GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO

U. S. GEOLOGICAL SURVEY

Water-Resources Investigations 79-14
Open-File Report

Prepared in cooperation

with the

Idaho Department of Water Resources

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By

Harold R. Seitz and R. F. Norvitch

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March 3, 1849

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February 1979

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UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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PREFACE

This report is written in the "STOP" format. STOP (Sequential Thematic Organization of Publications) is a writing format that presents a report in a series of independent, two-page units. The left page contains a brief, descriptive text; the right consists of graphic information that illustrates the text. The essence of the text is contained in the thematic heading and thesis statement, similar to a newsstory. The main body of the text contains supportive material and explanation. The accompanying table or illustration substantiates or supplements the text.

The STOP format permits quick review and helps the reader to understand the meaning of the section after reading only the thematic heading and thesis sentence.

CONTENTS

CONVERSION FACTORS

For the convenience of those who prefer to use International System (SI) units rather than the inch-pound system, the conversion factors for terms used in this report are listed below. Chemical data for concentrations are given only in milligrams per liter (mg/L) or micrograms per liter (µg/L). (One microgram equals 1,000 milligrams.) These values are (within the range of values presented) numerically equal to values expressed in parts per million, or parts per billion, respectively. Specific conductance is expressed as µmhos/cm (micromhos per centimeter at 25 degrees Celsius).

Multiply inch-pound unit	By	To obtain SI unit
	Length	
inch (in)	25.4	millimeter (mm)
foot (ft)	.3048	meter (m)
mile (m)	1.609	kilometer (km)
	Area	
square mile (m^2)	2.590	square kilometer (km^2)
	Flow	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Mass Per Unit Volume	
ton per acre-foot (ton/acre-ft)	0.823593	kilogram per cubic meter (kg/m^3)

Temperature-Conversion Table

Conversion of degrees Celsius (°C) to degrees Fahrenheit (°F) is based on the equation, °F = (1.8)(°C) + 32. Temperatures in °F are rounded to the nearest degree. Underscored equivalent temperatures are exact equivalents.

°C	°F	°C	°F	°C	°F
0	32	9	48	18	64
1	34	10	50	19	66
2	36	11	52	20	68
3	37	12	54	21	70
4	39	13	55	22	72
5	41	14	57	23	73
6	43	15	59	24	75
7	45	16	61	25	77
8	46	17	63		

U.S. GEOLOGICAL SURVEY WELL-NUMBERING SYSTEM

The well-numbering system used by the Geological Survey in Idaho indicates the location of wells within the official rectangular subdivision of the public lands, with reference to the Boise base line and meridian. The first two segments of the number designate the township and range. The third segment gives the section number, followed by three letters and a numeral, which indicate the quarter section, the 40-acre tract, the 10-acre tract, and the serial number of the well within the tract, respectively. Quarter sections are lettered A, B, C, and D in counterclockwise order from the northeast quarter of each section (see opposite page). Within the quarter sections, 40-acre and 10-acre tracts are lettered in the same manner. Well 8S-42E-17CAB1 is in the NW¼NE¼SW¼ sec. 17, T. 8 S., R. 42 E., and was the first well inventoried in that tract. (In the Data Section of the report, township and section numbers less than 10 are preceded by a "0" to conform with computer-printout data.)

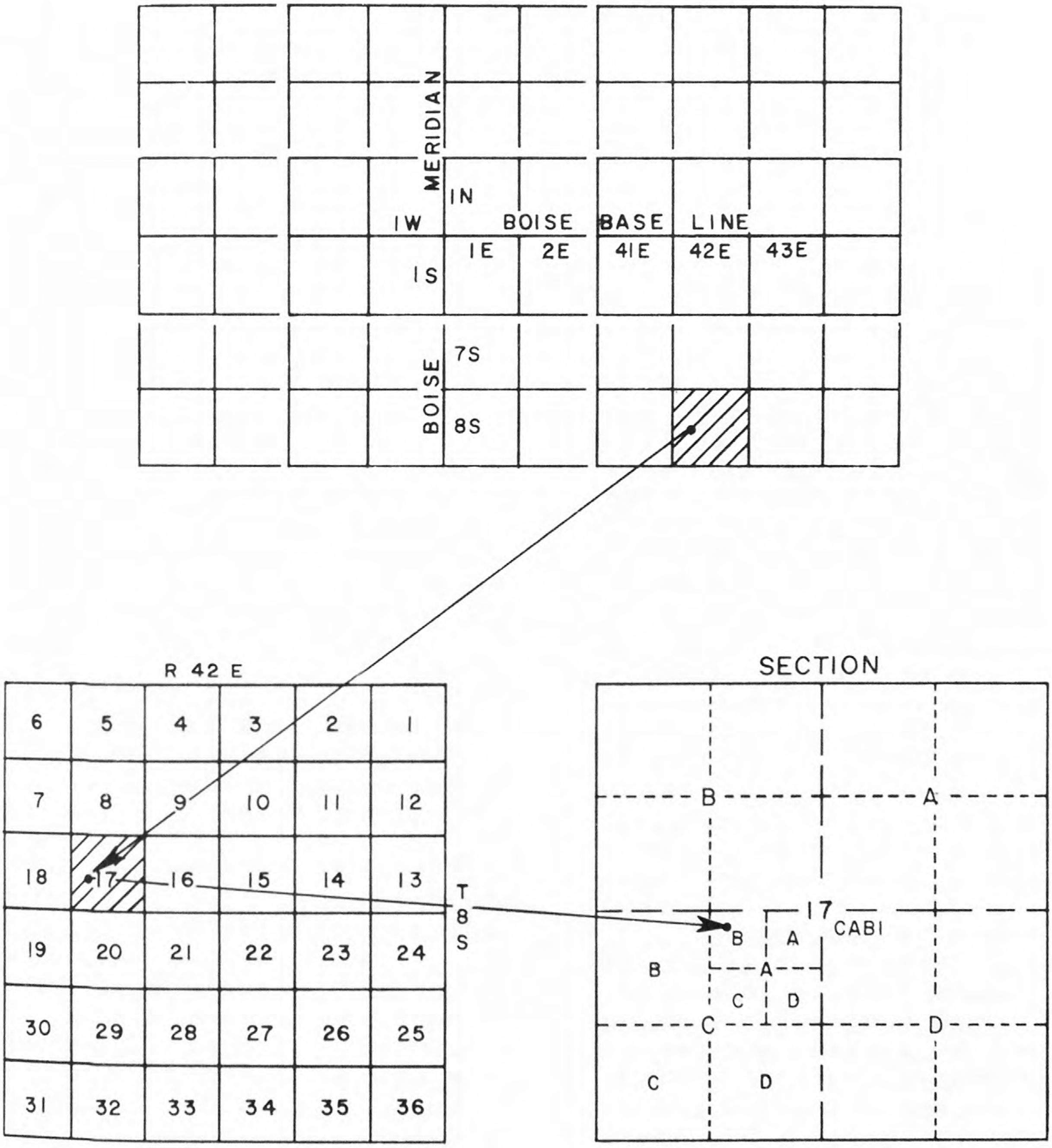


Diagram showing the well-numbering system

1.0 INTRODUCTION

SOUTHEAST IDAHO REPORT PROVIDES CURRENT GROUND-WATER-QUALITY CONDITIONS

This report provides information about the current quality of ground waters in southeastern Idaho and discusses the natural and manmade environmental controls on that quality. This information will be useful in planning and monitoring the development and use of the ground-water resources of southeastern Idaho.

The southeastern corner of Idaho, as described in this report, encompasses an area of about 4,000 mi^2 in Bannock, Bear Lake, Caribou, and part of Power Counties. The population of the area in 1975, based on best estimates by the Idaho Division of Budget, Policy Planning, and Coordination (1976) was 75,200. About 80 percent of the population is in and near the city of Pocatello, which is the second largest population center in the State.

Pocatello's economy depends largely on manufacturing and industrial processing, which includes chemical-fertilizer plants. The economy in the rural areas depends largely on agriculture--both dry and irrigated farming are practiced. Mining is important and expected to dominate the economy in the east-central part of the area in the future.

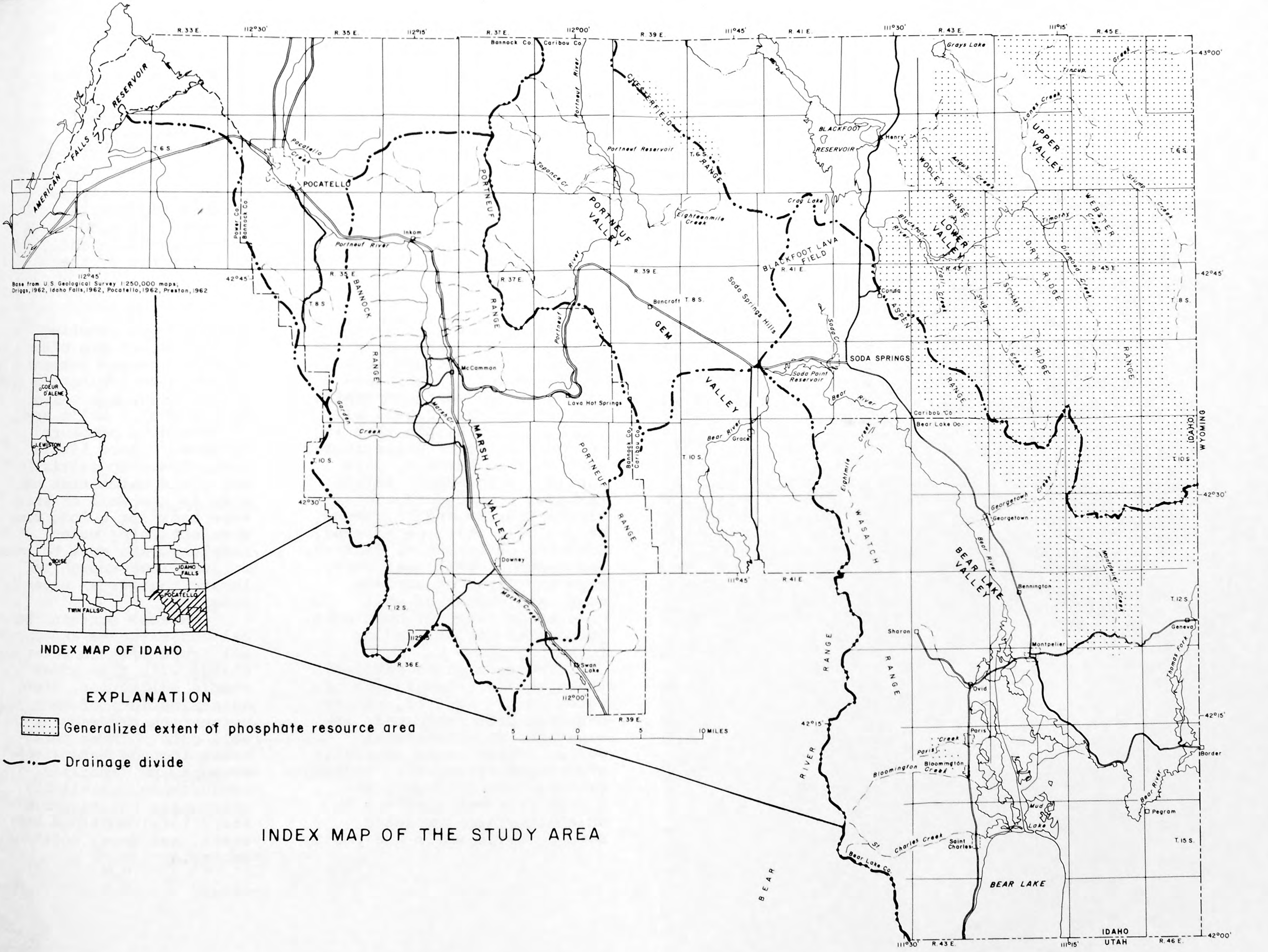
Natural resources include phosphate ore, which makes up about 35 percent of the U.S. reserves (U.S. Department of Interior and U.S. Department of Agriculture, 1977); ground water, which mostly underlies the several intermontane valleys that dissect the area; and hot springs, which indicate that geothermal energy sources may underlie part of the area. Also, current (1978) speculation is that petroleum reserves may be present in the vicinity of Bear Lake. Development of more sprinkler-irrigated lands, increases in population, and growth of phosphate mining are expected to place stress on the ground-water resources, both in quality and quantity.

The purpose of this report is to present the results of a study whose primary objectives were (1) to provide current water-quality data representative of the water in several different aquifers (water-bearing formations) in the study area, and (2) to relate these data to natural and manmade environmental controls. The wells sampled during this study establish a quasi-network, which could be resampled in the future to document and analyze changes (if any) in ground-water quality. Based on this information, planners and water managers could better understand the cause-and-effect relations controlling water quality and could better manage land and water-resource development.

The report is designed for ease of reading and presentation. It uses maps, tables, and abbreviated text to describe geology, hydrology, and ground-water quality and how they are interrelated. Some practical ways for improving water quality are discussed for the benefit of individual water users. The field data collected in making the study are contained in the Data Section of this report.

The authors gratefully acknowledge the many individual well owners, municipal officials, and private industries that provided well information and allowed access to their properties and collection of water samples. Without their help, this work could not have been done. Water samples were collected at 103 well sites. Water-level measurements were made at 98 of these sites during July, August, and September of 1976.

This study was made by the U.S. Geological Survey in cooperation with the Idaho Department of Water Resources. A similar study is being made (1978) in north Idaho. Other studies are planned, specifically to obtain ground-water-quality data in areas where land and water-resource development is expected or accelerating.



