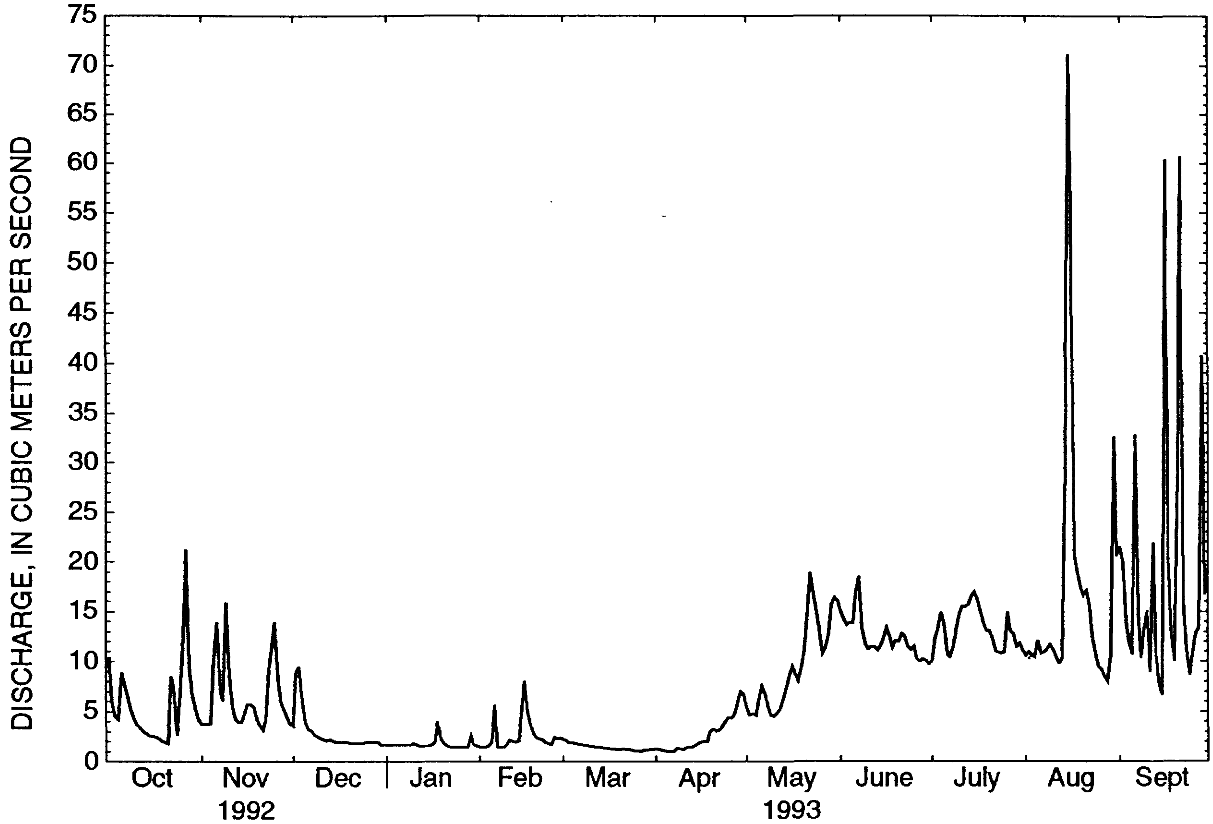


Figure 3. Hydrograph for Power Creek near Cordova, 1993 water year.

The Scott River drains Scott Glacier, approximately 155 km^2 in size, whose terminus is about 15 km north of the airport. The Glacier River drains Sheridan Glacier, approximately 100 km^2 in size, whose terminus is about 7 km to the northeast. The Glacier River is known to most Cordova residents as the "Sheridan River" and is referred to as the Sheridan River in the text of this report. The braided Scott and Sheridan Rivers have tributaries that flow near the airport approximately 1 km to the west and about 2 km to the east, respectively. (fig. 1).

Numerous streams and ponds are located near the airport. The major 9-27 runway is bordered on the north and south by ponds that begin on the east end, and run adjacent to it for approximately 1,500 m (fig. 2). These sloughs and ponds are drained by two natural processes: by infiltration into the underground aquifer system and by small streams that drain the local area. This slough and stream system drains runoff from the airport's impervious surface area.

The airport is located within the Copper River Delta, the largest wetland in the Gulf of Alaska region. This wetland is approximately 2,800 km^2 in size, and extends from a western boundary at Orca Inlet near Cordova to Cape Suckling, 105 km to the east (Prince William Sound Science Center and Copper River Delta Institute, 1991). The delta is composed of estuaries, mudflats, marshes, and barrier islands and is host to the largest spring gathering of migratory birds in the world. As many as 10 million shorebirds and waterfowl, including dusky Canada geese, trumpeter swans, Aleutian terns, dunlins, and western sandpipers, use the delta for feeding, gathering and rearing grounds. Approximately 100 km^2 of the Copper River Delta State Critical Habitat Area are within 15 km of the airport.

