Overview of Environmental and Hydrogeologic Conditions on Hinchinbrook Island, Alaska

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U.S. GEOLOGICAL SURVEY

Open-File Report 95-176

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

Anchorage, Alaska
1995

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CONVERSION FACTORS AND VERTICAL DATUM

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
liter per minute (L/min)	0.2642	gallon per minute
cubic meter per second per square kilometer [$(m^3/s)/km^2$]	91.49	cubic foot per second per square mile
degree Celsius (^oC)	$^oF = 1.8 \times {}^oC + 32$	degree Fahrenheit (^oF)

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.

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Abstract

Hinchinbrook Island is a large island in southcentral Alaska between the Gulf of Alaska and Prince William Sound. The Federal Aviation Administration operates air navigation support facilities on the northern and northeastern shores of Hinchinbrook Island. Disposal of hazardous materials, fuel spills, and other accidental releases of hazardous substances may affect the quality of local surface- and ground-water resources. The Federal Aviation Administration is considering the environmental and hydrogeologic conditions near these facilities when they evaluate options for remediation that may be required to comply with environmental regulations. The island generally has organic-rich soils developed primarily on till that overlies sedimentary and volcanic bedrock. The maritime climate of the region provides mild conditions with a mean annual temperature of about 5 °C. Dense stands of Sitka spruce and western hemlock on the island are interspersed with areas of treeless bog. Drinking water is provided by rain catchments or is transported to the island for a small number of users. Alternative sources of drinking water may be available from shallow ground-water wells or local surface-water bodies. However, no site-specific information is available concerning the quality or quantity of these potential sources.