Base from U.S. Geological Survey 1:250,000 maps; Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962

INDEX MAP OF THE STUDY AREA

DRILLERS' LOGS AND CARE IN SAMPLING ARE IMPORTANT FOR OBTAINING REPRESENTATIVE GROUND-WATER SAMPLES

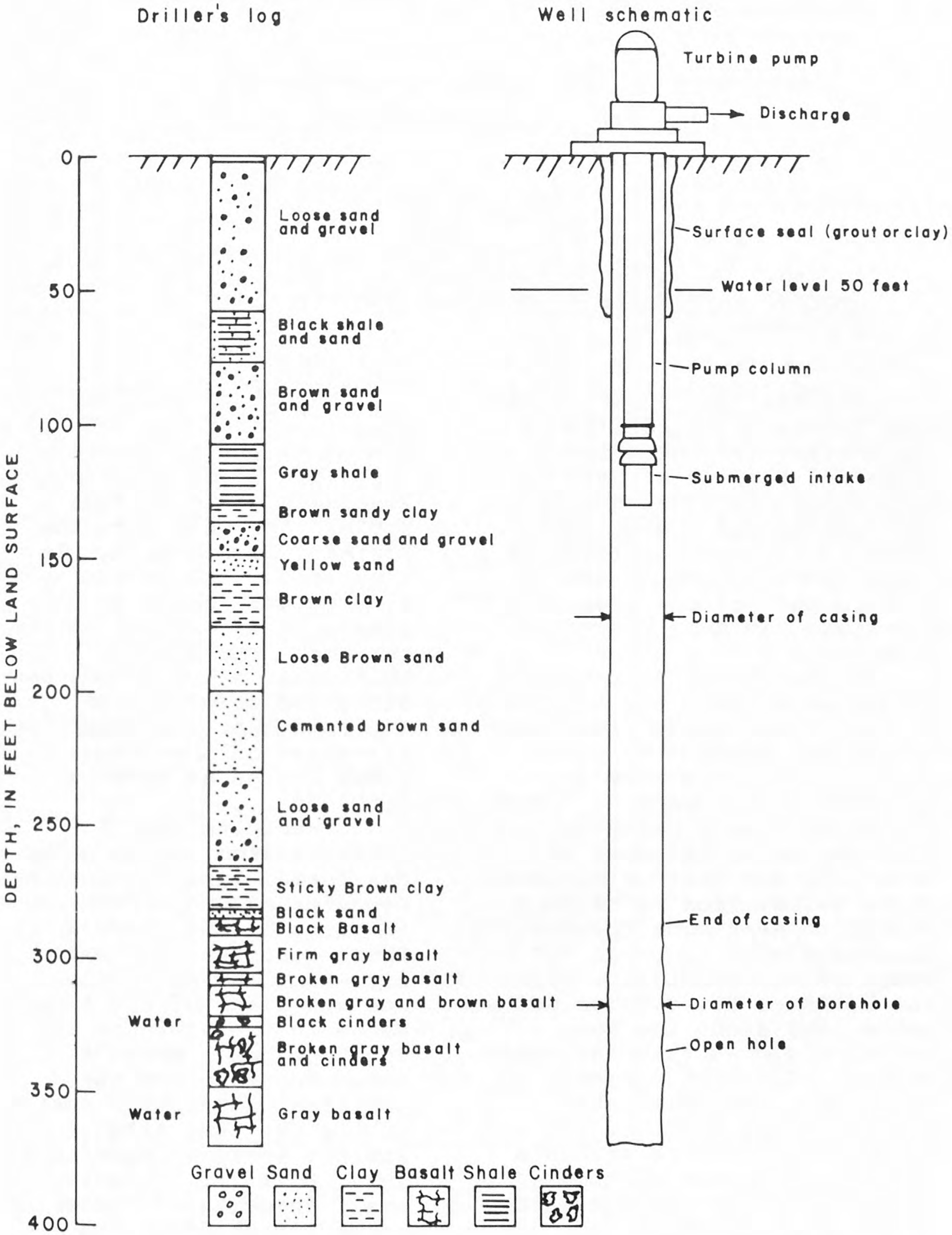
Representative water samples for chemical analyses can only be collected with confidence from wells for which drillers' logs are available. A good driller's log includes well-construction data and a record of geologic formations penetrated by the borehole.

Ideally, a driller's log furnishes two kinds of information: geologic and well construction. This information is needed to determine whether a specific well will yield a water sample that is representative of a particular aquifer (see table 1, Data Section). Log data include textural rock descriptions, classification and thickness of geologic units penetrated, diameter of borehole, diameter and depth of well casing(s), type and depth of surface seal, and manner of well completion (screen, open hole, perforated casing, and so forth).

The best water samples, those most representative of water in the aquifer, can be obtained from municipal, irrigation, and industrial wells. These wells generally are pumped frequently, thereby yielding water freshly obtained from the aquifers in which they are completed. Some domestic wells are poorly designed for sampling. Surface seals are often absent, thereby potentially allowing contamination from surface sources. Also, most domestic wells are connected to pressure systems. Where little used, the pump initially may yield water that has been in the well or pressure tank for a long time. When obtaining water samples, care must be taken to pump long enough to insure that fresh water is obtained.

Because certain chemical constituents and physical properties in water may change with time after sample collection, field determinations of some parameters are made at the well site. These parameters include water temperature, pH, specific conductance, alkalinity (carbonate and bicarbonate), total coliform bacteria, and fecal coliform bacteria.

TYPICAL SAMPLE WELL



3.0 GEOLOGY

3.1 Generalized Geology

GEOLOGY OF THE STUDY AREA IS GENERALIZED FROM EXISTING GEOLOGIC MAPS

Detailed geologic mapping by Mansfield (1920, 1927, 1929), Ross and Forrester (1947), Oriel (1965, 1968), Armstrong (1969), and Trimble (1976) is generalized to show the major rock types in the area and is grouped into units of pre-Tertiary, Tertiary, and Quaternary ages.

Pre-Tertiary rocks in the area consist of consolidated sedimentary and metamorphic rocks and include sandstone, limestone, dolomite, quartzite, shale, and chert. Intense folding and faulting of these rocks occurs in the eastern part of the area from Bear Lake north to Blackfoot Reservoir.

Rocks of the Salt Lake Formation of Tertiary age consist of fresh-water limestone, tuffaceous sandstone, rhyolitic tuff, and poorly consolidated conglomerate. Rocks of the Salt Lake Formation crop out on either side of Bear Lake and north along Bear River valley from below Montpelier to near Soda Springs. Exposures also occur in the Chesterfield Mountains, along the Portneuf River Gorge below Inkom, and along the low mountain slopes flanking Marsh Valley. Although variable in thickness, the Salt Lake Formation was estimated by Mansfield (1927) to attain a maximum thickness of about 1,000 ft in the eastern part of the study area.

Basalt of Tertiary and(or) Quaternary age dominates the landscape in the vicinity of Blackfoot Reservoir south to Soda Springs and west into the Portneuf River basin. In many areas, the basalt is mantled with soil; in some areas, it is exposed at the surface. The maximum thickness is not known, but Mabey and Oriel (1970) indicate that the aggregate thickness of the basaltic flows may be as much as 1,000 ft.

Precipitation of minerals from spring water has formed large travertine deposits of Quaternary age in parts of the study area. These deposits form extensive terraces along the western flank of the Aspen Range in the vicinity of Soda Springs. Many of these deposits are associated with active springs; others mark the site of extinct springs (Mansfield, 1927, p. 112). Locally, small deposits of travertine occur interbedded with basalt or as a cementing material in gravels, forming a conglomerate.

Sedimentary rocks of Quaternary age include unconsolidated deposits of sand, gravel, silt, and clay in stream channels, flood plains, and along the base of mountain slopes. Generally, these sediments are well sorted and fine textured. Locally, they are gravelly. They include deposits of a former level of Bear Lake, in which was deposited gravel terraces and benches that stand 30 ft or less above the present lake level. Thickness of the Quaternary sediments ranges from a thin veneer to a maximum of at least 300 ft in several of the wider stream valleys.

The geologic map (accompanying page) is a compilation of the work of several investigators who mapped in varying degrees of detail. Therefore, the geologic contacts do not coincide from area to area in all places. Also, for purposes of the hydrologic part of this report, pre-Tertiary rocks, differentiated as pTcl and pTc on the map, are grouped under the heading pTu (bedrock, undifferentiated) in table 2 (Data Section), because drillers' logs of wells are not descriptive enough to distinguish the subsurface pre-Tertiary rocks.


R. 33 E.
112°30'
R. 35 E.
112°15'
R. 37 E.
112°00'
R. 39 E.
111°45'
R. 41 E.
111°30'
R. 43 E.
111°15'
R. 45 E.
43°00'
42°45'
42°30'
42°15'
42°00'
AMERICAN FALLS RESERVOIR
POCATELLO
BLACKFOOT RESERVOIR
BANNOCK RANGE
PORTNEUF RANGE
ASATCH
BEAR RIVER RANGE
BEAR LAKE
IDAHO
WYOMING
UTAH
R. 46 E.
Qs
QTv
Ts
pTcl
pTc
pTu
Base from U.S. Geological Survey 1:250,000 maps;
Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962
CORRELATION OF MAP UNITS
Unconsolidated deposits
Travertine deposits
QUATERNARY
Basalt
TERTIARY AND (OR) QUATERNARY
Salt Lake Formation
TERTIARY
Sandstone, quartzite
Limestone, dolomite
Bedrock, undifferentiated
PRE-TERTIARY
Contact
5 0 5 10 MILES
Mansfield, 1920
Mansfield, 1929
Ross and Forrester, 1947
Trimble, 1976
Rioux and others, 1975
Ross and Forrester, 1947
Oriel, 1968
Armstrong, 1969
Mansfield, 1927
Oriel, 1965
Mitchell, 1976
Norvitch and Larson, 1970
Index map of the study area showing sources of geologic mapping

3.2 Water-Bearing Units

AVAILABILITY OF WATER TO WELLS IS RELATED TO AQUIFER LITHOLOGY

Ground water occurs, to some degree, in all the geologic units described in this report. Fractured basalt and coarse gravel may yield large volumes of water to wells, whereas fine-grained sedimentary and crystalline rocks generally yield little water to wells.

Most high-yield wells are completed in the basalt aquifers. Although basalt is a hard, dense rock, joints and fractures formed during cooling of the initial molten mass create an interconnected network of passageways suitable for movement and storage of ground water. Wells completed in the basalt aquifers commonly yield between 1,000 and 3,500 gal/min where sufficient thickness of fractured rock is penetrated.

Wells completed in the unconsolidated alluvial deposits generally yield sufficient quantities of water for domestic and some irrigation uses. Yields between 500 and 1,500 gal/min are common. The greater yields are from wells completed in coarse gravels.

Most wells completed in the Salt Lake Formation, composed of limestone, sandstone, tuff, and conglomerate, will yield some water, although many drilling attempts have resulted in dry holes. Drillers' logs of some wells in the Bear River basin, however, indicate yields as high as 1,800 gal/min from sandstone and conglomerate (Dion, 1969).

Few wells are completed in the undifferentiated pre-Tertiary bedrock complex, composed of fine-grained sedimentary and crystalline rocks, and data are insufficient to determine its water-yielding potential. However, yields of existing wells generally are low.

Travertine is not considered an important aquifer in the study area. Deposited by precipitation of calcium carbonate from spring waters, travertine is hard, dense, and finely crystalline; and, except where solution cavities are formed, little pore space is available for storage and transmission of ground water.

Description and water-bearing characteristics of geologic units

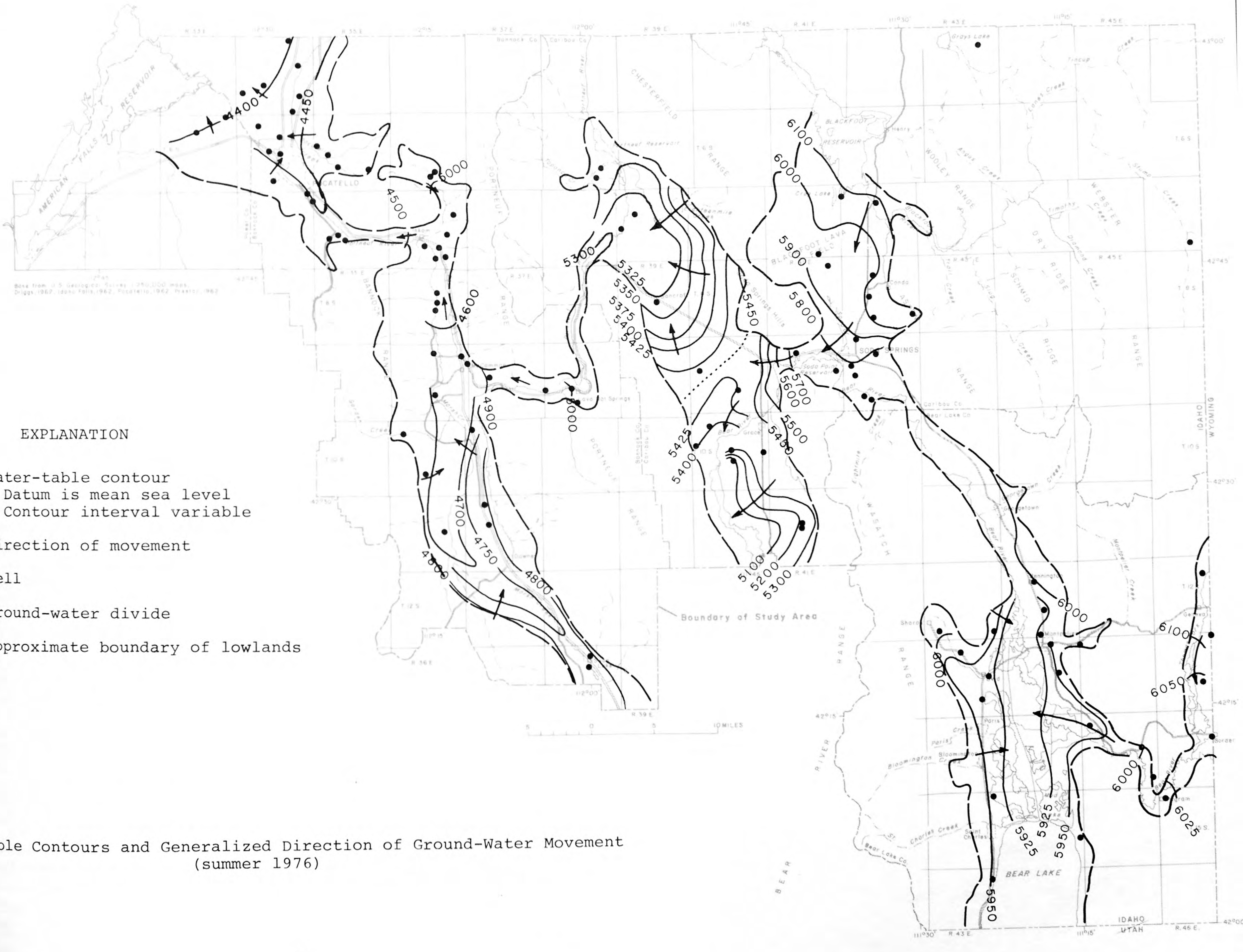
System	Geologic unit and symbol	Description	Water-bearing characteristics
Quaternary	Unconsolidated deposits (Qs)	Soil, clay, silt, sand, gravel, and boulders. Includes well-sorted Holocene alluvium deposited in stream channels and stream floodplains; lake clays interbedded with older alluvium in subsurface; alluvial fans at the base of mountain slopes; hill wash and landslide debris generally composed of poorly sorted rock fragments derived from nearby sources; and older alluvium. In some places, underlies basalt and overlies Tertiary sediments from which it is difficult to differentiate. Includes windblown (loess) sediments as overburden.	Sand, gravel, and boulder units are the major source of supply to irrigation and domestic wells in Marsh Valley, northern part of Portneuf Valley, western part of Gem Valley, and along the Bear River from Geneva to Georgetown.
Quaternary	Travertine (Qt)	Calcium carbonate deposit. Generally light-buff or cream colored; ranges from fine-textured hard varieties to coarse-textured open or cavernous varieties. Probable source is mineralized springs. Occurs as high, dam-like terrace deposits in Portneuf River Gorge, especially near Lava Hot Springs and along western slope of Aspen Range near Soda Springs.	Unknown as source of supply.
Quaternary and (or) Tertiary	Basalt (QTv)	Igneous extrusive flow rock (lava) and cinders. Basalt is generally medium-dark gray. Cinders are generally reddish brown. Textural varieties range from massive, very fine grained to vesicular. Fractured, fissured, and jointed; shows collapsed structure in places.	Major source of supply to irrigation and domestic wells in southern half of Portneuf and eastern part of Gem Valleys and north of Soda Springs. Magnitude of yield depends on local permeability of the formation at individual well sites.
Tertiary	Salt Lake Formation (Ts)	Conglomerate, limestone, sandstone, white calcareous clay, and volcanic tuff. Soils formed on surface are commonly white or light colored and interspersed with gravels of largely local origin. Contains boulders as much as 4 to 5 ft in diameter; matrix of conglomerate is white, relatively soft, loose textured, and calcareous.	Little known as to water-bearing capabilities, largely because it is difficult to distinguish from older alluvium in drillers' logs. Also, where unit is penetrated, the well generally is producing also from older alluvium. A good source of supply at some places.
Pre-Tertiary	Bedrock, undifferentiated (pTu)	Consolidated sedimentary rocks; composed of limestone, dolomite, sandstone, quartzite, and shale. (Includes pTcl and pTc on geologic map.)	Few wells are known to penetrate pre-Tertiary rocks; hence, little data are available. Solution cavities in limestone, if present and where penetrated, will transmit large quantities of water to wells.

