

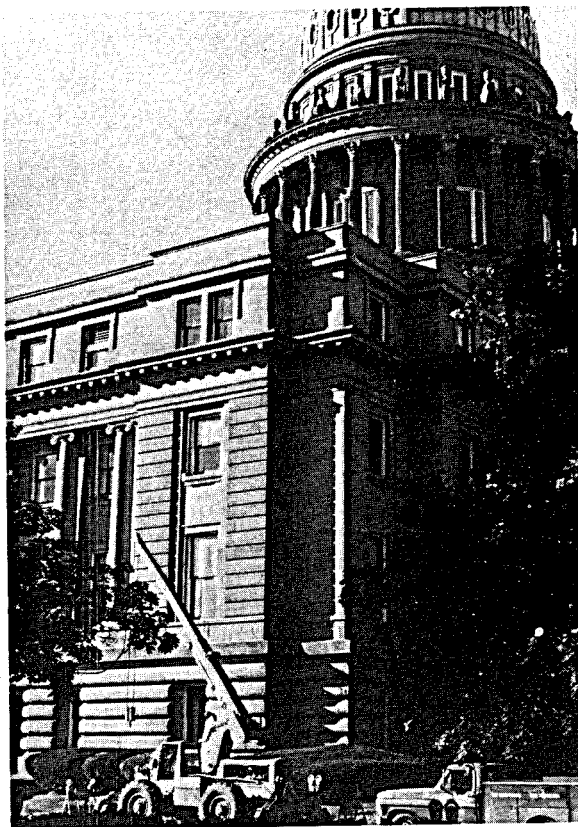
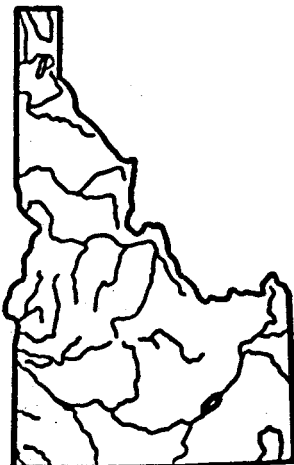
**MASTER**

# GEOHERMAL INVESTIGATIONS IN IDAHO

## PART 9

### POTENTIAL FOR DIRECT HEAT APPLICATION OF GEOHERMAL RESOURCES

*Drillers finish work on the first  
of several geothermal wells  
being planned for the Capitol Mall  
complex in Boise where it is  
hoped that enough hot water  
will be found to heat  
several state buildings.*



IDAHO DEPARTMENT OF WATER RESOURCES  
WATER INFORMATION BULLETIN NO. 30  
JUNE 1980

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**WATER INFORMATION BULLETIN NO. 30  
GEOHERMAL INVESTIGATIONS IN IDAHO**

**Part 9**

**Potential for Direct Heat Application of  
Geothermal Resources**

by

**John C. Mitchell  
Linda L. Johnson  
John E. Anderson**

**With a section on Preliminary Environmental Assessment  
of Idaho Geothermal Resource Areas**

by

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**Work performed under U.S. Department of Energy Contract  
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**Idaho Department of Water Resources  
Statehouse  
Boise, Idaho**

June 1980

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Field checking of many springs and well locations was accomplished by Andres Garcia, George Denman, Mark Von Lindern and Larry Beard of the Idaho Department of Water Resources (IDWR). Compilation of the computerized data on thermal springs and wells for the two maps was the responsibility of Sharron Chapman, IDWR. Other IDWR personnel, especially Ralph Mellin, provided review assistance and many details for the report.

National Oceanic and Atmospheric Administration (NOAA) published the map Geothermal Resources of Idaho (Plate 1 in pocket) using information on thermal springs and wells supplied by IDWR, the USGS Geotherm data bank, and many other sources.

All of these cooperative efforts are gratefully acknowledged and appreciated; without such generous support, this study could not have been accomplished.

## PREFACE

Geothermal energy (the natural heat energy of the earth) is receiving nationwide attention. Increasing involvement of many parties in the exploration for and development of this energy source has been accelerated by four factors:

1. Ecologically, geothermal energy appears to be a better alternative than other methods of power generation such as nuclear, fossil fuel or hydroelectric.
2. Economically, it competes favorably with hydroelectric and fossil fuel power generation and may be less expensive than nuclear methods.
3. Enormous reserves of geothermal resources have been identified and can be developed if the effort is made to utilize them.
4. Efficient use of all energy sources is recognized as necessary if present energy shortages are to be alleviated and future shortages avoided.

Published information on the geothermal potential in Idaho consists mostly of numerous reports that briefly describe or mention thermal water occurrences in particular areas or regions of the state. Seven published reports (Stearns and others, 1937; Waring, 1956; Ross, 1971; Nichols and others, 1972; Warner, 1972 and 1975; Young and Mitchell, 1973) have been written on Idaho's geothermal potential on a statewide basis. Three of the reports are mainly compilations of pre-existing data collected by various investigators over an extended time interval of approximately 50 to 60 years. Waring (1965, p. 26-31) essentially updates the data of Stearns and others (1973, p. 136-151). Godwin and others (1971) classified approximately 6,075,000 hectares (15 million acres) of land in Idaho as being prospectively valuable for geothermal exploration. Ross (1971) published geologic and chemical information on about 380 thermal water occurrences, and presented brief evaluations of the geothermal potential of different regions of the state. Nichols and others (1972) identified nonpower uses and the economic impact of these uses on Idaho. Warner (1972 and 1975) dealt with Idaho's geothermal potential based on its regional geologic setting. Other reports deal with localized areas. Young and Whitehead (1975a, 1975b) wrote on the geothermal potential of the Bruneau-Grand View and Weiser areas. Mitchell (1976a, 1976b, 1976c) published information on the northern Cache Valley, Blackfoot, and Camas Prairie areas.

Wilson and others (1976) reported on geothermal investigations of the Cascade, Idaho, area. Mink and Graham (1977) reported on the geothermal potential of the west Boise area. In addition to the above published reports, there are seven unpublished open-file reports prepared by the U.S. Geological Survey (USGS) that are listed in the selected references. These are available for public review.

In Idaho, the prospects for early development of geothermal energy as an energy source appear excellent. The regional geologic setting appears favorable for the existence of large geothermal fields, although little is known of the full potential of this resource. A great deal more must be learned of geothermal occurrence and utilization. The Idaho Department of Water Resources (IDWR) initiated a study of geothermal potential to generate interest in development of the resources and to properly perform the department's regulatory function (Water Information Bulletin No. 30, Part 1, Young and Mitchell, 1973). The study, prepared jointly with the USGS, located 25 areas in Idaho where indications of potential power development utilizing geothermal energy were found. Parts 2, 3, and 4 of Water Information Bulletin No. 30, prepared by the USGS, studied areas in southwest Idaho. Parts 5, 6, and 7, prepared by the IDWR, studied areas in south-central and southeastern Idaho. Part 8, prepared jointly by the IDWR and the Southern Methodist University, describes the heat flow regime in and around the Snake River Plain.

There are four objectives common to each of the studies: (1) to encourage the development of the resource through public knowledge of its occurrence, characteristics, origin, and properties; (2) to develop the expertise within the IDWR to properly perform its function of regulation of the resource; (3) to protect the ground and surface waters of the state from deleterious effects that might be brought about by large-scale geothermal development efforts by public or private parties; (4) to protect the geothermal resource from waste and mismanagement because of lack of knowledge of its occurrence, characteristics, and properties.

This study (Part 9 of Water Information Bulletin No. 30), prepared by IDWR, summarizes a part of the effort to obtain additional data on the properties, origin, occurrence, and characteristics of this resource in Idaho. It contains information on 899 thermal water occurrences with surface temperatures of 20°C or higher from both springs and wells. Chemical analyses of 357 of the 899 total thermal water sites are also contained herein, as well as previously published and unpublished geophysical, geological and hydrological information.



Thirty-six of the 44 counties in Idaho are discussed in separate chapters of this report. The eight counties not discussed in the report contain no known geothermal water discharges and little is known of their geothermal potential. Six of the eight counties not discussed are in northern Idaho: Bonner, Boundary, Kootenai, Benewah, Clearwater and Lewis counties. The other two (Lincoln and Minidoka counties) are within the eastern Snake River Plain aquifer, which may mask deep thermal anomalies in these counties.

## ABSTRACT

There are 899 thermal water occurrences known in Idaho, including 258 springs and 641 wells having temperatures ranging from 20 to 93°C. Fifty-one cities or towns in Idaho containing 30 percent of the state's population are within 5 km of known geothermal springs or wells. These include several of Idaho's major cities such as Lewiston, Caldwell, Nampa, Boise, Twin Falls, Pocatello, and Idaho Falls.

Fourteen sites appear to have subsurface temperatures of 140°C or higher according to the several chemical geothermometers applied to thermal water discharges. These include Weiser, Big Creek, White Licks, Vulcan, Roystone, Bonneville, Crane Creek, Cove Creek, Indian Creek, and Deer Creek hot springs, and the Raft River, Preston, and Magic Reservoir areas. These sites could be industrial sites, but several are in remote areas away from major transportation and, therefore, would probably be best utilized for electrical power generation using the binary cycle or Magma Max process.

Present uses range from space heating to power generation. Six areas are known where commercial greenhouse operations are conducted for growing cut and potted flowers and vegetables. Space heating is substantial in only two places (Boise and Ketchum) although numerous individuals scattered throughout the state make use of thermal water for space heating and private swimming facilities. There are 22 operating resorts using thermal water and two commercial warm-water fish-rearing operations.

The geothermal potential in Idaho's future can be most beneficial, providing the resource is utilized in an environmental and economical manner. While some thermal waters are being used to their maximum, most heat is dissipated through irrigation practices or is discharged unused.

It appears that the greatest potential for rapid on-line industrial process heat is in the Boise, Nampa-Caldwell, Pocatello, and Weiser areas where geothermal discharges from several wells are known. Existing industry in these areas could possibly be induced to retrofit to geothermal process or space heat if sufficient temperatures and flow rates can be found.

## GENERAL INTRODUCTION

### PURPOSE AND SCOPE

This report was prepared in response to the many requests from Idaho's citizens and industries for authoritative information pertaining to the state's geothermal resources. The report primarily outlines the characteristics, occurrences, and uses (present and potential) of low temperature (<150°C) thermal waters, with minor emphasis on high temperature (>150°C) waters. The information presented in this report is designed to expand the IDWR data bank, enabling the IDWR to better serve the public and private sector while enhancing the department's regulatory responsiveness. In addition, computerized well and spring data were supplied to the National Oceanic and Atmospheric Administration for the development of the first state geothermal map (Plate 1 in pocket) and to the U.S. Geological Survey for supplementing the geotherm data bank.

The general objectives of the study and report are as follows: (1) describe, in a single reference, the thermal water chemistry and quality from existing and newly acquired data on thermal springs and wells; (2) evaluate the state-wide geothermal potential from the standpoint of direct heat application; (3) pinpoint specific areas and general uses for direct heat application; (4) provide basic data on low temperature resources for potential uses; (5) give recommendations about areas of the state that could receive large benefits from detailed study.

Most locations were field checked to confirm the reported thermal discharge. Several occurrences reported in other publications were looked for but not found. These are not included in this report. Others in remote areas were not field checked but are included and labeled "not field checked" in the basic data tables in the appendix.

### WELL- AND SPRING-NUMBERING SYSTEM

The numbering system used by the IDWR and the USGS in Idaho indicates the location of wells or springs 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 a counter-

clockwise order from the northeast quarter of each section (figure 1). Within the quarter sections, 40-acre and 10-acre tracts are lettered in the same manner. Well 1S-17E-23aabl is in the NW1/4 NE1/4 NE1/4 of Section 23, T.1 S, R.17 E, and was the first well inventoried in that tract. Springs are designated by the letter "S" following the last numeral; for example, 1S-13E-34bcblS.

#### USE OF METRIC UNITS

The metric or International System (SI) of units are used in this report to present water chemistry and most other data. Concentrations of chemical substances dissolved in the water are given in milligrams per liter (mg/l) rather than in parts per million (ppm) as in some previous Water Information Bulletins. Numerical values for chemical concentrations are essentially equal, whether reported in mg/l or ppm for the range of values reported in this report. Water temperatures are given in degrees Celsius ( $^{\circ}\text{C}$ ). Figure 2 shows the relation between degrees Celsius and degrees Fahrenheit.

Linear measurements (inches, feet, miles) are given in their corresponding metric units (millimeters, meters, kilometers). Weight and volume measurements are also given in their corresponding metric units. Area measurements are also listed in SI units. Table 1 gives conversion factors for these units.

TABLE 1  
ENGLISH METRIC CONVERSION FACTORS

To Convert from	To	Multiply by
acres	hectares	0.405
inches	centimeters	2.540
feet	meters	0.305
yards	meters	0.914
miles	kilometers	1.609
sq. miles	sq. kilometers	2.589
gallons	liters	3.785
ounces	grams	28.349
hectares	acres	2.471
pounds	kilograms	0.454
tons (short)	tons (metric)	0.907
centimeters	inches	0.394
meters	feet	3.281
meters	yards	1.094
kilometers	miles	0.621
sq. kilometers	sq. miles	0.386
liters	gallons	0.264
grams	ounces	0.035
kilograms	pounds	2.205
tons (metric)	tons (short)	1.102

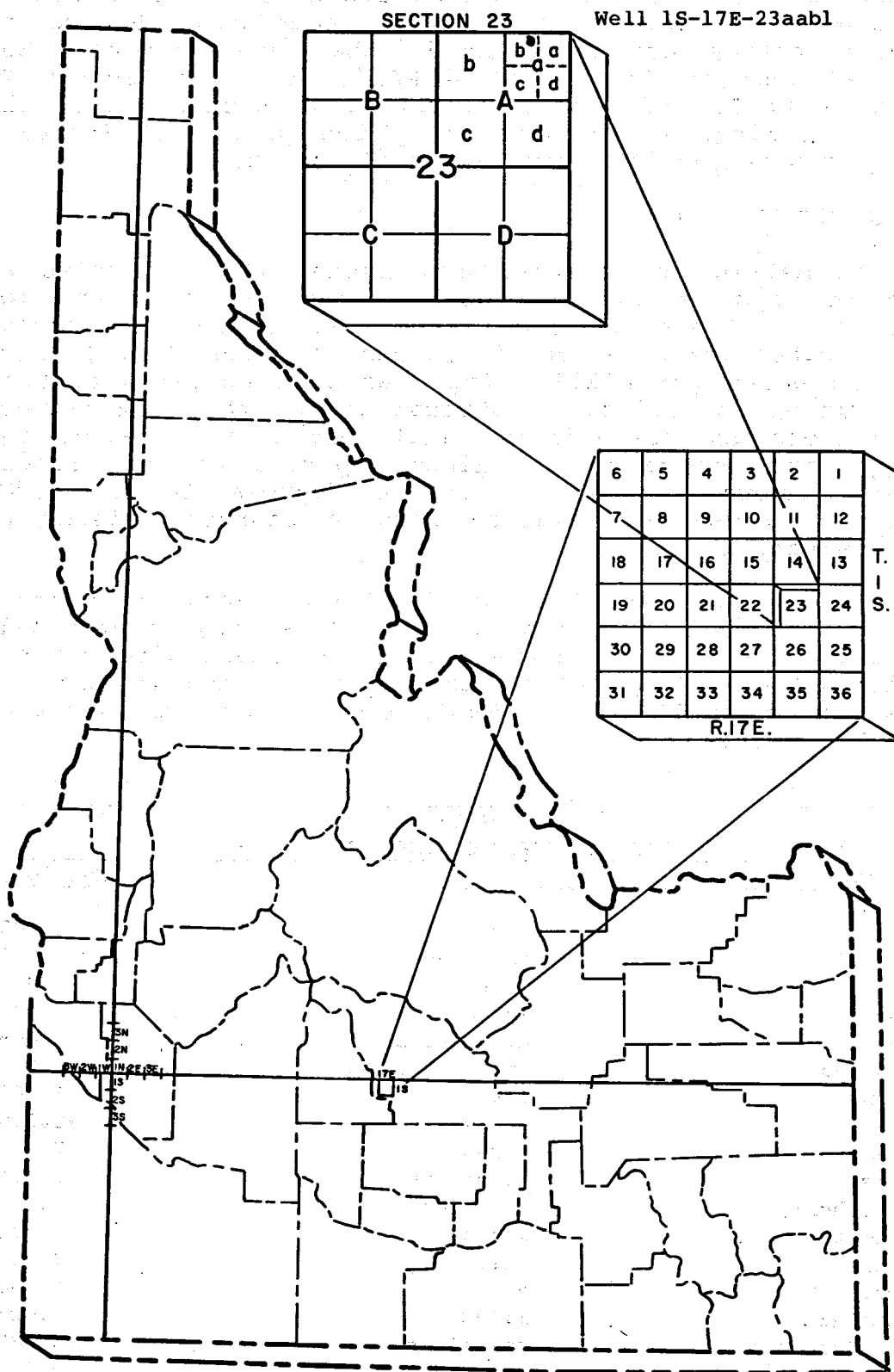
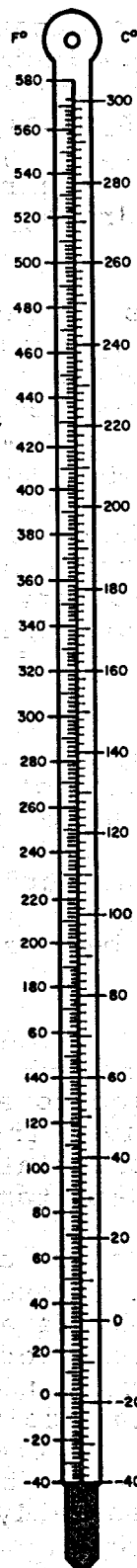


FIGURE 1. Diagram showing the well- and spring-numbering system for Idaho. (Using well 1S-17E-23aabl.)



(APPROX.)

FIGURE 2. Temperature conversion graph.

## CHEMICAL GEOTHERMOMETERS

In this report, the geothermal potential of various areas in Idaho has been evaluated from five factors, including several chemical geothermometers, water temperature at surface, geology, geophysical, and hydrology. As the chemical geothermometers are original interpretations, they are discussed to clarify their meaning. Much of the geology, geophysics and hydrology is from published reports and is not discussed here.

Preliminary evaluations of geothermal systems are being successfully conducted using chemical geothermometers. In the Raft River Valley of southeastern Idaho, the reliability of these chemical geothermometers has been tested by deep drilling. The quartz and sodium-potassium-calcium (Na-K-Ca) estimated aquifer temperatures (Young and Mitchell, 1973) and silica mixing model calculations (Young and Mitchell, 1973, unpublished data) agreed very closely (within 10°C) with temperatures found in depth (Kunze, 1975). This proven reliability in the Raft River Valley gives some measure of confidence in applying the same methods to other similar areas of the state.

The degree of reliance to be placed on a chemical geothermometer depends on many factors. The basic assumption is that the chemical character of the water obtained by temperature dependent equilibrium reactions in the thermal aquifer is conserved from the time the water leaves the aquifer until it reaches the surface. The concentration of certain chemical constituents dissolved in the thermal waters can, therefore, be used to estimate aquifer temperatures.

Aquifer temperatures, calculated from the quartz, Na-K-Ca chemical geothermometers and mixing models as well as the atomic ratios of selected elements found in the thermal waters of Idaho, are given in basic data table 2 in the appendix. These were calculated from values of concentration found in basic data table 1.

In basic data table 2, there are 10 columns which represent aquifer temperatures. These 10 columns of basic data table 2 were derived using different assumptions as to physical controls governing dissolved chemical constituents in thermal water. In most cases, it appears that the chalcedony (column T<sub>4</sub>) or Na-K-Ca (column T<sub>5</sub>) chemical geothermometers may be the most accurate for thermal water in Idaho. However, in many cases these differ by as much as 20-30°C. Chalcedony generally estimates temperatures somewhat higher than Na-K-Ca, particularly for high pH waters issuing from granitic terrains. It is not presently known which is closest to the actual aquifer temperature.

However, as drilling has confirmed the reliability of Na-K-Ca in Raft River Valley in Cassia County and for other reasons, the authors have more confidence stating that Na-K-Ca may be the more accurate. In any case, best correlation is obtained generally between Na-K-Ca and chalcedony chemical geothermometers. In several areas where high water temperatures at the surface ( $>65^{\circ}\text{C}$ ) have been measured, good agreement between quartz and Na-K-Ca chemical geothermometers indicates temperatures may be high enough for wet steam or binary cycle power generation.

#### PRESENT AND POTENTIAL GEOTHERMAL USE IN IDAHO

Geothermal energy has been used in Idaho for a long time. Figure 3 is a map of Idaho showing locations and current uses of geothermal energy in the state. Uses have been made ranging from electrical generation using pelton wheels to catfish farming. Present uses of geothermal energy are tabulated in table 2 (modified from Nichols, et. al., 1972).

Geothermal energy has been used for space heating in Boise since 1893 and in Ketchum. Currently several greenhouse operations are conducted near Boise for fresh and cut flowers. Other greenhouse operations using geothermal energy are located at Weiser, Grand View, White Arrow Ranch near Bliss, Banbury Hot Springs area in the Hagerman Valley, and on the South Fork Payette River and at Raft River.

Irrigation has been a long-standing use of thermal water in Idaho, although most irrigators consider hot water a nuisance as it must be cooled before being applied to crops. Some report heavier first and last cuttings of alfalfa as the growing seasons may be somewhat extended; however, the effect of the heat may be quite minor as opposed to the effect of the water from an extra early and a late season irrigation.

Stock watering in winter is another beneficial use which creates increases in weight gain on less feed with geothermally watered livestock compared to cold watered livestock.

The Department of Energy's Idaho Raft River Project is designed to gather information on various uses and applications of geothermal energy, including binary cycle power generation, reinjection of geothermal fluids, space heating, and cooling, potato processing, manure and cattle feed processing, irrigation, and aquaculture. In addition, environmental related studies of subsidence, microseismicity, flora and fauna, water quality, and groundwater levels are being made.

Many resorts using thermal water are operated in Idaho. These are listed in table 2 and locations shown in figure 3.



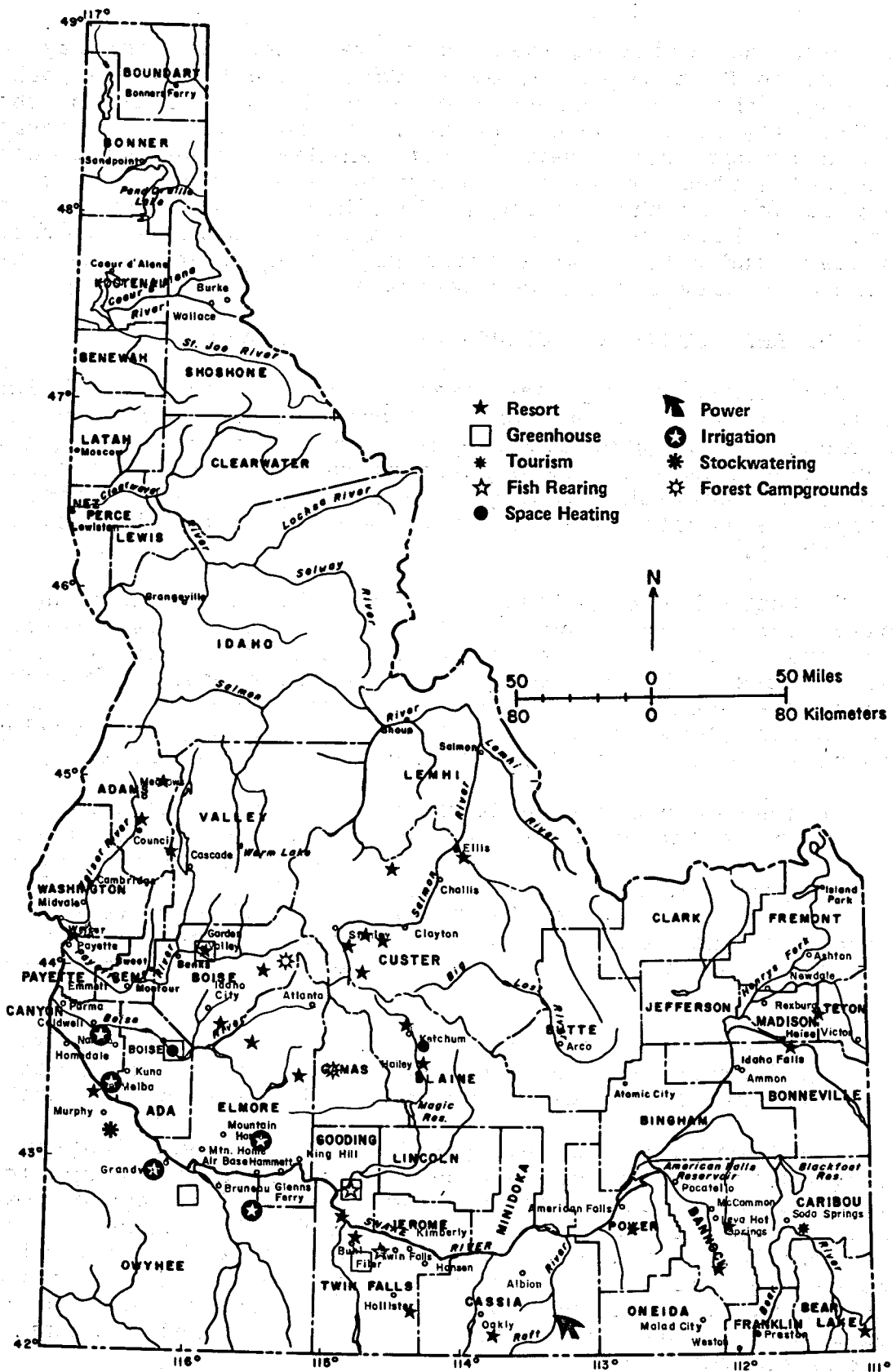


FIGURE 3. Index map of Idaho showing locations and present uses of geothermal energy.

TABLE 2  
 GEOTHERMAL DEVELOPMENT IN IDAHO - HOT WATER USES  
 (Table modified from Nichols, Brockway & Warnick, 1972)

(1978)

Name of Facility	County	Type of Development	Approximate Years in Operation	Approximate Dollar Value 1973	Length of Season In Months	Approximate Number of Employees	Water Supply	
							Approximate Discharge	Temperature °C
Warm Springs Water District	Ada	Space heating	1800's	Public supply	12	5	6400 lpm @	72
Edwards Greenhouse	Ada	Greenhouse	56	100,000	12	4	1400 lpm @	47
Hunt Brothers' Floral	Ada	Greenhouse	40	120,000	12	4	1100 lpm @	47
Zim's Resort	Adams	Resort	51	120,000	4	6	380 lpm @	63-66
Starkey H.S.	Adams	Resort	1900	70,000	4	4	490 lpm @	56
White Licks H.S.	Adams	Baths & camping	—	1,000	Summer	—	110 lpm @	60-68
Downata H.S.	Bannock	Resort	20	120,000	Summer	—	1900 lpm @	43
Lava H.S.	Bannock	Resort & health spa	75	1,500,000	12	20	5700 lpm @	45
Bear Lake H.S.	Bear Lake	Resort	80-100	60,000	4-5	3	@	48
Easley Store & Plunge	Blaine	Resort & camping	30	Church prop.	3	—	70 lpm @	37
Brandt's H.S.	Blaine	Motel & pool space heating	1800's	180,000	12	1	3800 lpm @	70
Claredon H.S.	Blaine	Resort	40-50	100,000	12	2	380 lpm @	52
Twin Falls H.S.	Boise	Resort	40	100,000	12	—	1900 lpm @	67
Warm Springs Resort	Boise	Resort	1800's	120,000	Summer	4	1100 lpm @	42
Donlay lodge H.S.	Boise	Greenhouse	9	200,000	12	6	265 lpm @	55
Haven Lodge H.S.	Boise	Space heating & resort	20	300,000	12	2	75 lpm @	48-64
Wards Greenhouse	Boise	Greenhouse	9	100,000	12	4	5700 lpm @	75
Terrace Lakes Resort	Boise	Space heating & resort	13	1,500,000	12	20	1900 lpm @	75
Kirkham H.S.	Boise	Forest campground	—	U.S. Forest Ser.	Summer	—	950 lpm @	65
Bonneville H.S.	Boise	Forest campground	—	U.S. Forest Ser.	Summer	—	1375 lpm @	85
Baumgartner H.S.	Camas	Forest campground	—	U.S. Forest Ser.	Summer	—	75 lpm @	44
Oakley H.S.	Cassia	Resort & health spa	15	10,000	12	2	40 lpm @	47
Sunbeam H.S.	Custer	Bath house	—	U.S. Forest Ser.	Summer	2	1700 lpm @	61-76
Snake River Boy Scout Council	Custer	Camp & pool	—	—	3	—	40 lpm @	35
Beardsley H.S. (Challis H.S.)	Custer	Resort & pool	92	20,000	12	3	5700 lpm @	43
Campground H.S.	Custer	Forest campground	5	10,000	Summer	—	330 lpm @	56
Robinson Bar	Custer	Resort	20	60,000	Summer	—	260 lpm @	55
Middle Fork Lodge	Custer	Resort	5	270,000	Summer	—	260 lpm @	43
Idaho Rocky Mtn. Ranch	Custer	Resort	—	130,000	Summer	—	@	50
Sawtooth Land Corp.	Custer	Resort	—	10,000	—	—	380 lpm @	41
Paradise H.S.	Elmore	Resort & space heating	50-60	100,000	Summer	—	950 lpm @	53
White Arrow Ranch	Gooding	Greenhouse, space heating, fish farming	10	100,000	12	15	3100 lpm @	65

6-1

Table 2. Geothermal Development in Idaho - Hot Water Uses (continued)

Name of Facility	County	Type of Development	Approximate Years In Operation	Approximate Dollar Value 1973	Length of Season In Months	Approximate Number of Employees	Water Supply	
							Approximate Discharge	Temperature °C
Heise Hot Springs, Inc.	Jefferson	Resort & pool	80	200,000	12	12	225 lpm @	49
Green Canyon Natatorium	Madison	Pool	--	50,000		--	-- @	44
Cooke's Greenhouse	Owyhee	Greenhouse	7	30,000	12	2	1700 lpm @	83
Given's H.S.	Owyhee	Pool	80	80,000	12	2	130 lpm @	47
Jacobson's Feed Lot	Owyhee	Stock Watering	10	270,000	12	10	1700 lpm @	37
Bybee's Pool	Owyhee	Pool	20	30,000	12	2	1000 lpm @	60
Indian Springs Natatorium	Power	Resort	65	100,000	5	8	5800 lpm @	32
Silgar's Resort	Twin Falls	Resort	25	100,000	8	4	450 lpm @	63
Salmon Falls H.S.	Twin Falls	Pool	--	--	--	--	-- @	67
Miracle H.S.	Twin Falls	Health spa	--	50,000	12	2	1325 lpm @	54
Banbury H.S.	Twin Falls	Resort	60	70,000	5	5	2300 lpm @	57
Archibald's Greenhouse	Twin Falls	Greenhouses	5	20,000	12	--	1300 lpm @	45
Lunty's Tropical Fish	Twin Falls	Test project	1	--	--	--	1500 lpm @	32
Nat-Soo-Pah H.S.	Twin Falls	Resort	60	70,000	6	--	115 lpm @	36
Welser H.S.	Washington	Resort & greenhouse	1900's	130,000	12	--	20 lpm @	70
Midvale City Well	Washington	Pool	20	City property	Summer	--	7600 lpm @	28

The most famous is probably Lava Hot Springs, a state-owned natatorium and health spa.

Potential uses for geothermal energy in Idaho are many and varied. Figure 4 shows minimum temperatures necessary for agricultural and industrial uses in which geothermal energy has been used or proposed. Many of these uses are related to agriculture, forest products, or tourism--three of Idaho's principal industries. The greatest potential, as far as present knowledge of the resource in Idaho is concerned, is for space heating and greenhouse use. In rapidly growing areas, such as Nampa, Caldwell, Boise, Pocatello, and Twin Falls, thermal water of sufficient quantity might be discovered and used for space heating large buildings and new subdivisions. Groundwater heat pumps generally would give a large energy savings over present heat sources if the water temperature was less than desirable for direct space heating use. Groundwater heat pumps used both for heating and cooling also have a large potential even in areas that have a normal cool groundwater temperature.

The area of greatest potential for greenhouse operation is the Bruneau-Grand View area where high yield irrigation wells tap thermal aquifers where water temperature ranges from 20-84°C. The area is far from markets and major transportation routes but so is most other farmland in Idaho. Winter crops could conceivably be grown in this area for use in Idaho rather than shipping crops in from states with more favorable climates.

Table 3 and figure 5 show 14 areas in Idaho where potential exists for power generation where subsurface temperatures might be greater than 140°C, based on the Na-K-Ca and quartz chemical geothermometers. The Blackfoot Reservoir area was chosen on the basis of geology. The 140°C temperature was chosen as the lower limit as it appears that technology and rapidly escalating energy costs may make this limit economically attractive in the foreseeable future. Five locations appear to have aquifer temperatures high enough for wet steam generation. The highest estimated aquifer temperature expected from any of the 14 listed areas appears to be 175°C at Big Creek and Crane Creek hot springs areas in Lemhi and Washington counties. The upper limit given for Battle Creek-Squaw Hot Springs area in Franklin County may or may not be valid, because of uncertainties in interpretation due to travertine (CaCO<sub>3</sub>) deposition at some spring vents. The Crane and Cove creeks to Weiser area have received initial evaluation by the USGS. Blackfoot Reservoir area and Battle Creek-Squaw hot springs areas have received initial evaluation by IDWR. The other areas need initial assessment work to more accurately determine their thermal potential. Many of these areas are remote and in rugged terrain. Assessment will, therefore, be somewhat

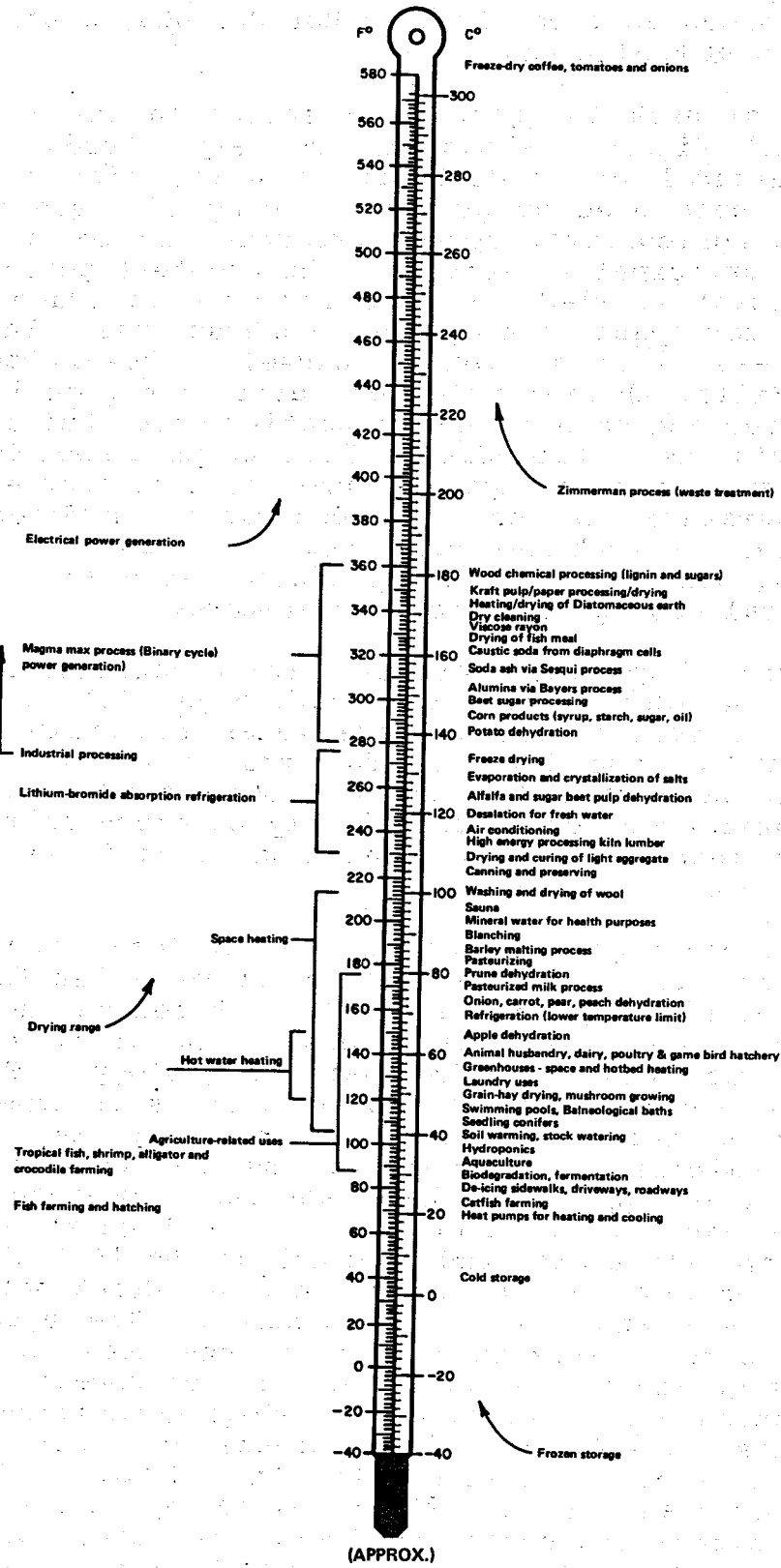


FIGURE 4. Required temperatures for geothermal fluids.

TABLE 3  
AREAS IN IDAHO MOST FAVORABLE FOR POWER GENERATION BASED ON SURFACE MANIFESTATIONS, GEOLOGY AND GEOTHERMOMETRY (1978)

Area	Location	County	Measured Surface Temperature °C	*Best Estimate Subsur. Temp. °C		Princi- pal Land Owner	Type of Genera- tion	Area Number Figure	Remarks
				Na-K-Ca	Quartz				
Battle Creek-Squaw H.S.	15S-39E-8bdc1S & 15S-39E-17bcd1S	Franklin	84	250	150	Private	Wet steam	1	Could be mixed water - geothermometers difficult to interpret.
Big Creek H.S.	23N-19E-22c1S	Lemhi	93	175	175	USFS	Wet steam	2	Ridge top discharge, silica & carbonate deposition, boiling at surface.
Blackfoot Reservoir	6S-41E-19bac1	Caribou	42	?	?	Private, BLM, BIA	?	3	Picked on basis of favorable geology & geophysics.
Bonneville H.S.	10N-10E-31c1S	Boise	85	142	137	USFS	Binary cycle	4	Used for a steam bath and bathing by campers.
Crane Creek H.S.	11N-3W-7bdb1S	Washington	92	166	176	Private	Wet steam	5	Near boiling at the surface.
Cove Creek H.S.	10N-3W-9ccc1S	Washington	74	172	152	Private	Wet steam	6	11 km southeast of Crane Creek H.S.
Deer H.S.	9N-3E-25bac1S	Boise	80	139	147	Private	Binary cycle	7	Siliceous sinter deposits.
Indian Creek H.S.	17N-11E-15acd1S	Valley	88	137	142	USFS	Binary cycle	8	In wilderness area.
Magic Reservoir	1S-17E-23aab1	Blaine-Camas	72	174	139	Private	Wet steam	9	Chemistry of waters somewhat similar to Raft River.
Raft River	15S-26E-23bbc1	Cassia	92	147	135	BLM	Binary cycle	10	Plant under construction. Geothermometers confirmed by drilling Na-K-Ca most accurate.
Roystone H.S.	7N-1E-8dda1S	Gem	54	150	147	Private	Binary cycle	11	Presently a natatorium.
Vulcan H.S.	14N-6E-11bda1S	Valley	84	147	135	USFS	Binary cycle	12	
White Licks H.S.	16N-2E-33bcc1S	Adams	65	145	145	USFS	Binary cycle	13	Bath houses for campers.
Weiser H.S.	11N-6W-10cca1	Washington	78	141	156	Private	Binary cycle	14	Presently a natatorium, with greenhouse operation.

\*See first footnote in Table 4.



difficult and expensive, but if geothermal energy is going to make an impact on Idaho's electrical power base, and it appears to have potential to do so, the initial assessment will have to be made.

#### ORGANIZATION OF DATA

This report has been organized into four subregions within the state boundaries due to thermal waters in the separate subregions having different characteristics or modes of occurrence. Individual counties within a specific subregion are discussed in separate chapters. Figure 6 shows the approximate subregion boundaries and the counties they encompass.

Basic data tables containing information on the known springs and wells comprise a major section in the appendix of this report. The appendix also contains preliminary environmental assessments of several geothermal resource areas.



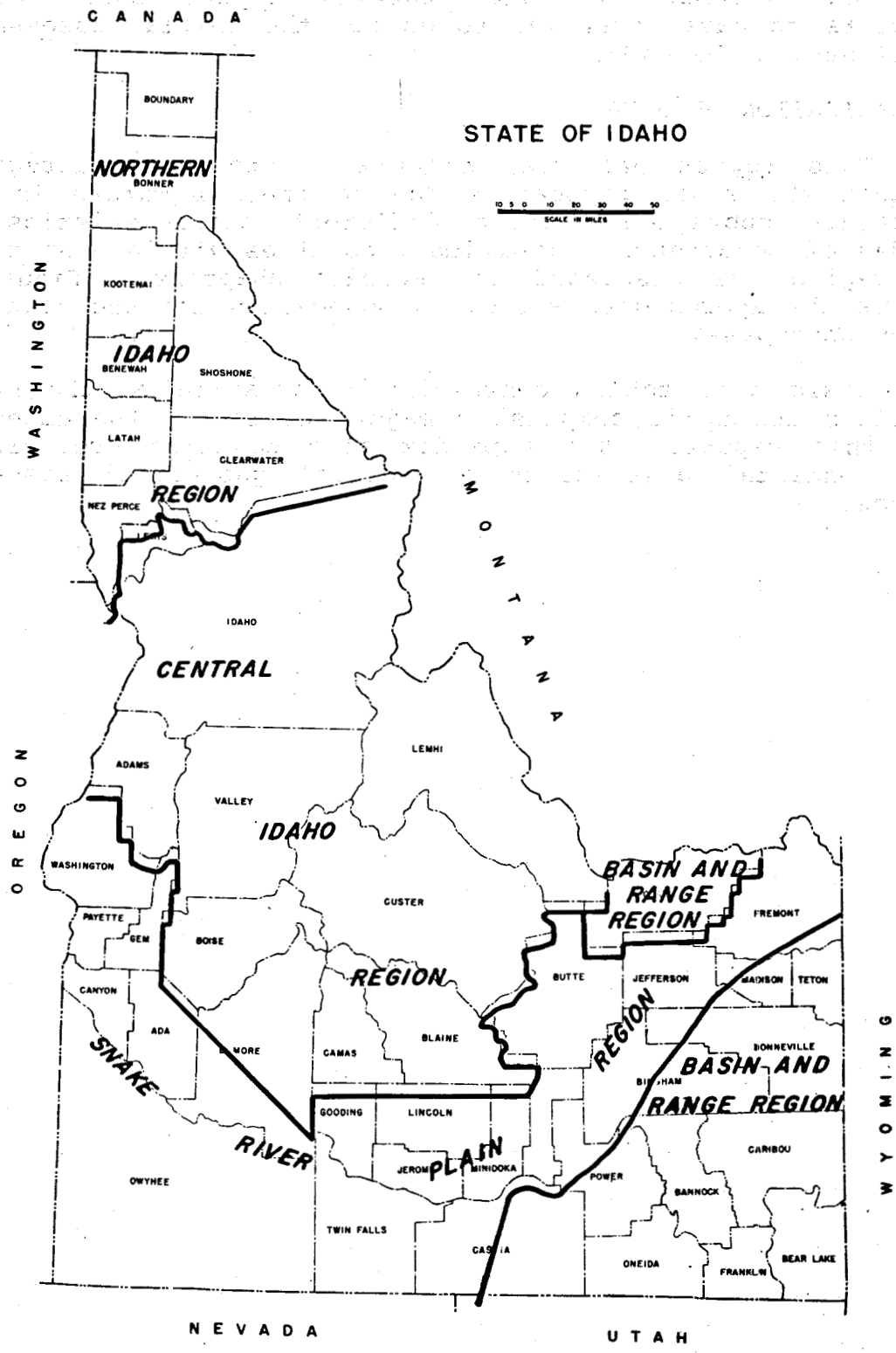


FIGURE 6. Index map of Idaho showing locations of counties and subregions covered in this report.

GEOHERMAL POTENTIAL  
OF THE NORTHERN IDAHO "PANHANDLE" REGION  
INCLUDING SHOSHONE AND NEZ PERCE COUNTIES

There are no known thermal anomalies located in the eight counties that make up the Northern Idaho Panhandle area with the exception of some hot rock material deep in the mines in Shoshone County (figure 7) and one warm well in NezPerce County (figure 8). Generally very little is known of the geothermal potential of this area. Specific information known and relating to the geothermal potential in NezPerce and Shoshone counties follows.

SHOSHONE COUNTY

Shoshone County, located in the Panhandle area, is known for its silver, lead, and zinc deposits.

The generalized geologic framework of the area consists of Precambrian metasediments of the Belt Supergroup formations. These formations have undergone slight metamorphism and are composed primarily of quartzites, argillites, shales, and impure limestones.

The Belt metasediments (undifferentiated) consist of the Prichard, Burke, Revett, St. Regis, Wallace, and Spruce formations with the ore being mainly contained in the lower Burke and upper Prichard formations.

The structure of the area is relatively complex with two major fault trends; one trending northwest-southeast and the other trending northeast-southwest.

Mining has taken place in the Coeur d'Alene mining district since the middle 1800's. Currently the Bunker Hill, Sunshine, Crescent, Galena, and Star Morning mines are just a few of the deeper active mines located in Shoshone County. Most of the mines in the area are relatively water barren and diamond drilling and/or mining excavation has not encountered a significant geothermal anomaly. Any water needed for drilling or mining purposes is piped into these mines from surface sources.

Thermal gradient studies of the rock temperatures in the mines show temperatures increase from a normal temperature at the surface to those exceeding 40°C at deeper levels within the mines.

In the Star Morning Mine, rock temperatures were recorded to be 42°C at the 7300 ft level. In the Galena

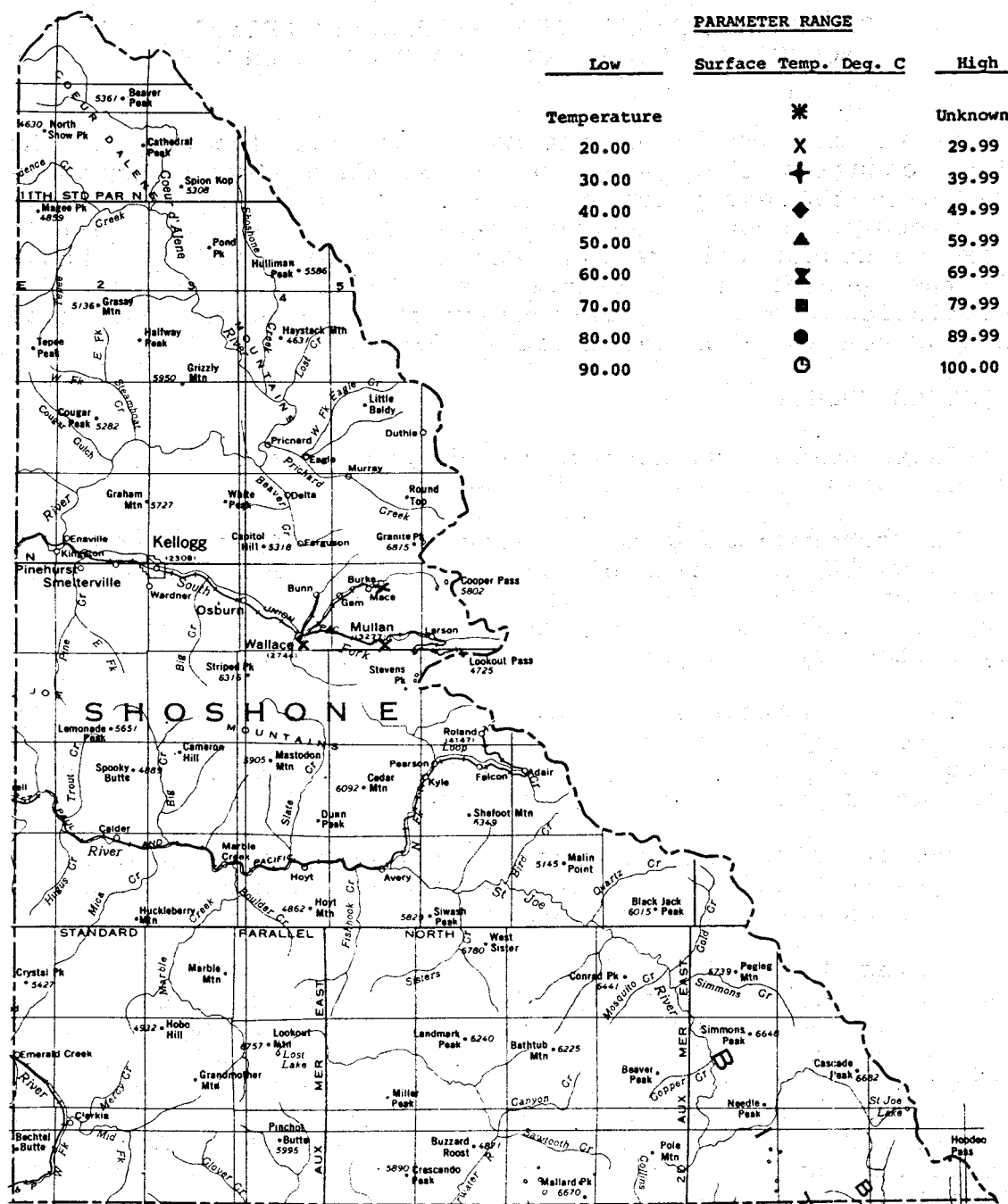
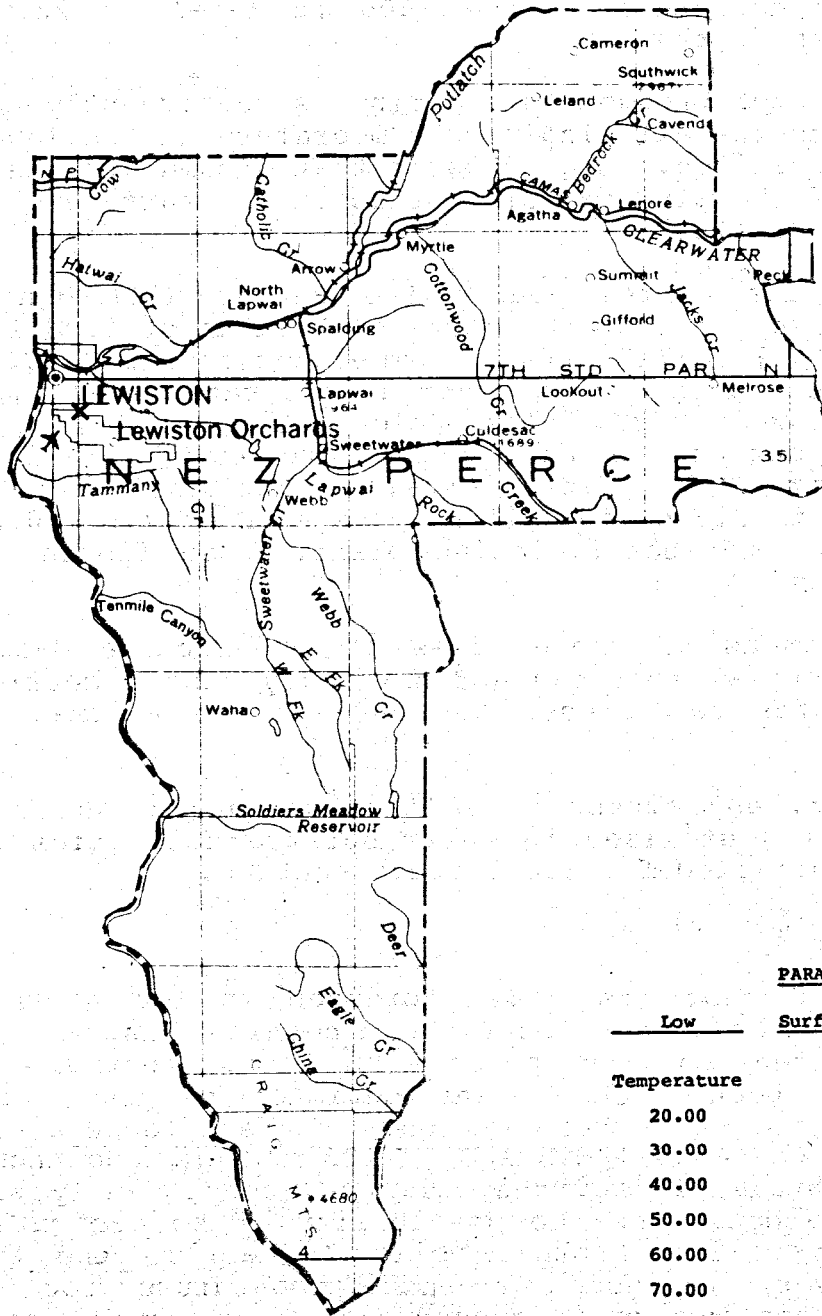


FIGURE 7. Index map of Shoshone County showing locations of known thermal water occurrences with surface temperatures above 20°C.



**PARAMETER RANGE**

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

FIGURE 8. Index map of Nez Perce County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Mine, rock temperature at the 1600 ft level is 22°C and increases with depth.

Surface water brought into a mine is subsequently heated through use to the existing rock temperature at the level at which it is utilized. Excess water that accumulates is then pumped out of the mine and discharged at the surface or used in a surface facility.

For the last three years, the Bunker Hill Mine has expelled excess water at the surface at rates of 4393 liters per minute (l/m) to 7153 l/m at temperatures near 22°C. The Crescent Mine expels excess water at the rate of 719 l/m at temperatures near 37°C. The Galena Mine in 1978 pumped excess water out of the mine at the rate of 397 l/m at temperatures near 24°C. Waters expelled from the Galena Mine are very low in dissolved solids, have a pH of  $7.6 \pm 0.2$  and are reused in the beneficiating plant. See figure 7 for mine locations.

Certain areas of these mines at some future date may have the potential to store and naturally heat a sufficient amount of water to be used for large scale thermal space heating.

Presently, any excess water that is pumped out of the mines not being utilized in their surface facilities could possibly be utilized for local space heating.

#### NEZ PERCE COUNTY

Little interest has been expressed in the geothermal potential of Nez Perce County and nothing has been previously written on its potential. One thermal well, however, has been drilled near Lewiston by the city of Lewiston (figure 8). This well has a surface temperature of 20°C, discharges 4500 l/min and is 183 m deep. No chemical analysis is available for the well and, consequently, it is impossible to determine the possibility of hotter water at depth. This well and other wells drilled in the future could, however, be used at this temperature for space heating and cooling using groundwater heat pumps provided sufficient flow rates are available. A water sample from this well should be chemically analyzed and aquifer temperature estimates should be made. It is possible that more and hotter thermal water might be found in the Lewiston area.

GEOHERMAL POTENTIAL OF THE CENTRAL IDAHO REGION  
INCLUDING IDAHO, ADAMS, VALLEY, LEMHI, BOISE, CUSTER,  
NORTHERN ELMORE, CAMAS AND  
NORTHERN BLAINE COUNTIES

The vast region of central Idaho, including the Idaho batholith, is discussed as a separate section due to similarities in geology, geochemistry, structurally related occurrences, and the depositional features thermal springs in this region have in common.

Most of the thermal water found in this region appears as springs, which range in temperature from 20-93°C. Locally, several wells have encountered thermal water. It is commonly known that these thermal springs and wells are located along the major and minor streams and rivers in the area. They thus emerge at the lowest possible elevation, although many are found in the upper reaches of drainages. An example are 18 thermal springs that occur along the Middle Fork of the Boise River along a 45 km stretch between Arrowrock Reservoir and Atlanta. However, a more detailed examination reveals that thermal springs in this region appear rather evenly spaced along narrow arcuate zones or trends, some of which cut across drainage divides (figure 9 in pocket). Other zones follow major drainages, as in the Boise and Payette river systems. In some cases, mostly along the longer zones, the spacing tends to increase regularly in one direction. In some cases, where zones intersect, as at Indian Creek and Middle Fork Salmon River, two springs occur near the zone intersections. The arcuate zones range in length from 20 to 80 km and appear to be very narrow. These arcuate zones are most numerous and well defined in the central batholith region in Idaho. Well drilling and spring locations in other regions of Idaho have revealed similar zones. The regular spacing of springs along these zones appears to result from the regular spacing of linear features associated with them. Why the springs occur at nearly the same point on separate parallel lineaments is unknown but probably is the result of another lineament or structure (not visible on Landsat images) which cross the regularly spaced linears. The springs occur at the intersections.

Springs along these arcuate zones tend to occur (1) near the confluence of streams and/or rivers, such as at Pistol Creek Hot Springs (16N-10E-14dbclS) and Little Pistol Creek Hot Springs (16N-10E-14dbclS); Riggins (24N-2E-14dbdlS), Loon Creek (17N-14E-19bdb1S) and Hailey Hot Springs (2N-18E-18dbblS); or (2) near where a drainage is diverted around a large promontory or rock outcropping which projects into the

stream and around which the stream was forced to make a horseshoe or U-shaped bend. Mormon Bend (11N-14E-20aablS), Riverside (16N-12E-16cbb1S), Sheepeater (15N-10E-24bbb1S), Sunflower Flat (16N-12E-8bbb1S), Thomas Creek Ranch (16N-12E-17dad1S), Lightfoot Hot Springs (3N-13E-7dca1S) and Warfield (4N-17E-3lbbclS) Hot Springs are examples of the second type of occurrence (see figure 10). It is conceivable that many undiscovered thermal springs issue from the bottoms of river channels where the flowing water masks the thermal water.

Figure 9 (in pocket) is a superposition of linears from Day (1974) and circular features of Haskett (1974) on a spring and well location map of Idaho. This figure shows that many of the thermal springs and wells are associated (found on or very near) with large linear features that are seen on high altitude U-2 and satellite photos. Few of Day's linears are found to fit the curvilinear zones defined by the spring occurrences, but data strongly suggest structural control for most thermal water in the region. Although the exact nature of the linears is not known, they could represent joints or faults or some other type of rock fracture. One theory of the origin of these thermal springs is that they occur where ancestral joints, formed by shrinkage or contraction of deeply buried, cooling igneous or metamorphic rock complex intersects faults, or other fractures allowing circulation of meteoric (rain and snow) water to depths where the water is heated by hot rock. The hot water being less dense than the colder water rises along the same or other joints, faults or fractures to form a thermal spring. Thus, most of the thermal springs in this region of Idaho probably represent deep circulation of meteoric waters to depths where the water is heated by contact with hot rock in a region or along zones of above normal geothermal gradient or heat flow.

These types of occurrences appear typical. Perhaps the localized geothermal anomalies--those associated with high intensity shallow seated heat sources (intrusions)--might be those which are not associated with arcuate belts or zones. Alternatively, at least some of the zones could represent fractures or other structures into which magma has intruded to shallow depths producing high intensity shallow seated heat sources.

#### IDAHO COUNTY

Thirteen thermal springs are known to occur in Idaho County (figure 11). They are fairly uniform in temperature, ranging from 41 to 59°C. They are not limited to any one locality or rock type, but are found sparsely distributed over a large area. Four springs, Wier Creek (36N-11E-13bcc1S), Colgate Licks (36N-12E-15abd1S), Jerry Johnson

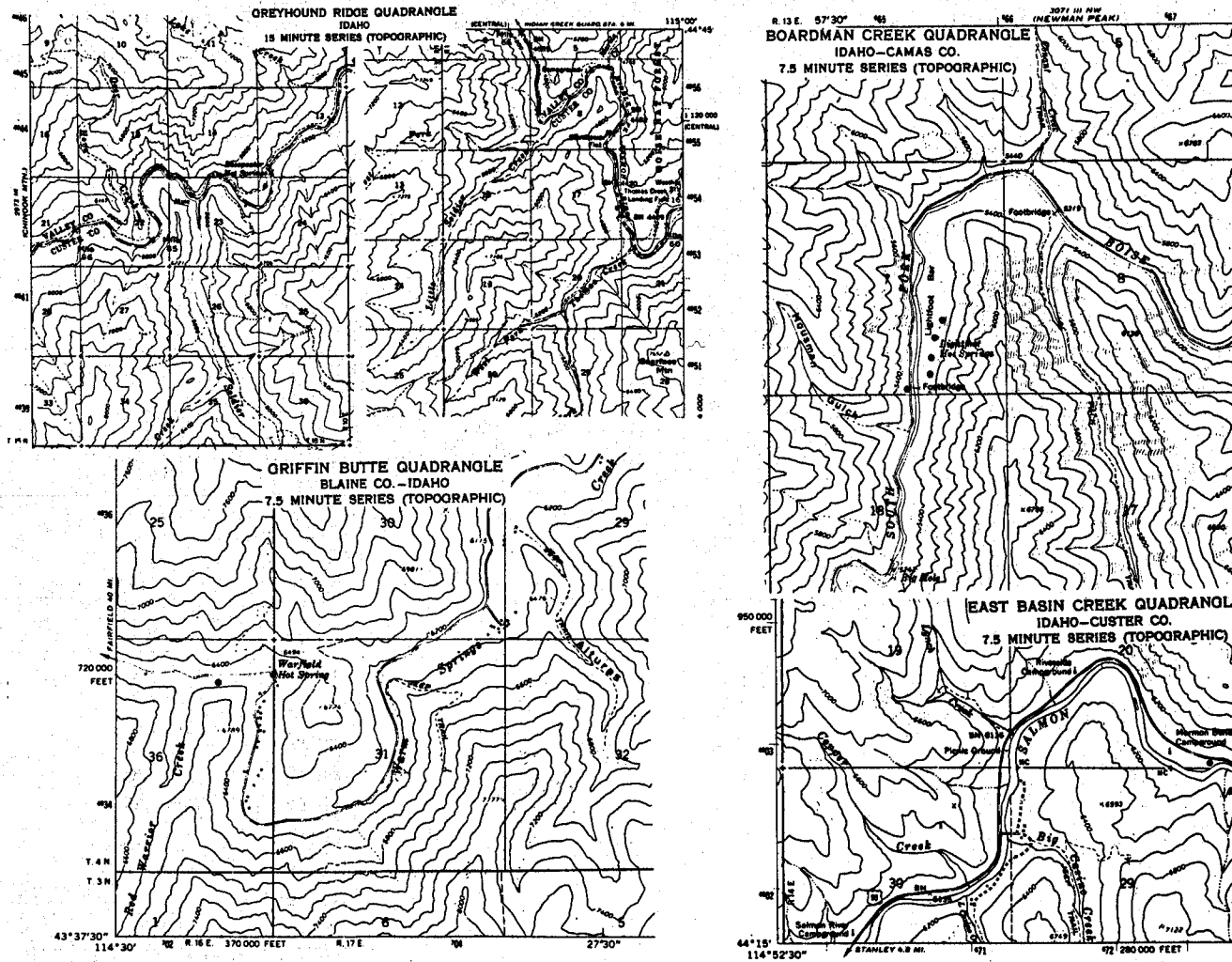
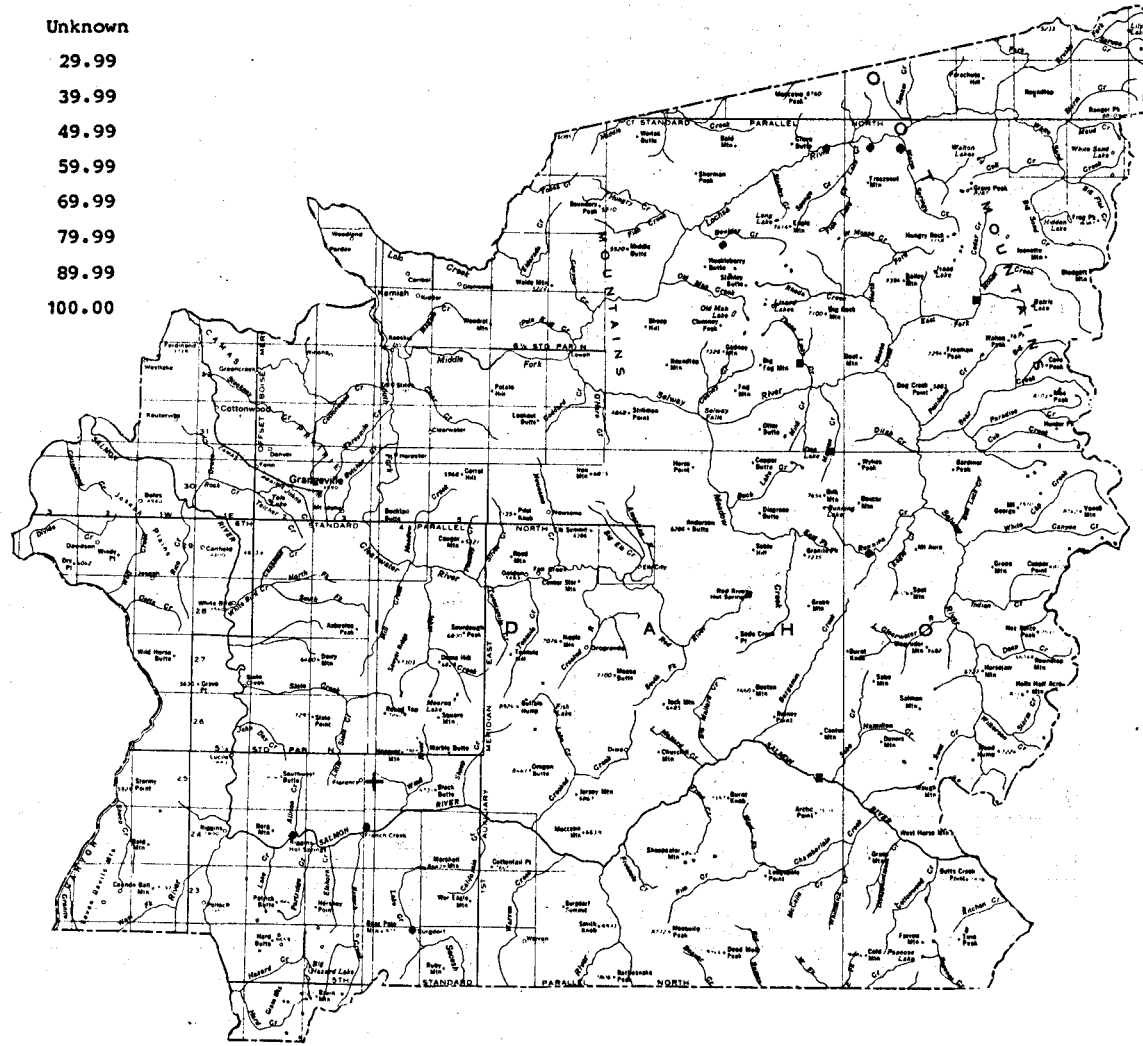


FIGURE 10. Topographic maps showing typical central Idaho thermal spring occurrences near sharp river bends. Black dots indicate spring locations.



FIGURE 11. Index map of Idaho County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

PARAMETER RANGE		
Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⌘	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00



(36N-13E-18add1S), and an unnamed spring occur within a small area in northeastern Idaho County on or near the Lochsa River. Most of the other springs are in remote locations, wilderness or recreational areas, accessible only by pack trail. This, along with restricted use of these areas, precludes large scale development. Riggins (24N-2E-14dbd1S), Burgdorf (22N-4E-1bdclS), and Red River Hot Springs (25N-12E-3ddd1S) are popular resort areas and boast improvements, although the Red River Resort recently burned down and the Burgdorf Resort pools have been officially closed by the district health officials. Jerry Johnson Hot Springs is used for informal bathing by campers and back-packers.

Most thermal springs in Idaho County occur within granitic rocks or near contacts of other rock types with granitic rocks. All are associated with known faults or linear features. The best defined arcuate trend in the region is represented by Stanley (34N-10E-6caalS), Stewart (32N-11E-4caalS), Martin (31N-11E-24dcd1S) hot springs and Running Springs (29N-12E-14abb1S) in east-central Idaho County (figure 9 in pocket).

Water quality chemical data from thermal water occurrences in Idaho County are given in basic data table 1. These analyses provide a chemical comparison of thermal water in the area and were used to calculate selected chemical-constituent ratios and to estimate aquifer temperatures.

Chemical analyses are available for only six of the fourteen hot springs found in Idaho County. All of the analyzed springs are low in total dissolved solids, ranging from 582 mg/l at Riggins Hot Springs to 133 mg/l at Wier Creek Hot Springs. The pH of these waters is alkaline, ranging from 8.1 to 9.0, except for Red River Hot Springs. These springs have a flouride content of 23 mg/l whereas other sampled springs in the county have a flouride content of less than 6 mg/l. Typically, the waters in Idaho County are similar to most other thermal waters throughout central and southwestern Idaho that issue from granitic rock or areas thought to be underlain by granitic type rocks.

Aquifer temperatures calculated from the silicia and Na-K-Ca chemical geothermometers and mixing models, as well as selected atomic ratios, are given in basic data table 2. Maximum subsurface temperature expected from wells drilled in the area of springs for which chemical analyses are available probably would not exceed 100°C and may be most closely approximated by the chalcedony or Na-K-Ca temperature, columns T<sub>4</sub> and T<sub>5</sub>, basic data table 2.

## ADAMS COUNTY

Seven thermal springs and two wells are known in Adams County with measured surface temperatures exceeding 20°C (figure 12). The two wells are located near the town of Council. Both are fairly low temperature at 22°C. Several other wells in the Council area have above normal temperatures of up to 17°C (10°C above mean annual temperature). Well 16N-1W-15bacl is 35 m deep and was drilled within 0.4 km of the Hornet Creek-Weiser River confluence. The other well, 16N-1W-11acdl, was drilled to a depth of 64 m near the valley-mountain boundary fault zone near Grossen Canyon. No chemical analyses are available from these wells. Samples should be collected to help determine their geothermal potential.

Starkey Hot Springs (18N-1W-34dbbls), an attractive resort area, discharges 500 l/min of 56°C water near the confluence of Warm Springs Creek and Weiser River where the Weiser River bends north and abruptly turns south again in the steep-walled canyon surrounding Fort Hall Hill. Starkey Hot Springs appears structurally typical of the thermal spring occurrences in central Idaho. Aquifer temperatures indicated by Na-K-Ca and chalcedony chemical geothermometers are 70 and 77°C, respectively. These temperatures could have uses up to and including the lower temperature limit of refrigeration (see figure 4). Dissolved solids and flouride concentration are low, being 348 mg/l and less than 1 mg/l, respectively. The pH is 8.6. The chemistry of the water suggests a source rock not similar in chemical or mineralogical constituents to granitic rocks.

Council Mountain Hot Springs (15N-1E-2bdbls) is located 2.5 km up Warm Springs Creek from its confluence with the Middle Fork Weiser River southeast of Council. It issues at 68°C and 190 l/min from Quaternary alluvium near granitic rock. No other information is available on this thermal spring. Its location appears atypical of most springs in central Idaho.

White Licks Hot Springs (16N-2E-33bcclS) is located in the Middle Fork Weiser River drainage and issues from Quaternary alluvium near Miocene basalt and Cretaceous granitic rocks. Ross (1971, p. 9) reported that White Licks Hot Springs occurred on a relatively short north trending fault and had an abnormally high mineral content. Water issues from numerous spring vents at 63 to 65°C (Young and Mitchell, 1973, p. 9) and has a slight sulfur odor. The quartz and Na-K-Ca chemical geothermometers estimate aquifer temperatures of 142 to 145°C, the lower limit of binary cycle power generation, might be found in the area by deep drilling.

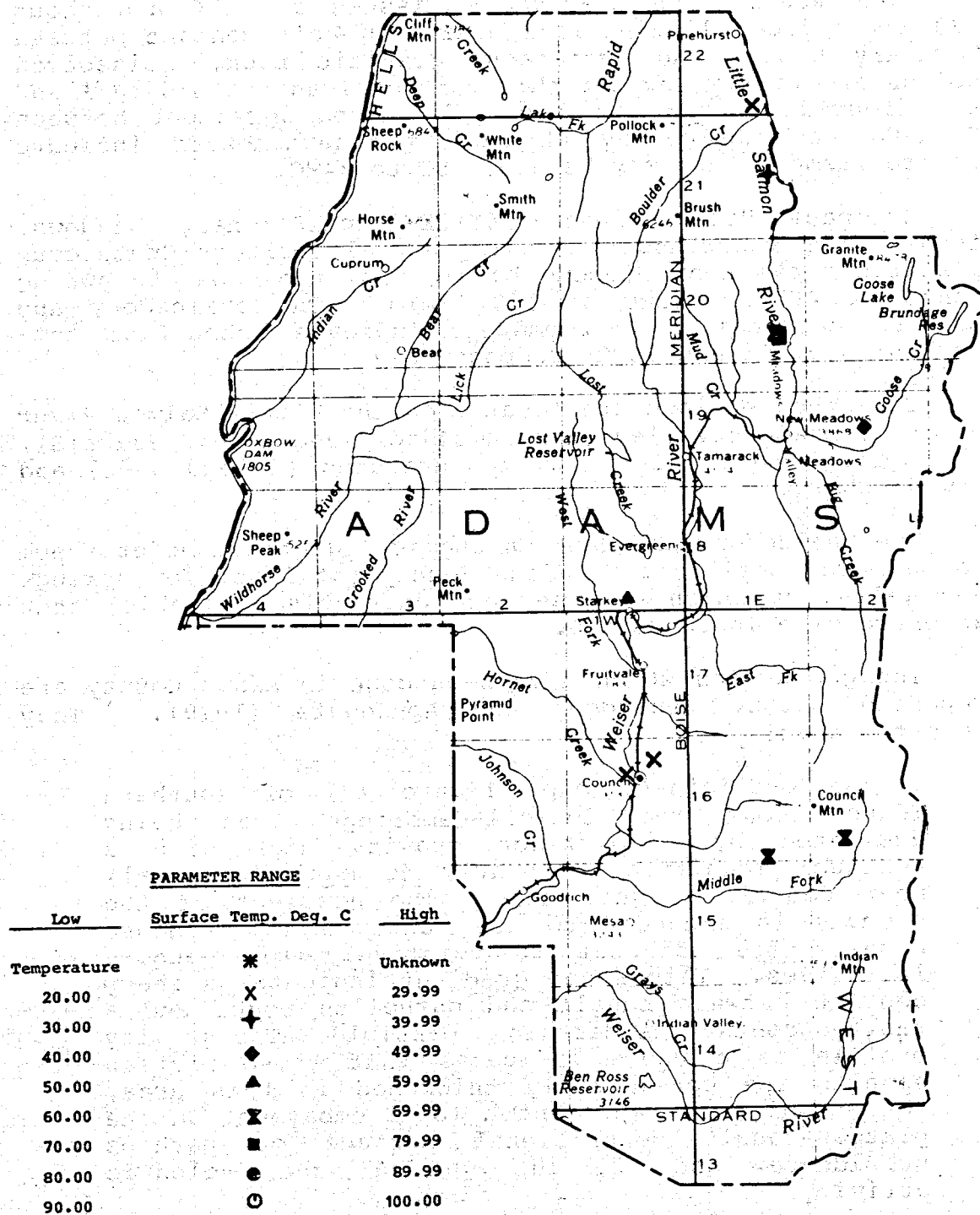


FIGURE 12. Index map of Adams County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Zims Resort (20N-1E-26ddals) issues at 65°C and about 380 l/min from alluvial fill near the fault contact between Tertiary basalt and Cretaceous granitic rock. Dissolved solids are fairly low for this part of Idaho at 666 mg/l and the fluoride content is 2.3 mg/l. Good agreement between Na-K-Ca and chalcedony chemical geothermometers indicate aquifer temperature may be about 83 to 84°C.

Krigbaum Hot Springs (19N-2E-22ccals) near Meadows, issues from a northeast trending normal fault in Cretaceous granitic rocks near Miocene basalt from two separate spring vents at 40 and 42°C at 150 l/min. The chalcedony and Na-K-Ca chemical geothermometers indicate subsurface temperatures of 91 and 96°C, respectively.