Floods

The Merle K. "Mudhole" Smith Airport is outside of the flood plain identified as producing a hazard to the city of Cordova (U.S. Department of Housing and Urban Development, 1978). According to Post and Mayo (1971), the Scott and Sheridan Rivers are known glacier outburst flood courses. Outburst floods may occur when glaciers flow across the mouths of adjoining valleys causing glacier-dammed lakes to form behind the ice streams. The failure of a glacier ice dam and subsequent release of stored water may cause a flood wave to propagate downstream making the airport area susceptible to inundation. The low relief in the airport area, the braided drainage networks of the glacial streams, and the difficulty in predicting outburst floods, limit reliable estimations of flood frequencies and flood elevations.

The wetland areas adjacent to the airport indicate that runoff and infiltration are slow, and heavy rains or increased streamflow could result in significant accumulation of water in these locations. The airport buildings, runways, and support facilities are all slightly elevated above the local terrain, and the local rivers to the northeast and southwest are at least several meters lower than the ground elevation at the airport. No reports of flooding at the airport have been identified, although a report by Ecology and Environment (1992) stated that the area surrounding the unused non-directional beacon facility on the eastern side of the Sheridan River was under about 1 m of water during a September 1990 site investigation.

Ground Water

Ground water near the airport generally occurs in the unconsolidated deposits of Quaternary age. The outwash deposits are probably the most productive water-bearing materials because they generally contain coarser grained materials, are better sorted, and are more extensive than other deposits. Beach and eolian sand deposits also have excellent permeability but because of their limited extent, are less important water-bearing units. Glacial moraine deposits have a wide range of permeability but are found only close to the mountains (Winkler and Plafker, 1981 and 1993).

On a regional scale, the shallow ground-water flow direction probably matches the local topography, flowing from the Chugach Mountains, southwestward to the coast. The mountains of the area are a poor source for ground water, although larger springs flow from fractures and fault contacts along the mountain flanks (Selkregg, 1974). The movement of ground water in the lower outwash plains generally follows the gentle topography and is toward drains such as rivers, streams, and ponds.

Recharge to the unconsolidated deposits primarily is from infiltration of precipitation and streamflow, and from subsurface inflow. The deposits having the most effective permeability are the unconsolidated outwash deposits of Holocene age that occur exclusive of local wetlands. These deposits are located throughout the airport except for a small band of fault contact material of Eocene age located in the northeast boundary of the airport property (Winkler and Plafker, 1981 and 1993). Recharge is probably greatest when precipitation is high and streamflows are at or near maximum for the year, although the quantity of recharge to the ground-water system is unknown.

Ground water discharges from the unconsolidated deposits into springs, streams, and sloughs and is lost through evapotranspiration and well withdrawal. Numerous unnamed springs occur at the headwaters of small streams and creeks in the area. Data are not available to determine the quantity of ground-water discharge to these springs. The numerous streams in the area appear to gain water from ground-water sources, but data have not been collected to estimate the quantity of ground-water discharge to the streams. In addition, data on ground-water discharge to local ponds and sloughs in the area are not available.

Ground-water discharge by evapotranspiration occurs throughout the area. In many locations, soils overlying the shallow ground-water system are saturated and evaporation from the soil occurs. Also, phreatophytic plants transpire water from the shallow ground-water system. Data on evapotranspiration from soils and plants are not available to estimate the quantity of ground water lost.

Ground-Water and Surface-Water Interaction

The water table near the airport is somewhat controlled by the elevation of local surface-water systems. The shallow ground-water system is recharged by local rivers and streams such as the Scott and Sheridan Rivers, whenever and wherever their water surface is higher in elevation than the ground-water table. Streamflow records from nearby gaging stations indicate that high discharges occur in late spring and during summer, and low flows occur in late winter. Two factors create the high-flow periods: snowmelt runoff in late spring and high precipitation during the summer. Low-flow periods result from decreased runoff during winter. The hydrograph of Power Creek (fig. 3) shows a representative flow pattern for streams in the Cordova area.

When river discharge increases and flows at a stage higher than the local ground-water table, the river will contribute surface water to the ground-water system, even in reaches where ground water normally discharges to streams. This inflow of water resulting from an increase in river stage will temporarily alter the direction of ground-water flow. During the period when river stage is higher than the ground-water table, shallow ground-water flow will be away from the river. When the river returns to a stage below the ground-water table, usually several days after a flood or high water, shallow ground-water flow will again be towards the river. These aquifer responses associated with variation in streamflow are known as "bank storage effects" (Linsley and others, 1982). The distance to the Scott and Sheridan Rivers probably reduces their effects on ground water at the airport.

The ground-water system that supplies the airport is located in unconsolidated deposits. No extensive confining layers significantly limiting the vertical or horizontal movement of ground water have been identified (McCoy and Freethey, 1978). The lack of confining layers also indicates that the aquifer may be vulnerable to infiltration of contaminants from spills on the land surface. The extent of ground-water and surface-water interaction in the area is unknown because no records of ground-water and surface-water elevations near the airport are available.