GROUND-WATER AQUIFERS RECHARGED BY INFILTRATION OF PRECIPITATION AND SEEPAGE LOSS FROM STREAMS AND A RESERVOIR

Aquifers in Marsh, upper Portneuf, and Bear Lake Valleys are recharged, in part, by seepage loss from streams; aquifers in Soda Creek basin are recharged, in part, from underflow out of Blackfoot Reservoir; aquifers in Gem Valley are recharged, in part, by seepage losses from Bear River. All aquifers mentioned receive recharge by direct infiltration of precipitation.

Throughout the study area, direct infiltration of precipitation is an important source of recharge. In addition, the alluvial aquifers in Marsh, upper Portneuf, and Bear Lake Valleys are recharged near the margins of the valleys by seepage losses from streams. The basalt aquifers of Soda Creek basin are also recharged, in part, by ground-water underflow out of Blackfoot Reservoir; aquifers in Gem Valley are also recharged by seepage losses from Bear River in the northeast corner of the valley west of Soda Point Reservoir.

Altitude of the water table is depicted on the accompanying map by contour lines based on water-level measurements in wells. Ground water moves approximately at right angles to the contour lines, from areas of recharge in the highlands to areas of discharge in the lowlands, where it ultimately contributes flow to the regional stream system.



EXPLANATION

5400 Water-table contour
Datum is mean sea level
Contour interval variable

← Direction of movement

• Well

..... Ground-water divide

— — Approximate boundary of lowlands

Water-Table Contours and Generalized Direction of Ground-Water Movement (summer 1976)

5.0 WATER QUALITY
5.1 Suitability for Use

SUITABILITY OF WATER FOR USE DEPENDS ON CHEMICAL AND BACTERIAL CONTENT

The chemical and bacterial properties of water are affected by several physical and biological factors that affect the ultimate suitability of the water for various uses.

The quality of ground water depends on physical and biological factors such as geologic environment, residence time of water, source of recharge, and influences of man. Geologic environment probably influences water quality most, although man's influences over a short time may cause dramatic changes.

Generally, water becomes more mineralized with depth below land surface and bacteria concentrations decrease. Where percolating water passes through rock, the water accumulates increasingly higher concentrations of dissolved solids as a function of contact time with, and solubility of, the rock minerals. Also, if recharge water contains chemical or bacterial pollutants, they may be flushed into the aquifer.

The accompanying table details sources of various chemical and bacterial properties and their effects on water use.

Dissolved solids, hardness, nitrite plus nitrate as nitrogen (N), and chloride concentrations in water are discussed in the following sections of this report. Fluoride and iron concentrations (table 2, Data Section) are anomalously high in some of the waters sampled. They are discussed as follows:

For community water systems, the maximum contaminant levels for fluoride in drinking water are related to the annual average of the maximum daily air temperatures for the location in which the system is situated (U.S. Environmental Protection Agency, 1975). Assuming that the average maximum daily air temperature at Pocatello, which is about 15°C, is the highest for the study area; then the fluoride concentration should be no greater than 2.0 mg/L in any of the waters used for drinking. Water from wells 5S-34E-26DBD1, near Pocatello, and 8S-41E-2DDC1, in the Blackfoot Lava Field northwest of Conda, both finished in basalt aquifers, contain fluoride concentrations of 2.5 and 2.0 mg/L, respectively. The former concentration exceeds the maximum level; the latter is at the maximum level.

Fluoride concentrations in all other waters sampled during this study ranged from 0.1 to 0.8 mg/L. The fluoride source of the anomalously high levels in the above two wells is not known, but it is probably associated with alkalic (basic) and glassy (obsidian) parts of the volcanic basaltic flow rocks that comprise the aquifers (see Hem, 1970, p. 177).

Dissolved-iron concentrations in ground water in the study area ranged from 10 to 4,600 µg/L. The National Secondary Drinking Water Standards set the advisable maximum contaminant level for iron in drinking water at 0.3 mg/L, or 300 µg/L. Fourteen of the 96 water samples in which iron concentrations were determined exceeded the advised level. The highest was from a shallow well finished in alluvial deposits near Ovid in Bear Lake Valley; however, concentrations in excess of the advised maximum level also occurred in wells finished in undifferentiated bedrock, Salt Lake Formation, and basalt aquifers. Because corroded pipes and pump parts can add iron to well water, it is difficult to determine the iron source unless more specific information is available. At the levels found in the study area, iron is not considered detrimental to health; however, the esthetic value of some of the waters may be lessened.

Although not a constituent, the temperature of a water can affect its suitability for immediate use. Ground-water temperatures in the study area ranged from 6.5° to 25°C. Under normal conditions, considering mean annual air temperatures and geothermal gradients, the expected temperature of water in wells less than 400 ft deep (table 1, Data Section) would be less than 12°C. However, hot flowing wells and hot springs are fairly common in the study area, so the warmest waters probably are indicative of geothermal reservoirs at depth. High silica concentrations in some of the waters sampled also may be indicative of the presence of geothermal reservoirs.

Source or cause and significance of dissolved mineral constituents and properties of water
(Modified after Hobba, 1976)

Constituent or property	Source or cause	Significance
Silica (SiO_2)	Dissolved from practically all rocks and soils.	Together with calcium and magnesium, silica forms a low, heat-conducting, hard, glassy scale in boilers and turbines. Silica inhibits deterioration of zeolite-type water softeners and corrosion of iron pipes by soft water.
Iron (Fe)	Dissolved from practically all rocks and soils. Found in some industrial wastes. Can be corroded from iron pipes, pumps, and other equipment.	More than 0.1 mg/L often precipitates on exposure to air, causing turbidity, staining, and tastes and colors that are objectionable in food, beverage, textile processes, and and ice manufacture, as well as causing problems in domestic use, such as staining plumbing fixtures and laundry. National secondary drinking-water standards advise a maximum of 0.3 mg/L, or 300 µg/L, in finished supply.[1]
Manganese (Mn)	Dissolved from some rocks, soils, and lake-bottom sediments. Sources associated with those of iron.	Same objectionable features as iron. Causes dark-brown or black stains. National secondary drinking-water standards advise a maximum concentration of 0.05 mg/L.[1] Manganese removal associated with those of iron but more difficult and generally less complete.
Calcium (Ca), Magnesium (Mg)	Dissolved from practically all soils and rocks, but especially from limestone, dolomite, and gypsum.	Causes most of the hardness and scale-forming properties of water; detergent consuming (see hardness). Water low in calcium and magnesium desired in electroplating, tanning, dyeing, and in textile manufacturing. Small amounts desirable to prevent corrosion.
Sodium (Na), Potassium (K)	Dissolved from practically all rocks and soils. Found in industrial wastes and sewage, and commercial fertilizers.	More than 50 mg/L sodium and potassium in the presence of suspended matter causes foam in boilers, which accelerates scale formation and corrosion. More than 65 mg/L of sodium can cause problems in ice manufacture (Durfor and Becker, 1964, p. 17).
Bicarbonate (HCO_3), Carbonate (CO_3)	Action of carbon dioxide in water on carbonate cementing material and rocks, such as limestone, dolomite, and travertine.	Produces alkalinity. On heating in the presence of calcium and magnesium, can form scales in pipes and release corrosive carbon-dioxide gas. Aid in coagulation for the removal of suspended matter from water.
Sulfate (SO_4)	Dissolved from rocks and soils containing gypsum, sulfides, and other sulfur compounds. May be derived from industrial wastes, both liquid and atmospheric.	Sulfate in water containing calcium forms hard scale in steam boilers. In large amounts, sulfate in combination with other ions gives bitter taste to water. Some calcium sulfate is considered beneficial in brewing processes. National secondary drinking-water standards advise that the sulfate content should not exceed 250 mg/L.[1]
Chloride (Cl)	Dissolved from rocks and soils. Present in sewage and industrial wastes.	Some people can detect salty taste in concentrations exceeding 100 mg/L. In large quantities, increases the corrosiveness of water. National secondary drinking-water standards advise a maximum concentration of 250 mg/L.[1] Present available removal methods not generally economical for most uses.
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils. Added to many waters by fluoridation of public supplies.	Fluoride concentrations in limited amounts have beneficial effect on the structure and resistence to decay of children's teeth.
Nitrate (NO_3) as nitrogen (N)	Decaying organic matter, sewage, fertilizers, and nitrates in soils.	Small amounts of nitrate help reduce cracking of high-pressure boiler steel. It encourages growth of algae and other organisms that produce undesirable taste and odors. National interim primary drinking-water regulations advi concentration of 10 ation of 10 mg/L;[2] concentrations in excess of limit are suspected as as cause of methemoglobinemia in infants.
Dissolved solids	Chiefly mineral constituents dissolved from rocks and soils.	National secondary drinking-water standards advise maximum of 500 mg/L.[1] Waters containing more than 1,000 mg/L of dissolved solids are unsuitable for many purposes.
Hardness as $CaCO_3$	In most waters, nearly all hardness is due to calcium and magnesium.	Consumes soap and synthetic detergents. Forms white scale on tea kettles and plumbing and rings on bathtubs. Although hardness is less of a factor with synthetic detergents than with soap, it is still desirable to soften hard waters for esthetic as well as economic reasons.
Specific conductance	Mineral content of the water.	Guide to mineral content. It is a measure of the capacity of the water to conduct a current of electricity, and varies with the concentration and degree of ionization of the different minerals in solution.
pH	Hydrogen-ion concentration.	A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote increased alkalinity; values lower than 7.0 indicate increased acidity. Corrosiveness of water generally increased with decreasing pH, but excessively alkaline waters may also attack metals.
Fecal coliform	Derived from human and animal intestines. Indicators of pathogenic bacteria.	Indicates contamination from human and/or animal wastes.

[1] U.S. Environmental Protection Agency, 1977

[2] U.S. Environmental Protection Agency, 1975

5.2. Selected Water-Treatment Methods

WATER-QUALITY PROBLEMS MAY BE ALLEVIATED BY PROPER WATER TREATMENT

Excessive amounts of some chemical constituents or bacteria create water-quality problems that can be alleviated by proper water-treatment methods.

Ground water in parts of the study area contains chemical and other properties that could restrict its use for some purposes. Properties in excess of advised limits (U.S. Environmental Protection Agency, 1975 and 1977) are iron, sulfate, chloride, nitrate, hardness, and dissolved solids (table 2, Data Section).

The quality of water generally reflects the mineral composition of the aquifer from which it is sampled. For example, excessive hardness is characteristic of water from aquifers containing calcium carbonate rocks (limestone, dolomite, and travertine) or rocks containing calcium carbonate as a cementing material (conglomerate).

Presence of bacteria sometimes reflects the source of ground-water recharge. Water that has percolated through a thick mantle of soil usually has a low or nonexistent bacterial count owing to the high filter efficiency of fine- to medium-grained sands and to bacterial capture by a filter mat that is formed around a point source of bacterial introduction (Vecchioli and others, 1972). Wherever the soil mantle covering fractured or faulted rocks is thin or absent, contaminated recharge water may reach the water table with little bacterial die-off, owing to a lack of filtering action. Lack of a good surface seal (see illustration of sample well) is one of the most common causes of bacterial contamination, because bacteria can be carried down the side of the well bore or casing without being filtered through a sufficient layer of soil. Fecal coliform bacteria are found in the intestines of warm-blooded animals and, where detected in water, are considered to be indicators of the potential presence of pathogenic bacteria.

Where chemical constituents or indicator bacteria concentrations exceed desirable limits, it may be necessary to reduce, remove, or control concentrations to meet acceptable water-quality standards. Some methods for treating chemical constituents and harmful pathogenic bacteria are given in the accompanying table.

Selected ways of removing or reducing
chemical and bacteriological constituents that exceed recommended concentrations
(Modified after Hobba, 1976)

Problem chemical constituent	Treatment
Hardness, Calcium (Ca), and Magnesium (Mg)	1. Lime-soda treatment--chemical reactions convert most of Ca and Mg in solution to insoluble calcium carbonate and magnesium hydroxide. The resulting sludge then can be removed by sedimentation and filtration. 2. Ion exchange--zeolite minerals or synthetic resin beads exchange sodium (Na) ions in their structure for Ca and Mg in the water. When the exchange capacity is exhausted, regeneration is accomplished by back flushing with a strong salt (sodium chloride) solution. The resin beads have a greater exchange capacity than the zeolite minerals.
Iron (Fe), and Manganese (Mn)	1. Oxidation and filtration--aeration followed by sedimentation will usually remove Fe and Mn when organic matter is not present. Chloride or potassium permanganate is also used to oxidize Fe and Mn, which is then filtered from the water. These agents commonly are used when the water is high in organic matter as it may be where it contains iron bacteria. The water should be made alkaline before any Fe or Mn removal is attempted. 2. Oxidation and filtration through manganese green sand--the green sand gives up oxygen to produce insoluble iron hydroxide and manganese oxide. When the available oxygen is exhausted, regeneration is accomplished by back flushing the green sand with potassium permanganate. 3. Chemical stabilizer--sodium hexametaphosphate (polyphosphate) stabilizes Fe and Mn and delays precipitation. Delay time varies with the amount of polyphosphate added. The polyphosphate must be added before the water is exposed to air.
Hydrogen Sulfide (H_2S)	Aeration--permits H_2S to escape to atmosphere. Aeration can be accomplished by spraying water into the air, trickling it through beds of coarse coke or stone, permitting it to cascade over steps, or by bubbling air into it (either in an open tank or in a closed system). After aeration, water still may be corrosive because of dissolved oxygen.
Chloride (Cl)	Demineralization by ion exchange--two types of resin beads remove nearly all dissolved mineral matter by cation and anion exchange. When the exchange capacity is exhausted, regeneration is accomplished by back flushing one type resin with acid (usually sulfuric acid) and the other type with alkali (usually sodium hydroxide). Cost is quite high for water containing more than 2,500 mg/L dissolved solids. Cost can be reduced if mixing demineralized water with raw water will produce an acceptable water.
Sulfate (SO_4)	
Nitrate (NO_3) as (N)	
Pathogenic bacteria	1. Heat--boiling or pasteurization by heating water to 161°F and holding for 15 seconds. These processes kill both bacteria and viruses and produce no disagreeable odors or tastes. 2. Chemical--chlorine is fed automatically into the water system at a concentration sufficient to kill the bacteria after a contact time of about 30 minutes. Other chemicals that may be used in a similar fashion are iodine and potassium permanganate. Chemical disinfecting may impart a taste to the water, but the taste can be removed by passing the water through an activated charcoal filter, if desired. 3. Ultraviolet light--the water passes within 1 to 5 inches of a quartz mercury-vapor lamp, which emits ultraviolet light. Depending on light intensity, the time of exposure required for disinfection may be as little as 1 second. This method produces no disagreeable odors or tastes. 4. Filtration--many bacteria can be removed by filtration through a thick bed of fine sand.