The other springs are located on the Little Salmon River north of Meadows Valley (22N-1E-34dadls and 21N-1E-23abals). The springs have fairly low temperatures (26 and 30°C) and low discharges.

The chalcedony and Na-K-Ca chemical geothermometers seem to be more consistent in Adams County (at least for springs and wells for which analyses are currently available) than anywhere else in the state.

The geophysics which have been done in Adams County are reported on by Donaldson and Applegate (1979). They reported that:

...the preliminary map (figure 13) of southern Idaho shows the Council-Cambridge area being dominated by a distinct gravity high with a residual magnitude of nearly 40 mgal (milligal) near Council (figure 14). The gradient of the anomaly is enhanced to the east where the dense basalts lie adjacent to relatively low density intrusives. This steep gradient indicates a sharp contact between basalt and batholith rocks and a faulted contact is certainly possible. The gravity profile as a whole indicates that these plateau basalts are considerably thickened in this area. The anomaly may represent a local embayment on the plateau-basalt depositional surface or perhaps subsidence and filling during the volcanic activity.

Bond (1975) shows many faults in this area and Witkind (1975) classifies several faults as active (figure 15). The faulting patterns (Bond, 1978) suggest that alluvial-filled river cut valleys in this area may be fault controlled. Unfortunately, the gravity data is very sparse and does not define the valley margins or allow any estimation of their depths or structural controls.

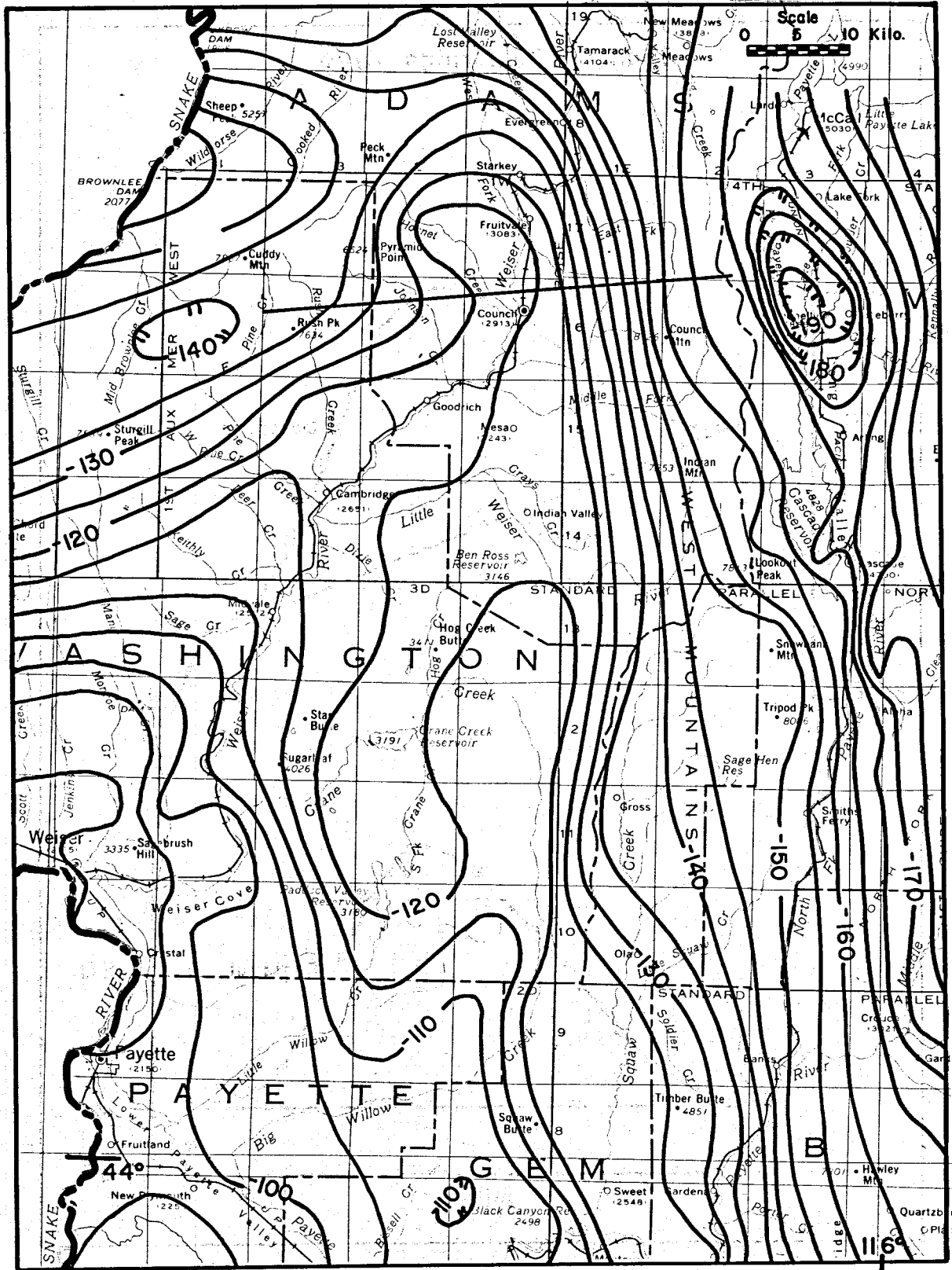


FIGURE 13. Gravity map of Council-Cambridge area, contour interval is 5 milligals. (Mabey, Peterson, and Wilson, 1974).

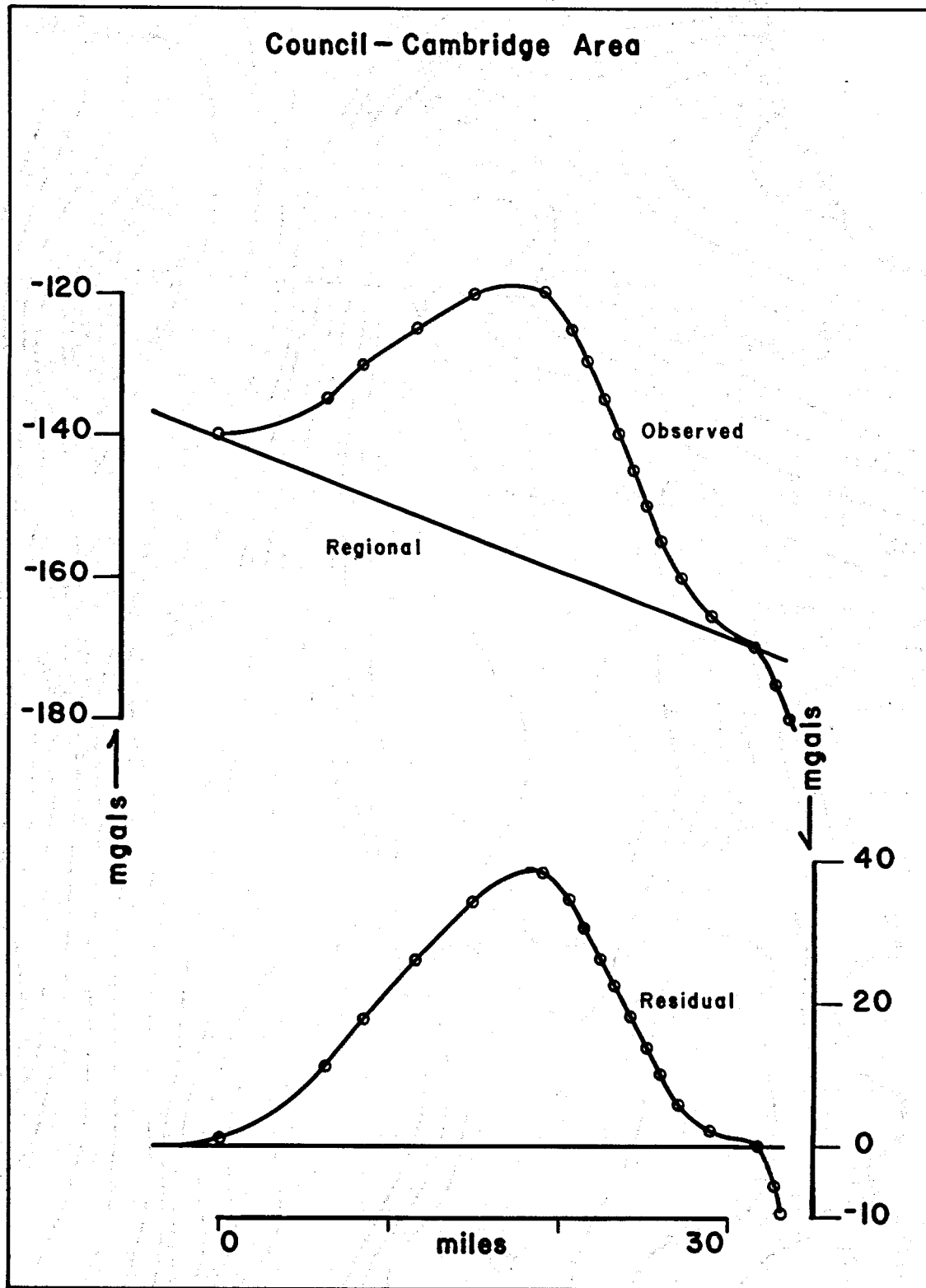


FIGURE 14. Gravity Profile near Council (from Donaldson and Applegate, 1979).

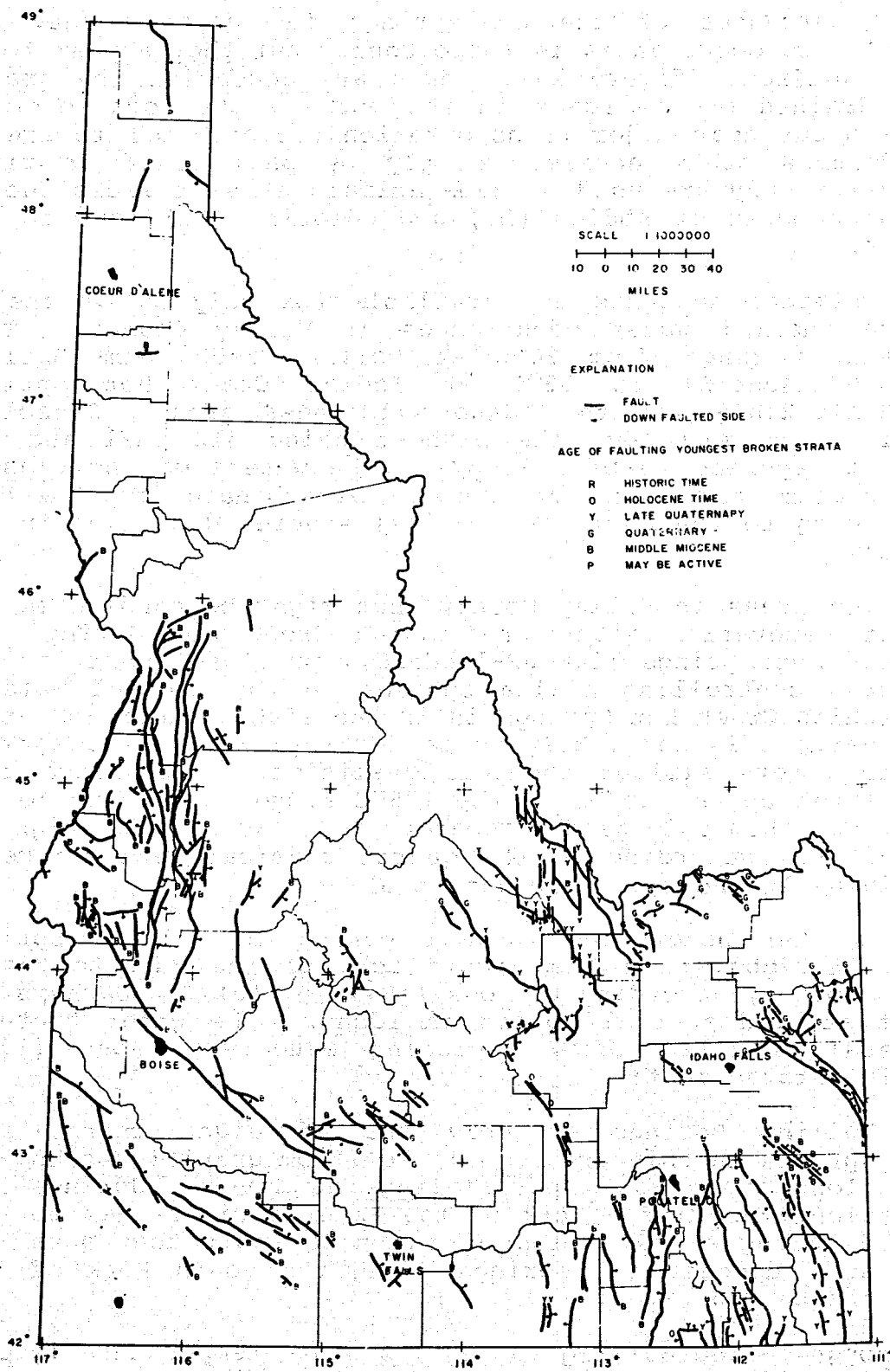


FIGURE 15. Index map of Idaho showing known and suspected active faults. (Modified from Witkind, 1975.)



## VALLEY COUNTY

Occurrences of thermal springs in Valley County are similar to occurrences in Idaho County but they appear to be more numerous (figure 16). Many are accessible by graded and drained gravel roads in the more remote locations and some occur near major transportation routes. Others are in wilderness areas accessible only by pack trail or river travel. Many are used by game animals as salt licks due to minor amounts of sodium (Na) and chlorine (Cl) ions in the water.

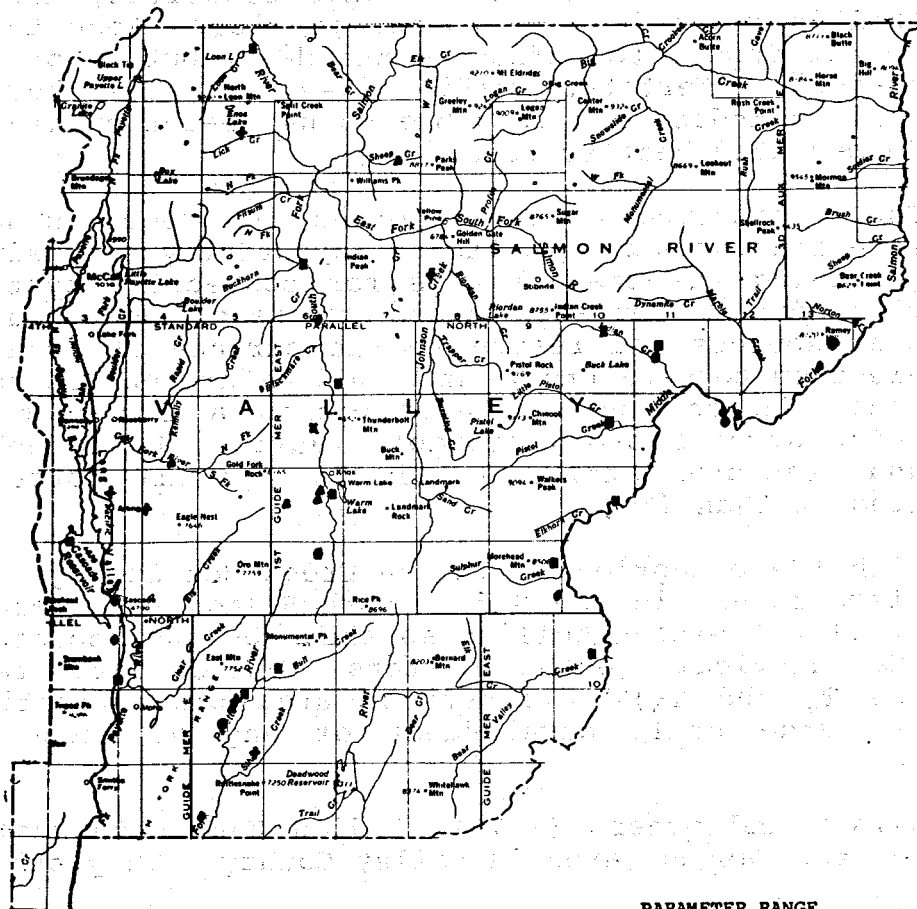
Chemical analyses are available for only 20 of the 41 known thermal water occurrences in Valley County. Temperatures range from 20°C at Dollar Creek Warm Springs (16N-6E-14ccclS) to 88°C at Indian Creek Hot Springs (17N-11E-21b1S) in the Idaho wilderness area. Dissolved solids are very low, the highest being 412 mg/l and the lowest reported to be 192 mg/l. The waters may be classed as sodium carbonate or sodium bicarbonate type waters according to the dominant chemical species dissolved in the water.

Two areas in Valley County that might be candidates for power generation sites are Indian Creek Hot Springs and Vulcan Hot Springs (14N-6E-11bdalS), provided quartz is the mineral controlling silica content in the thermal waters. As Indian Creek Hot Springs is in the Idaho wilderness area, however, it is not likely to be developed. The two springs exhibit very similar chemical qualities. Subsurface temperatures appear to be in the 135°C range, according to the Na-K-Ca chemical geothermometer and may be as high as 145-150°C, according to the quartz chemical geothermometer (columns T<sub>5</sub> and T<sub>1</sub>, basic data table 2.)

Another noteworthy thermal spring is Boiling Springs (12N-5E-22bbclS) on the Middle Fork of the Payette River. This spring, according to Ross (1971, p. 10), is perhaps the best studied thermal spring in Idaho. The water contains several metallic ions, including mercury. Ross (1971, p. 10) stated that:

Boiling Springs is only one of eight thermal springs in this area. All flow from granitic rocks along shear zones paralleling the river. Springs along the Middle Fork of the Payette River seem to be along an extension of the same fault that acts as a conduit for springs along the South Fork of the Salmon River.

Although called Boiling Springs, surface temperature is only 85°C. Subsurface temperatures appear to be not much higher, only 89°C according to the chemical geothermometer.



**PARAMETER RANGE**

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

FIGURE 16. Index map of Valley County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Cater and others (1973 p. 383-389) discussed the thermal springs in Valley and Custer counties along the Middle Fork of the Salmon River and stated:

Thermal springs in the Idaho primitive area are in an area of ...volcanics and tectonic activity. Most rocks are Cretaceous Idaho batholith, Eocene Challis volcanics and Eocene granite. Rock types do not appear to influence the distribution of the springs. Tertiary mafic dikes near the thermal springs indicate a possible mutual relationship to deep-seated heat sources.

The igneous rocks are not porous, but numerous surface fractures and faults are apparently extensive, providing the channel ways for convective systems that permit surface waters to reach deep-seated heat sources and return to the surface at greatly elevated temperatures. All springs are on numerous small faults and fractures within a few feet of major streams along probable faults. Most faults and fractures strike N. 45° W; dips are normally greater than 45°.

With the exception of Indian Creek Hot Springs, subsurface temperature in the Middle Fork Salmon River area probably will not exceed boiling as shown by the chalcedony and Na-K-Ca chemical geothermometers (basic data table 2, columns T<sub>4</sub> and T<sub>5</sub>). Wilderness area classification precludes large scale development of any of these thermal springs.

Wilson and others (1976) studied the geothermal potential of the Cascade area in Valley County. They stated:

Field and laboratory investigations show the existence of a geothermal resource in the Cascade area of west-central Idaho which may have development potential for non-electrical uses. Numerous high angle faults cut the Idaho batholith in this area; displacements on some of these faults are as great as 3050 m and many of them have associated alteration zones. X-ray analyses of samples collected from these zones indicate substantial hydrothermal alteration. Fault controlled hot springs have temperatures at the surface of up to 71°C.

Microseismic monitoring in the area suggests that east-west trending faults are active, supporting the plausibility of an accessible geothermal resource.



FIGURE 17. EROS false color infrared Landsat EDISE image of part of west-central Idaho and eastern Oregon showing selected linear features and thermal water locations with surface temperatures above 20°C. Note: Linear features occur between the black lines.



The domestic groundwater supply for most of the area is from very shallow wells, most of which are developed in the upper 200 feet of the valley floors and derive their water from joints rather than from fault systems. Preliminary data indicate no connection between the thermal systems and the water supply for the area.

The Na-K-Ca and chalcedony chemical geothermometers suggest aquifer temperatures may be as high as 46 to 66°C near the city of Cascade.

Thermal water is associated mostly with granitic rocks of the Idaho batholith.

Earth Resources Observation Systems (EROS) digital image enhancement system satellite image (figure 17) of the Cascade-Long Valley area shows that Cascade lies near the intersection of major linear features. These may control the occurrence of thermal water in the area. Other thermal water occurrences in west-central Idaho and selected linear features associated with them are also shown on the image.

#### LEMHI COUNTY

Eleven thermal springs have presently been documented in Lemhi County (figure 18). About half are in remote (primitive or recreation) areas which precludes development. Chemical data have been collected for only four of the eleven thermal springs located in Lemhi County.

The hottest thermal spring in the county and one of the hottest in Idaho is Big Creek Hot Springs (23N-18E-22cad1S) which has a surface temperature of 93°C (boiling). It is located high in the Hot Springs Creek drainage (over 330 m above the Salmon River, the major drainage in the area) near Panther Creek at the top of a divide (ridge top discharge). Quartz and Na-K-Ca chemical geothermometers both indicate subsurface temperatures are 160-175°C. Both siliceous and carbonate deposition is found near active vents. Water is presently used by big game hunters as a steam bath. Big Creek Hot Springs appears from available data to date to be one of the best prospects in Idaho for power generation.

Bennett (1977) reported on the geology and geochemistry of the Blackbird Mountain-Panther Creek region in Lemhi County, Idaho. He stated (p. 4):

The Panther Creek region is located in the Salmon River Mountains. The area is characterized by flattopped mountains and moderate to steep V-shaped canyons. This entire section of Idaho is quite striking from the air as concordant elevations give

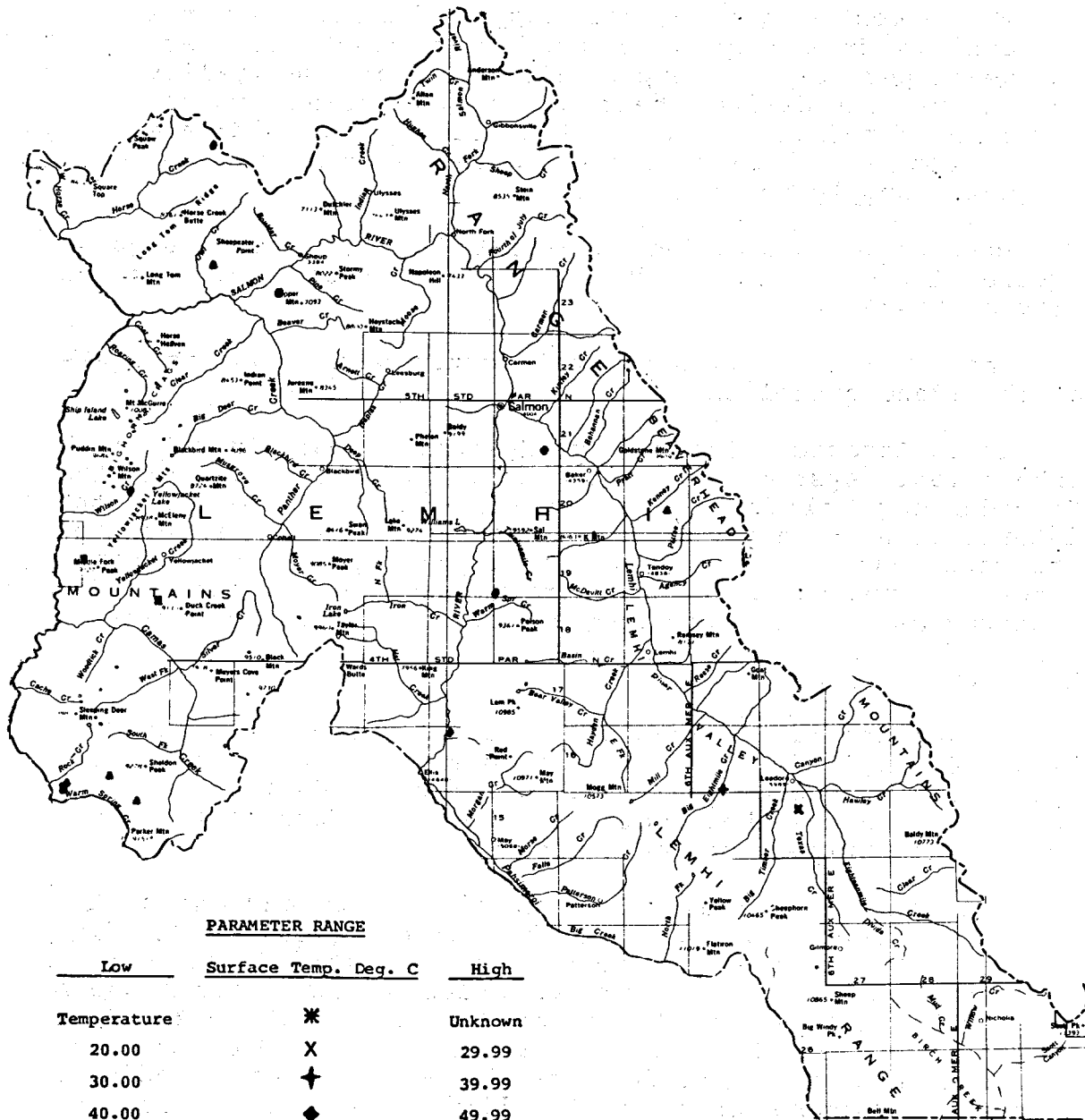


FIGURE 18. Index map of Lemhi County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

the appearance of a flat plain stretching from the Bighorn Crags (Tertiary pluton) which rise above the general remnant surfaces. Elevations range from 976 m in the Salmon River Canyon to over 2,700 m in the western part of the study area.

Bennett further stated (p. 8):

The rocks in the Blackbird Mountain quadrangle are, for the most part, Precambrian metasediments and intrusives which have undergone several episodes of folding and faulting. Large scale thrust faulting, block faulting, and Tertiary igneous activity (both intrusive and extrusive) have added to the complexity. Lack of good stratigraphic control greatly complicates the interpretation of the geology; indeed, even the gross ages of the main units remains questionable.

Bennett's linear map of the area is included here as figure 19. He noted five major trends:

- a. There are three prominent sets of linears, a northwest set, a northeast set and a north-northwest set.
- b. A set of linears which outlines the eastern edge of the Crags pluton may represent a curvilinear fracture system associated with emplacement of the pluton. These linears trend northwest along Roaring Creek, north-south just east of Cathedral Rock and north-northeast along Yellowjacket Creek.
- c. Many of the major drainages appear to coincide with linear segments such as the Panther Creek-Napias Creek lineament.
- d. Linears appear more concentrated in the area of Blackbird Creek, Musgrove Creek and Porphyry Creek. In this area, the intersection of northeast and northwest linears forms a boxwork pattern. Several of the northeast linears are confined to a belt bordered by the Panther Creek-Napias lineament to the east and the headwaters of Blackbird Creek, Musgrove Creek and Porphyry Creek to the west.
- e. Comparison of figures 20 and 21 shows that the -150 gamma contour, which may represent the western limit of the Leesburg stock, coincides with linear segments just east of



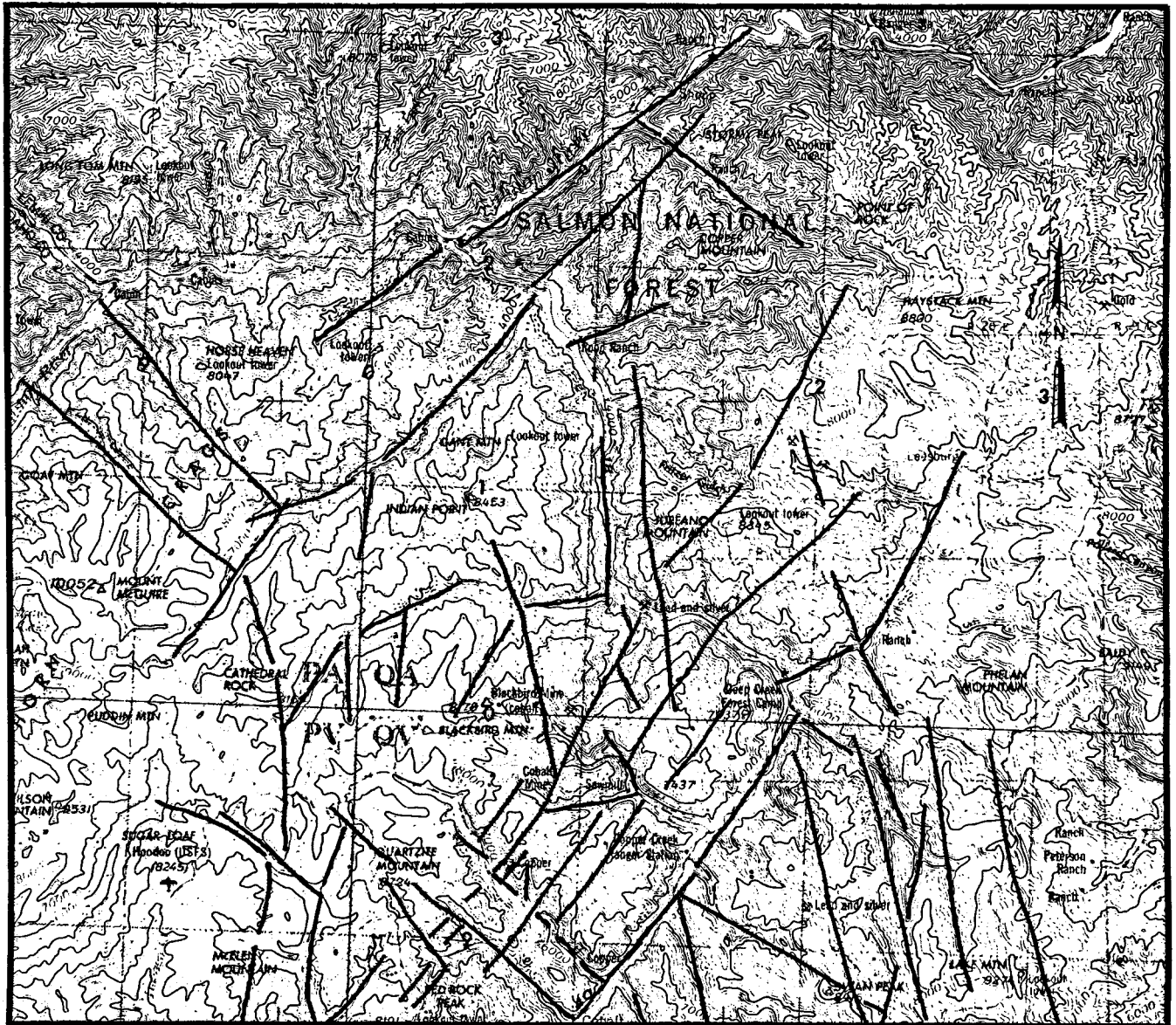


FIGURE 19. Linear map compiled from Landsat, false color, infrared imagery. Topographic base is from Elk City AMS map (scale 1:250,000). From Bennett, 1977, p. 33.

the Panther Creek and along Napias Creek and Moccasin Creek.

Of interest to this study are the linears that intersect in the vicinity of Big Creek Hot Springs. The Hot Springs Creek part of the Clear Creek-Hot Springs Creek lineament has been mapped as a fault (figure 19). The north trending lineament approximately follows the Augen-Greiss-Yellow-jacket Formation (figures 19 and 20).

Of interest to this report is Bennett's aeromagnetic map of the area as shown in figure 21. Bennett reported that:

A positive magnetic anomaly (maximum +150 gamma) is expressed northwest of Leesburg on Camp Creek.

Bennett believed this represented the magnetic expression of the Leesburg Stock. Bennett reported that:

The small part of the stock exposed along Arnett Creek extends from the +50 gamma contour across the 0 gamma contour. The -100 gamma line which surrounds the +150 line (south of Haystack Mountain) marks the western limit of silver, lead and molybdenum anomalies which are probably related to the stock. The -150 gamma contour near Jureano Mountain extends along the Leesburg fault and may mark the western limit of the stock in the subsurface.

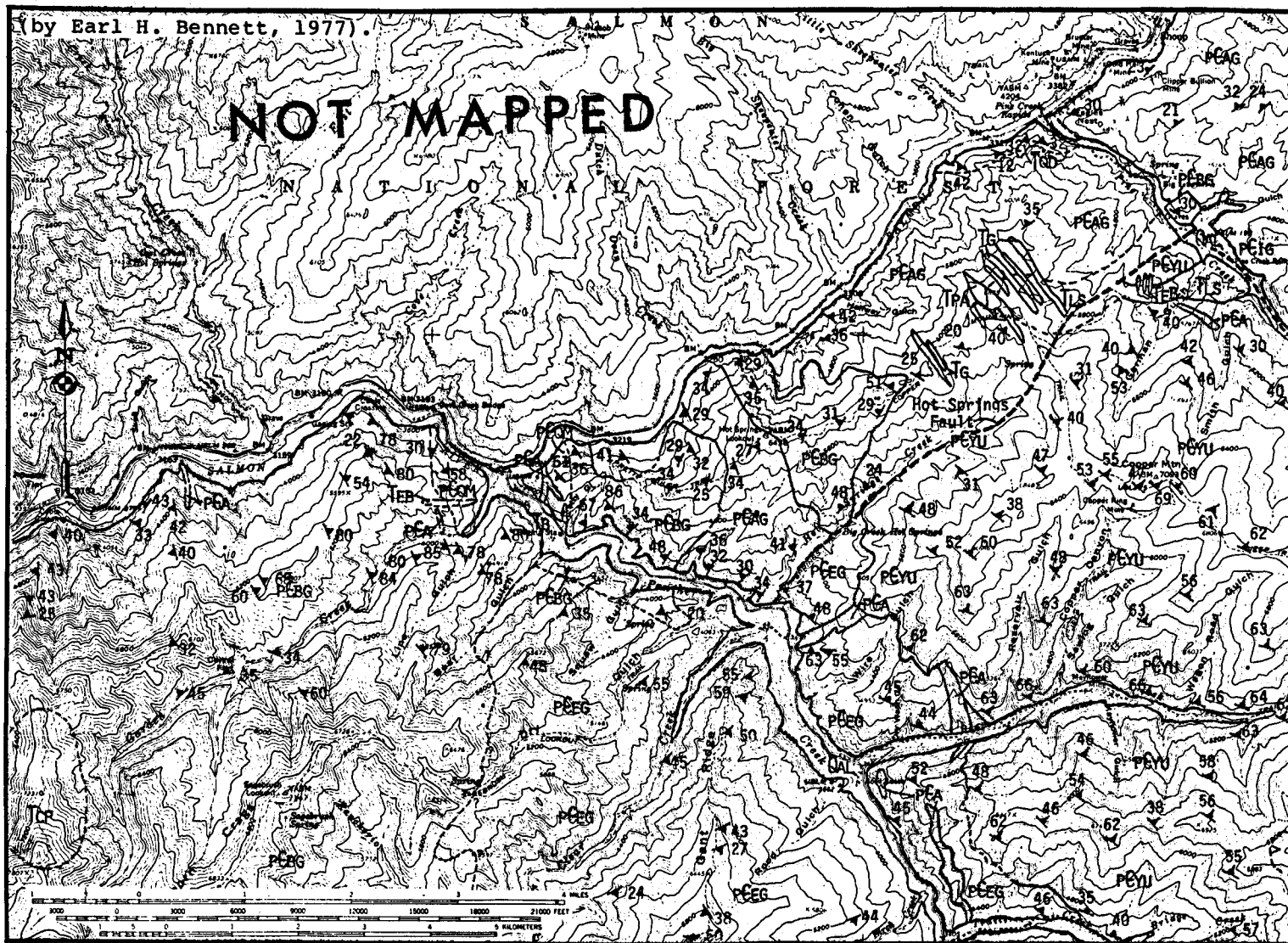
The area enclosed by the -210 gamma line over Gant Mountain and the surrounding -200 gamma line are most likely expressions of the augen/ellipsoidal gneiss unit and its subsurface extension to the northwest beneath the undifferentiated metamorphic rocks. In fact, most of the area which is less than -150 gammas, within the study area, appears to be related to the outcrop patterns of the augen gneiss.

Big Creek Hot Springs lies on the -170 to -200 gamma trough. This trough follows the general trend of the Hot Springs fault.

The land is administered by the U.S. Forest Service (USFS). Until leases are issued, prospects such as Big Creek Hot Springs cannot contribute to our energy supply. The area is remote but not roadless. The nearest sizable market for electricity would be Missoula, Montana; however, recent electric wheeling legislation could allow development by utilities located out of the area.

Salmon Hot Springs (20N-22E-3abd1S), 10 km south of Salmon, has a surface temperature of 45°C, and is the

FIGURE 20. Geologic map of the Big Creek Hot Spring area in Lemhi County, Idaho



- EXPLANATION -

TERTIARY

QUATERNARY

QAL	Alluvium
QLS	Landslide deposits
QGL	Glacial terrace deposits
QT	Terrace gravels
TA	Later Tertiary ash
Ti	Interbeds
TCV	Undifferentiated Challis Volcanics
TPA	Porphyritic andesite
TED	Undifferentiated Tertiary dikes
TEB	Basalt dikes
TG	Gabbroic dikes
TOD	Orbicular quartz diorite
TCP	Crag pluton
TLs	Late Cretaceous - Tertiary Leesburg stock

PRECAMBRIAN (Y)

PQOM	Quartz monzonite orthogneiss
Augen Gneiss Complex:	
PCAF	Augen gneiss (PCAG)/Ellipsoidal gneiss (PCEG)/gneiss intermediate between PCAG and PCEG = PCIG
PCIG	
PCEG	
PCA	Amphibolite dikes
PCHU	Hoodoo Quartzite PCHU, upper unit may be equivalent to Ruppel's (1975) Apple Creek Formation. PCHL, lower unit is probably equal to Ruppel's (1975) Big Creek Formation.
PCHL	
PQYU	Yellowjacket Formation PQYU-upper dark gray, impure quartzite member and PQYL-lower phyllite member.
PQYL	
PQOB	"Mixed unit" consists of quartzite, schists, phyllites and argillites, which are probably Yellowjacket Formation at a higher metamorphic grade.
PQGS	Garnet schist. Probably Yellowjacket Formation units at a higher metamorphic grade.
PQBG	Undifferentiated schists and other metamorphic rocks - Probably Yellowjacket Formation units at a higher metamorphic grade.

	Strike and dip of bedding
	Vertical beds
	Strike and dip of foliation
	Vertical foliation
	Strike and dip where foliation parallels bedding

	Contact - dashed where approximate, queried where uncertain or inferred
	Thrust fault, teeth on upper plate
	Fault - dashed where approximate, queried where inferred. May in part be thrust faults

Note: The Shoup and Ulysses Mtn. quadrangles (area north of 45° 15' north latitude) have a contour interval of 80 feet. The Blackbird Mtn. and Leesburg quadrangles (area south of 45° 15' north latitude) have a contour interval of 100 feet.



FIGURE 21. Aeromagnetic map of the study area (modified from U.S.G.S., 1975). Map is drawn with a 6.17 gamma/mile north and a 3.92 gamma/mile east regional trend removed. Magnetic contours are overlain on topography from the Elk City AMS map (scale 1:250,000). From Bennett, 1977, p.28.

nearest of any thermal springs in Lemhi County to a meaningful population center. Aquifer temperatures at Salmon Hot Springs appear to be only 50°C by the chalcedony chemical geothermometers (basic data table 2) although the Na-K-Ca chemical geothermometer indicated temperatures may be as high as 204°C. This discrepancy could be caused by mixing of hot and cold water or precipitation of calcium in the subsurface. There is excess travertine deposition by the spring. This site might have potential for space heating in or near Salmon.

Sharkey Hot Springs (20N-24E-34ccclS) issues from Oligocene silicic volcanic rocks along a northwest trending fault. It is actively depositing small quantities of carbonate material and apparently formerly deposited silica. It discharges 30 l/min. Measured surface temperature is 52°C. Maximum subsurface temperature is thought to be best represented by the chalcedony chemical geothermometers at 104°C. Sharkey Hot Springs is somewhat removed from population centers but is accessible by an improved road.

A spring (16N-21E-18adclS) located on the Salmon River discharges 25 l/min and has a surface temperature of 46°C. It issues from the alluvial material probably overlying Precambrian quartzite. This spring deposits small quantities of carbonate material locally. Subsurface temperatures may best be represented by the chalcedony chemical geothermometer at 57°C.

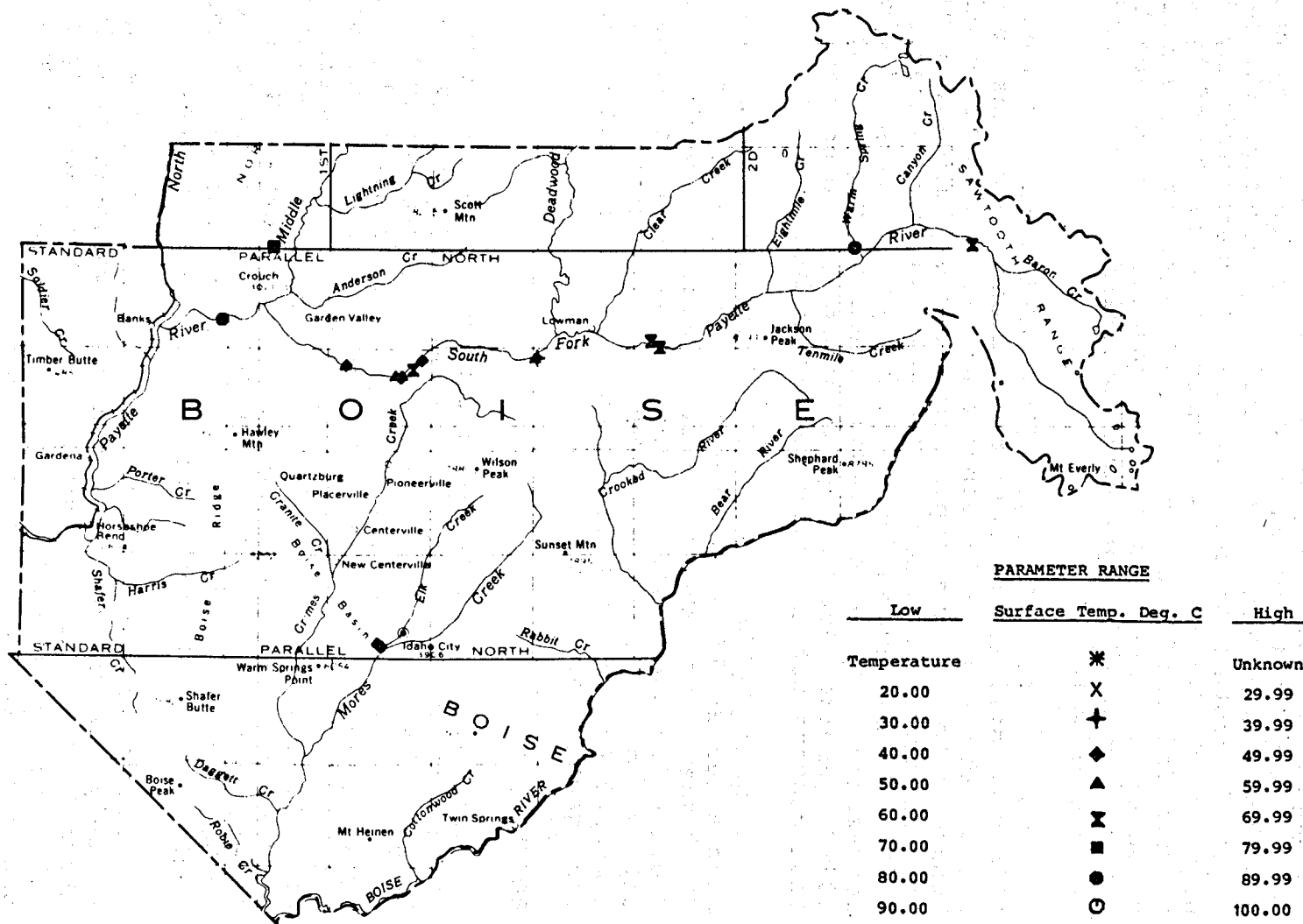
#### BOISE COUNTY

Thermal springs in Boise County are most numerous along the South Fork of the Payette River (figure 22). Garden Valley lies at the confluence of the South and Middle Forks of the Payette River and is popular as a summer home resort area. Several thermal springs and at least one thermal well are in the Garden Valley area. Two thermal springs exist near Idaho City. One, Stope Warm Springs (6N-5E-33abclS), occurs in an abandoned mine adit. The other, Warm Springs (6N-5E-33adclS), has been developed into a popular resort. Idaho City is also a popular summer home area where use could be made of thermal water for space heating.

Little is known of the characteristics of thermal water as only six chemical analyses are available from 19 known thermal occurrences in Boise County. More sampling of thermal water occurrences should be undertaken to more fully assess the area's geothermal potential.

In general, the dissolved solids are low except for flouride and sulfate concentrations in those thermal waters sampled; generally, the water is a sodium bicarbonate type.

FIGURE 22. Index map of Boise County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.





Bonneville Hot Springs (10N-10E-31bcclS) is the hottest thermal water in Boise County at 85°C and has a 1400 l/m discharge issuing from a fault in granite (Ross 1971). Bonneville Hot Springs may have potential for binary cycle power generation, as the quartz and Na-K-Ca chemical geothermometers estimate temperatures of 137 and 142°C.

Deer Hot Springs (9N-3E-25baclS) might also have potential for binary cycle power, as quartz and Na-K-Ca chemical geothermometers estimate temperatures of 147 and 134°C. Deer Hot Springs has a surface temperature of 80°C and discharges 76 l/min.

Other thermal springs are much cooler having surface temperatures between 46 and 67°C and subsurface temperatures between 60 and 104°C, according to the Na-K-Ca and chalcedony chemical geothermometers. The Na-K-Ca chemical geothermometer indicates subsurface temperatures cool in a fairly systematic way from a high of 142°C at Bonneville Hot Springs in the upper reaches of the South Fork Payette River to a low of 63°C near Danskin Creek Hot Springs (8N-5E-1bcclS).

Sacajawea Hot Springs (10N-11E-31aadlS) in the upper reaches of the South Fork Payette River drainage has not been sampled, but has a surface temperature of 68°C and reported discharge of 380 l/min.

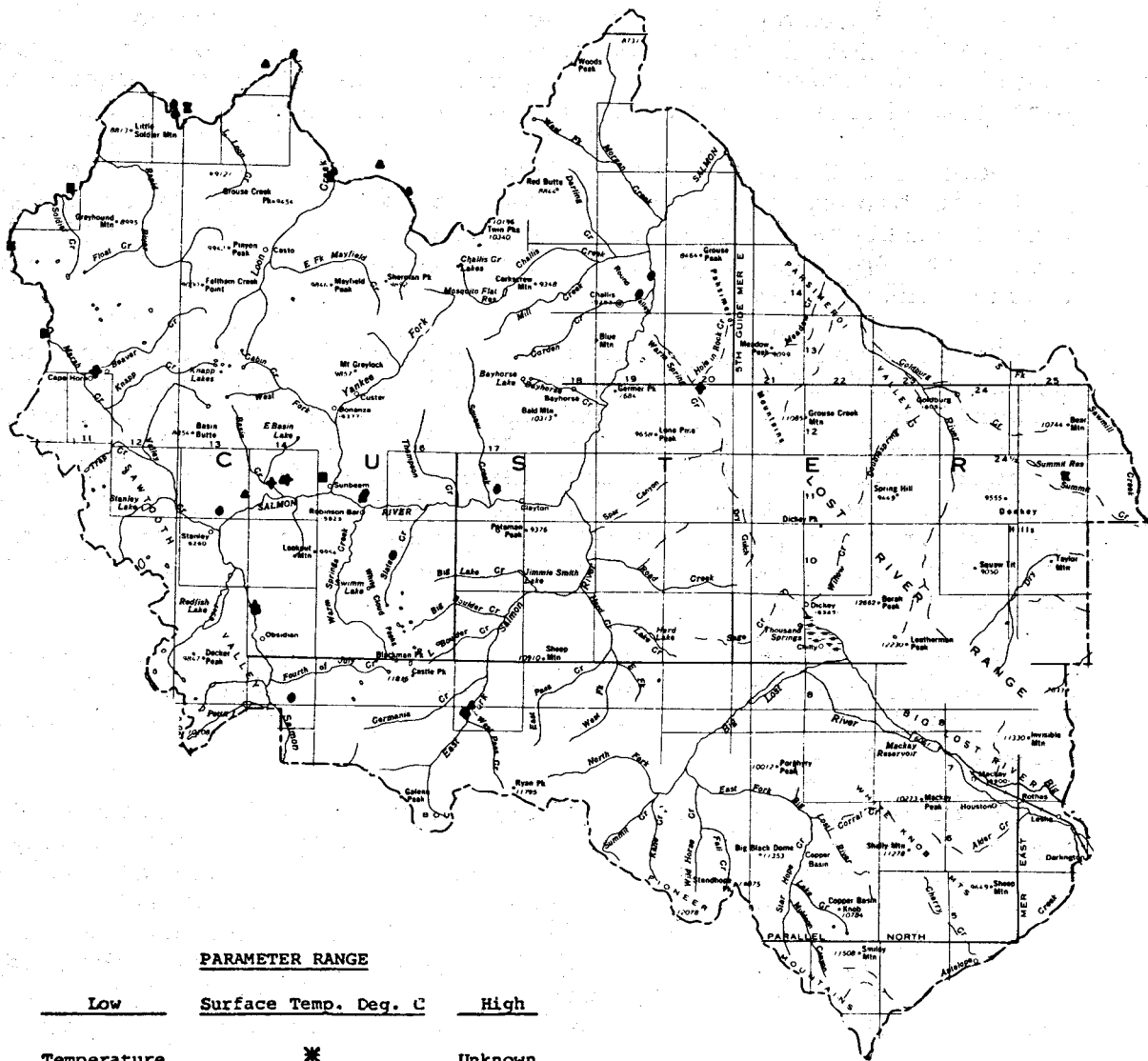
Twin Springs (4N-6E-24bcblS), a developed resort, is so named because a thermal and nonthermal spring occur in close proximity and is located in the lower reaches of the Middle Fork of the Boise River above Arrowrock Reservoir. The thermal spring discharges water at 67°C. Subsurface temperatures may be as high as 104°C, according to the chalcedony chemical geothermometer. The Na-K-Ca chemical geothermometer predicts 60°C, unexplainedly 7°C below measured surface temperatures.

#### CUSTER COUNTY

Thermal springs in Custer County (figure 23) are similar in occurrence to springs in most of the rest of north-central Idaho occurring near drainage confluences or near ridge points that protrude into the stream. The thermal waters are generally low in dissolved solids and have high pH values. About half are on lands administered by the USFS and many could be developed for recreational uses. One, Stanley Hot Springs (10N-13E-3cablS), has now been covered over.

Generalities on thermal spring occurrences along the Middle Fork of the Salmon River were given earlier in the section on Valley County. These are in remote areas, so





**PARAMETER RANGE**

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	⊙	89.99
90.00	⊛	100.00

FIGURE 23. Index map of Custer County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



FIGURE 24. EROS false color infrared Landsat EDISE image of central Idaho showing selected linear features and thermal water locations with surface temperatures above 20°C.



large scale development for industrial purposes is not likely. Springs along the main Salmon River between Smiley Creek and Salmon generally lie within recreation area boundaries on both private land and land administered by the USFS. Some of these springs have potential for recreational uses. Several are presently used as such and others have been previously used for such purposes. In areas that are being developed for recreational home sites, springs could be utilized for space heating. Some of these springs might be used similar to the way springs in Boise County are used by the Idaho Department of Fish and Game as a heat source for game bird production, particularly wild turkeys and grouse. As most of the area is far from markets and few good transportation facilities exist, most other uses appear to be excluded, although locally small scale uses, such as greenhouse operations, might be feasible.

Figure 24 is an enhanced Landsat false color infrared image of part of Central Idaho showing locations of selected thermal water discharges and linear features. The common occurrence of springs and lineaments is not striking on the figure. Nevertheless, several major linear features are shown near the thermal springs or wells. The chemical geothermometers are highly variable for Custer County. Highest aquifer temperatures appear to be near 104°C in the area of Basin Creek, Mormon Bend and Sunbeam Hot Springs.

#### NORTHERN ELMORE COUNTY

Thermal springs in northern Elmore County (figure 25) are distributed along the major drainages -- the North, Middle, and South Forks of the Boise River. These occurrences along the drainages are similar to other springs in central Idaho.

Ross (1971, p. 13 and 14) states that:

More than a dozen thermal springs occur along the lineament that marks the main Boise River and its Middle Fork tributary. All the springs issue from granite, in areas transected by granitic and mafic dikes. Between Twin Springs (4N-6E-24bcblS) in Boise County and Weatherby Mill well (6N-9E-35acal) springs average one every 2 miles. A single spring (6N-11E-35dcals) is northeast of Atlanta along the same lineament.

The 29°C water from the flowing well at Weatherby Mill is considered by local residents too mineralized to drink, although total dissolved solids are similar to those in the other springs.

Approximately a dozen thermal anomalies (figure 25) occur along the upper reaches of the South Fork of

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	✱	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00

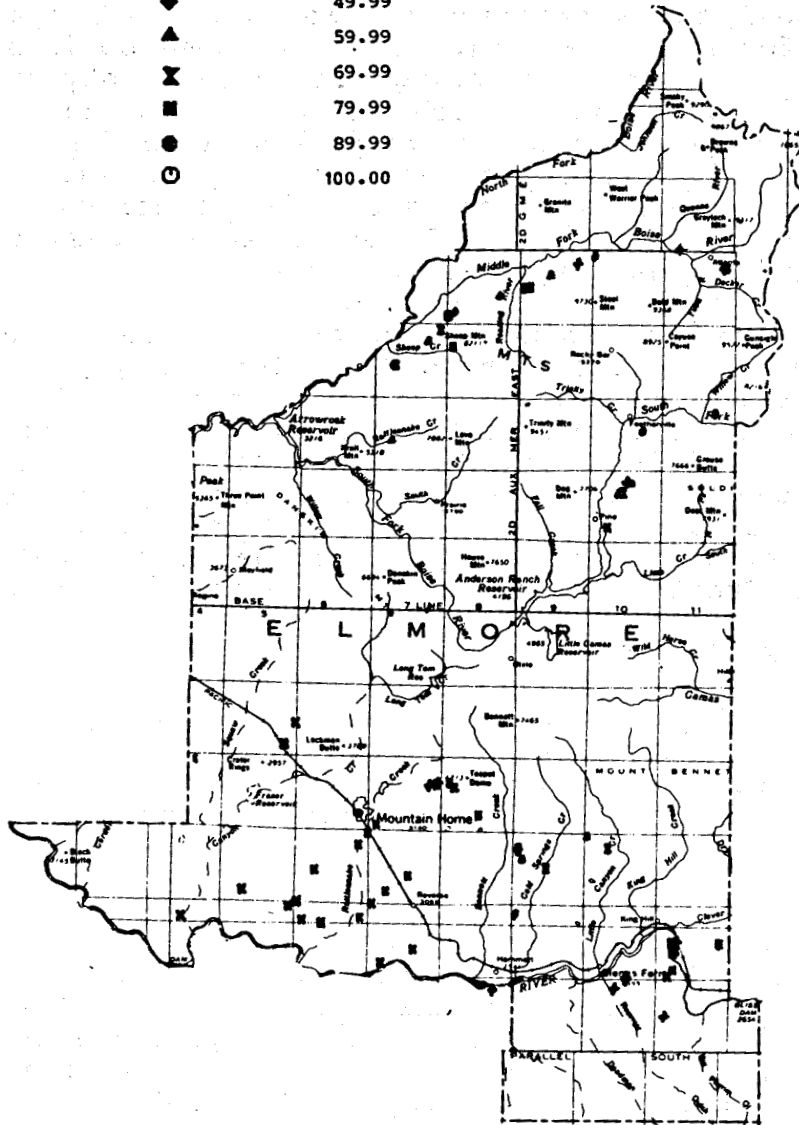


FIGURE 25. Index map of Elmore County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

the Boise River and its tributaries. All are in granitic rock, much of which is cut by mafic and pegmatitic dikes.

Paradise Hot Springs (3N-10E-33bdb1S) utilizes 60°C water in a swimming pool at a resort. A mile south, Bridge Hot Spring (2N-10E-5acalS) and related seeps flow more than 150 gpm, also at 60°C. A warm spring (3N-10E-10abalS) and several warm wells are at Featherville. The 46°C water at Baumgartner Hot Spring (3N-12E-7dcd1S) is used for bathing facilities at a Forest Service campground. Lightfoot Hot Spring (3N-13E-7dcals) apparently was used at one time for domestic heating and for irrigation of a small meadow. Maximum temperature is 62°C.

Highest temperatures along the South Fork of the Boise River are at the east and west extremities of the regions.

The chemical geothermometers indicate some of the hotter of the low temperature thermal water in Idaho might be found in northern Elmore County. The Na-K-Ca and quartz chemical geothermometers indicate temperatures as high as 126°C might be found by drilling at Neimeyer Hot Springs (5N-7E-24bdd1S). At Latty Hot Springs (3S-10E-31ddb1S), temperatures might be as high as 137°C. Most of the other springs in the area show subsurface temperatures below 80°C, according to the Na-K-Ca chemical geothermometer.

Most of these thermal springs are on lands administered by the USFS and several more probably could be developed by the USFS for recreation purposes. Those that occur near vacation homesites (table 4) could probably be developed for space heating, provided flows could be augmented by drilling. Some of them could be used by the Idaho Department of Fish and Game as a heat source for game bird production.

#### CAMAS COUNTY

Camas County (figure 26) contains several thermal springs and wells. Many are in the unpopulated Soldier Mountain area to the north of Camas Prairie. These occurrences are similar to the rest of the thermal springs in central Idaho. They are limited to the South Fork of the Boise River and its tributaries in northern Camas County. Located here are Worswick (3N-14E-28caals), Preis (3N-14E-19daclS), Wardrop (1N-13E-32abblS) and Lightfoot (3N-13E-7dcals) hot springs. Worswick Hot Springs is probably the most extensive thermal spring in Idaho covering more than 10 acres and having dozens of vents, according to Ross (1971).

TABLE 4  
TOWNS AND RECREATIONAL HOME AREAS IN CENTRAL IDAHO WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL (1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C		Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
				Na-K-Ca Min.	Chalcedony Max.					
Atlanta	Elmore	5N-11E-3	--	--	--	--	--	--	--	No chemical analyses available, summer home sites.
Cascade	Valley	14N-3E-36abd1	43	46	66	193	Municipal pool	916	City of Cascade	--
Challis	Custer	14N-19E-23ddd1S	40	60	68		Natatorium	850	Private	Summer home sites.
Clayton	Custer	11N-17E-27bdd1S	41	58	99**	640	Natatorium Recreation	41	Private	Summer home sites.
Council Ellis	Adams Custer	16N-1W-15bac1 16N-2E-18adc1S	22 46	--	--	--	Irrigation	923	Private	--
Feather- ville	Elmore	3N-10E-10aba1	43	--	--	--	Space heating	--	Private	Summers in Lemhi County. Summer home sites.
Garden Valley	Boise	8N-5E-10bdd1S	55	74	80	237	Space heating, private swim- ming	--	Private	Summer home sites.
Hailey	Blaine	2N-18E-18dbb1S	59	83	100	272	Space heating	1,840	Private	Heated Hiawatha Hotel.
Idaho City	Boise	6N-5E-30acd1S	41	--	--	--	Natatorium	194	Private	No chemical analyses available, summer home sites.
Ketchum	Blaine	4N-17E-15aac1S	71	88	101	324	Space heating	1,780	Private	Heats several condominiums.
Meadows	Adams	19N-2E-22cca1S	43	91	96**	489	Unused	--	--	Public water supply.
Stanley	Custer	10N-13E-3cab1S	41	47	76	210	Unused	52	Private	Bath house & pool.
Warm Lake	Valley	15N-6E-14cdb1S	55	62	83	258	Unused	--	--	Near summer home sites.

\*Minimum and maximum subsurface temperatures are based on the chemical geothermometers from basic data table 2. Both are given to call the reader's attention to the uncertainties involved in their interpretation. Maximum temperatures should be viewed with some skepticism. The geothermometers are useful in initial assessment of geothermal areas to establish priorities for further work in these areas.

\*\*Minimum temperature is chalcedony temperature. Maximum temperature is Na-K-Ca temperature.

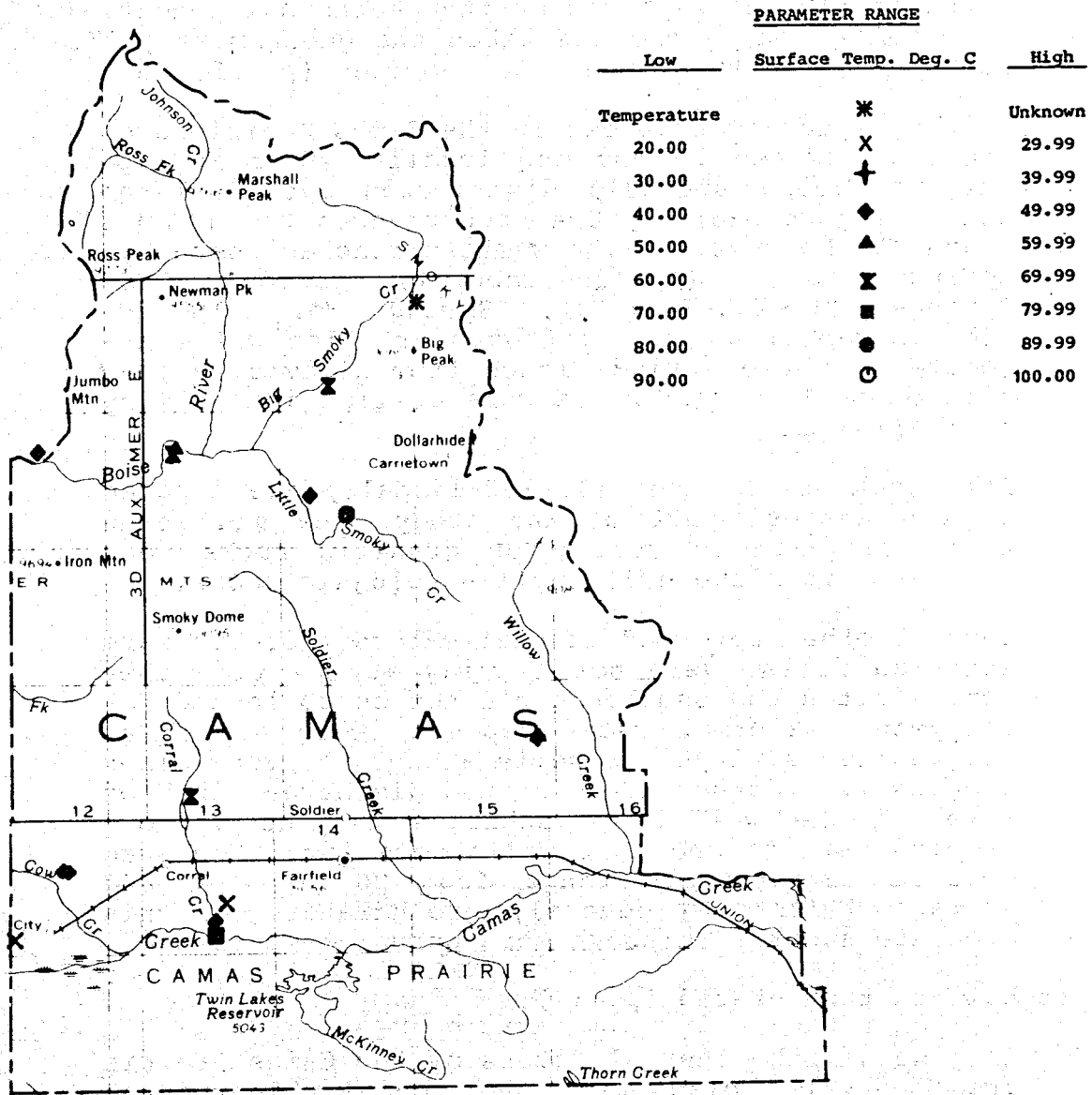


FIGURE 26. Index map of Camas County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



Most flow at temperatures near 76°C. Total discharge from the entire spring is over 1500 l/min. Ross (1971, p. 14) reported that the entire area, which is brecciated, bleached, and silicified, was the probable intersection of several fault zones.

Mitchell (1976c) reported on the geothermal potential of southern Camas County and described the geochemistry of the thermal springs in this area. He reported (p. 15) that:

Thermal water occurrences in the Camas Prairie area are not limited to any one locality or rock type but are found sparsely distributed over a large area (figure 26). The occurrences seem more abundant, however, in the western reaches where Hot Springs Ranch (1N-13E-32abc1S), Barron's Hot Springs (1S-13E-34bcblS), Spring No. (1S-12E-16cbalS-cab1S) and several warm artesian wells are located. These springs issue from alluvial valley fill deposits. The wells were drilled into valley fill alluvium.

Elk Creek Hot Springs (1N-15E-14ada1S) are located in the eastern part of the study area and issue from fractures in Cretaceous granitic rocks near Eocene(?) to Miocene(?) Challis volcanic rocks.

Several other reported thermal waters (notably warm artesian wells) were not flowing at the time they were visited and samples could not be collected for analysis. Thermal water deposits were absent at all visited springs and wells except for very minor evaporative incrustations around discharge pipes of some of the wells. Discharges of the various sampled springs and most wells were low. Measured surface temperatures range from 26 to 72°C and average 53°C. In general, groundwaters in this area are about 10°C above mean annual temperature.

Mitchell further stated (p. 17):

In general, the thermal waters of the Camas Prairie area can be classified as sodium bicarbonate ( $\text{NaHCO}_3$ ) type waters although the dominant element found in Hot Springs Ranch (1N-13E-32abc1S) water is silica rather than sodium. With the exception of Magic Hot Springs well (1S-17E-23aab1) these thermal waters are typified by:

1. High silica contents (50-90 mg/l) compared to low total dissolved solids of less than 365 mg/l;

2. High pH (7.8-9.2);
3. High carbonate compared to most thermal water in Idaho;
4. High fluoride contents compared to most thermal and cold groundwaters in Idaho;
5. Low calcium (Ca), magnesium (Mg), potassium (K), and chloride (Cl) contents.

Typically, these thermal waters are chemically similar to thermal waters found discharging from Cretaceous granitic rocks, or areas believed to be underlain by these type rocks elsewhere in Idaho (Ross, 1971, p. 23), (Young and Mitchell, 1972, unpublished data, and Young and Whitehead, 1975a, p. 30).

The cause of this chemical "fingerprint" for these waters is not well understood. At least three hypotheses might explain some of the observations.

1. Abundance of certain elements may reflect the availability of the elements in various minerals found in the granitic rocks and the minerals' solubility in heated water or steam. For example, the high fluoride content might be traced to the abundance of fluorite or fluorapatite, and its solubility at reservoir temperature, and pH, or to fluoride, concealed in interlattice silicate structures of hydroxyl bearing minerals such as the micas or amphiboles, which are found in the granitic rocks.
2. High fluoride waters may reflect an appreciable quantity of magmatic waters or volcanic gasses. Observations of gasses from volcanoes indicate magmatic waters should generally be high in volatiles such as fluoride, ammonia and boron.
3. High fluoride waters might be explained by enrichment of fluoride in a steam phase separated from water having a lower fluoride content (volatile enrichment).

The first explanation of the high fluoride content is considered by this author to be the best hypothesis because of:

1. The widespread occurrence of fluoride-rich thermal waters in Idaho;

2. Their close association with granitic rocks or areas believed to be underlain by granitic rocks;
3. Lack of fumarolic, geyser, and related geothermal activity (which would indicate volatile enrichment processes are actively taking place);
4. Low concentrations of other volatiles, i.e., ammonia and boron, chemical constituents found in volcanic gasses, and which are also capable of enrichment in separated steam. In nearly all geothermal systems investigated to date, isotopic studies have not revealed any magmatic or juvenile water contributions to these systems.
5. Thermodynamic calculations indicate that thermal waters from Elk Creek Hot Springs (1N-15E14ada1S), which issue directly from fractures in granitic rocks, are in equilibrium with fluorite at the measured spring temperatures. Fluorite is known as an accessory mineral in certain granitic rocks in Idaho.
6. In general, granitic rocks are known to contain relatively much fluoride, mostly in fluoroapatite, but, in some cases, a fluoride concealed in interlattice spaces of hydroxyl bearing minerals such as the micas or amphiboles where it substitutes for hydroxide due to size and charge similarities.

The geochemical data suggested to Mitchell (1976c, p. 22) that the thermal waters in the Camas Prairie area are from low temperature systems.

The chalcedony equilibrium chemical geothermometer ( $T_4$ , basic data table 2) or Na-K-Ca chemical geothermometer ( $T_5$ , basic data table 2) are considered the most reliable and representative of actual aquifer temperatures in most cases because of these considerations:

1. Thermal waters issuing from granitic terrains are generally considered to be supersaturated with silica with respect to quartz (Holland 1967, p. 393). Therefore, the quartz equilibrium chemical geothermometer ( $T_1$  and  $T_2$ ) and mixing models ( $T_9$  and  $T_{10}$ ) may not be valid because of excess silica in many of these springs and wells.

2. In no case does amorphous silica control silica concentration in the thermal water. The below-measured surface temperatures and in some cases below-zero temperatures predicted by the amorphous silica chemical geothermometer indicate that the thermal waters are considerably undersaturated with silica with respect to this phase. No exceptions to this generalization were noted from basic data table 2 in the Camas Prairie area.
3. No unusual conditions are suggestive of mixed hot and cold waters, such as cold spring seeps in the vicinity of the hot springs or wells, were observed.
4. Discharges were, in general, very low throughout the area, indicating little, if any, mixing of hot and cold waters. Exceptions to the low discharges are found only in drilled holes.
5. The low Na-K-Ca predicted aquifer temperatures are in general agreement with measured surface temperatures, indicating little mixing of hot and cold water, or that equilibrium conditions have been maintained since the waters have left the thermal aquifer. The low predicted Na-K-Ca aquifer temperatures show fair agreement with the chalcedony equilibrium aquifer temperatures.
6. The low chloride and certain other element concentrations found in these thermal waters could be the result of mixing. However, mixing would dilute certain other chemical constituents found in relatively high concentrations such as fluoride and carbonate.
7. Walton (1962, table 2, p. 35) reported higher calcium concentrations in cold groundwaters in the area than were found in the thermal waters. Dilution of thermal waters with cold groundwaters would mean the premixed thermal waters would have to be nearly devoid of calcium in order for the mixed water to show the calcium concentration found in the thermal waters. Thermal water devoid of calcium from granitic rocks is considered unlikely.
8. The extremely widespread geographical area in which these type waters are found would make it highly unlikely that such uniform mixing conditions could exist as to recognize these

waters by merely looking at unsynthesized geochemical data.

9. Arnórsson (1970, p. 537, 1975, p. 763) found that chalcedony generally controls silica concentration in Icelandic thermal waters when aquifer temperatures are below 100-110°C. Chalcedony equilibrium aquifer temperatures are below Arnórsson's upper limit. Chalcedony equilibrium is, therefore, indicated if this criterion is applicable to the Camas Prairie.
10. The depths postulated as necessary to give rise to the measured surface temperature are reasonable for the origin of these waters.

Mitchell (1976c, p. 25) concluded:

The Camas Prairie thermal waters are probably meteoric waters circulating to shallow (approximately 1,200 m) depths along fractures or fissures within the granitic rocks underlying and along the margins of the Prairie. Heated waters are discharging upward into the sediments of the Prairie, perhaps through faults or fissures within the underlying granite concealed by valley fill. Some water subsequently discharges to the surface, forming springs. The source of the heat related to the granitic rocks is unknown.

The possibility of a large thermal aquifer or reservoir within the sediments filling the basin is negligible due to the apparent shallow depth of the valley fill materials as shown by the two wells penetrating the entire thickness of sediments near the basin center. Any possibility of a large thermal reservoir could lie in large faults in highly fractured granitic rock underlying the Prairie. Fracture permeability may allow sufficient circulation and recharge to allow large volumes of water to be withdrawn if the fault system could be penetrated by drilling. Hot and cold groundwaters at depth probably are not mixing to any apparent degree. The thermal waters ascending from shallow depths could be cooling by conduction during their ascent to the surface.

Maximum temperatures encountered in drilling to 900 to 1,500 m are probably only about 100°C. Temperatures of this magnitude would be sufficient to have some industrial applications. These industrial applications and approximate temperatures necessary for them are shown in figure 4.

## NORTHERN BLAINE COUNTY

Northern Blaine County (figure 27) is another region in Idaho where geothermal resources have been an energy source of long standing. Fifteen thermal springs are known in northern Blaine County. Several wells have been drilled near some of the thermal springs that yield hot water as at Magic Hot Springs (1S-17E-23aabl), Hailey Hot Springs (2N-18E-18dbblS), Clarendon Hot Springs (3N-17E-27dcblS), Guyer Hot Springs (4N-17E-15aac1S) and Easley Hot Springs (5N-16E-10dbclS).

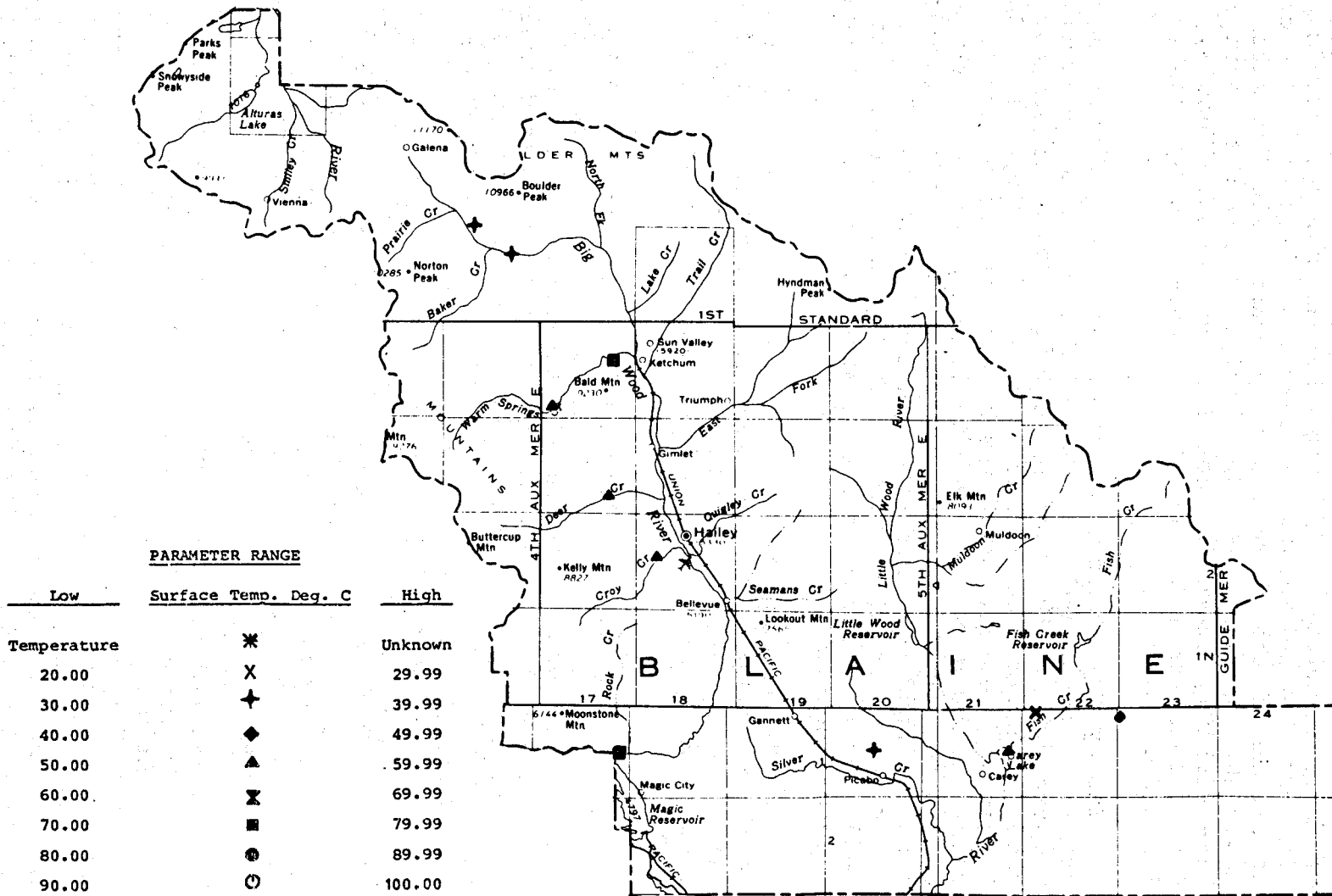
Easley Hot Springs is being used as a natatorium. The drilling of a well at Magic Hot Springs increased the temperature by 36°C from 38 to 74°C. These waters have been used to space heat small cabins. At Magic Hot Springs Landing, chemical geothermometers indicate aquifer temperature could be near 175°C, which would make this area a candidate for power generation using methods similar to those planned for Raft River in Cassia County. Even a small power plant at this site could furnish much of the power needs for this rural area of Idaho. Cascading uses could be made of the power plant effluent.