DRINKING WATER

Present Drinking-Water Supplies

An undetermined number of wells are located at the airport and an unquantified yield is extracted. According to Ecology and Environment (1992), two wells are presently being used at the FAA facility. A well approximately 49 m deep (well 1, fig. 2) is used to provide water to the FAA facilities and the various private users, including the airline terminals and diner (Darryl Reindl, Federal Aviation Administration, oral commun., 1994). The second well is located north of the Copper River Highway and serves only a shop site.

Water use at the FAA facility in 1987, while serving approximately 35 people, was estimated to be 13,000 L/d or about 370 L/d per person (Darryl Reindl, Federal Aviation Administration, oral commun., 1994). Using the estimated average water consumption for domestic and commercial uses from a self-supplied source in Alaska (Solley and Pierce, 1993) for comparison, 35 people would use an average 19,000 L/d or about 540 L/d per person.

The U.S. Coast Guard (fig.2) uses two wells at their Aviation Support facility (Kenneth Cochrane, U.S. Coast Guard Aviation Support Facility, Cordova, oral commun., 1994). One 60-m deep well serves the hangar where water is used for washing equipment and a second well, 53-m deep, serves the barracks, which has a maximum summertime population of 14 people.

Quality of Present Supply

According to Selkregg (1974), the water in coastal lowland wells generally has lower dissolved mineral content than ground-water sources farther inland in Alaska. Salt-water intrusion may affect coastal lowland wells. A study done at Ocean Cape, which is about 300 km southeast of Cordova, but in a similar coastal setting, indicated that pumping of a well near the Gulf of Alaska at a rate greater than 1.25 L/s caused salt-water intrusion (Feulner and others, 1967).

Water-quality information obtained from FAA well sampling and analyses records indicates that acceptable drinking-water quality is currently present at their facility (Harry Gilmore, Federal Aviation Administration, written commun., 1994). Some sample analyses for the period December 1992 through November 1993 are shown in the appendix.

According to the USGS ground-water site inventory (GWSI), water samples were collected in 1976 from two wells at the airport. Analyses of these water samples indicated that major inorganic constituents were at concentrations that are acceptable for drinking water. A 49-m-deep FAA well drilled in 1967 (well 1, fig. 2) produced water having an iron content of 0.07 mg/L, a silica content of 16 mg/L, and a hardness as $CaCO_3$ of 131 mg/L. A 63-m-deep well owned by the Alaska Department of Highways (well 2, fig. 2), drilled in 1972, produced water having an iron content of 0.34 mg/L, a silica content of 14 mg/L, and a hardness as $CaCO_3$ of 73 mg/L. The iron content is higher than the 0.30 mg/L secondary maximum contaminant level regulations set by the U.S. Environmental Protection Agency (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. A summary describing water resources of the Cordova area and these wells is included in a report by McCoy and Freethey (1978).

Alternative Drinking-Water Sources

Alternative drinking water for the FAA facility may be obtained from rivers in the area, from Cordova's public supply, from new wells, or from local ponds. The Scott and Sheridan Rivers flow near the airport and represent an alternative source of drinking water for the FAA facility. Mean annual flow of the Scott and Sheridan Rivers should be adequate to provide the current estimated water use at the airport. Other possible sources of drinking water are rivers and streams near the airport. One of the largest local sources is the Copper River, which crosses the Copper River Highway near Flag Point approximately 25 km to the east (fig. 1). Water from areas not located near the airport, such as the Copper River or Cordova's public water supply, could be transported by tanker truck or piped to the facility. New wells drilled farther inland and uphill from the airport may provide adequate water. Although no confined aquifers have been identified under the aquifer presently supplying the airport, undiscovered sources of drinking water may exist in bedrock or deep materials underlying the airport. Local ponds and creeks also provide another potential source of drinking water, but because the recharge to these sources is undetermined, an accurate quantity of available water is unknown. Costs associated with development of any alternative drinking water sources would likely be significantly greater than using existing supplies.

Quality of Alternative Sources

Drinking water from glacial drainages such as the Scott, Sheridan, and Copper Rivers would have to be treated to reduce the sediment concentrations. Some treatment of alternative drinking water sources, except transported water from the city of Cordova, would most likely be necessary.

Water-quality samples were obtained from the Copper River at Million Dollar Bridge (fig. 1) from October 1991 to September 1992. Water-sample analyses indicate that the Copper River water had iron concentrations as high as 0.21 mg/L, a silica content ranging from 3.5 to 4.8 mg/L, and a hardness reported as $CaCO_3$ ranging from 58 to 62 mg/L. A sample collected on August 13, 1992 recorded a suspended-sediment concentration of 2,900 mg/L. The sample contained glacial sediments of which 95 percent was finer than 0.062 mm (U.S. Geological Survey, 1993). On the basis of the available water records, the Copper River could be used as a drinking-water source, but sediment extraction and transportation would be required.