5.3 Dissolved Solids

DISSOLVED-SOLIDS CONCENTRATIONS RANGE FROM 165 TO 1,690 MG/L

Some of the most mineralized water occurs in the basalt aquifer, close to travertine deposits near Soda Springs. The least mineralized water occurs in undifferentiated bedrock aquifers, which crop out in the mountains and underlie aquifers of pre-Tertiary age in the foothills.

Dissolved-solids concentrations in the study area range from 165 to 1,690 mg/L. Some of the most mineralized water occurs in wells completed in the basalt aquifer, close to travertine deposits in the vicinity of Soda Springs. The least mineralized water occurs in wells completed in the undifferentiated bedrock aquifers, which crop out in the mountains and underlie aquifers of pre-Tertiary age in the foothills.

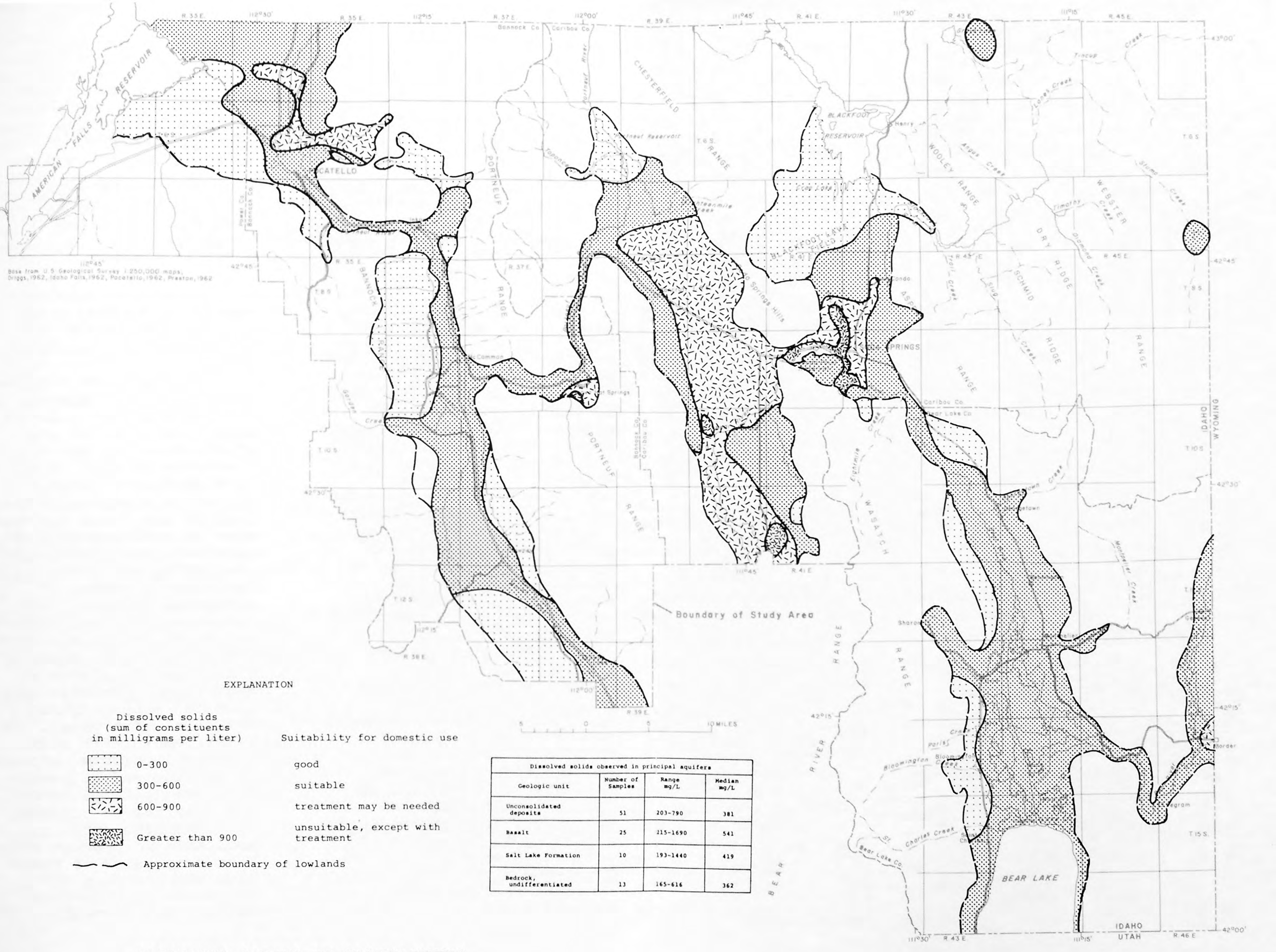
The accompanying map shows the distribution of dissolved-solids concentrations in water in aquifers that locally provide the first occurrence (with depth) of a suitable water supply. Thus, the map indicates specific water-quality conditions on a regional basis. However, water occurs in different geologic units, several of which may be present in a vertical section at any one place. The table accompanying the map shows the range and median of dissolved-solids concentrations observed, depending on the geologic unit in which a well is completed. The extents of the patterned areas on the map are based on a limited number of sampled sites and, as such, must be considered as approximations.

Dissolved-solids concentrations are an indication of total mineral content in a water. As used in this report, dissolved solids (salts) are the sum of the mineral constituents analyzed in each water sample, measured in mg/L. They consist mainly of the sum of the anions (chloride, bicarbonate, carbonate, nitrates, and sulfate) and cations (calcium, magnesium, sodium, and potassium), plus traces of iron, manganese, and other salts.

As advised by the U.S. Environmental Protection Agency (1977), dissolved-solids concentrations in water for domestic supplies should not exceed 500 mg/L. Concentrations higher than 500 mg/L may be consumed without harmful physiological effects and even may be beneficial for some health purposes. Waters containing dissolved solids of more than 1,000 mg/L should be judged on the basis of the local situation, alternative supplies, and the reaction of the local population (California State Water Resources Control Board, 1963, p. 182).

Dissolved solids are also important for consideration of waters used for livestock consumption and irrigation. At the levels of concentration observed in the study area, there is little cause for concern for livestock consumption. Suitability of the waters for irrigation are discussed in section 5.6 of this report.

Where a complete chemical analysis is not available for a water, the dissolved-solids concentration can be estimated from a specific-conductance value, which is a measure of the ability of a water to conduct an electric current. Specific-conductance measurements can be made readily in the field using a conductivity meter. The dissolved-solids concentration, in mg/L, in the study area generally ranges from 45 to 75 percent of the specific-conductance value, measured in µmhos/cm. Thus, an approximation of dissolved solids in the water can be made by multiplying specific conductance by 0.60. Specific-conductance values in the study area range from 262 to 2,730 µmhos.



Base from U.S. Geological Survey 1:250,000 maps; Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962

EXPLANATION

Dissolved solids (sum of constituents in milligrams per liter)	Suitability for domestic use
⠿ 0-300	good
▒ 300-600	suitable
▨ 600-900	treatment may be needed
▩ Greater than 900	unsuitable, except with treatment

~~ Approximate boundary of lowlands

Dissolved solids observed in principal aquifers

Geologic unit	Number of Samples	Range mg/L	Median mg/L
Unconsolidated deposits	51	203-790	381
Basalt	25	215-1690	541
Salt Lake Formation	10	193-1440	419
Bedrock, undifferentiated	13	165-616	362

DISSOLVED SOLIDS IN GROUND WATER

5.4 Hardness

HARDNESS OF GROUND WATER RANGES FROM 78 TO 1,700 MG/L

Hardness of ground water in the study area ranges from 78 to 1,700 mg/L. Most of the water is very hard. The softest water occurs in unconsolidated deposits and undifferentiated bedrock aquifers. The hardest water occurs in the basalt aquifer.

Most of the ground water in the study area is very hard; softening may be required for some uses. The softest water occurs in unconsolidated deposits and undifferentiated bedrock aquifers. The hardest water occurs in the basalt aquifer, especially where it is adjacent to travertine deposits, which are composed mostly of calcium carbonate.

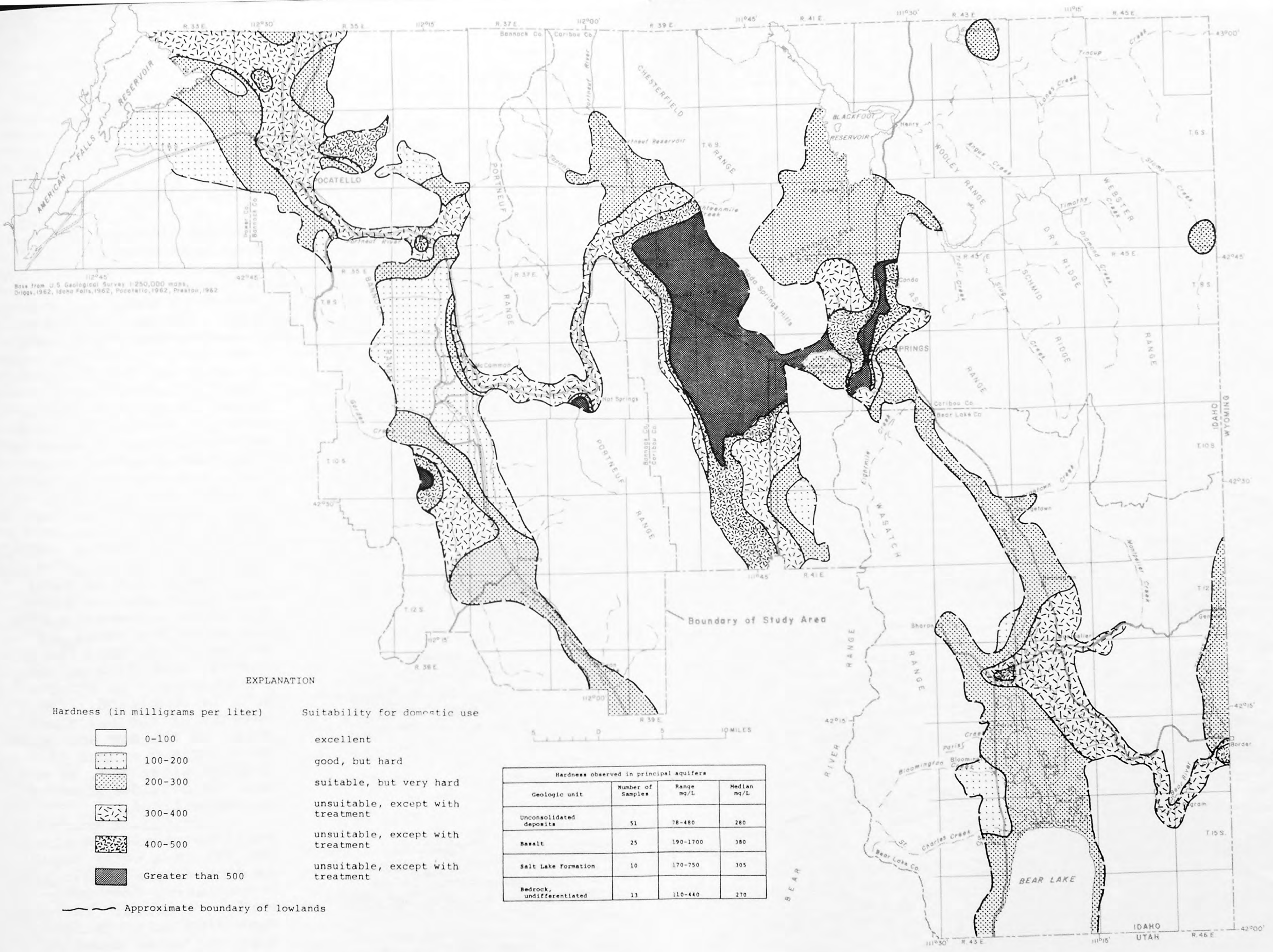
The accompanying map shows the distribution of hardness concentrations in water in aquifers that locally provide the first occurrence (with depth) of a suitable water supply. Thus, the map indicates specific water-quality conditions on a regional basis. However, water occurs in different geologic units, several of which may be present in a vertical section at any one place. The table accompanying the map shows the range and median of hardness observed, depending on the geologic unit in which a well is completed. The extents of the patterned areas on the map are based on a limited number of sampled sites and, as such, must be considered as approximations.

Hardness, as discussed here, is total hardness and is computed from analyzed weights of calcium (Ca) plus magnesium (Mg) and expressed in mg/L of calcium carbonate ($CaCO_3$). Carbonate hardness is that part of the total hardness that is equivalent to the carbonate and bicarbonate present in the water. Any hardness in excess of carbonate hardness is "permanent" or noncarbonate hardness. This usually is attributed to sulfates or chlorides of calcium and magnesium. Hardness measures the soap-consuming potential of a water. Hard water reacts with soap, forming insoluble compounds of calcium and magnesium that precipitate. After the reaction is complete, the remaining soap is available to produce suds. When hard water is heated, high temperatures and pressures usually cause calcium and magnesium compounds to precipitate and form scale in pipes, hot-water tanks, and tea kettles.

High concentrations of hardness generally are not a health problem but may create an economic problem, for the costs of softening treatment of some natural waters may be considerable before the waters are suitable for domestic uses, and especially for some industrial uses.

Common use of the terms "hard" water and "soft" water is relative and only of local significance. In an attempt to be more exact in describing the hardness concentrations in public water supplies throughout the United States, Durfor and Becker (1964, p. 27) use the following classification:

Hardness range (mg/L of $CaCO_3$)	Hardness description
0 - 60	Soft
61 - 120	Moderately hard
121 - 180	Hard
> 180	Very hard



Base from U.S. Geological Survey 1:250,000 maps, Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962

EXPLANATION

	Hardness (in milligrams per liter)	Suitability for domestic use
☐	0-100	excellent
▨	100-200	good, but hard
▨	200-300	suitable, but very hard
▨	300-400	unsuitable, except with treatment
▨	400-500	unsuitable, except with treatment
■	Greater than 500	unsuitable, except with treatment

—⁓ Approximate boundary of lowlands

Hardness observed in principal aquifers			
Geologic unit	Number of Samples	Range mq/L	Median mq/L
Unconsolidated deposits	51	78-480	280
Basalt	25	190-1700	380
Salt Lake Formation	10	170-750	305
Bedrock, undifferentiated	13	110-440	270

HARDNESS OF GROUND WATER

5.5 Nitrate

NITRITE PLUS NITRATE AS NITROGEN (N) CONCENTRATIONS RANGE FROM 0 TO 29 MG/L

Significant concentrations of nitrate nitrogen (N) in a water supply are generally an indication of pollution from land-surface sources. Of 103 water samples in the study area, nitrite plus nitrate as nitrogen (N) concentrations exceeded 10 mg/L in 5 samples and 1 mg/L in 56 samples. The natural background level of nitrate in most of the study area was probably less than 1 mg/L.

The amount of nitrite plus nitrate ions dissolved in a given quantity of water often is expressed in terms of the concentration of elemental nitrogen present. Nitrite plus nitrate as nitrogen (N) concentrations in water sampled from wells in the study area range from 0 to 29 mg/L. (The nitrite fraction is a small part of this combination analysis.) The highest concentration is in water obtained from a well completed in deep, unconsolidated deposits and Salt Lake Formation in Marsh Valley. Nitrate nitrogen concentrations up to 19 mg/L are in water from wells completed in undifferentiated bedrock and in basalt, in Bear River valley south of Montpelier and in an area north of Soda Springs, respectively. Concentrations up to 15 mg/L are in water from wells completed in the basalt aquifer in Gem Valley.