In Blaine County three warm water wells occur near the northern margin of the eastern Snake River Plain near Carey, and three more occur 3 km northwest of Picabo. Condie Hot Springs (1S-21E-14ddclS) occurs near Carey Lake.

The Hailey area is located in south-central Idaho on the Big Wood River drainage. The geologic framework of the area consists of undifferentiated Paleozoic and Mesozoic marine sedimentary rocks. Hailey Hot Springs is located about 3 km from Hailey (population 1,840, 1976) on Democrat Gulch, a tributary to Croy Creek which in turn is a tributary to the Big Wood River with confluence at Hailey (figure 28). Sufficient thermal water might possibly be withdrawn from near Hailey Hot Springs to space heat the entire town of Hailey. The surface temperature of the spring is 59°C. The chemical geothermometers suggest a temperature of 78 to 97°C might be encountered by deeper drilling. It is not known at what depth this temperature might be encountered, but it may be as deep as 900 to 1200 m.

Hailey Hot Springs' structural setting is typical of the hot springs in central Idaho; that is, many do occur near the confluence of streams, indicating fault or similar structural control. Fault controlled geothermal systems may provide a significant resource in Idaho for local use, as has been found at Raft River and Boise. Hailey Hot Springs occurs on the curvilinear zone connecting Clarendon Hot Springs, Warfield Hot Springs, and Easley Hot Springs (see

FIGURE 27. Index map of Blaine County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



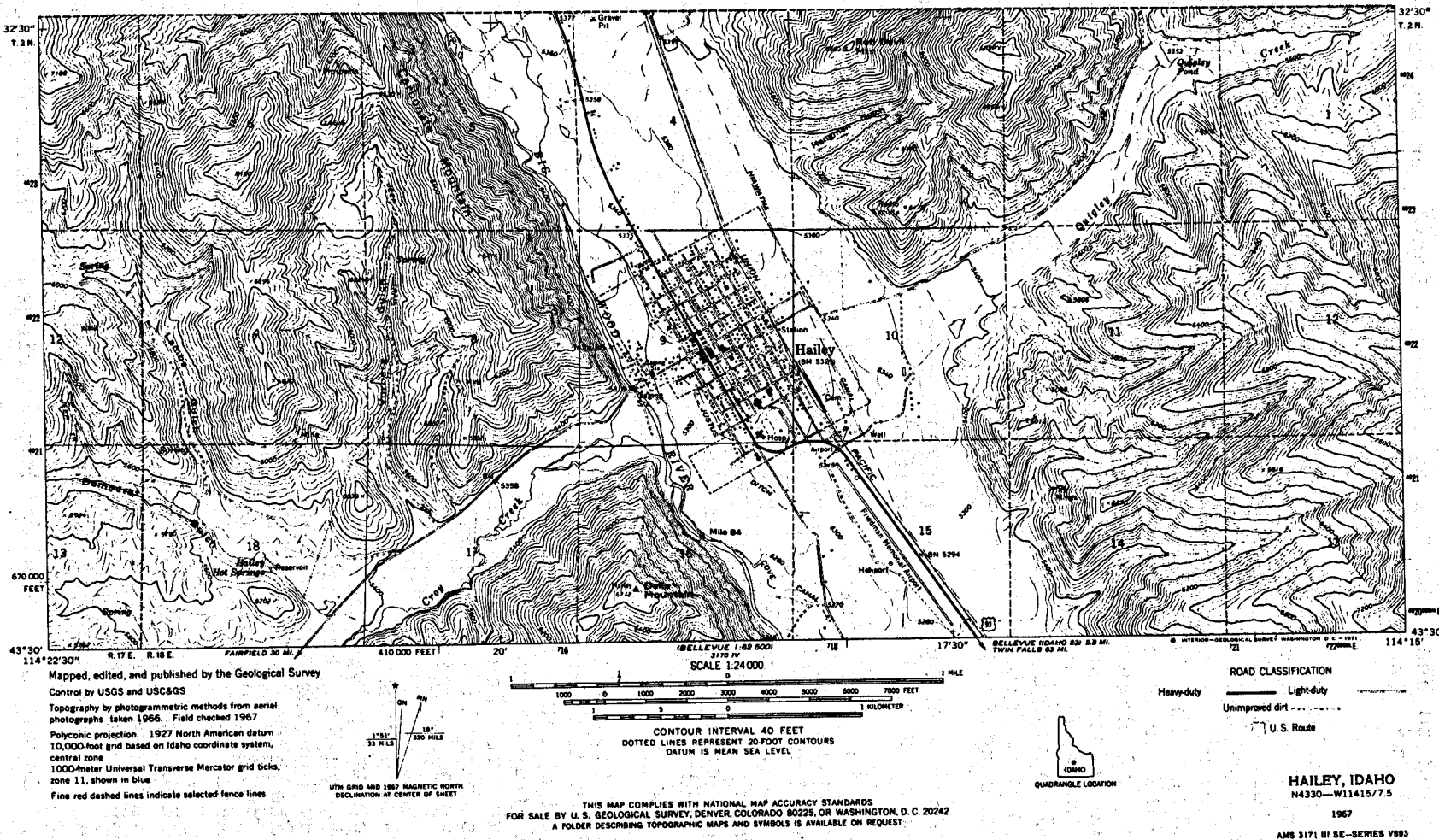


FIGURE 28. Topographic map of Hailey area showing location of Hailey Hot Springs with respect to the City of Hailey.



figure 9 in pocket and figure 29). Hailey Hot Springs was formerly used to heat the Hailey Hiawatha Hotel, an approximately 560 m<sup>2</sup> (square meter) structure which recently burned.

It is not known at present which structure or structures control the occurrence of thermal water at Hailey Hot Springs (Big Wood structure, Croy Creek-Quigley Creek structure, or Democrat Gulch structure). To confirm the size and exact location of the geothermal reservoir for space heating the town's buildings and residences, it will be advisable to evaluate, in some detail, reservoir characteristics and determine the amount and characteristics of geothermal water which could be withdrawn for use. This would be done by drilling observation wells, running well tests and perhaps drilling exploration holes to see if existing water flows could be augmented, or a new source found closer to Hailey.

Donaldson and Applegate (1979), reporting on geophysics in the Hailey-Ketchum area, stated:

Gravity in the Ketchum-Hailey area is dominated by a strong regional gradient controlled by the transition from the Snake River Plain gravity high to the gravity low over the Idaho batholith. Any detailed interpretation from gravity in this area would necessarily involve increasing the amount of data and carefully removing the strong regional gradient.

Witkind (1975) (figure 15) has identified an active fault in the lower Wood River Valley which is terminated about 7 km north of Hailey. Distortions in the regional gradient contours are, however, suggestive of faulting further up the valley and faults are indicated on the Idaho State Geologic Map (Bond, 1978).

A relatively small-amplitude, low-frequency magnetic high roughly centered over Bald Mountain and an associated low to the north may be indicative of a buried igneous unit (see figure 30). A strong elongate high and associated low centered about 15 miles NE of Sun Valley appears to be a near surface phenomena.

Guyer Hot Springs (4N-17E-15aac1S) near Ketchum on Warm Springs Creek is another area where thermal water is presently being used for space heating. Guyer Hot Springs occurrence is very similar to that at Hailey Hot Springs and lies along a suspected curvilinear zone connecting Hailey, Clarendon, Guyer and Easley hot springs. Warfield Hot

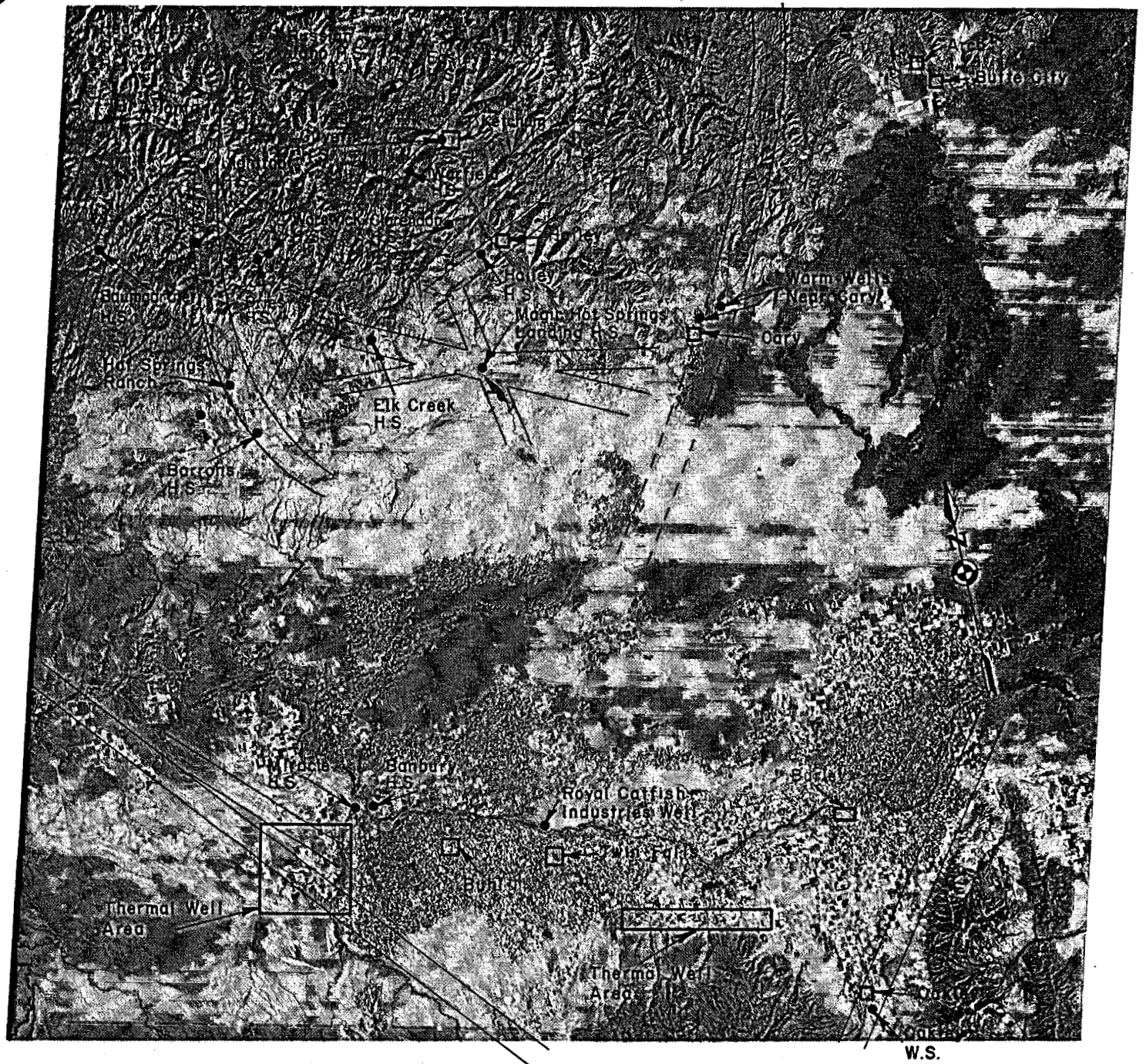


FIGURE 29. EROS false color infrared Landsat EDISE image of south-central Idaho showing selected linear features and thermal water locations with surface temperature above 20°C.



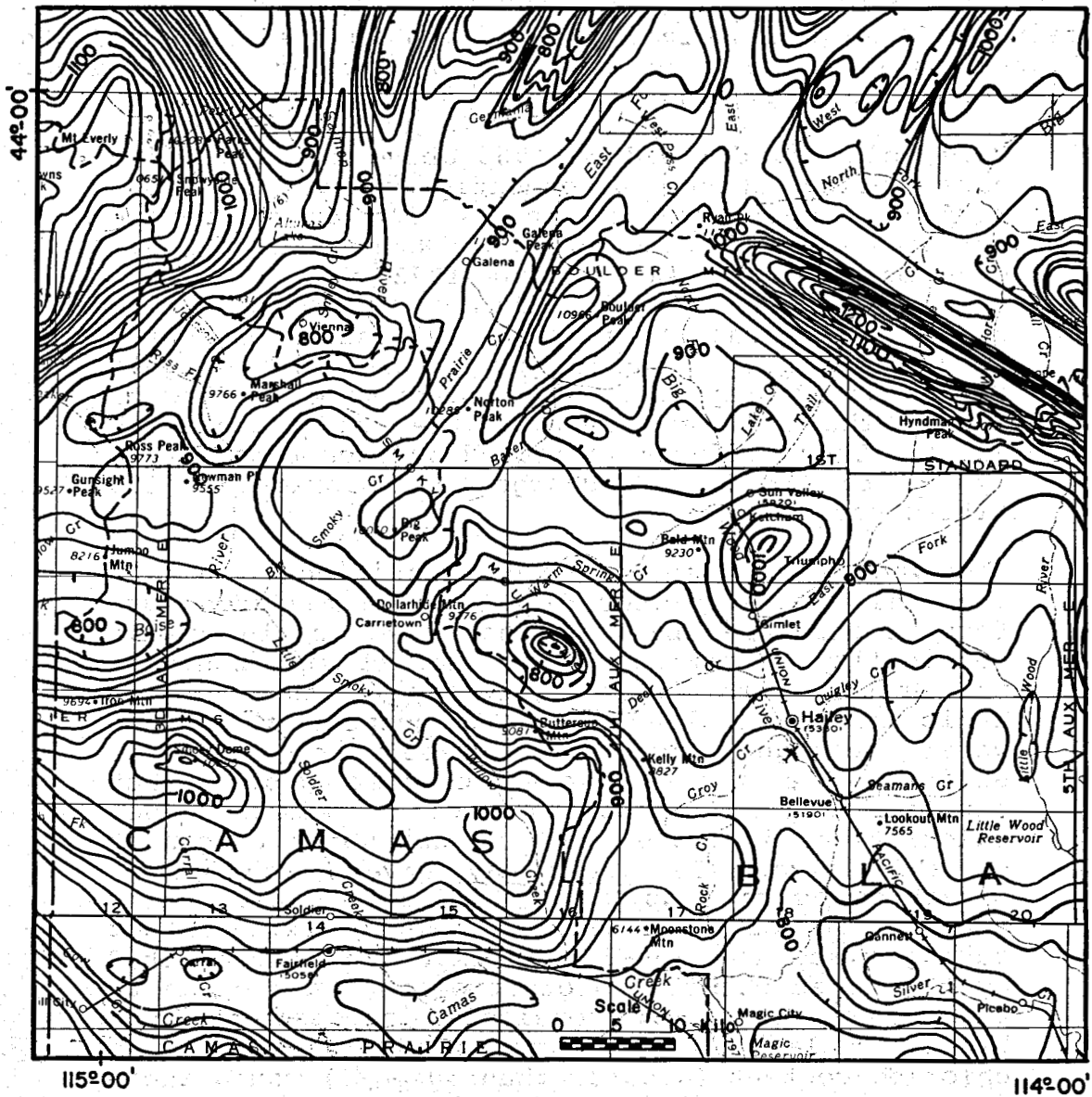


FIGURE 30. Magnetic anomalies near Bald Mountain (right of center) and NE of Sun Valley (upper right) (U.S. Geological Survey, 1971).

Springs is further up Warm Springs Creek from Guyer and will probably be used to heat vacation homes near Ketchum in the future.

Magic Hot Springs Landing was reported on by Mitchell (1977) who stated that water from Magic Hot Springs well (1S-17E-23aabl) near the north shore of Magic Reservoir contained 978 mg/l dissolved solids, 105 mg/l silica, and was higher in chloride than other thermal water in the area. Mitchell stated (p. 23):

This well was drilled in 1965 above the site of a warm spring which subsequently ceased to flow. Surface temperature of the spring water before drilling of the well was 36°C (Ross 1971, p. 56). When measured in the fall of 1973 the well had a surface temperature of 72°C. In 1975, during attempts to cap this well, artesian pressures reached 30 psig (pounds per square inch gauge), then started dropping. The owners were in fear of losing the well and removed the newly installed valve. These efforts increased surface temperature by 2°C to 74°C and discharge to approximately 250 liters per min.

The indicated disequilibrium conditions (Na-K-Ca chemical geothermometer differs from measured surface temperatures by more than 20°C) could mean a possibility of mixing of the thermal with nonthermal groundwaters. The proximity of the well to Magic Reservoir leads one to suspect that cold water leakage from Magic Reservoir could be entering the thermal water conduit system that supplies Magic Hot Springs well. Mixing model calculations indicate that the hot water component of this mixed (?) water may have reached temperatures as high as 200°C with cold water making up about 70% of total water. Even if mixing is not taking place the 150-175°C temperatures predicted by the other chemical geothermometers are close to that temperature now considered necessary for a binary cycle geothermal power plant. The high chloride content (greater than 50 mg/l) would indicate that this system would probably be a hot water rather than a dry steam system.

The marked difference in chemistry between Magic Hot Springs well waters and other thermal waters in the Camas Prairie area would indicate: (1) Magic Hot Springs well waters have been at higher temperatures than the other thermal waters in the area, and/or (2) the aquifer or reservoir rocks for Magic Hot Springs well waters are mineralogically

and/or chemically different from the aquifer or reservoir rock for the rest of the Prairie area. Although in many instances it is possible, using geochemical methods, to determine the aquifer or rock type from which thermal waters are in equilibrium, available data does not indicate which rock type could constitute an aquifer. The geology of the area would, however, suggest the aquifer to be either Quaternary alluvium, Middle Pliocene basalts of the Idaho Group, Lower Pliocene Idavada volcanic rocks, Eocene or Miocene Challis volcanic rocks, Cretaceous granitic rocks, or perhaps a combination of two or more of these.

The heat source for these waters could either be (1) an intruded sill or stock, related perhaps to the Holocene basalt flows found south of Magic Reservoir, or (2) a regionally high geothermal gradient and heat flow. Brott and others (1976) have determined that geothermal gradients and heat flow along the margins of the Snake River Plain are higher (about 3 HFU) than the regional norm which would indicate a regional heat source rather than a localized anomaly.

Mitchell (1976) further stated (p. 15) that Magic Hot Springs:

...well was drilled near the intersection of two curvilinear features that are probably faults. These faults may represent the controlling structure for the occurrence of thermal water in this particular part of the study area. Landsat false color infrared satellite imagery shows one of these lineaments as extending northwesterly, from near the southern tip of Magic Reservoir, along its eastern shoreline, and into the Soldier Mountains as the northern margin of the study area. The other feature extends at a slight northwesterly angle along the northern margin of the Claybank Hills and into the Soldier Mountains. (Malde and others, 1963, show a fault lying somewhat east of and nearly parallel to the Magic Reservoir (?) fault. Their mapped fault passes through the Claybank Hills and lies very near Magic Hot Springs well.) A hypothetical block diagram showing the possible control of Magic Hot Springs well is shown in figure 31.





## SUMMARY OF CENTRAL IDAHO REGION

Most thermal water in central Idaho occurs as springs, although several well drillers have accidentally discovered thermal water while drilling for cold water. Most of these springs appear to be fault controlled, therefore, prospecting for new thermal water areas would probably be most profitable along the major drainages near large river bends, near stream confluences, near gaps in suspected curvilinear zones connecting existing known thermal springs or along major lineaments. Significant amounts of thermal water may yet be undiscovered as it may be discharging directly into river bottoms where it cannot be observed. A thermal scanner could conceivably be used for river bottom prospecting.

Several of the larger towns, notably Cascade, Hailey, Ketchum and Council, occur within 5 km of a thermal water discharge. These towns should probably receive first priority in initial assessment surveys, as they contain the greater population concentration (see table 4 for a complete listing). Many of these and smaller communities could heat public buildings and schools with geothermal water. Some may have small industries that could utilize geothermal fluids. Geothermal water could also be used for space heating in recreational home areas. Recreational uses could be increased, particularly by the USFS. Game bird hatcheries might be established at some sites by the Idaho Department of Fish and Game.



MEMORANDUM FOR THE RECORD

On 11/13/54, the following information was received from the [illegible] office regarding the [illegible] case. The [illegible] office advised that the [illegible] had been [illegible] and that the [illegible] had been [illegible]. The [illegible] office also advised that the [illegible] had been [illegible] and that the [illegible] had been [illegible].

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GEOHERMAL POTENTIAL OF THE SNAKE RIVER PLAIN REGION  
INCLUDING WASHINGTON, PAYETTE, GEM, CANYON, ADA,  
SOUTHERN ELMORE, GOODING, JEROME, MINIDOKA,  
OWYHEE, TWIN FALLS, NORTHERN FREMONT, BUTTE AND  
WESTERN CASSIA COUNTIES

The Snake River Plain region of Idaho is endowed with certain geologic features that favor the occurrence of geothermal energy. The Snake River Plain is one of the largest and possibly least studied (in terms of origin) structural features of the North American continent. It extends some 480 km in a broad arcuate plain from Weiser near the west-central border of Idaho, southeastward to Burley, thence northeastward to its abrupt termination with the western rim of the Island Park caldera in eastern Idaho adjacent to Yellowstone Park. In width, the plain varies from 32 km in the west to 90 km in the east (see figure 32).

The Snake River Plain is generally divided according to surface and shallow subsurface geology into the northwestward-trending western Snake River Plain and a northeastward-trending eastern Snake River Plain for purposes of discussion. The dividing line between the two subregions, is approximated by the Salmon Falls Creek-Snake River area in western Twin Falls and Gooding counties. Elevations vary uniformly from a low of 700 m near Weiser to a high of 1,830 m near the Island Park caldera rim. The gently undulating plain is flanked on the east, southeast, and northeast by transverse mountain ranges and valleys. Other structural features, faulting, lineament, and joint patterns surrounding the plain are generally parallel to (in the western Snake River Plain) or transverse to (in eastern Snake River Plain) the borders of the plain.

The Snake River enters the plain from the southeast through a mountain valley in the eastern part of Idaho. The Snake River flows along the southern margin of the plain until it reaches the western border of Idaho, then abruptly swings across the plain, exiting through Hells Canyon. Smaller streams and rivers enter the plain from adjacent mountains and valleys.

The plain proper represents the surface of a thick sequence of silicic, andesitic, and basaltic lava flows interlayered with volcanic ash, tuff and sedimentary material. Estimates of the thickness of this sequence varies from 3,000 to 9,000 m. Volcanic cinder cones and buttes puncture the thick pile of volcanic and sedimentary material throughout the entire plain in many places. Many of these volcanic and sedimentary units are water saturated.

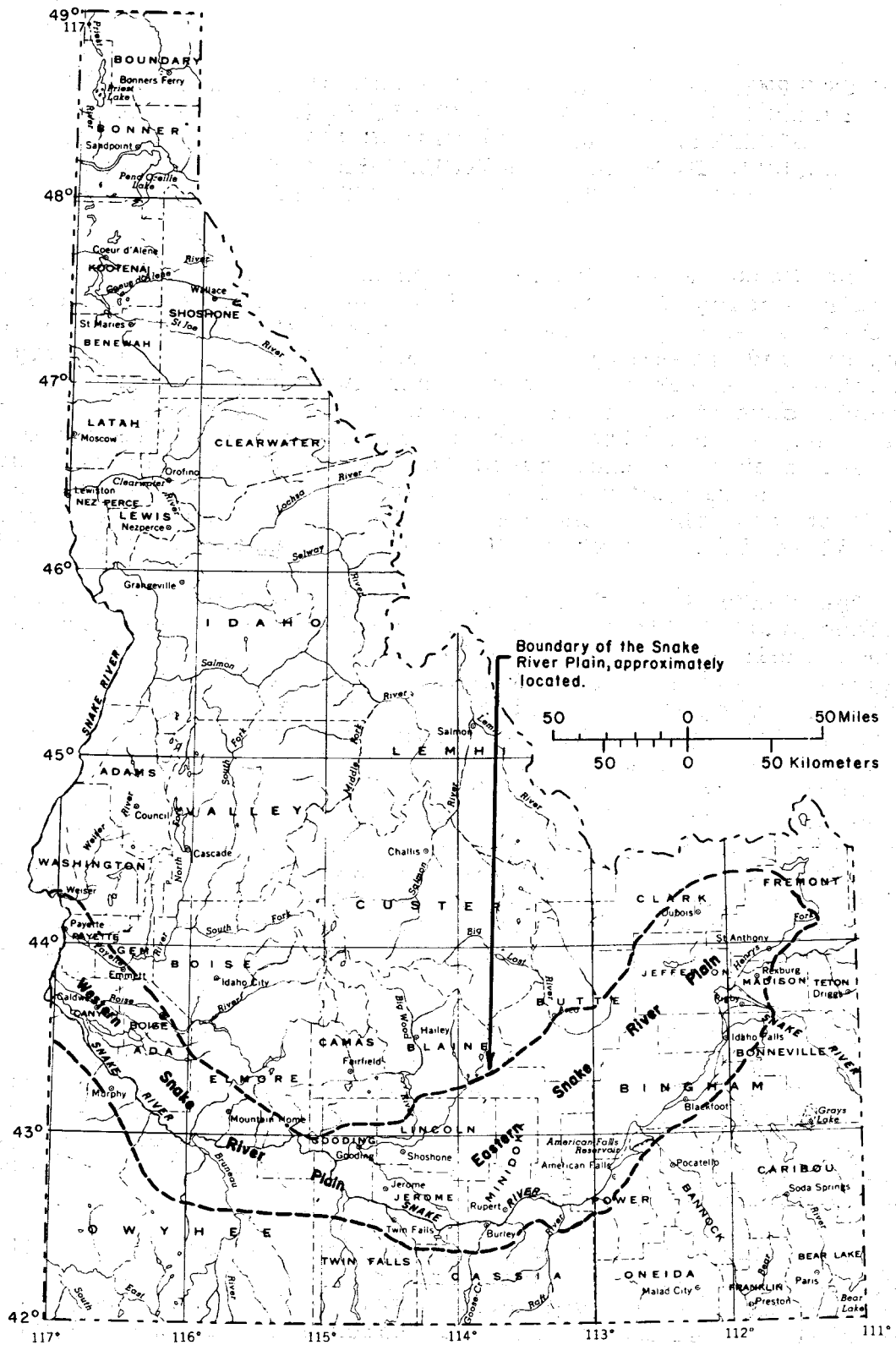


FIGURE 32. Index map of Idaho showing the Snake River Plain and its subdivisions.

One of the largest fresh groundwater bodies known, the Snake Plain aquifer with more than  $1.2 \times 10^9$  cubic meters of water withdrawn annually, underlies a large portion of the eastern Snake River Plain.

The Snake River Plain is also one of the more youthful geologic features in Idaho. It apparently had its inception in Pliocene time some 3-15 million years ago. Volcanism has continued sporadically through Holocene time (the present epoch). This volcanism and associated deformation has apparently migrated from west to east, as age dating of volcanic rocks by Armstrong and others (1975) has shown decreasing ages of rocks from west to east. This widespread deformation and volcanism, both rhyolitic and basaltic, are fundamental features of geothermal provinces.

Brott and others (1976) determined that heat flow throughout the Snake River Plain is consistently 0.5 to 3 HFU (heat flow units) higher than in areas of normal heat flow. The higher values are found along the margins of the plain. Although few heat flow measurements could be obtained above the Snake Plain aquifer due to the aquifer's masking effect, Brott and others (1978) showed that elevation changes from west to east in the plain could be due to thermal expansion of underlying hot rocks. Consequently, the rocks beneath the eastern Snake River Plain where elevations are highest should be much hotter than those beneath the western Snake River Plain. This concept is strengthened by Armstrong's rock age dates.

Although the eastern Snake River Plain may ultimately have higher geothermal potential than the western Snake River Plain, most thermal water wells have been drilled in the western Snake River Plain. These wells extend in a belt some 65 km wide and 270 km long, which stretches from Raft River in the extreme south-central part of Idaho, northwestward to Weiser in the west-central part of Idaho (Plate 1 in pocket). Another, shorter and narrower belt, about 80 km long and 15 km wide, extends northwestward from Weiser through the Council-Cambridge area to Meadows. This belt contains numerous wells with surface water temperatures exceeding mean annual temperature by 5-10°C and several up to 20°C (see map, Plate 1). Thermal springs generally seem confined to the margins of the Snake River Plain as do thermal wells in the eastern Snake River Plain, or are found along the Snake River.

Three areas in Idaho where thermal aquifers may exist are located within the large western Snake River Plain thermal zone. These are the Lake Lowell-Nampa-Caldwell area, the Blue Gulch area west of Buhl, and the Bruneau-Grand View area in northern Owyhee County. Others may exist, but well drilling has not revealed their extent

to date. Some evidence indicates these aquifers may be recharged through large faults in the subsurface.

Discussion of the geothermal resources in the western Snake River Plain region follows on a county basis. No geothermal resource was found in Lincoln County.

#### WASHINGTON COUNTY

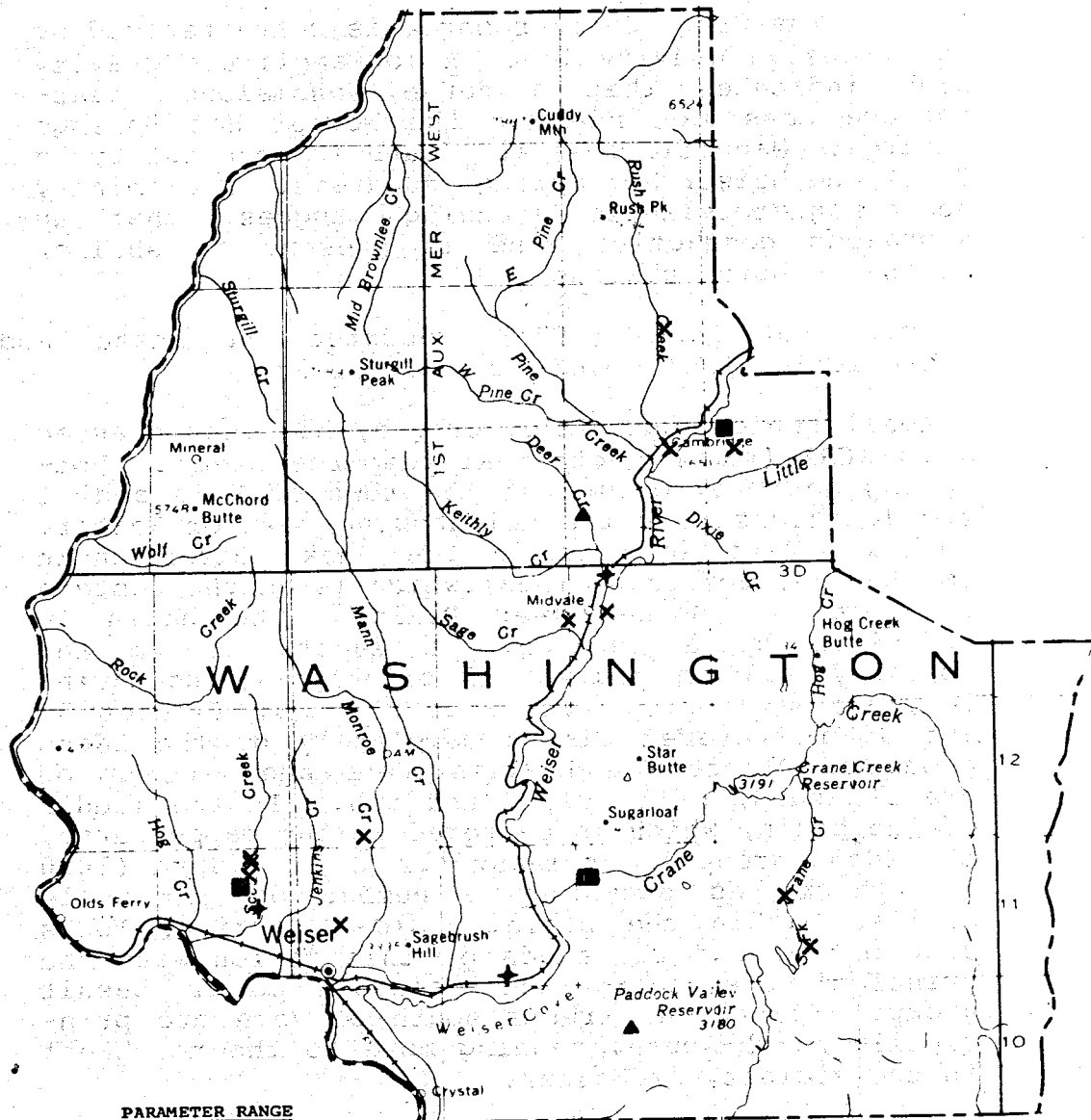
Washington County contains several areas where there are thermal water discharges (see figure 33). Weiser Hot Springs (11N-6W-10acblS), northwest of Weiser, has long been utilized for swimming, balneological bathing, and greenhouse operations as well as small scale space heating. Several small diameter wells yield enough water at the site of a former hot spring to carry on the above operations. Another location which indicates promise of electrical generation capability is the Crane Creek Hot Springs (11N-3W-7bcblS) area northeast of Weiser.

Young and Whitehead (1975, p. 31-32) summarized the geothermal potential of these areas.

The Weiser area comprises about 518 sq km in southwestern Washington County and includes two subareas having thermal water: the Crane Creek subarea, which is about 19 km east of Weiser, and the Weiser Hot Springs subarea, which is about 8 km northwest of Weiser.

Although the surficial geology of the Crane Creek and Weiser Hot Springs geothermal subareas is somewhat different, the general stratigraphy is similar. Volcanic and sedimentary rocks of Permian and younger age, granite of Cretaceous age, or the older basalts of the Columbia River Group of Miocene and Pliocene age may underlie the Weiser area. However, the scant data available indicate that the reservoir rock is most likely composed of the older basalts of the Columbia River Group. Miocene and Pliocene (?) sedimentary rocks, termed the Payette Formation, overlie older basalts and are, in turn, overlain by a younger sequence of basalts of the Columbia River Group. For the most part, sedimentary rocks of the Idaho Group of Pliocene and Pleistocene age overlie the younger basalts. Alluvium and colluvium of Pleistocene and Holocene age cover much of the older rock units, particularly in the lowlands and valleys.

Gravity surveys indicate that the Weiser area is at the northwest end of a large regional gravity high that is associated with the western Snake River



**PARAMETER RANGE**

Low	Surface Temp. Deg. C	High
Temperature	※	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	×	69.99
70.00	■	79.99
80.00	●	89.99
90.00	◎	100.00

FIGURE 33. Index map of Washington County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Plain. The Crane Creek subarea is characterized by an extensive gravity low. A low-amplitude gravity high indicates that a dense, anomalous, near-surface mass may underlie the Weiser Hot Springs subarea. Magnetic lows are found in both the Crane Creek and Weiser Hot Springs subareas. Preliminary audio-magnetotelluric soundings suggest that an anomalous conductive zone is present at shallow depths in both subareas.

Hoover and Long (1975) reported on these audio-magnetotelluric (AMT) soundings and stated:

A small region near Vale, Oregon, has been classed as a KGRA (known geothermal resource area). Hot-spring activity occurs at the town of Vale and at two locations near the neighboring town of Weiser, Idaho. This area is in the Snake River basin (Newton and Corcoran, 1963) which is on the western edge of the Snake River Plain. The basin is underlain by a section, at least 1.5 km and possibly 4.6 km thick, of principally nonmarine Cenozoic sediments. The area shown in figures 34 and 35 is covered almost completely by the Idaho group of Pliocene and Pleistocene age made up of gravel, sand, silt, clay, and ash. In the middle of the basin, which is centered in the mapped area, the Idaho group is at least 1.2 km to 1.5 km (5000 ft) thick, as shown by a number of gas wells drilled within the basin. Older Tertiary rocks crop out around the edges of this region with the principal one being the Columbia River basalt group. Structural trends south of Vale are principally north-south, bending more to the northwest in the vicinity of Weiser.

Figures 34 and 35 show the two 27-Hz AMT maps obtained in the basin. At the Crane Creek Hot Springs northeast of Weiser, one of the lowest apparent resistivities was measured, 0.5 ohm-m, at 8 Hz. The maps in the Weiser region show rather complex structures and evidence of much lateral change. The higher resistivities in the northern part of the area are associated with older rocks at the edge of the Idaho batholith.

Within the basin proper, the principal trend in the electrical data is northeast. A resistivity low runs through Vale and extends about 20 km to the southwest. Extension of this trend northeast runs into the low at Crane Creek about 20 km northeast of Weiser. A local high of about 16 ohm-m just northeast of Vale, apparent only in figure 34 is

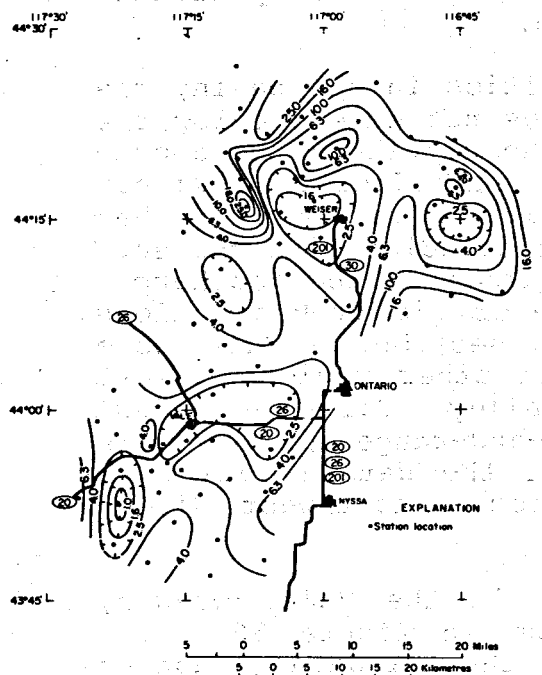


FIGURE 34. 27-Hz apparent-resistivity map (telluric line north-south), Weiser, Idaho-Vale, Oregon. Contours in ohm-meters.

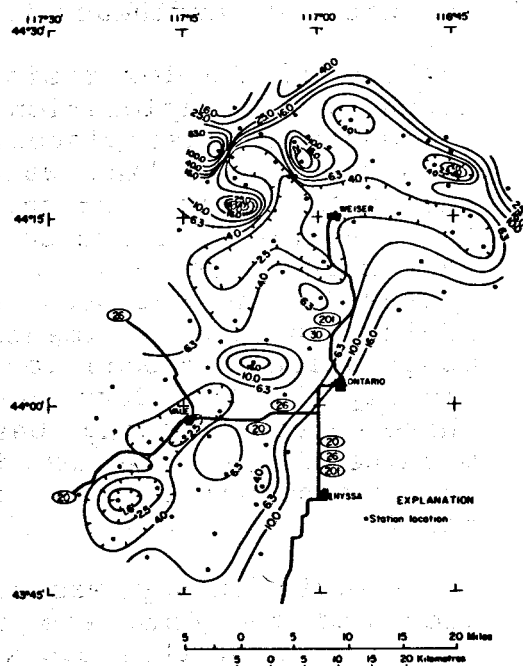


FIGURE 35. Map of 27-Hz apparent resistivity (telluric line east-west), Weiser, Idaho-Vale, Oregon. Contours in ohm-meters.

(Hoover and Long, 1975.)

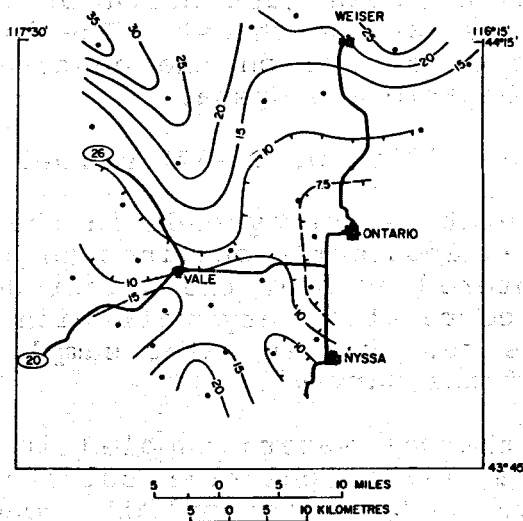


FIGURE 36. Telluric anomaly map at 20- to 30-sec period, Vale, Oregon-Weiser, Idaho. Contour interval  $2K = 10 \sqrt{J}$ .



also on the same trend. This high is related to the rocks comprising Malheur Butte, next to which the sounding was made. This is a small prominent plug whose emplacement may be structurally related to this same northeast trend.

Because of the low resistivities in the basin, the depth of AMT exploration does not extend below the sediments in most places. We attribute the anomalies to hot, saline waters and alteration within the sedimentary section. It is interesting that the electrical trends do not coincide with the surface structural trends. Leakage of the geothermal system to the surface, however, is probably along faults in the sedimentary section. This same observation has been made in other regions - most clearly in the Surprise Valley, California KGRA where north-trending basin-and-range faulting is prominent, yet the trend of the data relating to the geothermal system implies a northwest direction.

A telluric survey was made in the Vale, Oregon, area and the data are shown in figure 36. The correlation of this map with the AMT data is not as direct as in Island Park, which might be expected. The AMT survey is sampling principally the young basin sediments, while the telluric data sample a larger part of the crust and may be reflecting basement topography. A low saddle in the telluric data, however, is seen just north of Vale with a trend to the east and northeast. The lowest values on the telluric map are on the eastern edge near the towns of Ontario and Nyssa.

Young and Whitehead (1975, p. 31-32) stated further that:

A ground-temperature survey made in the Weiser Hot Springs subarea apparently outlines an area of high heat flow centered or near the Weiser Hot Springs, and it also correlates very well with high boron concentrations measured in water samples collected in the area of the survey.

Most of the thermal waters sampled in the Weiser area are of a sodium chloride sulfate or sodium sulfate type. Dissolved-solids concentrations ranged from 1,070 to 1,140 mg/l for thermal water in the Crane Creek subarea and from 225 to 852 mg/l in the Weiser Hot Springs subarea. Thermal water sampled in the Crane Creek subarea had noticeably higher concentrations of chloride and boron than did thermal water sampled in the Weiser Hot Springs subarea.

Measured groundwater temperatures ranged from 13.0 to 92.0°C, and were highest at a spring in the Crane Creek subarea. Estimated aquifer temperatures, using the silica and the sodium-potassium-calcium chemical geothermometers, ranged from 153 to 177°C in the Crane Creek subarea and from 3 to 157°C in the Weiser Hot Springs subarea. Estimated aquifer temperatures for samples from wells at the Weiser Hot Springs ranged from 141 to 157°C. In the Crane Creek and Weiser hot springs subareas, respectively, estimated maximum temperatures at depth, using the mixed water method, ranged from 212 to 270°C and from 200 to 242°C with percentages of cold water ranging from 67 to 76 percent from 70 to 97 percent.

Analyses of hot-spring deposits from active and inactive-spring vents indicated that, although the mineral constituents in samples from both subareas are similar, the deposits in the Crane Creek subarea contain much greater amounts of sinter than those from the Weiser Hot Springs subarea. This indicates that the water depositing this material was at temperatures in excess of 180°C at depth.

The source of the heat for the thermal water in the Weiser area is believed to be a cooling young intrusive implanted at shallow depth in late Miocene or early Pleistocene time, or above-normal heat flow caused by the high temperatures at relatively shallow depth resulting from a general thinning of the earth's upper crust in this area.

Aside from the power generation possibilities in the Crane Creek area, the Weiser and Crane Creek hot springs represent areas where geothermal energy could be harnessed for agricultural use as well. The Weiser area is on the Union Pacific Railroad Mainline with a spur branch extending into the Crane Creek subarea to very near the springs. The entire Vale, Ontario-Weiser area is a rich, agricultural area where approximately one-third of the nation's onions are grown. Much of Idaho's fruit and sugar beets are also grown in this area. Uses such as onion, beet pulp, and fruit drying suggest themselves. Meat packers could make use of the thermal water for refrigeration.

Thermal waters also extend northeastward, in a belt from Vale, Oregon, through Weiser to Council-Cambridge in Washington County to the Meadows area in Adams County (see Plate 1 in pocket). Little is known about the Council-Cambridge area geothermally except that there are approximately eight wells ranging in temperatures from 20 to 30°C and one hot spring at 69°C. Discharge of wells ranges from

379 to 1500 l/m. The wells range in depth from 56 to 283 meters. Chemical analyses of discharge water from these wells should be made to establish priorities for further work in this area.

#### PAYETTE COUNTY

Little is known of the geothermal potential of Payette County. Nine thermal wells are known to have been drilled there and all are relatively cool, between 20 to 29°C (figure 37). Four are in the southwestern corner of Payette County north of Parma. Two more are up Little Willow Creek about 13 km northeast of Fruitland. Two occur about 5 km east of Fruitland and one occurs .4 km east of Payette.

Highest surface temperatures were measured up Little Willow Creek at 25 and 29°C from wells 9N-3W-21bdcl and 9N-3W-19ddal. Well head temperatures of 20°C have been measured from wells 9N-5W-35ccb1 near Payette and 8N-4W-7ccd1 near Fruitland.

No chemical analyses are available from any thermal wells in Payette County. Assessment of the resource should begin with sampling the hottest ones and those near Fruitland and Payette. It is possible that more and hotter water could be found in the Fruitland-Payette-Ontario area where several food processing plants are located.

#### GEM COUNTY

Four thermal anomalies are known in Gem County (see figure 37). Roystone Hot Springs (7N-1E-8ddalS) may have potential for binary cycle power generation. Roystone occurs near the intersection of a prominent north trending lineament that connects with the Dry Valley thermal anomaly north of Boise and a less pronounced northeast trending lineament (figure 17). These are visible on enhanced false color composite satellite images of the area. Surface temperature at Roystone Hot Springs is 55°C and discharge is 75 l/m. As estimated by the quartz and Na-K-Ca chemical geothermometers, subsurface temperature is 147 and 150°C, respectively.

A spring (7N-1E-9cdclS) about .4 km from Roystone Hot Springs has a 45°C surface temperature and may have an aquifer temperature between 84 and 106°C according to the Na-K-Ca and chalcedony chemical geothermometers.

A well 9.5 m deep has been drilled recently near Emmett in Gem County. This well has a surface temperature of 24°C which is sufficient for space heating if groundwater heat pumps are used. No other data are presently available for this well, but its presence suggests that the Emmett area

PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⌵	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

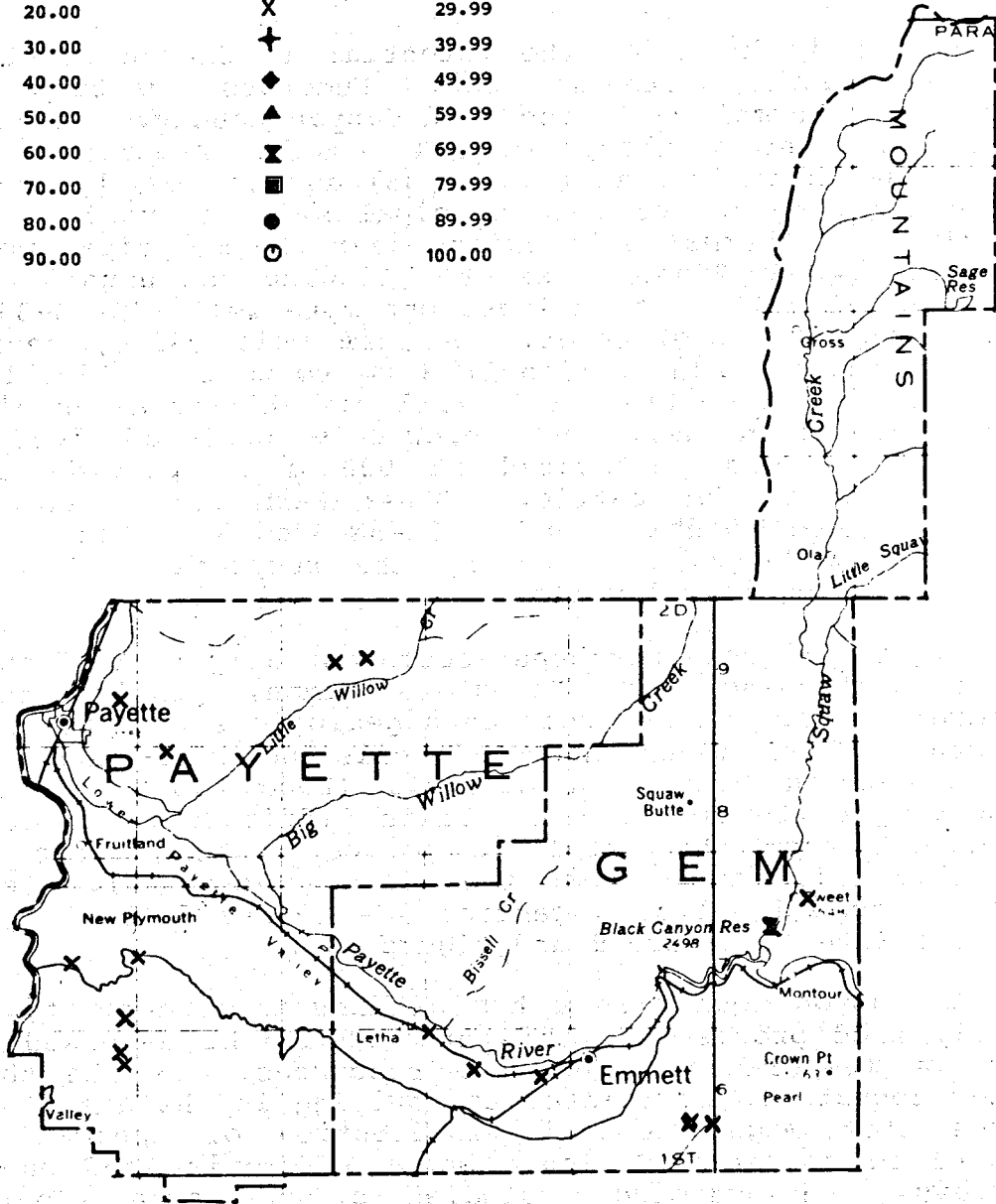


FIGURE 37. Index map of Payette and Gem counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

may have potential for low temperature geothermal energy. A chemical analysis should be obtained from the well to see if subsurface temperatures might be substantially higher before other work is undertaken in this area.

#### CANYON COUNTY

Little is known of the potential in Canyon County for low temperature geothermal use. Numerous low temperature (20-41°C) thermal wells occur in Canyon County. In a large area south and southeast of Lake Lowell, numerous 20-30°C wells have been drilled (figure 38) and are mostly used for irrigation. Water for the municipal swimming pool in Nampa is 31°C. A thermal well exists near the municipal pool in Caldwell (4N-3W-28aabl presently flowing and unused). The city of Caldwell owns at least one more well (4N-3W-35abd1) which provides 20°C water. A warm well (41°C) near the Simplot feedlot (4N-3W-19adcl) 3 km south of Caldwell provides water for cattle. This well was drilled as an oil and gas exploration well and reportedly produced "very hot water," but was perforated at 900 m to provide cooler drinking water for cattle. Other warm wells exist near Parma (5N-5W-9adbl and 5N-5W-4dcd1S) and Melba (1N-2W-36caal) (24°C) owned by the respective cities and operated as municipal wells.

Figure 38 shows northeast-southwest alignment of thermal wells stretching from Parma to Nampa, passing through Caldwell, which might indicate a geologic structure of some length. This linear trend of wells has been mapped as a fault between Nampa and Caldwell (Bond, 1978). Due to obscuring cultural features, it is difficult to identify a lineament from the satellite photos, although one might possibly exist on or near the wells (figure 39). Several closely spaced wells in central Ada County fall along this trend (Plate 1, figure 9 and figure 38).

As Canyon County is a hub of industrial activity, primarily food processing, this area should be assessed early for low temperature geothermal resources. As the thermal water appears to be related to faulting in the area, structures that might control distribution of thermal water should be sought. Geologic mapping, gravity and magnetic surveys, and hydrologic studies of the area should be accomplished first to determine gross structural patterns. Reflective seismic and resistivity surveys could be designed and run from the previously mentioned data base to site several drill holes in promising areas near Nampa or Caldwell. (This has been started through the purchase of oil exploration survey data as part of the IDWR-DOE Nampa-Caldwell area study.) From here, stepout surveys or drilling should be undertaken in other parts of the western Snake River Plain to uncover other favorable geologic struc-

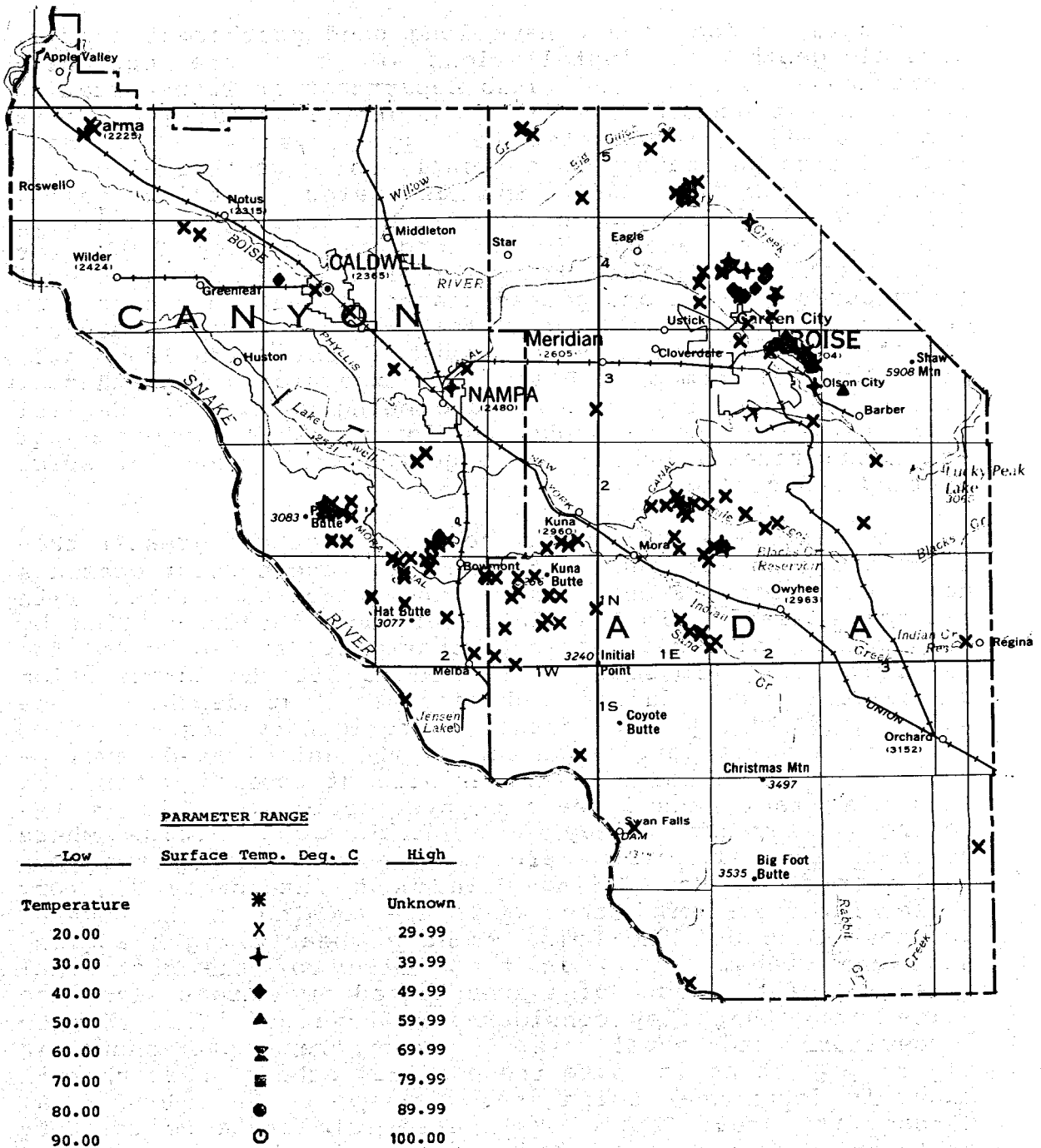


FIGURE 38. Index map of Canyon and Ada counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

tures where thermal water may be found. These types of exploration could lead to discovery of many valuable energy resources in this section of Idaho.

#### ADA COUNTY

People in Ada County have long used geothermal energy. Several geothermal installations of note are currently operating in Boise. The Idaho Department of Transportation heats and air conditions its main office building on State Street using a groundwater heat pump system. The Idaho State Health Laboratory is currently using geothermal energy obtained from the Warm Springs Water District wells. Approximately 185 homes on and near Warm Springs Avenue have used geothermal energy (well head temperature 74°C) for their heat source since the turn of the century. Several greenhouses for cut and potted plants derive their heat from geothermal wells (well head temperature 47°C). Several domestic wells provide heat throughout the Boise Front area to individual homes. Plans for expansion of geothermal heating by the city of Boise are being made. The Capital Mall Complex is being looked at for possible conversion of state and federal buildings to geothermal energy for space heating and cooling.

There are 119 wells (well head temperatures greater than 20°C) known in Ada County (figure 38). The hottest ones are near the Boise Front, where they are associated with extensive, large displacement faulting. Wells drilled by Boise State University Geology Department, funded by DOE for the Boise City Project, were sited to hit the intersection of several known faults and lineaments at depth. These wells were highly successful. Preliminary tests by DOE indicate a sufficient resource for the anticipated development in downtown Boise. Another area of thermal water also lies near fault and lineament intersections. This is the Spring Valley-Dry Valley area northwest of Boise where several thermal wells are located. Here, the Dry Valley-Roystone Hot Springs lineament intersects the Dry Valley fault system. Other wells are located in the several gulches which cut the Boise Front at nearly right angles. Mink and Graham, 1977, in their study of the geothermal potential of the west Boise area, sited five areas along the Boise Front that they considered to have potential for low temperature geothermal use. These areas are shown in figure 40. In addition to these areas, others where thermal water is found near Boise are: Strawberry Glen Road area, Garden City area, Capitol Mall area, Old State Penitentiary area, and Glenwood Street-Chinden Boulevard area.

Donaldson and Applegate (1979) have conducted reconnaissance level resistivity surveys along the Boise Front to determine thermal water locations. They state:



Dry Creek  
Thermal Well  
Area

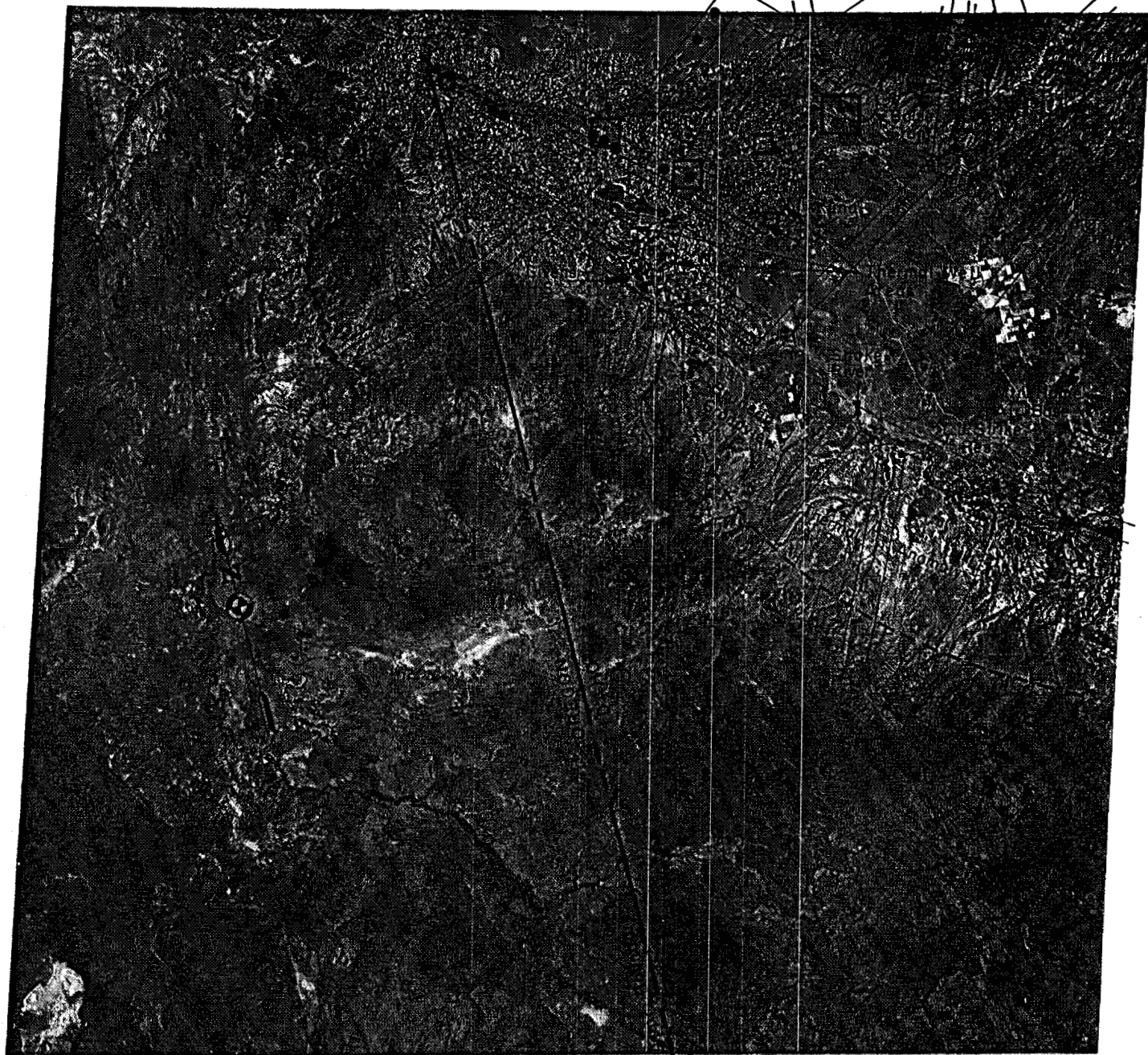


FIGURE 39. EROS false color infrared Landsat EDISE image of part of southwestern Idaho and southeastern Oregon showing selected linear features and thermal water locations with surface temperatures above 20°C.





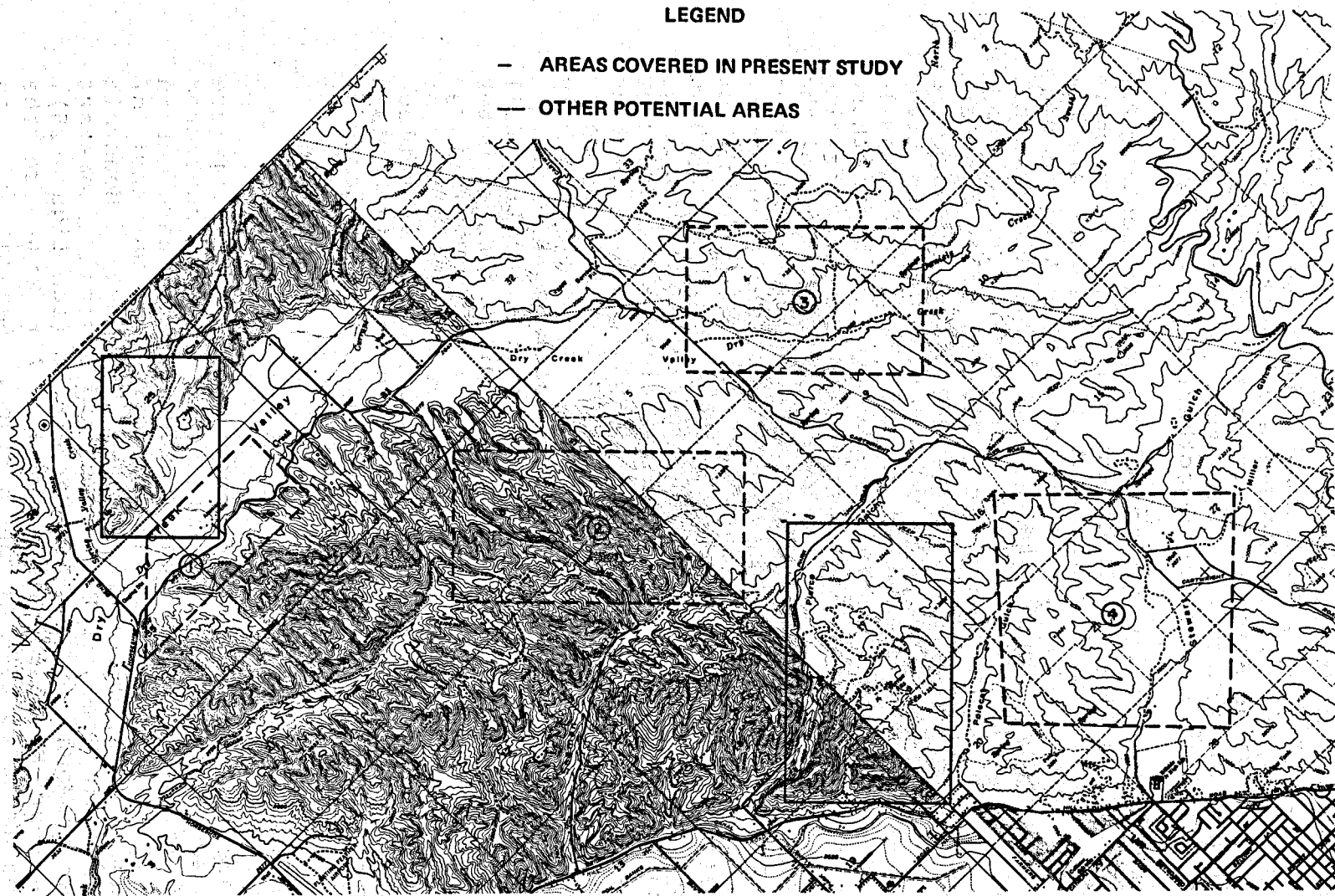


FIGURE 40. Topographic map of west Boise Front area showing locations of potential geothermal sites. (Modified from Mink and Graham, 1977.)

Of direct interest are the resistivity surveys (figures 41, 42, 43, and 44) which have outlined several anomalously conductive areas. The steep resistivity gradients associated with these anomalies probably reflect the presence of faults intersecting the major Boise Front fault at high angles. Such fault intersections, where they are proven to exist, offer very attractive geothermal prospects.

A large number of irrigation wells occur in central Ada County in the vicinity of Eight and Ten Mile creeks where well head temperatures in this part of Ada County are between 20 and 25°C. Another group occurs near Kuna in west central Ada County. There are several large linears that apparently extend from the Middle Fork Boise River drainage and appear to cross the Snake River Plain in the Eight and Tenmile creeks area. A long, more pronounced linear runs northwest-southeast up the axis of the western Snake River Plain and intersects the other linears south of Tenmile Creek. Knowledge of the type of geologic features these linears represent appears to be fundamental to obtaining much more information on geothermal occurrences in the western Snake River Plain region. A speculation is that they represent surface expressions of basement or other faults or rock fractures. They may act as conduits for thermal water. Recharge of these systems could be anywhere along them. There could even be interbasin transfer of groundwater along some of the regional linears and transfer could take place anywhere from one kilometer or less to tens of kilometers or more. Any holes drilled for the purpose of obtaining thermal water would have to be very carefully targeted to intersect faults or rock fractures where thermal water may be circulating. In the alluvium and valley fill sediments away from the mountain front faults, thermal water conduits would be difficult to locate. Analysis of large scale enhanced false color Landsat images may allow some of these faults to be found. A systematic program of reflective seismic profiling across the western Snake River Plain is highly recommended to determine the location and depth of any faulting in the area.

#### SOUTHERN ELMORE COUNTY

Numerous thermal wells and several thermal springs are known in southern Elmore County. Springs are scattered widely but are principally located along the northern margin of the western Snake River Plain northeast and east of Mountain Home. Some wells are located just west of Mountain Home and Mountain Home Air Force Base and several kilometers to the east of Mountain Home Air Force Base (see figure 25). The wells near Mountain Home and the Air Base are the coolest, being 20 to 25°C at the surface. Several wells in southern Elmore County are located near the Snake River.

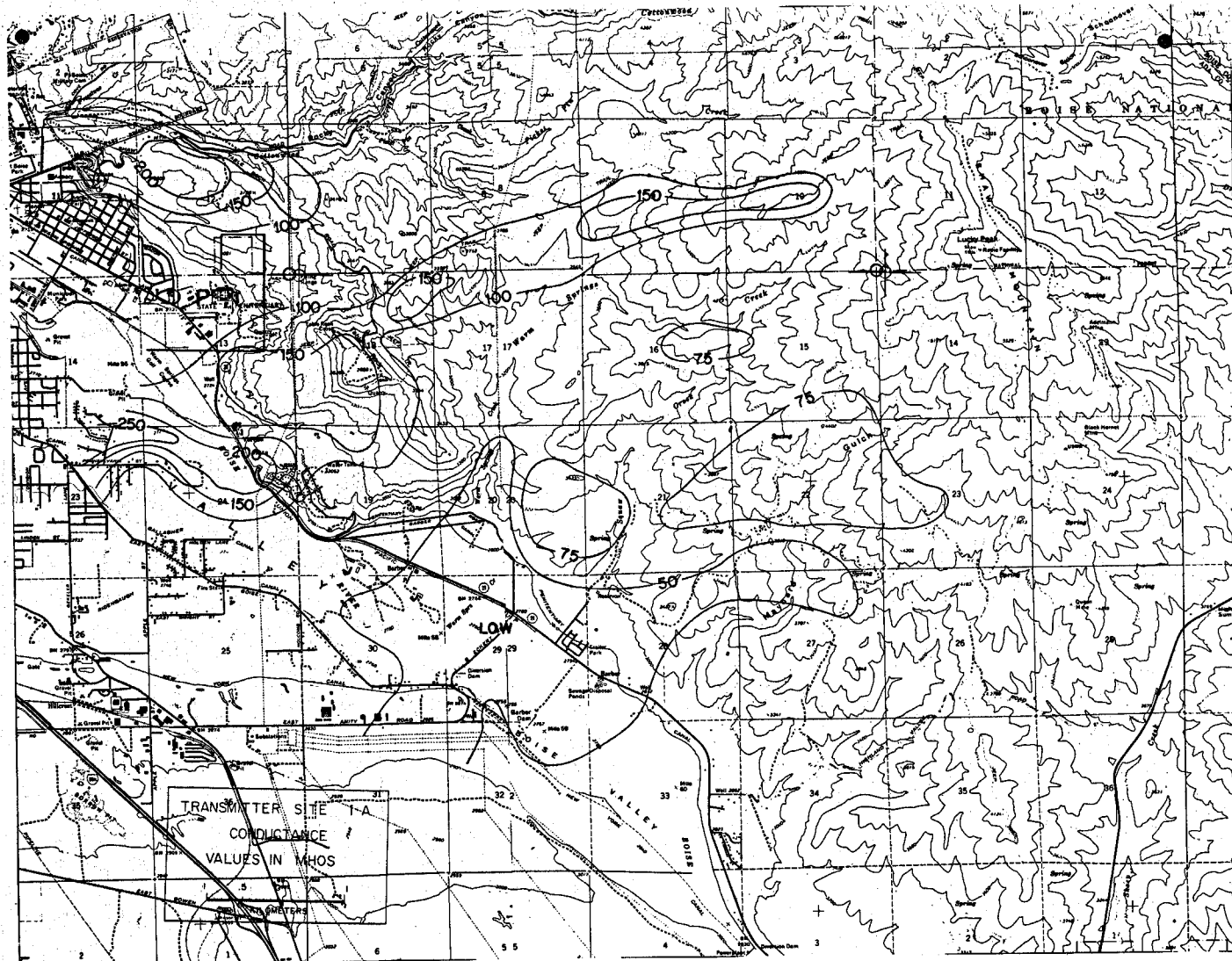
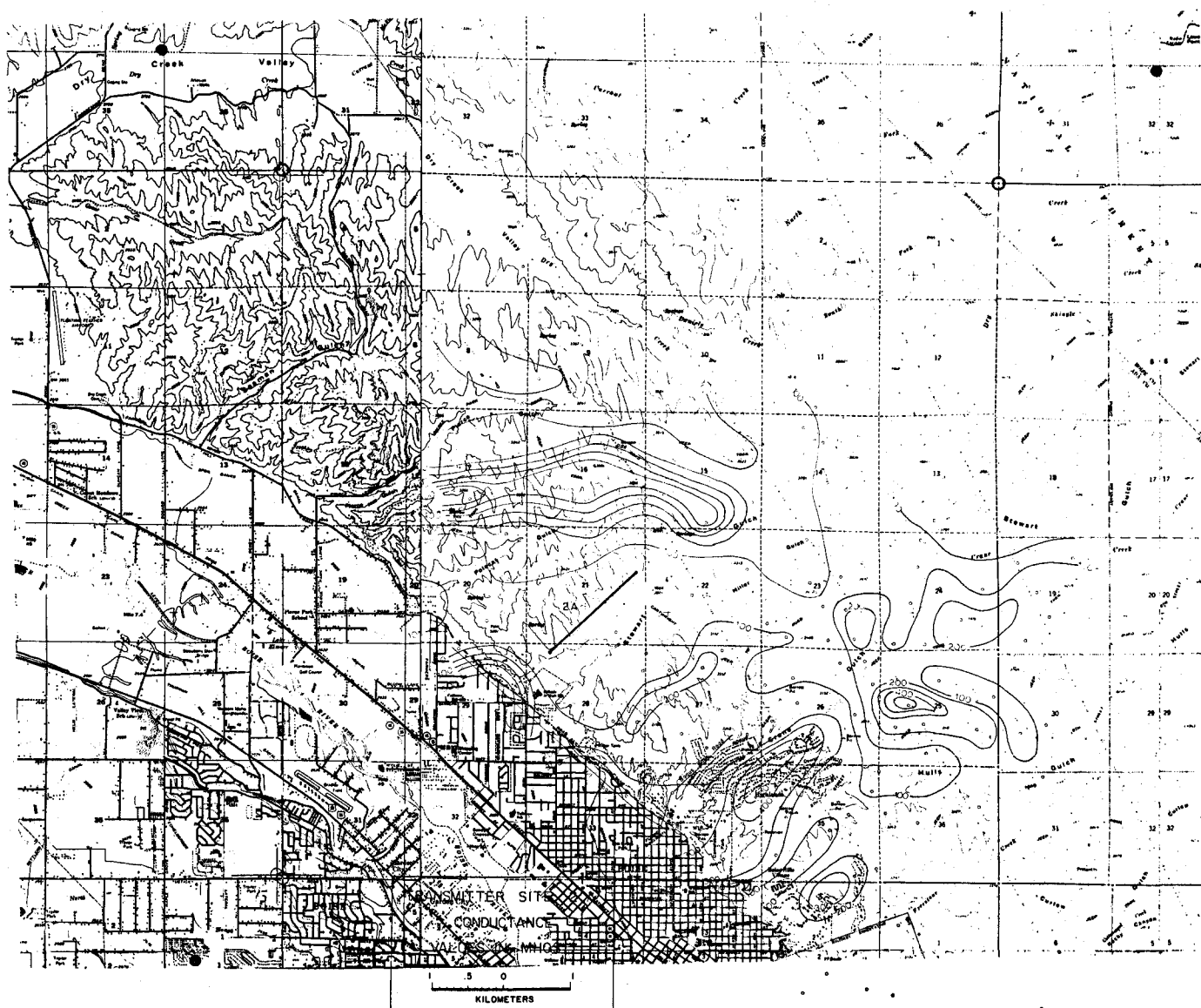


FIGURE 41. Map of Boise Front area showing total conductance for transmitter 1 A array (Donaldson and Applegate, 1979, modified).