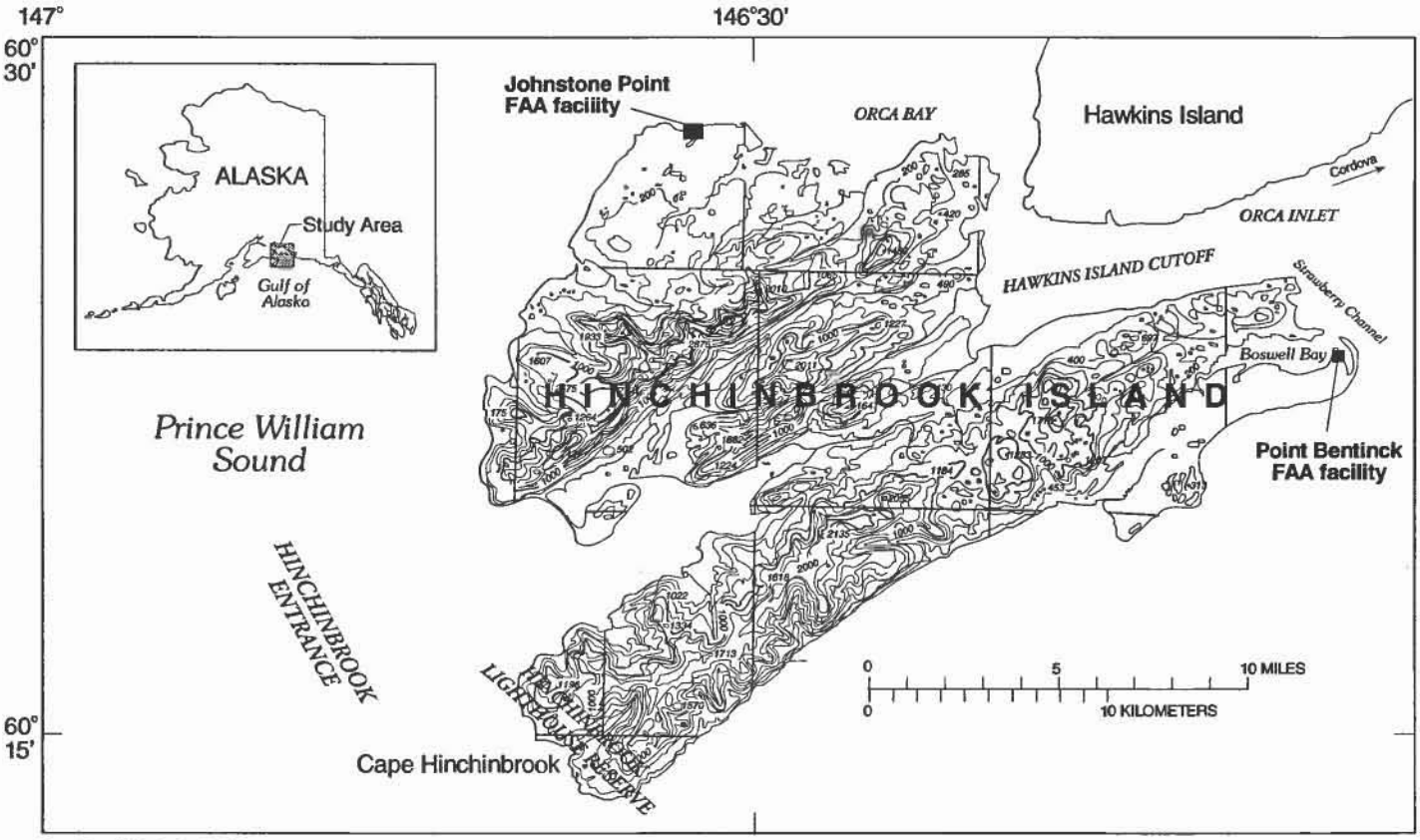
INTRODUCTION

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 and the Resource Conservation and Recovery Act. To assist with completing these more comprehensive environmental studies, the FAA requires information on the hydrology and geology of areas surrounding the sites. This report, the product of compilation, review, and summary of existing hydrologic and geologic data by the U.S. Geological Survey (USGS), in cooperation with the FAA, provides such information for the Point Bentinck and Johnstone Point FAA facilities and nearby areas on Hinchinbrook Island, Alaska. Also presented in this report is a description of the history and physical setting of the Hinchinbrook Island area.

BACKGROUND

Location

Hinchinbrook Island is a large island about 20 km long and 15 km wide at the entrance to Prince William Sound (fig. 1). Two FAA facilities on the island provide navigational aids to aircraft: the Point Bentinck facility, along the northeast shore of the island, is approximately 24 km southwest of Cordova, and the Johnstone Point facility, along the northern shore of the island, is approximately 45 km southwest of Cordova. The approximate coordinates for the Point Bentinck facility are lat 60°24' N. and long 146°06' W.; for the Johnstone Point facility, approximate coordinates are lat 60°28' N. and long 146°34' W.



Base from U.S. Geological Survey, Cordova, Alaska, 1959

Figure 1. Location of Hinchinbrook Island, Alaska, and Federal Aviation Administration facilities.

History and Facility Descriptions

The Point Bentinck FAA facility (fig. 2) was established in December 1946 and the Johnstone Point facility (fig. 3) was established in 1964 (Ecology and Environment, 1992a, b). The FAA facility at Point Bentinck includes navigation equipment, a small aircraft runway, and numerous support structures. The Johnstone Point FAA facility includes a small aircraft runway, several support structures, and air navigation equipment. A detailed description of both the Point Bentinck and Johnstone Point FAA facilities and an investigation of potential sources of contamination are included in reports by Ecology and Environment (1992a, b).