The accompanying map shows the distribution of nitrate concentrations in water in aquifers that locally provide the first occurrence (with depth) of a suitable water supply. Thus, the map indicates specific water-quality conditions on a regional basis. However, water occurs in different geologic units, several of which may be present in a vertical section at any one place. The table accompanying the map shows the range and median of nitrates observed, depending on the geologic unit in which a well is completed. The extents of the patterned areas on the map are based on a limited number of sampled sites and, as such, must be considered as approximations.

Significant concentrations of nitrate nitrogen (N) in a water supply is generally an indication of pollution from land-surface sources. In recommending criteria for domestic water supplies, the U.S. Environmental Protection Agency (1978, p.

108) states:

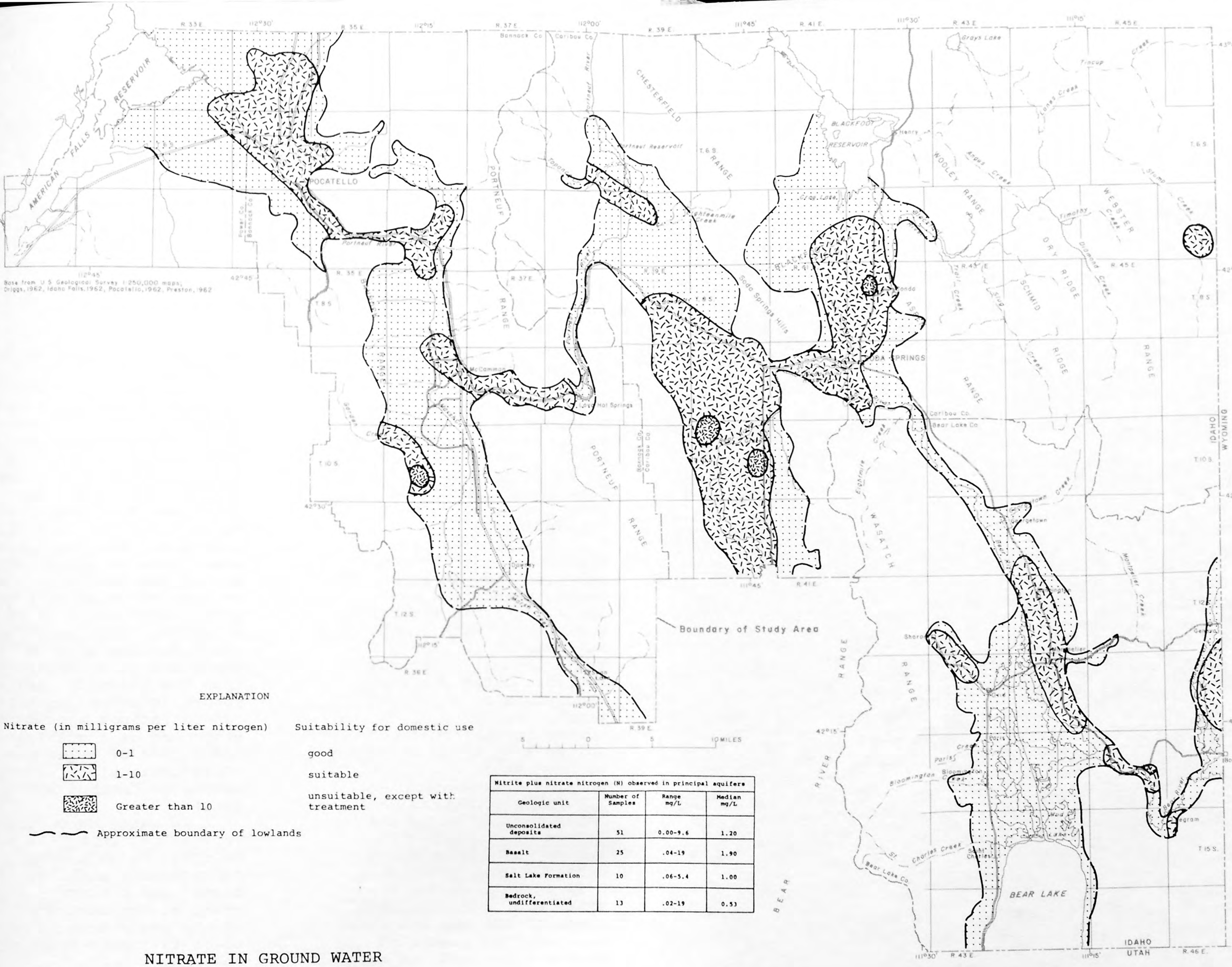
> "Because of the potential risk of methemoglobinemia to bottle-fed infants, and in view of the absence of substantiated physiological effects at nitrate concentrations below 10 mg/L nitrate nitrogen, this level is the criterion for domestic water supplies. Water with nitrite nitrogen concentrations over 1 mg/L should not be used for infant feeding. Waters with a significant nitrite concentration usually would be heavily polluted and probably bacteriologically unacceptable."

(Nitrite is formed from nitrate or ammonium ions by certain micro-organisms found in soil, water, sewage, and the digestive tract.)

Some major man-caused sources of nitrate nitrogen in water supplies are municipal and industrial waste waters, septic tanks, barnyard and feedlot discharges, cropland and lawn fertilizers, animal wastes, leachates from garbage dumps and sanitary landfills, and certain kinds of mine drainage.

Natural sources of nitrates in ground water in arid regions may be from successively buried soil zones, which formed as basins filled with rock debris while precipitation was not sufficient to keep the soils leached of soluble salts (Hem, 1970, p. 182).

Of the 103 water samples in the study area, nitrite plus nitrate as nitrogen (N) concentrations exceeded 10 mg/L in 5 samples and 1 mg/L in 56 samples.



Base from U.S. Geological Survey 1:250,000 maps; Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962

EXPLANATION

Nitrate (in milligrams per liter nitrogen)		Suitability for domestic use
⋯	0-1	good
▨	1-10	suitable
▩	Greater than 10	unsuitable, except with treatment

〰 Approximate boundary of lowlands

Nitrite plus nitrate nitrogen (N) observed in principal aquifers

Geologic unit	Number of Samples	Range mg/L	Median mg/L
Unconsolidated deposits	51	0.00-9.6	1.20
Basalt	25	.04-19	1.90
Salt Lake Formation	10	.06-5.4	1.00
Bedrock, undifferentiated	13	.02-19	0.53

NITRATE IN GROUND WATER

5.6 Chloride

CHLORIDE CONCENTRATIONS RANGE FROM 1.9 TO 360 MG/L

Chloride concentrations in water sampled from wells in the study area range from 1.9 to 360 mg/L. At these levels, the chlorides are generally not harmful for drinking-water purposes. Any sudden increase in concentrations should be suspected as a possible indication of pollution.

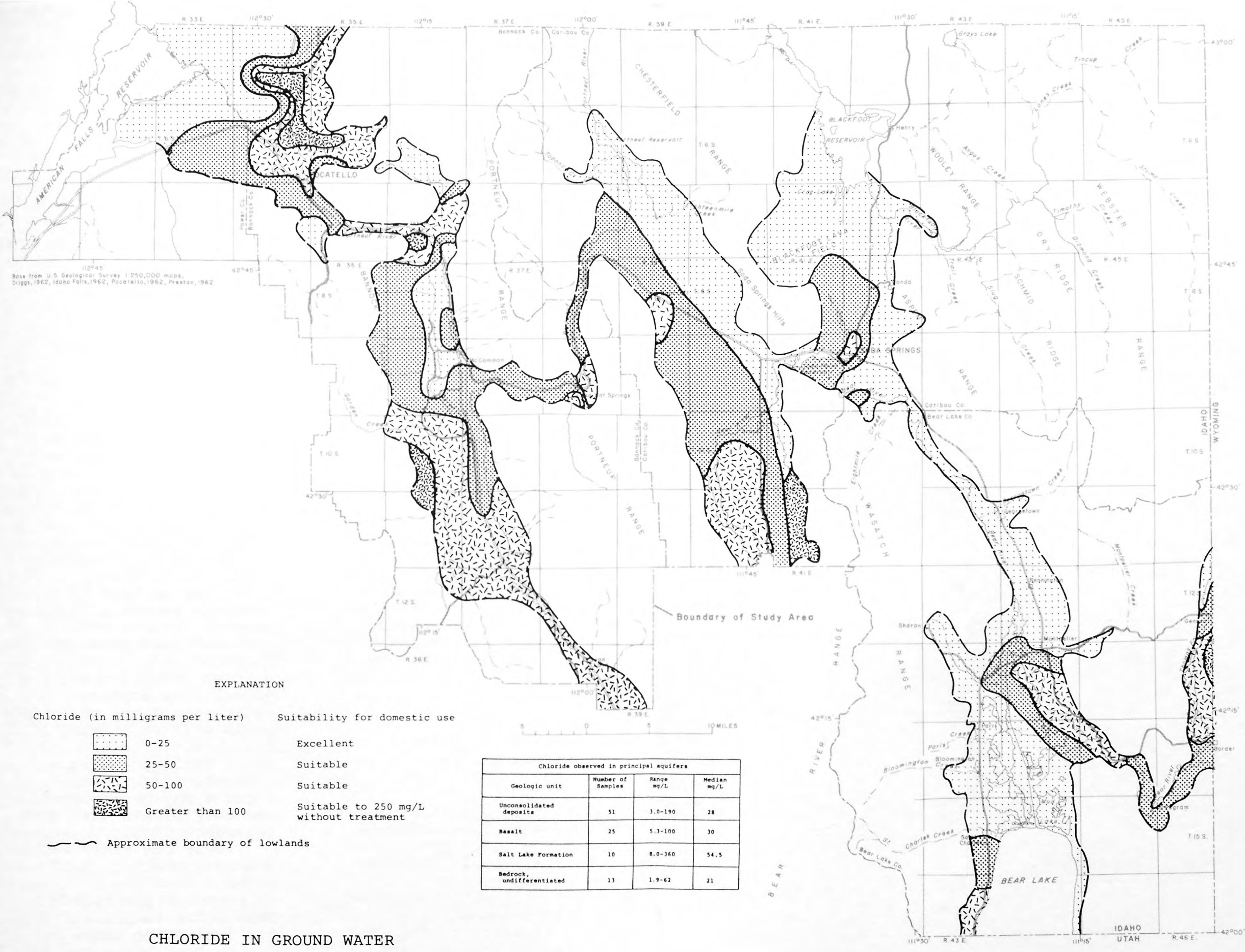
Only 6 of the 103 ground-water samples obtained during this study contained chloride concentrations in excess of 100 mg/L. The highest was 360 mg/L in a water sample from a well completed in the Salt Lake Formation in the Portneuf River valley near Lava Hot Springs.

The accompanying map shows the distribution of chloride concentrations in water in aquifers that locally provide the first occurrence (with depth) of a suitable water supply. Thus, the map indicates specific water-quality conditions on a regional basis. However, water occurs in different geologic units, several of which may be present in a vertical section at any one place. The table accompanying the map shows the range and median of chlorides observed, depending on the geologic unit in which a well is completed. The extents of the patterned areas on the map are based on a limited number of sample sites and, as such, must be considered as approximations.

The advised limit for chloride concentrations in drinking water is 250 mg/L (U.S. Environmental Protection Agency, 1977). At concentration levels found in the study area, the chlorides are generally not harmful for drinking-water purposes. They may impart some taste to the water at the higher levels and could be harmful to persons who suffer from heart or kidney diseases. The source of chlorides may be more important in drinking water than the quantity, and any sudden increase in chloride concentrations should be suspected as a possible indication of pollution (California State Water Resources Control Board, 1963).

In water used for irrigation, chlorides can be toxic to some plants, particularly alfalfa, fruit trees, and potatoes; however, at the concentrations in the study area, it seems there is little cause for concern.

Chlorides are a common constituent in practically all natural water. Some sources of chlorides in ground water include precipitation; solution of rock minerals; leaching of evaporite deposits; salts spread on highways; effluents from septic tanks, barnyards, and industrial wastes; and fertilizers or conditioners spread on soils for agricultural purposes.



Base from U.S. Geological Survey 1:250,000 maps, Driggs, 1962, Idaho Falls, 1962, Pocatello, 1962, Preston, 1962

EXPLANATION

	Chloride (in milligrams per liter)	Suitability for domestic use
⬚	0-25	Excellent
░	25-50	Suitable
▨	50-100	Suitable
▩	Greater than 100	Suitable to 250 mg/L without treatment

—— Approximate boundary of lowlands

Chloride observed in principal aquifers			
Geologic unit	Number of Samples	Range mg/L	Median mg/L
Unconsolidated deposits	51	3.0-190	28
Basalt	25	5.3-100	30
Salt Lake Formation	10	8.0-360	54.5
Bedrock, undifferentiated	13	1.9-62	21

CHLORIDE IN GROUND WATER

SODIUM AND SALINITY CONCENTRATIONS IN IRRIGATION WATERS CAN BE HAZARDOUS TO CROP GROWTH

All waters sampled in the study area are classified as having a low sodium content and can be used with little danger of developing harmful levels of exchangeable sodium (alkali). Most waters sampled are classified as having medium and high salinity hazard and can be used where consideration is given to leaching, drainage, and plant tolerance.

Suitability of different waters for irrigation use is shown on the diagram (partial copy, following page) for classification of irrigation waters (U.S. Salinity Laboratory Staff, 1954). The sample locations on the diagram are numbered as shown in the "Irrigation diagram number" column in table 2 (Data Section). The classifications are based on specific conductance and on SAR (sodium-adsorption ratio),

$$SAR = \frac{NA^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

in which the concentrations are expressed in milliequivalents per liter.

Values for 103 samples of water are plotted on the diagram. All waters sampled fall within the S1, low sodium, classification. S1 water can be used on most soils with little danger of developing harmful levels of exchangeable sodium (alkali), except perhaps when used for sodium-sensitive crops (Wilcox, 1955, p. 10). Most of the waters sampled fall within the C2 and C3 classifications, medium and high salinity waters, respectively. C2 water can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most places without special practices of salinity control. C3 water should not be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required, and only plants with good tolerance should be grown.

Only one water sample (No. 45, table 2, Data Section) falls within the C4, very high salinity, classification. This water is not suitable for irrigation under ordinary conditions but may be used occasionally under special circumstances, which consider soil permeability, adequacy of drainage, excess application of irrigation water, and salt tolerance of crops.

The well (9S-42E-19ACCl, table l, Data Section) containing C4 water is used for domestic purposes and is finished in the basalt aquifer, close to travertine deposits in the vicinity of Soda Springs. Travertine is composed mostly of calcium carbonate, which is readily soluble and imparts high mineral concentrations in water. Other wells finished in basalt close to travertine deposits could yield similar type water.