FIGURE 42. Map of Boise Front area showing total conductance for transmitter 2 A array (Donaldson and Applegate, 1979, modified).



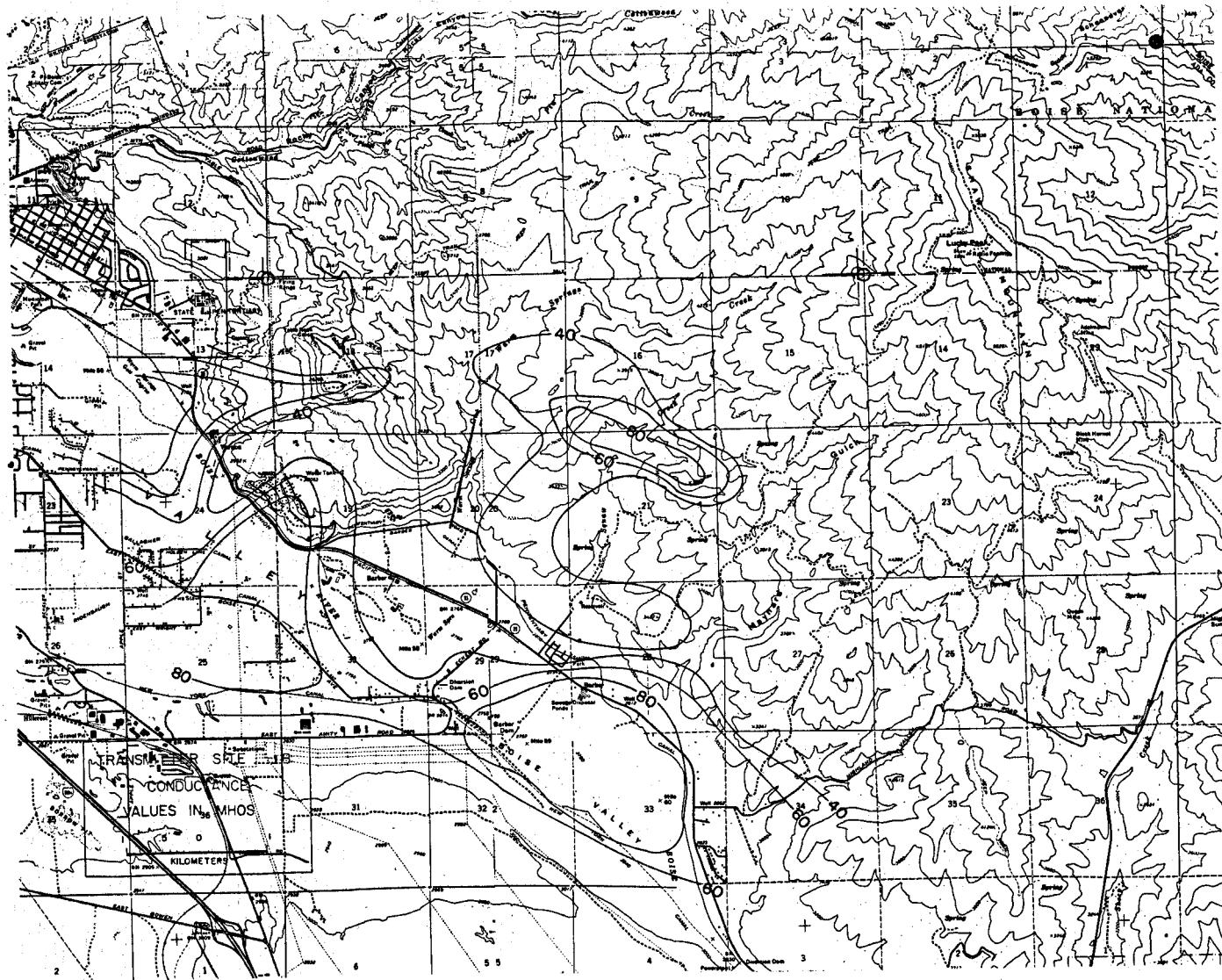
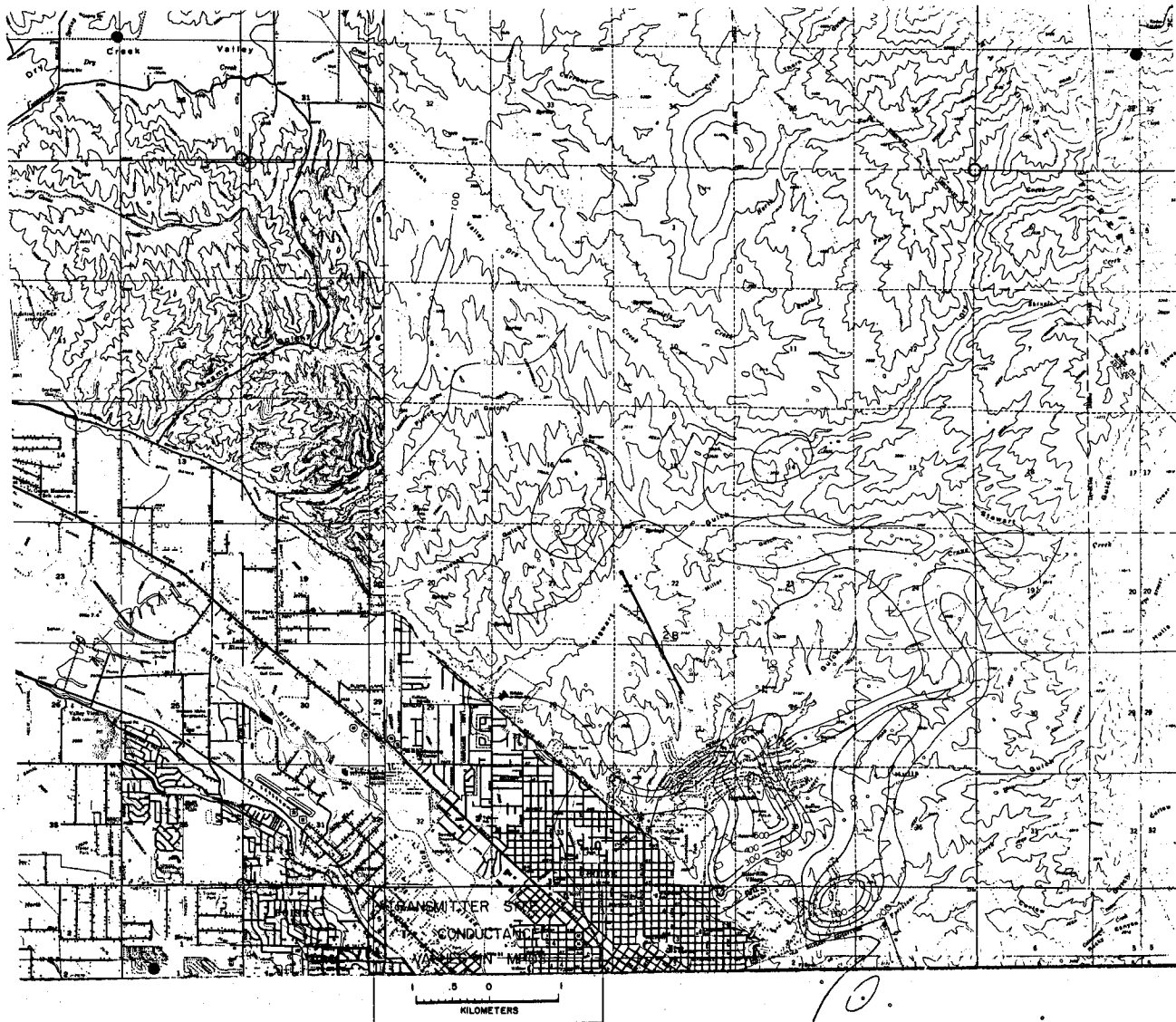


FIGURE 43. Map of Boise Front area showing total conductance for transmitter 1 B array (Donaldson and Applegate, 1979, modified).

FIGURE 44. Map of Boise Front area showing total conductance for transmitter 2 B array (Donaldson and Applegate, 1979, modified).



Some of the wells drilled near Mountain Home and east of the Air Base form linear patterns that could reveal structural control for the thermal water occurrence. The alignment is transverse to the western Snake Plain axis and, as in Ada and Canyon counties, thermal water occurrences could be at least partially controlled by faulting running across the plain. However, the springs and wells that occur along the plain margin seem to be influenced by structures running parallel to the western Snake Plain axis or northwest-southeast.

Mountain Home and Mountain Home Air Force Base are the two principal population centers in southern Elmore County where thermal water occurs and where greatest use could probably be made for it. Other towns are King Hill and Glens Ferry. Low temperature (20 - 30°C) thermal wells are located within 5 km of the above sites. Prospecting for more thermal water in each of these areas might prove fruitful, and the prospect of hotter water at depth is possible. These areas should be further investigated to determine their full potential, beginning with chemical analyses of existing thermal well waters so an estimate can be made of the maximum water temperature through the use of chemical geothermometers.

#### GOODING COUNTY

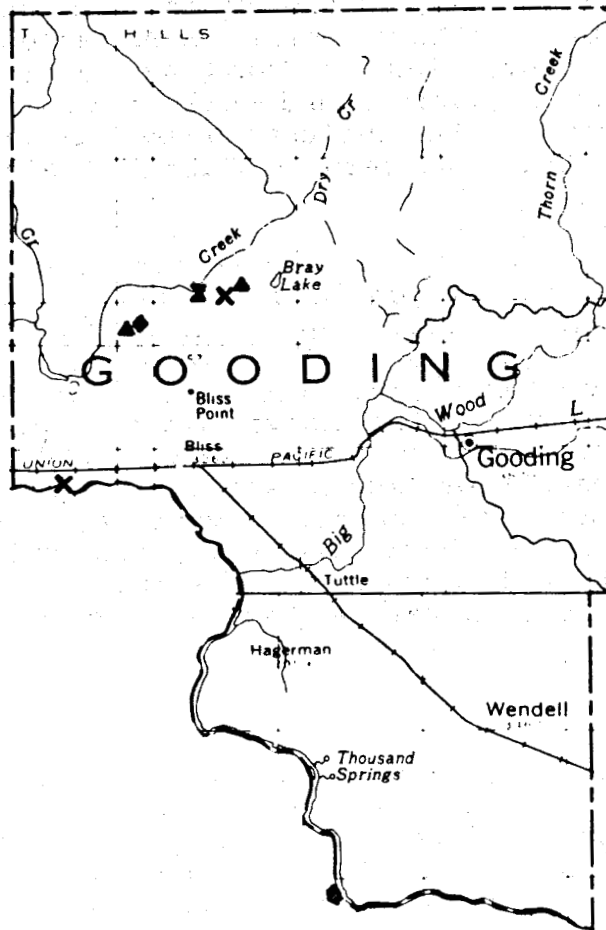
Seven thermal anomalies occur in Gooding County (figure 45). Four wells and a spring occur along Clover Creek near the foot of the Mount Bennett Hills and another occurs near the Snake River. All are in western Gooding County and far removed from most population centers.

Chemical analyses are available on three of the seven thermal sites in Gooding County. White Arrow Hot Springs (4S-13E-30adbls) is the hottest at 65°C. Agreement between the chalcedony and Na-K-Ca chemical geothermometers (108°C and 112°C, respectively) indicates subsurface temperatures are probably in this range. However, in drilling the well at White Arrow Hot Springs, the owner reports blue quartz was found in the hole. The quartz chemical geothermometer predicts temperature of 135°C. White Arrow is presently the scene of private agricultural research and commercial production of tomatoes in geothermally heated greenhouses. Idaho Image (May-June, 1975) reported the following activities at White Arrow Ranch by Bob Erkins:

Tomatoes are harvested at the White Arrow Ranch at Bliss from September through July, when temperatures range from 38 to -2°C.

Tomato plants are very sensitive to extremes of temperatures; however, the secret at White Arrow





PARAMETER RANGE

<u>Low</u>	<u>Surface Temp. Deg. C</u>	<u>High</u>
Temperature	✱	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	●	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

FIGURE 45. Index map of Gooding County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Ranch is that they use a large natural hot spring to maintain optimum growing temperature during the winter in their two 12 by 40 m hothouses.

The water which comes from the ground at a temperature of 65°C flows into heat exchangers at the end of the building. Air is blown across them and through large plastic pipes and carried the length of the building. Hot water is also carried through some 3 km of black plastic pipe which provides further radiant heat.

In hot weather, the south end of the building can be opened and ventilation provided by six large exhaust fans. The temperature is further controlled by blowing air through large cooling pads through which cold water is dripped.

Throughout the year, according to owner Robert A. Erkins, the temperature can easily be maintained at between 18° and 28°C. Production is stopped in the summer months not by the weather, but because that is the season when there are plenty of tomatoes already on the market from growers using more conventional methods.

Just getting out of the experimental stage and into full production, White Arrow Ranch has been shipping about 600 pounds of tomatoes per week but, within the next month or two, expects to be shipping around 4,000 pounds per week. Erkins projects a crop of up to 30 tons of tomatoes annually from a quarter acre of space.

Some 3,000 Manapal tomato plants were planted for the first crop. Erkins said it was one of several hothouse varieties that could have been used.

Future plans include cucumbers and potted house plants. Land is already cleared and piping in for 12 more hothouse buildings, although their construction will not be completed until they are needed.

The key to the system is a free-flowing hot spring which provides heated water at a rate of 3800 l/min, much more than needed for any projected expansion. Erkins said his electric bill is not high, but dependable power supply is important to proper operation of the system. In the two existing buildings some 18 electric fans are used for heating and cooling. In addition, three electric pumps move the well and spring water used to water

the tomato plants. (Water from the hot spring is not used for this purpose.)

Erkins requires only one employee to operate the first building. One of his most important functions is to walk through the structure three times a day with a gasoline-powered blower strapped on his back to pollinate the plants. Tomatoes are normally pollinated by wind, but there is none in the buildings.

One of the biggest problems, according to Erkins, was a lack of data. There have been other hot-houses using natural hot water, but no one seemed to be able to provide much really expert information, so much had to be learned by experimentation.

Erkins and his wife have been in the trout farming business in Idaho for 23 years, but it is their first venture in tomato growing. White Arrow Ranch was originally settled in the 1800's, but had been deserted for some time before being purchased by the Erkins. It was named for an Indian tribe that had camped at the site and which was noted for making white arrowheads.

A well in Gooding County (4S-13E-28abb1) is 47°C at the surface, with the Na-K-Ca and chalcedony chemical geothermometers indicating temperatures of 98-105°C at depth. Uses similar to that of White Arrow could probably be made with this water. Another well (5S-12E-3aaal) is 57°C at the well head; the Na-K-Ca and chalcedony chemical geothermometers predict maximum subsurface temperatures from 70-83°C might be found in this area.

Little information is available from the other wells in Gooding County.

#### JEROME COUNTY

Royal Catfish Industries has used geothermal water to raise catfish in Jerome County (figure 46). The operation is now closed. Thermal water at 43°C is discharged from a thermal well (9S-17E-29dbb1) located along the Snake River north of Twin Falls to supply water to the facility which had 30 fish rearing ponds. Subsurface temperatures predicted by the chalcedony and Na-K-Ca chemical geothermometers are 89 and 93°C respectively. No other thermal water is known in Jerome County and the potential for further prospects is unknown.

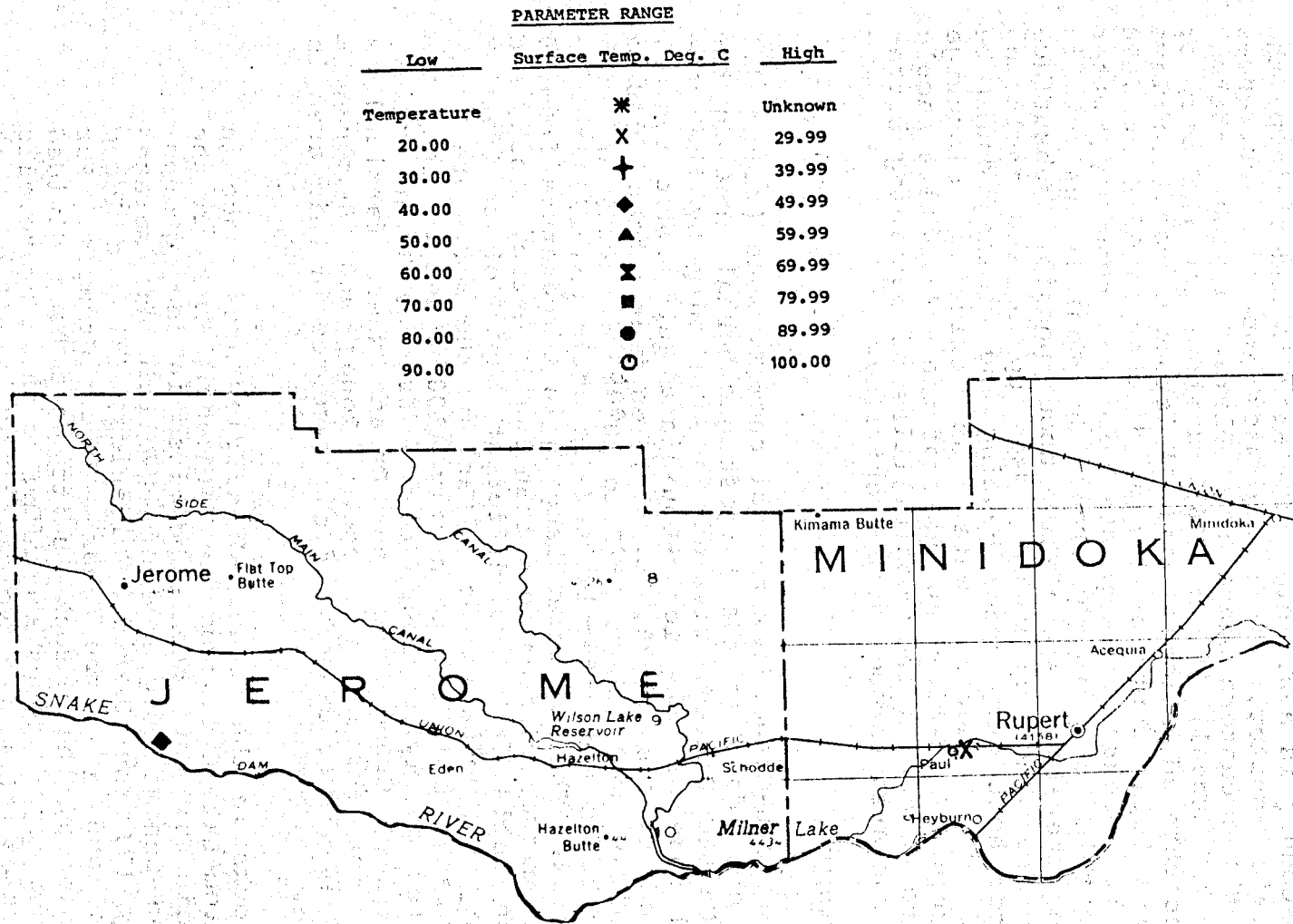


FIGURE 46. Index map of Jerome and southern Minidoka counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

## MINIDOKA COUNTY

Little information on the geothermal potential of Minidoka County is available. The area is underlain by the Snake Plain aquifer, which may mask thermal occurrences throughout the eastern Snake River Plain. A single thermal well (9S-23E-28ccal) (figure 46), drilled for the city of Paul, encountered Pliocene and Pleistocene basaltic lava flows to a total depth of 137 m, discharges 22°C at 7570 l/min. Its occurrence suggests more and possibly hotter water might be found in the area. No chemical analysis is available, therefore, speculation about possible subsurface temperatures cannot be made. Uses up to and including groundwater heat pump space heating and cooling could be made of the thermal water at existing discharge temperatures. A chemical analysis of the well waters should be made to ascertain the possibilities of obtaining hotter water in the area through deeper drilling.

## OWYHEE COUNTY

The Bruneau-Grand View thermal anomaly zone (figure 47) in southwest Idaho is the largest geothermal area in the western United States, rivaled in size only by the geopressured zones in the Texas-Louisiana Gulf Coast region. Renner and others (1975, p. 39) estimate that  $1100 \times 10^{18}$  joules of heat (above 15°C to 10 km of depth) are contained in rocks and water beneath an estimated 2250 sq. km of land area. Thermal water ranging in temperature from 20 to 84°C is extracted from more than 100 domestic, stock, and irrigation wells from two different types of aquifers - sedimentary and volcanic rock. Many of the wells are artesian and range from 150 to nearly 1100 m deep. They are concentrated mostly in four areas - Bruneau River Valley, Little Valley, Grand View, and Oreana where farmland is available for agricultural use. Young and Whitehead's (1975, p. 44-45) assessment of the resource in this area is summarized.

The rocks in the Bruneau-Grand View area range in age from Late Cretaceous to Holocene. Rocks of the Cenozoic Era have been subdivided in four groups: (1) an unnamed sequence of rhyolitic and related rocks, (2) the Idavada Volcanics, (3) the Idaho Group, and (4) the Snake River Group. For convenience, these rocks units have been divided into two major groups according to their hydrologic properties: (1) the volcanic-rock aquifers that include the Idavada Volcanics, the Banbury Basalt of the Idaho Group and undifferentiated silicic volcanic rocks; (2) the sedimentary-rock aquifers, which include chiefly sedimentary units of the Idaho and Snake River Groups.

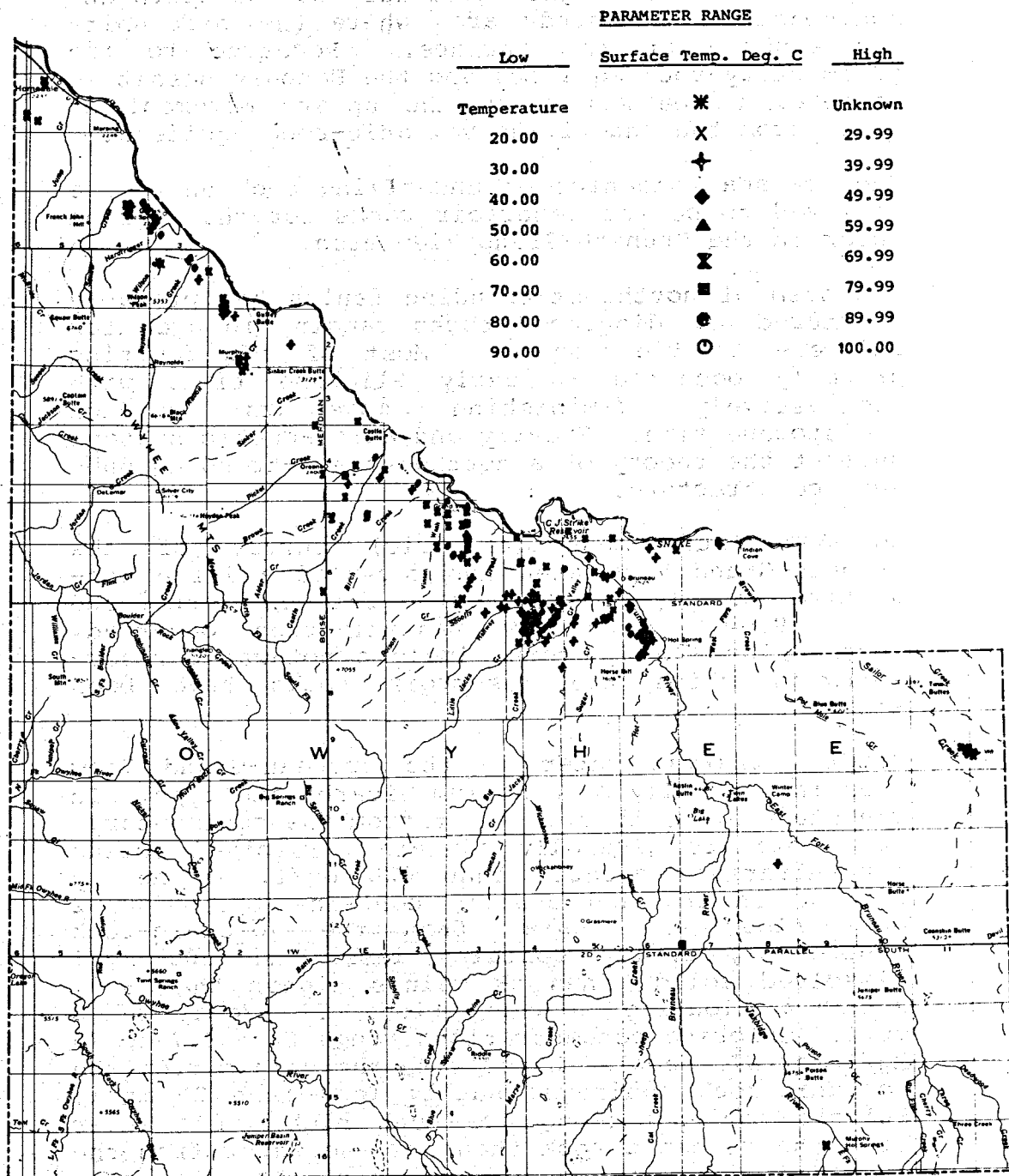


FIGURE 47. Index map of Owyhee County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Recharge to the volcanic-rock aquifer (except the Banbury Basalt) is thought to be chiefly from precipitation in the higher altitudes to the south and southwest of the study area where the rock units are exposed at the surface. Recharge to the sedimentary-rock aquifers and the Banbury Basalt is believed to be mainly by the upward movement of water from the underlying volcanic-rock aquifers.

The Idavada Volcanics or underlying rock units are believed to be the reservoir rocks for the thermal water in the Bruneau-Grand View area.

A system of northwest-trending faults has probably fractured and displaced rocks ranging in age from Pliocene to Pleistocene. Most of the faulting probably occurred in early Pliocene time, with progressively diminishing movements through Pleistocene time. Gravity and aeromagnetic surveys support the theory of a northwestward-trending subsurface structure.

An AMT (audio-magnetotelluric) survey of the Bruneau-Grand View area has revealed a large conductive anomaly in the region between Oreana and Grand View. The low resistivities observed, approaching 2 ohm-meters, imply a hot-water reservoir in which the reservoir rocks have been altered.

Sampled thermal water in the Bruneau-Grand View area is generally of a sodium bicarbonate type. In the study area, thermal water from the sedimentary-rock aquifers generally contains dissolved solids concentrations greater than 600 mg/l, is nearly neutral in pH, and usually contains less than 2 mg/l flouride. Water from the volcanic-rock aquifers generally contains less than 500 mg/l dissolved solids, has pH values higher than 8.0, and has flouride concentrations in excess of 8 mg/l. Chloride concentrations range from 2.7 to 79 mg/l for all sampled water with the values from the volcanic-rock aquifers usually less than 20 mg/l. Sulfate concentrations are much higher for water from the volcanic rock than for the water from the overlying sedimentary-rock aquifers. The chemistry of the thermal water from the volcanic-rock aquifers is very similar to that of thermal water flowing from the granitic rocks of the Idaho batholith.

(Note: Recent deep drilling in the area has revealed the existence of granitic rock underlying the silicic volcanic rock aquifers.)

Ratios of concentration of selected chemical constituents are used to distinguish water from the volcanic-rock and sedimentary-rock aquifers. The chloride-fluoride ratio is probably the best indicator with ratios generally less than 0.6 for water from the volcanic-rock aquifers. Chloride-boron ratios of the hotter water aquifers showed a marked decrease near Bruneau and Grand View because of increased boron concentrations.

Measured groundwater temperatures at the surface in the Bruneau-Grand View area range from 9.5 to 83°C with the higher temperatures (40 to 83°C) found in the water from the volcanic-rock aquifers. Temperatures of the water from the sedimentary-rock aquifers seldom exceed 35°C. The observed groundwater temperatures in the volcanic-rock aquifers seem to be related to the depth to the aquifers.

The gas in samples collected from water in the Bruneau-Grand View area consists primarily of nitrogen, oxygen, and methane. Methane was found primarily in samples from the sedimentary rock aquifers. Analysis of the gas in water from the volcanic-rock aquifers indicates that the gas is essentially that contained in meteoric water recharging the system.

Mineral deposition at wells and springs in the Bruneau-Grand View area is noticeably absent, largely because of the low dissolved-solids concentration in the water.

The source of heat for the deeply circulating thermal waters in the Bruneau-Grand View area is believed to be an above normal geothermal gradient. This above normal gradient could be related to a thinning of the earth's upper crust in this area.

The Bruneau-Grand View area represents a complex geothermal system consisting of several aquifers that may be interconnected by faulting and by wells that have been drilled through the overlying sedimentary rock aquifers into the volcanic rock aquifers. The complexity and intermingling of water from wells drilled into the various aquifers precludes accurate subsurface determinations for every well. Consequently, only aquifer temperatures are given in basic data table 4 (in basic data table 2 all available aquifer temperatures are given) for wells cased at least two thirds of their total depth and to those with surface temperatures of 40°C or above. These estimated aquifer temperatures suggest that the waters in the Bruneau-Grand View area have never been very hot (100 to 110°C) and in



some cases may have come from depths where temperatures are even cooler (70 to 100°C). Deep drilling in the area has given conflicting results, although the most accurate seems to come from Phillips Petroleum's Lawrence D. No. 1 well (5S-1E-24ad1) with a reported bottom hole temperature of 108°C at a depth of 2,672 m.

Young and Whitehead's study was limited to an area south of the Snake River. It is not known whether the aquifer systems extend north of the Snake River. Warner (1975) postulated the existence of a large northwest striking left lateral rift system near the present course of the Snake River, with clockwise or northwestward rotation of about 80 km of the northern block relative to the southern block. Rifting postdates formation of the sedimentary and volcanic rock aquifers of the Bruneau-Grand View area. If this rifting hypothesis is correct, the sedimentary and volcanic rock aquifers in the Bruneau-Grand View area have been rifted also, and the other "half" of this thermal anomaly may have been subsequently shifted northwestward to now lie somewhere between Boise and Weiser. Indeed, much thermal water has been found by well drillers in Ada, Canyon, Payette and Washington counties.

#### TWIN FALLS COUNTY

Thermal water in Twin Falls County (figure 48) is widely scattered occurring principally in the northeastern and eastern part of the county. There are 56 thermal water occurrences with surface temperatures of 20°C or above.

Miracle (8S-14E-31acbls) and Banbury (8S-4E-33cbals) hot springs are resorts located along the Snake River in northwestern Twin Falls County. Several wells are also located along the Snake River north and west of Buhl.

A number of wells have encountered warm water in the Blue Gulch area northwest of Balanced Rock and west of Salmon Falls Creek. A fairly large warm water aquifer may exist here, judging from the number and spacing of thermal wells. A general alignment of wells and springs along the eastern margin of the thermal anomaly may indicate faulting or other geologic structure that may control thermal water here. A large northwest-trending linear feature (figure 29), which stretches from Mountain Home to Salmon Falls Creek (90 km), may also control thermal water here and feed the aquifer system. Wells generally average 190 m deep and well head temperatures average about 27°C.

A well 0.8 km east of Buhl may indicate some potential for low temperature geothermal use in the Buhl area. No other information is available on this well except that the well head temperature is 26°C.

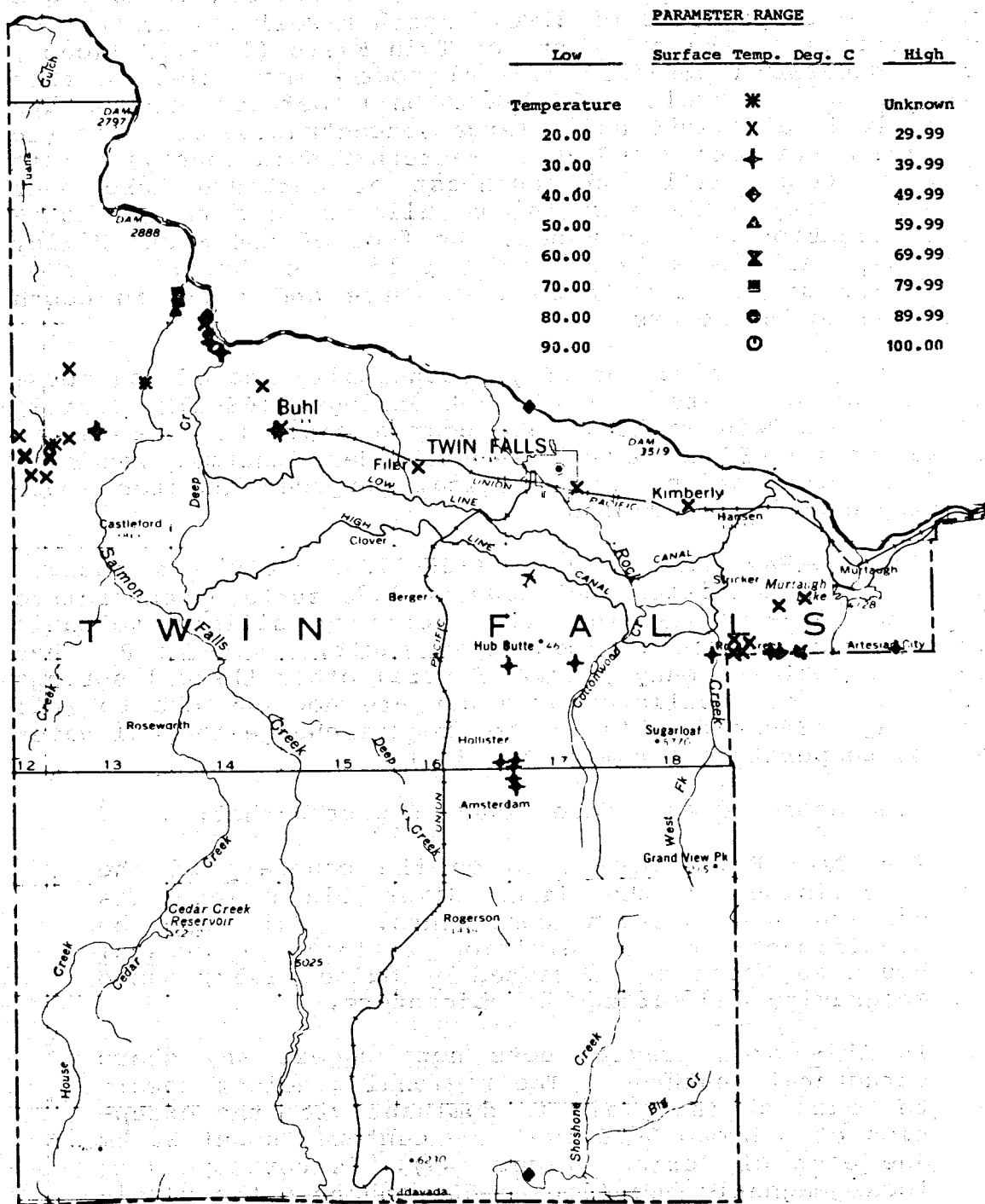


FIGURE 48. Index map of Twin Falls County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

The city of Filer owns a well (10S-16E-8cdal) having a well head temperature of 27°C. Another well temperature of 29°C exists on the outskirts of Twin Falls (10S-17E-14ccd1) and indicates a possible thermal source may exist in this area also. A well (10S-18E-26bbal) between Hansen and Kimberly is also 20°C and a large concentration of wells (10 in Twin Falls County and 20 in western Cassia County) exists east of Cedar Hill and southwest of Murtaugh Lake near Artesian City. These wells are aligned in a nearly east-west direction and occur near the foot of the South Hills. This may indicate a large fault could exist here. Most of the wells are in the 27 to 37°C range and range in depth from 150 to 365 meters.

Perhaps the first or only geothermally heated dog house in the world exists at Magic Hot Springs (16S-17E-30acalS) in southern Twin Falls County near a small private resort close to the Idaho-Nevada border. Here thermal water is used for recreation, balneological purposes and for space heating a number of cabins.

Nat-Soo-Paw Warm Springs (12S-17E-31bab1S) is located 5 km east of Hollister and flows at 36°C surface temperature from Quaternary alluvium near Tertiary silicic volcanic rocks along a possible concealed fault. Nat-Soo-Paw has been a resort for many years. Several other thermal springs existed in the Hollister area but are now dry due to well drilling. Several wells in the area discharge thermal water of low temperature (from 20 to 38°C).

Donaldson and Applegate (1979) reported that:

The Twin Falls area lies on the boundary of the subdivision of the Snake River Plain into its eastern and western components. This may be significant if the division reflects a crustal break as has been suggested by Malde (1959) based on gravity and earthquake epicenters.

In this area gravity does not suggest any sharp structural features. The regional gradient toward the axis of the plain is dominant with the exception of a broad 5-10 mgal low centered about 23 km due east of Jerome (figure 49). A corresponding local magnetic low (figure 50) enhances the possibility that a structural depression exists. There are no active faults documented by Witkind (1975) in this subarea but Day (1974) has mapped lineaments from ERTS imagery which approximate the trend of the western plain in direction (figure 10).

A series of warm wells in the southern portion of this area match quite closely the trends of 3 active faults reported by Witkind (1975).

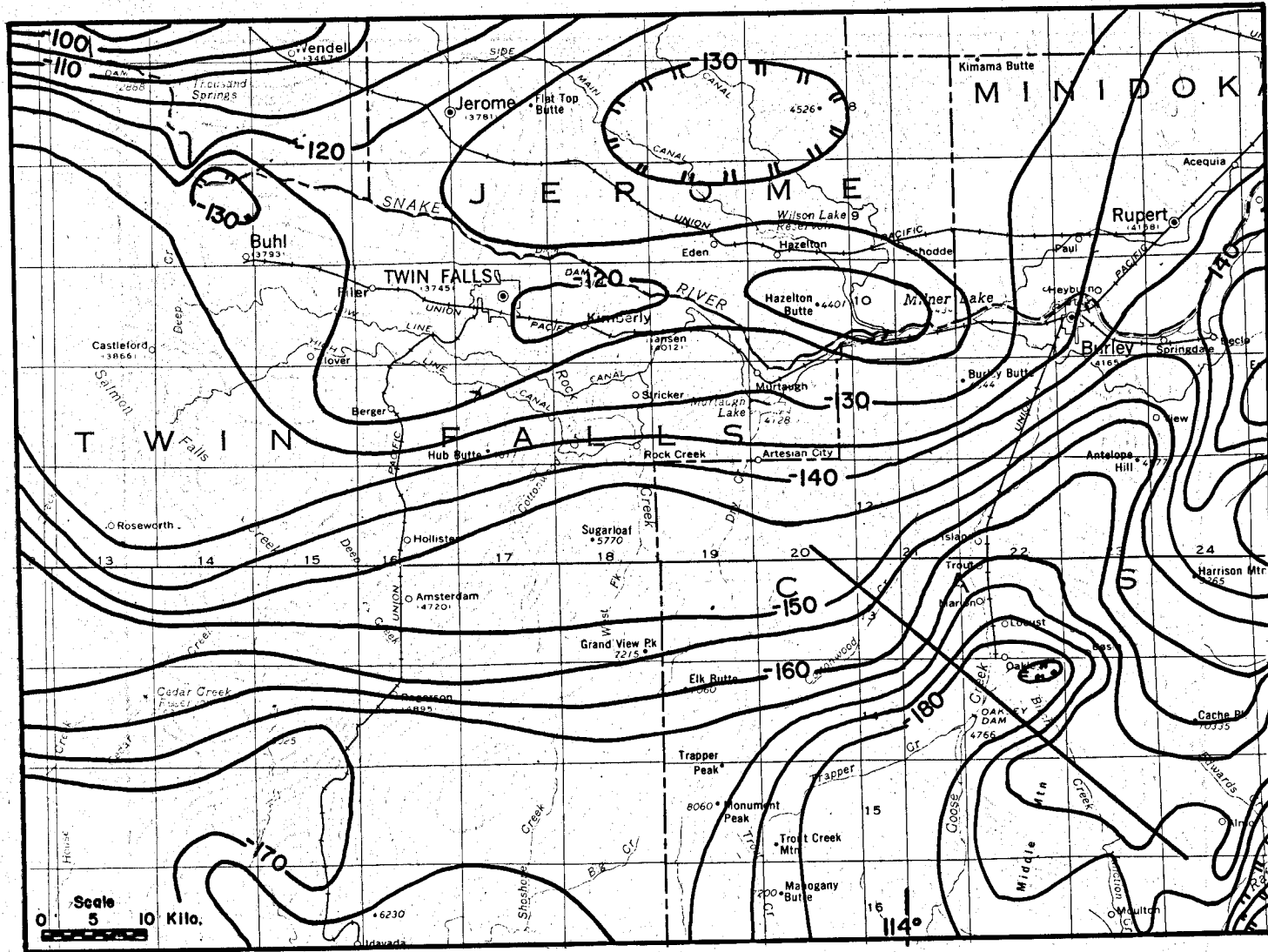


FIGURE 49. Gravity map showing lows near Buhl (upper left), east of Jerome (upper center) and near Oakley (lower right). (Mabey, Peterson and Wilson, 1974.)

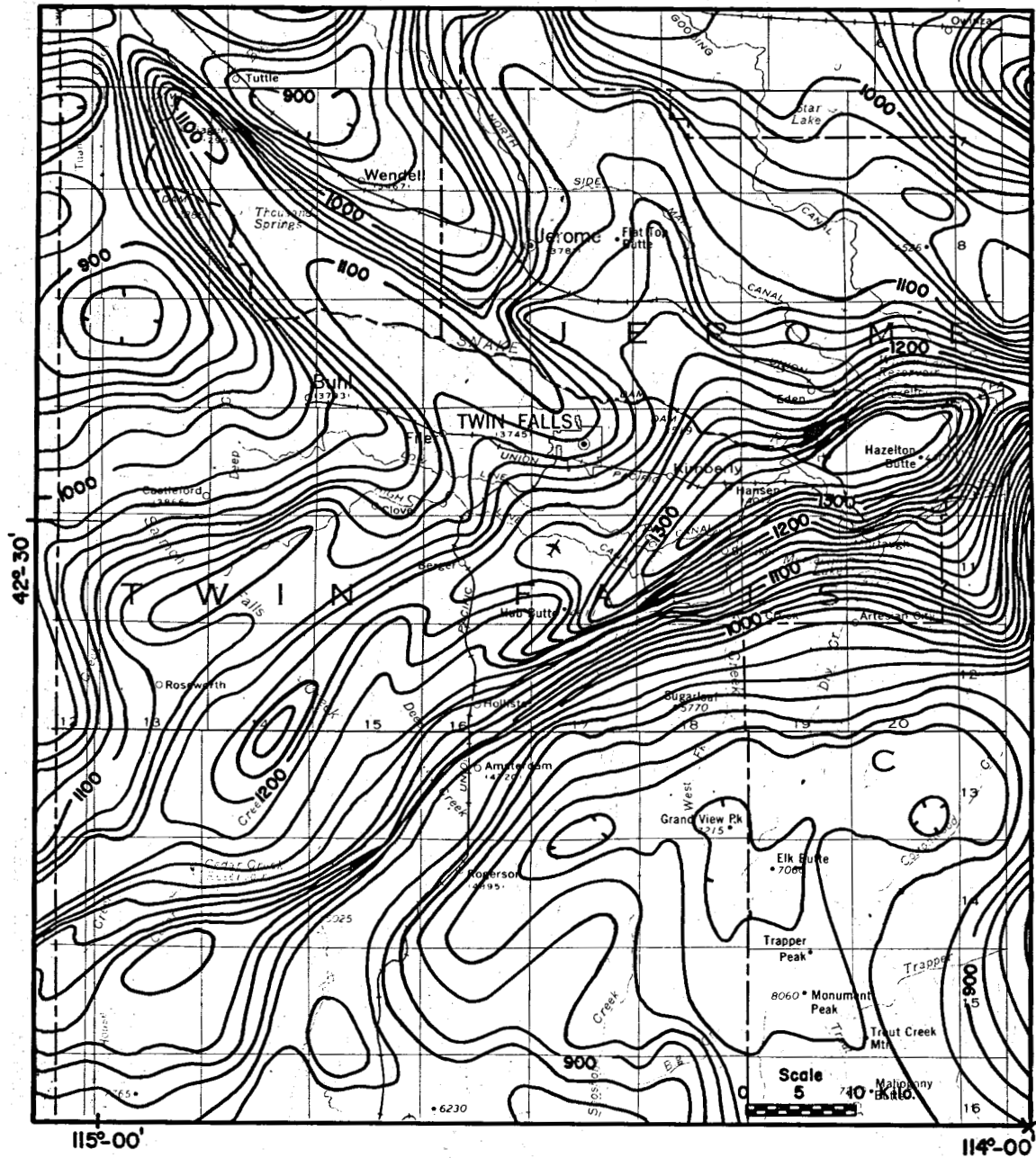


FIGURE 50. Aeromagnetic map showing low west of Jerome (upper right) (U.S. Geological Survey, 1971).

## NORTHERN FREMONT COUNTY

Extensive geothermal leasing activity is ongoing in the Island Park basin in east-central Fremont County near Yellowstone Park (figure 51). Stearns and others, (1939, p. 28-29) recognized this basin as a caldera. Hamilton (1965, p. C1) described the "Island Park caldera" as "an elliptical collapse structure 29 by 37 km in diameter that was dropped from the center of a shield volcano composed of rhyolite ash flows." Hamilton further described the caldera as:

...part of the Snake River-Yellowstone province of intense Pliocene and Quaternary volcanism of olivine basalt and rhyolite. In this province, as in other bimodal volcanic provinces, rhyolite and basalt erupted from vents interspersed in both time and space, and simultaneous eruptions of both liquids from the same or nearby vents are known to have occurred. In the Island Park caldera the eruptive sequence and geometry suggest that the large magma chamber contains liquid rhyolite overlying liquid olivine basalt.

Hoover and Long (1975, p. 1,062) stated:

Current geologic evidence suggests that a Yellowstone-type system does not exist at Island Park because the last major rhyolite body was emplaced about one million years ago and subsequent eruptions were of basaltic composition coming from the mantle along fractures in the older caldera (R.L. Christiansen, oral commun., 1975). The general absence of hot springs also suggests an old system. AMT and telluric surveys were made in August 1974 to study the possible existence of concealed hydrothermal activity.

The generalized geology of rock types in the caldera is shown in figure 52 with the 7.6 Hz north-south AMT data. The caldera stands out as an area of high resistivity, generally above 100 ohm-m surrounded by a region of intermediate values. Within the caldera local highs around 1000 ohm-m are associated with small rhyolite domes on the surface, and most hidden by later basalt flows. The AMT data shows the possibility of another rhyolite body on the western rim of the caldera which has been covered by tuff and rhyolite flows and may represent a source for some of these materials.

An east-west cross section is shown in figure 53. Included in the figure is a skin-depth

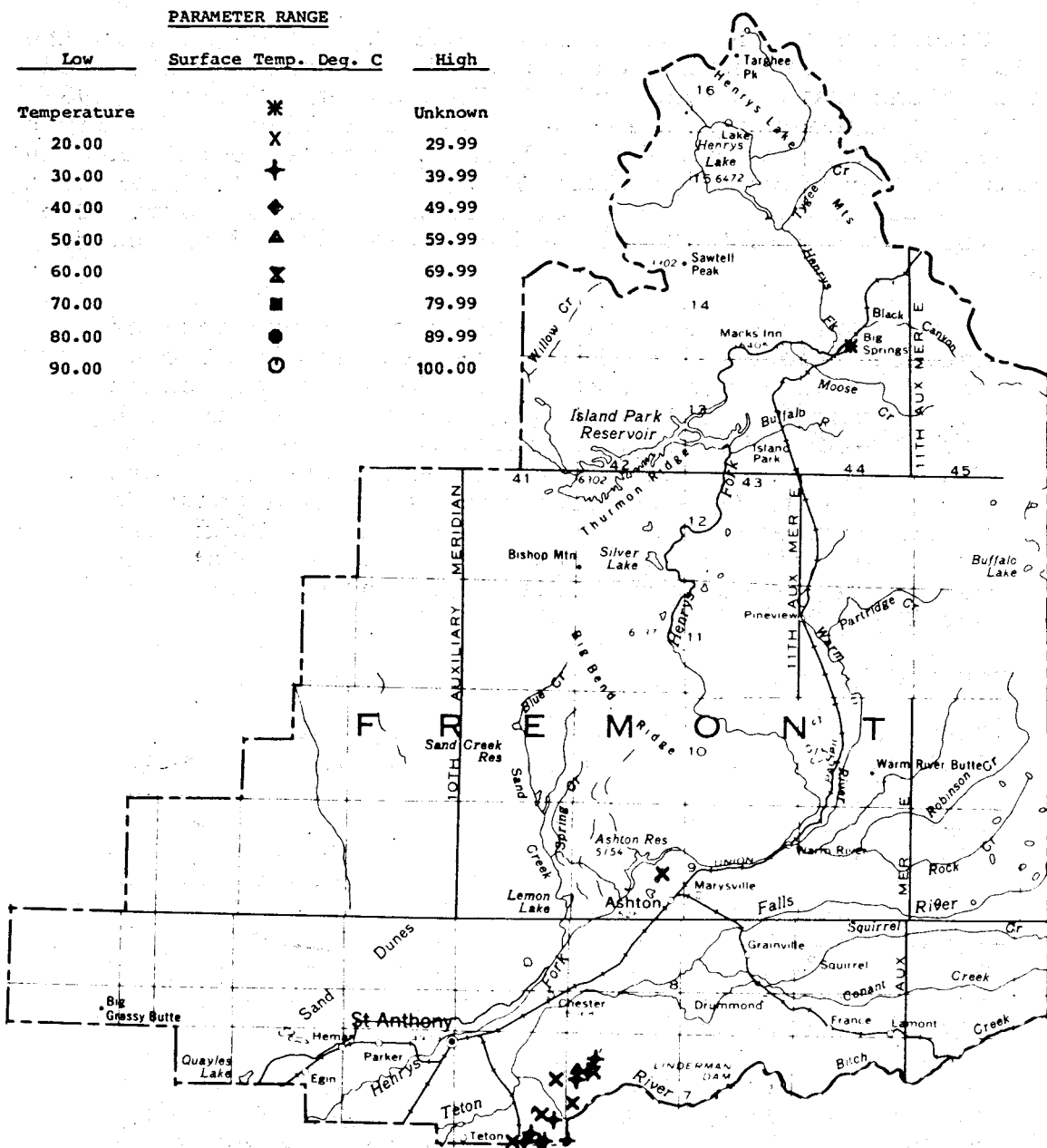


FIGURE 51. Index map of Fremont County showing the locations of thermal water occurrences with surface temperatures of 20°C or higher.

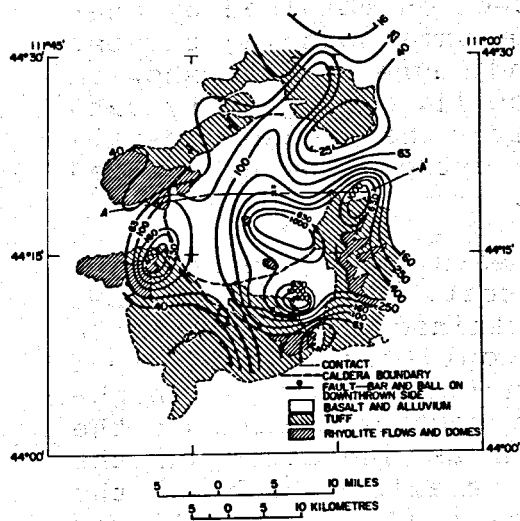


FIGURE 52. Map of rock types and 26 Hz apparent-resistivity (telluric line north-south), Island Park, Idaho. Contours in ohm-meters and logarithmic basis.

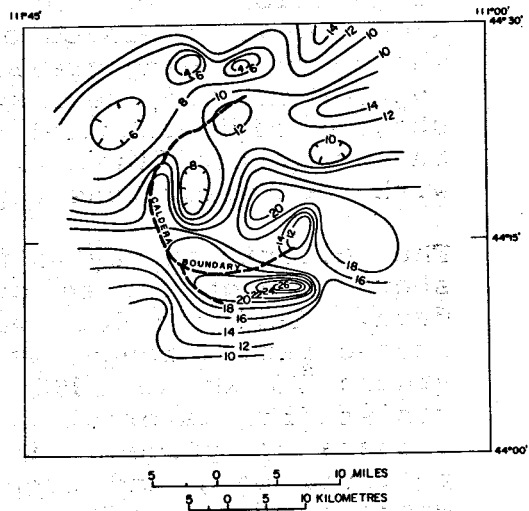


FIGURE 54. Telluric anomaly map at 20- to 30-sec period, Island Park, Idaho. Contour interval  $2K = 10 \sqrt{V}$ .

(Hoover and Long, 1975.)

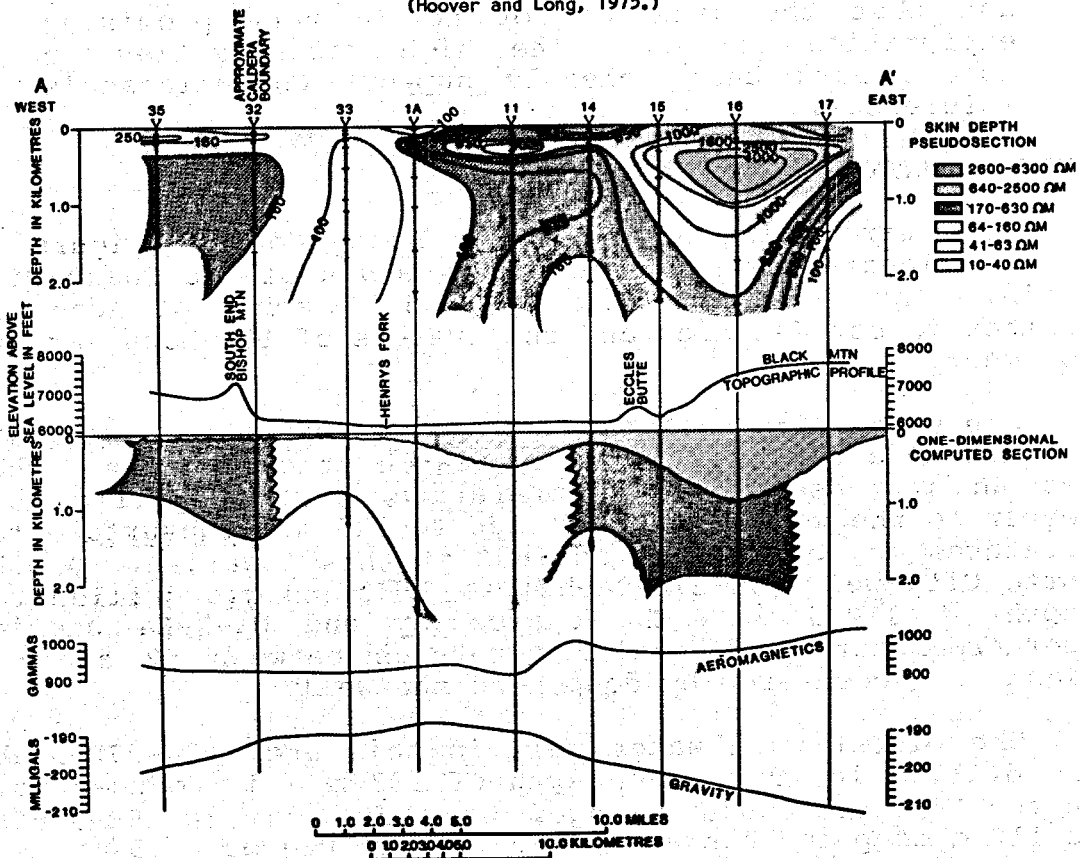


FIGURE 53. Comparison of skin-depth pseudosections and one-dimension inverted section with gravity and magnetic data across the Island Park area. Line of section (A-A') shown in Figure 6.



pseudosection obtained by contouring the apparent resistivities at their corresponding skin depths on the section, and a second section obtained by one-dimensional inversion of the same sounding curves. The corresponding gravity and magnetic data show an edge of the body near station 11. The gravity data show a high associated with the caldera partly masked by the flanks of the extreme low associated with the Yellowstone region.

The telluric survey data appears in figure 54 which shows a high degree of correlation with the AMT data. Telluric data was obtained in the 20 to 30 second period range, which would give a skin depth around 25 km in 1000 ohm-m material. The high-resistivity material in the southeast part of the caldera is present at depth as indicated on the telluric map, and even the smallest high on the western edge can be seen as well. The telluric data also clearly shows the caldera as a region of high resistivity. This implies that the caldera has cooled, that there is little rock alteration, and that the area is not now a very promising exploration target. The high resistivities in Island Park basin clearly support Christiansen's inferences.

#### BUTTE COUNTY

Four warm wells are known in Butte County (figure 55) and are located near the northern margin of the Snake River Plain. Three are in Butte City, 5 km south of Arco, and another is between Arco and the Craters of the Moon National Monument.

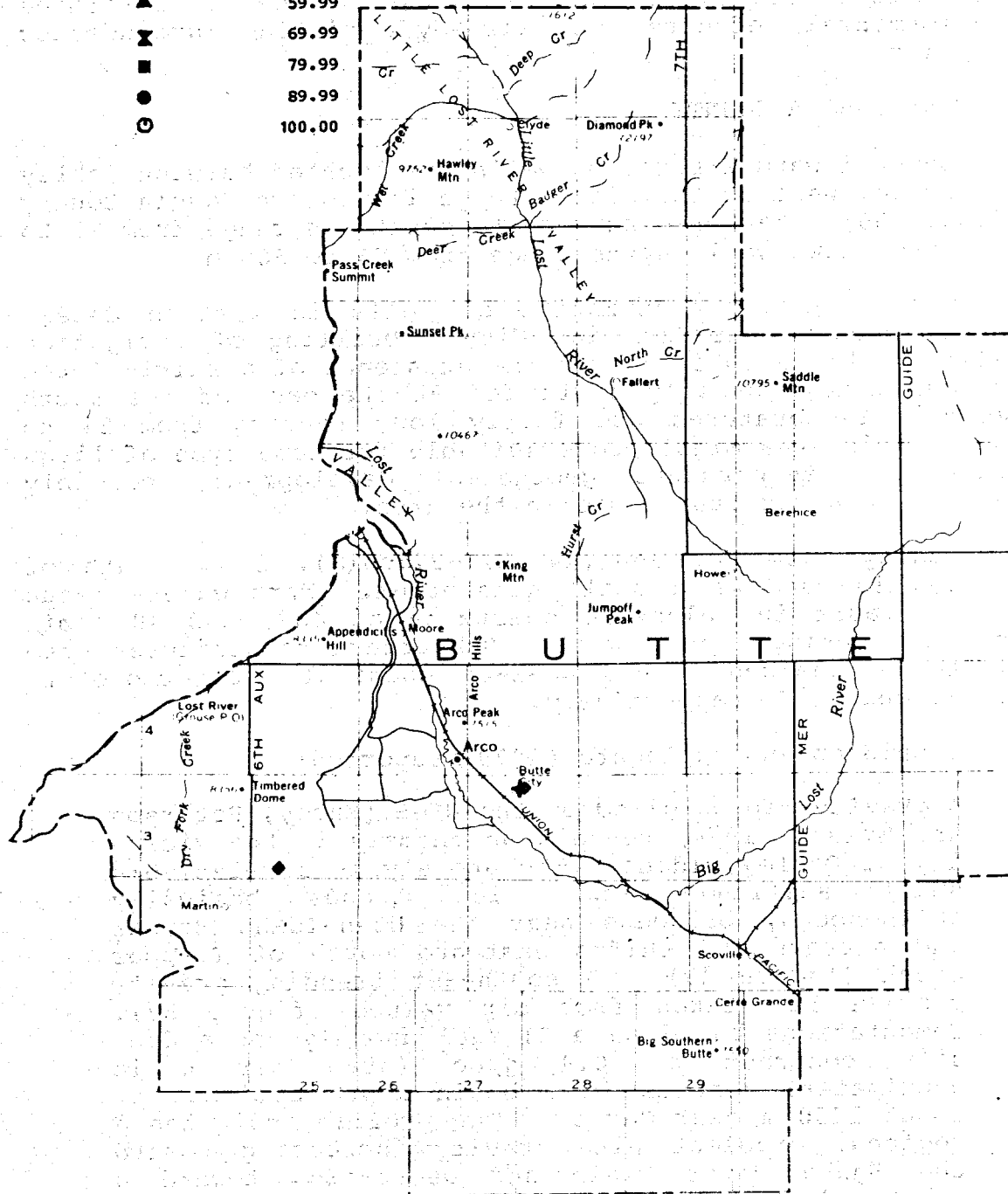
One Butte City well (3N-27E-9abb1) (35°C) was originally drilled to a depth of 259 m in search of cold water. There was an increase in the temperature as the drilling went deeper so the well was backfilled to 145 m. Subsurface temperatures may be as high as 76°C at this location. Another Butte City well (3N-27E-9abb2) is 33°C and was drilled to a depth of 152.5 m. The chalcedony and Na-K-Ca chemical geothermometers indicate temperatures between 52 and 54°C might be encountered by deepening the well.

The oldest warm water well in this area (3N-27E-9aab1) was drilled in 1919 to a depth of 183 m and produced water in the 40°C temperature range. Another well (3N-25E-32cdcl) is 110 m deep and has a surface temperature of 43.5°C.

Butte City-Arco might be an area where use of thermal water for space heating could prove feasible. As other wells in the area have not encountered thermal water, it

**PARAMETER RANGE**

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	●	49.99
50.00	▲	59.99
60.00	X	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00



**FIGURE 55.** Index map of Butte County showing locations of thermal occurrences with surface temperatures of 20°C or higher.

appears these thermal occurrences are structurally controlled (maybe drilled into faults along which the thermal water is rising). Any studies should be designed to delineate the faults and determine the extent of the resource along them. This could be accomplished by geophysical techniques, coupled with detailed geologic mapping, of the area around Butte City and Arco. Hydrologic and geochemical studies should be pursued in order to determine developmental effects on already existing groundwater supplies.

#### WESTERN CASSIA COUNTY

Several warm irrigation wells are located between Oakley and Burley west of the Albion Range in western Cassia County (figure 56). Measured surface temperatures range from 21 to 39°C and known well depths range from 76 to 585 m.

The largest concentration of wells in western Cassia County occurs near Artesian City. Drilling of irrigation wells in this area indicates the existence of a fairly large thermal zone, possibly fault fed at the base of the South Hills. Temperatures are fairly low, ranging from 24 to 38°C. This area might prove suitable for some type of large scale low temperature geothermal development, possibly related to agricultural use in the area.

Oakley Warm Springs (14S-22E-27dcb1S), 5 km south of Oakley, is used as a small natatorium. Warm waters issue from a fault in Paleozoic quartzite at 48°C and 40 l/min from two springs and a well. Subsurface temperatures predicted by chalcedony and Na-K-Ca chemical geothermometers are 89 and 92°C, respectively.

Donaldson and Applegate (1979) reported:

A gravity map compiled by the USGS (Mabey, Peterson and Wilson, 1974) reveals an anomaly in the vicinity of Oakley, Idaho. The anomaly is a relatively small amplitude low which trends basically north-south, broadens near the Utah-Idaho Border and narrows and shifts eastward north of Trapper Creek (figure 49). A southeast trending gravity profile was taken from map values (figure 57). Computations based on a 21 mgal anomaly and a density contrast of 0.4 g/cc (gram per cubic centimeter) results in a basin depth estimate of about 1250 m near Oakley. The profile indicates a regional gradient with gravity increasing toward the Snake River Plain and decreasing toward a neighboring gravity low southeast of Almo, Idaho.

The Oakley anomaly is not strongly definitive of structure and Witkind (1975) does not document

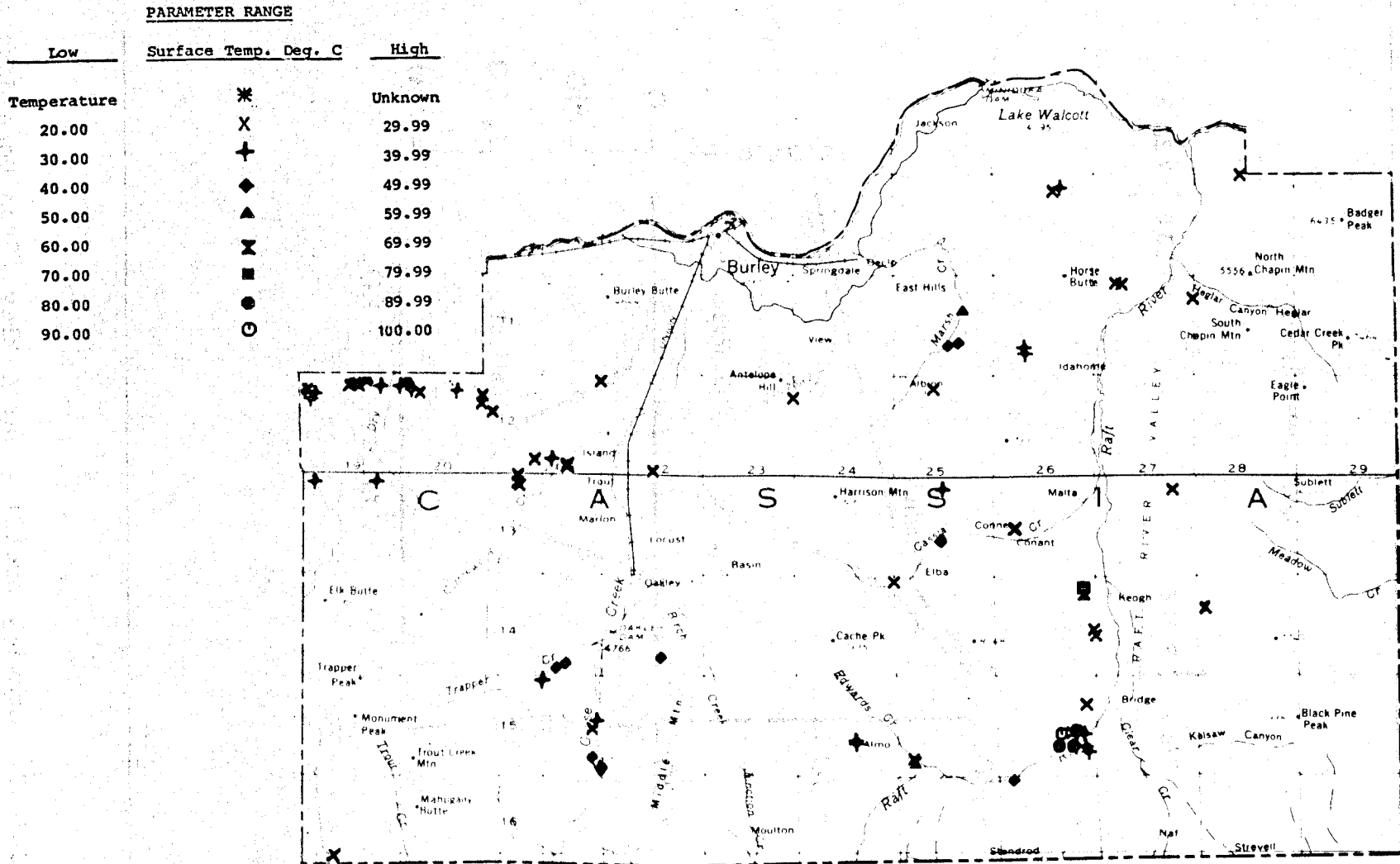


FIGURE 56. Index map of Cassia County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

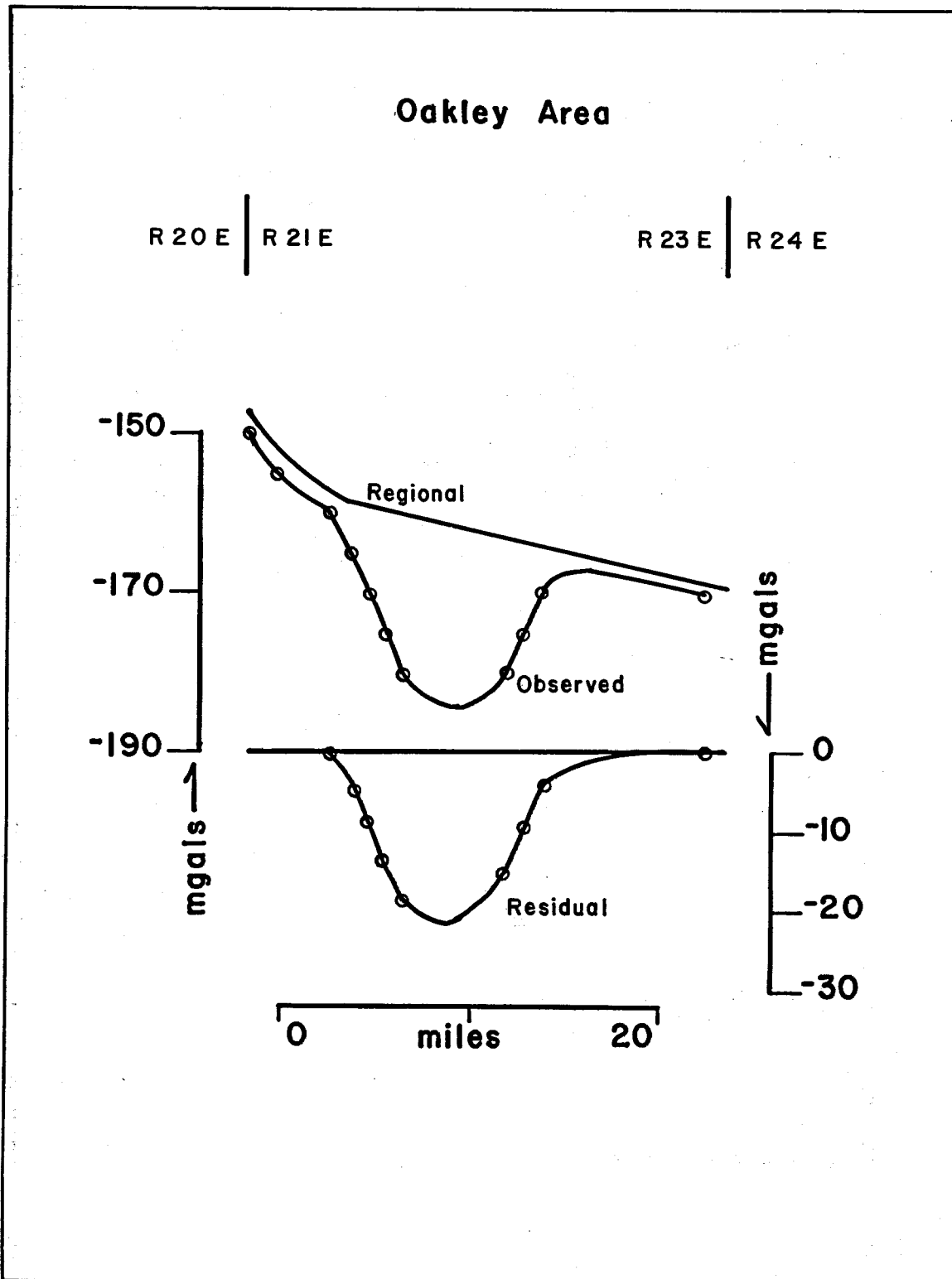


FIGURE 57. Gravity profile near Oakley (from Donaldson and Applegate, 1979).

known or suspected active faults which would control the nose of the anomaly to the northeast. He does identify a fault suspected of being active since mid-Miocene which lies about 11 km west of Oakley, trends northwest and appears to control a rather linear topographic break. The position of this fault does correlate very well with a coherent distortion of gravity contours as expected for movement downward toward the basin.

While faults are not documented to define the gravity suggested structure, Day (1974) has mapped lineaments from ERTS imagery which correspond very well to the location, shape and trend of the gravity anomaly (figure 9).

The basin depth estimate of about 1250 m near Oakley is a very conservative estimate based on calculations using a Bouger approximation. This approximation is generally quite accurate where basin width is several times the basin depth and results in increasingly conservative estimates as the width to depth ratio decreases.

Assuming a 1250 m deep basin structure with a basement rock thermal conductivity of 6.0 mcal/cm/°C, a basin fill thermal conductivity of 3.0 mcal/cm/°C, and a heat flow of 3.0 HFU (see Brott, et al., 1976), one can calculate a predicted temperature of about 90°C at maximum depth (Diment, et al., 1975). This maximum temperature estimate is conservative in the same sense that the depth estimate is considered conservative.

## SUMMARY - SNAKE RIVER PLAIN REGION

Table 5 shows cities, towns, and recreational home areas in central Idaho that are near known thermal water. These towns probably could make use of thermal water for space heating of schools and public buildings if sufficient flow rates and temperatures could be obtained by drilling. The subsequent reuse of the warm water effluent through water-source heat pumps would give a greater and more economic use of a limited heat source. The hot springs near transportation lines might be used to establish small industries suitable to thermal water found in the area. In certain places (see basic data table 1) fluoride concentrations in the thermal water that exceed EPA's drinking water standard (to 2.4 mg/l depending on temperature) might lead to disposal problems. The areas near these towns would probably be evaluated without large capital outlays for exploration as the target areas are limited in size. In this area, those with the potential for the highest return in conventional energy savings should be evaluated first. These would include areas of largest population or of greatest industrial potential. Initial evaluations of the geothermal resource in the Boise Front area has already been conducted. Several successful exploration holes have been drilled. Other areas needing initial assessment work are Nampa-Caldwell, Twin Falls, Mountain Home, and Mountain Home Air Base. Weiser has received an initial assessment, but no drill sites have been selected. More work is needed there and near Payette to select possible drill sites.

Exploration programs including detailed geophysical studies, such as gravity, magnetic, resistivity, and reflective seismic surveys, as well as hydrologic studies including isotope and additional geochemical work should be pursued in areas near known thermal water to determine structure and select drill sites. These surveys probably should be conducted by federal or state people or by private entities with federal or state assistance as these studies are expensive and small private companies have little capital to invest in such programs. Large corporations with exploration money presently are not interested in what they feel are minor energy users and will not invest money to supply energy to one or even several users. However, combined users switching to a geothermal source in several of these areas could significantly affect the present energy consumption pattern in Idaho and help Idaho toward becoming more energy self-sufficient.

TABLE 5  
CITIES AND TOWNS IN THE SNAKE RIVER PLAIN REGION WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL (1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C		Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
				Min. Na-K-Ca	Max. Chalcedony					
Boise	Ada	3N-2E-12cdd1	71	80	96	286	Space Heating	92,901	Private	One of several wells in Boise area. Depth range 122-430 m.
Buhl	Twin Falls	9S-14E-36d	--	--	--	--	--	3,382	Private	No chemical analyses available.
Caldwell	Canyon	4N-3W-28aab1	28	54	70	203	Irrigation Recreation	15,643	City of Caldwell	Flowing well.
Cambridge Emmett	Washington Gem	14N-3W-19cbd1S 6N-2W-14acc1	26 20	65 --	76 --	312 --	Unused Domestic	451 3,943	-- Private	Plans are for space heating a shop. No chemical analyses available.
Filer	Twin Falls	--	--	--	--	--	--	1,420	Private	--
Glenns Ferry	Elmore	5S-10E-32bdb1	38	67	68*	364	Natatorium	1,387	Private	--
Hanson	Twin Falls	10S-18E-26bba1	20	--	--	--	Irrigation	450	--	--
Hollister	Twin Falls	12S-17E-31bab1S	36	81	29	279	Natatorium	63	City of Hollister	Well located half-way between Hanson and Kimberly.
Homedale	Owyhee	--	--	--	--	--	--	1,601	Private	--
Kimberly	Twin Falls	10S-18E-26bba1	--	--	--	--	Irrigation	1,780	Private	Well located half-way between Hanson and Kimberly.
King Hill	Elmore	5S-11E-7acd	32	63	65*	235	Domestic	--	Private	--
Kuna	Ada	2N-1W-35caa1	25	--	--	--	Irrigation	941	Private	96 meters deep 3,595 lpm.
Melba	Canyon	--	--	--	--	--	--	221	Private	--
Midvale	Washington	13N-3W-8ccc1	23	46	68*	318	Public supply	447	--	Municipal well.
Mountain Home	Elmore	3S-6E-26adc1	23	--	--	--	Municipal water supply	6,755	City of Mountain Home	City well 305 m deep.
Mountain Home Air- base	Elmore	4S-5E-25bbc1	24	47	62	114	Irrigation	6,000	Private	Well 162 m deep.
Murphy	Owyhee	--	--	--	--	--	--	--	Private	--
Nampa	Canyon	--	--	--	--	--	Recreation	23,584	City of Nampa	Well No chemical analyses available.