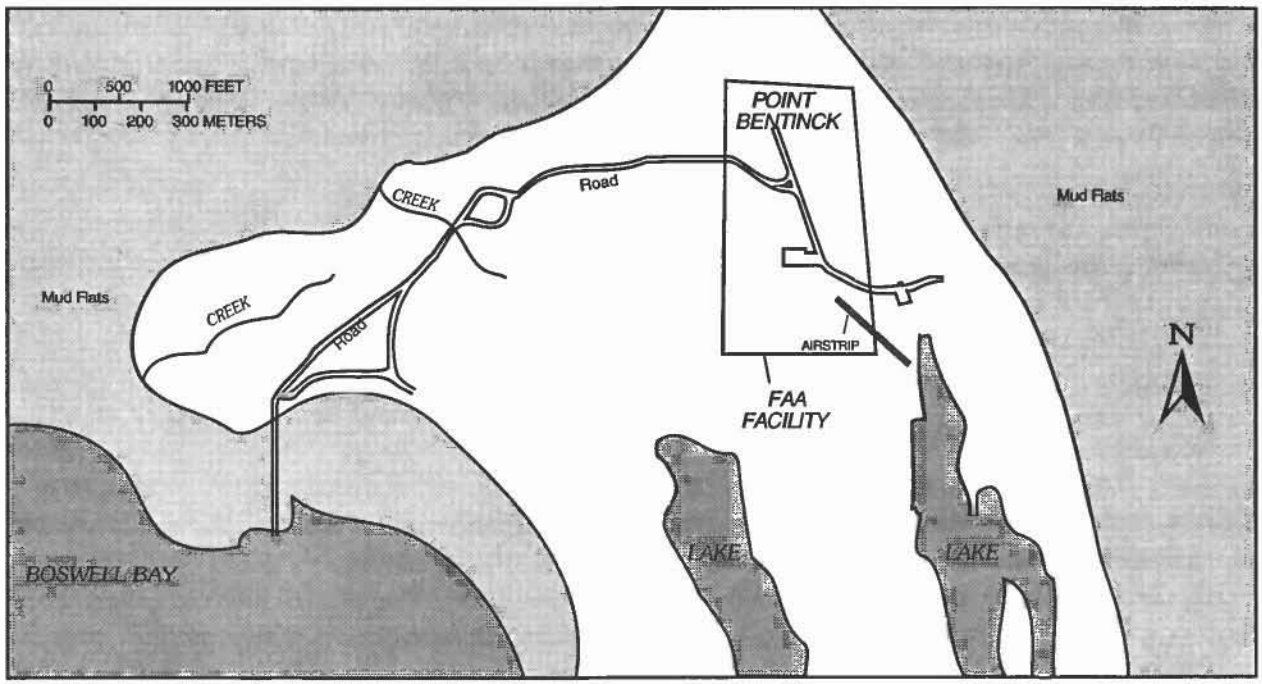


Figure 2. Location of Point Bentinck Federal Aviation Administration facility. [Modified from Ecology and Environment, 1992a.]