SUMMARY

Cordova's location makes it dependent on the airport or the Alaska marine highway for transportation. The location of the Merle K. "Mudhole" Smith Airport near a critical habitat area for shorebirds and waterfowl requires consideration when remediation or further investigation at the site is undertaken. Glacier outburst floods, and (or) high runoff may cause the airport area to become inundated and allow the movement and infiltration of surface contaminants. The Scott, Sheridan, and Copper Rivers, transported water from Cordova, new wells, and local ponds and streams represent alternative drinking water supplies; however, economics may inhibit the development of these sources.

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APPENDIX

Selected ground water-quality data for the FAA well at

Merle K. "Mudhole" Smith Airport Cordova, Alaska

MAR 18 '94 15:11 FROM AAL-420/460

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS ST. ANCHORAGE, ALASKA 99503 907-277-8378

DOT FAA CDV AF
Cordova
PO Box 80
Cordova AK 99584-0800

Attn: Rick Plucker

Report Date: 01/13/93

Date Arrived: 12/31/92
Date Sampled: 12/29/92
Time Sampled: 1030
Collected By: -

MDL = Method Detection Limit

*. Flag Definitions
B = Below Regulatory Min.
H = Above Regulatory Max.

Our Lab #: F121612
Location/Project: -
Your Sample ID: 293103
Sample Matrix: Water
Comments:

Method	Parameter	Units	Results *	MDL	Date Prepared	Date Analyz
EPA 206.2	Arsenic	mg/l	0.003	0.001		01/07/
~~EPA 200.7~~	~~Barium~~	mg/l	<MDL	0.002		~~01/04/~~
EPA 213.2	Cadmium	mg/l	<MDL	0.0001		01/12/
EPA 218.2	Chromium	mg/l	<MDL	0.001		01/04/
EPA 340.2	Fluoride	mg/l	0.27	0.02		01/07/
EPA 239.2	Lead	mg/l	<MDL	0.001		01/05/
EPA 245.1	Mercury	mg/l	<MDL	0.0002		01/12/
EPA 300.0	Nitrate-N	mg/l	<MDL	0.50		01/04/
EPA 270.2	Selenium	mg/l	<MDL	0.002		01/07/
EPA 272.2	Silver	mg/l	<MDL	0.0002		01/04/

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ► 15

To JIM SOKUP From H. GILMORE
Dept./Agency Phone # 271-5280
Fax # 786-7150 Fax #
NSN 7540-01-317 7368 5099-101 GENERAL SERVICES ADMINISTRATION

Reported By: James H. Johnson
Vice President

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 (907) 456-3116 • FAX 456-3125
2505 FAIRBANKS STREET ANCHORAGE, ALASKA 99503 (907) 277-8378 • FAX 274-9645

DOT FAA CDV AF Cordova
P.O. Box 80
Cordova AK 99584-0800

Attn: Rick Plucker

1/2

Report Date: 12/23/92

Date Arrived: 12/10/92
Date Sampled: 12/10/92
Time Sampled: 1030
Collected By: RP

* Definitions *
B = Below Regulatory Min.
H = Above Regulatory Max.
E = Estimated Value
M = Matrix Interference
D = Lost to Dilution
MDL = Method Detection Limit

Our Lab #: A121730
Location/Project: -
Your Sample ID: -
Sample Matrix: Water
Comments: PWS ID #293108.

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analyz
A121730	EPA 502.2	Benzene	ug/l	<MDL		0.2		12/17/
		Bromobenzene	ug/l	<MDL		0.3		
		Bromochloromethane	ug/l	<MDL		0.3		
		Bromodichloromethane	ug/l	4.4		0.2		
		Bromoform	ug/l	3.6		1.0		
		Bromomethane	ug/l	<MDL		2.0		
		n-Butylbenzene	ug/l	<MDL		0.3		
		sec-Butylbenzene	ug/l	<MDL		0.3		
		tert-Butylbenzene	ug/l	<MDL		0.5		
		Carbon Tetrachloride	ug/l	<MDL		0.2		
		Chlorobenzene	ug/l	<MDL		0.2		
		Dibromochloromethane	ug/l	8.6		0.4		
		Chloroethane	ug/l	<MDL		2.0		
		Chloroform	ug/l	2.1		0.2		
		Chloromethane	ug/l	<MDL		2.0		
		o-Chlorotoluene	ug/l	<MDL		0.3		
		p-Chlorotoluene	ug/l	<MDL		0.2		
		1,2-Dibromo-3-Chloropropane	ug/l	<MDL		2.0		
		Dibromomethane	ug/l	<MDL		0.4		
		1,4-Dichlorobenzene	ug/l	<MDL		0.2		
		m-Dichlorobenzene	ug/l	<MDL		0.2		
		o-Dichlorobenzene	ug/l	<MDL		0.2		
		Dichlorodifluoromethane	ug/l	<MDL		2.0		
		1,1-Dichloroethane	ug/l	<MDL		0.2		
		1,2-Dichloroethane	ug/l	<MDL		0.2		
		1,1-Dichloroethylene	ug/l	<MDL		1.0		
		cis-1,2-Dichloroethylene	ug/l	<MDL		0.2		
		trans-1,2-Dichloroethylene	ug/l	<MDL		0.2		
		Methylene Chloride	ug/l	<MDL		1.0		
		1,2-Dichloropropane	ug/l	<MDL		0.2		
		1,3-Dichloropropane	ug/l	<MDL		0.2		