Table 5. Cities and Towns in the Snake River Plain Region within 5 km (3 mi) of a 20°C or Higher Thermal Spring or Well (continued)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C		Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
				Min. Na-K-Ca	Max. Chalcedony					
Parma	Canyon	4N-3W-35abc1	28	54	70	--	Municipal water use	1,879	City of Parma	Well 46 m deep.
Paul	Minidoka	9S-23E-28cca1	22	--	--	--	Municipal water use	911	City of Paul	Well 137 m deep.
Twin Falls	Twin Falls	10S-17E-14cdd1	29	--	--	--	Irrigation	23,616	Municipal well	--
Weiser	Washington	11N-6W-10cca1	70	145	152***	197	Natatorium, greenhouse	4,607	Private	Several small diameter wells.
Oakley	Cassia	14S-22E-7dcb1S	47	90	90	295	Natatorium	698	Private	Warm spring.

\*See first footnote, Table 4.

\*\*Minimum temperature is chalcedony temperature. Maximum temperature is Na-K-Ca temperature.

\*\*\*Minimum temperature is quartz temperature. Maximum temperature is Na-K-Ca temperature.

GEOHERMAL POTENTIAL OF THE BASIN AND RANGE  
OF SOUTHEASTERN IDAHO  
INCLUDING EASTERN CASSIA, ONEIDA, FRANKLIN, BEAR LAKE  
CARIBOU, BANNOCK, POWER, BINGHAM, BONNEVILLE, MADISON,  
JEFFERSON, SOUTHERN FREMONT, CLARK  
AND TETON COUNTIES

Thermal springs and wells in the Basin and Range-Central Rocky Mountain Region (figure 6) generally share several characteristics - including high dissolved solids, high HCO<sub>3</sub> content and generally precipitation of CaCO<sub>3</sub> in the form of travertine. This area also is endowed with certain geologic characteristics that favor the occurrence of geothermal energy.

The eastern margin of the Basin and Range Province is within a long narrow curvilinear zone of earthquake activity stretching from Las Vegas, Nevada, on the south to Flathead Lake, Montana, on the north, known as the Intermountain Seismic Belt (Smith and Sbar, 1974). This zone is interpreted to be a boundary between subplates of the greater North American crustal plate, where differential movements between the Basin and Range and Colorado Plateau-Rocky Mountain provinces are taking place (Sbar and others, 1972). Plate and subplate boundaries are considered to be excellent areas for prospecting for geothermal resources. Youthful magmatic activity, areas of high heat flow, and thermal spring activity are known to occur along the Intermountain Seismic Belt. In Idaho, the approximate axis of the belt passes near Preston, in Cache Valley, through the Soda Springs area in Caribou County to Driggs in Teton County and into the Yellowstone Park area.

The Basin and Range Province in Idaho consists predominantly of block faulted mountain ranges separated by Intermontane basins arranged in an echelon pattern. Mountain front faults are considered to be normal faults by most authorities. Most of the block fault ranges tilt eastward, and valleys have been partially filled with eroded waste rock from adjacent mountains. Rock types here differ from most of the rest of the state, since they are mostly marine limestones, dolomites, shales, siltstones, and sandstones ranging in age from Precambrian through Permian, and Cretaceous, and younger land derived sediments. The rocks in general are older in the central part of the area and become increasingly younger toward the edges of the Province.

Thermal spring activity is widely distributed through the Basin and Range Province, and wells have encountered

thermal water locally. Most springs are associated with known faulting or lineaments but not necessarily with valley-mountain range boundary faults. Most springs are near drainages and are therefore at low elevations. Thermal springs and wells in southeast Idaho exhibit the highest dissolved solids of any found in Idaho, presumably reflecting the soluble nature of the marine sedimentary bedrock. Thermal springs and wells are found in areas of no known adjacent igneous activity.

Thermal springs and wells in southeastern Idaho seem to occur along suspected curvilinear zones (figure 9) similar to springs in the central part of the state. The curvilinear zones may not be quite so well defined here as in the crystalline granitic terrain of central Idaho. One zone, stretching from Bear Lake Hot Springs to Blackfoot River Hot Springs near the north end of Blackfoot Reservoir, has an apparent gap between Georgetown and Soda Springs where no thermal springs appear. Actually, a cold water spring associated with voluminous travertine deposits does exist near the center of the gap. It is thought that this spring was once thermal.

The largest curvilinear zone, stretching from the southern Idaho border up to Big Springs in Island Park (near Yellowstone National Park), coincides with a lineament that stretches from the northern part of the Great Salt Lake, somewhat discontinuously, up to at least Brockman Creek warm springs.

Discussion of the geothermal potential of this region follows on a county basis.

#### EASTERN CASSIA COUNTY

The best known and most studied geothermal anomaly in Idaho is in the Raft River Valley (figure 56), a north trending basin and range valley in southern Idaho immediately south of the Snake River Plain. The Raft River KGRA (known geothermal resource area), was formerly known as the Frazier KGRA after C.W. Frazier who drilled the first hot water well there for irrigation and stock watering purposes. This well was drilled to a depth of 122 m and issued 95°C water. Later, another hot well (92°C), was drilled on the Crank property and is presently used for greenhouse heating. Many other thermal wells exist in the Raft River Valley ranging from 20 to 148°C.

The largest variety of geothermal testing and experimentation at any single location in the world is presently underway or developing (Chappell and others, 1978, p. 83) at the Raft River site. The principal experiments have been summarized by the above authors (p. 85) as follows:

Soil Cooling  
Soil Heating Agriculture  
Aquaculture  
Agriculture  
Fluidized Bed Drying  
Gas Air Conditioning  
Component Testing  
Tube & Shell Heat Exchanger  
Direct Contact Heat Exchanger  
60-KW Turbine-Generator  
Environmental  
Reservoir Engineering  
Heat Dissipation (Pond Cooling)  
Supply Well Mixing Tests  
Injection Testing  
Aerated Geothermal Water Corrosion  
Cooling Tower Chemistry of Brine as Makeup Water  
Sulfide Oxygen Scavenge Test  
Asbestos Cement Pipe  
Downhole Pump Test  
500-KW Turbine-Generator Direct Contact

Many reports describing results of these experiments are available and listed as the ANCR & TREE reports in the Selected References.

Geophysical studies (Mabey and others, 1978, p. 1,470-1,478) have been conducted to infer the structure and general lithology underlying the valley (figures 58-60).

The thermal waters are believed to be derived from a deep fault and may be similar to other basin and range occurrences in Idaho. From several deep well tests in the Raft River Valley, a certain degree of reliability has been proven relating to the chemical geothermometers. The quartz and Na-K-Ca predicted aquifer temperatures (Young & Mitchell, 1973 and mixing models in unpublished data) agreed very closely (within 10°C) with temperatures found at depth (Kunze, 1975). Indeed, the Na-K-Ca chemical geothermometer predicted temperatures almost exactly as were found. This proven reliability in the Raft River Valley gives some measure of confidence in applying the same methods to other similar areas of the state.

To date, seven deep wells have been drilled to depths of 1,525 m into indicated fault zones, and large quantities of thermal water near 150°C have been encountered. From further well tests, it appears that the geothermal system is capable of sustained production of sufficient water to run a 50 megawatt power plant, although present plans are limited to 10 megawatts. The power generation system will be a binary cycle system.

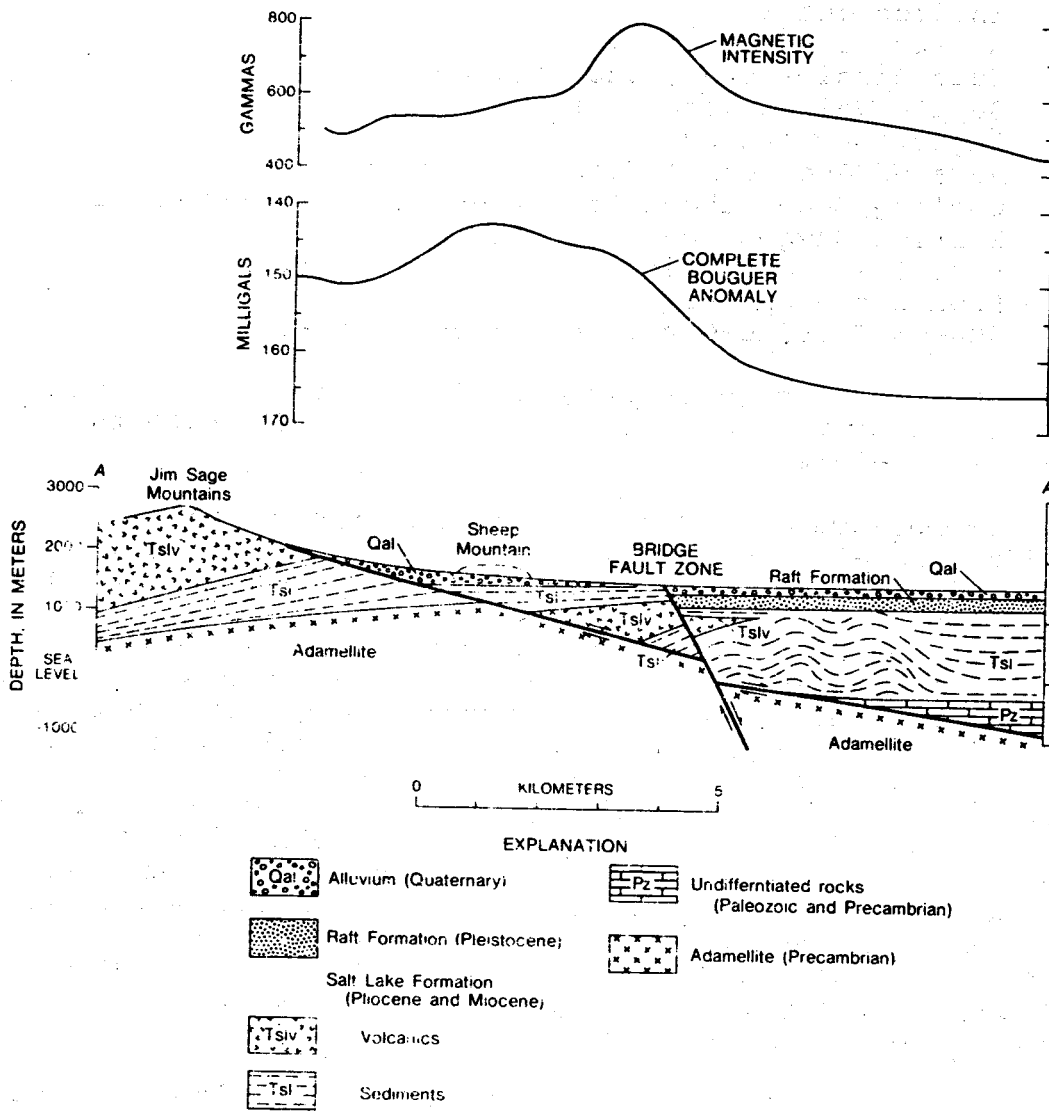


FIGURE 58. Interpreted section across the west side of the southern Raft River Valley. (From Mabey and others, 1978.)

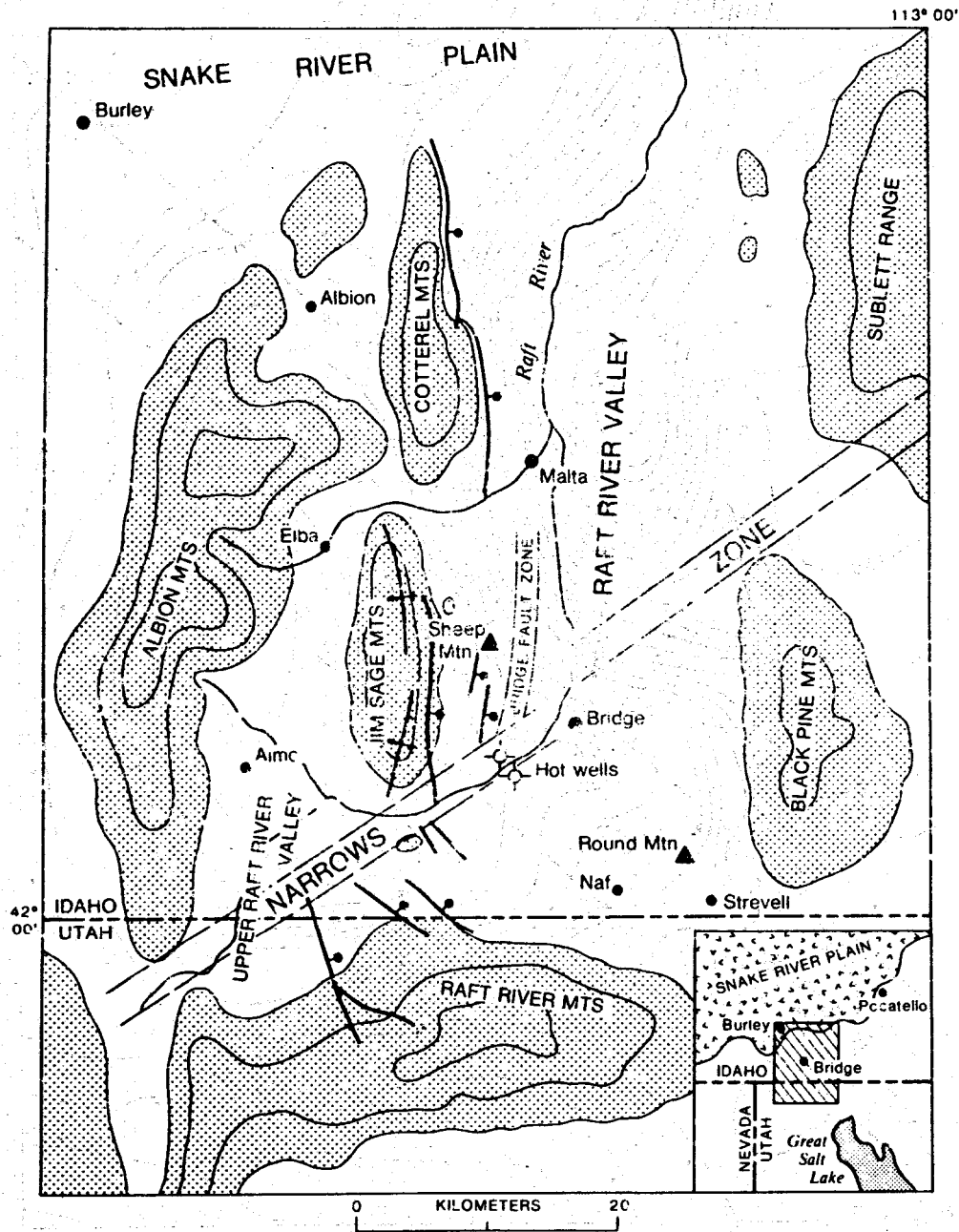


FIGURE 59. Map of the Raft River Valley region, Utah and Idaho, showing major topographic features and faults. (From Mabey and others, 1978.)

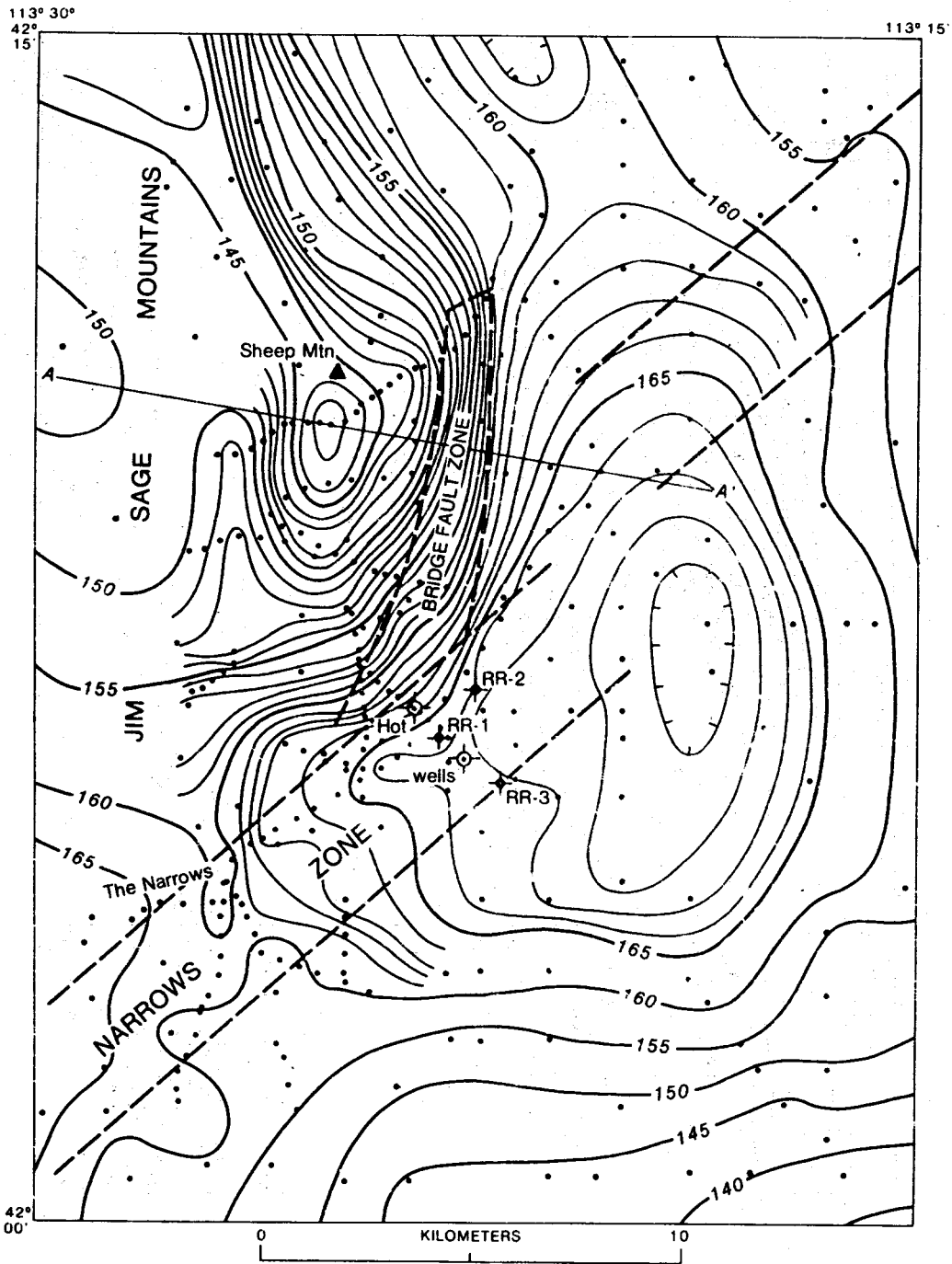


FIGURE 60. Complete Bouguer gravity anomaly map of the southern Raft River Valley. Contour interval is 1 and 5 milligals. Deep drill holes are shown and numbered. Dots are gravimeter stations. (From Mabey and others, 1978.)

Other springs and wells exist in the Raft River Valley and Cassia County, some of which are located along arcuate trends, as in north-central Idaho.

Oakley Warm Springs (14S-22E-27dcb1) located near Oakley in an adjoining valley west of Raft River issues at 47°C from Paleozoic quartzite and is developed as a small resort. The other wells documented in Cassia County are for irrigation or domestic uses and are in rural locations as are the springs.

#### ONEIDA COUNTY

Five thermal springs are located in Oneida County (figure 61) in the Malad Valley. All are fairly low in surface temperature and most occur near surface drainages. Pleasantview Warm Springs (15S-35E-3aablS) issues at 25°C from Precambrian quartzite and presently is unused. Woodruff Warm Springs (16S-38E-10bbclS) is the warmest spring at 27°C. Price's Hot Spring (16S-38E-23bbdlS) reported by Ross (1971) could not be found. An unnamed spring (12S-34E-36bcblS) exists near the upper end of Malad Valley. Its surface temperature is 24°C. Malad Warm Springs (14S-36E-27cdalS) issues at 25°C from a travertine mound in the fairgrounds area near Malad City. This spring, being in close proximity to Malad City, appears to have the most potential for development, due to its proximity to a population center.

In addition to the thermal springs, Burnham and others (1969, p. 33) report three areas of saline groundwater in Malad Valley. These saline groundwaters were: "(1) small in volume compared to recharge and groundwater in storage, (2) associated directly with deep circulation along or on the bedrock side of the boundary faults of the valley, and (3) localized in only three small areas." These saline waters might indicate that mineral rich thermal water is mixing with cold groundwaters. Indeed, the cold saline groundwaters are all found near thermal springs - one area near the eastern margin of the Malad Valley from Malad City to Cherry Creek, one area near Pleasantview Warm Springs, and one near Woodruff Warm Springs. If mixing is occurring, there is a good possibility that hotter water could be found by drilling near the warm springs. Careful targeting of drill holes to intersect faults at depth should be undertaken before any drilling commences. However, the chalcedony chemical geothermometer indicates aquifer temperature only a few degrees above surface temperature except at Woodruff Warm Springs where aquifer temperature may be as high as 46°C.

None of the mixing models applied to these three thermal springs in these areas are definitive (basic data table 2, columns T<sub>8</sub>, 9, 11).



PARAMETER RANGE

<u>Low</u>	<u>Surface Temp. Deg. C</u>	<u>High</u>
Temperature	✱	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⌘	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00

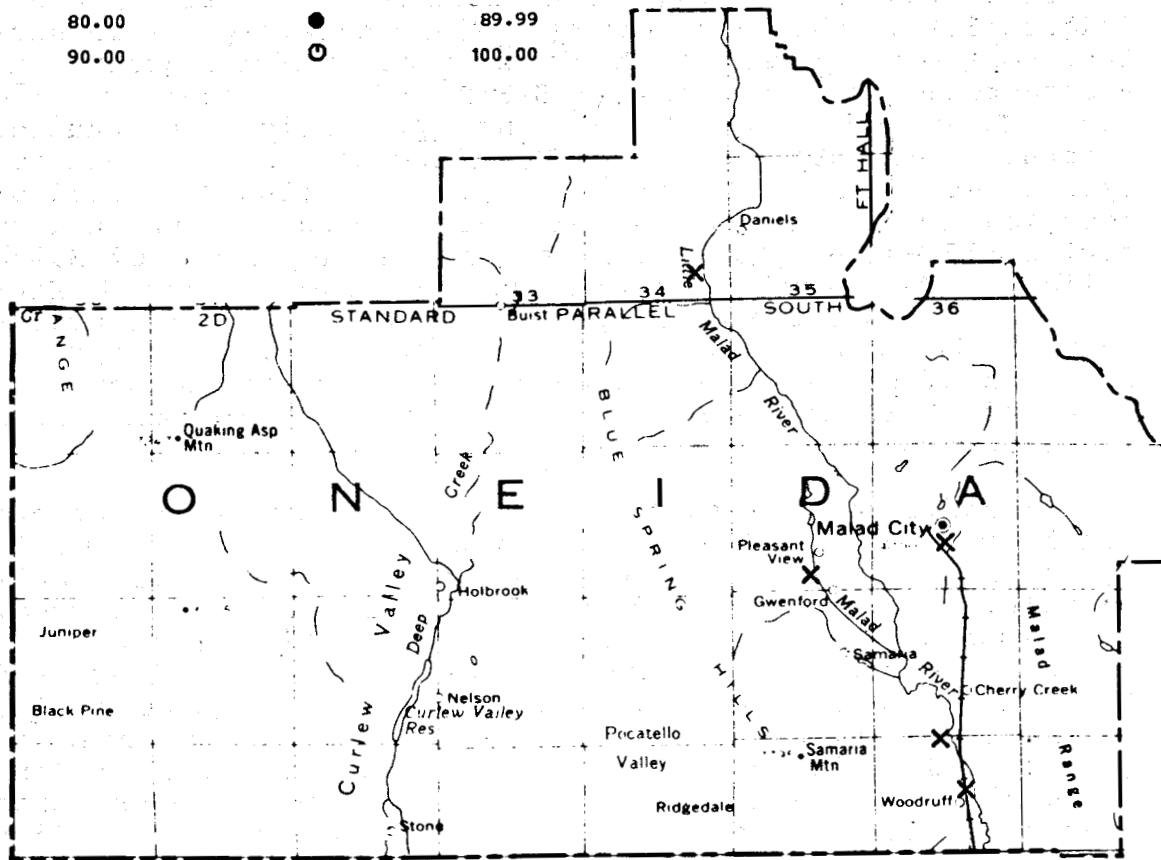


FIGURE 61. Index map of Oneida County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

## FRANKLIN COUNTY

Mitchell, 1976, p. 17-19, summarized the thermal water occurrences in the northern Cache Valley area as follows:

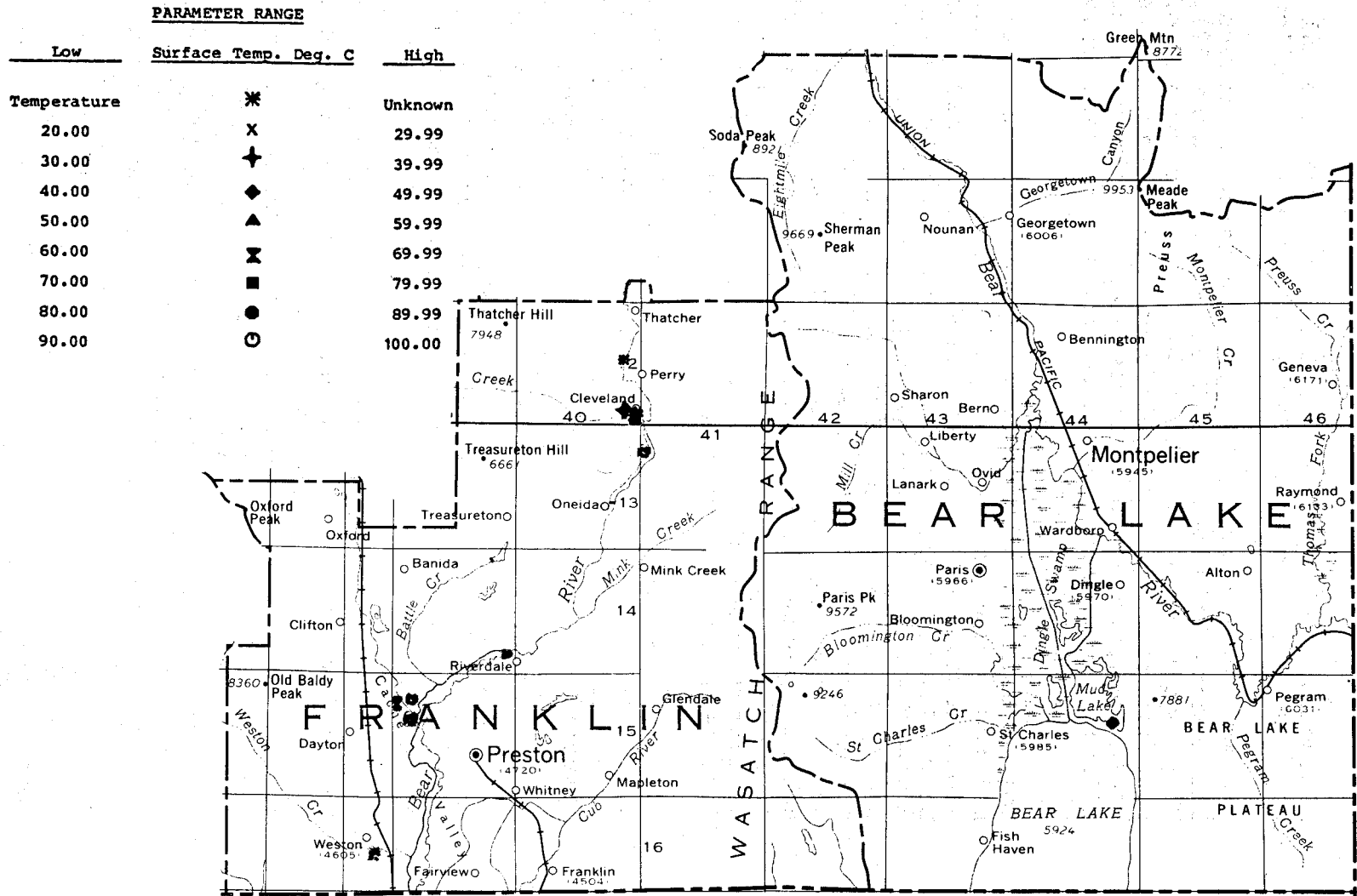
Thermal springs and wells are scattered at irregular intervals along the Bear River (figure 62). They occur in conjunction with various types of consolidated and unconsolidated sedimentary rocks including travertine, limestone, quartzite, and alluvial deposits. Thermal wells penetrate only alluvial deposits.

Most springs in the area appear to be fault related. The springs near Cleveland are situated along a northwest linear trend on both sides of Bear River. On the west side, spring vents (12S-41E-30caals) issue from the bottom of circular pools 6 to 9 m in diameter within travertine formations. Numerous seeps and many small pools occur near the river edge. Numerous seeps and spring vents issue from a travertine bluff overlooking Bear River on the east. Much gas, thought to consist mostly of CO<sub>2</sub>, escapes from the riverbed, audible for some tens of meters.

No fresh deposits of travertine were forming near Cleveland. The springs on the west side issuing from pools may even be dissolving the existing travertine deposits. The waters on the west side are much cooler (35°C) than the waters from the east bluff (66°C). Waters from the vents on the west side have been used for recreational purposes. Samples were taken for chemical analyses from the large pools on the west side and from several vents on the east side.

Maple Grove Hot Springs (13S-41E-7acals) are located in an area of intense local faulting near the shore of Oneida Narrows Reservoir. The numerous vents and seeps and the one large pool that make up the spring system are more or less aligned with each other. Unlike the Cleveland springs, Maple Grove waters are depositing much travertine. Gas, probably CO<sub>2</sub>, is also being evolved. Several small, cold (10°C) mud pots near the smaller vents at Maple Grove evolve small quantities of gas which bubbles up through the mud. The bubbling might be interpreted by a casual observer as evidence of boiling. These waters have been used for recreational purposes and also for power generation as evidenced by an old Pelton wheel found below the spring on the shore of Oneida

FIGURE 62. Index map of Franklin and Bear Lake counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



Narrows Reservoir. This may have been the first use of geothermal water for power generation in Idaho; even though the wheel was designed to make use of kinetic energy of the flowing water, rather than its enthalpy or heat content. Total installed capacity probably did not exceed 5 kilowatts (kw).

Well 14S-39E-36adal, on the Bear River flood plain at Riverdale, has a surface water temperature of 40°C and was reportedly drilled to a depth of 12.1 m. For years, water from this well has been used for beneficial purposes in a dairy operation. Rulon F. Mitchell, a resident of the area for 40 years, reports that snow in a 40-acre tract around the well would melt much more quickly than in surrounding areas.

The Clifton Hill high angle boundary faults may exist at Battle Creek Hot Springs (Wayland) (15S-38E-8bdclS) and Squaw Hot Springs (15S-39E-17bcdlS) (Oriel and Platt, 1967; Peterson and Oriel, 1970; and Mabey, 1974, unpublished data). These faults may intersect the Mink Creek-Bear River lineament near these two hot springs (figure 63). The structural implications of this transverse lineament are unknown but it could represent a strike-slip or normal fault. The controlling structure for these two hot springs could be the intersection of the Clifton Hill high angle boundary faults with the Mink Creek-Bear River(?) fault.

Battle Creek Hot Springs consists of one large pool about 6 m in diameter, a smaller pool (probably a collapsed travertine structure), numerous vents and seeps. This spring system is located on the western edge of Bear River. Numerous vents are marked by gas bubbles in the riverbed. Travertine is actively being deposited around the pool and vents of this spring system. These waters have been used for hog carcass scalding and recreation. Samples were taken from the two pools and two smaller vents. Cold water seeps (temperature 6°C and total discharge 5-10 l/m) were issuing from a clay bank just above the spring vents at Battle Creek Hot Springs. Other cold water seeps were issuing at approximately the same elevations as the thermal vents about 40 m down river from the thermal vents. The cold water may be seepage along impermeable clay layers from an irrigation canal which runs along the bottom edge of the uppermost terrace level of the river valley above the hot springs, or from irrigation water applied on farmlands above the canal. Significant quantities of cold water could be mixing with the thermal water.

Squaw Hot Springs (15S-39E-17bcd1S) are located about 1 km south of Battle Creek Hot Springs near the confluence of Deep Creek and Bear River. This system consists of one well, reportedly 6.7 m deep, four other vents and several seeps. Discharge from the well (15S-39E-17bcd1) is depositing travertine at the end of the discharge pipe some 30 m from the well head, and a small mound of travertine 1.5 m high and 3 m across the base has been formed on the edge of Deep Creek. Only minor travertine deposition or evaporative incrustation was evident at the well head itself, where water samples were taken. The other vents are now only very minor depositors of travertine with small incrustations and a few travertine-coated pebbles along discharge channels. Older travertine deposits crop out in the immediate spring area, indicating prior deposition by the springs. Samples were taken from the well, from a vent situated near the road, and from another vent located near the Bear River-Deep Creek confluence. All spring vents were evolving minor quantities of gas, probably CO<sub>2</sub>. The well being the most prolific gas evolver, gave a false appearance of vigorous boiling. These spring waters were formerly used for recreational purposes, and for heating hot houses.

Basic data table 2 lists apparent subsurface temperatures in Franklin County. Mitchell (1976) listed reasons for believing that at Squaw and Battle Creek hot springs, subsurface temperatures would approach 150°C provided quartz controlled silica in these waters. If mixing of thermal and non-thermal groundwater were taking place, temperatures could be as high as 235-245°C. In other areas of Franklin County the chalcedony chemical geothermometer (T<sub>4</sub>, basic data table 2) probably gives good subsurface temperature estimates.

#### BEAR LAKE COUNTY

In Bear Lake County (figure 62), located in the central Rocky Mountain Province, there are only two known thermal springs presently active. Extensive travertine deposits, particularly on the west side of Bear Lake Valley north of Bern, attest to much greater thermal spring activity in the past. It is not known whether the springs here ceased flowing because of cooling or to self sealing because of travertine deposition, or both. Prospecting for thermal water might prove fruitful in areas of extensive travertine deposition near known faults.

Pescadero Warm Spring (12S-44E-7bdalS) (26°C) is located two miles south of the Nounan-Georgetown Road near the



FIGURE 63. EROS false color infrared Landsat EDISE image of part of southeastern Idaho and northern Utah showing selected thermal water locations with surface temperatures above 20°C.





Bern-Pescadero Road on a travertine-covered bluff overlooking the Bear River. It issues at about 40 l/min. It is presently used for stock water.

Bear Lake Hot Springs (15S-44E-13bcals) is a popular resort area and has been for many years. Formerly known as Joe Rich's Spring, vents issue from limestone along a fault scarp at the base of the steep slope, which forms the western edge of the Bear Lake Plateau. The water issues at 48°C. Bear Lake Hot Springs and Pescadero Warm Springs are remote from population centers in Bear Lake Valley. Maximum subsurface temperatures expected at depth may be best represented by the chalcedony equilibrium temperature at about 54°C (see basic data table 2, column T<sub>5</sub>). Bear Lake Hot Springs could probably support a natatorium and a greenhouse provided additional flow could be found by drilling.

Donaldson and Applegate (1979) reported that:

Gravity mapping (Mabey, Peterson and Wilson, 1974) in the Bear Lake-Montpelier area of southeastern Idaho reveals steep east-west gradients suggesting a north-south striking basin and range type graben valley (figure 64). An east-west profile taken from the aforementioned map along the Idaho Standard Parallel south through the Bear Lake anomaly (figure 65) defines a 21 mgal residual low. Calculations made assuming a 0.4 gm/cm<sup>3</sup> density contrast between valley fill and flanking bedrock result in an estimated basin depth of about 1250 m. Witkind (1975) defines faults along both margins of the gravity inferred graben (figure 15) which are presumed active with late Quaternary beds broken. Day (1974) has mapped linears from band 5m MSS-ERTS imagery which also coincide very well with the gravity inferred graben (figure 9).

The basin depth estimate must be considered very conservative. A similar depth estimate was calculated in the Oakley area where a maximum temperature-at-depth of about 90°C was calculated. Given similar assumption, similar temperature estimates would be appropriate for this area.

#### CARIBOU COUNTY

Six thermal springs and four thermal wells are known in Caribou County. They are widely scattered but principally located around the margins of the Blackfoot lava field and near the principal drainages of the Blackfoot, Bear, and Portneuf rivers (figure 66).

The best known thermal occurrence in Caribou County is located within the town of Soda Springs and is known as Soda



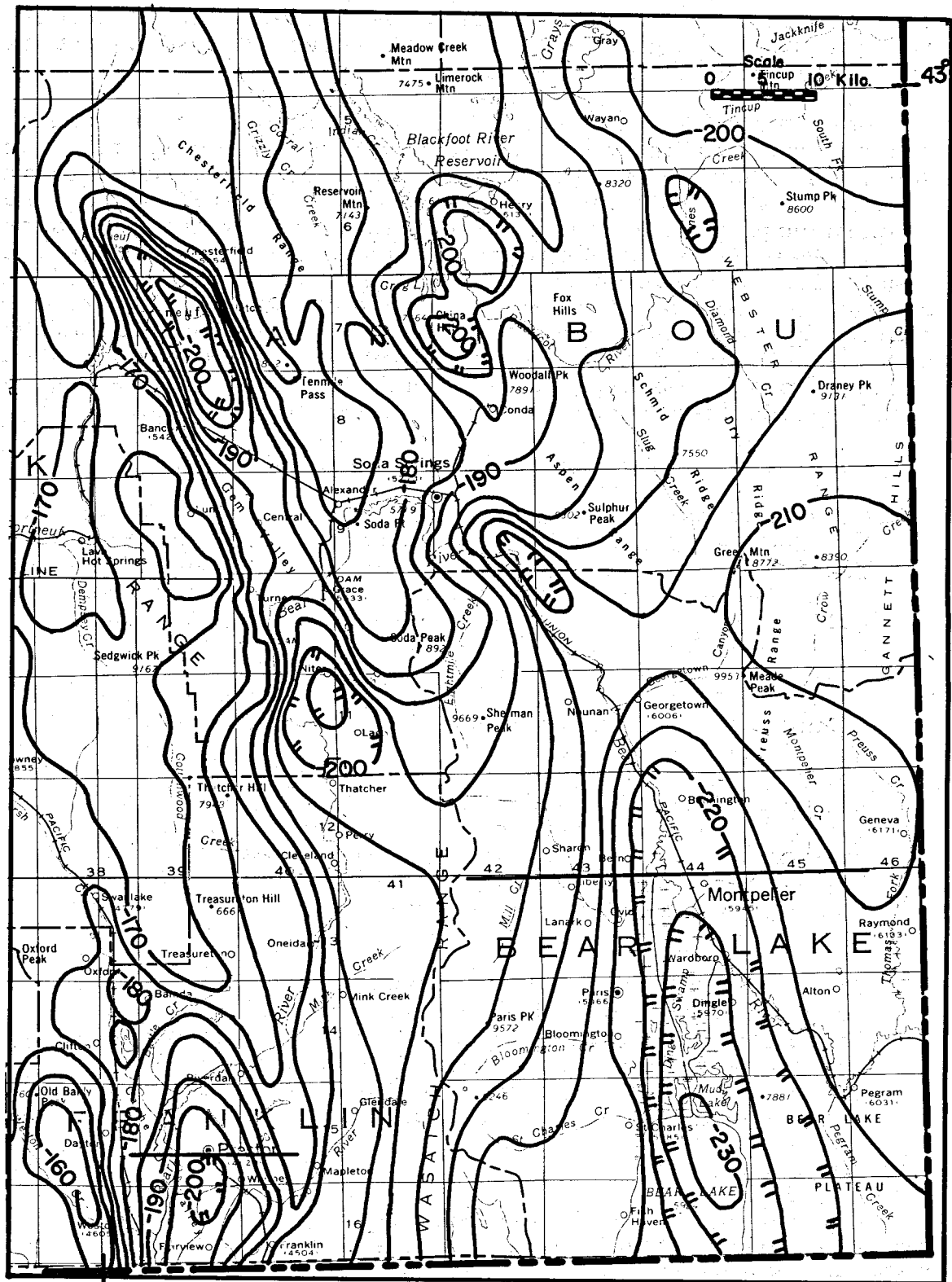


FIGURE 64. Gravity lows from Gem Valley (upper left), near Preston in Cache Valley (lower left), and near Bear Lake (lower right) (Mabey, Peterson and Wilson, 1974.) Contour interval = 5 milligals.

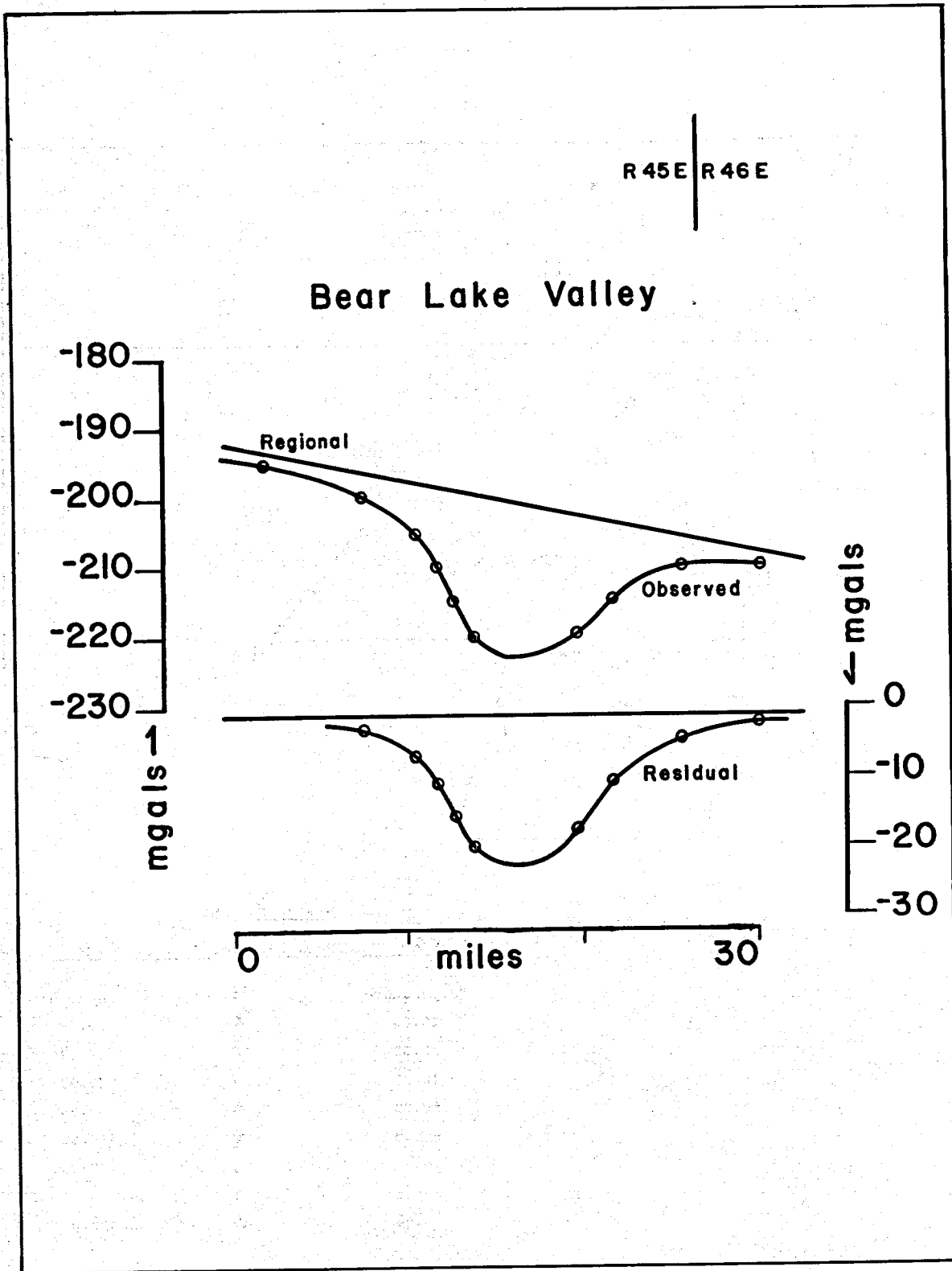
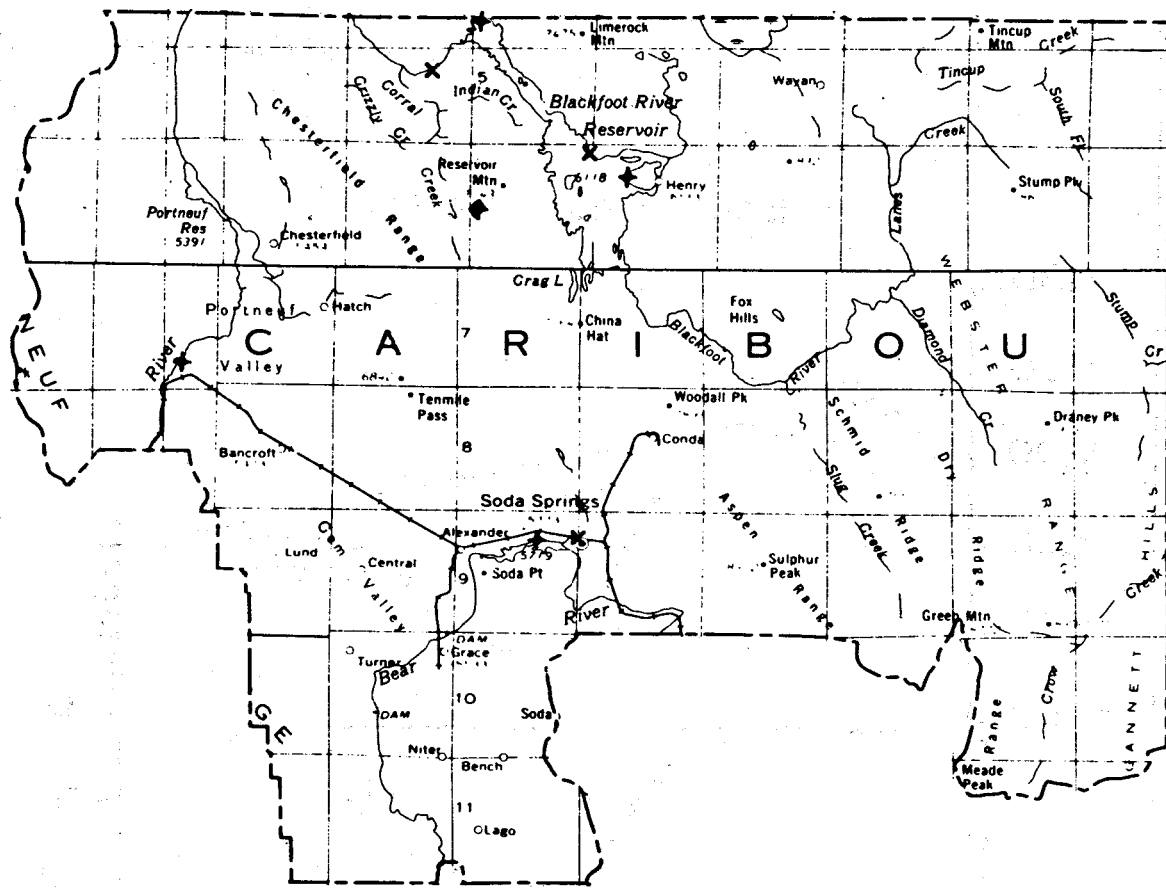


FIGURE 65. Gravity profile near Bear Lake. (From Donaldson and Applegate, 1979.)



PARAMETER RANGE

Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00

FIGURE 66. Index map of Caribou County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Springs Geyser (9S-41E-12add1). It is actually a well drilled near a former hot spring, and geysering is caused by high pressure carbon dioxide gas rather than steam pressure generated by superheated water. Soda Springs Geyser is now a tourist attraction erupting through automatic valves every hour (at the will of the city police) when the wind is right. It is 28°C at the wellhead.

A spring (6S-42E-8dbals) with a surface temperature of 21°C issues from a large circular travertine mound west of Henry near the shore of Blackfoot Reservoir, and another (6S-41E-1adclS) issues at 22°C across the Meadow Creek arm of the reservoir. Steamboat Springs (9S-41E-10daals) issues from travertine beneath the waters of Soda Point Reservoir. Blackfoot River Warm Springs (5S-40E-14bcd1S) issues from travertine overlying basalt on the edge of the Blackfoot River. Its temperature is 26°C. Another spring (7S-38E-26cbd1S) known in the area is on the bank of the Portneuf River on the west side of the Portneuf Valley. It has a temperature of 41°C.

The Corral Creek wells (6S-41E-19ba, temperature 36 to 41°C) are located in an extremely faulted area. Strike-slip, normal, and reverse faults were encountered when Food Machinery Corporation (FMC) drilled for phosphate in the area. The thermal water was encountered when drilling reached the Mead Peak member of the phosphoria formation. The wells were drilled near an old geyser cone.

Mitchell (1976) summarized the geothermal potential of Caribou County as follows:

Geologic evidence of geothermal activity is abundant in Caribou County. The Intermountain Seismic Belt, related to plate and subplate boundaries, passes through the area. A known zone of high heat flow coincides with the seismic zone, and is manifested by numerous thermal springs. Mansfield (1927) reports a high geothermal gradient. The Pleistocene basalt flows, thought to be less than 700,000 years old, exist west and south of the Blackfoot Reservoir. Possibly present is a geologically young volcanic collapse structure (caldera) or low density granitic intrusive (heat source?). The extremely young (less than 100,000 years old) rhyolite structures (China Hat, North Cone and South Cone) exist near the center of the area surrounded by the somewhat younger basalts. Thermal spring deposits, warm springs and geyser activities are evident. All are strong geologic evidence of large-scale geothermal potential.

The audio-magnetotelluric (AMT) survey indicates that no shallow, low-conductive zone (typical of

geothermal systems) exists to depths approaching 2 km. This indicates the absence of geothermal reservoirs to 2 km depths in the survey area.

The chemical geothermometers indicate that the thermal waters of the Blackfoot Reservoir area probably have never reached high temperatures (above 50°C).

Published estimates of temperature gradients suggest that the thermal springs could emerge from depths as shallow as 1,000 m. The close association of these springs and wells with normal faults indicates that the waters are probably meteoric waters circulating to shallow depths along faults and re-emerging as thermal springs or wells. Water ascending from shallow depths may provide little information concerning any deep thermal system, which in this area would be the real exploration target.

The geochemistry of the thermal waters, the results of the AMT survey, and the speculative geothermal gradient and heat flow estimates from the Blackfoot Reservoir area indicate little potential for geothermal power generation from shallow depths (less than 2 km). The possibility of deeper geothermal resources is, however, attested to by the favorable geologic framework. The possible deep reservoirs would not be accessible to exploration or development except by very expensive techniques such as deep resistivity, heat flow, or deep test drilling.

Heat flow measurements taken from three or four strategically placed 300 m deep drill holes would indicate the approximate intensity of any deep heat source in the area, and consequently may be the better and less expensive method of exploration. This activity should be deferred until other, more accessible geothermal systems in Idaho have been assessed.

Caribou County does, however, represent a unique region where prospecting for geothermal water for low temperature use might be successfully conducted by local individuals, small businessmen, or corporations who wish to make use of low temperature geothermal energy but who lack large amounts of speculative investment capital. Local water well drillers might locate hot water in areas of obvious faulting where surface deposits of travertine are found. If the extinct springs have ceased to flow

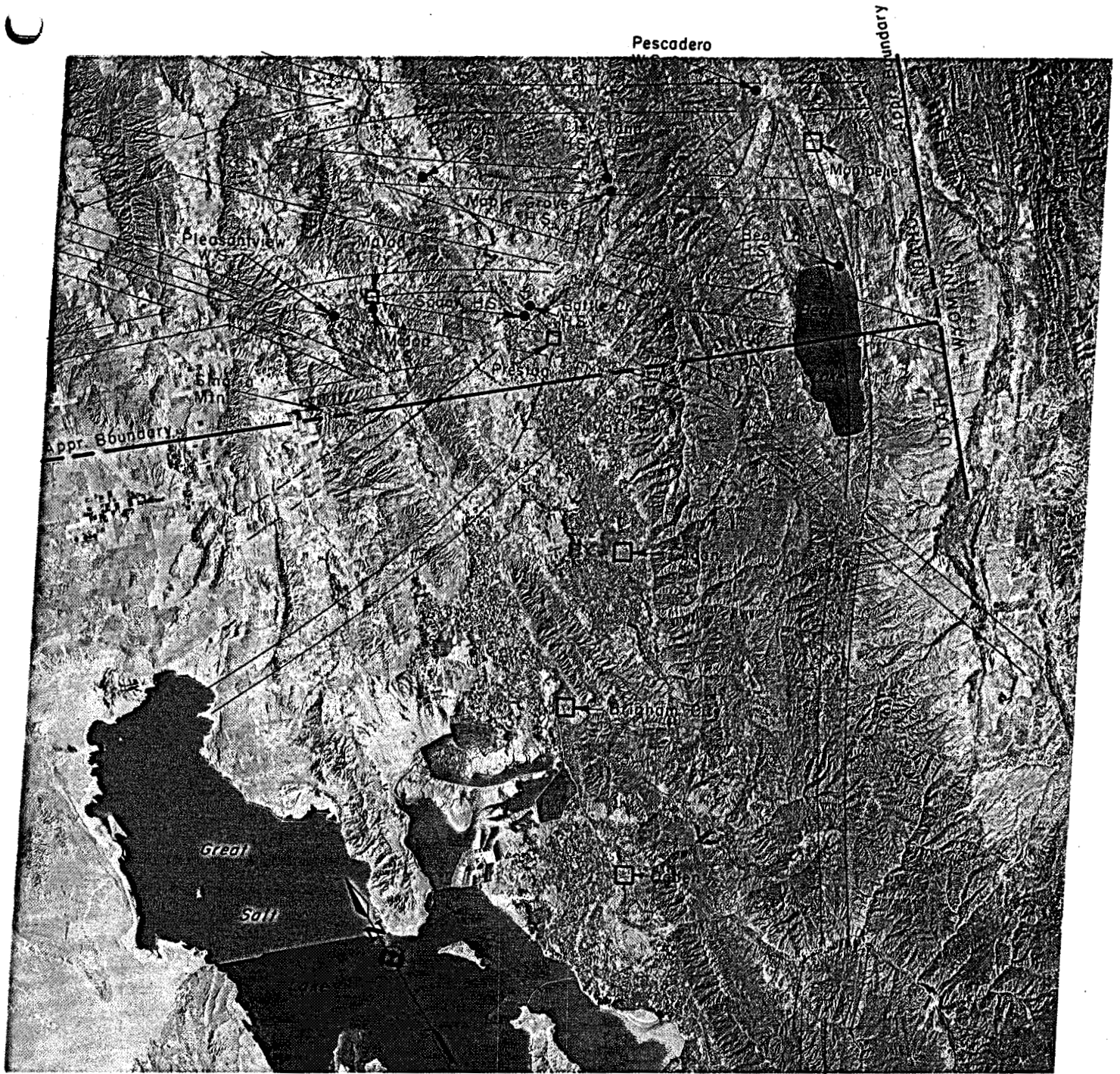


FIGURE 67. EROS false color infrared Landsat EDISE image of part of southeastern Idaho showing selected linear features and thermal water locations with surface temperatures above 20°C.



because of self-sealing due to  $\text{CaCO}_3$  deposition, rather than regional cooling or more arid conditions than formerly existed, substantial amounts of low temperature water (less than  $75^\circ\text{C}$ ) might be found by drilling into fault zones associated with travertine deposits. Self-reliant, enterprising individuals may even devise methods of scaling control, a potential hazard in geothermal water utilization in this area.

The moderately high dissolved solids in these waters preclude their use for irrigation purposes or stockwatering. Their low temperatures suggest uses such as mushroom growing, balneological baths, soil warming, recreational usages, warm water for winter mining operations or de-icing. Space heating for vegetable greenhouses or animal husbandry may be practical if efficient heat pumps were utilized.

The saline waters may challenge engineers who work toward their utilization. Activities related to the large-scale withdrawal and use of these waters must be very carefully monitored. Cooperation between those individuals making use of the water, as well as state and local officials, is necessary to avoid potential thermal and saline pollution, which could be a danger due to the higher temperature and salinity of these waters should large-scale withdrawal be attempted.

Figure 67 is an enhanced false-color infrared satellite image of part of southeastern Idaho showing major linear features and thermal water occurrences. Many of the thermal springs and wells are near the intersection of these major linear features. The exact nature of these features is not known but the features may represent some type of crustal fracture along which meteoric water circulates to depths where it is heated by hot rock.

An irregular, somewhat discontinuous and curved lineament can be traced on satellite images (figures 63 and 67) from the north end of the Great Salt Lake in northern Utah through Woodruff Hot Springs south of Malad, near Squaw Hot Springs west of Preston, through Cleveland Hot Springs, through Soda Springs, through Henry Warm Springs, through Brockman Creek Warm Springs, through Fall Creek Mineral Springs, and further north, perhaps to Ashton Warm Springs. This lineament coincides with the suspected curvilinear zone revealed by thermal spring activity as shown on figure 9. Springs along this zone appear near where east-west trending lineaments intersect the curvilinear lineament or zone.



The geothermal potential of the Blackfoot Reservoir area indicates that much of the energy requirements for the growing phosphate industry, as well as space heating for the expanding population, might be supplied by geothermal energy.

#### BANNOCK COUNTY

Four thermal spring areas and seven thermal wells are located in Bannock County (figure 68). The most promising areas for development are north of Pocatello near Tyhee and Lava Hot Springs.

In the Tyhee area the warm water wells, drilled to depths of 177 m, are used for irrigation, domestic, and stock water. The wells range from 20 to 41°C in temperature. They are more or less aligned in a northeast-southwest direction approximately following an inferred fault through the area (Trimbé, 1976). A faint linear feature can be seen in enhanced false color satellite images of the area. The feature is consistent with the warm water well alignment and inferred fault. A magnetic high similar to one found near Heise Hot Springs also exists near the wells (Corbett, 1978, oral commun.). These facts are evidence of both structural control for thermal water in the area and possible deep circulation of meteoric water along faults. Chalcedony and Na-K-Ca chemical geothermometers give 63 and 47°C respectively in one well (5S-34E-26dab1) in the Tyhee area. Quartz predicts 63°C for the subsurface temperature in another well (basic data 2, columns T<sub>1</sub>, T<sub>4</sub>, T<sub>5</sub>). Further work in the area should be considered to determine the attitude and exact position of the controlling structures to target drill holes to intersect the structure at predetermined depth. Gravity, magnetic, and hydrologic studies should be performed first to best determine the type of followup approaches to use in further reservoir assessment in the Pocatello-Tyhee area. This area is currently being studied in greater detail. Any thermal water discovered here could be utilized for space heating and industrial uses in Pocatello.

Another area of thermal water occurrence is Lava Hot Springs where two groups of thermal springs and several wells of above normal temperatures are known. Lava Hot Springs has been a popular resort area for years boasting a state-owned health spa. Before renovation, the swimming pool contained natural thermal water; now, the water must be heated by natural gas to give a comfortable swimming temperature. The city is interested in further development of the resource, particularly for space heating.

McClain (1978) reported on the geothermal occurrences near Lava Hot Springs and stated:

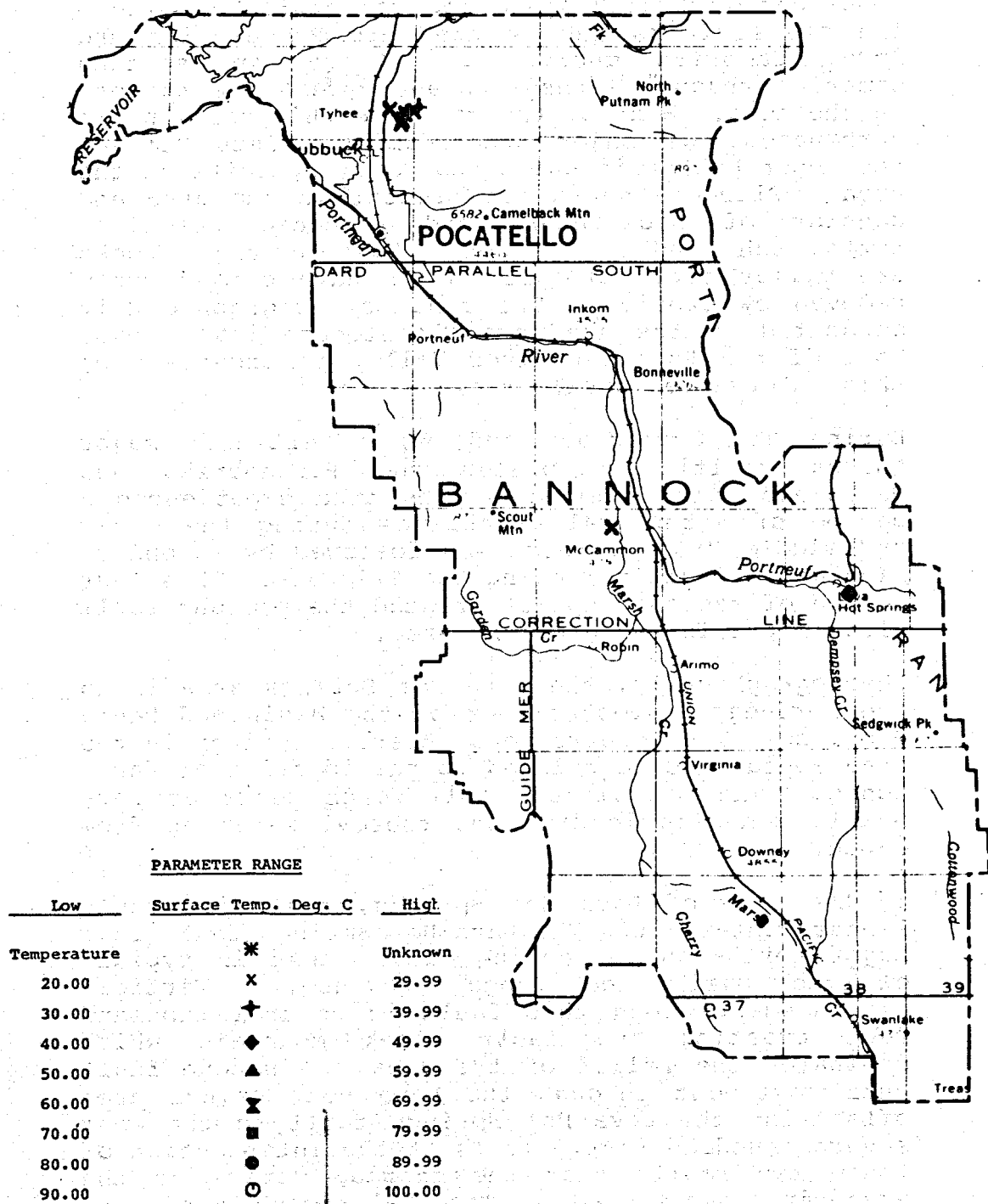


FIGURE 68. Index map of Bannock County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Geologically, the Lava Hot Springs area is a complicated stratigraphic and structural location. The oldest rocks in the area are Precambrian and lower Cambrian quartzite. Units representing Cambrian through Pennsylvanian systems are present in the area. Most of the rocks in this section are carbonates. A major unconformity exists between the upper Paleozoic units and Tertiary units of the area. Pliocene units are present in the area and consist of sedimentary and volcanic breccias, tuffs, ash, and lava flows. Most of these rocks are valley fill materials which have been largely removed by erosion. The final stratigraphic unit deposited in the area are Pleistocene lava flows. Most of the Portneuf River Valley is underlain by this intervalley basalt flow.

During the Cretaceous and early Tertiary, major thrust faulting displaced the Precambrian and Paleozoic units eastward. The area experienced a period of structural quiescence during the early and middle Miocene which was followed by extensive high angle faulting during the Pliocene. This last period of tectonic uplift created the present fault block mountain range of the area.

Physiographically, the Lava Hot Springs area is in the northeasternmost corner of the Basin and Range Province. The occurrence of thermal springs in the area appears to be related to the location of fault zones. The brecciated fault zones serve as permeable conduits leading the thermal water up from depth.

In the city of Lava Hot Springs, two major fault linears intersect. The Lava Hot Springs fault is a major north-south trending linear that is typical of the Basin and Range Province. Vertical displacement along this fault is several thousand feet creating the fault block mountain which dominates the relief of the area. A second fault cuts east-west through the Lava Hot Springs area offsetting the Lava Hot Springs fault to the east several hundred feet. It is at the intersection of these two faults that the thermal waters of the area are manifested. The relationship of the thermal waters to the thrust plain of the region is unclear.

The hot waters of the Lava Hot Springs area range in temperature from 21-68°C. The major springs which feed the Foundation Spa are 38°C. The presence of fault zones can be easily determined in the

area by extensive travertine deposits. These thermal waters are most logically associated with deeper sources of thermal fluids which are circulating up through the Paleozoic units along the fault intersection.

Most of the thermal springs and wells in the area occur from the basaltic rocks which underlie the Portneuf River Valley. Several shallow wells have been dug with backhoes to depths of less than 20 feet. Hot fluids are intersected along the bottom contact of the basalts. This may indicate that thermal water of the area is rising along the fault zones and spreading horizontally along the basalt contact.

Using the sodium-potassium-calcium geothermometer, a reservoir temperature of 211°C has been predicted, and using silica, a temperature of 80°C. In either case, the temperature would be sufficient for space heating. A surface temperature of 71°C has been reported on the bank of the Portneuf River just west of the spa. Investigations are presently being undertaken to determine the feasibility of designing a district heating project. The reported flow (over 1500 l/min.) and the location appears to favor this project. A district heating project would also avoid the present apparent interference between the very shallow individual wells in towns.

Downata Hot Springs (12S-37E-12ccd1S), a popular resort area of long standing, rises from Quaternary alluvium near Tertiary sediments. It is associated with an east-west lineament (see figure 67). It is 43°C at the surface. Subsurface temperatures here probably are not much higher than 46°C, as estimated by the Na-K-Ca chemical geothermometer. These hot springs are remote enough from a large population center to exclude large scale development. Greenhouses or other agricultural uses could be made of excess water over and above the resort's needs.

One warm domestic well (22°C) exists near Marsh Creek between McCammon and Inkom. It has not been sampled.

#### POWER COUNTY

Power County has one popular resort area, Indian Springs (8S-31E-18dab1S) (figure 69), which has been in existence for many years. It is located a few kilometers south of American Falls. Indian Springs is 32°C and discharges 5,830 l/min. Maximum subsurface temperatures expected are best represented by the Na-K-Ca chemical geothermometer at 71°C with the quartz chemical geothermometer indicating 63°C.

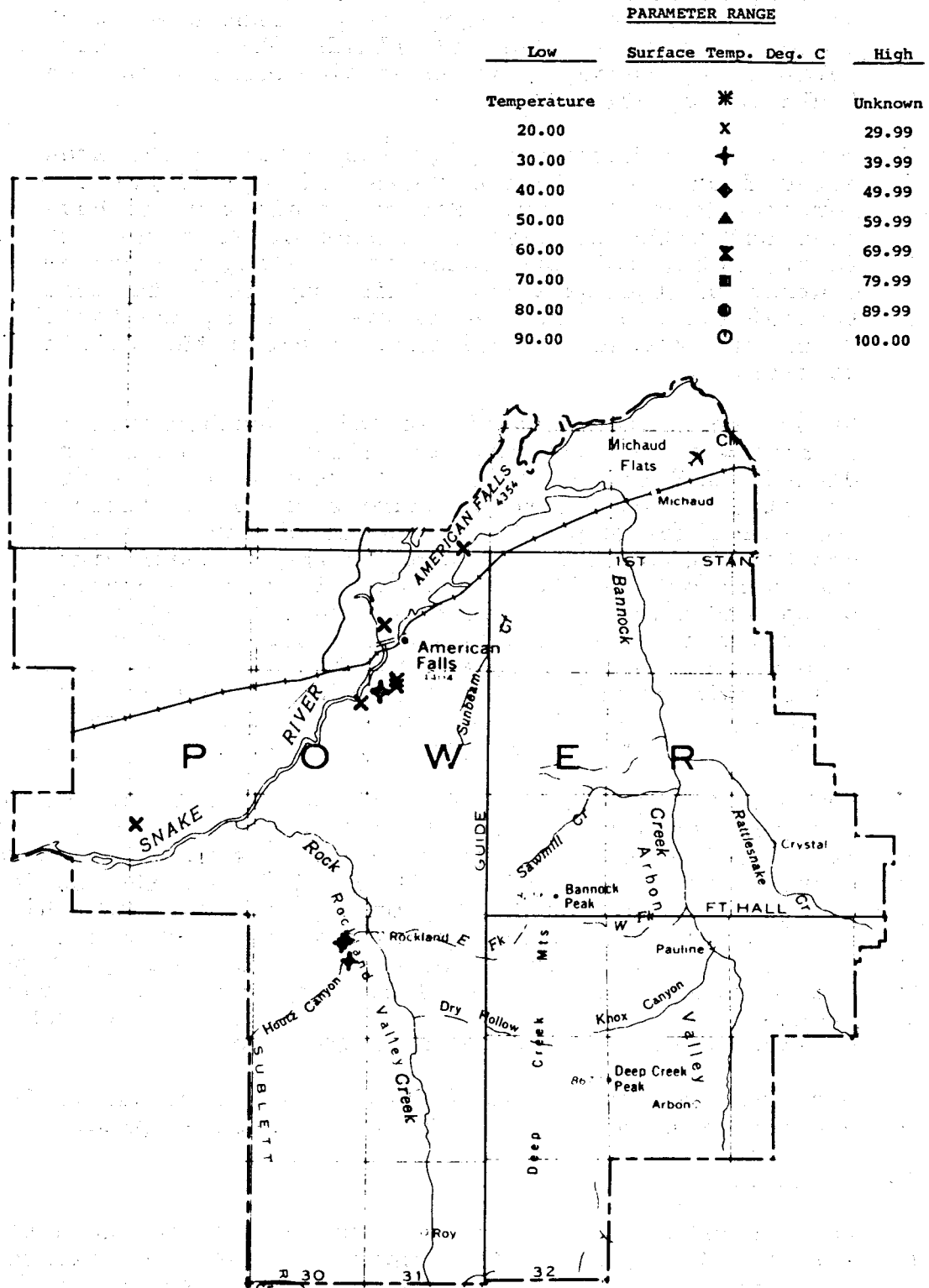


FIGURE 69. Index map of Power County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

Two other springs, Rockland Warm Springs (10S-30E-13cd1S) and an unnamed spring (9S-28E-19acd1S) located west of Massacre Rocks State Park on the shore of Lake Walcott, are undeveloped. Rockland Warm Springs has a chemistry and surface temperature similar to Indian Springs.

Several large travertine deposits occur in Power County (figure 70). Past flows of thermal water may have deposited them. If the thermal springs ceased flowing due to self sealing from travertine deposition in spring vents, thermal water might be found by prospecting along known faults near the travertine deposits. Trimble and Carr (1976, p. 62-64) reported on the geology in the Rockland and Arbon quadrangles, Power County. They stated:

Travertine and travertine-cemented conglomerate and breccia occur at several localities in the Rockland and Arbon quadrangles. Yellowish-white travertine as much as 1.83 m thick overlies the Little Creek Formation in the valley of Warm Creek from a point near Indian Springs to a point near the community of Neeley. An isolated exposure of travertine apparently overlies basalt of the Massacre Volcanics on the east side of the valley of Rock Creek, in the SW1/4 NE1/4 sec. 13, T.9S., R.31E. Several outcrops of travertine overlie alluvial pebbly silt or gravel that, in turn, rests on the Starlight Formation (1) on the north side of Rocky Hollow east of the highway between American Falls and Rockland (State Highway 37), (2) in secs. 28 and 29, T.9S., R.31E., between Rocky Hollow and Spring Creek and (3) along the valley of Spring Creek.

Travertine and travertine-cemented conglomerate and breccia are exposed in the valley of East Fork Rock Creek and in Sand Hollow and Dry Hollow in the Rockland quadrangle and are exposed in the area of Pete Lish Canyon, Howard Flat, and Warner Flat in the Arbon quadrangle. The thickest travertine deposits are adjacent to the frontal fault of the Deep Creek Mountains and to a normal fault of large displacement in the Arbon quadrangle. In Sand Hollow, travertine-cemented conglomerate immediately adjacent to the frontal fault is about 68 m thick and ends abruptly on the east at a breccia zone. In the valley of East Fork Rock Creek, it is more than 15 m thick. Travertine is found down-valley from the fault for as much as 5 km in some places and appears to be younger than the coarse pediment gravel in this area.

The volume of travertine-cemented breccia at the locality in the Arbon quadrangle is notable. An

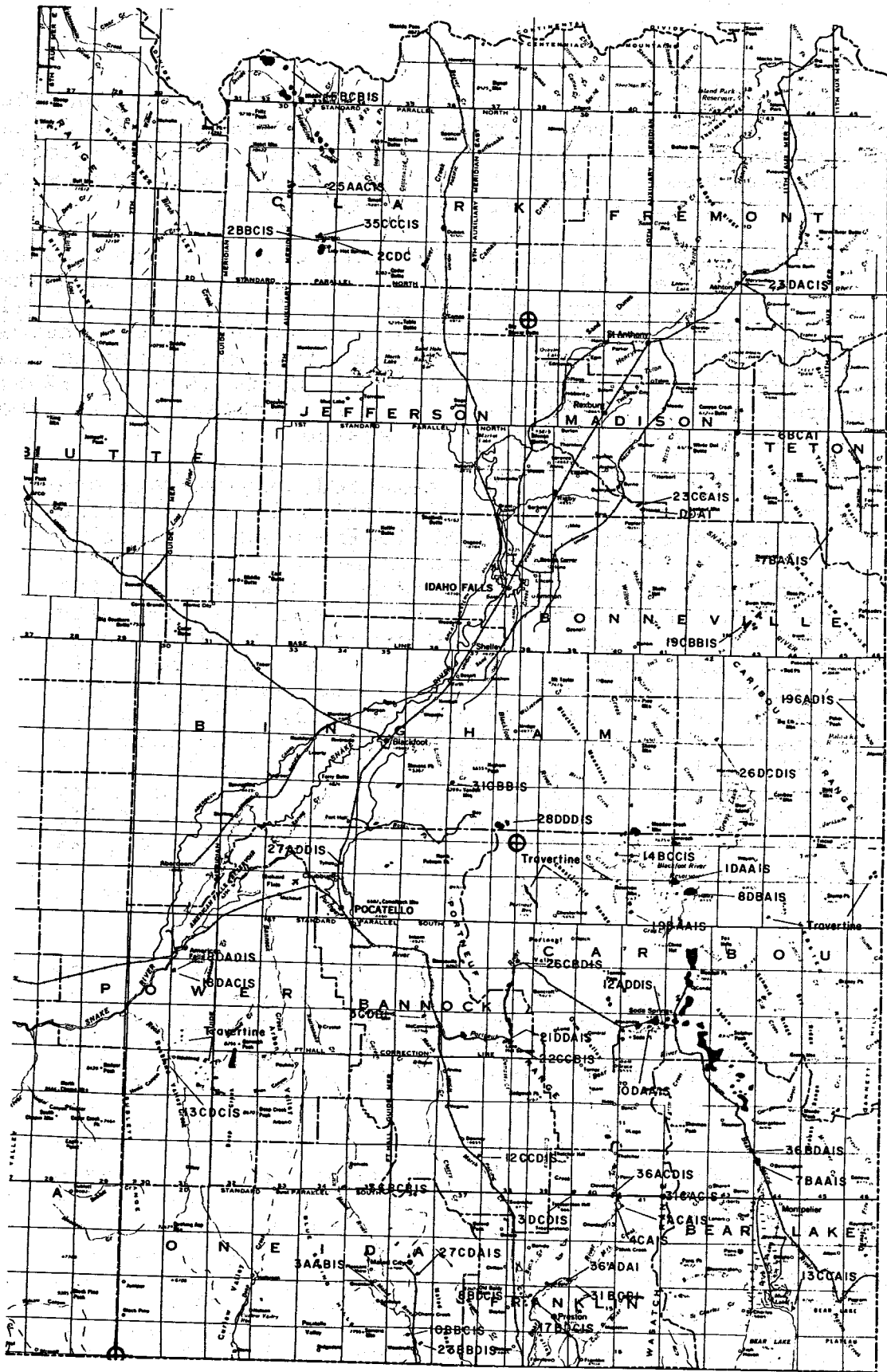


FIGURE 70. Travertine deposits and associated known springs in southeastern Idaho (modified from Bodnar and Bush, 1978).

area more than 4 km long and locally more than half a mile wide between Pete Lish Canyon and Warner Flat is completely covered. Locally, this deposit probably is more than 150 m thick. The breccia is composed mainly of fragments 0.65 - 1.25 m across of Paleozoic rocks in a travertine matrix. Travertine-cemented sandstone and tuffaceous sandstone is locally interbedded with the breccia.