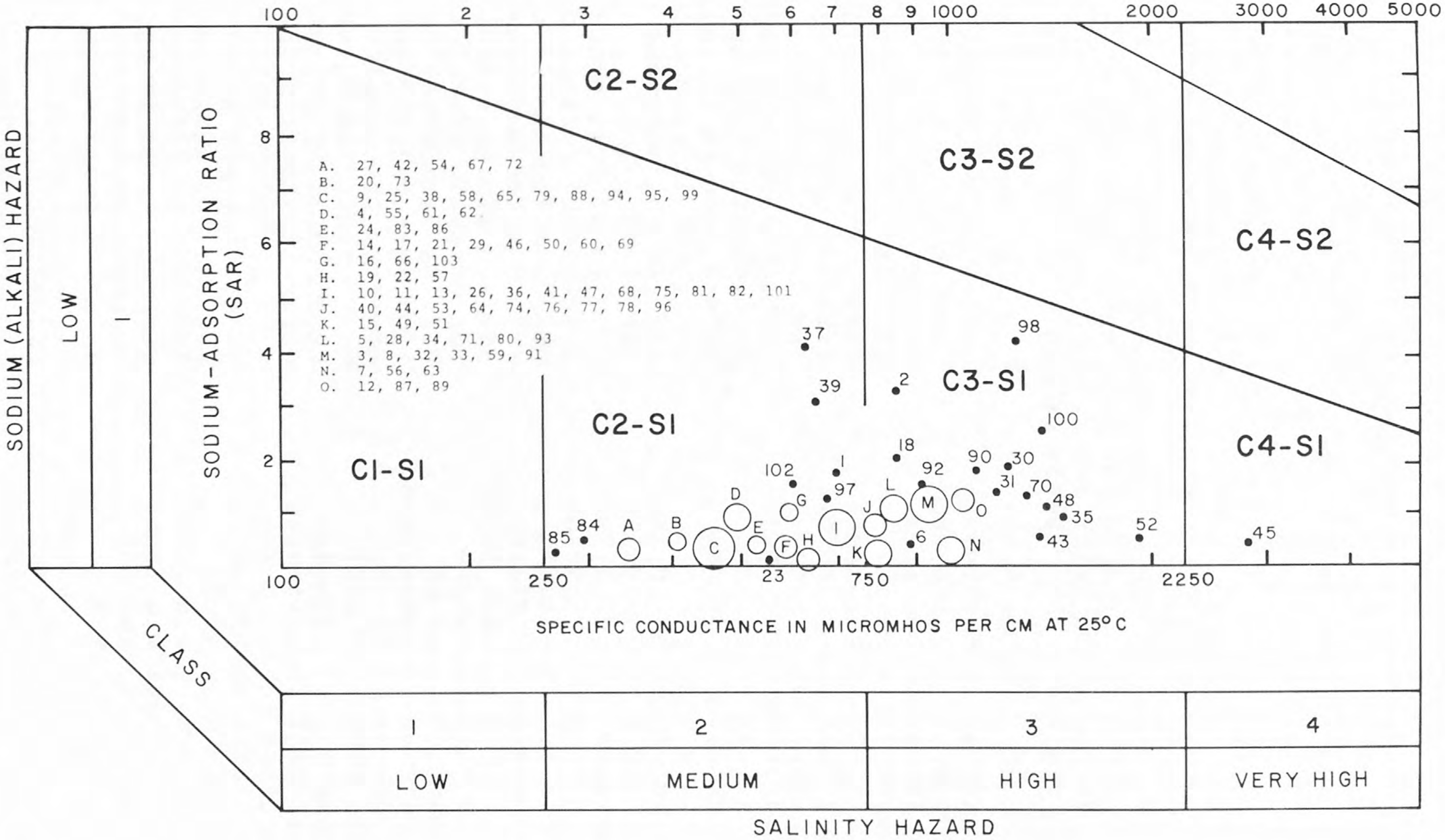


Diagram for the classification of irrigation waters
(Numbers refer to those shown in table 2, Data Section)

6.0 SUMMARY

GROUND WATER IN THE STUDY AREA IS CHEMICALLY SUITABLE FOR MOST USES

Ground water occurs in unconsolidated alluvial deposits of Quaternary age; basalt of Quaternary and(or) Tertiary age; Salt Lake Formation of Tertiary age; and, to a lesser extent, undifferentiated bedrock of pre-Tertiary age. The water is suitable for most uses. However, water from some wells may require treatment to achieve acceptable levels of quality.

Ground water occurs, to some degree, in all the geologic units described in this report--in alluvial deposits of Quaternary age; basalt of Quaternary and(or) Tertiary age; Salt Lake Formation of Tertiary age; and, to a lesser extent, undifferentiated bedrock of pre-Tertiary age.

Wells completed in the alluvial deposits generally yield between 500 and 1,500 gal/min, the greater yields being from coarse gravel. Wells completed in basalt commonly yield between 1,000 and 3,500 gal/min, where sufficient thickness of saturated rock is penetrated. Most of the wells in the Salt Lake Formation will yield some water, although many well-drilling attempts have resulted in dry holes. Some Salt Lake Formation wells in the Bear River basin, however, yield as high as 1,800 gal/min from beds of sandstone and conglomerate (Dion, 1969). Few wells are completed in the undifferentiated bedrock, composed of fine-grained sedimentary and crystalline rocks, and data are insufficient to determine its water-yielding potential. However, yields of existing wells generally are low. Travertine, a calcium carbonate deposit precipitated from spring waters, occurs in the study area, but it is not considered an important aquifer.

In places, concentrations of certain chemical constituents in the ground water may exceed the advised limits established for domestic use by the U.S. Environmental Protection Agency (1975 and 1977); however, the quality of most unsuitable water can be enhanced by selected water-treatment processes.

Dissolved-solids concentrations in water in the various aquifers range from 165 to 1,690 mg/L. In general, water in aquifers adjacent to travertine deposits contain the highest dissolved-solids concentrations.

Hardness of the ground

water ranges from 78 to 1,700 mg/L; most of the water is very hard (more than 180 mg/L). The highest hardness concentrations are in aquifers influenced by travertine deposits.

Nitrite plus nitrate as nitrogen (N) concentrations range from 0 to 29 mg/L. Of 103 water samples, concentrations exceeded 10 mg/L in 5 samples and 1 mg/L in 56 samples.

Chloride concentrations range from 1.9 to 360 mg/L. Only 6 of the 103 groundwater samples obtained during this study contained chloride concentrations in excess of 100 mg/L.

For irrigation purposes, all of the waters are classified as having low-sodium hazard. Most have medium-to high-salinity hazard, and only one is classified as having very high salinity hazard. The very high salinity water was sampled from a well finished in the basalt aquifer adjacent to travertine deposits, which impart high mineral concentrations to water.

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DATA SECTION

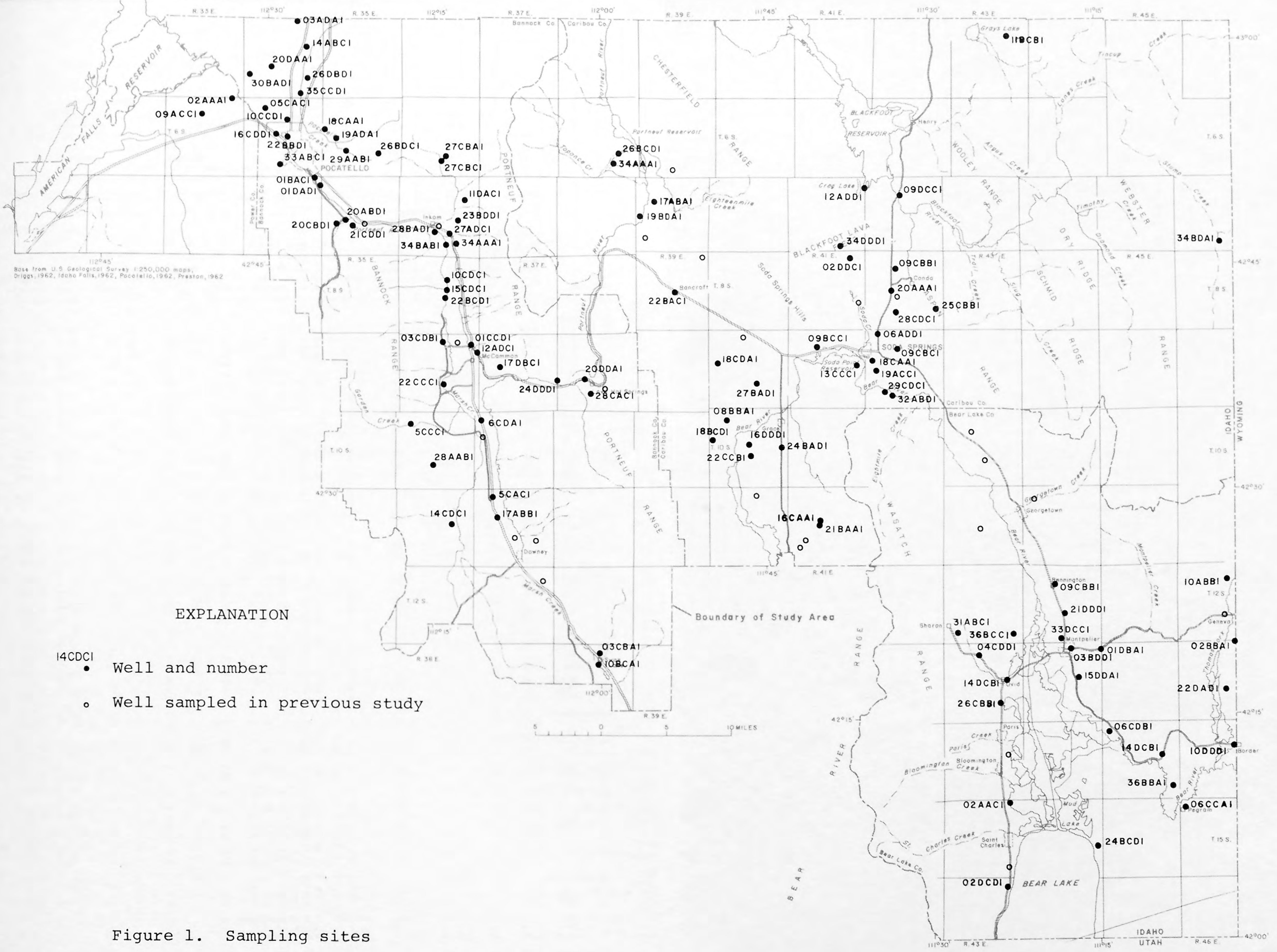

Figure 1. Sampling sites

Table 1. Well characteristics

Altitude: From topographic map

Well finish: O - Open end
P - Perforated casing
X - Open hole

Water level: F - Flowing
P - Pumping
R - Recently pumped

Aquifer: Qs - Unconsolidated deposits
QTv - Basalt
Ts - Salt Lake Formation
pTu - Clastic and carbonate rocks, undifferentiated

Notation: < - less than
> - greater than
* - zero drawdown at time of pump test

Use of water: H - Domestic
I - Irrigation
M - Municipal
N - Industrial
S - Stock

Well number	Altitude of land surface (feet above mean sea level)	Reported depth of well (feet below land surface)	Casing		Well finish	Water level		Aquifer(s)	Reported discharge (gal/min)	Reported specific capacity [(gal/min)/ft of drawdown]	Use of water	Date of well completion
			Diameter (in)	Feet below land surface to first perforation or bottom of casing		Feet below land surface	Date measured					
BANNOCK COUNTY												
05S-34E-03ADA1	4,425	--	6	--	--	28.20	07-13-76	--	>15	--	H	--
14ABC1	4,480	160	6	160	O	54.80	07-13-76	Qs	>15	--	H	1973
20DAA1	4,445	85	6	84	X	50.40	07-13-76	Qs	30	*	H	1974
26DBD1	4,570	240	6	196	X	182.20 R	07-13-76	QTv	15	--	H	1975
30BAD1	4,440	151	6	151	O	40.85	07-13-76	Qs	40	--	H	1974
35CCD1	4,490	--	6	--	--	83.89 R	07-14-76	--	>15	--	H	--
06S-34E-05CAC1	4,460	84	6	84	O	53.24 R	07-14-76	Qs	>15	--	H	1972
10CCD1	4,465	120	6	120	O	56.45 R	07-14-76	Qs	20	5	H	1972
16CDD1	4,440	68	8	68	O	31.45 R	07-14-76	Qs	100	12	N	1974
22BBD1	4,430	80	6	80	O	25.94 R	07-15-76	Qs	20	<1	H	1974
33ABC1	4,800	100	6	100	O	56.43 R	07-15-76	Qs	25	--	H	1973
06S-35E-18CAA1	4,800	282	6	250	P	192.3 R	07-14-76	Qs	30	*	H	1972
19ADA1	4,920	102	6	98	X	49.75 R	07-15-76	Qs	15	*	H	1972
26BDC1	5,860	209	6	197	X	93.18 R	07-15-76	pTu	15	*	H	1972
29AAB1	5,180	42	6	41.5	X	5.28 R	07-15-76	Qs	15	*	H	1972
06S-36E-27CBA1	5,235	260	6	213	P	52.54	08-03-76	pTu	27	--	H	1973
27CBC1	5,160	80	6	60	X	17.48	08-03-76	pTu	7.5	--	H	1975
07S-34E-01BAC1	4,480	63	6	63	O	20.90	08-11-76	Qs	45	--	I	1973
01DAD1	4,480	172	6	172	O	39.13	08-11-76	pTu	3.5	<1	H	1971
07S-35E-20ABD1	4,520	102	8	100	X	46.72	08-05-76	Qs	150	--	H,I	1973
20CBD1	4,660	150	8	150	O	25.93 R	08-05-76	Ts	43	--	H	1973
21CDD1	4,560	195	6	195	O	90.75 R	08-05-76	Qs	28	<1	H	1972
07S-36E-11DAC1	5,000	126	6	106	P	F	08-04-76	Qs	20	--	H	1972
23BDD1	4,940	90	8	90	O	55.98	08-03-76	Qs	20	--	H	1972
27ADC1	4,540	43	6	43	O	27.17	08-04-76	Qs	--	--	H	1972
28BAD1	4,620	185	10	110	P	85.38	08-04-76	Qs	325	81	H,N	1972
34AAA1	4,540	25	6	25	O	7.05 P	08-10-76	Qs	15	*	H	1972
34BAB1	4,580	90	8	80	X	50.18	08-04-76	pTu	8	--	H	1972
08S-36E-10CDC1	4,570	126	8	126	O	31.1	08-06-76	Qs	--	--	H	1972
15CDC1	4,600	233	6	233	O	91.59 P	08-06-76	Qs	20	<1	H	1974
22BCD1	4,580	239	6	192	X	F	08-07-76	Qs	12	--	H	1973
09S-36E-01CCD1	4,710	80	6	73	X	26.45	08-08-76	Qs	15	*	H	1972
03CDB1	4,740	88	6	88	O	22.91	08-07-76	Qs	25	3	H	1973
12ADC1	4,780	42	6	30	P	16.95	08-07-76	Qs	10	5	H	1973
22CCC1	4,680	145	8	145	O	17.14	08-07-76	Qs	50	--	H	1972
09S-37E-17DBC1	4,930	80	6	40	P	17.52	08-29-76	Ts	32	--	H	1975
24DDD1	4,950	65	6	20	X	18.48	08-10-76	QTv	27	--	H	1975
09S-38E-20DDA1	5,060	105	6	72	X	60.73	08-10-76	QTv	15	3	H	1972
28CAC1	5,160	240	6	122	X	81.06 R	08-09-76	Ts	6	<1	H	1974
10S-36E-05CCC1	5,050	100	6	80	X	2.60	08-08-76	Ts	32	--	H	1975
28AAB1	4,930	355	16	170	P	165.60 P	08-08-76	Qs,Ts	--	--	I	1974
10S-37E-06CDA1	4,680	150	16	80	P	F	08-08-76	Qs	--	--	M	1974
11S-36E-14CDC1	4,780	160	8	80	P	90.98 R	08-09-76	Qs,Ts	93	--	H	1973
11S-37E-05CAC1	4,800	140	6	140	O	19.44	08-09-76	Qs	13	--	H	1973
17ABB1	4,820	85	6	67	P	35.40	08-09-76	Ts	24	<1	H	1971
13S-38E-03CBA1	4,790	96	6	72	P	9.76 R	08-29-76	Qs	10	<1	H	1972
10BCA1	4,780	110	6	100	X	14.42 R	09-13-76	Ts	48	--	H	1973
BEAR LAKE COUNTY												
12S-43E-31ABC1	6,180	90	6	79	P	40.32 R	09-14-76	Ts	20	<1	H	1973
36BCC1	5,960	73	6	63	P	1.70 R	09-16-76	Qs	20	2	H	1971
12S-44E-09CBB1	6,030	113	6	93	P	37.40 R	09-17-76	Qs	20	1	H	1974
21DDD1	5,920	84	6	73	P	3.90 P	09-15-76	Qs	20	2	H,S	1972
33DCC1	5,935	52	6	42	P	3.08	09-19-76	Qs	20	*	S	1967
12S-46E-10ABB1	6,290	128	6	63	X	33.92 R	09-15-76	pTu	15	1	H	1972
13S-43E-04CDD1	5,970	64	6	52	P	8.75 R	09-14-76	Qs	25	2	H,S	1971
14DCB1	5,920	46	6	37	P	5.0	05-29-66	Qs	20	--	H	1966
26CBB1	5,960	82	6	75.5	X	17.30 R	09-14-76	Qs	--	--	H	1958