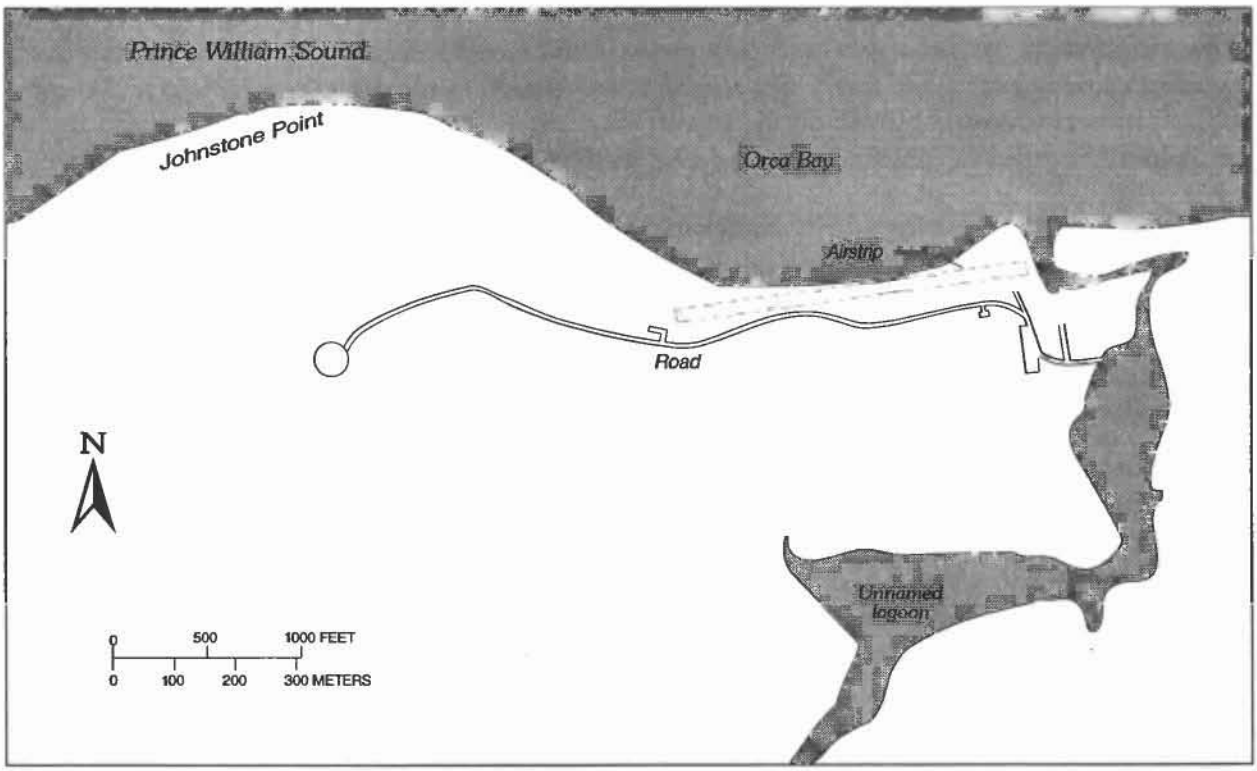


Figure 3. Location of Johnstone Point Federal Aviation Administration facility. [Modified from Ecology and Environment, 1992b.]

Most of the island is uninhabited. Ecology and Environment (1992a, b) reported that a single resident lives on the northern end of the island. Seasonal use of the island consists mainly of sport hunting and fishing. In addition to the FAA, the U.S. Coast Guard provides navigation aids to boats at the Hinchinbrook Lighthouse Reserve site, on the southwestern edge of the island (fig. 1)

Access to the island is primarily by float plane or small aircraft using the unimproved airstrips around the island. In addition to the landing strips, air access is also provided by a helipad at the Hinchinbrook Lighthouse Reserve site. The only other year-round means of access to the island is by boat.

PHYSICAL SETTING

Climate

Hinchinbrook Island has a moist maritime climate (Hartman and Johnson, 1984). High precipitation, high humidity, fog, mild temperatures, and low clouds are typical both in winter and in summer. The Point Bentinck and Johnstone Point sites do not have records of their weather; however, weather data are available for Cape Hinchinbrook, which is on the southwestern end of the island near the Hinchinbrook Lighthouse Reserve (fig. 1).

Records for temperature and precipitation are available from 1944-74 for Cape Hinchinbrook (table 1) (Leslie, 1989). These weather records indicate a mean annual temperature of about 5 °C, a mean maximum temperature in July and August of about 15 °C, and the mean minimum temperature, which occurs in January, of about -3 °C (Leslie, 1989). The annual precipitation at Cape Hinchinbrook is about 2,355 mm, and most rainfall occurs in September and October. Annual snowfall is about 2,530 mm and the greatest amount falls in January.

Vegetation

Viereck and Little (1972) describe the vegetation on Hinchinbrook Island as coastal spruce-hemlock forest. This forest type is common throughout south-central coastal and southeastern Alaska and consists of dense stands of Sitka spruce and western hemlock interspersed with open treeless bogs (Viereck and Little, 1972). Eck (1983) characterized the forest vegetation and deer forage on Hinchinbrook Island and provided information on specific species of trees, shrubs, flowering plants, and grasses across the islands of Prince William Sound.

At Johnstone Point, bog and muskeg compose approximately 80 percent of the ground cover, Sitka spruce covers approximately 15 percent, and the other 5 percent is open. Sitka spruce grows on the well-drained upland areas, and the wet muskeg and bog areas are closer to the coast. Grasses are the predominant vegetation in the coastal areas near Point Bentinck. Farther inland from the FAA facilities, sedges and shrubs begin to dominate. To the south of the facilities, parallel to the present coast, are stands of Sitka spruce that grow on the well-drained, raised beach margins. Shrubs that grow in this environment are willow, dwarf arctic birch, Labrador tea, lingonberry, shrubby cinquefoil, and bog cranberry (Eck, 1983; Selkregg, 1976). Grasses and other plants that grow in this environment include lyme grass, pendant grass, cotton grass, bur reed, mare's tail, rushes, sedges, mosses, liverworts, lichens, mushrooms, and other fungi (Eck, 1983; Selkregg, 1976).