The common occurrences of travertine-cemented conglomerate and breccia adjacent to major faults, and the abundance of travertine near Indian Springs, a hot spring apparently on a fault line, indicate that the travertine was deposited by water containing a high percentage of calcium carbonate that issued from artesian springs along the faults.

A late Pleistocene age for most of the travertine is suggested by two lines of evidence. First, the isolated exposure of travertine overlying basalt east of Rock Creek, in the SE1/4 NW1/4 sec. 13, T.9S, R.30E., contains mollusks of possible Pleistocene age (USGS Cenozoic loc. 21644). According to D.W. Taylor (written commun., 1959) the absence of extinct species tends to suggest a late Pleistocene age, but the small number of species makes even this age uncertain. The stratigraphic position, in several localities, of the travertine above gravel that probably is generally equivalent to the Sunbeam Formation also suggests a late Pleistocene age for much of the deposit. Eastward dips in the travertine cemented breccia and sandstone in the Arbon quadrangle indicate that there has been renewed tectonic movement along the major fault after deposition of the travertine. This suggests that these deposits are somewhat older than flat-lying deposits west of the frontal fault of the Deep Creek Mountains.

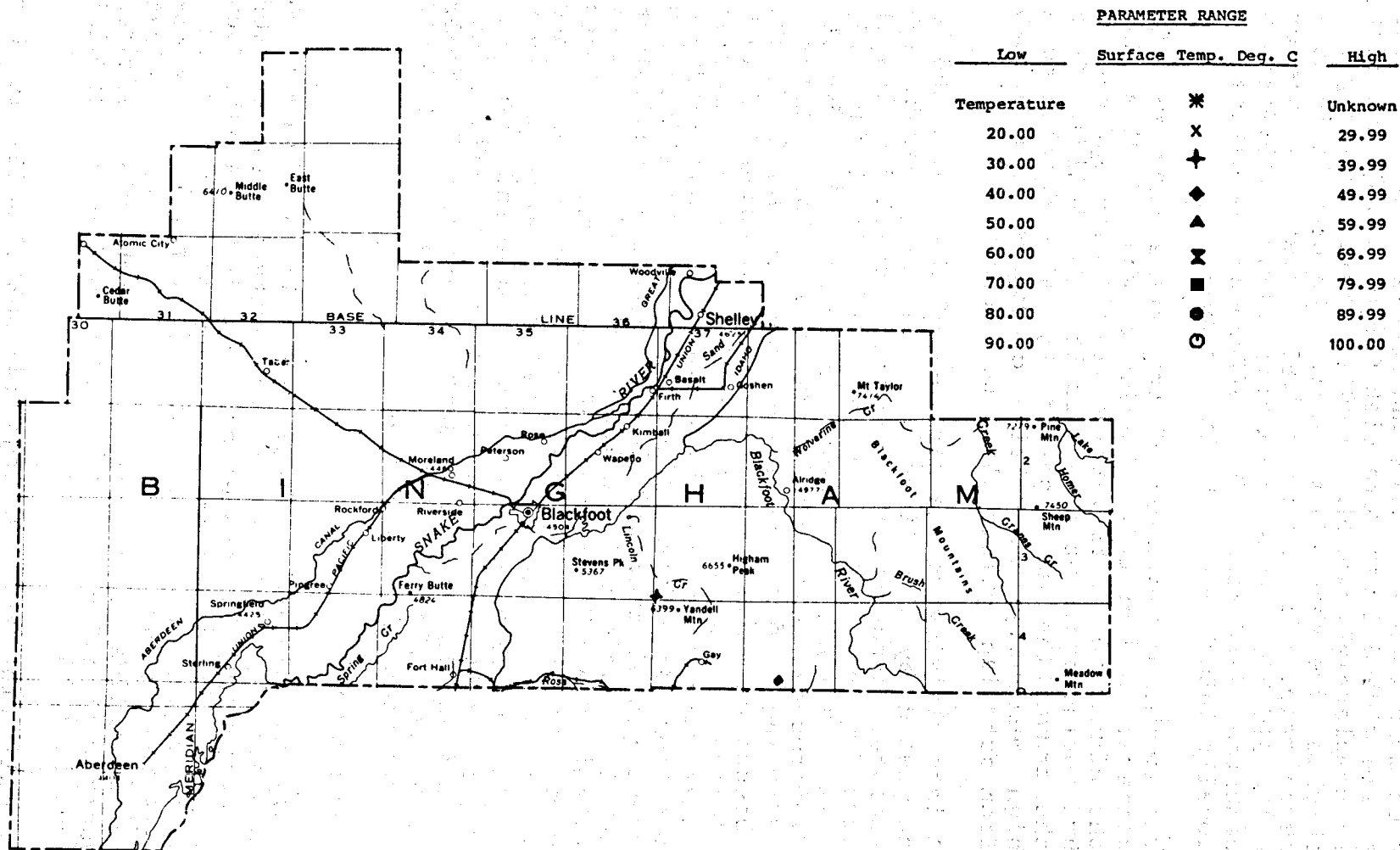
#### BINGHAM COUNTY

Only two thermal springs are known in Bingham County (figure 71). Both are of low temperature. Yandall Springs (3S-37E-31dbb1S) is located at the base of Yandall Mountain along a fault in Paleozoic limestone. It issues from several vents at 22 - 32°C. This is a fairly large spring, discharging 5,700 l/min and is used for irrigation. Dissolved solids are only 197 mg/l. Subsurface temperature probably will not exceed 35°C, as predicted by the chalcedony chemical geothermometer.

Alkali Flat Warm Springs (4S-38E-28ddd1S) is a small seep situated in a bowl in travertine and closely resembles



FIGURE 71. Index map of Bingham County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.



springs found in Caribou County. It has a surface temperature of 34°C, discharges about 75 l/min and is located in the Gay Mine (phosphate) area. Thermal water in this area could possibly be used in winter mining operations. The spring is presently used for stock water. Subsurface temperatures are predicted to be about 58°C by the chalcedony chemical geothermometer.

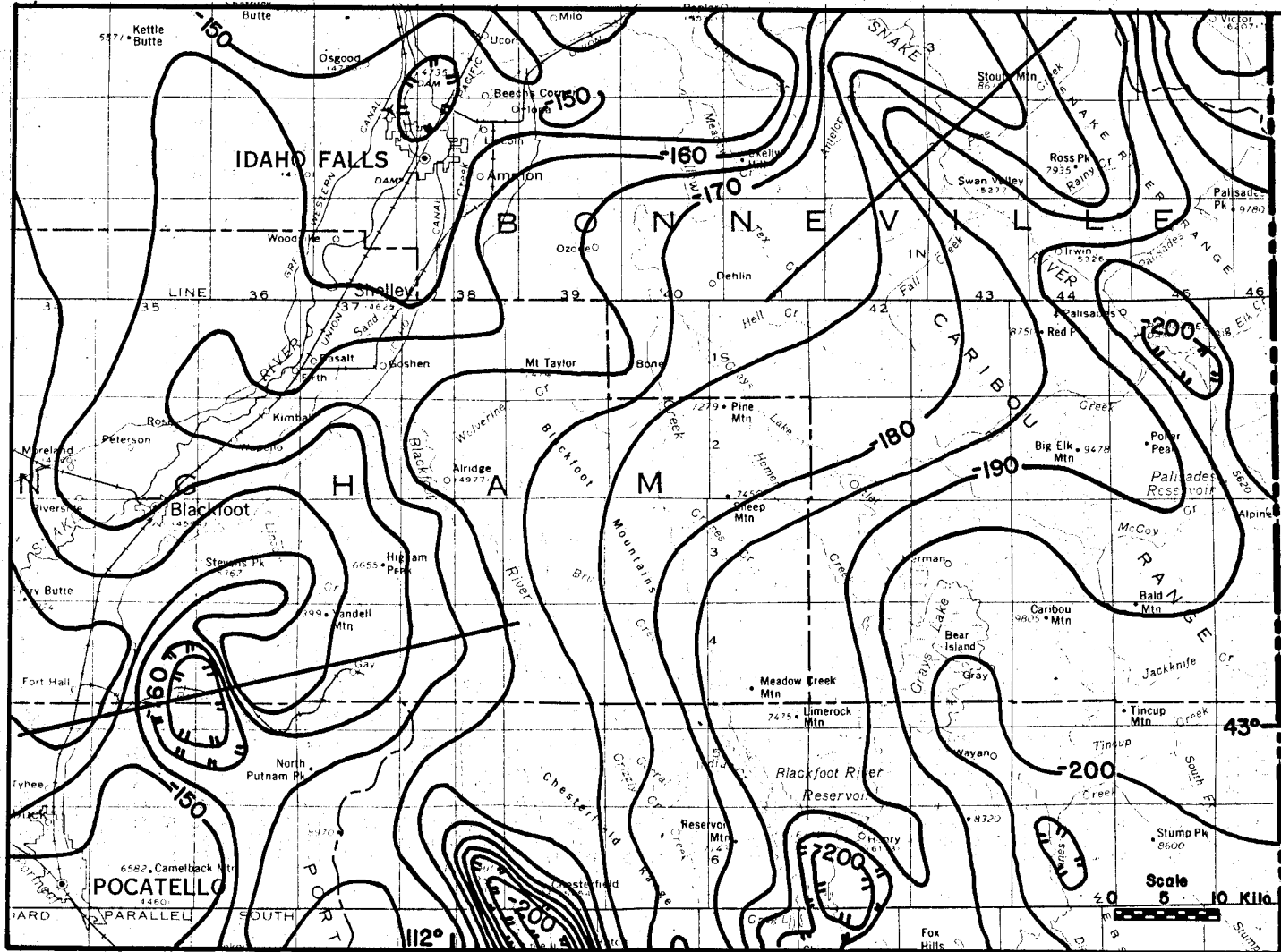
Donaldson and Applegate (1979) reported that:

The preliminary Gravity Map of southern Idaho (Mabey, Peterson and Wilson, 1974) defines a prominent low about 12 miles south of Blackfoot (figure 72). An east-northeast profile through this anomaly (figure 73) defines a 22.5 mgal low which, assuming a 0.4 gm/cm<sup>3</sup> density contrast, results in calculations estimating a basin depth of about 1,342 m. A steep gravity gradient on the east side of the anomaly is very suggestive of a fault but the equi-dimensional nature of the main part of the anomaly does not suggest a preferred direction of valley strike. Witkind (1975) defines a 105 km long active fault which is terminated in the vicinity of the east flank of the gravity anomaly (figure 15). This fault has been recurrently active since Middle Miocene time. East of this anomaly, gravity is quite featureless and exhibits only a regional gradient of about -.64 mgal/km eastward. Day (1974) has mapped a lineament from ERTS imagery (figure 9) which approximates a portion of the Witkind fault but terminates before reaching the gravity anomaly. In the vicinity of the gravity anomaly, Day has mapped several northeast trending linears which parallel the trend of the eastern Snake River Plain, only a short distance northward (figure 9). It is probably significant that gravity contours enclosing the main portion of the previously mentioned anomaly are distorted toward the northeast (figure 72). Gravity, mapped lineaments and a prominent fault interruption all indicate effects of the force or forces responsible for the presence of the eastern Snake River Plain and the complexity expected in the transition into this dominating structural feature.

#### BONNEVILLE COUNTY

Three thermal spring areas are located in Bonneville County and warm water of 20°C has been encountered by well drilling near Ammon west of Idaho Falls (figure 74). Alpine Warm Springs (2S-46E-19cad1S), the hottest at 37°C, is now covered by the waters of Palisades Reservoir. A sample of

FIGURE 72. Gravity lows south of Blackfoot (lower right) and Swan Valley (upper left) (Mabey, Peterson and Wilson, 1974).



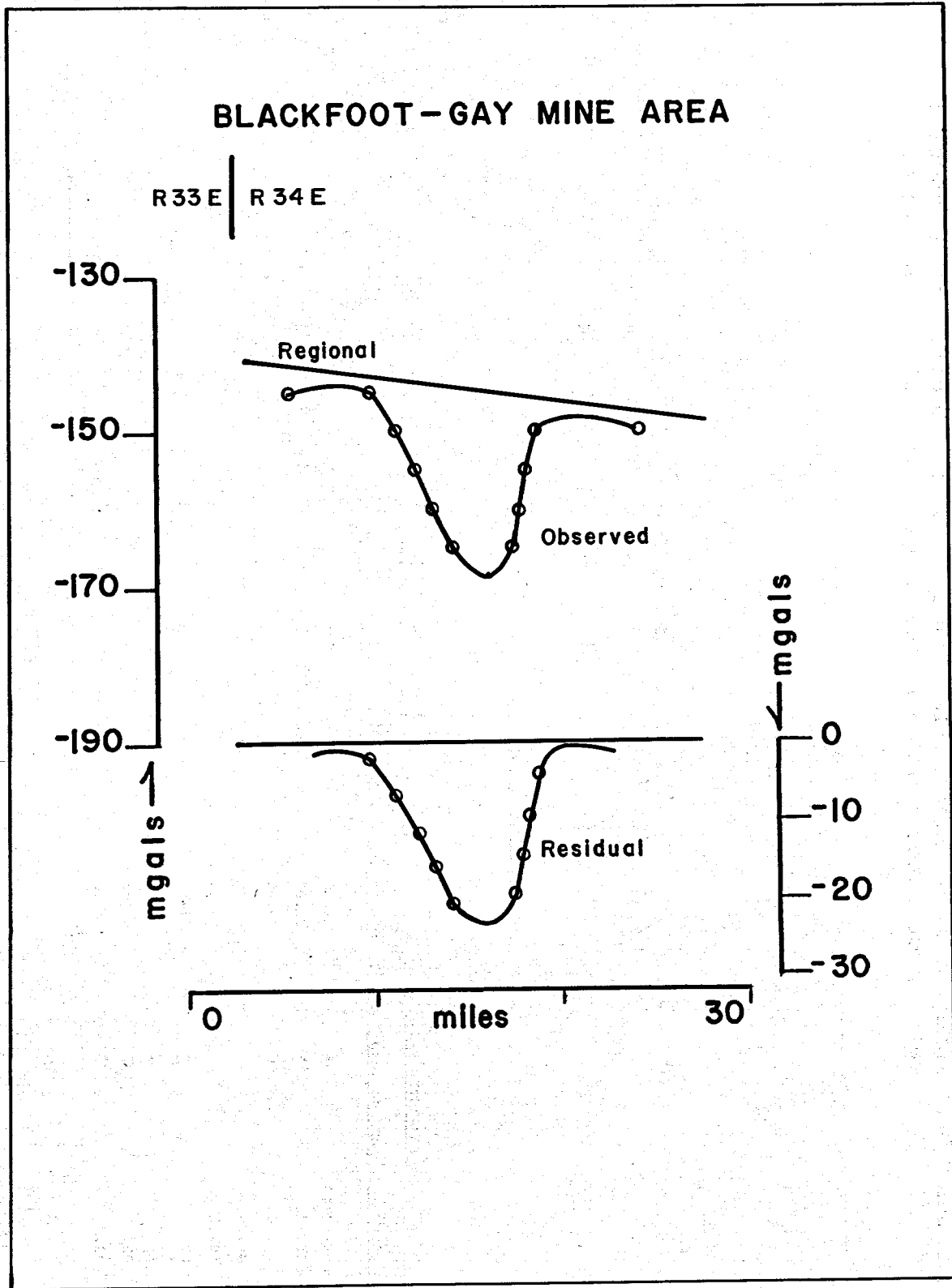
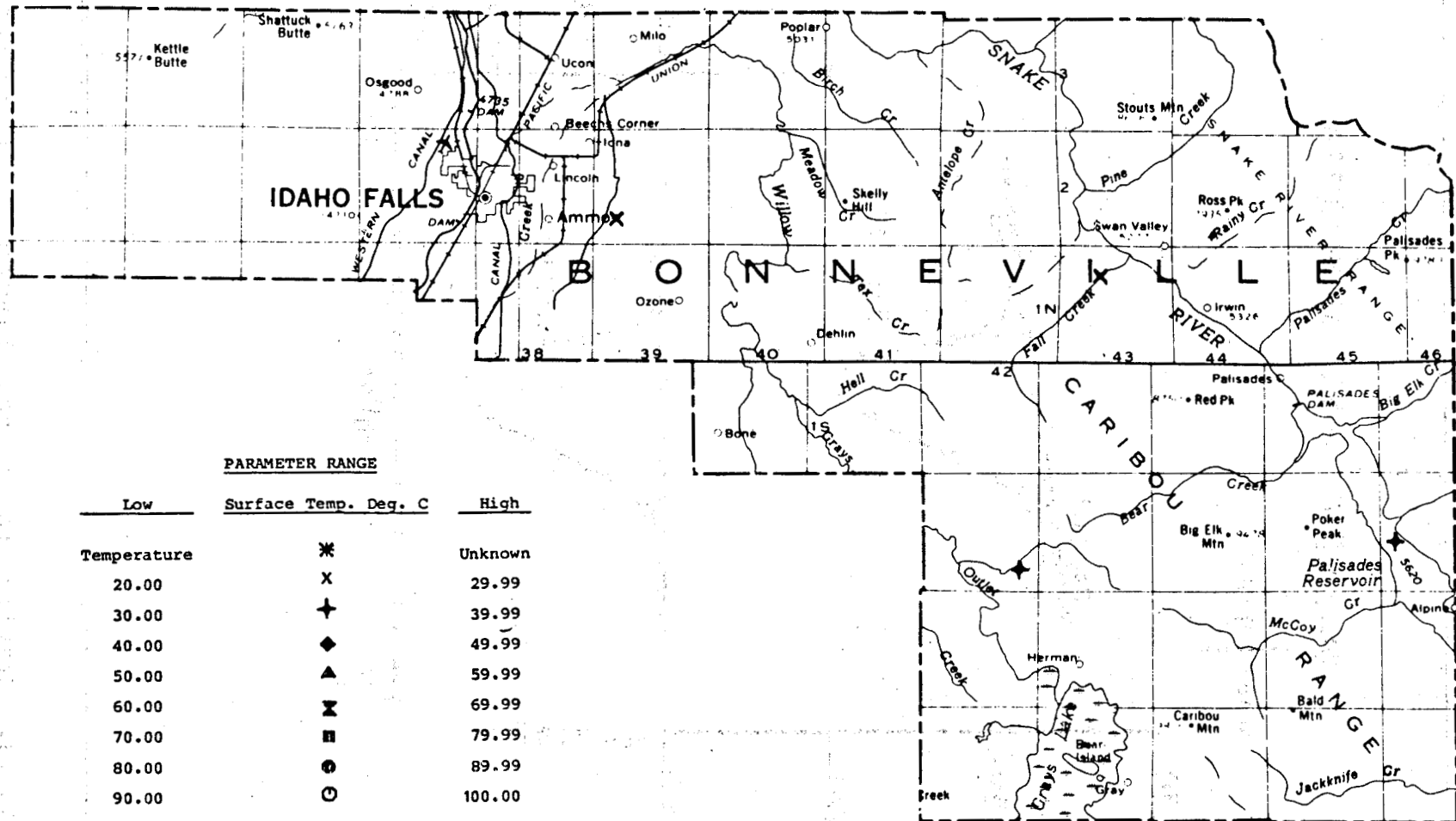


FIGURE 73. Gravity profile near Blackfoot. (From Donaldson and Applegate, 1979.)

FIGURE 74. Index map of Bonneville County showing locations of thermal water occurrences with surface temperatures of 20° or higher.



this group of springs was obtained during low water caused by the drought of 1977. Subsurface temperature here might be 61°C as predicted by the chalcedony chemical geothermometer.

Brockman Creek Hot Springs (2S-42E-26dcd1S) is 35°C, discharges 49 l/min and bubbles gas.

Fall Creek Mineral Springs (1N-43E-9cbb1S) is the coolest thermal spring at 25°C. It discharges water along a three-fourths mile long stretch of Fall Creek and deposits travertine in several locations. The spring appears to be fault controlled.

Subsurface temperatures in these areas are best represented by the chalcedony ( $T_4$ , basic data table 2) temperature, with the exception of Fall Creek Mineral Spring, where quartz ( $T_1$ ) may be the best estimated subsurface temperature. At Fall Creek, subsurface temperatures may approach 40°C, while at Brockman Creek and Alpine Warm Springs, subsurface temperatures might be as high as 38 and 61°C, respectively.

This area lies along what is locally known geologically as the Heise Alpine Trend.

#### MADISON COUNTY

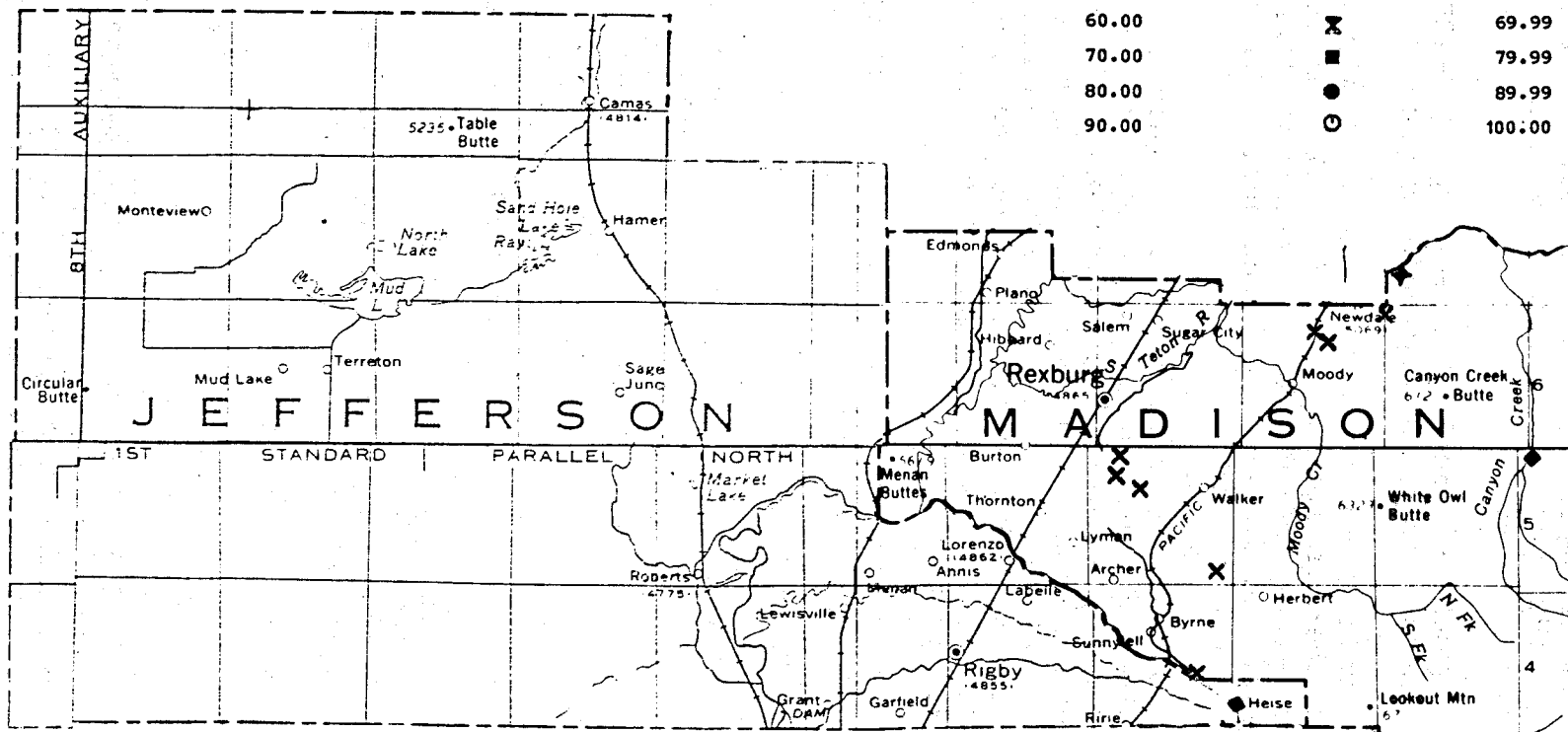
Madison County near Rexburg and Fremont County near Newdale have been scenes of intense geothermal research activity by the DOE and the USGS. Since the destruction of Sugar City by the Teton Dam failure and flood of 1976, efforts have been aimed at finding a thermal source to heat the rebuilt town of Sugar City. The area lies along the southern margin of the eastern Snake River Plain in a zone of high heat flow recognized by Brott and others, 1976. Heat flow values in excess of 5 HFU extend in a northeast-southwest zone from Rexburg to Newdale. Several thermal wells are also known here (figure 75). The Na-K-Ca chemical geothermometer predicts a shallow warm water system with temperatures that might range between 30 and 81°C.

Mabey (1978) reports:

A caldera complex in the Rexburg area of the eastern Snake River Plain has been defined on the basis of geologic evidence provided by H.J. Prostka and G.F. Embree (written communication, 1977) and named the Rexburg caldera complex (figure 76). Geothermal resources in the Rexburg area are likely to be related directly or indirectly by this caldera complex.

FIGURE 75. Index map of Madison and Jefferson counties showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

PARAMETER RANGE		
Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	◆	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	⊙	100.00



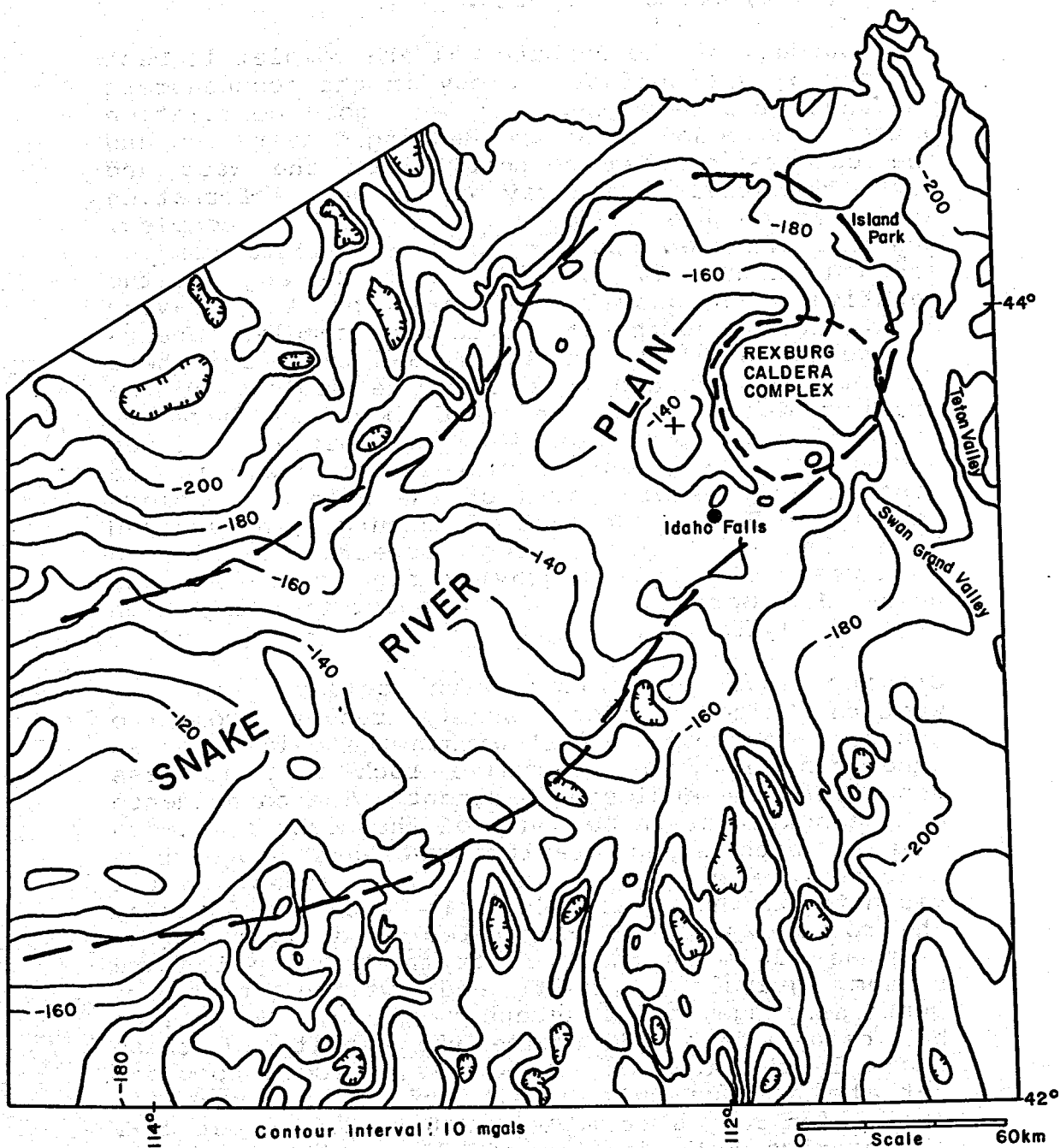


FIGURE 76. Bouguer gravity anomaly map of southeastern Idaho showing the location of the Rexburg caldera complex (from Mabey, 1978).



A gravity map of the caldera complex (Mabey, 1978) is shown in figure 77.

Mabey (1978) further reports:

The boundary of the Rexburg caldera complex is best defined by the surface geology in the southeastern quadrant, and here there is very good correlation between the boundary of the Rexburg gravity low and the caldera complex boundary. On the west and north the gravity data may be the best information available on the boundary of the caldera complex, and the inferred boundary of the caldera complex shown in figure 77 coincides with the edge of the negative mass anomaly indicated by the gravity data. To the northeast the caldera complex appears to overlap another depression, and the margin here is not well defined by either the geology or the gravity data. The inferred boundary here is primarily a connection of the better defined segments. The lowest gravity values occur in the eastern and western parts of the caldera complex, near Menan Buttes and east of Rexburg. The subdued high between these lows appears to be a northwestward-trending gravity high centered over Heise Hot Springs and a southwest-trending high west of Sugar City.

Gravity lows associated with calderas in the western United States usually result from two sources: low density fill within the caldera or an underlying body of intrusive rock that is less dense than the enclosing basement. The coincidence of the southwestern boundary of the Rexburg caldera complex with steep gravity gradients suggests a near-surface source, caldera fill. Except in the vicinity of the gravity high at Heise Hot Springs, the rocks exposed or penetrated by drill holes as deep as 420 m in the area of the gravity low are stream gravels, basalt and welded tuff of Quaternary age, and Pliocene rhyolite. No attempt has been made to determine the density of these rocks in the area of the Rexburg caldera complex, but the average bulk density of similar rocks in the region ranges from about 2.0 to 2.65 g per cm<sup>3</sup>. The average bulk density of pre-Tertiary rocks in the region is about 2.65 g per cm<sup>3</sup>. Thus a mass of the low-density Quaternary and Tertiary sedimentary and volcanic rock enclosed by pre-Tertiary rock would produce a gravity low, and this seems a probable cause of a major part of the low. Nowhere does the gravity anomaly require a deep source, although the existence of such a source smaller in

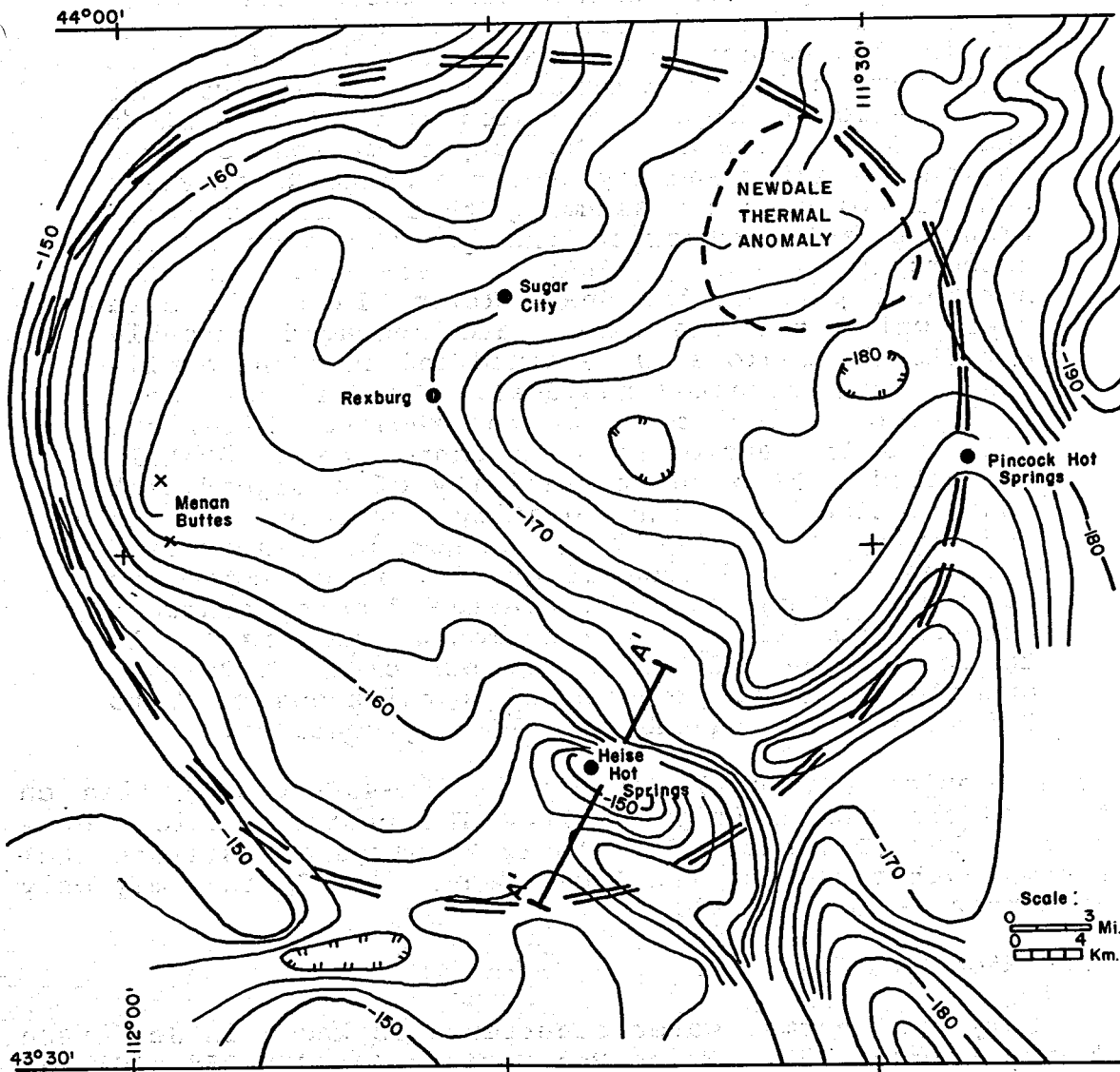


FIGURE 77. Bouguer gravity anomaly map of the Rexburg area showing the outline of the Rexburg caldera complex as inferred from the gravity data. Contour interval is 2 milligals (from Mabey, 1978).

extent than the inferred caldera complex is not inconsistent with the gravity data.

Although the Rexburg gravity low appears in large part to reflect fill within the Rexburg caldera complex, a precise quantitative interpretation of the anomaly is not justified. The amplitude of the gravity low cannot be accurately determined because of uncertainties in isolating the anomaly from the more regional high associated with the eastern Snake River Plain. No approximation of the regional gravity anomaly over the Snake River Plain can be computed by assuming that a linear relationship exists between the gravity anomaly and topography (Mabey, 1966). However, in the northeast part of the Snake River Plain, the area over which the elevations are averaged strongly affects the regional determined and thus the amplitude of the computed residual. Even if the local low could be isolated from the regional high, the fill and the enclosing rock cannot be accurately estimated. Also the possibility of a significant contribution to the gravity anomaly by an underlying intrusive body cannot be discounted. The residual amplitude of gravity is estimated to be about 20 mgals. The average density contrast between the fill and the enclosing rock is likely to be between 0.2 and 0.5 g per cm<sup>3</sup>. A 20-mgal anomaly could be produced by a thickness of 1 to 2.5 km of rocks having this density contrast.

Green Canyon (Pincock) Hot Spring (5N-43E-6bcals) lies on the caldera margin (figure 77). The quartz chemical geothermometer (T<sub>1</sub>, basic data table 2) gives an estimate that thermal water feeding the Green Canyon Hot Springs may only have been as hot as 72°C.

#### JEFFERSON COUNTY

Only one thermal water occurrence is known in Jefferson County (figure 75). Heise Hot Springs (4N-40E-25ddals), an established popular resort area located near the South Fork of the Snake River near the edge of the Snake River Plain, is in the extreme southeastern part of the county. Surface temperature is 49°C. The quartz chemical geothermometer gives an estimate of a subsurface temperature of 79°C. This spring deposits free sulfur and travertine and has a distinct sulfur odor. It issues from Tertiary silicic volcanic rocks along a northwest-trending fault. Heise lies within and near the southern margin of the Rexburg caldera on a large gravity high.

Mabey (1978) reports:

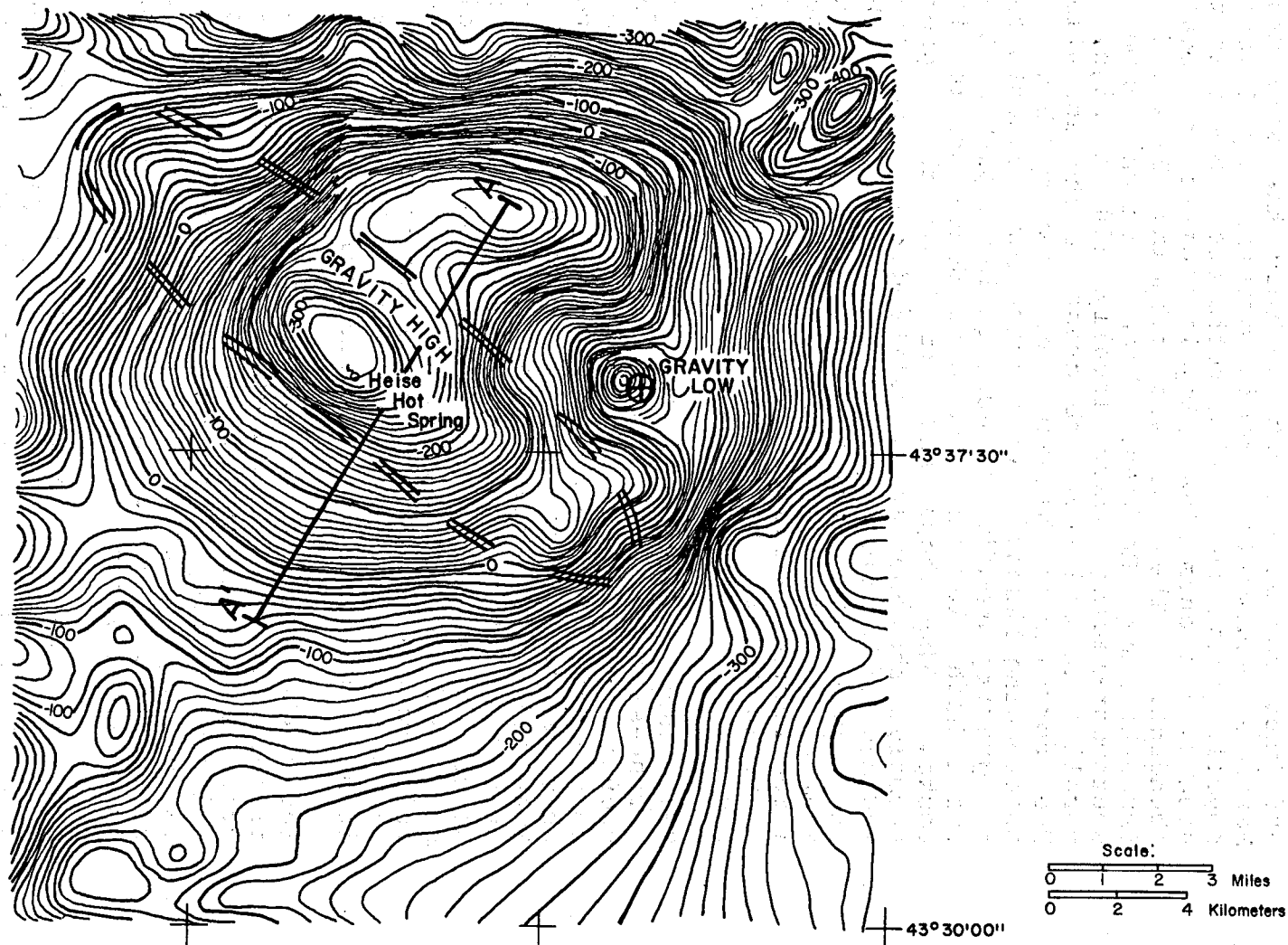
The most prominent local gravity and magnetic anomalies are highs within the Rexburg caldera complex in the area of Heise Hot Springs (figure 77.) Although the crests of the anomalies are coincident, the extent of the anomalies are different and they cannot reflect entirely the same mass. Mesozoic sedimentary rocks overlain by Pliocene rhyolite flows and welded tuffs are exposed in the area of the anomalies. Rhyolite dikes are locally abundant. The northwest-trending Heise fault (Prostka and Hackman, 1974), which forms a southwest-facing scarp locally 300 m high, is parallel to and near the crest of the anomalies. The correlation between the gravity high and outcropping Mesozoic sedimentary rock suggests that the gravity anomaly reflects in large part a structural high elevating the more dense pre-Tertiary rocks. The shape and extent of the magnetic anomaly, the abundant rhyolite dikes in the area, and the indication by the magnetic gradients that the source lies below the surface all suggest that a major part of the magnetic high is produced by a large buried intrusive body. Some features of the magnetic anomaly reflect the near-surface volcanic rocks.

Heise Hot Springs and the warm springs to the northwest occur along the crest of the gravity and magnetic highs. The springs are in a structurally complex area where northwest-trending faults, probably related to the Basin and Range structure of Swan and Grand valleys, displace a structural high over the inferred intrusive body. Although the Heise fault forms a prominent southwest-facing scarp and the presence of the Snake River against this scarp attests to recent movement of the fault, the geophysical data indicate that the Heise fault is near the crest of the structural high.

The north side of the magnetic high is an east-trending zone that coincides with a subtle east trend in the gravity anomaly contours. The zone coincides with west-trending segments of major canyons and is north of the northernmost outcrops of rhyolite. Another east-trending gravity feature is apparent about 5 km farther north.

About 8 km east of Heise Hot Springs are coincident gravity and magnetic lows (figure 78). The cause of the lows is not apparent on the geologic map of Prostka and Hackman (1974). The anomalies appear to reflect a zone in which both the density and magnetization of the underlying rocks are lower than those of the enclosing rocks.

FIGURE 78. Residual aeromagnetic map of the area of Heise Hot Springs showing the location of the gravity high at Heise Hot Springs and a gravity low to the east.



Pincock Hot Spring, on the east edge of the Rexburg caldera, lies midway between two flight lines about 9 km apart on the regional map (figure 78). Along both flight lines a magnetic high was measured opposite the hot spring. Although existing data are not adequate to define this anomaly, the data suggest a magnetic high in the area of Pincock Hot Spring.

A profile (figure 79) normal to the trend of the gravity high shows a section that would produce the major features of the gravity and magnetic fields in the vicinity of Heise Hot Springs. The gravity anomaly is attributed to a high on the surface of the pre-Cenozoic rocks at Heise Hot Springs and to an area of thicker Cenozoic rocks under the valley of the Snake River to the southwest. The depression containing the thicker Cenozoic rocks is parallel to and within a northwestward projection of the Swan-Grand Valley trend into the Rexburg caldera complex. The magnetic anomaly has two major components: a local high at Heise Hot Springs superimposed on broader, more deeply buried source. Both components probably reflect a large body of intrusive rock with the apex near Heise Hot Springs. The intrusive mass, which may be the same age as the rhyolite dikes, lies within the Rexburg caldera complex where the Swan-Grand Valley trend intersects the caldera. Magnetic anomalies suggesting a similar intrusive body occur elsewhere along the southeastern margin of the Snake River Plain, where major Basin and Range structures intersect the plain (Mabey, in press). Along the northeastern part of the profile, the magnetic anomaly appears to reflect both Cenozoic volcanic rock and the underlying intrusive body.

#### SOUTHERN FREMONT COUNTY

One thermal spring in southern Fremont County referred to as Ashton Warm Springs (9N-42E-23daclS) is located outside the Rexburg caldera boundaries near the community of Ashton (figure 51). It seeps into a nearby creek at 41°C. Silica content is quite high, indicating superheated water could be obtained here. The Na-K-Ca chemical geothermometer indicates that a maximum subsurface temperature of 91°C may be obtained. Ashton Warm Springs is close enough to Ashton to represent a significant energy source for low temperature space heating, and uses up to low temperature blanching (figure 4) might be possible if increased flow rates and temperatures could be found through deep drilling. Geophysical and geological studies to determine structure should be pursued before any drilling in the area begins to best site a target prior to any contemplated deep holes.

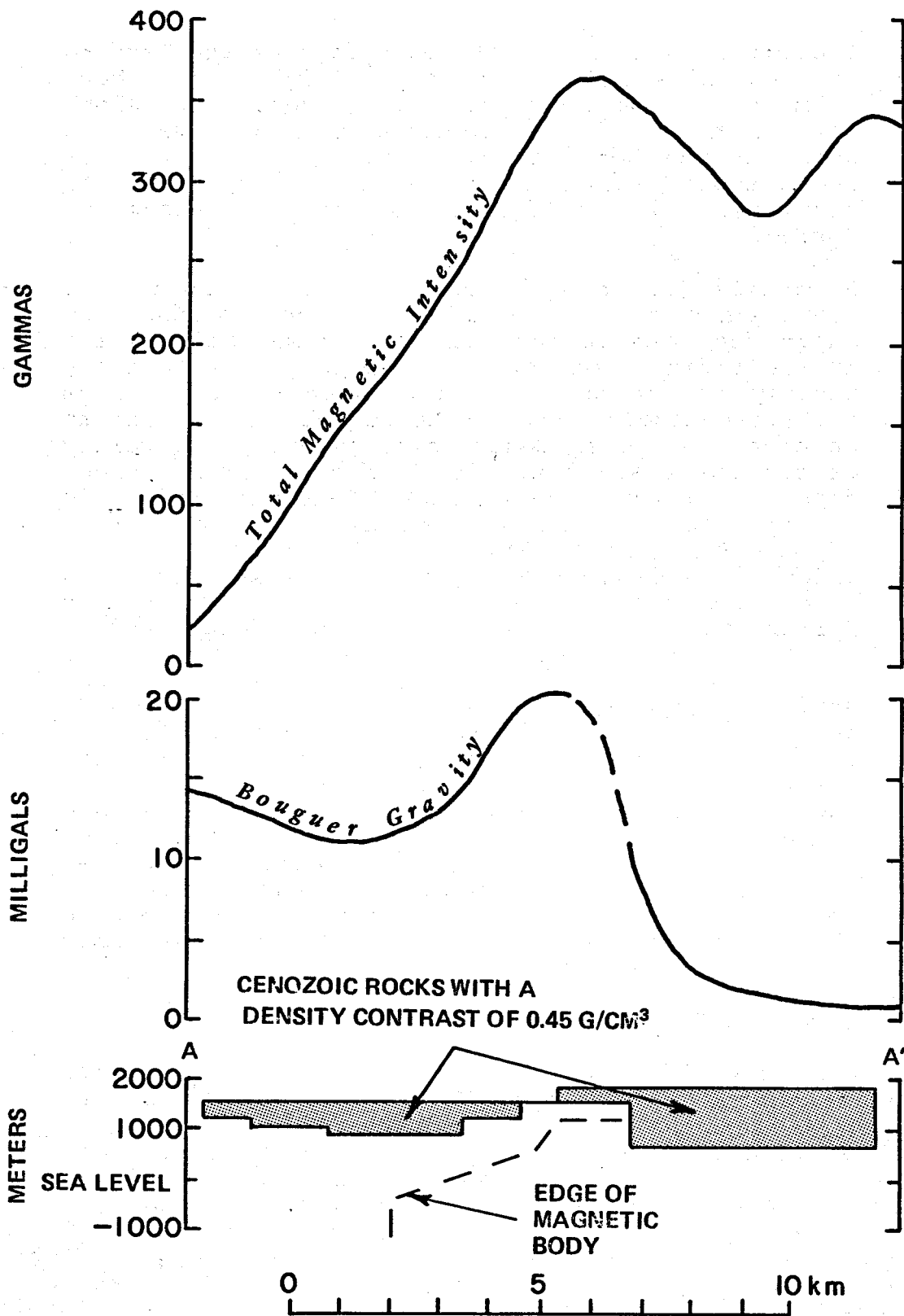


FIGURE 79. Magnetic and gravity profiles and interpreted section across the anomalies at Heise Hot Springs (from Mabey, 1978).

Seventeen thermal wells ranging from 22 to 51°C exist in southern Fremont County in and around the city of Newdale (10 km southeast of St. Anthony). This thermal anomaly seems to be related to the Rexburg caldera previously discussed in the sections on Madison and Jefferson counties. Further work in this area might be oriented toward determining if thermal water could possibly extend further to the northwest, toward St. Anthony.

#### CLARK COUNTY

Three thermal spring areas are known in Clark County (figure 80). Liddy Hot Springs (10N-33E-35ccclS) is located near where the mountain front meets the northern margin of the eastern Snake River Plain. Liddy is located on an active fault and is used presently for phosphate fertilizer processing and in a domestic laundry room. It was formerly used at the Liddy Hot Springs natatorium, which has been closed for several years. Discharge is near a ridgecrest several tens of meters above the Snake River Plain. It is one of the two ridgetop discharges known in Idaho. A well has been drilled near the spring site and the owner reports that water shot to the top of the 12 m drilling mast, so the well apparently is under some degree of shut-in pressure. Surface temperature is 51°C. Best estimated subsurface temperature is 54°C by the chalcedony chemical geothermometer. The Na-K-Ca chemical geothermometer gives an estimate of 65°C as the probable highest temperature that might be obtained from the well.

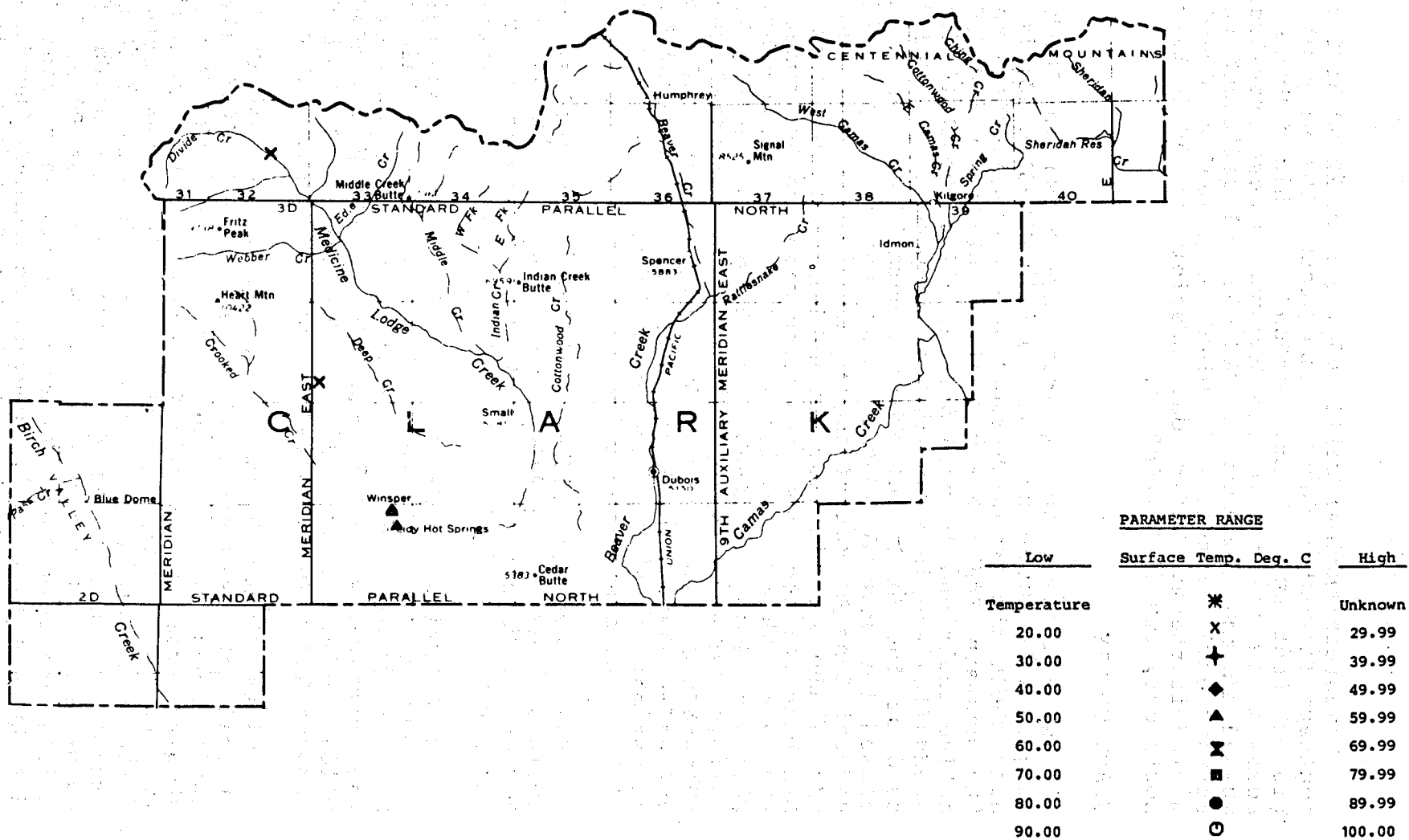
Big Springs (13N-32E-15bcblS) is located on Warm Springs Creek, a tributary to Medicine Lodge Creek in the Beaverhead Mountain Range. It is 23°C and is not used. It discharges 140 l/min. No chemical analysis is available.

Warm Springs (11N-32E-25aac1S) is 29°C, discharging 3400 l/m and is currently used for stock water. Chalcedony and Na-K-Ca chemical geothermometers give an estimate of subsurface temperatures of 25 and 23°C, 4 and 6°C, respectively, below surface temperatures. The quartz chemical geothermometer gives an estimated subsurface temperature of 51°C.

Clark County thermal areas apparently lie on the same thermal water structure or issue from deep rocks similar to those found on the south side of the Snake River Plain, judging from the travertine deposits found in both areas (figure 70). Clark County is the only area north of the Snake River Plain where travertine deposits of large areal extent are known. Commercial quarrying operations for onyx occur here. Water quality appears to be good; dissolved solids are less than 500 mg/l. Flouride content at Liddy Hot Springs is 6 mg/l; however, as maximum subsurface temperatures appear to be not greater than 68°C, limited use



FIGURE 80. Index map of Clark County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

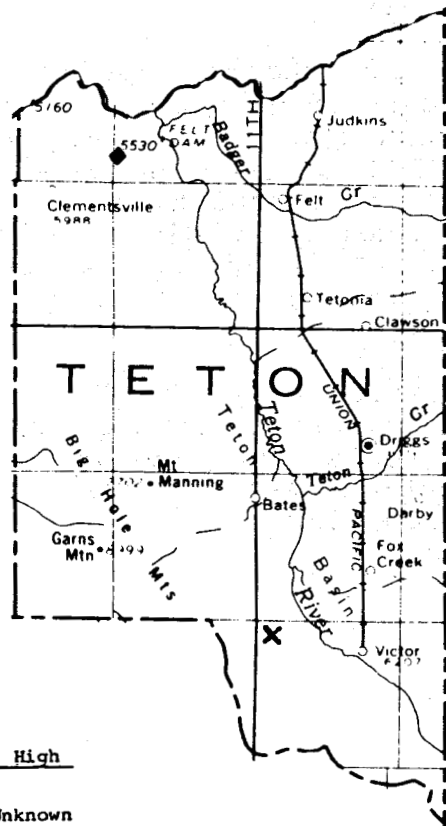


could be made of the thermal water. Uses such as animal husbandry, greenhouse, space heating, and hay and grain drying are suggested in figure 4. Other thermal water might be discovered in Clark County in areas of obvious faulting near travertine deposits provided extinct springs have ceased flowing caused by self sealing from travertine deposition in the thermal water conduits.

#### TETON COUNTY

Only one thermal spring (13N-45E-7baals) is known in Teton County (figure 81). It is located east of Victor near the western flank of the Big Hole range in the Teton Basin. It is 20°C at the surface. Chemical analysis is not available, so speculation on the subsurface temperature cannot be made. It discharges 950 l/min and is used for swimming. This spring is located near a thrust fault in Triassic marine sedimentary rocks near the nose of an anticline.

A thermal well (7N-43E-36aacl), 353 m deep, has been reported in northwestern Teton County. The reported surface temperature is 49°C. The well was not field checked, but the well location seems to "fit" the suspected curvilinear zone outlined on figure 9.



PARAMETER RANGE		
Low	Surface Temp. Deg. C	High
Temperature	*	Unknown
20.00	X	29.99
30.00	+	39.99
40.00	●	49.99
50.00	▲	59.99
60.00	⊗	69.99
70.00	■	79.99
80.00	●	89.99
90.00	○	100.00

FIGURE 81. Index map of Teton County showing locations of thermal water occurrences with surface temperatures of 20°C or higher.

SUMMARY  
BASIN AND RANGE  
CENTRAL ROCKY MOUNTAIN PROVINCE  
SOUTHEASTERN IDAHO

Table 6 shows towns in southeastern Idaho that are near thermal water. These towns probably could be heated by geothermal water if sufficient flow rates and temperatures could be obtained by drilling. School districts could perhaps lower heating costs by developing geothermal heating. New schools or other public buildings planned could be built near thermal water locations. In certain places, as at Preston, Malad, and Soda Springs,  $\text{CaCO}_3$  deposition and high dissolved solids may lead to scaling and disposal problems. In other areas, heat dissipation and objectionable gasses may pose environmental problems. Areas near towns in southeastern Idaho could be evaluated without large capital outlays for exploration as the target areas are limited in size.

Pocatello, due to its large population and industrial base, shows the most promise of the largest impact upon conventional energy supply savings by converting to geothermal energy; the potential in this area should be studied first. Gravity, magnetic, seismic refraction or resistivity studies should be able to pinpoint controlling structure and thermal water occurrence in a limited area near Tyhee, north of Pocatello. Pump tests on existing wells should be conducted to determine aquifer characteristics.

Preston may show promise of power generation. If such is the case, cascading uses could be made of thermal water effluent from the power plant. These uses range from steam electric generation to fish farming (see figure 4).

Malad, Soda Springs, Lava Hot Springs, Rexburg, and Ashton represent towns where an economical assessment of geothermal resources for space heating of business establishments and area subdivisions could be made. Rexburg also has potential to use geothermal heat in food processing plants, as well as to heat large buildings at Ricks College. Other areas may have potential and could see development as well, but assessment might be a little more difficult and costly. The engineering and economic feasibility of retrofitting the above communities for space heating could also be studied.

Wells to tap the geothermal resource would have to be carefully targeted to intersect thermal water bearing structures which, in most cases, appear to be faults.

TABLE 6  
CITIES AND TOWNS IN SOUTHEAST IDAHO WITHIN 5 KM (3 MI) OF A 20°C OR HIGHER THERMAL SPRING OR WELL

(1978)

Town	County	Location	Spring or Well Surface Temperature °C	*Best Estimated Subsurface Temperature °C		Total Dissolved Solids	Present Water Use	Population	Surface Owner	Remarks
				Min. Na-K-Ca	Max. Chalcedony					
Alblon	Cassia	11S-25E-11cca1	60	81	89****	372	Irrigation	243	--	--
Ammon	Bonneville	3N-39E-30adc1	20	--	--	--	Domestic	3,360	Private	No chemical analyses available.
Ashton	Fremont	9S-42E-23dab1S	41	91	116	204	Unused	1,181	Private	Thermal spring just north of town.
Lava Hot Springs	Bannock	9S-38E-21dda1S	45	50	82***	960	Natatorium balneological baths	512	State of Idaho	Recreational area.
Malad	Oneida	14S-36E-27cda1S	25	29	61***	--	Unused	1,848	Private	Spring in travertine bowl near fairgrounds.
McCammon	Bannock	9S-36E-3cdb1	20	--	--	--	Domestic	619	Private	No chemical analyses available.
Newdale	Fremont	7N-41E-35cdd1	32	84	93	377	Irrigation	285	City	Several wells in vicinity of Newdale.
Pocatello	Bannock	5S-34E-26dab11	41	47	62	718	Domestic & Irrigation	42,565	Private	Several wells aligned in a NE direction.
Preston	Franklin	15S-39E-17bcd1	84	125	250**	9,830	Unused	3,284	Private	Geothermometers difficult to interpret.
Rexburg	Madison	5N-40E-36ddb1	26	--	--	--	Irrigation	9,761	Private	No chemical analyses available, not field checked.
Soda Springs	Caribou	9S-41E-12add1S	28	30	54	3,207	Tourism	3,487	City	Really a well drilled near a former spring.
Victor	Teton	3N-45E-7abb1	20	--	--	--	Private swimming	254	Private	No chemical analyses available.
Weston	Franklin	16S-38E-24acd1	23	84	92	566	Irrigation	229	Private	Well 3 km SE of Weston.

\*See first footnote of Table 4.

\*\*Maximum temperature is from Na-K-Ca chemical geothermometer, minimum temperature is from quartz chemical geothermometer.

\*\*\*Maximum temperature is from quartz chemical geothermometer, minimum temperature is from the chalcedony chemical geothermometer.

\*\*\*\*Maximum temperature is from Na-K-Ca chemical geothermometer, minimum temperature is from the chalcedony chemical geothermometer.

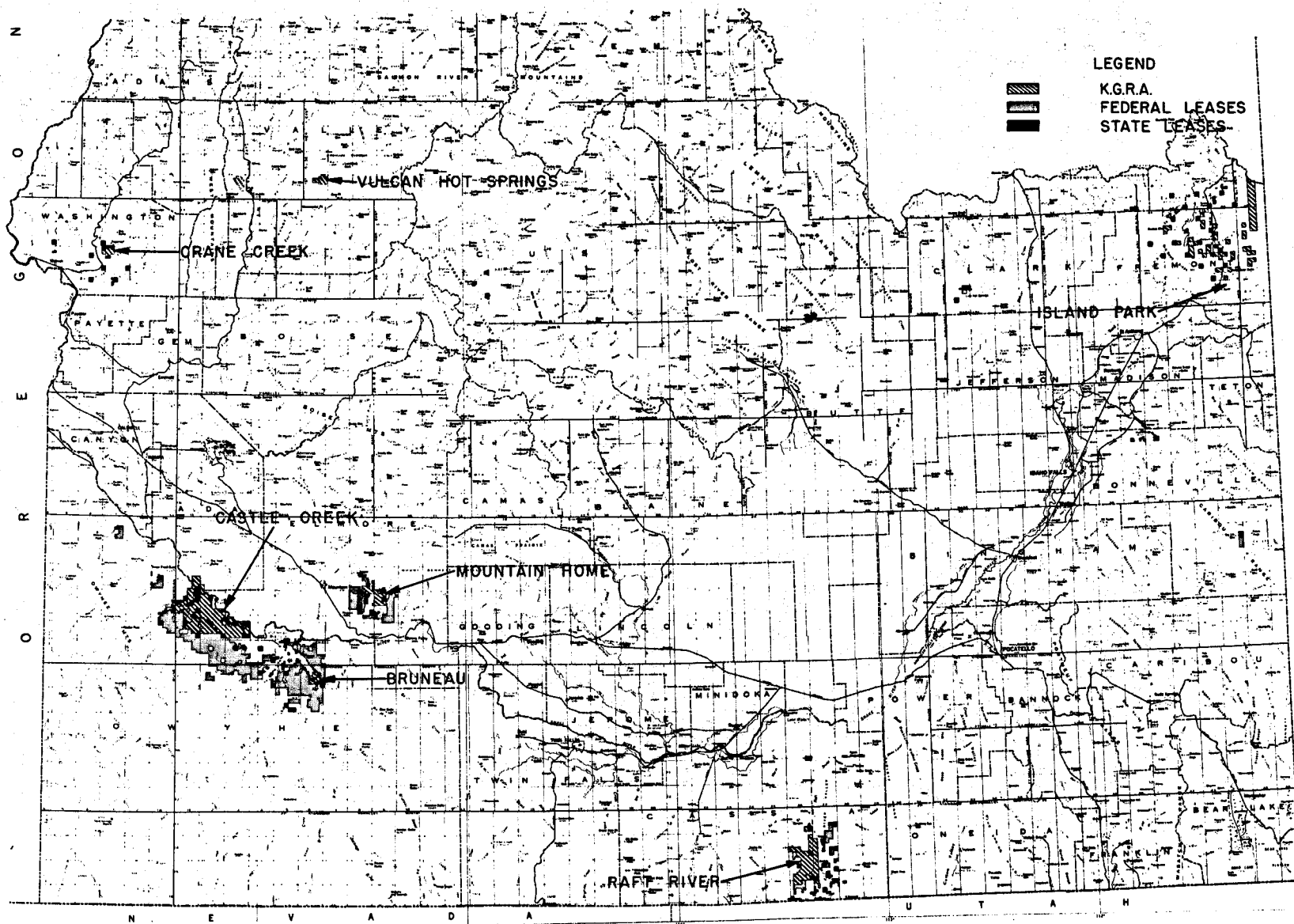
## CONCLUSIONS AND RECOMMENDATIONS

It has become apparent that much of the thermal water discharged through wells and springs is probably of low temperature (<100°C). Much of it discharges near small towns and cities throughout southern Idaho where it could reasonably be used for space heating. Figure 82 shows locations of towns and cities in Idaho within 5 km of a thermal water discharge. In these areas, and to some extent in favorable rural areas, the federal 1978 Energy Tax Act has provided significant incentives for private development. These cities and towns near thermal water discharges represent approximately 30 percent of Idaho's present population.

Prior to the development of any geothermal resource, the prospective developer/user should be sure there is a necessary amount of water appropriated and a drilling permit secured from the IDWR. The subsurface ownership should be checked for ownership of the mineral rights. If not, the developer/user will need to secure a geothermal lease from the appropriate party or agency.

As found in the statewide study done for this report, most of the thermal water is associated with known faults or linear features thought to represent some type of rock fracture. Even the three main thermal aquifers presently known to have thermal water are widespread--Bruneau-Grand View, Blue Gulch-Artesian City, and Nampa-Caldwell areas may ultimately be fed through deep-seated regional fractures. Recharge to the fracture controlled systems could be anywhere along their length and interbasin groundwater transfer may be associated with those that are regional in length. More and perhaps hotter water might be discovered by exploration along faults and fractures throughout the Snake River Plain region. (Drill holes would have to be targeted carefully to intersect the water bearing structure at predetermined depth. Detailed knowledge of the dip, strike, and throw of faults would be needed to site the drill holes.) Reflective seismic profiling and deep electrical resistivity methods appear to be the best methods of delineating fractures containing thermal water in much of the western Snake River Plain region. A systematic program for seismic and resistivity profiling should be initiated in the Western Snake River Plain region and in areas of heavy population density in eastern Idaho, such as Pocatello, Twin Falls, and Idaho Falls, to map fracture patterns, provided geologic conditions are conducive to seismic techniques in these areas.

FIGURE 82. Index map showing known geothermal resource areas (KGRAs) and federal and state leased lands in Idaho (current to October, 1978).



In the Western Snake River Plain region, the faults and linear features associated with thermal water appear to be regional in character, some stretching the length and breadth of the plain. In the Western Snake River Plain, a systematic seismic reflection profiling program should be initiated to cover most of the plain proper where geologic conditions are favorable to seismic reflection techniques. This could be in the Nampa-Caldwell-Boise region and be extended into other areas later on. The seismic profiling could be followed by resistivity surveys of faulted and fractured areas discovered by the seismic profiling. This would provide information on deep water movement, recharge, and discharge areas. It would leave well-defined target areas for large-scale energy users to explore in greater depth.

The small towns and cities outside the Western Snake River Plain could be assessed at relatively small cost as surveys could be concentrated in smaller areas.

The preceding three regional summaries give specific conclusions regarding towns that could receive the most significant and the greatest benefits from further study.



The first part of the report deals with the general situation in the country. It is noted that the economy is in a state of stagnation and that the government is unable to meet its financial obligations. The report also mentions that the population is suffering from a lack of food and shelter, and that the government is unable to provide for their basic needs. The report concludes that the situation is dire and that the government must take immediate action to address the crisis.

The second part of the report deals with the specific situation in the city. It is noted that the city is in a state of chaos and that the government is unable to maintain order. The report also mentions that the population is suffering from a lack of food and shelter, and that the government is unable to provide for their basic needs. The report concludes that the situation is dire and that the government must take immediate action to address the crisis.

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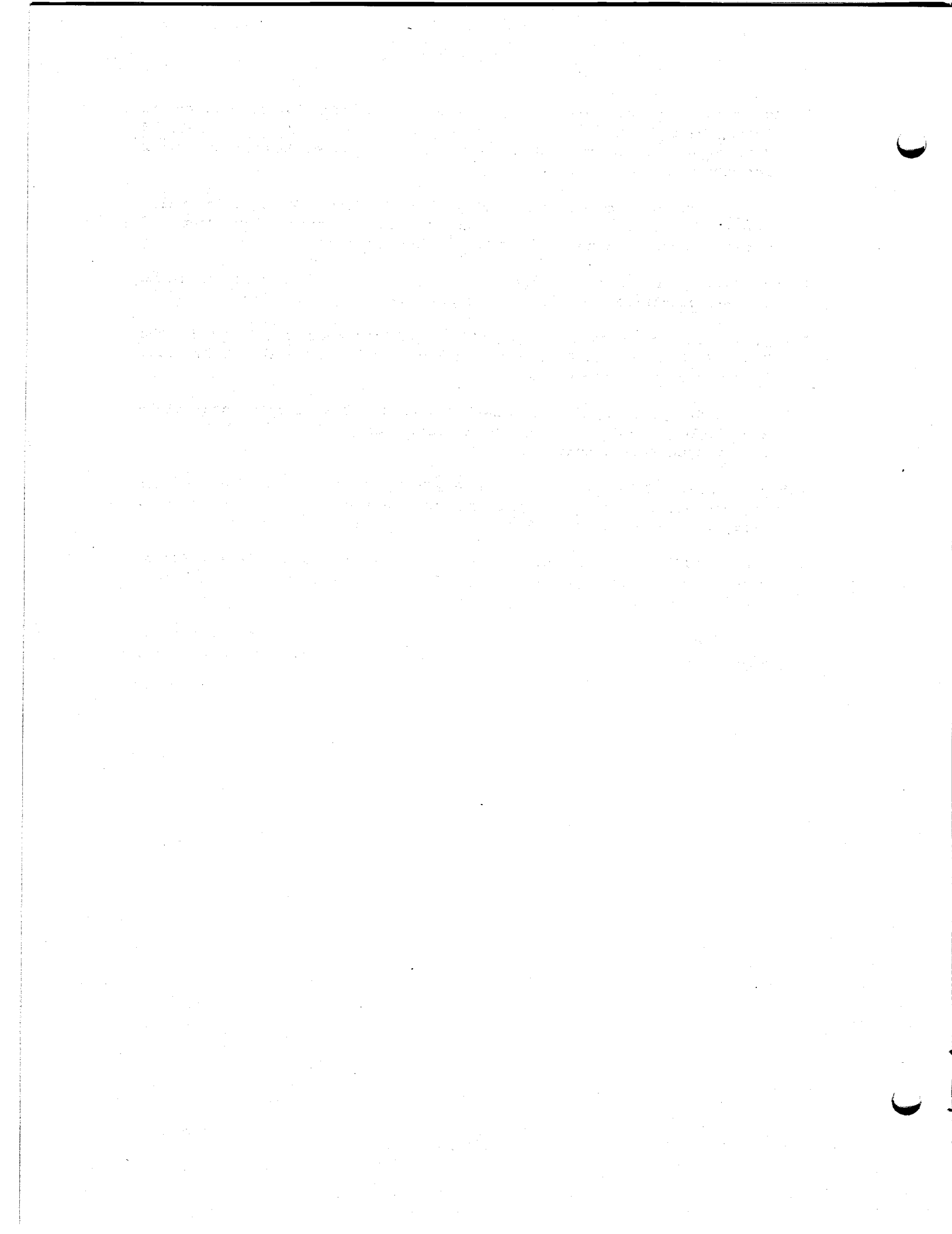
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The basic data tables list information on thermal springs and wells so far as is presently known. In some instances the spring number given in the basic data tables may differ slightly from that found on the map, Geothermal Resources of Idaho, Plate 1, in pocket. The location given in the basic data tables represents a sample location while that given on the map represents that of the main discharge points. When a spring location is given in the text, it refers to the basic data tables.