Reported By: William E. Buchan
Organic Chemistry Supervisor

1/7

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS STREET · ANCHORAGE, ALASKA 99503 · (907) 277-8378 • FAX 274-9645

2/2

Lab Number	Method	Parameter	Units	Result	*	MDL	Date Prepared	Date Analy:
A121730	EPA 502.2	2,2-Dichloropropane	ug/l	<MDL		1.0		12/17,
		1,1-Dichloropropene	ug/l	<MDL		0.5		
		1,3-Dichloropropene	ug/l	<MDL		0.2		
		Ethylbenzene	ug/l	<MDL		0.2		
		1,2-Dibromoethane	ug/l	<MDL		1.0		
		Fluorotrichloromethane	ug/l	<MDL		0.5		
		Hexachlorobutadiene	ug/l	<MDL		0.3		
		Isopropylbenzene	ug/l	<MDL		0.3		
		p-Isopropyltoluene	ug/l	<MDL		0.3		
		Naphthalene	ug/l	<MDL		0.3		
		n-Propylbenzene	ug/l	<MDL		0.3		
		Styrene	ug/l	<MDL		0.2		
		1,1,1,2-Tetrachloroethane	ug/l	<MDL		0.2		
		1,1,2,2-Tetrachloroethane	ug/l	<MDL		0.3		
		Tetrachloroethylene	ug/l	<MDL		0.2		
		Total Trihalomethane	ug/l	19		2.0		
		Toluene	ug/l	<MDL		0.3		
		1,2,3-Trichlorobenzene	ug/l	<MDL		0.3		
		1,2,4-Trichlorobenzene	ug/l	<MDL		0.3		
		1,1,1-Trichloroethane	ug/l	<MDL		0.2		
		1,1,2-Trichloroethane	ug/l	<MDL		0.4		
		Trichloroethylene	ug/l	<MDL		0.2		
		1,2,3-Trichloropropane	ug/l	<MDL		0.3		
		1,2,4-Trimethylbenzene	ug/l	<MDL		0.2		
		1,3,5-Trimethylbenzene	ug/l	<MDL		0.2		
		Vinyl Chloride	ug/l	<MDL		2.0		
		m,p-Xylenes	ug/l	<MDL		0.4		
		o-Xylene	ug/l	<MDL		0.2		
		Surrogate Spike (Recovery)	%	104				

Reported By: William E. Buchan
Organic Chemistry Supervisor

NORTHERN TESTING LABORATORIES, INC.
3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 907-456-3116
2505 FAIRBANKS STREET ANCHORAGE, ALASKA 99503 907-277-8378

Drinking Water Analysis Report for Total Coliform Bacteria

TO BE COMPLETED BY CLIENT

☑ PUBLIC WATER SYSTEM I.D. # [ ]

☐ PRIVATE WATER SYSTEM

FAA #1
NAME

Mailing Address P.O. Box 80

City Cordova State AK Zip Code 99574

SAMPLE DATE: 1 (Mo.) 4 (Day) 93 (Year) Phone 424-7110

Purchase Order No. ______

SAMPLE TYPE:

☒ Routine ☑ Treated Water

☐ Special Purpose ☐ Untreated Water

☐ Check Sample (for original contaminated sample with lab reference no. ______)

Sample No.	Location	Time Collected	Collected by	Laboratory Ref. No.	Direct Count	Verification LSB	Verification BGB	Final Result*	Com
1	FSS	11:45A	RFD	AA13816	0		—	0	S
2									
3									
4									
5									
6									
7									
8									
9									
10									

Signature of Representative [signature]

TO BE COMPLETED BY LABORATORY

Received at: ☒ Anch. ☐ Fbks.