Table 1. Well characteristics (Continued)

			Casing			Water level						
Well number	Altitude of land surface (feet above mean sea level)	Reported depth of well (feet below land surface)	Diameter (in)	Feet below land surface to first perforation or bottom of casing	Well finish	Feet below land surface	Date measured	Aquifer(s)	Reported discharge (gal/min)	Reported specific capacity [(gal/min)/ft of drawdown]	Use of water	Date of well completion
BEAR LAKE COUNTY (CONTINUED)												
13S-44E-01DBA1	6,110	75	8	40	P,X	4.52	09-18-76	Ts(?)	30	2	H	1967
03BDD1	5,975	300	16	250	P	63.0	10-27-54	Qs	1,300	43	M	1944
15DDA1	5,960	71	6	63	P	8.41 R	09-18-76	Qs	20	2	H	1970
13S-46E-02BBA1	6,180	118	6	108	P	59.58 P	09-15-76	Qs	20	2	H	1961
22DAD1	6,140	208	12	83	P	98.33 P	09-15-76	Qs	900	30	I	1961
14S-45E-06CDB1	5,960	98	6	86	P	21.55 R	09-18-76	Qs	20	2	H	1971
14DCB1	6,010	97	6	47	P	10.63 R	09-16-76	pTu	20	1	H,S	1973
36BBA1	6,050	76	6	58	P,X	27.02 R	09-16-76	pTu	20	2	H	1970
14S-46E-10DDD1	6,060	108	6	100	P	2.0	07-01-68	Qs	20	2	H	1968
15S-43E-02AAC1	5,940	50	6	46	O	6.33 R	09-14-76	Qs	20	2	H,S	1969
15S-44E-24BCD1	5,980	232	6	220	P,X	3.32 R	09-14-76	Qs	15	<1	H	1973
15S-46E-06CCA1	6,030	40	6	--	P	5.85	09-16-76	Qs	--	--	I	1967
16S-43E-02DCD1	5,950	130	8	120	P	F	09-19-76	Ts	25	1	H	1965
CARIBOU COUNTY												
05S-43E-11BCB1	6,430	225	6	215	P	14.88	09-17-76	pTu	--	--	H	1958
06S-38E-26BCD1	5,525	64	6	29	P	20.98 R	08-24-76	Qs	20	4	H	1966
34AAA1	5,560	53	6	36	P	--	--	Qs	--	--	H	1956
07S-39E-17ABA1	5,326	46	8	41	X	22.0	02-13-70	QTv	20	--	H	1970
19BDA1	5,320	65	6	45	P	17.15	08-26-76	QTv	30	--	S	1972
07S-41E-12ADD1	6,100	63	6	41	P	18.95 R	09-20-76	QTv	100	--	H	1975
34DDD1	6,100	160	6	140	P	108.91 R	08-30-76	QTv	20	*	H	1966
07S-42E-09DCC1	6,130	111	6	75	P	54.11 R	09-20-76	QTv	30	--	H	1974
07S-46E-34BDA1	6,240	90	6	70	P	20.23	09-17-76	pTu	15	1	H	1970
08S-39E-22BAC1	5,425	185	8	93	X	78.11	08-25-76	QTv	300	1,760	M	1935
08S-41E-02DDC1	6,050	100	6	21	X	74.85	08-30-76	QTv	15	--	H,N	1965
08S-42E-09CBB1	6,140	245	6	225	X	149.76 R	09-20-76	QTv	--	--	H	1970
20AAA1	6,090	162	6	105	P,X	65.51	09-20-76	QTv	25	--	H	1975
25CBB1	6,575	392	6	362	P	360.0	10-16-66	pTu	10	--	H	1966
28BCD1	6,085	90	6	65	X	53.32 R	08-30-76	QTv	--	--	H	1966
09S-40E-18CDA1	5,520	190	18	150	P,X	93.2 P	08-25-76	QTv	1,350	150	I	1954
27BAD1	5,620	220	4	200	P	186.80	08-25-76	QTv	--	--	H,S	1974
09S-41E-09BCC1	5,750	70	6	20	X	44.59 P	08-28-76	QTv	9	<1	H	1975
13CCC1	5,810	138	5	117	P	84.10	08-27-76	QTv	30	--	H	1974
09S-42E-06ADD1	5,925	105	5	85	P	23.33	08-27-76	QTv	35	--	H	1974
09CBC1	5,950	219	6	209	P	175.48 R	08-27-76	pTu	10	1	H	1969
18CAA1	5,825	108	5	62	P,X	45.47 R	08-28-76	QTv	20	<1	H	1975
19ACC1	5,850	120	6	88	X	67.38 R	08-27-76	QTv	20	--	H	1973
29CDC1	5,850	100	6	70	P	33.91 R	08-27-76	Ts	--	--	H	1966
32ABD1	5,825	104	5	83	P	33.43	08-27-76	Qs	20	--	H	1974
10S-40E-08BBA1	5,477	300	16	70	P	76.96 P	08-25-76	QTv	1,680	8	I	1960
16DDD1	5,440	170	6	142	P	110.29 R	08-26-76	QTv	--	--	H	1956
18BCD1	5,490	134	6	100	P	65.0	06-20-73	Qs	10	--	H	1973
22CCB	5,200	125	6	84	P	84.17	08-28-76	QTv	17	--	H	1975
24BAD1	5,510	210	6	16	X	166.0	03-23-63	QTv	--	--	H,S	1963
11S-41E-16CAA1	5,270	60	6	55	P	38.20 R	08-26-76	pTu	15	--	H	1973
21BAA1	5,270	65	6	10	P	9.75 P	08-26-76	Qs	--	--	H	1974
POWER COUNTY												
06S-33E-02AAA1	4,420	180	6	156	X	19.67 R	08-31-76	Qs	20	--	H	1975
09ACC1	4,450	370	20	287	X	49.85	08-31-76	QTv	2,500	625	I	1972

B - Results based on colony count outside the statistically ideal range (nonideal colony count)
E - Estimated
ND - Material specifically analyzed for but not detected
< - Less than
\> - Greater than

WELL NUMBER	DATE OF SAMPLE	IRRIGATION DIAGRAM NUMBER	FLOW RATE (GPM)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	ALKA-LINITY AS CACO3 (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)
													BANNOCK
05S 34E 03ADA1	76-07-13	103	E15	23	10	68	19	38	2.6	312	0	256	38
05S 34E 14ABC1	76-07-13	101	E15	39	10	81	28	29	5.5	366	0	300	53
05S 34E 20DAA1	76-07-13	100	E15	37	10	88	45	120	9.1	305	0	250	140
05S 34E 26DBD1	76-07-13	98	E15	41	30	45	37	160	2.7	468	0	384	100
05S 34E 30BAD1	76-07-13	99	E15	26	20	49	15	17	3.3	188	0	154	38
05S 34E 35CCD1	76-07-14	96	E15	47	20	82	31	37	7.4	391	0	321	53
06S 34E 05CAC1	76-07-14	97	E15	30	20	50	31	49	7.0	370	0	303	44
06S 34E 10CCD1	76-07-14	93	E20	24	20	77	33	51	7.3	389	0	319	46
06S 34E 16CDD1	76-07-14	91	E100	23	10	88	35	54	6.7	411	0	337	55
06S 34E 22BBD1	76-07-15	90	E20	25	20	92	39	88	7.8	451	0	370	90
06S 34E 33ABC1	76-07-15	82	E25	19	10	71	23	25	1.8	236	0	194	54
06S 35E 18CAA1	76-07-14	92	E30	29	30	71	36	61	2.8	293	0	240	74
06S 35E 19ADA1	76-07-15	89	E15	27	30	89	46	66	2.5	393	0	322	88
06S 35E 26BDC1	76-07-15	87	E15	34	10	110	40	59	3.0	559	0	458	29
06S 35E 29AAB1	76-07-15	88	E15	21	30	49	17	20	1.1	201	0	165	27
06S 36E 27CBA1	76-08-03	85	E15	26	940	28	10	7.8	1.9	133	0	109	6.0
06S 36E 27CBC1	76-08-03	84	E5.0	60	1200	29	12	12	4.9	176	0	144	7.2
07S 34E 01BAC1	76-08-11	81	E45	25	10	77	28	34	6.7	331	0	271	38
07S 34E 01DAD1	76-08-11	80	E3.0	26	20	82	28	45	5.4	331	0	271	52
07S 35E 20ABD1	76-08-05	75	E100	24	30	76	26	32	6.0	319	0	262	38
07S 35E 20CBD1	76-08-05	72	E20	13	10	55	7.2	7.1	.7	176	0	144	6.1
07S 35E 21CDD1	76-08-05	71	E15	26	20	90	33	38	3.0	302	0	248	76
07S 36E 11DAC1	76-08-04	78	E20	30	10	89	23	29	1.0	267	0	219	27
07S 36E 23BDD1	76-08-03	74	E20	29	60	81	27	35	1.5	312	0	256	23
07S 36E 27ADC1	76-08-04	69	E15	22	10	66	16	21	1.7	218	0	179	22
07S 36E 28BAD1	76-08-04	70	E100	24	60	130	38	69	3.5	220	0	180	230
07S 36E 34AAA1	76-08-10	67	E15	21	10	34	16	12	2.0	174	0	143	9.9
07S 36E 34BAB1	76-08-04	68	E10	51	10	78	25	24	6.1	281	0	230	24
08S 36E 10CDC1	76-08-06	62	E15	18	1300	56	12	36	4.3	276	0	226	2.4
08S 36E 15CDC1	76-08-06	61	E15	17	540	56	15	29	3.6	281	0	230	1.6
08S 36E 22BCD1	76-08-07	58	E12	69	180	53	11	16	7.3	264	0	217	2.0
09S 36E 01CCD1	76-08-08	53	E15	32	20	78	38	29	7.3	398	0	326	43
09S 36E 03CDB1	76-08-07	54	E15	25	10	44	9.2	13	1.9	143	0	117	13
09S 36E 12ADC1	76-08-17	51	E10	25	10	71	47	17	1.6	433	0	276	11
09S 36E 22CCC1	76-08-07	42	E15	59	180	45	7.9	12	5.3	190	0	156	3.5
09S 37E 17DBC1	76-08-29	47	E15	49	70	86	22	27	5.8	354	0	290	21
09S 37E 24DDD1	76-08-10	41	E15	28	30	73	34	26	3.0	388	0	318	18
09S 38E 20DDA1	76-08-10	44	E15	45	30	83	26	35	7.8	379	0	311	36
09S 38E 28CAC1	76-08-09	39	E5.0	53	1800	200	60	200	41	833	0	683	110
10S 36E 05CCC1	76-08-08	36	E15	29	80	81	23	18	2.0	215	0	176	23
10S 36E 28AAB1	76-08-08	30	E200	41	20	150	40	100	5.8	527	0	432	55
10S 37E 06CDA1	76-08-08	37	--	86	150	21	6.1	84	26	280	0	230	22
11S 36E 14CDC1	76-08-09	26	E15	54	10	65	35	22	4.3	232	0	190	24
11S 37E 05CAC1	76-08-09	29	E10	57	170	36	26	14	18	229	0	188	12
11S 37E 17ABB1	76-08-09	28	E15	39	60	71	36	51	3.2	343	0	281	57
13S 38E 03CBA1	76-08-29	16	E15	22	70	50	22	32	3.8	203	0	167	45
13S 38E 10BCA1	76-09-13	13	15	48	310	72	16	37	4.8	242	0	198	24

DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	TOTAL PHOS-PHORUS (P) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED SOLIDS (TONS PER AC-FT)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	IMME-DIATE COLI-FORM (COL. PER 100 ML)	FECAL COLI-FORM (COL. PER 100 ML)
COUNTY														
24	.1	.30	.10	377	.51	250	0	25	1.1	599	7.5	13.0	<1	<1
20	.2	2.8	.03	449	.61	320	17	16	.7	688	7.5	14.0	B3	<1
190	.3	2.2	.02	790	1.07	410	150	39	2.6	1340	6.8	13.5	<1	<1
100	2.5	1.2	.02	724	.98	260	0	57	4.3	1220	7.2	25.0	<1	<1
20	.8	.74	.00	265	.36	180	30	16	.5	459	7.5	13.0	<1	<1
24	.3	3.2	.05	486	.66	330	12	19	.9	752	7.3	16.0	28	--
16	.4	2.4	.03	420	.57	250	0	29	1.3	669	7.5	14.0	<1	<1
53	.3	3.4	.03	498	.68	330	9	25	1.2	804	8.6	16.5	>160	<1
65	.2	2.0	.04	538	.73	360	27	24	1.2	910	7.4	18.0	<1	<1
81	.2	4.2	.01	664	.90	390	20	32	1.9	1070	6.9	17.0	<1	<1
59	.3	.17	.04	370	.50	270	78	17	.7	654	7.4	13.5	<1	<1
110	.4	.80	.03	532	.72	330	35	29	1.5	902	7.6	15.0	<1	<1
100	.3	2.0	.06	621	.84	410	89	26	1.4	1020	7.6	14.0	<1	<1
52	.3	.82	.12	616	.84	440	0	22	1.2	1040	7.3	10.5	<1	<1
34	.2	.75	.05	272	.37	190	25	18	.6	447	7.0	13.0	--	--
10	.2	.22	.01	165	.22	110	0	13	.3	262	7.1	11.5	B1	B1
6.8	.3	.02	.05	220	.30	120	0	17	.5	289	7.5	9.5	<1	<1
39	.2	2.0	.04	420	.57	310	38	19	.8	697	7.2	11.5	B4	<1
61	.2	2.5	.05	474	.64	320	48	23	1.1	793	7.3	14.0	<1	<1
38	.2	1.9	.04	406	.55	300	38	19	.8	690	7.1	12.0	B1	<1
17	.1	.08	.00	193	.26	170	26	8	.2	349	7.5	18.0	<1	<1
72	.3	3.0	.04	500	.68	360	110	19	.9	835	7.5	14.0	<1	<1
57	.2	9.6	.04	430	.58	320	98	17	.7	755	7.2	14.5	<1	<1
67	.2	3.2	.09	432	.59	310	58	19	.9	756	7.2	11.5	<1	<1
44	.2	3.8	.08	317	.43	230	51	16	.6	574	7.4	14.0	<1	<1
120	.1	8.8	.03	762	1.04	480	300	24	1.4	1260	7.5	15.0	<1	<1
20	.2	.39	.02	203	.28	150	7	15	.4	346	7.4	14.0	<1	<1
58	.2	1.9	.04	413	.56	300	69	15	.6	684	7.6	18.0	<1	<1
21	.2	.02	.02	287	.39	190	0	29	1.1	509	7.7	12.5	B11	<1
18	.1	.06	.03	280	.38	200	0	23	.9	496	7.7	14.5	<1	<1
12	.2	.02	.06	301	.41	180	0	16	.5	428	7.5	15.0	<1	<1
31	.3	2.2	.05	466	.63	350	25	15	.7	753	7.1	16.0	B2	<1
24	.1	2.2	.07	210	.29	150	33	16	.5	349	7.2	22.0	<1	<1
20	.3	.66	.10	416	.57	370	94	9	.4	761	7.1	13.0	<1	<1
16	.3	.06	.04	243	.33	150	0	15	.4	334	7.3	17.0	<1	<1
49	.2	1.0	.08	439	.60	310	15	16	.7	714	7.6	11.5	<1	<1
21	.1	2.3	.05	404	.55	320	2	15	.6	678	7.2	15.0	<1	<1
48	.3	.99	.07	482	.66	340	29	18	.8	782	7.4	15.0	B2	<1
360	.1	.27	.10	1440	1.96	750	63	35	3.2	2300	6.6	19.0	<1	<1
84	.1	1.7	.02	374	.51	300	120	12	.5	682	7.1	11.0	B2	<1
120	.1	29	.12	811	1.10	540	110	28	1.9	>1199	7.4	18.5	<1	<1
53	.8	.07	.04	437	.59	78	0	62	4.2	623	7.1	16.5	<1	<1
97	.3	.27	.03	417	.57	310	120	13	.5	714	7.2	14.0	<1	<1
26	.3	.07	.02	303	.41	200	9	12	.4	552	7.4	12.0	22	B1
69	.2	2.2	.05	505	.69	330	49	25	1.2	843	7.8	12.0	1	<1
59	.2	.91	.04	338	.46	220	49	24	.9	575	7.6	13.0	<1	<1
77	.3	.06	.05	399	.54	250	47	24	1.0	660	7.5	13.0	<1	<1