**BASIC DATA TABLE 1**

BASIC DATA TABLE 1

CHEMICAL ANALYSES OF THERMAL WATER FROM SELECTED SPRINGS AND WELLS IN IDAHO  
(Chemical constituents in milligrams per liter)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth Below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
																						Carbonate	Non-Carbonate					
<u>Ada County</u>																												
LILLIE COLLIAS WELL 1N 1E 1A0C1	8/12/76	25	146.	0.	31	22.0	5.80	48	2.60	149.	0.0	33.00	0.02	17.0	0.70	1.00	0.0	0.0	342	0.1	234	79.	0.	122.	56.0	2.4	-0.198	12
NICHOLSON WELL 1N 1E 25DBA1	8/ 2/76	25	162.	0.	38	17.0	2.60	30	2.30	119.	0.0	15.00	0.01	6.8	0.40	0.76	0.0	0.0	287	7.9	171	53.	0.	98.	53.8	1.8	-2.209	12
AGRI-CON WELL #4 1N 1E 36AAD1	0/ 0/ 0	22	0.	0.	46	377.0	105.00	444	124.00	0.	0.0	528.00	0.0	291.0	0.27	0.0	0.0	0.0	248	7.8	1915	1372.	1372.	0.	38.7	5.2	44.406	12
IDU LAND AND BEEF 1N 2E 6ABA1	5/ 6/54	25	123.	0.	29	14.0	2.90	49	2.10	134.	0.0	22.00	0.0	16.0	1.10	0.0	0.0	0.0	299	8.3	201	47.	0.	110.	68.3	3.1	-1.900	9
TOM BEVINS WELL 2N 1E 22DOB1	0/ 0/ 0	31	0.	0.	26	224.0	6.10	889	99.00	5992.	0.0	1013.00	0.0	227.0	1.60	0.0	0.0	0.0	237	8.1	5431	584.	0.	4910.	73.1	16.0	-40.813	12
GEORGE WHITMORE WELL 2N 1E 24OAD1	0/ 0/ 0	27	0.	0.	30	377.0	44.00	841	99.00	6784.	0.0	1383.00	0.0	390.0	0.56	0.0	0.0	0.0	294	7.6	6500	1122.	0.	5559.	59.4	10.9	-42.094	12
WARREN TOZER WELL 2N 3E 10BCB1	8/ 3/76	20	144.	0.	32	17.0	4.20	14	1.10	77.	0.0	16.00	0.01	7.3	0.30	1.30	0.0	0.0	193	7.9	131	60.	0.	63.	33.3	0.8	-0.592	12
ST. TRANS. DEPT. WELL 2N 3E 28CAC1	8/ 3/76	22	297.	0.	44	23.0	4.90	19	1.60	119.	0.0	7.60	0.05	4.6	0.30	2.00	0.0	0.0	232	7.4	165	78.	0.	98.	34.2	0.9	0.883	12
FEND KOCH WELL 3N 2E 2CBD1	8/10/77	49	0.	76.	39	3.0	0.10	720	0.60	89.	15.00	25.00	0.0	7.3	3.10	0.0	0.0	0.0	320	9.0	856	8.	0.	98.	99.4	111.5	83.400	10
BEARD WELL 3N 2E 11ABC1	10/21/77	76	0.	568.	80	5.5	0.0	89	1.40	120.	19.00	21.00	0.01	3.1	17.00	0.02	0.0	0.09	420	8.5	295	14.	0.	130.	92.6	10.5	1.851	10
WARM SPRINGS WATER DIST 3N 2E 12CDD1	5/31/72	75	122.	727.	78	2.0	0.0	75	1.30	141.	4.00	23.00	0.01	9.3	24.00	0.08	0.0	0.0	386	7.3	286	5.	0.	122.	96.1	14.6	-13.543	3
OLD PENITENTIARY WELL #1 3N 2E 13ACB1	11/ 6/76	59	266.	2649.	42	1.6	0.01	77	0.78	100.	20.00	0.0	0.32	8.9	18.00	0.0	0.05	0.50	402	8.7	217	4.	0.	115.	97.1	16.7	-1.219	10
BOISE WATER CORP. WELL 3N 2E 36ABC1	7/29/77	21	0.	0.	23	19.0	0.80	22	1.10	97.	0.0	14.00	0.0	5.9	0.50	0.28	0.0	0.03	204	7.3	134	51.	0.	79.	47.9	1.3	-3.582	12
DENNIS FLAKE WELL 4N 1E 24OCC1	8/ 9/77	27	310.	95.	60	22.0	2.10	42	5.40	200.	0.0	3.10	0.12	2.6	0.60	0.0	0.0	0.11	310	7.6	236	64.	0.	164.	56.5	2.3	-3.507	10
CARL RUSH WELL 4N 2E 4BDC1	8/ 9/77	29	0.	0.	27	34.0	3.10	30	1.20	150.	0.0	36.00	0.0	3.9	2.00	0.0	0.0	0.02	290	7.3	210	98.	0.	123.	39.7	1.3	-2.235	10
EDWARDS GREENHOUSE WELL 4N 2E 29ACD1	5/31/72	47	364.	0.	46	4.5	0.30	55	2.40	145.	2.00	21.00	0.02	4.4	10.00	0.06	0.0	0.0	311	7.1	216	12.	0.	122.	88.5	6.8	-13.927	3



Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth Below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*	
																						Carbonate	Non-Carbonate						
<u>Bannock County</u>																													
SHOAL SUBDIVISION WELL 5S 34E 260BA1	6/20/79	26	72.	378.	38	93.0	39.00	176	25.00	425.	0.0	156.00	0.0	228.0	2.70	6.90	0.0	0.0	0	0.0	973	392.	44.	348.	47.4	3.9	-2.248	10	
ROBERT BROWN WELL #1 5S 34E 260AB1	7/27/72	41	177.	57.	20	70.0	25.00	150	21.00	478.	0.0	95.00	0.0	87.0	3.20	0.02	0.0	0.0	1170	7.7	706	277.	0.	392.	51.7	3.9	0.700	3	
DEAN MORRIS WELL 9S 36E 30DB1	8/ 7/76	22	8.	0.	25	44.0	9.20	13	1.90	143.	0.0	13.00	0.0	24.0	0.10	0.0	0.0	0.0	349	7.2	200	148.	30.	117.	15.9	0.5	3.373	9	
LAVA H S 9S 38E 21DDA1S	8/15/72	45	0.	0.	32	120.0	32.00	170	39.00	542.	0.0	110.00	0.04	190.0	0.70	0.38	0.0	0.0	1579	6.6	960	431.	0.	444.	43.5	3.6	1.310	3	
DOWNATA H S 12S 37E 12CCD1S	5/17/72	43	0.	1855.	29	43.0	15.00	20	9.10	214.	0.0	18.00	0.0	20.0	0.40	0.50	0.0	0.0	413	6.7	260	169.	0.	175.	19.4	0.7	0.135	3	
<u>Bear Lake County</u>																													
PESCADERO W S 11S 43E 368DA1S	9/12/73	26	0.	38.	31	188.0	65.00	63	14.00	658.	0.0	225.00	0.0	83.0	1.80	0.14	0.01	0.26	169	6.4	994	736.	197.	539.	15.4	1.0	-0.229	10	
BEAR LAKE H S 15S 44E 13CCA1S	5/ 9/72	48	0.	0.	35	210.0	55.00	180	61.00	256.	0.0	800.00	0.01	79.0	7.10	0.56	0.0	0.0	2039	6.6	1553	750.	540.	210.	32.1	2.9	1.937	3	
<u>Bingham County</u>																													
YANDELL SPRINGS 3S 37E 310BB1S	8/18/77	32	0.	568.	22	150.0	35.00	22	7.20	240.	0.0	330.00	0.02	29.0	0.90	0.0	0.0	0.05	950	7.1	714	518.	321.	197.	8.3	0.4	-0.755	10	
ALKALI FLAT W S 4S 38E 280DD1S	8/18/77	34	0.	0.	19	210.0	68.00	34	37.00	640.	0.0	340.00	0.03	17.0	0.90	0.0	0.0	1.10	1529	6.6	1040	804.	279.	524.	8.0	0.5	1.084	10	
<u>Blaine County</u>																													
HAILEY H S 2N 18E 180BB1S	7/11/72	59	0.	265.	85	2.0	0.0	68	1.50	88.	0.0	51.00	0.02	10.0	12.00	0.07	0.0	0.0	337	8.7	272	5.	0.	72.	95.5	13.2	-5.164	3	
CLARENDON H S 3N 17E 27DCB1S	7/11/72	47	0.	378.	80	2.2	0.10	81	1.70	29.	30.00	68.00	0.01	11.0	15.00	0.06	0.0	0.0	400	8.2	303	6.	0.	74.	95.6	14.5	-4.353	3	
GUYER H S 4N 17E 15AAC1S	7/11/72	71	0.	3785.	86	2.9	0.0	84	2.10	51.	25.00	72.00	0.02	11.0	16.00	0.06	0.0	0.0	421	8.0	324	7.	0.	83.	94.8	13.6	-5.779	3	
WARFIELD H S 4N 17E 31BBC1S	10/13/77	62	0.	378.	97	2.6	0.0	67	1.90	55.	37.00	35.00	0.01	8.1	14.00	0.0	0.0	0.01	370	8.7	289	6.	0.	107.	94.2	11.4	-11.009	10	
EASLEY H S 5N 16E 10DBC1S	0/ 0/ 0	37	0.	68.	54	3.8	0.10	69	0.60	24.	28.00	46.00	0.0	5.9	21.00	0.0	0.0	0.0	0	9.2	240	10.	0.	66.	93.4	9.5	-5.416	11	
RUSSIAN JOHN H S 6N 16E 33CCA1S	0/ 0/ 0	35	0.	4.	54	2.3	0.10	70	0.60	25.	29.00	46.00	0.0	6.5	19.00	0.0	0.0	0.0	0	8.8	239	6.	0.	69.	95.7	12.3	-5.364	11	
MAGIC H S LANDING WELL 1S 17E 23AAB1	6/21/72	71	79.	57.	100	22.0	1.30	330	19.00	766.	0.0	60.00	0.04	83.0	13.00	0.06	0.0	0.0	1499	6.4	1005	60.	0.	628.	89.5	18.5	-2.466	8	

MAGIC H S LANDING WELL	15 17E 32AB1	10/29/73	72	79.	38.	103	20.0	0.15	321	23.00	735.	0.0	52.00	0.01	85.0	10.00	0.56	0.06	0.08	0.10	0.08	0.01	376	8.9	310	6.	0.	81.	95.9	15.7	1.346	8
CONDIE H S	15 21E 14DC1S	8/ 8/72	52	0.	1310.	28	56.0	11.00	63	17.00	360.	0.0	28.00	0.01	14.0	1.70	0.05	0.0	0.0	0.10	0.0	0.01	333	8.9	296	6.	0.	57.	95.9	16.2	5.229	8
MILFORD SWEAT H S	15 22E 10AB1S	8/ 8/72	44	0.	76.	26	60.0	12.00	48	8.90	294.	0.0	63.00	0.03	6.5	2.30	0.0	0.0	0.0	0.10	0.0	0.01	353	8.9	296	6.	0.	57.	95.9	16.2	5.229	8
TWIN SPRINGS	4N 6E 24BC1S	7/ 0/55	67	0.	0.	90	2.0	0.0	52	0.80	22.	17.00	22.00	0.0	2.0	4.80	0.0	0.0	0.0	0.10	0.0	0.0	230	9.4	221	5.	0.	80.	95.0	10.1	0.017	1
DANSKIN CREEK H S	8N 5E 18CC1S	6/ 8/72	40	0.	8.	48	2.4	0.10	66	0.90	85.	1.00	42.00	0.01	5.1	3.10	0.25	0.0	0.0	0.10	0.0	0.0	317	8.8	210	6.	0.	71.	95.0	11.3	6.821	3
HOT SPRINGS	8N 5E 60CB1	10/20/77	48	0.	19.	64	3.9	0.0	73	1.30	71.	26.00	24.00	0.01	7.3	15.00	0.01	0.0	0.0	0.10	0.0	0.0	370	8.9	249	10.	0.	102.	93.3	10.2	-1.881	10
DONLAY RANCH H S	8N 5E 1080D1S	8/18/72	55	0.	265.	59	1.9	0.0	68	1.10	40.	30.00	38.00	0.02	5.6	14.00	0.04	0.0	0.0	0.10	0.0	0.0	336	8.6	237	5.	0.	83.	96.0	13.6	-4.113	3
DEER H S	8N 3E 25AC1S	8/ 4/72	80	0.	76.	120	4.5	0.0	130	4.80	160.	0.0	79.00	0.02	34.0	13.00	0.04	0.0	0.0	0.10	0.0	0.0	600	8.1	464	11.	0.	131.	94.2	16.9	0.585	3
KIRKHAM H S	9N 8E 32CB1S	7/14/72	65	0.	946.	69	1.9	0.10	66	1.30	46.	21.00	45.00	0.02	3.0	15.00	0.06	0.0	0.0	0.10	0.0	0.0	322	7.8	244	5.	0.	73.	95.5	12.6	-4.389	3
BONNEVILLE H S	10N 10E 31BC1S	8/18/72	85	0.	1374.	100	2.2	0.10	67	2.90	58.	21.00	52.00	0.03	7.2	17.00	0.02	0.0	0.0	0.10	0.0	0.0	377	8.1	297	6.	0.	83.	93.8	12.0	-10.961	3
FALL CREEK	MINERAL SPG	8/10/72	25	0.	265.	11	440.0	96.00	1110	120.00	1200.	0.0	390.00	0.04	1900.0	1.70	0.05	0.0	0.0	0.10	0.0	0.0	749	6.3	4638	1493.	509.	983.	59.5	12.5	-0.170	3
BROOKMAN CREEK H S	2S 4ZE 26DC1S	10/19/76	35	0.	49.	24	150.0	41.00	2100	34.00	1900.	0.0	2502.00	0.0	590.0	2.60	0.0	0.0	0.0	0.10	0.0	0.0	8649	6.4	6377	543.	0.	1557.	86.6	39.2	1.491	9
ALPINE H S	2S 46E 19CA1S	9/27/77	37	0.	38.	40	560.0	100.00	1500	180.00	880.	0.0	1000.00	0.53	2800.0	2.70	0.05	0.0	0.0	0.10	0.0	0.0	10499	6.5	6615	1808.	1087.	721.	61.5	15.3	-3.802	10
LEWIS ROTHWELL	3N 25E 32DC1	8/ 9/72	41	110.	43.	53	74.0	24.00	72	21.00	322.	0.0	170.00	0.02	21.0	3.20	0.12	0.0	0.0	0.10	0.0	0.0	898	6.3	598	283.	19.	264.	33.5	1.9	-1.293	3
BUTTE CITY	3N 27E 9ABB1	8/ 9/72	35	145.	0.	33	64.0	24.00	31	7.70	315.	0.0	56.00	0.02	22.0	0.80	0.98	0.0	0.0	0.10	0.0	0.0	648	7.2	394	258.	0.	258.	20.1	0.8	-2.174	3
WARDROP H S	13E 32AB1S	6/20/72	66	0.	731.	73	1.4	0.0	54	3.00	51.	37.00	12.00	0.03	5.1	4.10	0.07	0.0	0.0	0.10	0.0	0.0	252	8.0	214	3.	0.	103.	94.1	12.6	-3.553	3
HOT SPRINGS RANCH	13E 32AB1S	10/31/73	60	0.	0.	81	1.0	0.0	56	0.78	45.	36.00	11.00	0.0	5.7	3.70	0.03	0.0	0.0	0.10	0.0	0.0	226	9.2	217	2.	0.	97.	97.2	15.4	-0.719	8
HOT SPRINGS RANCH	13E 32AB1S	10/31/73	67	0.	95.	78	1.0	0.0	56	2.00	58.	30.00	12.00	0.0	5.7	3.50	0.70	0.0	0.0	0.10	0.0	0.0	215	9.2	217	2.	0.	98.	96.0	15.4	0.044	8
HOT SPRING RANCH	13E 32AB1S	10/31/73	64	0.	0.	78	1.2	0.12	55	1.20	54.	32.00	11.00	0.0	5.7	3.20	0.09	0.0	0.0	0.10	0.0	0.0	220	9.2	214	3.	0.	98.	96.0	12.8	-0.638	8
ELK CREEK H S	14WD1S	10/30/73	55	0.	95.	82	2.2	0.12	91	2.00	65.	2.40	44.00	0.0	23.0	18.00	0.10	0.0	0.0	0.10	0.0	0.01	333	8.9	296	6.	0.	57.	95.9	16.2	5.229	8
ELK CREEK H S	14WD2S	10/30/73	55	0.	8.	83	2.4	0.12	92	1.60	96.	1.20	44.00	0.0	23.0	16.00	0.10	0.0	0.0	0.10	0.0	0.01	376	8.9	310	6.	0.	81.	95.9	15.7	1.346	8

Boise County

Bonneville County

Butte County

Camas County

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature, °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Date Reference*
																						Carbonate	Non-Carbonate					
<u>Camas County (cont'd.)</u>																												
ELK CREEK H S 1N 19E 14ADA3S	10/30/73	45	0.	8.	78	2.2	0.0	92	1.60	96.	2.40	48.00	0.01	24.0	17.00	0.86	0.03	0.01	418	8.9	313	5.	0.	83.	96.4	17.1	-1.055	8
LIGHTFOOT H S 3N 13E 70CA1S	10/14/77	56	0.	38.	72	1.7	0.0	82	2.00	110.	16.00	26.00	0.01	16.0	13.00	0.03	0.0	0.11	460	8.7	282	4.	0.	117.	96.3	17.3	-4.026	10
BAUMGARTNER H S 3N 12E 70CD1S	10/14/77	44	0.	76.	44	2.5	0.0	54	0.80	80.	11.00	22.00	0.01	15.0	6.50	0.27	0.0	0.07	270	8.5	195	6.	0.	84.	94.2	9.4	-7.960	10
WORSWICK H S 3N 14E 28CA1S	7/10/72	81	0.	1764.	96	1.8	0.0	69	1.90	51.	28.00	35.00	0.02	5.0	15.00	0.07	0.0	0.0	328	7.3	276	4.	0.	88.	95.6	14.2	-4.773	3
SHEEP H S 1S 12E 16CAB1S	10/31/73	49	0.	0.	68	1.0	0.0	49	0.78	0.	57.00	7.70	0.0	4.2	2.00	0.04	0.0	0.00	208	9.9	189	2.	0.	95.	96.8	13.5	-2.290	8
WOLF H S 1S 12E 16CBA1S	10/31/73	45	0.	0.	68	0.8	0.0	49	0.39	5.	51.00	8.20	0.0	3.2	1.90	0.06	0.0	0.00	206	9.9	184	2.	0.	89.	97.7	15.1	0.706	8
KEITH STROM WELL 1S 12E 31CBC1	6/20/72	31	122.	57.	36	0.6	0.0	32	0.30	31.	26.00	3.30	0.04	2.1	0.80	0.03	0.0	0.0	150	9.2	116	1.	0.	69.	97.4	11.4	-4.176	3
LEE BARRON WELL #1 1S 13E 22CC1	11/ 1/73	26	58.	4.	78	3.0	0.61	86	2.40	193.	0.0	5.30	0.03	10.0	9.80	0.0	1.30	0.02	460	7.8	290	10.	0.	158.	93.5	11.8	-0.888	8
LEE BARRON WELL #2 1S 13E 27CCB1	11/ 1/73	35	58.	303.	83	3.0	0.12	94	1.60	205.	0.0	5.80	0.02	11.0	11.00	0.02	0.48	0.02	491	8.0	310	8.	0.	168.	95.3	14.5	-1.231	8
LEE BARRON WELL #3 1S 13E 27CCB2	11/ 1/73	45	120.	0.	64	2.2	0.12	99	2.00	215.	0.0	9.10	0.03	12.0	10.00	0.02	0.06	0.0	411	8.5	304	6.	0.	176.	96.2	17.6	-1.234	8
BARRON H S 1S 13E 34BCB1S	11/ 1/73	72	0.	38.	84	3.6	0.12	108	3.10	227.	0.0	13.00	0.01	13.0	13.00	0.0	0.06	0.02	335	8.2	349	9.	0.	186.	94.6	15.3	-0.881	8
LEE BARRON WELL #4 1S 13E 34BC1	11/ 1/73	49	0.	0.	84	3.4	0.12	106	2.70	211.	0.0	12.00	0.0	14.0	13.00	0.19	0.02	0.02	347	8.3	339	9.	0.	173.	94.9	15.4	0.463	8
FAIRFIELD CITY WELL 1S 14E 90AA1	8/ 9/77	21	0.	814.	26	5.6	1.10	35	0.60	88.	0.0	6.30	0.0	2.6	2.40	0.0	0.0	0.0	172	8.0	122	18.	0.	72.	79.8	3.5	3.036	12
<u>Canyon County</u>																												
LEONARD TIEGS WELL #1 1N 2N 5ADD1	8/27/75	22	223.	0.	28	45.0	7.80	37	3.40	146.	0.0	72.00	0.0	30.0	0.30	0.0	0.0	0.0	483	8.0	295	144.	25.	120.	35.1	1.3	-2.671	9
DON TIEGS WELL #2 1N 2N 8ACC1	10/ 6/77	22	0.	0.	35	70.0	8.80	46	6.70	110.	0.0	130.00	0.04	55.0	0.20	1.20	0.0	0.07	610	7.5	407	211.	121.	90.	31.3	1.4	1.733	10
MELBA CITY WELL 1N 2N 36CAA1	10/ 6/77	25	0.	757.	42	9.1	2.30	88	3.80	200.	0.0	34.00	0.04	17.0	1.40	0.40	0.0	0.0	420	8.2	296	32.	0.	164.	83.8	6.7	-0.192	10

WESLEY SCHOBEL WELL 2N 2W 34BDA1	6/ 4/79	48	97.	2271.	38	3.3	0.20	131	1.00	227.	16.00	68.00	0.03	28.0	4.10	0.02	0.0	0.0	650	8.7	401	9.	0.	213.	96.5	18.9	-6.272	10
CANNON FARMS WELL #4 2N 3W 22DCC1	5/ 6/54	30	0.	2952.	59	40.0	11.00	55	6.40	242.	0.0	62.00	0.0	7.9	0.50	0.0	0.0	0.0	509	8.2	360	145.	0.	198.	43.8	2.0	-0.551	9
CALDWELL MUNIC. PARK WELL 4N 3W 28AAB1	10/ 5/77	28	67.	568.	49	11.0	0.10	53	2.00	160.	0.0	2.60	0.04	5.4	1.50	0.04	0.0	0.09	280	7.7	203	28.	0.	131.	79.1	4.4	-0.058	10
CALDWELL CITY WELL 4N 3W 35ABD1	10/ 5/77	20	131.	3028.	29	19.0	1.80	37	1.60	140.	0.0	11.00	0.04	6.9	0.80	0.30	0.0	0.05	250	7.6	176	55.	0.	115.	58.6	2.2	-1.773	10

Caribou County

BLACKFOOT RIVER W S 5S 40E 14BDD1S	9/27/73	26	0.	4.	33	674.0	245.00	147	217.00	2357.	0.0	1132.00	0.0	110.0	3.70	0.06	1.30	0.42	470	6.2	3720	2689.	758.	1952.	9.7	1.2	0.210	8
BLACKFOOT RESERVOIR W S 6S 41E 1ADC1S	10/11/73	23	0.	568.	25	232.0	58.00	26	14.00	956.	0.0	70.00	0.0	28.0	2.30	0.03	0.01	0.04	146	6.2	925	817.	34.	783.	6.3	0.4	-0.559	7
CORRAL CREEK WELL #1 6S 41E 19BAA1	9/12/73	42	40.	598.	28	701.0	263.00	101	237.00	2845.	0.0	898.00	0.0	41.0	2.30	0.16	1.20	0.52	4519	6.5	3670	2830.	499.	2331.	6.6	0.8	0.383	7
CORRAL CREEK WELL #2 6S 41E 19BAB1	9/12/73	41	37.	397.	30	620.0	246.00	97	242.00	2763.	0.0	908.00	0.01	43.0	3.50	0.24	1.90	0.47	4519	6.8	3548	2598.	294.	2264.	6.9	0.8	-3.111	7
CORRAL CREEK WELL #3 6S 41E 19BAC1	9/12/73	41	56.	79.	30	697.0	263.00	101	233.00	2723.	0.0	896.00	0.0	40.0	2.40	0.14	1.30	0.52	4589	6.6	3601	2820.	589.	2231.	6.6	0.8	1.731	7
CORRAL CREEK WELL #4 6S 41E 19BAD2	9/12/73	36	64.	42.	30	649.0	253.00	99	233.00	2803.	0.0	884.00	0.0	40.0	2.50	0.15	1.20	0.53	4399	6.6	3568	2660.	363.	2297.	6.8	0.8	-1.624	7
PORTNEUF RIVER W S 7S 38E 26CDD1S	8/23/77	34	0.	189.	38	280.0	64.00	81	62.00	1060.	0.0	270.00	0.06	62.0	0.80	0.0	0.0	0.31	2399	6.2	1379	962.	93.	869.	14.5	1.1	-0.906	10
SODA SPRINGS GEYSER 9S 41E 12ADD1S	9/ 2/73	28	0.	4.	35	851.0	193.00	12	23.00	2613.	0.0	801.00	0.0	5.7	1.60	0.21	0.06	0.05	1959	6.5	3207	2917.	776.	2141.	0.9	0.1	-0.258	7

Cassia County

SIX S RANCH WELL #1 11S 25E 11CCA1	7/26/72	60	136.	7911.	60	8.2	0.50	110	3.90	125.	0.0	59.00	0.0	55.0	14.00	0.0	0.0	0.0	574	7.7	372	23.	0.	102.	89.7	10.1	-2.726	3
SIX S RANCH WELL #2 11S 26E 20DD1	8/ 5/75	32	0.	5095.	46	31.0	0.50	34	3.80	143.	0.0	29.00	0.0	5.9	1.60	0.0	0.0	0.0	310	7.9	222	79.	0.	117.	46.7	1.7	-1.520	9
CRITCHFIELD WELL 11S 26E 28BCB1	7/25/75	35	0.	5095.	47	31.0	0.40	34	4.10	141.	0.0	13.00	0.0	20.0	1.40	0.0	0.0	0.0	0	7.6	220	79.	0.	116.	46.7	1.7	-1.438	9
C & Y RANCH WELL #2 11S 27E 5BAB1	9/ 0/66	29	0.	0.	78	26.0	7.20	100	0.0	230.	0.0	14.00	0.0	90.0	3.40	0.90	0.0	0.0	655	7.6	432	94.	0.	188.	69.7	4.5	-4.275	1
LYLE DURFEE WELL 13S 25E 22BCB1	9/ 0/66	30	0.	0.	18	22.0	5.40	19	0.0	94.	0.0	13.00	0.0	22.0	1.40	0.80	0.0	0.0	238	7.3	147	77.	0.	77.	34.9	0.9	-3.515	1
WARD SPRINGS 13S 26E 17CCD1S	8/ 8/75	21	0.	322.	45	34.0	0.60	14	3.00	92.	0.0	9.50	0.0	25.0	0.50	0.0	0.0	0.0	217	8.2	176	87.	12.	75.	25.0	0.7	-1.138	9
14S 21E 34BDC1	7/26/72	43	0.	189.	47	14.0	1.10	44	9.60	144.	0.0	15.00	0.01	7.0	1.30	0.01	0.0	0.0	282	8.0	209	39.	0.	118.	64.9	3.0	-0.233	3
OAKLEY H S 14S 22E 27CCB1S	10/26/72	47	0.	38.	70	2.7	0.0	87	2.20	43.	29.00	22.00	0.03	33.0	8.00	0.04	0.0	0.0	421	9.6	295	7.	0.	84.	95.2	14.6	-0.952	3



Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)		Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference#			
																					Carbonate	Non-Carbonate	Carbonate	Non-Carbonate								
<i>Cassia County (cont'd.)</i>																																
SEARS SPRING																																
14S 25E 68881S	8/ 5/75	28	0.	662.	22	29.0	7.50	15	3.30	120.	0.0	10.00	0.0	19.0	0.40	0.0	0.0	0.0	270	8.2	165	103.	5.	98.	23.3	0.6	0.365	9				
GRIFFETH-WIGHT WELL																																
14S 26E 18001	0/ 0/ 0	77	1982.	378.	64.	5.0	12.00	14	2.50	116.	124.00	27.00	0.01	62.0	0.0	1.20	1.00	0.0	10000	8.4	368	62.	0.	302.	31.9	0.8	-62.093	10				
HAROLD WIGHT WELL																																
14S 26E 100A1	6/14/77	63	0.	0.	83	1.0	0.20	170	2.90	240.	36.00	25.00	0.0	72.0	7.30	0.50	0.0	0.08	600	9.3	515	3.	0.	257.	98.1	40.6	-3.683	12				
HAROLD WARD WELL #1																																
14S 27E 180001	7/24/75	24	0.	3399.	90	55.0	2.20	170	29.00	131.	0.0	23.00	0.0	300.0	1.10	0.0	0.0	0.0	960	7.6	734	146.	39.	107.	66.8	6.1	-0.457	9				
MORRIS MITCHELL WELL #2																																
15S 21E 290001	9/22/77	46	0.	38.	28	2.0	0.10	110	1.80	230.	11.00	21.00	0.02	17.0	2.40	0.03	0.0	0.08	475	8.7	306	5.	0.	207.	96.9	20.6	-2.673	10				
HAROLD WARD WELL #2																																
15S 24E 2200B1	7/25/72	38	152.	378.	44	37.0	9.30	70	3.10	169.	0.0	33.00	0.03	80.0	2.90	0.56	0.0	0.0	606	7.4	362	131.	0.	138.	53.1	2.7	-1.377	3				
BLM																																
15S 25E 2900C1	10/ 7/76	60	0.	0.	68	3.6	0.10	120	3.40	65.	20.00	40.00	0.0	82.0	7.60	0.0	0.0	0.0	540	8.9	376	9.	0.	87.	95.0	17.0	1.840	9				
BLM																																
15S 26E 12ACC1	12/ 5/74	26	0.	0.	88	300.0	1.40	2000	270.00	58.	0.0	45.00	0.0	3900.0	3.90	0.0	0.0	0.88	998	7.8	6636	754.	707.	48.	79.8	31.7	-1.427	9				
BLM																																
15S 26E 2200D1	12/ 6/74	82	0.	189.	56	56.0	0.50	1300	14.00	63.	0.0	52.00	0.0	2000.0	5.00	0.0	0.0	0.04	6609	8.0	3514	142.	90.	52.	94.7	47.5	0.762	9				
IYAN DARRINGTON WELL #1																																
15S 26E 23AAA1	10/23/75	85	0.	15.	140	43.0	1.00	400	37.00	63.	0.0	40.00	0.0	680.0	9.10	0.0	0.0	0.0	1879	8.1	1381	111.	60.	52.	84.6	16.5	-2.265	9				
FRAZIER H S WELL																																
15S 26E 23BBC1	5/18/72	95	126.	220.	90	53.0	0.40	560	22.00	55.	0.0	57.00	0.0	900.0	5.70	0.54	0.0	0.0	3049	7.4	1715	134.	89.	45.	88.3	21.1	-0.381	3				
HARRIAT CRANK WELL																																
15S 26E 23DDC1	5/18/72	90	165.	227.	97	130.0	0.40	1110	35.00	36.	0.0	61.00	0.01	1900.0	14.00	0.37	0.0	0.0	6089	7.7	3365	326.	296.	30.	86.7	26.7	-0.474	3				
IYAN DARRINGTON WELL #3																																
15S 26E 2300D1	7/30/75	33	0.	0.	53	140.0	8.30	450	19.00	174.	0.0	69.00	0.0	820.0	2.30	1.10	0.0	0.0	2499	7.0	1648	383.	241.	143.	70.6	10.0	0.265	12				
REID STEWART WELL																																
15S 26E 24BAD1	7/24/75	32	0.	3399.	47	100.0	6.30	380	16.00	177.	0.0	65.00	0.0	650.0	1.90	0.0	0.0	0.0	2179	7.3	1353	275.	130.	145.	73.6	10.0	-0.596	9				
IYAN DARRINGTON WELL #4																																
15S 26E 2400C1	7/29/75	31	0.	3399.	55	88.0	7.10	340	16.00	161.	0.0	52.00	0.0	560.0	2.50	0.0	0.0	0.0	1839	7.5	1199	249.	117.	132.	73.3	9.4	1.293	9				
BLM																																
15S 26E 25ACA1	1/14/75	30	0.	83.	88	35.0	3.90	370	34.00	176.	0.0	32.00	0.0	570.0	2.80	0.0	0.0	0.21	1949	7.7	1222	103.	0.	144.	84.6	15.8	-2.119	9				
BLM																																
16S 26E 58BA1	3/28/75	40	0.	151.	37	58.0	9.00	240	13.00	138.	0.0	44.00	0.0	380.0	4.40	0.0	0.0	0.14	1539	6.8	853	182.	69.	113.	72.5	7.7	0.971	9				

Clark County

LIDY H S #1 9N 33E 28BC1S	8/25/72	50	0.	946.	34	87.0	16.00	27	15.00	179.	0.0	190.00	0.03	8.0	6.00	0.02	0.0	0.0	691	6.3	471	283.	136.	147.	16.3	0.7	-1.495	3
LIDY H S WELL 10N 33E 35CC1	8/22/77	59	149.	6813.	37	55.0	14.00	24	12.00	180.	0.0	100.00	0.03	7.1	4.40	0.0	0.0	0.09	490	7.6	342	195.	47.	148.	19.9	0.7	-2.047	10
WARM SPRINGS 11N 32E 29AAC1S	8/28/72	29	0.	7267.	17	54.0	19.00	9	2.90	209.	0.0	62.00	0.02	5.3	1.00	0.12	0.0	0.0	457	7.0	274	213.	42.	171.	9.0	0.3	-2.285	3

Custer County

BOWERY H S 7N 17E 6ABA1S	8/17/72	43	0.	76.	62	22.0	4.50	84	8.40	139.	0.0	110.00	0.0	12.0	12.00	0.0	0.0	0.0	549	7.3	383	73.	0.	114.	68.5	4.3	-2.352	11
PIERSON H S 8N 14E 27DB1S	7/ 3/72	60	0.	49.	70	1.8	0.10	73	1.00	31.	35.00	31.00	0.0	7.8	19.00	0.0	0.0	0.0	331	9.0	253	5.	0.	84.	96.3	14.3	-3.652	11
WEST PASS H S 8N 17E 32BC1S	7/12/72	51	0.	95.	43	21.0	5.50	100	13.00	234.	0.0	94.00	0.02	26.0	8.40	0.06	0.0	0.0	651	6.7	426	75.	0.	192.	70.4	5.0	-6.316	3
STANLEY H S 10N 13E 3CAB1S	7/12/72	41	0.	416.	55	2.2	0.10	60	0.50	30.	28.00	31.00	0.01	5.0	14.00	0.05	0.0	0.0	293	8.8	210	6.	0.	71.	95.2	10.7	-4.042	3
SLATE CREEK H S 10N 16E 30BA1S	7/11/72	50	0.	700.	86	8.1	0.10	83	4.50	110.	0.0	110.00	0.02	7.0	8.70	0.03	0.0	0.0	437	8.0	361	21.	0.	90.	87.3	8.0	-7.145	3
ELKHORN H S 11N 13E 36BA1S	9/ 0/54	57	0.	0.	75	1.0	0.30	72	2.40	20.	38.00	32.00	0.0	6.0	16.00	0.0	0.0	0.0	328	9.6	252	4.	0.	80.	95.8	16.2	-0.602	1
BASIN CREEK W S 11N 14E 21DB1S	7/ 3/72	38	0.	0.	88	2.1	0.0	62	1.20	23.	35.00	38.00	0.0	4.3	14.00	0.0	0.0	0.0	304	8.8	255	5.	0.	77.	95.2	11.8	-6.077	9
MORMON BEND H S 11N 14E 29AB1S	0/ 0/ 0	38	0.	4.	89	2.2	0.10	62	1.50	23.	35.00	38.00	0.0	4.4	14.00	0.0	0.0	0.0	0	8.8	257	6.	0.	77.	94.7	11.1	-6.033	11
SUNBEAM H S 11N 15E 19CAB1S	7/12/72	76	0.	1681.	91	1.5	0.0	85	2.40	119.	0.0	54.00	0.02	12.0	15.00	0.06	0.0	0.0	413	8.5	319	4.	0.	98.	96.4	19.1	-4.741	3
ROBINSON BAR H S 11N 15E 27DC1S	0/ 0/ 0	49	0.	151.	80	2.0	0.40	77	3.60	28.	41.00	57.00	0.0	6.0	12.00	0.0	0.0	0.0	0	9.3	292	7.	0.	91.	93.7	13.0	-3.919	11
SULLIVAN H S 11N 17E 27BD1S	7/12/72	41	0.	265.	38	49.0	11.00	170	15.00	554.	0.0	26.00	0.02	57.0	1.80	0.06	0.0	0.0	1069	7.0	640	167.	0.	454.	66.5	5.7	-0.873	3
BARNEY W S 11N 25E 23CAB1S	7/13/72	29	0.	643.	18	37.0	20.00	9	1.50	181.	0.0	35.00	0.03	4.0	0.50	0.25	0.0	0.0	364	7.8	214	175.	26.	148.	10.0	0.3	0.937	3
BILL JOHNSTON WELL 14N 19E 34DA1	7/12/72	40	915.	189.	23	55.0	21.00	45	7.60	226.	0.0	130.00	0.01	4.0	1.10	0.10	0.0	0.0	625	7.3	397	224.	38.	185.	29.6	1.3	0.188	3
SUNFLOWER FLAT H S 16N 12E 8DB1S	0/ 0/ 0	43	0.	16.	59	4.5	0.0	91	1.60	79.	0.0	100.00	0.0	13.0	12.00	0.0	0.0	0.0	0	7.4	319	11.	0.	65.	93.7	11.8	-1.956	2
THOMAS CREEK RANCH H S 16N 12E 17DA1S	7/ 4/71	43	0.	257.	81	2.1	0.0	82	1.80	54.	28.00	63.00	0.0	10.0	12.00	0.0	0.0	0.0	377	9.0	306	5.	0.	91.	95.9	15.6	-4.483	2
LOWER LOON CREEK H S 17N 14E 19BB1S	7/ 4/71	49	0.	30.	72	2.9	0.0	93	1.30	114.	76.00	51.00	0.0	12.0	12.00	0.0	0.0	0.0	433	8.7	318	7.	0.	123.	95.8	15.0	-3.271	2

Elmore County

CHARLES BAKER WELL 3N 10E 10ABA1	10/14/77	41	90.	19.	67	7.4	0.0	55	0.60	65.	52.00	18.00	0.05	1.9	2.40	0.06	0.0	0.05	260	9.7	236	18.	0.	140.	86.2	5.6	-9.694	10
PARADISE H S 3N 10E 33AC1S	10/14/77	53	0.	946.	73	9.2	0.0	48	1.10	66.	34.00	15.00	0.01	3.2	3.30	0.01	0.0	0.03	230	9.2	219	23.	0.	111.	81.1	4.4	-4.079	10

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*	
																						Carbonate	Non-Carbonate						
<i>Elmore County (cont'd.)</i>																													
PARADISE H S WELL 3N 10E 33BDB1	8/29/72	38	0.	0.	69	1.5	0.10	50	1.00	45.	35.00	17.00	0.03	2.6	3.10	0.04	0.0	0.0	232	9.2	201	4.	0.	95.	95.2	10.7	-4.613	3	
NINEMEYER H S 5N 7E 24BDD1S	8/17/72	76	0.	1321.	100	1.1	0.10	67	1.80	5.	51.00	31.00	0.03	2.9	10.00	0.02	0.0	0.0	295	8.5	267	3.	0.	89.	96.4	16.4	-0.688	3	
DUTCH FRANK'S H S 5N 9E 78BA1S	8/17/72	65	0.	1135.	72	2.2	0.20	57	1.20	17.	40.00	30.00	0.03	2.4	10.00	0.02	0.0	0.0	268	8.6	223	6.	0.	81.	94.0	9.9	-3.980	3	
ATLANTA H S 6N 11E 35DAD1S	7/ 0/55	38	0.	0.	78	3.0	0.40	65	1.60	41.	21.00	39.00	0.0	6.0	14.00	0.10	0.0	0.0	300	9.6	248	9.	0.	69.	92.7	9.4	-1.439	1	
JOHN MALOTA WELL 2S 5E 25BBC1	8/10/76	22	128.	0.	48	17.0	6.90	34	6.50	139.	0.0	19.00	0.01	8.3	0.80	1.30	0.0	0.0	272	8.0	210	71.	0.	114.	48.3	1.8	0.128	12	
LONG TOM RANCH WELL #1 3S 7E 1ACA1	8/13/76	20	53.	0.	59	26.0	5.60	18	5.80	108.	0.0	15.00	0.01	14.0	0.70	2.60	0.0	0.0	273	7.5	199	88.	0.	89.	29.1	0.8	1.406	12	
LESLIE BEAM WELL 3S 8E 36CAD1	8/14/72	68	183.	2649.	86	1.5	0.0	87	0.80	74.	50.00	14.00	0.04	4.5	17.00	0.06	0.0	0.0	382	8.5	297	4.	0.	144.	97.5	19.6	-4.152	3	
LATTY H S 3S 10E 310DB1S	7/ 5/72	55	0.	0.	100	0.4	0.0	54	1.70	90.	33.00	10.00	0.04	2.7	7.00	0.07	0.0	0.0	243	8.4	253	1.	0.	129.	97.4	25.5	-14.838	3	
ROBERT BRUCE WELL 4S 5E 25BBC1	8/16/76	24	162.	0.	41	13.0	2.80	9	3.00	72.	0.0	6.60	0.20	2.3	0.20	0.63	0.0	0.0	128	8.2	114	44.	0.	59.	30.0	0.6	-4.394	12	
BEVERLY OLSON WELL 4S 7E 19BDB1	8/10/76	26	184.	0.	65	23.0	8.10	27	5.60	144.	0.0	19.00	0.01	9.3	1.00	0.78	0.0	0.0	306	8.0	229	91.	0.	118.	37.5	1.2	0.597	12	
NORTHWEST PIPELINE WELL 4S 8E 36BBA1	6/ 6/72	38	579.	30.	86	3.2	0.20	160	3.70	447.	0.0	5.40	0.05	10.0	3.00	0.06	0.0	0.0	703	7.8	491	9.	0.	366.	96.3	23.5	-4.534	3	
BILL DAVIS WELL 4S 9E 8ACA1	8/29/72	62	358.	0.	85	0.9	0.0	82	0.80	81.	41.00	14.00	0.03	3.2	16.00	0.05	0.0	0.0	387	9.2	282	2.	0.	135.	98.2	25.8	-4.076	3	
GARY LAWSON WELL 5S 3E 14CBB1	7/23/73	59	701.	238.	81	2.4	0.0	91	0.80	66.	42.00	10.00	0.05	18.0	23.00	0.0	0.0	0.10	419	9.6	300	6.	0.	124.	96.6	16.2	-3.904	5	
MIKE WISSEL WELL 5S 7E 16ABD1	8/10/76	21	137.	0.	73	51.0	14.00	33	7.80	202.	0.0	77.00	0.02	12.0	1.10	0.15	0.0	0.0	515	7.8	368	185.	19.	166.	26.9	1.1	-0.009	12	
CHARLES BOYD WELL 5S 8E 34BDC1	7/ 5/72	34	402.	8.	58	9.1	1.00	320	11.00	797.	0.0	6.50	0.04	59.0	2.20	0.04	0.0	0.0	1339	7.7	858	27.	0.	653.	94.5	26.9	-0.812	3	
MAGIC WEST CO. WELL 5S 10E 32BDB1	6/22/72	38	285.	204.	46	2.5	0.20	130	0.90	270.	8.00	2.50	0.03	29.0	13.00	0.06	0.0	0.0	590	7.9	364	7.	0.	235.	97.2	21.3	-3.885	3	
CHARLES ANDERSON WELL 5S 11E 7ACC1	6/19/72	32	396.	0.	42	2.5	0.0	79	0.90	115.	16.00	12.00	0.03	6.1	20.00	0.03	0.0	0.0	367	8.5	235	6.	0.	121.	95.9	13.8	-4.459	3	

Franklin County

TREASURTON W S #1 12S 40E 36ACD1S	9/ 6/73	35	0.	38.	54	265.0	68.00	563	127.00	704.	0.0	788.00	0.01	632.0	2.20	0.93	1.30	3.40	4149	6.6	2846	941.	364.	577.	52.6	8.0	0.771	6
TREASURTON W S #2 12S 40E 36ADB1S	9/ 6/73	33	0.	38.	52	259.0	64.00	517	137.00	704.	0.0	755.00	0.01	633.0	1.90	0.37	1.20	3.40	4199	6.6	2765	909.	332.	577.	50.9	7.5	-1.101	6
CLEVELAND H S #1 12S 41E 31CAC1S	9/ 6/73	66	0.	76.	60	208.0	50.00	458	98.00	718.	0.0	533.00	0.01	532.0	1.90	0.11	1.60	2.80	3229	6.4	2294	725.	136.	588.	54.0	7.4	-1.334	6
CLEVELAND H S #2 12S 41E 31CCA1S	9/ 6/73	56	0.	38.	63	172.0	50.00	460	100.00	583.	0.0	538.00	0.01	532.0	1.90	0.76	0.80	2.80	3189	6.5	2204	635.	157.	478.	56.7	7.9	-0.856	6
CLEVELAND H S #3 12S 41E 31CDB1S	9/ 6/73	61	0.	189.	64	178.0	50.00	460	102.00	576.	0.0	530.00	0.01	530.0	1.90	0.21	1.50	2.90	3379	6.5	2199	650.	178.	472.	56.2	7.9	0.194	6
MAPLE GROVE H S 13S 41E 7ACA1S	9/ 5/73	78	0.	76.	84	85.0	30.00	492	82.00	494.	0.0	256.00	0.01	596.0	1.10	0.07	1.40	2.30	2909	6.6	1869	335.	0.	405.	70.8	11.7	-0.057	6
MAPLE GROVE H S 13S 41E 7ACA2S	9/ 5/73	72	0.	378.	85	93.0	29.00	501	82.00	495.	0.0	261.00	0.02	601.0	1.10	0.12	1.30	2.30	2979	6.8	1896	351.	0.	406.	70.5	11.6	0.670	5
MAPLE GROVE H S 13S 41E 7ACA3S	9/ 5/73	60	0.	3539.	86	93.0	25.00	492	80.00	494.	0.0	251.00	0.01	584.0	1.00	0.06	0.90	2.30	2899	6.8	1854	335.	0.	405.	71.0	11.7	0.486	6
BEN MEEK WELL 14S 39E 36ADA1	9/ 5/73	40	4.	0.	89	24.0	6.60	368	22.00	513.	0.0	13.00	0.01	322.0	9.60	0.10	1.10	0.58	1809	6.9	1106	87.	0.	420.	87.4	17.2	0.144	6
ELDIN BINGHAM 15S 39E 7DBC1	8/24/77	63	0.	38.	68	320.0	36.00	4600	770.00	930.	0.0	48.00	0.12	7800.0	3.90	0.0	0.0	4.40	27999	6.2	14103	946.	184.	762.	83.8	65.0	0.469	10
BATTLE CREEK H S 15S 39E 8BDC1S	9/ 5/73	82	0.	189.	109	174.0	19.00	3161	552.00	696.	0.0	35.00	0.01	5241.0	6.00	0.11	7.60	3.50	16619	6.7	9639	512.	0.	570.	84.9	60.8	0.613	6
BATTLE CREEK H S 15S 39E 8BDC2S	9/ 5/73	43	0.	8176.	107	166.0	15.00	3071	535.00	697.	0.0	29.00	0.01	5048.0	6.00	0.42	7.30	3.40	15439	6.5	9320	476.	0.	571.	85.2	61.2	0.786	6
BATTLE CREEK H S 15S 39E 8BDC3S	9/ 5/73	81	0.	0.	109	162.0	19.00	3053	533.00	757.	0.0	37.00	0.01	5034.0	6.00	0.28	7.20	3.60	15949	6.5	9325	482.	0.	620.	85.1	60.5	0.318	6
BATTLE CREEK H S 15S 39E 8BDC4S	9/ 5/73	84	0.	19.	97	215.0	24.00	4184	686.00	610.	0.0	33.00	0.01	6967.0	6.40	0.06	10.00	5.30	18479	6.8	12512	635.	135.	500.	85.7	72.2	1.255	6
SQUAW H S WELL 15S 39E 17BCD1	9/ 4/73	84	2.	435.	124	279.0	24.00	4368	782.00	791.	0.0	35.00	0.02	7398.0	4.30	0.12	8.10	4.30	20459	6.5	13403	795.	147.	648.	84.1	67.4	0.836	6
SQUAW H S 15S 39E 17BCD1S	8/22/73	69	0.	140.	126	271.0	23.00	4184	708.00	816.	0.0	27.00	0.03	6877.0	4.30	0.16	7.30	4.20	20519	6.5	12621	771.	102.	669.	84.4	65.6	1.833	6
SQUAW H S 15S 39E 17BCD2S	9/11/73	73	0.	450.	126	241.0	26.00	3844	533.00	866.	0.0	23.00	0.02	6396.0	4.80	0.06	9.70	4.60	16859	6.6	11619	708.	0.	710.	85.7	62.8	0.046	6
MYRON FONNESBECK WELL 16S 38E 24ABC1	9/ 3/73	23	48.	*****	74	78.0	27.00	68	18.00	418.	0.0	4.30	0.03	91.0	0.50	0.08	0.10	0.42	889	6.8	566	306.	0.	343.	31.0	1.7	-0.017	6

Fremont County

DONALD TRUPP WELL 7N 41E 25CBD1	7/20/76	32	0.	0.	76	23.0	3.30	88	12.00	181.	0.0	26.00	0.0	25.0	6.20	0.0	0.0	0.0	524	7.8	348	71.	0.	148.	68.9	4.5	9.829	9
WAYNE LARSEN WELL 7N 41E 26ACC1	0/ 0/ 0	22	0.	0.	94	19.0	2.70	93	12.00	243.	0.0	23.00	0.0	28.0	7.10	0.0	0.0	0.10	531	8.1	398	59.	0.	199.	73.3	5.3	-1.445	13
HENRY HARRIS WELL 7N 41E 34ADD1	6/16/77	33	0.	0.	64	25.0	5.90	69	6.90	204.	0.0	26.00	0.0	22.0	5.70	0.83	0.0	0.15	450	7.6	325	87.	0.	167.	61.1	3.2	0.083	12
NEWDALE CITY WELL 7N 41E 34CCD1	0/ 0/ 0	32	99.	0.	71	31.0	6.40	73	8.60	236.	0.0	0.0	0.0	29.0	4.70	0.0	0.0	0.10	535	8.0	339	104.	0.	193.	58.1	3.1	4.706	13
WALLACE LITTLE WELL 7N 41E 35CCD1	8/ 9/72	36	122.	0.	75	28.0	6.30	78	8.60	240.	0.0	33.00	0.02	24.0	5.40	0.79	0.0	0.0	538	7.9	377	96.	0.	197.	61.4	3.5	-0.833	3

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth Below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
																						Carbonate	Non-Carbonate					
<u>Fremont County (cont'd.)</u>																												
CLAUDE HAWS WELL 7N 41E 3600A1	6/24/76	32	0.	0.	68	24.0	7.30	44	4.90	188.	0.0	16.00	0.0	12.0	3.00	0.0	0.0	0.0	375	7.5	271	90.	0.	154.	49.9	2.0	-1.575	9
DEAN SWINDELMAN WELL 7N 42E 8CAA1	6/22/76	32	0.	0.	65	38.0	14.00	22	4.80	205.	0.0	8.80	0.0	14.0	2.00	0.0	0.0	0.0	388	7.6	269	152.	0.	168.	23.2	0.8	0.782	9
REMINGTON PRODUCE WELL 7N 42E 19CCA1	7/19/76	26	0.	0.	33	35.0	17.00	15	2.20	144.	0.0	22.00	0.0	24.0	2.20	0.0	0.0	0.0	383	7.9	221	157.	39.	118.	16.9	0.5	3.179	9
ASHTON H S 9N 42E 23DAC1S	8/28/72	41	0.	8.	110	1.1	0.10	36	1.60	92.	0.0	4.70	0.05	2.9	2.20	0.24	0.0	0.0	166	7.6	204	3.	0.	75.	93.8	8.8	-4.591	3
BIG SPRINGS 14N 44E 34BBC1S	8/28/72	12	0.	*****	47	5.6	0.60	14	3.00	46.	0.0	3.20	0.03	2.5	3.10	0.05	0.0	0.0	102	6.4	101	16.	0.	38.	60.0	1.5	-4.456	3
<u>Gem County</u>																												
ROYSTONE H S 7N 1E 800A1S	11/24/72	55	0.	76.	120	8.7	0.60	160	7.70	187.	0.0	110.00	0.04	62.0	16.00	0.0	0.0	0.0	799	7.5	576	24.	0.	153.	91.1	14.2	-2.421	3
EAST ROYSTONE H S 7N 1E 900C1S	8/ 4/72	45	0.	0.	94	15.0	2.40	99	5.30	169.	0.0	57.00	0.02	30.0	8.00	0.67	0.0	0.0	529	7.6	394	47.	0.	138.	79.9	6.3	1.154	3
<u>Gooding County</u>																												
J. SHANNON WELL 4S 13E 28ABB1	6/21/72	47	49.	0.	92	9.8	1.20	100	5.90	278.	0.0	19.00	0.05	8.2	12.00	0.49	0.0	0.0	497	7.0	385	29.	0.	228.	85.5	8.0	-7.062	3
WHITE ARROW H S 4S 13E 30ADB1S	5/26/72	65	0.	3126.	97	1.2	0.0	91	1.60	141.	22.00	15.00	0.03	6.6	12.00	0.11	0.0	0.0	407	7.5	315	3.	0.	152.	97.5	22.9	-1.598	3
DAVE ARCHER WELL 5S 12E 3AAA1	6/19/72	57	211.	0.	62	1.6	0.10	90	0.80	83.	42.00	19.00	0.03	8.4	19.00	0.17	0.0	0.0	413	8.6	283	4.	0.	138.	97.3	16.7	-4.755	3
<u>Idaho County</u>																												
BURGDORF H S 22N 4E 180C1S	8/ 1/72	45	0.	613.	73	2.3	0.0	49	0.80	19.	41.00	18.00	0.02	3.0	2.00	0.03	0.0	0.0	218	8.1	198	6.	0.	84.	94.0	8.9	0.067	3
RIGGINS H S 24N 2E 140BD1S	8/ 1/72	42	0.	189.	72	6.2	0.10	160	3.40	11.	25.00	300.00	0.02	8.0	2.10	0.02	0.0	0.0	812	8.6	582	16.	0.	51.	94.5	17.5	-1.703	3
BARTH H S 25N 12E 180D 1S	0/ 0/ 0	61	0.	742.	70	1.6	0.0	50	0.50	51.	29.00	5.30	0.0	3.6	5.70	0.0	0.0	0.0	0	9.0	190	4.	0.	90.	95.9	10.9	-1.300	2
RED RIVER H S 28N 10E 300D1S	8/21/72	55	0.	132.	76	2.7	0.0	81	1.60	36.	36.00	44.00	0.01	4.4	23.00	0.04	0.0	0.0	380	8.6	286	7.	0.	89.	95.3	13.6	-4.630	3
WEIR CREEK H S 36N 11E 130CC1S	8/23/72	48	0.	151.	49	3.3	0.0	29	0.50	21.	22.00	15.00	0.03	2.1	2.20	0.03	0.0	0.0	148	8.5	133	8.	0.	54.	87.7	4.4	-4.667	3
JERRY JOHNSON H S 36N 13E 18ADD1S	8/23/72	48	0.	1135.	49	2.7	0.20	37	0.40	24.	25.00	25.00	0.04	1.9	1.60	0.03	0.0	0.0	186	8.7	154	8.	0.	61.	90.9	5.9	-3.915	3

Jefferson County

HEISE H S  
4N 40E 29DDA1S 7/27/72 49 0. 227. 30 450.0 82.00 1500 190.00 1100. 0.0 740.00 0.04 2400.0 3.10 0.10 0.0 0.0 0.0 8839 6.7 5936 1460. 558. 901. 65.7 17.1 -1.000 3

Jerome County

ROYAL CATFISH  
INDUSTRY  
9S 17E 29DBB1 5/24/73 43 0. \*\*\*\*\* 74 2.2 0.0 98 1.90 108. 42.00 17.00 0.10 16.0 11.00 0.0 0.0 0.0 454 9.0 315 5. 0. 158. 96.4 18.2 -1.775 9

Lemhi County

CRONKS CANYON H S  
16N 21E 18ADC1S 8/24/72 46 0. 76. 37 11.0 1.40 160 11.00 339. 0.0 66.00 0.04 26.0 7.00 0.06 0.0 0.0 757 7.4 486 33. 0. 278. 88.0 12.1 -1.016 3  
SALMON H S  
20N 22E 3ABD1S 8/24/72 45 0. 549. 33 23.0 11.00 190 28.00 565. 0.0 34.00 0.04 50.0 1.80 0.03 0.0 0.0 1059 6.3 648 103. 0. 463. 74.9 8.2 -1.960 3  
SHARKEY H S  
20N 24E 34CCC1S 8/24/72 52 0. 30. 91 7.3 0.60 270 17.00 470. 0.0 160.00 0.02 51.0 12.00 0.08 0.0 0.0 1269 7.4 840 21. 0. 385. 93.3 25.8 -2.196 3  
BIG CREEK H S  
23N 18E 22CAD1S 7/13/72 93 0. 284. 150 5.3 0.20 220 14.00 488. 0.0 53.00 0.05 29.0 15.00 0.07 0.0 0.0 1009 7.5 726 14. 0. 400. 93.7 25.5 -2.482 3

Madison County

LAVERE RICKS WELL  
5N 40E 9CBA1 0/ 0/ 0 21 98. 0. 42 34.0 12.00 18 3.10 174. 0.0 11.00 0.0 20.0 1.30 0.0 0.0 0.0 341 7.9 226 134. 0. 143. 22.1 0.7 -2.345 4  
MARK RICKS WELL  
5N 40E 8BCC1 6/15/77 26 0. 0. 50 33.0 11.00 20 3.90 170. 0.0 12.00 0.0 12.0 1.70 0.81 0.0 0.03 0 7.6 227 128. 0. 139. 24.7 0.8 0.489 4  
PAULINE SMITH WELL  
5N 40E 9CCC1 0/ 0/ 0 21 140. 0. 40 37.0 15.00 14 2.70 189. 0.0 11.00 0.0 16.0 0.60 0.0 0.0 0.0 365 8.0 229 154. 0. 155. 16.2 0.5 -0.920 13  
GREEN CANYON H S  
5N 43E 68CA1S 8/ 9/72 44 0. 0. 25 140.0 32.00 3 3.60 167. 0.0 330.00 0.01 1.7 1.60 0.13 0.0 0.0 846 6.8 620 481. 344. 137. 1.7 0.1 0.412 3  
WALZ ENTER.  
INC. WELL  
6N 41E 10ACC1 0/ 0/ 0 26 0. 0. 65 31.0 6.90 65 9.00 232. 0.0 26.00 0.0 27.0 3.70 0.0 0.0 0.10 492 7.7 347 106. 0. 190. 54.7 2.7 -1.945 13  
WANDA WOOD  
WELL #1  
6N 41E 10BBB1 0/ 0/ 0 24 81. 0. 66 33.0 7.20 64 8.60 240. 0.0 0.0 0.0 24.0 3.50 0.0 0.0 0.10 493 8.0 324 112. 0. 197. 53.1 2.6 4.162 13  
WANDA WOOD  
WELL #2  
6N 41E 10DBB1 6/16/77 27 0. 0. 80 31.0 7.60 70 8.50 217. 0.0 26.00 0.0 25.0 4.50 1.10 0.0 0.13 470 7.6 360 109. 0. 178. 56.0 2.9 3.029 12

Oneida County

KENT H S  
12S 34E 368CB1S 5/17/72 24 0. 715. 33 56.0 19.00 15 4.30 226. 0.0 18.00 0.0 35.0 0.30 0.73 0.0 0.0 479 6.7 292 218. 33. 185. 12.7 0.4 0.293 3  
MALAD W S  
14S 36E 27CDA1S 5/16/72 25 0. 167. 19 240.0 79.00 1200 210.00 958. 0.0 25.00 0.0 2100.0 0.40 0.95 0.0 0.0 7589 6.5 4345 924. 139. 785. 68.6 17.2 0.370 3  
PLEASANTVIEW W S  
15S 35E 3AAB1S 5/16/72 25 0. \*\*\*\*\* 21 110.0 33.00 280 29.00 331. 0.0 110.00 0.0 470.0 0.70 1.50 0.0 0.0 2189 6.8 1217 410. 139. 271. 57.7 6.0 0.229 3  
WOODRUFF H S  
16S 36E 10BBC1S 5/11/72 27 0. 0. 29 130.0 45.00 910 87.00 454. 0.0 58.00 0.03 1600.0 0.60 1.40 0.0 0.0 5369 7.3 3084 509. 137. 372. 76.1 17.5 -1.735 3

Owyhee County

GIVENS H S  
1N 3W 218BD1S 5/ 0/57 49 0. 0. 75 1.0 0.0 126 1.40 150. 35.00 31.00 0.0 23.0 14.00 0.20 0.0 0.0 582 9.2 380 2. 0. 181. 98.5 34.7 -0.890 1

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (SNa)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*	
																						Carbonate	Non-Carbonate						
<i>Owyhee County (cont'd.)</i>																													
WESLEY HIGGINS WELL 1N 4W 12DBB1	6/13/72	36	195.	1552.	40	2.2	0.0	110	0.30	214.	0.0	8.60	0.01	28.0	7.90	0.04	0.0	0.0	483	7.2	302	5.	0.	175.	97.6	20.4	0.024	3	
EARL FOOTE WELL 1S 2W 7CCB1	6/ 5/72	46	518.	640.	32	1.9	0.0	120	1.20	187.	12.00	45.00	0.01	19.0	11.00	0.04	0.0	0.0	545	8.7	334	5.	0.	173.	97.7	24.0	-1.631	3	
ALFRED HEYWOOD WELL 3S 1E 35DAC1	7/24/73	20	91.	0.	55	43.0	9.90	35	6.00	246.	0.0	25.00	0.07	7.7	2.10	0.01	0.0	0.06	440	7.8	304	148.	0.	202.	32.8	1.3	-3.394	5	
WILLIAM COX WELL #1 4S 1E 250CD1	7/24/73	30	0.	19.	120	25.0	2.90	310	29.00	952.	0.0	5.50	0.25	25.0	0.60	0.02	0.0	0.0	1419	7.3	986	74.	0.	780.	85.8	15.6	-2.564	5	
WILLIAM COX WELL #2 4S 1E 26ABC1	6/ 8/73	27	518.	189.	96	13.0	2.80	250	29.00	763.	0.0	3.60	0.16	13.0	0.60	0.01	0.0	0.78	1159	7.3	783	44.	0.	625.	87.0	16.4	-2.177	5	
T. ADCOCK WELL 4S 1E 290CD1	6/ 5/73	70	927.	5602.	83	1.2	0.0	100	0.80	69.	51.00	39.00	0.01	12.0	12.00	0.0	0.0	0.15	476	9.2	332	3.	0.	142.	98.2	25.1	-2.256	5	
GEORGE KING WELL 4S 1E 34BAD1	6/ 6/72	75	902.	0.	83	1.1	0.20	98	0.70	108.	33.00	40.00	0.03	12.0	12.00	0.05	0.0	0.0	454	7.9	333	4.	0.	144.	97.9	22.6	-3.963	3	
G. CHRISTENSEN WELL 4S 2E 290BC1	7/27/73	28	305.	38.	100	21.0	6.90	330	24.00	1010.	0.0	4.50	0.0	31.0	0.30	0.0	0.0	0.62	1389	7.4	1014	81.	0.	828.	86.6	16.0	-3.016	5	
R. KETTERLING WELL 4S 2E 32BCC1	7/ 9/73	43	824.	95.	110	5.8	0.70	150	8.50	383.	0.0	5.20	0.07	17.0	8.70	0.70	0.0	0.0	699	8.8	494	17.	0.	314.	92.0	15.7	-2.134	5	
C. STEINER WELL 5S 1E 3AAB1	7/24/73	32	579.	0.	120	27.0	1.30	260	29.00	787.	0.0	7.20	0.22	18.0	0.50	0.0	0.0	0.80	1229	7.8	850	73.	0.	645.	83.7	13.3	-0.399	5	
E. LAWRENCE WELL #1 5S 1E 10BDD1	6/ 5/73	64	902.	4542.	83	2.2	0.0	100	0.70	63.	49.00	42.00	0.01	13.0	15.00	0.0	0.0	0.16	514	9.3	335	5.	0.	133.	97.1	18.6	-2.591	5	
E. JOHNSTON WELL #2 5S 1E 21CBC1	6/ 6/73	65	201.	1382.	77	1.3	0.0	100	0.70	57.	50.00	42.00	0.02	13.0	15.00	0.05	0.0	0.17	468	9.2	327	3.	0.	130.	98.1	24.2	-2.404	5	
E. LAWRENCE WELL #2 5S 1E 24ACD1	7/ 9/73	65	756.	7646.	89	1.1	0.0	100	1.30	82.	39.00	41.00	0.01	14.0	15.00	0.78	0.0	0.15	463	9.3	341	3.	0.	132.	98.0	26.3	-2.766	5	
E. LAWRENCE WELL #3 5S 1E 24ADB1	7/24/72	66	951.	4012.	82	1.2	0.10	100	0.80	105.	31.00	45.00	0.23	13.0	14.00	0.04	0.0	0.0	459	7.9	338	3.	0.	138.	98.0	23.6	-4.260	3	
OSCAR FIELDS WELL 5S 2E 18BC1	7/ 9/73	50	549.	95.	77	1.7	0.0	86	0.60	46.	59.00	7.10	0.0	16.0	15.00	0.36	0.0	0.0	423	9.8	285	4.	0.	136.	97.4	18.2	-3.567	5	
CLARENCE HOPKINS WELL 5S 2E 20DA1	6/ 7/73	37	750.	38.	89	9.9	2.00	250	22.00	675.	0.0	3.40	0.06	25.0	6.40	0.01	0.0	0.20	1099	7.5	739	33.	0.	533.	89.9	19.0	-0.335	5	

COX AND LAWRENCE WELL		5S 2E 580D1	6/ 5/73	43	613.	284.	110	5.2	1.10	150	6.70	225.	75.00	8.10	0.04	20.0	8.60	0.0	0.0	0.99	648	9.3	494	17.	0.	308.	92.6	15.6	-2.234	5
H. DRISKELL WELL #1		5S 2E 13ADA1	6/22/73	23	533.	19.	110	13.0	2.60	260	28.00	767.	0.0	3.20	0.10	30.0	1.50	0.0	0.0	0.0	1259	7.6	825	43.	0.	629.	87.8	17.2	-2.750	5
N. MCKEETH WELL		5S 3E 20ADA1	7/13/73	60	738.	0.	110	1.1	0.10	85	0.70	27.	61.00	6.40	0.01	15.0	19.00	0.09	0.0	0.78	396	9.6	311	3.	0.	124.	97.9	20.8	-3.594	5
BURGHARDT CO. WELL		5S 3E 2088B1	7/23/73	27	738.	19.	110	42.0	3.90	230	19.00	703.	0.0	6.70	0.13	30.0	0.50	3.60	0.0	0.79	1129	7.2	791	121.	0.	576.	77.5	9.1	0.973	5
LEROY BEAMAN WELL		5S 3E 22AAD1	6/22/73	25	396.	19.	140	19.0	3.40	250	18.00	683.	0.0	4.00	0.70	38.0	0.70	0.02	0.0	0.20	1279	7.3	809	61.	0.	560.	86.6	13.9	0.490	5
COOK'S GREENHOUSE WELL #		5S 3E 260CB1	6/ 7/73	83	905.	0.	110	2.1	0.0	110	1.70	22.	64.00	62.00	0.02	15.0	15.00	0.01	0.0	0.57	530	9.3	390	5.	0.	125.	97.0	20.9	-0.837	105
COOK'S GREENHOUSE WELL #		5S 3E 260CB2	6/ 8/73	67	905.	0.	100	1.5	0.10	110	1.50	35.	55.00	64.00	0.01	15.0	14.00	0.03	0.0	0.55	529	9.3	378	4.	0.	120.	97.5	23.5	-0.151	205
D. BYBEE WELL #1		5S 3E 278DD1	7/13/73	60	884.	0.	69	1.4	0.10	81	0.90	63.	39.00	12.00	0.0	17.0	20.00	0.25	0.0	0.83	403	9.4	271	4.	0.	117.	97.2	17.8	-6.761	5
A. WHITTED WELL		5S 3E 288CC1	5/31/73	65	774.	0.	98	0.8	0.0	97	1.30	27.	67.00	9.80	0.02	15.0	21.00	0.0	0.0	0.62	437	9.4	323	2.	0.	134.	98.3	29.9	-1.421	5
D. BYBEE WELL #2		5S 3E 350CC1	5/31/73	72	784.	0.	100	2.2	0.0	100	1.10	54.	49.00	72.00	0.03	16.0	15.00	0.01	0.0	0.56	551	9.3	381	5.	0.	126.	96.9	18.6	-7.947	5
IDAHO POWER CO WELL		5S 4E 340CB1	7/20/73	27	111.	0.	94	85.0	7.80	83	12.00	227.	0.0	240.00	0.03	18.0	1.70	0.0	0.0	0.15	845	8.3	653	244.	98.	186.	41.0	2.3	-3.235	5
CHESTER TINDALL WELL		5S 5E 338BD1	7/31/73	22	76.	0.	40	86.0	66.00	170	6.90	425.	0.0	450.00	0.0	50.0	0.60	5.30	0.0	0.30	1649	7.2	1083	486.	138.	348.	42.8	3.4	-1.695	5
CLAY ATKINS WELL		5S 5E 340DD1	7/31/73	25	270.	0.	87	29.0	12.00	190	26.00	625.	0.0	12.00	0.0	24.0	0.60	0.33	0.0	0.70	1099	7.5	688	122.	0.	512.	72.7	7.5	0.719	5
LOWER BIRCH SPRING		6S 1E 328BA1S	7/12/73	25	0.	0.	45	37.0	8.50	22	1.60	126.	0.0	35.00	0.01	21.0	0.50	0.56	0.0	0.03	344	7.2	233	127.	24.	103.	27.0	0.8	1.067	5
L. POST WELL #1		6S 3E 208B1	5/31/73	62	930.	0.	99	1.2	0.0	120	2.80	86.	52.00	45.00	0.02	19.0	17.00	0.01	0.0	0.85	599	9.1	398	3.	0.	157.	97.5	30.2	-1.663	5
L. POST WELL #2		6S 3E 200C1	7/ 6/73	53	991.	2725.	100	1.2	0.10	110	4.00	120.	37.00	27.00	0.02	18.0	17.00	0.03	0.0	0.76	504	9.2	373	3.	0.	160.	96.6	25.9	-2.158	5
W. BUNT WELL		6S 3E 480C1	6/ 4/73	48	512.	0.	110	1.6	0.0	110	6.40	58.	74.00	42.00	0.02	11.0	12.00	0.0	0.0	0.44	534	9.4	395	4.	0.	171.	95.2	25.9	-2.106	5
J. AGENBROAD WELL		6S 3E 50AC1	6/ 4/73	61	1098.	0.	94	4.6	0.0	99	3.40	78.	12.00	20.00	0.01	9.7	11.00	0.08	0.0	0.15	320	8.6	252	11.	0.	84.	89.0	7.6	-1.290	5
NIELSON & CAROTHERS WELL		6S 3E 9ACC1	6/ 4/73	39	434.	6283.	130	3.6	0.10	97	8.10	157.	25.00	42.00	0.06	11.0	9.10	0.0	0.0	0.42	516	8.8	403	9.	0.	170.	91.4	13.8	-4.844	5
TRIANGLE DAIRY WELL #1		6S 3E 110AD1	7/25/73	34	427.	0.	120	5.6	0.30	86	6.10	155.	0.0	33.00	0.12	11.0	11.00	0.03	0.0	0.40	433	8.9	349	15.	0.	127.	89.0	9.6	0.639	5
LITTLE VALLEY IRR. WELL		6S 4E 1AABC1	5/30/73	54	581.	5602.	140	5.0	0.10	110	4.70	20.	74.00	65.00	0.06	19.0	24.00	0.02	0.0	0.54	583	9.4	451	13.	0.	140.	92.7	13.3	-7.328	5
KENT KOHRING WELL #1		6S 4E 25BCC1	6/26/73	20	534.	341.	73	41.0	2.30	95	13.00	129.	0.0	190.00	0.03	14.0	3.90	0.23	0.0	0.13	702	7.8	495	112.	6.	106.	61.7	3.9	0.012	5



Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth Below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Barium (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*	
																						Carbonate	Non-Carbonate						
<i>Owyhee County (cont'd.)</i>																													
DICK WARD WELL 6S 4E 35CDA1	6/26/73	33	303.	0.	96	4.6	0.10	47	8.90	96.	0.0	24.00	0.04	9.0	8.00	0.0	0.0	0.10	273	8.5	244	12.	0.	79.	81.5	5.9	-5.182	5	
COLYER CATTLE CO. WELL 6S 5E 10DD1	7/ 5/73	39	508.	19.	78	2.6	0.30	120	4.30	159.	19.00	24.00	0.02	15.0	29.00	0.04	0.0	0.69	508	8.4	370	8.	0.	162.	95.2	18.8	-2.129	5	
J.R. SIMPLOT WELL #1 6S 5E 18CCB1	6/26/73	27	902.	0.	120	3.9	0.10	100	7.30	93.	25.00	52.00	0.03	20.0	13.00	0.13	0.0	0.54	520	7.6	387	10.	0.	118.	91.8	13.7	0.356	5	
J.R. SIMPLOT WELL #2 6S 5E 20AAB1	5/30/73	44	0.	19.	59	4.7	0.10	110	5.60	198.	18.00	3.70	0.04	17.0	24.00	0.0	0.0	0.95	562	8.8	339	12.	0.	192.	92.5	13.7	-4.796	5	
GEORGE HUTCHINSON WELL 6S 5E 24BCA1	6/25/73	34	334.	19.	89	3.6	0.0	120	4.60	149.	21.00	28.00	0.02	13.0	27.00	0.0	0.0	0.57	509	9.1	379	9.	0.	157.	94.6	17.4	-0.106	5	
BRUNEAU CITY WELL 6S 5E 24DOB1	7/25/73	33	591.	0.	79	2.8	0.0	99	2.30	127.	10.00	35.00	0.05	11.0	25.00	0.0	0.0	0.38	418	9.0	326	7.	0.	121.	95.6	16.3	-2.959	5	
DON DAVIS WELL #1 6S 5E 29DCC1	7/ 5/73	33	476.	19.	120	7.1	0.30	87	6.30	117.	4.00	42.00	0.04	15.0	19.00	0.05	0.0	0.40	435	8.8	358	19.	0.	103.	87.5	8.7	-0.672	5	
CARL & HARRY LOOS WELL 6S 5E 35CCA1	7/19/73	22	140.	0.	73	38.0	3.30	54	8.60	166.	0.0	66.00	0.02	11.0	6.90	0.17	0.0	0.10	462	9.1	342	108.	0.	136.	49.6	2.3	-0.773	5	
IDAHO PARKS DEPT. WELL 6S 6E 12CCD1	7/ 6/73	37	302.	0.	120	10.0	0.60	180	15.00	493.	0.0	3.60	0.07	19.0	5.90	3.00	0.0	0.10	843	8.2	599	27.	0.	404.	89.4	15.0	-1.910	5	
MILDRED BACHMAN WELL 6S 6E 19CCD1	5/22/73	38	278.	19.	88	3.0	0.0	93	3.10	94.	19.00	38.00	0.01	10.0	26.00	0.01	0.0	0.34	457	9.0	326	7.	0.	109.	94.6	14.8	-3.875	5	
BRUNEAU CEMENTARY WELL 6S 6E 19DBD1	7/18/73	42	333.	0.	84	2.3	0.0	94	1.90	87.	24.00	28.00	0.0	10.0	26.00	0.02	0.0	0.34	421	9.2	312	6.	0.	111.	96.2	17.1	-2.650	5	
ACE BLACK WELL 6S 6E 32BDD1	6/25/73	35	427.	95.	87	3.1	0.10	94	3.10	132.	8.00	28.00	0.02	11.0	27.00	0.01	0.0	0.35	413	9.3	326	8.	0.	122.	94.4	14.3	-4.688	5	
WILBUR WILSON WELL #1 6S 7E 1ACB1	8/ 1/73	41	305.	19.	73	7.0	0.60	260	8.00	614.	0.0	3.40	0.0	62.0	4.40	0.0	0.0	0.50	239	8.0	720	20.	0.	503.	94.9	25.3	-1.045	5	
WILBUR WILSON WELL #2 6S 7E 10BD1	8/ 1/73	33	320.	38.	72	8.1	1.20	250	8.20	585.	0.0	3.60	0.0	79.0	3.20	0.02	0.0	0.90	169	8.0	712	25.	0.	479.	93.9	21.7	-2.089	5	
CARL JOHNSON WELL 6S 7E 20DD1	6/25/73	35	412.	19.	75	5.8	0.50	210	7.60	524.	0.0	2.80	0.01	56.0	7.60	0.30	0.0	0.70	951	8.0	623	17.	0.	429.	94.6	22.5	-5.056	5	
SAND DUNES FARMS WELL 6S 7E 8BBA1	7/26/73	23	111.	0.	87	26.0	17.00	240	31.00	530.	0.0	250.00	0.04	17.0	0.70	0.01	0.0	0.28	209	7.0	929	135.	0.	434.	75.0	9.0	-1.708	5	