Table 1. Mean monthly temperature, precipitation, and snowfall for the period 1944-74, Cape Hinchinbrook, Alaska
[Modified from Leslie (1989); °C, degree Celsius; mm, millimeter]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature (°C)													
Mean maximum	0.8	1.8	2.3	5.3	8.7	12.8	14.8	14.8	12.2	7.7	4.2	1.8	7.3
(Record maximum 27.2 °C, June and July 1963)													
Mean minimum	-2.9	-2.0	-1.8	0.7	4.0	7.5	10.2	10.6	8.1	3.7	0.5	-1.9	3.1
(Record minimum -26.1 °C, March 1963)													
Mean	-1.1	0.0	0.2	3.1	6.3	10.2	12.5	12.7	10.2	5.7	2.3	-0.1	5.2
Precipitation (mm of moisture)	164.6	157.5	140.7	143.5	163.6	115.3	184.2	238.3	325.6	307.8	200.4	213.1	2355
Snowfall (mm)	556.3	406.4	508.0	208.3	22.9	0.0	0.0	0.0	0.0	83.8	271.8	467.4	2527.3

Geology

The geology of Hinchinbrook Island was described by Beikman (1974), Condon (1965), and Winkler (1973). Bedrock on the island primarily consists of metamorphosed sedimentary and volcanic rocks of Tertiary age (Beikman, 1974; Winkler, 1973). Sedimentary rocks compose two parallel mountain ranges and part of a third that trend from the southwest to the northeast across the island (fig. 1). These sedimentary rocks are chiefly sandstone and siltstone (Winkler, 1973). The harder sandstone units form the ridges, cliffs, and headlands. The siltstone units form the slopes, valleys, and wave-cut platforms. The cliffs and pillars visible near Johnstone Point primarily are composed of sandstone (Winkler, 1973). Limited exposures of volcanic rock also are present near the airstrip at Johnstone Point (Winkler, 1973).

Volcanic rocks predominate in the central portion and the northeastern corner of Hinchinbrook Island (Winkler, 1973). These rocks primarily are altered basalt with subordinate sandstones and siltstones and some minor lenticular clasts of limestone and chert. Areas of volcanic bedrock commonly form rounded hummocky slopes with numerous lake-filled depressions.

Surficial deposits of Quaternary age overlie most of the bedrock on Hinchinbrook Island. These deposits consist of till, beach sands, and alluvium (Winkler, 1973). Till dominates the Johnstone Point area, whereas beach and alluvial deposits dominate the Point Bentinck area. Rieger and others (1979) provide a description of soil types on Hinchinbrook Island. Soils on the island are characterized by a thin layer of well-drained, organic matter that overlies till. In the broad valleys and gently sloping foothills, the soils are poorly drained and relatively thick. These soils are characterized by thick deposits of partially decomposed sedge peat (Rieger and others, 1979). To the west of the Point Bentinck facility, the soils are poorly drained. Along the beach area to the east, the soils are well drained and consist of thin lenses of loam over beach sands. Near the Johnstone Point facility, the soils are formed on a gentle slope overlying till. These soils are poorly drained and mantled by a thick organic mat of decomposed vegetation.

HYDROLOGY

Surface Water

Hinchinbrook Island is surrounded by Prince William Sound on the north, the Gulf of Alaska on the south, Hinchinbrook Entrance on the west, and Hawkins Island Cutoff and Strawberry Channel on the east (fig. 1). Surface-water-drainage patterns in the central part of the island are a result of the northeast-southwest-trending hills that form a broad linear valley draining into Hinchinbrook Entrance on the west and Hawkins Island Cutoff on the east. Many small streams drain the steep, hilly perimeter of the island. Streamflow on the island is derived from rainfall runoff and snowmelt. The nearest gaging station having long-term streamflow records is Power Creek near Cordova, which drains an area of about 53 km^2. Mean annual runoff for Power Creek is about 0.14 (m^3/s) /km^2 (U.S. Geological Survey, 1994). Runoff on Hinchinbrook Island may be similar; however, weather records indicate an approximately 2,050 mm decrease in mean annual precipitation between Cape Hinchinbrook and Cordova (Leslie, 1989). Jones and Fahl (1994) also report a significant decrease in mean annual precipitation across Prince William Sound towards Hinchinbrook Island from Cordova.