Date Received 1·5·93

Time Received 0830

Next Sample Due 2/93

COMMENTS:

SATISFACTORY S

UNSATISFACTORY U

RESAMPLE R

OTHER BACTERIA OB

TOO NUMEROUS TO COUNT TNTC

1·6·93 @1615 MF

*No. of Total Coliform Colonies pe[r]

[signature]
Reported by

1·6·93 1600
Date

FOR LABORATORY USE ONLY					
CASH	CHARGE	PREPAID	TRANSMITTAL	SPECIAL INSTRUCTIONS	MAIL / HOLD FOR PICKUP

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 (907) 456-3116 • FAX 456-3125
2505 FAIRBANKS STREET ANCHORAGE, ALASKA 99503 (907) 277-8378 • FAX 274-9645

DRINKING WATER ANALYSIS REPORT FOR TOTAL COLIFORM BACTERIA

DOT, FAA, CDV AF
P.O. Box 80
Cordova AK 99584-0800

Public Water System I.D.# 293108

Date Received: 07/06/93 Time Received: 17:00
Date Analyzed: 07/07/93 Time Analyzed: 19:00
Date Reported: 07/14/93 Time Reported: 14:56
Next Sample Due: 8/93

Collected by: R. Plucker
Sample Type:
Routine Treated

Method of Analysis:
Membrane Filtration

Comments:

Comments:
- S = Satisfactory
- U = Unsatisfactory
- POS = Positive Test Result
- ND = None Detected
- TNTC = Too Numerous To Count (>200 Colonies)
- CG = Confluent Growth
- HSM = Heavy Sediment Masking, Results May Not Be Reliable
- SA = Sample Age >30 Hours But <48 Hours, Results May Not Be Reliable
- Old = Sample Age >48 Hours, Too Old For Analysis
- R = Resample Required
- NT = No Test

* # Colonies/100 ml ** # Colonies/ml

Location	Sample Date	Sample Time	Lab#	Total* Coliform	Fecal* Coliform	Other* Bacteria	HPC** Result	Comments
1 WSM	07/06/93	10:10	AB1697	0	NT	0	NT	S

Susan C.Tifental
Microbiology Supervisor

MAR 18 '94 15:13 FROM AAL-420/460

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 456-3125
(907) 277-8378 • FAX 274-9645

DRINKING WATER ANALYSIS REPORT FOR TOTAL COLIFORM BACTERIA

DOT, FAA, CDV AF
P.O. Box 80
Cordova AK 99584-0800

Public Water System I.D.# 293108

Date Received: 09/08/93 Time Received: 08:00
Date Analyzed: 09/08/93 Time Analyzed: 17:00
Date Reported: 09/16/93 Time Reported: 08:38
Next Sample Due: 10/93

Collected by: RBP
Sample Type:
Routine Treated

Method of Analysis:
Membrane Filtration

Comments:

Comments:
S = Satisfactory
U = Unsatisfactory
POS = Positive Test Result
ND = None Detected
TNTC = Too Numerous To Count (>200 Colonies)
CG = Confluent Growth
HSM = Heavy Sediment Masking, Results May Not Be Reliable
SA = Sample Age >30 Hours But <48 Hours, Results May Not Be Reliable
Old = Sample Age >48 Hours, Too Old For Analysis
R = Resample Required
NT = No Test

* # Colonies/100 ml ** # Colonies/ml

Location	Sample Date	Sample Time	Lab#	Total* Coliform	Fecal* Coliform	Other* Bacteria	HPC** Result	Comments
1 FSS 700	09/07/93	09:00	AB1705	0	NT	0	NT	S

Susan C.Tifental
Microbiology Supervisor

MAR 18 '94 15:13 FROM AAL-420/460

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE
2505 FAIRBANKS STREET

FAIRBANKS, ALASKA 99701
ANCHORAGE, ALASKA 99503

(907) 456-3116 • FAX 455-3125
(907) 277-8378 • FAX 274-9645

DRINKING WATER ANALYSIS REPORT FOR TOTAL COLIFORM BACTERIA

DOT, FAA, CDV AF
P.O. Box 80
Cordova AK 99584-0800

Public Water System I.D.# 293108

Date Received: 10/14/93 Time Received: 08:00
Date Analyzed: 10/14/93 Time Analyzed: 17:00
Date Reported: 10/18/93 Time Reported: 13:25
Next Sample Due: 11/93

Comments:
- S = Satisfactory
- U = Unsatisfactory
- POS = Positive Test Result
- ND = None Detected
- TNTC = Too Numerous To Count (>200 Colonies)
- CG = Confluent Growth
- HSM = Heavy Sediment Masking, Results May Not Be Reliable
- SA = Sample Age >30 Hours But <48 Hours, Results May Not Be Reliable
- Old = Sample Age >48 Hours, Too Old For Analysis
- R = Resample Required
- NT = No Test

Collected by: RP

Sample Type:
Routine

Method of Analysis:
Membrane Filtration

Comments:

* # Colonies/100 ml ** # Colonies/ml

Location	Sample Date	Sample Time	Lab#	Total* Coliform	Fecal* Coliform	Other* Bacteria	HPC** Result	Comments
1 FSS	10/13/93	09:05	A81692	0	NT	0	NT	S

Susan C. Tifental
Microbiology Supervisor

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 (907) 456-3116 • FAX 456-3125
2505 FAIRBANKS STREET ANCHORAGE, ALASKA 99503 (907) 277-8378 • FAX 274-9645