Table 2. Water-sample

WELL NUMBER	DATE OF SAMPLE	IRRIGATION DIAGRAM NUMBER	FLOW RATE (GPM)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	ALKA-LINITY AS CACO3 (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)
													BEAR LAKE
12S 43E 31ABC1	76-09-14	21	E20	31	70	74	23	15	.7	329	0	270	14
12S 43E 36BCC1	76-09-16	20	E15	40	80	38	18	19	8.9	229	0	188	13
12S 44E 09CBB1	76-09-17	23	E20	12	40	87	15	6.8	.8	286	0	235	33
12S 44E 21DDD1	76-09-15	22	E20	13	30	83	27	7.4	1.0	242	0	198	110
12S 44E 33DCC1	76-09-19	19	E20	12	40	86	24	9.5	1.2	294	0	241	59
12S 46E 10ABB1	76-09-15	24	E10	18	790	81	15	15	.8	314	0	258	24
13S 43E 04CDD1	76-09-14	14	>25	24	30	74	24	15	1.1	351	0	288	8.5
13S 43E 14DCB1	76-09-19	12	E10	11	4600	93	53	60	4.9	594	0	487	34
13S 43E 26CBB1	76-09-14	9	>15	25	10	61	17	14	2.3	260	0	213	7.4
13S 44E 01DBA1	76-09-18	15	E20	13	350	110	31	10	1.4	323	0	265	140
13S 44E 03BDD1	76-09-19	17	1300	13	40	78	25	9.6	1.2	277	0	227	84
13S 44E 15DDA1	76-09-18	11	E20	25	80	72	28	23	5.4	239	0	148	43
13S 46E 02BBA1	76-09-15	18	E20	11	40	66	20	76	1.1	266	0	218	52
13S 46E 22DAD1	76-09-15	10	>100	10	40	66	27	36	1.4	228	0	187	32
14S 45E 06CDB1	76-09-18	8	E15	40	180	73	51	40	5.9	380	0	236	99
14S 45E 14DCB1	76-09-16	6	E20	15	60	95	38	20	1.8	224	0	184	120
14S 45E 36BBA1	76-09-16	5	E20	11	60	76	36	47	3.3	248	0	203	180
14S 46E 10DDD1	76-09-15	7	E20	17	40	110	48	23	1.9	209	0	171	300
15S 43E 02AAC1	76-09-14	4	E15	18	690	41	21	32	1.3	307	0	252	1.6
15S 44E 24BCD1	76-09-14	2	15	36	870	41	26	110	8.8	271	0	222	190
15S 46E 06CCA1	76-09-16	3	E15	11	30	84	45	58	3.9	412	0	338	57
16S 43E 02DCD1	76-09-18	1	5.0	14	40	34	30	59	25	273	0	224	34
													CARIBOU
05S 43E 11BCB1	76-09-17	102	>15	10	540	52	19	53	2.7	371	0	304	10
06S 38E 26BCD1	76-08-24	86	E15	33	--	61	17	14	1.2	262	0	215	18
06S 38E 34AAA1	76-08-24	83	E15	33	--	54	19	14	3.4	258	0	212	13
07S 39E 17ABA1	76-08-26	77	E15	26	10	79	45	27	8.6	436	0	358	56
07S 39E 19BDA1	76-08-26	76	E15	22	1400	100	26	31	4.0	369	0	303	63
07S 41E 12ADD1	76-09-20	79	E15	22	140	51	19	8.2	2.6	244	0	152	14
07S 41E 34DDD1	76-08-30	65	E15	49	300	37	27	13	6.1	251	0	206	10
07S 42E 09DCC1	76-09-20	73	E20	21	560	56	15	8.2	1.6	237	0	194	8.8
07S 46E 34BDA1	76-09-17	66	E15	12	100	55	20	39	2.1	290	0	238	13
08S 39E 22BAC1	76-08-25	59	E300	29	--	89	44	39	3.4	437	0	358	55
08S 41E 02DDC1	76-08-30	64	E15	34	--	66	44	30	4.0	386	0	317	28
08S 42E 09CBB1	76-09-20	63	E20	29	200	120	54	15	3.6	447	0	282	110
08S 42E 20AAA1	76-09-20	60	E20	25	180	66	23	18	4.0	210	0	172	55
08S 42E 25CBB1	76-08-30	57	E15	15	40	95	25	5.8	1.1	412	0	338	16
08S 42E 28CDC1	76-08-30	56	E15	14	20	150	43	6.1	1.6	656	0	538	33
09S 40E 18CDA1	76-08-25	48	E1500	33	10	100	88	68	12	590	0	484	120
09S 40E 27BAD1	76-08-25	43	E15	42	30	120	94	37	13	781	0	641	97
09S 41E 09BCC1	76-08-28	52	E15	51	180	13	260	49	4.7	1420	0	1170	88
09S 41E 13CCC1	76-08-27	46	E15	22	30	70	24	13	2.5	269	0	221	26
09S 42E 06ADD1	76-08-27	55	E15	30	40	120	62	42	6.7	478	0	392	150
09S 42E 09CBC1	76-08-27	50	E15	44	10	76	19	16	5.7	305	0	250	27
09S 42E 18CAA1	76-08-26	49	E15	25	80	98	47	12	3.4	505	0	414	49
09S 42E 19ACC1	76-08-27	45	E20	73	--	140	320	46	9.5	1930	0	1580	140
09S 42E 29CDC1	76-08-27	40	E15	40	--	80	22	9.2	3.5	312	0	317	28
09S 42E 32ABD1	76-08-27	38	E15	24	180	68	20	6.7	2.3	254	0	208	11
10S 40E 08BBA1	76-08-25	35	>100	69	--	76	130	55	21	855	0	538	90
10S 40E 16DDD1	76-08-26	33	E15	22	10	66	50	58	6.9	434	0	356	77
10S 40E 18BCD1	76-08-28	34	E15	25	30	98	28	51	2.5	392	0	322	78
10S 40E 22CCB1	76-08-28	31	E20	31	270	71	72	68	11	548	0	449	88
10S 40E 24BAD1	76-08-26	32	E15	27	10	70	49	52	6.8	359	0	294	71
11S 41E 16CAA1	76-08-26	27	E15	5.4	10	56	12	1.8	.4	217	0	178	5.4
11S 41E 21BAA1	76-08-26	25	E15	19	10	80	17	5.3	1.2	337	0	276	8.1
													POWER
06S 33E 02AAA1	76-08-31	95	E15	24	60	59	17	17	3.3	242	0	198	38
06S 33E 09ACC1	76-08-31	94	E1500	26	70	51	16	19	3.9	183	0	150	60

analyses (Continued)

DIS- SOLVED CHLO- RIDE (CL) (MG/L)	DIS- SOLVED FLUO- RIDE (F) (MG/L)	DIS- SOLVED NITRITE PLUS NITRATE (N) (MG/L)	TOTAL PHOS- PHORUS (P) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)	HARD- NESS (CA,MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	PERCENT SODIUM	SODIUM AD- SORP- TION RATIO	CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	TEMPER- ATURE (DEG C)	DIATE COLI- FORM (COL. PER 100 ML)	FECAL COLI- FORM (COL. PER 100 ML)
COUNTY														
8.0	.5	4.0	.06	346	.47	280	10	10	.4	561	7.2	9.5	<1	<1
7.6	.4	.21	.02	267	.36	170	0	19	.6	409	7.5	10.0	B24	<1
5.2	.1	4.3	.01	320	.44	280	45	5	.2	545	7.2	9.0	<1	<1
5.3	.2	3.3	.02	381	.52	320	120	5	.2	625	7.6	9.0	<1	<1
4.3	.1	1.9	.01	353	.48	310	46	6	.2	601	7.4	8.5	<1	<1
9.1	.2	.25	.09	320	.44	260	2	11	.4	536	7.2	8.5	23	<1
13	.2	1.2	.04	338	.46	280	0	10	.4	567	7.4	8.5	<1	<1
37	.1	.46	.46	592	.81	450	0	22	1.2	1040	7.5	10.0	B8	B6
3.1	.1	.36	.04	260	.35	220	9	12	.4	468	7.6	10.0	<1	<1
9.8	.2	.08	.01	475	.65	400	140	5	.2	754	7.3	8.0	<1	<1
4.8	.2	1.5	.01	359	.49	300	73	7	.2	584	7.4	9.0	<1	<1
63	.8	7.9	.02	384	.52	300	150	14	.6	703	7.5	11.5	B14	B3
110	.1	1.6	.03	474	.64	250	32	40	2.1	827	7.5	10.0	<1	<1
80	.2	4.6	.01	385	.52	280	93	22	.9	712	7.4	9.0	<1	<1
53	.2	.93	.02	462	.63	390	160	18	.9	911	7.5	10.0	B2	<1
49	.1	19	.02	478	.65	390	210	10	.4	867	7.4	9.0	<1	<1
39	.5	.74	.01	518	.70	340	140	23	1.1	829	7.5	10.5	<1	<1
28	.1	.74	.02	634	.86	470	300	10	.5	969	7.3	9.0	<1	<1
3.1	.3	.01	.26	270	.37	190	0	27	1.0	492	7.5	8.5	--	<1
16	.5	.00	.00	563	.77	210	0	52	3.3	831	7.8	15.0	<1	<1
33	.2	2.0	.01	500	.68	400	100	24	1.3	966	7.4	8.5	B5	<1
60	.8	.57	.00	394	.54	210	0	35	1.8	697	7.6	10.0	<1	<1
COUNTY														
15	.2	.02	.01	345	.47	210	0	35	1.6	597	7.7	9.0	<1	<1
22	.4	.35	.01	297	.40	220	5	12	.4	513	7.5	9.0	B1	B1
18	.3	2.0	.10	291	.40	210	0	12	.4	522	7.4	9.5	B4	B4
23	.3	1.0	.12	484	.66	380	22	13	.6	794	7.3	10.5	B3	<1
45	.3	.04	.03	475	.65	360	57	16	.7	777	7.4	9.5	B7	<1
6.2	.3	.04	.09	253	.34	210	54	8	.2	430	7.2	10.5	<1	<1
9.9	.2	1.9	.09	285	.39	200	0	12	.4	435	6.4	11.5	<1	<1
5.3	.2	.82	.06	237	.32	200	6	8	.3	404	7.2	8.5	<1	<1
39	.2	1.1	.00	328	.45	220	0	28	1.1	587	7.4	7.5	<1	<1
54	.2	2.8	.06	541	.74	400	42	17	.8	903	7.5	9.5	<1	<1
38	2.0	5.4	.11	458	.62	350	29	16	.7	769	7.1	7.5	B8	<1
23	.2	19	.07	575	.78	550	260	6	.3	1030	7.4	8.0	<1	<1
46	.2	4.8	.06	364	.50	260	87	13	.5	590	7.2	8.0	<1	<1
6.0	.2	.21	.01	368	.50	340	2	4	.1	630	7.3	11.0	<1	<1
7.8	.3	.98	.01	584	.79	550	14	2	.1	992	7.1	12.5	<1	<1
47	.3	3.1	.07	790	1.07	610	260	70	1.2	1350	7.5	10.0	<1	<1
30	.3	1.1	.08	823	1.12	690	49	10	.6	1340	7.1	14.5	<1	<1
12	.5	.13	.88	1180	1.60	1100	0	9	.6	1910	7.8	13.0	1	1
26	.2	4.1	.06	334	.45	270	49	9	.3	557	7.4	9.5	<1	<1
63	.4	6.8	.08	726	.99	560	160	14	.8	1170	7.3	11.0	B1	B1
21	.7	.53	.03	362	.49	270	18	11	.4	564	7.5	11.5	<1	<1
12	.3	1.1	.03	501	.68	440	24	6	.3	802	7.4	9.0	<1	<1
13	.1	.11	.50	1690	2.30	1700	82	6	.5	2730	6.9	10.0	ND	ND
38	.2	5.4	.11	458	.62	350	29	16	.7	769	7.1	7.5	B8	<1
8.8	.1	.92	.03	272	.37	250	120	5	.2	489	7.4	8.5	<1	<1
45	.2	15	.08	909	1.24	730	190	14	.9	1440	7.2	10.0	B2	<1
53	.3	2.8	.09	559	.76	370	14	25	1.3	927	7.6	11.0	B1	<1
42	.1	3.4	.17	533	.72	360	38	23	1.2	854	7.5	11.0	<1	<1
56	.4	2.4	.17	678	.92	470	20	23	1.4	1130	7.3	12.0	<1	<1
51	.4	15	.44	571	.78	380	82	23	1.2	971	7.5	13.0	<1	<1
1.9	.1	.03	.01	190	.26	190	11	2	.1	338	7.7	6.5	<1	<1
3.0	.2	.17	.05	301	.41	270	0	4	.1	482	7.5	9.0	<1	<1
COUNTY														
17	.7	1.0	.01	300	.41	220	19	14	.5	477	7.8	11.5	<1	<1
23	.7	.71	.03	293	.40	190	43	17	.6	447	7.9	11.5	<1	<1