The northern tip of the island near the FAA facility at Johnstone Point is about 8 km northwest from the closest hills. The facility is at an elevation of about 15 m, and the hills are about 800 to 900 m higher. Surface water drains from these hills toward the northeast and northwest into Prince William Sound and does not reach the FAA facility. Numerous small lakes between the hills and the tip of the island store some of the surface runoff, thereby attenuating streamflow response to storms.

The Point Bentinck FAA facility is on an abandoned beach ridge about 15 m in elevation. The facility is more than 15 km from the nearest hills, which are higher than 500 m in elevation. Extensive wetlands near the facility preclude accurate definition of the local surface-water drainage. Major streams in the area drain into Boswell Bay north of the airstrip, and smaller streams—not visible on maps of the area but identified by Ecology and Environment (1992a)—also are north of the facility.

Ground Water

Ground water is not currently being used to supply drinking water at either FAA facility on the island (Ecology and Environment, 1992a, b). No information for ground-water wells on Hinchinbrook Island was found in a search of the Ground Water Site Inventory files at the USGS. However, Ecology and Environment (1992a) reports the existence of an abandoned well near the Point Bentinck facility, and Ecology and Environment (1992b) reports two wells, which are about 7 m and 27 m deep, near the Johnstone Point facility. Only the shallower well is currently being used, and it supplies only nonpotable water (Ecology and Environment, 1992b). In September 1990, the depth to water in these two wells was between 2.4 and 3.4 m below land surface (Ecology and Environment, 1992b).

The water table near both FAA facilities most likely is shallow and close to sea level. Till that predominates over the island likely is less permeable than the beach sands and alluvium near the Point Bentinck facility. Because information on aquifer characteristics and depth to the ground water is not available, it is difficult to determine the susceptibility of shallow ground water to contamination. In areas such as Hinchinbrook Island that lack information on ground-water flow, most hydrologists assume that ground water flows in the direction of the topographic gradients. In most areas of the Chugach Mountains in southcentral Alaska, small quantities of ground water—up to 10 L/min—are commonly available from wells drilled into fractured bedrock (Gordon L. Nelson, U.S. Geological Survey, oral commun., 1995). There is no reason to believe that this would not also be the case in upland areas on Hinchinbrook Island.

PRESENT DRINKING-WATER SUPPLY AND ALTERNATIVES

No public water-supply system exists on Hinchinbrook Island, and drinking water is provided by transporting it to the island or by rain catchments at both FAA facilities and local residences (Ecology and Environment, 1992a; 1992b). Alternative drinking-water sources may be available from shallow wells away from contaminated areas or from nearby surface-water bodies. However, no facilities are in place to use surface-water sources and no information is available concerning the quality of these potential alternative drinking-water sources.

SUMMARY

Hinchinbrook Island's remote location between the Gulf of Alaska and Prince William Sound makes it dependent on small aircraft and boats for access. The maritime climate of this southcentral Alaskan coastal area is mild and humid—an environment in which rainfall runoff and snowmelt determine the hydrologic characteristics of the area. Surface-water drainage is influenced by the northeast-southwest-trending hills, by the broad valley through the center of the island, and by the steep, hilly perimeter. Shallow ground water on the island may be present in bedrock, till, alluvium, and beach deposits. Drinking water for the FAA facilities and local residents is provided by rain catchments or is transported to the island. Other sources of drinking water may be available from undiscovered aquifers or surface-water sources; however, no information about the quality of these sources is available, and no facilities are in place to use surface water as a drinking-water supply.

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