DRINKING WATER ANALYSIS REPORT FOR TOTAL COLIFORM BACTERIA

DOT, FAA, CDV AF
P.O. Box 80
Cordova AK 99584-0800

Public Water System I.D.# 293108

Date Received: 11/02/93 Time Received: 09:00
Date Analyzed: 11/02/93 Time Analyzed: 16:30
Date Reported: 11/08/93 Time Reported: 16:15
Next Sample Due:

Comments:
- S = Satisfactory
- U = Unsatisfactory
- POS = Positive Test Result
- ND = None Detected
- TNTC = Too Numerous To Count (>200 Colonies)
- CG = Confluent Growth
- HSM = Heavy Sediment Masking, Results May Not Be Reliable
- SA = Sample Age >30 Hours But <48 Hours, Results May Not Be Reliable
- Old = Sample Age >48 Hours, Too Old For Analysis
- R = Resample Required
- NT = No Test

Collected by: RP
Sample Type:
Routine

Method of Analysis:
Membrane Filtration

Comments:

* # Colonies/100 ml ** # Colonies/ml

Location	Sample Date	Sample Time	Lab#	Total* Coliform	Fecal* Coliform	Other* Bacteria	HPC** Result	Comments
1 FSS	11/01/93	09:00	ab1288	0	NT	0	NT	S

Susan C.Tifental
Microbiology Supervisor

MAR 18 '94 15:15 FROM AAL-420/460

NORTHERN TESTING LABORATORIES, INC.

3330 INDUSTRIAL AVENUE FAIRBANKS, ALASKA 99701 (907) 456-3116 • FAX 456-3125
2505 FAIRBANKS STREET ANCHORAGE, ALASKA 99503 (907) 277-8378 • FAX 274-9645

DRINKING WATER ANALYSIS REPORT FOR TOTAL COLIFORM BACTERIA

DOT, FAA, CDV AF
P.O. Box 80
Cordova AK 99584-0800

Public Water System I.D.# 293108

Date Received: 01/06/94 Time Received: 08:00
Date Analyzed: 01/06/94 Time Analyzed: 14:00
Date Reported: 01/10/94 Time Reported: 15:25
Next Sample Due: 2/94

Comments:
- S = Satisfactory
- U = Unsatisfactory
- POS = Positive Test Result
- ND = None Detected
- TNTC = Too Numerous To Count (>200 Colonies)
- CG = Confluent Growth
- HSM = Heavy Sediment Masking, Results May Not Be Reliable
- SA = Sample Age >30 Hours But <48 Hours, Results May Not Be Reliable
- Old = Sample Age >48 Hours, Too Old For Analysis
- R = Resample Required
- NT = No Test

Collected by: R Plucker
Sample Type:
Routine Treated

Method of Analysis:
MMO-MUG (Colilert)

Comments:

* # Colonies/100 ml ** # Colonies/ml

Location	Sample Date	Sample Time	Lab#	Total* Coliform	Fecal* Coliform	Other* Bacteria	HPC** Result	Comments
1 FSS	01/05/94	10:40	AB1700	ND	ND	ND	NT	S

Julie Schaefer
Environmental Analyst

COMMERCIAL TESTING & ENGINEERING CO.

ENVIRONMENTAL LABORATORY SERVICES

SINCE 1908

REPORT of ANALYSIS

5633 B STREET
ANCHORAGE, AK 99518
TEL: (907) 562-2343
FAX: (907) 561-5301

Chemlab Ref.# :93.4466-1
Client Sample ID :C-1 FAA STACK QUARTERS 107-1
Matrix :WATER

Client Name :HARDING LAWSON & ASSOC
Ordered By :KERRY SLATTERY
Project Name :
Project# :
PWSID :UA

WORK Order :70374
Report Completed :09/10/93
Collected :08/26/93 @ 14:10 hrs.
Received :08/30/93 @ 11:50 hrs.
Technical Director:STEPHEN C. EDE
Released By :

Sample Remarks: SAMPLE COLLECTED BY: KERRY A. SLATTERY. JOB #25504 TASK 1, CORDOVA. TAG MARKED LOCATION AS KITCHEN FAUCET FIRST DRAW, SAMPLING WITNESSED BY JOHANN BRUNS.

Parameter	Results	QC Qual	Units	Method	Allowable Limits	Ext. Date	Anal Date	Init
Copper & Lead				EPA	n/a			
Copper	0.05	U	mg/L	EPA 200.7 ICP	1.3 max	09/03	09/06	DLG
Lead	0.0050	U	mg/L	EPA 239.2 GF	0.015 max	09/02	09/03	KAW

* See Special Instructions Above
** See Sample Remarks Above
U = Undetected, Reported value is the practical quantification limit.
D = Secondary dilution.

UA = Unavailable
NA = Not Analyzed
LT = Less Than
GT = Greater Than

COMMERCIAL TESTING & ENGINEERING CO.
ENVIRONMENTAL LABORATORY SERVICES
SINCE 1908

REPORT OF ANALYSIS

5633 B STREET
ANCHORAGE, AK 99518
TEL: (907) 562-2343
FAX: (907) 561-5301

Chemlab Ref.# :93.4466-2
Client Sample ID :C-2 FAA HOUSE 102
Matrix :WATER

Client Name :HARDING LAWSON & ASSOC
Ordered By :KERRY SLATTERY
Project Name :
Project# :
PWSID :UA

WORK Order :70374
Report Completed :09/10/93
Collected :08/26/93 @ 14:15 hrs.
Received :08/30/93 @ 11:50 hrs.
Technical Director:STEPHEN C. EDE
Released By :

Sample Remarks: SAMPLE COLLECTED BY: KERRY A. SLATTERY. JOB #25504 TASK 1 CORDOVA. TAG MARKED LOCATION AS KITCHEN FAUCET FIRST DRAW, SAMPLING WITNESSED BY JOHANN BRUNS.

Parameter	Results	QC Qual	Units	Method	Allowable Limits	Ext. Date	Anal Date	Init
Copper & Lead				EPA	n/a			
Copper	0.05	U	mg/L	EPA 200.7 ICP	1.3 max	09/03	09/06	DLG
Lead	0.005	U	mg/L	EPA 239.2 GF	0.015 max	09/02	09/03	KAW

* See Special Instructions Above
** See Sample Remarks Above
U = Undetected, Reported value is the practical quantification limit.
D = Secondary dilution.

UA = Unavailable
NA = Not Analyzed
LT = Less Than
GT = Greater Than

MAR 18 '94 15:16 FROM AAL-420/460

COMMERCIAL TESTING & ENGINEERING CO.

ENVIRONMENTAL LABORATORY SERVICES

SINCE 1908

REPORT of ANALYSIS

Chemlab Ref.# :93.4466-3
Client Sample ID :C-3 CFR BLDG, BACK LEFT APT.
Matrix :WATER

5633 B STREET
ANCHORAGE, AK 99518
TEL: (907) 562-2343
FAX: (907) 561-5301

Client Name	:HARDING LAWSON & ASSOC	WORK Order	:70374
Ordered By	:KERRY SLATTERY	Report Completed	:09/10/93
Project Name	:	Collected	:08/26/93 @ 14:25 hrs.
Project#	:	Received	:08/30/93 @ 11:50 hrs.
PWSID	:UA	Technical Director	:STEPHEN C. EDE
		Released By	:

Sample Remarks: SAMPLE COLLECTED BY: KERRY A. SLATTERY. JOB #25504 TASK 1 / CORDOVA. TAG MARKED LOCATION AS KITCHEN FAUCET FIRST DRAW, SAMPLING WITNESSED BY JOHANN BRUNS.

Parameter	Results	QC Qual	Units	Method	Allowable Limits	Ext. Date	Anal Date	Init
Copper & Lead				EPA	n/a			
Copper	0.05	U	mg/L	EPA 200.7 ICP	1.3 max	09/03	09/06	DLG
Lead	0.0073		mg/L	EPA 239.2 GF	0.015 max	09/03	09/08	KAW

* See Special Instructions Above
** See Sample Remarks Above
U = Undetected, Reported value is the practical quantification limit.
D = Secondary dilution.

UA = Unavailable
NA = Not Analyzed
LT = Less Than
GT = Greater Than

MAR 18 '94 15:16 FROM AAL-420/460

COMMERCIAL TESTING & ENGINEERING CO.

ENVIRONMENTAL LABORATORY SERVICES

SINCE 1908

REPORT of ANALYSIS

5633 B STREET
ANCHORAGE, AK 99518
TEL: (907) 562-2343
FAX: (907) 561-5301

Chemlab Ref.# :93.4466-4
Client Sample ID :C-5 ALASKA AIR TERMINAL
Matrix :WATER

Client Name :HARDING LAWSON & ASSOC
Ordered By :KERRY SLATTERY
Project Name :
Project# :
PWSID :UA

WORK Order :70374
Report Completed :09/10/93
Collected :08/27/93 @ 09:00 hrs.
Received :08/30/93 @ 11:50 hrs.
Technical Director:STEPHEN C. EDE
Released By :

Sample Remarks: SAMPLE COLLECTED BY: KERRY A. SLATTERY. JOB #25504 TASK 1 CORDOVA. TAG MARKED LOCATION AS KITCHEN FAUCET FIRST DRAW, SAMPLING WITNESSED BY JOHANN BRUNS, COLLECTION TIME AS 0950 HRS.

Parameter	Results	QC Qual	Units	Method	Allowable Limits	Ext. Date	Anal Date	Init
Copper & Lead				EPA	n/a			
Copper	0.05	U	mg/L	EPA 200.7 ICP	1.3 max	09/03	09/06	DLG
Lead	0.0050	U	mg/L	EPA 239.2 GF	0.015 max	09/03	09/08	KAW

* See Special Instructions Above
** See Sample Remarks Above
U = Undetected, Reported value is the practical quantification limit.
D = Secondary dilution.

UA = Unavailable
NA = Not Analyzed
LT = Less Than
GT = Greater Than