BILL BURGHARDT WELL #2 7S 3E 4ACD1	6/ 8/73	34	245.	2725.	94	51.0	2.80	31	15.00	214.	0.0	36.00	0.02	7.2	1.70	0.02	0.0	0.08	437	7.4	343	139.	0.	175.	29.9	1.1	-1.210	5
KEITH THOMAS WELL 7S 4E 1ACC1	5/21/73	40	549.	2896.	83	6.9	0.20	53	6.70	79.	100.00	17.00	0.02	8.6	9.70	0.29	0.0	0.10	278	8.6	324	18.	0.	231.	81.2	5.4	-34.337	5
PETE MERRICK WELL #1 7S 4E 3ABD1	6/28/73	42	348.	6283.	95	5.8	0.10	46	7.40	88.	5.00	20.00	0.01	8.7	8.90	0.12	0.0	0.12	272	8.4	240	15.	0.	80.	80.4	5.2	-5.188	5
PETE MERRICK WELL #2 7S 4E 10BDB1	6/11/73	38	349.	1874.	99	7.2	0.10	47	8.30	106.	0.0	24.00	0.04	8.6	9.40	0.26	0.0	0.11	284	8.6	256	18.	0.	87.	77.9	4.8	-6.581	5
FRANK MILLETT WELL #1 7S 4E 11CBC1	6/12/73	36	457.	7475.	99	16.0	0.30	45	9.00	113.	0.0	30.00	0.03	9.3	8.20	1.30	0.0	0.10	312	8.3	273	41.	0.	93.	65.0	3.1	-3.270	5
FARIA BROTHERS WELL 7S 4E 12BDD1	5/21/73	43	337.	0.	96	7.0	0.10	51	7.00	97.	0.0	17.00	0.02	8.4	8.70	0.29	0.0	0.10	293	8.7	243	18.	0.	79.	80.5	5.2	1.994	5
CLARENCE COOK WELL 7S 4E 13BCC1	7/26/73	39	323.	5602.	95	7.3	0.20	49	7.80	89.	6.00	20.00	0.06	8.0	9.00	0.26	0.0	0.10	289	9.0	246	19.	0.	83.	78.6	4.9	-1.866	5
DAVE LATHINEN WELL 7S 4E 13DCD1	5/30/73	40	305.	4750.	97	8.7	0.10	53	7.50	80.	11.00	19.00	0.02	9.0	11.00	0.25	0.0	0.09	261	8.7	255	22.	0.	84.	78.4	4.9	0.200	5
FRANK MILLETT WELL #2 7S 4E 14ABC1	6/12/73	39	349.	6283.	96	7.2	0.10	45	7.80	104.	0.0	18.00	0.04	8.1	6.00	1.20	0.0	0.11	275	8.6	240	18.	0.	85.	77.5	4.6	-2.830	5
ROBERT BLACK WELL 7S 4E 15ACD1	6/12/73	33	325.	*****	100	23.0	0.80	48	9.90	123.	0.0	54.00	0.04	9.9	14.00	0.80	0.0	0.11	359	8.0	320	61.	0.	101.	58.7	2.7	-9.081	5
BLAINE RAWLINS WELL #3 7S 4E 23CB82	6/13/73	39	247.	*****	96	12.0	0.20	58	8.70	108.	6.00	36.00	0.0	11.0	10.00	1.10	0.0	0.0	352	8.4	292	31.	0.	99.	75.1	4.5	-3.571	5
BELL BRAND RANCHES WELL 7S 4E 25ADC1	5/24/73	37	224.	*****	100	6.8	0.10	25	6.40	108.	0.0	29.00	0.04	11.0	15.00	0.58	0.0	0.12	364	8.9	247	17.	0.	89.	68.0	2.6	-37.484	5
GUTHERIES RANCH WELL 7S 4E 26BCB1	7/10/73	31	264.	4920.	91	13.0	0.40	45	8.30	103.	0.0	22.00	0.05	12.0	8.20	0.82	0.0	0.11	300	8.2	251	34.	0.	84.	68.7	3.4	-1.873	5
DAVE LATHINEN WELL 7S 4E 27BCC1	7/10/73	27	424.	5261.	76	16.0	1.30	46	7.70	109.	0.0	28.00	0.06	14.0	6.60	1.90	0.0	0.11	292	8.0	251	45.	0.	89.	64.5	3.0	-1.121	5
ACE BLACK WELL #2 7S 5E 50BC1	6/25/73	32	733.	95.	75	4.4	0.10	63	6.10	87.	4.00	48.00	0.02	9.5	8.20	0.0	0.0	0.17	332	9.0	261	11.	0.	78.	87.7	8.1	-2.290	5
DAVIS BROTHERS WELL #1 7S 5E 7ABB1	7/ 6/73	39	495.	*****	91	8.5	0.20	51	7.40	96.	0.0	17.00	0.04	9.8	9.70	0.95	0.0	0.09	279	8.5	242	22.	0.	79.	77.9	4.7	1.912	5
DAVIS BROTHERS WELL #2 7S 5E 80CC1	5/21/73	40	457.	3066.	90	5.9	0.10	55	6.90	81.	11.00	19.00	0.01	9.3	11.00	0.25	0.0	0.11	291	8.7	248	15.	0.	85.	83.3	6.2	-1.580	5
HARRY LOOS WELL 7S 5E 90DD1	6/14/73	40	630.	3406.	89	12.0	0.50	50	6.80	85.	9.00	18.00	0.0	9.0	11.00	0.71	0.0	0.06	290	8.6	247	32.	0.	85.	72.8	3.8	0.453	5
ROY DAVIS WELL #2 7S 5E 13AAC1	7/17/73	25	46.	1325.	93	18.0	2.30	51	9.20	100.	0.0	50.00	0.04	10.0	10.00	0.15	0.0	0.12	361	8.4	292	54.	0.	82.	62.6	3.0	0.301	5
CARL STEINER WELL 7S 5E 13CBB1	6/21/73	36	596.	0.	83	6.7	0.0	90	7.10	86.	5.00	19.00	0.04	9.0	11.00	0.13	0.0	0.13	284	8.7	233	17.	0.	79.	80.8	5.3	-2.142	5
ROBERT TINDALL WELL 7S 5E 16ACD1	5/30/73	40	462.	0.	90	6.7	0.10	53	6.50	101.	0.0	20.00	0.02	9.8	16.00	0.26	0.0	0.09	278	8.7	252	17.	0.	83.	81.9	5.6	-6.649	5

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
																						Carbonate	Non-Carbonate					
<u>Owyhee County (cont'd.)</u>																												
BELL BRAND INC. WELL 7S 5E 1900C1	7/23/73	37	232.	4428.	95	7.7	0.10	55	7.60	103.	0.0	24.00	0.0	11.0	12.00	0.24	0.0	0.11	309	8.4	263	20.	0.	84.	80.3	5.4	-2.863	5
GENE TINDALL WELL 7S 5E 28ACD1	5/24/73	34	306.	4239.	94	8.3	0.30	52	9.20	97.	0.0	24.00	0.01	9.5	11.00	0.23	0.0	0.11	297	8.6	256	22.	0.	79.	77.0	4.8	-0.525	5
GEORGE TURNER WELL 7S 6E 7AAC1	7/19/73	25	331.	0.	100	2.8	0.10	61	6.80	80.	16.00	23.00	0.03	10.0	10.00	0.01	0.0	0.14	310	9.2	269	7.	0.	92.	89.2	9.8	-3.063	5
COLYER CATTLE CO. WELL 3 7S 6E 9BAD1	7/ 5/73	51	277.	0.	100	1.6	0.30	100	2.80	59.	43.00	27.00	0.04	10.0	24.00	0.06	0.0	0.21	461	9.4	337	5.	0.	120.	96.1	19.0	-0.312	0
R.L. OWENS WELL #2 7S 6E 16CDC1	6/14/73	43	156.	0.	81	7.4	0.40	49	5.10	99.	3.00	18.00	0.0	9.0	8.90	0.33	0.0	0.06	287	8.5	230	20.	0.	86.	80.0	4.8	-3.509	5
HOT SPRINGS RANCH WELL 7S 6E 21DBC1	6/14/73	43	232.	0.	82	5.9	0.30	54	4.60	91.	7.00	18.00	0.0	9.0	12.00	0.28	0.0	0.07	287	8.5	237	16.	0.	86.	84.3	5.9	-4.179	5
R.L. OWENS WELL #4 7S 6E 23BBB1	11/ 0/53	47	0.	0.	75	9.0	1.20	51	6.10	110.	0.0	17.00	0.0	9.0	10.00	1.30	0.0	0.0	287	7.2	233	27.	0.	90.	75.9	4.2	-0.854	1
ROSE WILLIAMS WELL 7S 6E 23CAD1	5/22/73	44	396.	0.	100	12.0	1.10	53	7.20	126.	0.0	17.00	0.01	8.7	8.20	0.54	0.0	0.12	327	8.3	269	34.	0.	103.	72.5	3.9	1.103	5
R.L. OWENS WELL #7 7S 6E 26ADA1	5/22/73	38	305.	3899.	82	16.0	2.80	36	6.90	134.	0.0	15.00	0.02	8.6	3.10	0.66	0.0	0.10	288	8.0	236	51.	0.	110.	56.5	2.2	-4.157	5
JAMES PRESCOTT WELL 7S 6E 27ADB1	6/19/73	43	122.	2044.	84	12.0	1.10	48	6.20	129.	0.0	17.00	0.03	8.6	5.40	0.59	0.0	0.08	287	9.2	246	34.	0.	106.	71.1	3.6	-1.244	5
JEAN PRESCOTT H S 7S 6E 34DCB1S	6/19/73	41	0.	1703.	83	6.2	0.30	55	5.50	103.	6.00	18.00	0.03	8.8	8.50	0.46	0.0	0.01	288	9.1	242	17.	0.	94.	83.4	5.9	-2.243	5
PRESCOTT W S 7S 6E 35BBB1S	7/18/73	40	0.	0.	89	13.0	1.80	43	6.70	126.	0.0	15.00	0.03	8.8	4.50	0.60	0.0	0.11	287	8.5	244	40.	0.	103.	65.9	3.0	-1.934	5
INDIAN BATHTUB H S 8S 6E 38DD1S	7/ 5/73	39	0.	1699.	87	6.5	0.60	53	6.70	113.	5.00	15.00	0.06	9.1	6.00	0.66	0.0	0.08	300	8.3	245	19.	0.	101.	80.9	5.3	-2.148	0
INDIAN H S 12S 7E 33C 1S	6/ 2/72	69	0.	6548.	75	1.5	0.0	75	0.60	67.	30.00	24.00	0.04	8.4	14.00	0.06	0.0	0.0	360	8.0	261	4.	0.	105.	97.3	16.9	-3.409	3
MURPHY H S 16S 9E 24BBB1S	5/23/72	51	0.	265.	83	0.6	0.0	30	2.00	67.	1.00	4.70	0.10	2.3	3.60	0.64	0.0	0.0	137	7.1	160	1.	0.	57.	94.1	10.7	-3.507	3
<u>Power County</u>																												
INDIAN SPRINGS 8S 31E 180AB1S	7/27/72	32	0.	5829.	20	76.0	19.00	110	10.00	254.	0.0	19.00	0.02	220.0	0.70	0.13	0.0	0.0	1099	7.5	599	268.	60.	208.	46.0	2.9	-1.917	3

ROCKLAND WARM SPRINGS  
10S 30E 130C01S 7/27/72 38 0. 1582. 22 92.0 33.00 62 14.00 160. 0.0 23.00 0.02 250.0 0.80 0.02 0.0 0.0 1109 7.6 575 365. 234. 131. 26.0 1.4 0.795 3

Twin Falls County

MIRACLE H S  
8S 14E 31ACB1S 5/24/72 54 0. 1325. 93 2.2 0.0 120 1.50 63. 54.00 29.00 0.03 35.0 20.00 0.50 0.0 0.0 560 9.0 386 5. 0. 142. 97.2 22.3 -1.125 3

HARRY MUTTANUS  
WELL #2  
8S 14E 33CBA1 5/24/72 59 64. 227. 97 1.1 0.0 100 1.50 88. 38.00 26.00 0.03 27.0 15.00 0.54 0.0 0.0 479 8.5 349 3. 0. 135. 97.9 26.3 -4.029 3

ED KERPA WELL  
9S 14E 9ADD1 10/ 8/76 31 0. 1699. 51 7.3 0.30 61 3.20 120. 6.00 27.00 0.0 16.0 3.20 0.0 0.0 0.10 300 9.3 234 19. 0. 108. 84.9 6.0 -3.949 9

SAM HIGH AND SONS  
WELL  
11S 19E 330DD1 5/25/72 33 189. 7305. 63 27.0 3.90 17 8.60 118. 0.0 12.00 0.04 15.0 0.30 1.00 0.0 0.0 266 6.6 205 83. 0. 97. 28.1 0.8 -1.971 3

T. STURGILL WELL  
11S 20E 34CC01 9/ 0/52 32 0. 0. 28 43.0 8.90 11 7.40 186. 0.0 13.00 0.0 5.0 0.70 0.60 0.0 0.0 326 7.5 209 144. 0. 152. 13.5 0.4 -0.515 1

12S 17E 6CBB1 9/28/77 37 0. 7570. 28 37.0 9.90 46 11.00 250. 0.0 20.00 0.01 5.8 2.20 0.09 0.0 0.14 430 7.3 282 133. 0. 205. 40.5 1.7 0.779 10

NAT-SOO-PAH W S  
12S 17E 51BAB1S 7/25/72 36 0. 114. 19 34.0 14.00 43 11.00 266. 0.0 18.00 0.01 8.0 1.90 0.02 0.0 0.0 469 7.6 279 142. 0. 218. 37.4 1.6 -0.602 3

IDAHO STATE WELL  
12S 18E 1BBA1 7/25/72 38 236. 2055. 67 18.0 2.00 16 6.00 95. 0.0 9.30 0.26 8.0 0.60 0.63 0.0 0.0 198 7.6 174 53. 0. 78. 36.4 1.0 -2.647 3

HOLLISTER VILLAGE  
WELL  
13S 17E 7BAB1 9/28/77 35 0. 946. 22 34.0 10.00 44 12.00 250. 0.0 15.00 0.0 5.5 2.20 0.04 0.0 0.13 450 7.2 267 126. 0. 205. 40.4 1.7 0.630 10

MAGIC H S  
16S 17E 30ACA1S 5/23/72 46 0. 1457. 23 30.0 8.90 13 4.50 162. 0.0 15.00 0.03 3.8 0.30 0.42 0.0 0.0 281 6.4 178 111. 0. 133. 19.4 0.5 -4.542 3

Valley County

BOILING SPRINGS  
12N 3E 22BC1S 8/ 3/72 85 0. 625. 94 1.9 0.10 71 1.70 81. 24.00 12.00 0.02 12.0 13.00 0.04 0.0 0.0 331 8.8 269 5. 0. 106. 95.5 13.6 -2.902 3

SILVER CREEK  
PLUNGE  
12N 3E 36DBA1S 10/ 0/55 39 0. 0. 53 2.0 0.40 52 5.10 70. 12.00 20.00 0.0 6.0 7.50 0.20 0.0 0.0 254 9.0 192 7. 0. 77. 89.6 8.8 -0.760 1

CABARTON H S  
13N 4E 31CAB1S 8/ 3/72 71 0. 265. 78 1.7 0.0 100 1.90 70. 26.00 46.00 0.02 49.0 11.00 0.05 0.0 0.0 511 7.7 348 4. 0. 101. 97.0 21.1 -5.041 3

CASCADE CITY WELL  
14N 3E 36ABD1 8/ 3/72 43 15. 0. 45 1.6 0.0 58 0.40 62. 22.00 17.00 0.04 15.0 3.80 0.09 0.0 0.0 275 9.2 193 4. 0. 87. 96.6 12.6 -2.346 3

VULCAN H S  
14N 6E 116DA1S 8/ 2/72 87 0. 1892. 120 1.8 0.10 94 3.00 120. 0.0 43.00 0.02 17.0 24.00 0.05 0.0 0.0 451 8.5 361 5. 0. 98. 95.9 18.5 -3.955 3

ARLING W S  
15N 3E 13BBC1S 8/ 2/72 34 0. 3020. 60 1.3 0.10 60 0.60 17. 45.00 16.00 0.02 16.0 2.60 0.0 0.0 0.0 279 9.8 209 4. 0. 89. 96.7 13.7 -0.475 3

MOLLY'S H S  
15N 6E 14ABB1S 8/ 2/72 59 0. 76. 87 2.0 0.0 70 1.50 48. 30.00 17.00 0.02 10.0 17.00 0.03 0.0 0.0 326 7.7 258 5. 0. 89. 95.7 13.6 -2.277 3

SOUTH FORK PLUNGE  
15N 6E 14CDB1S 8/ 0/55 55 0. 0. 62 4.0 0.30 60 1.30 59. 22.00 14.00 0.0 9.0 12.00 0.20 0.0 0.0 284 9.3 213 11. 0. 85. 91.0 7.8 -0.737 1

PISTOL CREEK H S  
16N 10E 14DBG2S 0/ 0/ 0 46 0. 13. 67 5.0 0.0 83 1.40 98. 0.0 67.00 0.0 12.0 10.00 0.0 0.0 0.0 0 6.3 293 12. 0. 80. 92.7 10.2 0.241 2

SUNFLOWER FLAT HS  
16N 12E 15BBB1S 7/ 3/71 65 0. 136. 82 3.0 0.10 77 1.60 51. 30.00 41.00 0.0 9.0109.00 0.0 0.0 0.0 369 8.8 377 8. 0. 92. 94.4 11.9 -42.244 12

RIVERSIDE H S  
16N 12E 16CBB1S 7/ 4/71 43 0. 0. 75 3.2 0.0 79 1.80 62. 19.00 56.00 0.0 8.9 9.90 0.0 0.0 0.0 377 8.8 283 8. 0. 82. 94.4 12.2 0.466 2

Basic Data Table 1. Chemical Analyses of Thermal Water from Selected Springs and Wells in Idaho (continued)

Spring or Well Identification Number and Name	Sample Collection Date	Measured Surface Temperature °C	Reported Well Depth below Land Surface (meters)	Discharge (l/min)	Silica (SiO <sub>2</sub> )	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO <sub>3</sub> )	Carbonate (CO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Phosphate (PO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Ammonia (NH <sub>3</sub> )	Specific Conductance (field)	pH (field)	Total Dissolved Solids (TDS)	Hardness		Alkalinity as CaCO <sub>3</sub>	Percent Sodium (%Na)	Sodium Absorption Ratio (SAR)	Cation-Anion Balance	Data Reference*
																						Carbonate	Non-Carbonate					
<i>Valley County (cont'd.)</i>																												
HOLDOVER H S 17N 6E 28AA1S	10/18/77	46	0.	95.	67	1.6	0.0	60	1.00	62.	34.00	9.90	0.01	9.8	8.90	0.02	0.0	0.05	280	9.0	222	4.	0.	107.	96.1	13.1	-6.623	10
KWISKWIS H S 17N 10E 11BB1S	0/ 0/ 0	69	0.	57.	77	2.3	0.0	110	2.00	87.	22.00	73.00	0.0	19.0	17.00	0.0	0.0	0.0	0	8.7	365	6.	0.	108.	96.6	20.0	-1.588	2
MID FK INDIAN CRK HS 17N 11E 16ACB1S	0/ 0/ 0	72	0.	6.	110	2.1	0.0	120	3.70	116.	25.00	64.00	0.0	14.0	17.00	0.0	0.0	0.0	0	8.7	412	5.	0.	137.	96.3	22.8	0.410	0
INDIAN CREEK H S 17N 11E 21B 1S	0/ 0/ 0	88	0.	151.	110	2.0	0.0	110	3.60	131.	14.00	62.00	0.0	14.0	18.00	0.0	0.0	0.0	0	8.6	398	5.	0.	131.	96.1	21.4	-2.802	2
COX H S 17N 13E 27AAC1S	0/ 0/ 0	55	0.	68.	69	1.9	0.0	84	1.00	83.	20.00	42.00	0.0	9.0	15.00	0.0	0.0	0.0	0	8.8	282	5.	0.	101.	96.8	16.8	-2.213	2
HOSPITAL H S 17N 14E 5CBC1S	0/ 0/ 0	0	0.	8.	55	3.4	0.0	87	1.30	149.	0.0	43.00	0.0	14.0	13.00	0.0	0.0	0.0	0	8.3	289	8.	0.	122.	94.9	13.0	-5.208	2
TEAPOT H S 18N 6E 9ADC1S	10/18/77	60	0.	95.	69	2.3	0.0	63	1.20	66.	31.00	12.00	0.01	6.2	9.90	0.0	0.0	0.07	360	8.9	227	6.	0.	106.	95.0	11.4	-3.033	10
HOT CREEK W S 18N 8E 17DBA1S	9/ 0/58	35	0.	0.	60	3.0	0.0	63	1.80	58.	12.00	45.00	0.0	10.0	6.40	0.0	0.0	0.0	343	8.7	229	7.	0.	68.	93.3	10.0	0.151	1
<i>Washington County</i>																												
COVE CREEK H S 10N 3W 9CCC1S	8/ 9/73	74	0.	19.	130	20.0	0.20	320	22.00	107.	0.0	310.00	0.12	310.0	4.70	0.0	0.0	7.80	1939	7.4	1169	51.	0.	88.	89.8	19.5	-5.286	4
ELVIN CRAIG WELL 11N 2W 16AAB1	8/14/75	20	41.	0.	81	31.0	19.00	26	13.00	283.	0.0	11.00	0.0	2.2	0.30	0.0	0.0	0.0	440	8.0	322	155.	0.	232.	24.7	0.9	-3.909	9
CRANE CREEK H S 11N 3W 7BDB1S	8/ 2/73	92	0.	19.	180	29.0	0.50	280	18.00	201.	0.0	250.00	0.0	200.0	3.20	0.01	0.0	10.00	1629	7.8	1059	74.	0.	165.	86.2	14.1	-0.795	4
CRANE CREEK H S 11N 3W 7BDB2S	8/ 2/73	57	0.	19.	190	29.0	0.60	280	19.00	202.	0.0	250.00	0.0	200.0	3.20	0.03	0.0	10.00	1569	8.0	1071	75.	0.	166.	86.0	14.1	-0.762	4
DOUGLAS MCGINNIS WELL 11N 5W 20BDD1	8/ 9/73	21	59.	0.	54	31.0	5.30	21	6.90	136.	0.0	25.00	0.0	6.8	0.50	1.80	0.0	0.00	271	7.2	219	99.	0.	111.	29.7	0.9	0.684	4
11N 6W 3DBB1	8/ 8/73	24	183.	0.	542	4.4	0.0	120	0.60	67.	0.0	180.00	0.03	28.0	1.90	0.01	0.0	2.00	624	8.6	909	11.	0.	55.	95.7	15.8	-2.680	4
GLENN HILL WELL 11N 6W 3DCB1	8/ 7/73	25	66.	0.	577	4.0	0.10	130	1.20	15.	36.00	150.00	0.0	55.0	0.60	0.0	0.0	2.40	579	7.4	961	10.	0.	72.	96.0	17.5	-2.274	4
WEISER H S 11N 6W 10ACB1S	8/ 6/73	22	0.	19.	31	12.0	1.80	50	1.40	44.	0.0	53.00	0.08	17.0	1.20	8.00	0.0	0.82	335	7.3	197	37.	1.	36.	73.5	3.6	7.097	4
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	8/ 2/73	78	28.	0.	140	2.6	0.0	140	4.80	32.	37.00	150.00	0.0	56.0	2.90	0.01	0.0	2.10	734	9.2	549	6.	0.	88.	96.0	23.9	-2.265	4

GEOSOLAR GROWERS																														
WELL #2																														
11N	6W	10CCA2	8/23/73	77	31.	0.	130	2.7	0.10	140	5.30	33.	41.00	150.00	0.01	52.0	3.90	0.01	0.0	2.20	683	9.1	541	7.	0.	95.	95.6	22.8	-2.698	4
GEOSOLAR GROWERS																														
WELL #3																														
11N	6W	10CCA3	8/ 2/72	70	122.	0.	140	2.9	0.0	140	5.00	35.	38.00	150.00	0.06	56.0	3.30	1.00	0.0	2.20	7299	9.3	553	7.	0.	92.	95.7	22.6	-2.856	4
MIDVALE CITY WELL																														
13N	3W	80CC1	6/28/72	28	294.	0.	84	8.7	0.80	73	23.00	225.	0.0	14.00	0.04	3.1	0.70	0.04	0.0	0.0	338	8.3	318	25.	0.	184.	74.5	6.4	1.122	3
FAIRCHILD LUMBER CO.																														
13N	4W	13BAC1	6/28/72	28	412.	0.	73	3.5	0.20	86	0.70	188.	20.00	14.00	0.03	3.2	0.70	0.04	0.0	0.0	375	8.5	293	10.	0.	187.	94.7	12.1	-3.114	3
LAKEY H S																														
14N	2W	68BA1S	6/28/72	70	0.	1631.	72	17.0	0.10	200	3.80	24.	20.00	200.00	0.09	140.0	1.90	0.06	0.0	0.0	999	7.8	666	43.	0.	53.	90.1	13.3	1.830	3
CAMBRIDGE CITY WELL																														
14N	3W	30DC1	6/28/72	26	282.	0.	70	2.6	0.20	73	6.80	157.	16.00	15.00	0.04	3.8	1.00	0.04	0.0	0.0	309	8.7	265	7.	0.	155.	90.8	11.7	-1.722	3
FAIRCHILD H S																														
14N	3W	19CB01S	6/27/72	50	0.	220.	55	8.0	0.80	80	1.90	81.	1.00	110.00	0.05	15.0	0.80	0.30	0.0	0.0	406	8.5	312	23.	0.	68.	87.1	7.2	-2.676	3



**BASIC DATA TABLE 2**



BASIC DATA TABLE 2

ESTIMATED AQUIFER TEMPERATURES, ATOMIC AND MOLAR RATIOS OF SELECTED CHEMICAL CONSTITUENTS, FREE ENERGIES OF FORMATION OF SELECTED MINERALS, PARTIAL PRESSURES OF CO<sub>2</sub> GAS AND R VALUES FROM SELECTED THERMAL SPRINGS AND WELLS IN IDAHO

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios							Molar Ratios							Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium						
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	K	Na	Mg	Ca	Cl	Br	I	F	S	Ca	CO <sub>3</sub>	Cl	NH <sub>4</sub>	NH <sub>4</sub>	Cl			SO <sub>4</sub>	Ca	Na	Quartz	Chalcedony	Amorphous Silica
			Na	Ca	Mg	Ca	Cl	Br	I	F	S	Ca	CO <sub>3</sub>	Cl	NH <sub>4</sub>	NH <sub>4</sub>	Cl	SO <sub>4</sub>	Ca	Na	Quartz	Chalcedony	Amorphous	PCO <sub>2</sub>	Mg** Mg+Ca+K													
<u>Ada County</u>																																						
LILLIE COLLIAS WELL 1N 1E 1ADC1	0.	25	80	84	-31	49	48	122	113	97	91	999	86	0	31.4	3.80	0.43	13.02	0.0	14.90	0.26	0.22	0.19	0.0	0.0	1.40	11.22	0.93	0.34	-0.38	0.00119	0.0						
NICHOLSON WELL 1N 1E 25DBA1	0.	25	89	91	-24	58	45	154	120	154	128	103	92	88	22.2	3.08	0.25	9.11	0.0	20.15	0.33	0.22	0.10	0.0	0.0	1.23	15.78	1.05	0.47	-0.26	0.00155	0.0						
AGRI-CON WELL #4 1N 1E 36AAD1	0.	22	97	99	-17	67	232	232	346	232	265	167	229	96	6.1	2.05	0.46	577.65	0.0	661.92	0.49	0.0	0.0	0.0	0.0	1.49	5.02	1.23	0.63	-0.08	0.0	28.2						
IDU LAND AND BEEF 1N 2E 6ABA1	0.	25	78	81	-34	46	50	102	50	999	72	999	0	0	39.7	6.10	0.34	7.80	0.0	6.03	0.16	0.16	0.20	0.0	0.0	1.97	8.77	0.88	0.29	-0.43	0.00067	0.0						
TOM BEVINS WELL 2N 1E 220DB1	0.	31	73	77	-37	41	195	185	196	129	999	47	999	0	15.3	6.92	0.04	76.04	0.0	66.37	0.14	0.06	0.06	0.0	0.0	0.61	1.93	0.73	0.16	-0.58	0.04476	3.5						
GEORGE WHITMORE WELL 2N 1E 24DAD1	0.	27	79	83	-32	48	192	177	203	114	999	83	999	0	14.4	3.89	0.19	373.26	0.0	319.14	0.26	0.08	0.10	0.0	0.0	0.76	2.65	0.91	0.33	-0.40	0.15199	14.5						
WARREN TOZER WELL 2N 3E 10BCB1	0.	20	82	85	-30	50	21	157	21	117	108	999	94	0	21.6	1.44	0.41	13.04	0.0	26.86	0.70	0.34	0.16	0.0	0.0	1.24	33.82	1.04	0.44	-0.27	0.00093	0.0						
ST. TRANS. DEPT. WELL 2N 3E 28CAC1	0.	22	95	97	-19	65	27	164	105	243	161	224	96	96	20.2	1.44	0.35	8.22	0.0	36.34	0.69	0.29	0.07	0.0	0.0	1.64	28.99	1.20	0.60	-0.11	0.00471	0.0						
FERD KOCH WELL 3N 2E 20BD1	76.	49	90	92	-23	59	34	34	-67	34	109	103	999	62	02040.9	418.41	0.05	1.26	0.0	0.46	0.00	0.05	0.12	0.0	0.0	0.79	0.28	0.42	-0.10	-0.88	0.00009	0.0						
BEARD WELL 3N 2E 11ABC1	568.	76	125	122	6	97	62	62	37	62	164	131	75	58	0	108.1	28.21	0.0	0.10	10.49	0.15	0.04	0.07	0.04	0.0	0.0	0.40	3.03	0.56	0.12	-0.70	0.00065	0.0					
WARM SPRINGS WATER DIST 3N 2E 120DD1	727.	75	123	121	5	95	79	79	42	69	162	130	75	58	0	98.1	65.38	0.0	0.21	0.0	0.04	0.02	0.02	0.11	0.0	0.0	1.09	2.17	0.71	0.27	-0.55	0.01609	0.0					
OLD PENITENTIARY WELL #1 3N 2E 13ACB1	2649.	59	93	95	-20	63	68	68	15	68	111	104	999	53	0	167.9	83.90	0.01	0.27	5.42	0.04	0.01	0.02	0.13	0.01	0.00	0.0	1.89	0.38	-0.11	-0.91	0.00028	0.0					
BOISE WATER CORP. WELL 3N 2E 36ABC1	0.	21	68	73	-41	36	22	22	115	89	999	999	999	0	0	34.0	2.02	0.07	6.32	59.92	18.01	0.50	0.30	0.10	0.0	0.0	1.14	22.75	0.84	0.24	-0.48	0.00480	0.0					
DENNIS FLAKE WELL 4N 1E 24DDC1	95.	27	110	110	-6	81	68	68	215	131	999	174	282	0	95	13.2	3.33	0.16	2.32	7.20	17.38	0.30	0.17	0.02	0.0	0.0	2.27	12.82	1.30	0.72	-0.01	0.00538	0.0					
CARL RUSH WELL 4N 2E 4BDC1	0.	29	75	79	-36	43	18	18	97	77	999	55	999	0	0	42.5	1.54	0.15	1.05	59.41	8.06	0.65	0.35	0.04	0.0	0.0	0.29	22.32	0.79	0.22	-0.52	0.00829	0.0					
EDWARDS GREENHOUSE WELL 4N 2E 29ACD1	0.	47	97	99	-17	67	78	78	104	91	126	117	91	70	56	39.0	21.31	0.11	0.24	0.0	0.21	0.05	0.05	0.05	0.0	0.0	0.57	4.43	0.82	0.29	-0.48	0.01732	7.9					

SHADOW VALLEY WELL 5N 1E 25BCC1 1703.	28	89	91	-24	58	42	42	215	42	139	121	97	88	83	13.2	1.28	0.19	1.22	31.23	10.01	0.78	0.39	0.05	0.0	0.0	0.0	0.21	25.28	0.95	0.37	-0.36	0.00036	0.0
BEN STADLER WELL 5N 1E 2600D1 3406.	29	82	85	-30	50	54	54	177	130	98	94	99	82	0	18.0	2.93	0.14	0.74	292.47	2.98	0.34	0.30	0.07	0.0	0.0	0.28	14.56	0.88	0.31	-0.42	0.00151	0.0	
JULIUS JEKER WELL 5N 1E 35ACA1 83.	40	83	86	-29	52	87	87	139	118	95	93	99	67	0	26.0	19.87	0.0	0.24	0.0	0.19	0.05	0.06	0.07	0.0	0.0	0.58	4.86	0.72	0.18	-0.58	0.00476	0.0	
JERRY DAVIS WELL #1 1N 1W 7ACC1	0.	21	96	98	-18	66	59	223	144	999	170	260	0	97	12.5	1.68	0.63	115.23	0.0	123.25	0.60	0.46	0.43	0.0	0.0	1.16	16.56	1.22	0.62	-0.09	0.00156	0.0	
CLATER FORSGREN WELL 1N 1W 7BCC1	0.	20	94	96	-19	64	61	185	115	999	171	262	0	97	16.7	2.32	0.66	48.24	0.0	71.11	0.43	0.26	0.17	0.0	0.0	0.66	12.84	1.22	0.62	-0.09	0.00970	0.0	
IRVIN BOEHLKE WELL 1N 1W 8DBA1 3028.	22	85	88	-27	54	43	43	186	120	144	123	100	93	90	16.6	1.15	0.21	147.39	239.37	165.92	0.87	0.97	0.85	0.0	0.0	1.15	20.89	1.06	0.47	-0.25	0.00330	0.0	
SHANE BJES WELL 1N 1W 150AA1	0.	23	98	100	-16	68	66	212	149	255	164	227	96	95	13.5	3.40	0.58	26.80	0.0	31.60	0.29	0.23	0.20	0.0	0.0	1.10	13.17	1.21	0.62	-0.10	0.00101	0.0	
TERRY TLUCEK WELL #1 1N 1W 2200D1	0.	23	88	90	-25	57	205	194	253	119	161	130	105	93	90	10.2	2.40	0.22	792.30	0.0	884.21	0.42	0.10	0.09	0.0	0.0	0.95	4.02	1.10	0.51	-0.21	0.22100	16.1
BISCHOF REALTY WELL 3N 1W 25ADD1	0.	21	82	85	-30	50	27	109	73	113	105	99	92	0	36.5	1.14	0.37	46.45	113.16	140.64	0.88	0.44	0.14	0.0	0.0	0.50	18.68	1.03	0.44	-0.28	0.02867	0.0	
LETHA FISHER WELL 5N 1W 16CAB1	0.	20	112	111	-5	83	70	415	179	999	222	999	0	0	4.6	1.28	0.39	4.50	0.0	32.24	0.78	0.22	0.03	0.0	0.0	0.71	26.78	1.42	0.83	0.11	0.00278	25.6	
HARRY CHARTERS WELL 1S 1W 5ABC1	0.	26	94	96	-19	64	71	181	71	189	141	134	93	90	17.4	5.23	0.71	16.08	0.0	15.17	0.19	0.18	0.19	0.0	0.0	0.99	9.57	1.10	0.52	-0.21	0.00085	38.2	
INITAL BUTTE WELL 1S 1W 36BBC1	0.	23	82	85	-30	50	68	166	68	103	101	99	89	0	20.0	4.95	0.49	21.44	0.0	18.01	0.20	0.25	0.30	0.0	0.0	0.87	9.27	0.98	0.39	-0.33	0.00088	0.0	

Adams County

WHITE LICKS H S 16N 2E 33BCC1S 114.	65	142	137	21	116	145	145	98	117	201	150	186	73	71	42.0	18.77	0.01	9.14	0.0	2.10	0.05	0.84	3.58	0.0	0.0	0.62	1.71	1.10	0.62	-0.18	0.00296	1.0
KRIGBAUM H S 19N 2E 22CCA1S 151.	43	120	118	2	91	96	96	60	96	169	137	127	81	74	72.2	46.05	0.06	4.98	0.0	0.90	0.02	0.10	0.49	0.0	0.0	0.37	1.89	1.02	0.48	-0.29	0.00012	4.5
ZIM'S RESORT 20N 1E 26UDA1S	0.	65	113	112	-3	84	83	47	83	121	117	86	52	27	89.8	27.60	0.01	7.46	0.0	2.47	0.04	0.39	0.97	0.0	0.0	0.26	2.09	0.61	0.13	-0.67	0.00017	1.2
STINKY W S 21N 1E 25ABA1S 38.	30	106	106	-10	76	85	85	74	85	123	114	97	85	80	58.2	22.66	0.28	7.15	8.31	2.63	0.04	0.19	0.50	0.0	0.0	0.28	2.79	1.16	0.59	-0.14	0.0	19.0
BOULDER CREEK RESORT 22N 1E 34DAD1S 19.	26	94	96	-19	64	8	8	4	8	999	999	999	0	0	212.6	5.13	0.0	2.68	0.0	8.06	0.20	0.56	0.11	0.0	0.0	0.34	9.47	0.84	0.25	-0.47	0.0	0.0
STARKEY H S 18N 1W 34DBB1S 492.	56	107	107	-9	77	70	70	46	70	116	109	86	58	40	91.4	33.32	0.0	8.34	0.0	2.37	0.03	0.11	0.36	0.0	0.0	0.25	2.83	0.66	0.16	-0.63	0.00018	0.0

Bannock County

SHOAL SUBDIVISION WELL 5S 34E 26DBA1 378.	26	89	91	-24	58	187	187	229	131	118	108	999	86	0	12.0	3.30	0.69	45.26	0.0	16.33	0.30	0.33	0.91	0.0	0.0	3.96	6.29	1.05	0.47	-0.26	0.02061	37.8
ROBERT BROWN WELL #1 5S 34E 26DAB1 57.	41	63	68	-46	31	185	185	227	136	999	999	999	0	0	12.1	3.74	0.59	14.57	0.0	10.37	0.27	0.22	0.31	0.0	0.0	2.48	6.41	0.39	-0.15	-0.91	0.01166	33.8

T1=SILICA TEMP ASSUMING QUARTZ EQUILIBRIUM AND CONDUCTIVE COOLING (NO STEAM LOSS)  
T2=SILICA TEMP ASSUMING QUARTZ EQUILIBRIUM AND ADIABATIC EXPANSION AT CONSTANT ENTHALPY (MAX STEAM LOSS)  
T3=SILICA TEMP ASSUMING EQUILIBRIUM WITH AMORPHOUS SILICA  
T4=SILICA TEMPERATURE ASSUMING EQUILIBRIUM WITH CHALCEDONY AND CONDUCTIVE COOLING (NO STEAM LOSS)  
T5=NA-K-CA TEMP  
T6=NA-K-CA TEMP CORRECTED FOR MG. IF T<sub>5</sub> = T<sub>6</sub>, THERE WAS NO CORRECTION  
T7=NA-K TEMP

T8=NA-K-CA TEMP CORRECTED FOR P<sub>CO2</sub>  
T9=FOURNIER-TRUESDELL MIXING MODEL 1 TEMP (QUARTZ-NO STEAM LOSS)  
T10=FOURNIER-TRUESDELL MIXING MODEL 2 TEMP (QUARTZ-STEAM LOSS)  
T11=FOURNIER-TRUESDELL MIXING MODEL 1 TEMP (CHALCEDONY-NO STEAM LOSS)  
\$9=PERCENTAGE OF COLD WATER IN T9 CALCULATION  
\$11=PERCENTAGE OF COLD WATER IN T11 CALCULATION  
\* =999 MEANS HOT WATER CALCULATION NOT POSSIBLE  
\*\* =R NOT CALCULATED IF T<sub>5</sub> <70°C



CONDIE H S 1S 21E 14DDC1S1310.	52	76	80	-35	45	89	89	339	145	78	78	999	36	0	6.3	1.96	0.32	4.41	0.0	15.62	0.51	0.24	0.07	0.0	0.0	1.35	13.64	0.42	-0.10	-0.88	0.02715	21.9
MILFORD SWEAT H S 1S 22E 10AB1S 76.	44	73	77	-37	41	64	64	269	128	999	70	999	0	0	9.2	1.39	0.33	1.51	0.0	12.37	0.72	0.31	0.04	0.0	0.0	0.28	18.53	0.51	-0.03	-0.80	0.01972	0.0

Boise County

TWIN SPRINGS 4N 6E 24BCB1S 0.	67	131	127	11	104	60	60	36	60	189	141	151	69	60	110.5	45.33	0.0	0.22	0.0	0.20	0.02	0.14	0.06	0.0	0.0	0.25	3.12	0.23	-0.24	-1.04	0.0	0.0
DANSKIN CREEK H S 8N 5E 18CC1S 8.	40	99	100	-15	69	63	63	29	63	144	125	100	78	68	124.7	47.94	0.07	0.88	0.0	0.37	0.02	0.04	0.10	0.0	0.0	0.33	2.70	0.82	0.27	-0.49	0.00014	0.0
HOT SPRINGS CAMPGROUND 8N 5E 6DCB1 19.	48	113	112	-3	84	65	65	44	65	173	135	129	78	69	95.5	32.63	0.0	0.26	22.24	0.12	0.03	0.08	0.13	0.0	0.0	0.82	3.11	0.81	0.29	-0.49	0.0	0.0
DONLAY RANCH H S 8N 5E 10BDD1S 265.	55	109	109	-7	80	74	74	38	74	148	125	104	68	54	105.1	62.39	0.0	0.21	0.0	0.06	0.02	0.07	0.14	0.0	0.0	0.40	2.33	0.72	0.21	-0.58	0.00011	0.0
DEER H S 9N 3E 25BAC1S 76.	80	147	141	26	122	139	139	91	139	209	149	196	66	65	46.1	50.36	0.0	1.40	0.0	0.16	0.02	0.04	0.36	0.0	0.0	1.17	1.87	0.87	0.44	-0.38	0.00267	0.0
KIRKHAM H S 9N 8E 32CAB1S 946.	65	117	115	0	88	79	56	49	93	155	128	197	63	133	86.3	60.56	0.09	0.11	0.0	0.06	0.02	0.06	0.08	0.0	0.0	0.18	2.40	0.77	0.30	-0.51	0.00133	6.0
BONNEVILLE H S 10N 10E 31BCC1S1374.	85	137	132	16	110	142	142	103	142	176	137	152	56	56	39.3	53.09	0.07	0.23	0.0	0.06	0.02	0.06	0.15	0.0	0.0	0.37	2.54	0.65	0.24	-0.58	0.00091	4.3

Bonneville County

FALL CREEK MINERAL SPG 1N 43E 9CBB1S 265.	25	42	50	-63	9	191	191	193	102	999	999	999	0	0	15.7	4.40	0.36	599.02	0.0	122.70	0.23	0.56	2.68	0.0	0.0	13.19	2.17	0.35	-0.23	-0.96	0.50716	24.0
BROCKMAN CREEK W S 2S 42E 26DCD1S 49.	35	70	75	-40	38	119	119	38	50	89	86	999	66	0	105.0	24.41	0.45	121.62	0.0	27.35	0.04	0.12	0.53	0.0	0.0	0.64	0.67	0.64	0.08	-0.66	0.77384	28.8
ALPINE W S 2S 46E 19CAD1S 38.	37	91	93	-22	61	200	200	206	114	146	122	100	79	68	14.2	4.67	0.29	555.82	164.04	98.32	0.21	0.97	5.39	0.0	0.0	7.58	1.81	0.93	0.37	-0.38	0.26729	20.2

Butte County

LEWIS ROTHWELL WELL 3N 25E 32CCD1 45.	41	106	106	-10	76	91	91	356	126	171	134	127	82	75	5.8	1.70	0.53	3.52	0.0	10.96	0.59	0.35	0.11	0.0	0.0	0.33	13.72	1.03	0.49	-0.27	0.20374	31.8
BUTTE CITY WELL #1 3N 27E 9ABB1 0.	35	83	86	-29	52	54	54	322	132	97	94	999	73	0	6.8	0.84	0.62	14.74	0.0	37.92	1.18	0.31	0.12	0.0	0.0	1.06	29.63	0.81	0.25	-0.49	0.02306	0.0

Camas County

WARDROP H S 1N 13E 32ABB1S 731.	66	120	118	2	91	154	154	124	154	150	128-467	62***	30.6	67.24	0.0	0.67	0.0	0.16	0.01	0.04	0.10	0.0	0.0	0.0	1.15	2.52	0.77	0.30	-0.50	0.00091	0.0	
HOT SPRINGS RANCH 1N 13E 32ABC1S 0.	60	125	123	6	97	74	74	30	74	174	137	129	71	60	122.1	97.63	0.0	0.83	434.13	0.13	0.01	0.03	0.12	0.0	0.0	1.40	2.05	0.51	0.02	-0.78	0.0	0.0
HOT SPRINGS RANCH 1N 13E 32ABC2S 95.	67	123	121	5	95	136	136	88	136	161	131	122	64	50	47.6	97.63	0.0	0.93	0.0	0.14	0.01	0.03	0.11	0.0	0.0	1.29	2.05	0.32	-0.15	-0.95	0.00000	0.0
HOT SPRING RANCH 1N 13E 32ABC3S 0.	64	123	121	5	95	84	84	55	84	165	133	124	67	54	78.0	79.90	0.16	0.95	0.0	0.18	0.01	0.03	0.11	0.0	0.0	1.40	2.29	0.39	-0.08	-0.89	0.0	9.8
ELK CREEK H S 1N 15E 14ADA1S 95.	55	126	123	7	98	94	57	56	94	187	142	150	76	70	77.4	72.11	0.09	0.68	700.71	0.06	0.01	0.05	0.58	0.0	0.0	1.42	1.87	0.81	0.31	-0.48	0.00006	5.8
ELK CREEK H S 1N 15E 14ADA2S 8.	55	127	124	7	99	84	54	42	84	189	143	151	76	70	97.8	66.83	0.08	0.77	500.50	0.07	0.01	0.04	0.40	0.01	0.01	1.42	1.93	0.82	0.32	-0.47	0.00012	5.8
ELK CREEK H S 1N 15E 14ADA3S 8.	45	123	121	5	95	86	86	42	86	201	148	159	83	79	97.8	72.90	0.0	0.76	522.26	0.06	0.01	0.03	0.41	0.00	0.00	1.35	1.85	0.99	0.45	-0.32	0.00011	0.0
LIGHTFOOT H S 3N 13E 7DCA1S 38.	56	119	117	1	91	99	99	62	99	164	133	124	72	61	69.7	84.09	0.0	0.66	44.31	0.06	0.01	0.02	0.21	0.0	0.0	1.67	1.83	0.80	0.30	-0.49	0.0	0.0
BAUMGARTNER H S 3N 12E 7DCC1S 76.	44	95	97	-19	65	56	56	34	56	107	101	999	67	0	114.8	37.66	0.0	1.24	65.28	0.18	0.03	0.05	0.28	0.0	0.0	1.85	3.36	0.80	0.27	-0.50	0.0	0.0

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios							Molar Ratios						Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = $\frac{\text{Magnesium} + \text{Calcium} + \text{Potassium}}{\text{Mg} + \text{Ca} + \text{K}}$						
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	%g	%l	Na	K	Ca	Mg	Cl	Br	F	Na	Ca	Cl	NH <sub>4</sub>	NH <sub>4</sub>	Cl	SO <sub>4</sub>			Ca	Na	Quartz	Chalcedony	Amorphous Silica	PCO <sub>2</sub>
			Sodium Potassium Sodium Calcium Magnesium Calcium Calcium Fluoride Chloride Boron Chloride Fluoride Calcium Sodium Calcium Bicarbonate Chloride Carbonate & Bicarbonate Ammonia Chloride Ammonia Fluoride Chloride Sulfate $\frac{\text{Calcium}}{\text{Sodium}}$											$\frac{\text{Ca}}{\text{HCO}_3}$	$\frac{\text{Cl}}{\text{CO}_3 + \text{HCO}_3}$	$\frac{\text{NH}_4}{\text{Cl}}$	$\frac{\text{NH}_4}{\text{F}}$	$\frac{\text{Cl}}{\text{SO}_4}$	$\frac{\text{Ca}}{\text{Na}}$	$\frac{\Delta G}{\text{Quartz}}$	$\frac{\Delta G}{\text{Chalcedony}}$	$\frac{\Delta G}{\text{Amorphous}}$	PCO <sub>2</sub>														
<u>Camas County (cont'd.)</u>																																					
WORSWICK H S 3N 14E 28CAA1S1764.		81	134	130	14	107	93	93	70	93	171	136	132	57	45	61.8	66.83	0.0	0.18	0.0	0.06	0.01	0.05	0.11	0.0	0.0	0.39	2.23	0.76	0.33	-0.49	0.00620	0.0				
SHEEP H S 1S 12E 16CAB1S	0.	49	116	115	-1	88	73	73	37	73	167	134	123	77	68	106.8	85.42	0.0	1.13	639.77	0.24	0.01	0.0	0.12	0.0	0.0	1.48	2.34	-0.02	-0.55	-1.33	0.0	0.0				
WOLF H S 1S 12E 16CBA1S	0.	45	116	115	-1	88	57	57	4	57	174	137	129	80	73	213.7	106.78	0.0	0.90	243.72	0.20	0.01	0.25	0.10	0.0	0.0	1.06	2.10	0.11	-0.42	-1.20	0.0	0.0				
KEITH STROM WELL 1S 12E 31CBC1	57.	31	87	89	-26	56	51	51	11	51	999	63	999	0	0	181.4	92.98	0.0	1.41	0.0	0.36	0.01	0.03	0.06	0.0	0.0	1.72	2.78	0.70	0.12	-0.61	0.00001	0.0				
LEE BARRON WELL #1 1S 13E 22CCC1	4.	26	123	121	5	95	92	92	71	98	999	189	999	0	0	60.9	49.98	0.34	0.55	190.41	0.15	0.02	0.02	0.09	0.27	0.15	5.11	2.31	1.47	0.88	0.16	0.00322	19.2				
LEE BARRON WELL #2 1S 13E 27CCB1	303.	35	127	124	7	99	79	79	41	79	269	168	253	92	91	99.9	54.63	0.07	0.54	197.13	0.13	0.02	0.02	0.09	0.09	0.05	5.14	2.12	1.36	0.80	0.05	0.00022	4.9				
LEE BARRON WELL #3 1S 13E 27CCB2	0.	45	113	112	-3	84	95	58	51	95	165	133	124	79	71	84.2	78.45	0.09	0.64	0.0	0.10	0.01	0.02	0.09	0.01	0.01	3.57	1.72	0.98	0.44	-0.33	0.00089	5.8				
BARRON H S 1S 13E 34BCB1S	38.	72	127	124	8	99	127	127	73	102	165	133	124	61	47	59.3	52.30	0.05	0.54	198.03	0.13	0.02	0.02	0.10	0.01	0.01	2.71	2.02	0.72	0.27	-0.54	0.00286	3.7				
LEE BARRON WELL #4 1S 13E 34BCC1	0.	49	127	124	8	99	96	96	65	104	205	149	160	82	76	66.8	54.35	0.06	0.58	236.95	0.12	0.02	0.02	0.11	0.00	0.00	3.16	2.00	1.11	0.59	-0.19	0.00150	4.0				
FAIRFIELD CITY WELL 1S 14E 90AA1	814.	21	73	77	-37	41	31	31	42	31	999	999	999	0	0	99.2	10.90	0.32	0.58	0.0	1.11	0.09	0.10	0.05	0.0	0.0	1.12	7.76	0.90	0.30	-0.41	0.00086	0.0				
<u>Canyon County</u>																																					
LEONARD TIEGS WELL #1 1N 2W 5ADD1	0.	22	76	80	-35	45	40	40	174	125	999	999	999	0	0	18.5	1.43	0.29	53.60	0.0	71.11	0.70	0.47	0.35	0.0	0.0	1.13	20.82	0.92	0.33	-0.39	0.00138	0.0				
DON TIEGS WELL #2 1N 2W 8ACC1	0.	22	85	88	-27	54	52	52	232	135	999	999	999	0	0	11.7	1.15	0.21	147.39	239.37	165.92	0.87	0.97	0.85	0.0	0.0	1.15	20.89	1.06	0.47	-0.25	0.00330	0.0				
MELBA CITY WELL 1N 2W 36CAA1	757.	25	93	95	-20	63	83	83	103	117	999	999	999	0	0	39.4	16.86	0.42	6.51	0.0	3.08	0.06	0.07	0.14	0.0	0.0	1.35	3.94	1.10	0.52	-0.21	0.00127	25.6				
WESLEY SCHOBEL WELL 2N 2W 34BDA1	2271.	48	89	91	-24	58	66	66	2	66	999	999	999	0	0	222.8	69.21	0.10	3.66	0.0	0.38	0.01	0.02	0.20	0.0	0.0	1.12	1.59	0.54	0.01	-0.76	0.00059	0.0				
CANNON FARMS WELL #4 2N 3W 22DCC1	2952.	30	109	109	-7	80	63	63	202	141	999	999	999	0	0	14.6	2.40	0.45	8.47	0.0	37.92	0.42	0.25	0.06	0.0	0.0	0.35	13.21	1.29	0.70	-0.02	0.00150	0.0				

CALDWELL MUNC. PARK WELL 4N 3W 28AB1	568.	28	100	101	-14	70	54	54	92	95	999	999	999	0	0	45.1	8.40	0.01	1.93	18.28	3.48	0.12	0.10	0.06	0.0	0.0	5.62	7.19	1.16	0.58	-0.15	0.00350	0.0
CALDWELL CITY WELL 4N 3W 35ABD1	3028.	20	78	81	-34	46	36	36	103	93	999	999	999	0	0	39.3	3.39	0.16	4.62	42.04	11.26	0.29	0.21	0.08	0.0	0.0	1.70	13.53	0.99	0.39	-0.33	0.00338	0.0

Caribou County

BLACKFOOT RIVER W S 5S 40E 14BCD1S	4.	26	83	86	-29	52	329	329	1191	173	999	70	999	0	0	1.2	0.38	0.60	15.93	79.79	86.35	2.63	0.44	0.08	0.02	0.39	0.26	20.28	0.98	0.40	-0.33	1.25606	34.0
BLACKFOOT RESERVOIR W S 6S 41E 1ADC1S	568.	23	72	76	-39	40	46	46	529	119	999	999	999	0	0	3.2	0.20	0.41	6.52	213.26	47.82	5.12	0.37	0.05	0.00	0.00	1.08	67.27	0.86	0.27	-0.45	0.54346	0.0
CORRAL CREEK WELL #1 6S 41E 19BA1	598.	42	76	80	-35	45	362	362	2087	198	999	59	999	0	0	0.7	0.25	0.62	9.55	24.02	144.48	3.98	0.38	0.02	0.06	0.58	0.12	30.10	0.61	0.07	-0.69	0.91403	34.5
CORRAL CREEK WELL #2 6S 41E 19B1	397.	41	79	83	-32	48	369	369	2295	213	999	68	999	0	0	0.7	0.27	0.65	6.58	27.87	83.97	3.67	0.34	0.03	0.09	0.61	0.13	29.48	0.67	0.12	-0.64	0.44635	35.3
CORRAL CREEK WELL #3 6S 41E 19B1	79.	41	79	83	-32	48	360	360	2036	201	999	68	999	0	0	0.7	0.25	0.62	8.93	23.43	137.67	3.96	0.39	0.02	0.07	0.60	0.12	30.02	0.67	0.13	-0.64	0.68542	34.7
CORRAL CREEK WELL #4 6S 41E 19B2	42.	36	79	83	-32	48	363	363	2097	203	999	62	999	0	0	0.7	0.27	0.64	8.58	22.99	123.06	3.76	0.35	0.02	0.06	0.54	0.12	29.55	0.75	0.20	-0.55	0.67343	35.2
PORTNEUF RIVER W S 7S 38E 26CDB1S	189.	34	89	91	-24	58	268	268	679	147	101	100	999	78	0	2.2	0.50	0.38	41.54	60.93	165.92	1.98	0.40	0.10	0.0	0.0	0.62	23.72	0.92	0.36	-0.38	0.69332	25.3
SODA SPRINGS GEYSER 9S 41E 12ADD1S	4.	28	85	88	-27	54	30	30	1590	152	999	88	999	0	0	0.9	0.02	0.37	1.91	34.73	252.14	40.68	0.50	0.00	0.02	0.04	0.02	279.16	0.98	0.40	-0.33	0.70321	0.0

Cassia County

SIX S RANCH WELL #1 11S 25E 11CCA1	7911.	60	110	110	-6	81	89	79	88	101	136	120	95	61	42	48.0	23.39	0.10	2.11	0.0	0.28	0.04	0.10	0.74	0.0	0.0	2.52	2.99	0.77	0.28	-0.52	0.00436	7.5
SIX S RANCH WELL #2 11S 26E 20DDD1	5095.	32	97	99	-17	67	49	49	197	130	129	117	96	83	76	15.2	1.91	0.03	1.98	0.0	9.18	0.52	0.33	0.07	0.0	0.0	0.55	18.81	1.05	0.48	-0.26	0.00205	0.0
CRITCHFIELD WELL 11S 26E 28BCB1	5095.	35	98	100	-16	68	51	51	207	126	126	117	95	80	72	14.1	1.91	0.02	7.66	0.0	10.50	0.52	0.33	0.24	0.0	0.0	4.17	18.81	1.02	0.46	-0.28	0.00428	0.0
C & Y RANCH WELL #2 11S 27E 58AB1	0.	29	123	121	5	95	0	0	0	0	999	178	999	0	0	0.0	6.71	0.46	14.19	0.0	3.63	0.15	0.17	0.66	0.0	0.0	17.41	5.86	1.43	0.85	0.12	0.00621	35.3
LYLE DURFEE WELL 13S 25E 22BCB1	0.	30	59	65	-49	27	0	0	0	0	999	999	999	0	0	0.0	1.51	0.40	8.42	0.0	7.45	0.66	0.36	0.40	0.0	0.0	4.58	28.35	0.53	-0.04	-0.78	0.00534	34.7
WARD SPRINGS 13S 26E 17CCD1S	322.	21	96	98	-18	66	34	34	294	34	173	136	129	95	93	7.9	0.72	0.03	26.80	0.0	32.24	1.39	0.56	0.46	0.0	0.0	7.13	47.83	1.21	0.62	-0.10	0.00054	0.0
14S 21E 34BCD1	189.	43	98	100	-16	68	97	97	297	173	122	111	86	72	57	7.8	5.48	0.13	2.89	0.0	5.11	0.18	0.15	0.08	0.0	0.0	1.26	9.77	0.88	0.34	-0.43	0.00195	8.8
OKLEY H S 14S 22E 27CCB1S	38.	47	118	116	0	89	92	92	65	92	180	139	131	79	72	67.3	56.18	0.0	3.55	0.0	0.16	0.02	0.10	1.25	0.0	0.0	6.52	2.17	0.38	-0.14	-0.92	0.0	0.0
SEARS SPRING 14S 25E 68BB1S	662.	28	67	72	-43	35	39	39	299	39	999	999	999	0	0	7.7	0.90	0.43	25.46	0.0	34.37	1.11	0.37	0.27	0.0	0.0	5.15	41.23	0.66	0.08	-0.64	0.00079	0.0
GRIFFETH-WIGHT WELL 14S 26E 1BDD1	378.	77	113	112	-3	84	63	63	263	63	126	117	75	43	0	9.5	4.88	3.96	0.0	0.0	0.0	0.20	0.07	0.44	0.03	0.0	6.22	18.34	0.42	-0.02	-0.84	0.00084	0.0
HAROLD WIGHT WELL 14S 26E 1CDA1	0.	63	127	124	7	99	121	121	41	121	175	137	130	69	58	99.7	296.37	0.33	5.29	274.19	0.06	0.00	0.01	0.44	0.0	0.0	7.80	0.68	0.33	-0.13	-0.93	0.00010	11.7

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios					Molar Ratios					Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium					
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Cl/Br	Cl/I	Cl/Na	Ca/Na	Ca/HCO <sub>3</sub>	Cl/CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F			Cl/SO <sub>4</sub>	Ca/Na	ΔG Quartz	ΔG Chalcedony	ΔG Amorphous
			Na	Ca	Mg	Cl	Br	I	Na	Ca	Cl	CO <sub>3</sub>	HCO <sub>3</sub>	NH <sub>4</sub>	F	SO <sub>4</sub>	Ca	Na	Ca	Cl	NH <sub>4</sub>	F	SO <sub>4</sub>	Ca	Na	Quartz			Chalcedony	Amorphous	PCO <sub>2</sub>	Mg** Mg+Ca+K	

Cassia County (cont'd.)

HAROLD WARD WELL #1 14S 27E 180CC1 3399.	24	131	127	11	104	201	180	256	165	999	213	999	0	0	10.0	5.39	0.07	146.17	0.0	23.70	0.19	0.64	3.88	0.0	0.0	35.32	5.01	1.59	1.00	0.28	0.00317	4.9
MORRIS MITCHELL WELL #2 15S 21E 250CC1 38.	46	76	80	-35	45	94	52	39	94	999	56	999	0	0	103.9	95.89	0.08	3.80	64.74	0.40	0.01	0.01	0.12	0.0	0.0	2.19	1.48	0.39	-0.14	-0.92	0.00059	5.3
HAROLD WARD WELL #2 15S 24E 2200B1 378.	38	95	97	-19	65	47	47	105	89	119	108	999	76	0	38.4	3.30	0.41	14.79	0.0	6.05	0.30	0.33	0.80	0.0	0.0	6.56	9.98	0.94	0.39	-0.37	0.00834	0.0
BLM 15S 25E 2900C1 0.	60	116	115	-1	88	128	128	72	128	151	127	126	66	69	60.0	58.11	0.05	5.78	0.0	0.22	0.02	0.08	1.63	0.0	0.0	5.55	1.82	0.59	0.10	-0.70	0.00007	3.0
BLM 15S 26E 12ACC1 0.	26	130	126	10	102	220	213	222	220	999	201	999	0	0	12.6	11.62	0.01	535.97	1351.71	36.47	0.09	7.87	113.85	0.0	0.0	234.70	0.99	1.56	0.98	0.25	0.00074	0.5
BLM 15S 26E 2200D1 189.	82	107	107	-9	77	103	103	18	103	112	109	75	29	0	157.9	40.47	0.01	214.39	*****	5.31	0.02	1.35	53.75	0.0	0.0	104.16	0.66	0.31	-0.11	-0.93	0.00092	1.3
IVAN DARRINGTON WELL #1 15S 26E 23AAA1 15.	85	156	149	34	132	185	183	175	185	219	153	216	65	65	18.4	16.22	0.04	40.05	0.0	2.24	0.06	1.04	18.27	0.0	0.0	46.04	1.88	0.89	0.47	-0.35	0.00069	2.6
FRAZIER H S WELL 15S 26E 23B8C1 220.	95	131	127	11	104	146	146	95	146	150	127	107	40	12	43.3	18.42	0.01	84.63	0.0	4.41	0.05	1.47	27.71	0.0	0.0	42.76	1.49	0.51	0.11	-0.71	0.00476	1.0
HARRIAT CRANK WELL 15S 26E 2310C1 227.	90	135	131	15	108	139	120	79	139	163	132	123	49	30	53.9	14.89	0.01	72.74	0.0	4.40	0.07	5.50	89.36	0.0	0.0	84.35	1.18	0.60	0.20	-0.62	0.00102	0.4
IVAN DARRINGTON WELL #3 15S 26E 2300D1 0.	33	104	104	-11	74	94	92	101	94	164	132	123	86	81	40.3	5.60	0.10	191.08	0.0	28.86	0.18	1.22	7.98	0.0	0.0	32.18	3.02	1.14	0.58	-0.17	0.01823	8.4
REID STEWART WELL 15S 26E 24BAD1 3399.	32	98	100	-16	68	94	94	101	100	136	120	98	84	77	40.4	6.62	0.10	183.36	0.0	24.95	0.15	0.86	6.22	0.0	0.0	27.08	3.02	1.08	0.51	-0.23	0.00931	8.8
IVAN DARRINGTON WELL #4 15S 26E 2410C1 3399.	31	106	106	-10	76	96	96	110	109	180	139	131	89	85	36.1	6.74	0.13	120.06	0.0	16.69	0.15	0.83	5.89	0.0	0.0	29.16	3.17	1.19	0.62	-0.12	0.00528	10.9
BLM 15S 26E 25ACA1 83.	30	130	126	10	102	185	146	174	149	999	186	999	0	0	18.5	18.43	0.18	109.11	830.88	5.93	0.05	0.30	5.48	0.0	0.0	48.24	1.84	1.48	0.91	0.18	0.00364	10.9
BLM 16S 26E 58BA1 151.	40	88	90	-25	57	94	94	122	97	83	88	999	60	0	31.4	7.21	0.26	46.29	832.87	6.25	0.14	0.64	4.66	0.0	0.0	23.39	3.64	0.80	0.26	-0.50	0.02705	18.7

Clark County

LIDY H S #1 9N 33E 28BC1S 946.	50	84	87	-28	53	66	66	540	144	89	91	999	46	0	3.1	0.54	0.30	0.71	0.0	6.87	1.85	0.74	0.08	0.0	0.0	0.11	39.67	0.58	0.06	-0.72	0.12949	0.0
LIDY H S WELL 10N 33E 350CC1 6813.	59	88	90	-25	57	68	68	503	176	89	95	999	34	0	3.4	0.76	0.42	0.86	24.03	5.93	1.31	0.47	0.07	0.0	0.0	0.19	35.49	0.47	-0.02	-0.82	0.00738	0.0

WARM SPRINGS  
11N 32E 25AAC1S7267. 29 57 63 -50 25 23 23 357 124 999 999 999 0 0 5.8 0.32 0.58 2.84 0.0 25.60 3.13 0.39 0.04 0.0 0.0 0.23 85.24 0.52 -0.06 -0.79 0.02253 0.0

Custer County

BOWERY H S  
7N 17E 6ABA1S 76. 43 112 111 -5 83 89 89 184 124 193 143 153 84 80 17.0 6.66 0.34 0.54 0.0 0.87 0.15 0.24 0.15 0.0 0.0 0.30 6.41 1.07 0.53 -0.23 0.00945 22.0

PIERSON H S  
8N 14E 27DBD1S 49. 60 118 116 0 89 73 64 30 73 170 134 126 71 60 124.2 70.70 0.09 0.22 0.0 0.04 0.01 0.09 0.20 0.0 0.0 0.68 2.11 0.55 0.06 -0.74 0.0 6.7

WEST PASS H S  
8N 17E 32BCA1S 95. 51 94 96 -19 64 185 185 216 117 119 110 999 65 0 13.1 8.30 0.43 1.66 0.0 1.19 0.12 0.14 0.19 0.0 0.0 0.75 5.26 0.71 0.20 -0.59 0.07181 24.7

STANLEY H S  
10N 13E 3CABA1S 416. 41 106 106 -10 76 47 47 6 47 175 137 130 84 77 204.1 47.55 0.07 0.19 0.0 0.07 0.02 0.11 0.15 0.0 0.0 0.44 2.84 0.88 0.34 -0.42 0.00003 0.0

SLATE CREEK H S  
10N 16E 30BAB1S 700. 50 128 125 9 101 91 91 122 124 230 156 220 84 83 31.4 17.86 0.02 0.43 0.0 0.44 0.06 0.11 0.11 0.0 0.0 0.17 3.94 1.14 0.63 -0.16 0.00160 1.6

ELKHORN H S  
11N 13E 36BAA1S 0. 57 121 119 3 93 137 137 83 137 187 141 133 75 66 51.0 125.52 0.49 0.20 0.0 0.03 0.01 0.08 0.18 0.0 0.0 0.51 1.59 0.15 -0.35 -1.14 0.0 18.2

BASIN CREEK W S  
11N 14E 21DDB1S 0. 38 130 126 10 102 73 73 48 73 999 178 999 0 0 87.9 51.47 0.0 0.16 0.0 0.07 0.02 0.14 0.13 0.0 0.0 0.31 2.68 1.23 0.68 -0.07 0.00001 0.0

MORMON BEND H S  
11N 14E 29AAB1S 4. 38 130 127 11 103 75 46 53 75 999 179 999 0 0 81.1 49.13 0.07 0.17 0.0 0.07 0.02 0.15 0.13 0.0 0.0 0.31 2.75 1.24 0.69 -0.06 0.00001 5.4

SUNBEAM H S  
11N 15E 19CABA1S1681. 76 131 128 12 104 129 129 72 129 180 138 136 63 52 60.2 98.79 0.0 0.43 0.0 0.05 0.01 0.02 0.17 0.0 0.0 0.60 1.65 0.65 0.20 -0.61 0.00064 0.0

ROBINSON BAR H S  
11N 15E 27DDC1S 151. 49 125 122 6 97 148 148 109 148 219 153 216 83 83 36.4 67.12 0.33 0.27 0.0 0.08 0.01 0.11 0.15 0.0 0.0 0.29 2.11 0.68 0.16 -0.62 0.0 14.6

SULLIVAN H S  
11N 17E 27BDD1S 265. 41 89 91 -24 58 99 99 169 103 115 106 999 73 0 19.3 6.05 0.37 16.97 0.0 12.90 0.17 0.13 0.17 0.0 0.0 5.94 4.73 0.80 0.26 -0.50 0.07063 24.2

BARNEY W S  
11N 25E 23CABA1S 643. 29 59 65 -49 27 13 13 252 123 999 999 999 0 0 10.2 0.42 0.89 4.29 0.0 35.08 2.36 0.31 0.04 0.0 0.0 0.51 77.61 0.54 -0.04 -0.77 0.00307 0.0

BILL JOHNSTON WELL  
14N 19E 34DAA1 189. 40 68 73 -41 36 60 60 254 127 999 36 999 0 0 10.1 1.43 0.63 1.95 0.0 23.70 0.70 0.37 0.03 0.0 0.0 0.08 18.93 0.50 -0.04 -0.60 0.01423 0.0

SUNFLOWER FLAT H S  
16N 12E 800B1S 16. 43 109 109 -7 80 71 71 43 78 184 139 132 83 77 96.7 35.25 0.0 0.58 0.0 0.18 0.03 0.09 0.28 0.0 0.0 0.35 2.68 1.04 0.50 -0.27 0.00434 0.0

THOMAS CREEK  
RANCH H S  
16N 12E 17DAD1S 257. 43 125 123 6 97 90 90 56 90 248 162 225 88 87 77.5 68.07 0.0 0.45 0.0 0.08 0.01 0.06 0.21 0.0 0.0 0.43 2.03 1.01 0.47 -0.30 0.00003 0.0

LOWER LOON  
CREEK H S  
17N 14E 19BBB1S 30. 49 119 117 1 91 73 73 31 73 199 146 158 81 76 121.7 55.91 0.0 0.54 0.0 0.11 0.02 0.04 0.15 0.0 0.0 0.64 2.10 0.93 0.41 -0.37 0.00027 0.0

Elmore County

CHARLES BAKER WELL  
3N 10E 10ABA1 19. 41 115 114 -1 87 30 30 18 30 198 146 158 83 79 155.9 12.96 0.0 0.42 11.58 1.46 0.08 0.17 0.03 0.0 0.0 0.29 5.68 0.47 -0.07 -0.83 0.0 0.0

PARADISE H S  
3N 10E 33ACD1S 946. 53 120 118 2 91 40 40 58 40 183 140 132 75 66 74.2 9.10 0.0 0.52 32.50 1.32 0.11 0.21 0.05 0.0 0.0 0.58 7.26 0.62 0.11 -0.67 0.0 0.0

PARADISE  
H S WELL  
3N 10E 33BDB1 0. 38 117 115 0 88 73 73 50 73 216 153 214 86 86 85.0 58.11 0.11 0.45 0.0 0.23 0.02 0.05 0.06 0.0 0.0 0.41 2.81 0.50 -0.00 -0.79 0.00000 7.6

NINEMEYER H S  
5N 7E 24BDD1S1321. 76 137 132 16 110 126 91 69 126 189 142 150 63 53 63.3 106.19 0.15 0.16 0.0 0.05 0.01 0.33 0.09 0.0 0.0 0.25 1.80 0.72 0.27 -0.54 0.0 7.5

DUTCH FRANK'S H S  
5N 9E 78BA1S1135. 65 119 117 1 91 72 72 53 72 161 131 -77 63\*\*\* 80.8 45.17 0.15 0.13 0.0 0.10 0.02 0.20 0.07 0.0 0.0 0.22 2.99 0.66 0.18 -0.62 0.0 10.5

ATLANTA H S  
6N 11E 35DAD1S 0. 38 123 121 5 95 76 76 63 76 243 162 224 88 87 69.1 37.77 0.22 0.23 0.0 0.10 0.03 0.11 0.16 0.0 0.0 0.42 3.06 0.71 0.16 -0.60 0.0 14.7

JOHN MALOTA WELL  
2S 5E 23BBC1 0. 22 99 100 -15 69 77 77 274 165 224 156 218 94 94 8.9 3.49 0.67 3.56 0.0 10.07 0.29 0.19 0.10 0.0 0.0 1.18 13.93 1.24 0.65 -0.07 0.00135 35.9



Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)																			Atomic Ratios											Molar Ratios											Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Ca/Fluoride	Chloride/Boron	Chloride/Fluoride	Ca/Sodium	Ca/Bicarbonate	Chloride Carbonate & Bicarbonate	Ammonia Chloride	Ammonia Fluoride	Chloride Sulfate	Ca/Sodium	Quartz	Chalcedony	Amorphous Silica	CO <sub>2</sub>	Mg**															
			Na	Ca	Mg	Ca	Cl	B	Cl	Fluoride	Ca	Na	Ca	Cl	NH <sub>4</sub>	NH <sub>4</sub>	Cl	Ca	Δ G Quartz	Δ G Chalcedony	Δ G Amorphous	Mg+Ca+K																										
<i>Elmore County (cont'd.)</i>																																																
LONG TOM RANCH WELL #1 35 7E 1ACA1	0.	20	109	109	-7	80	58	58	379	166	999	188	999	0	0	5.3	1.21	0.35	10.72	0.0	17.61	0.83	0.37	0.22	0.0	0.0	2.53	32.53	1.40	0.80	0.09	0.00327	0.0															
LESLIE BEAM WELL 35 8E 36CAD1 2649.	68	128	125	9	101	71	71	10	71	179	138	133	66	54	185.0	101.12	0.0	0.14	0.0	0.04	0.01	0.03	0.06	0.0	0.0	0.87	1.62	0.76	0.29	-0.52	0.00033	0.0																
LATTY H S 35 10E 310DB1S	0.	55	137	132	16	110	137	137	79	137	229	157	220	80	79	54.0	235.35	0.0	0.21	0.0	0.03	0.00	0.01	0.04	0.0	0.0	0.73	1.34	1.11	0.61	-0.19	0.00050	0.0															
ROBERT BRUCE WELL 45 5E 258BC1	0.	24	92	94	-21	62	47	47	376	47	164	131	106	90	85	5.3	1.26	0.35	6.16	0.0	30.81	0.79	0.27	0.05	0.0	0.0	0.94	44.05	1.11	0.52	-0.20	0.00046	0.0															
BEVERLY OLSON WELL 45 7E 19BDB1	0.	26	114	113	-3	85	63	63	288	161	999	173	265	0	94	8.2	2.05	0.58	4.98	0.0	10.90	0.49	0.24	0.11	0.0	0.0	1.33	20.40	1.35	0.77	0.04	0.00148	0.0															
NORTHWEST PIPELINE WELL 45 8E 36BBA1	30.	38	128	125	9	101	124	74	59	89	268	169	252	89	88	73.5	87.17	0.10	1.79	0.0	0.51	0.01	0.01	0.04	0.0	0.0	5.01	1.28	1.34	0.79	0.04	0.00887	6.1															
BILL DAVIS WELL 45 9E 8ACA1	0.	62	128	125	9	100	82	82	13	82	188	142	150	71	63	174.3	158.84	0.0	0.11	0.0	0.03	0.01	0.02	0.04	0.0	0.0	0.62	1.33	0.49	0.01	-0.79	0.00002	0.0															
GARY LAWSON WELL 55 3E 14CB81	238.	59	125	123	6	97	62	62	8	62	187	141	134	72	61	193.5	66.10	0.0	0.42	55.39	0.05	0.02	0.06	0.28	0.0	0.0	4.87	1.95	0.14	-0.35	-1.15	0.0	0.0															
MIKE WISSEL WELL 55 7E 16ABD1	0.	21	120	118	2	91	60	60	312	156	999	205	999	0	0	7.2	1.13	0.45	5.85	0.0	21.98	0.89	0.38	0.10	0.0	0.0	0.42	24.85	1.51	0.91	0.19	0.00298	0.0															
CHARLES BOYD WELL 55 8E 34BDC1	8.	34	108	108	-7	79	144	124	86	99	197	146	157	87	84	49.5	61.31	0.18	14.37	0.0	1.96	0.02	0.02	0.13	0.0	0.0	24.58	1.08	1.17	0.60	-0.14	0.01817	10.1															
MAGIC WEST CO. WELL 55 10E 32BDB1	204.	38	97	99	-17	67	68	68	-1	56	141	122	99	78	68	245.7	90.66	0.13	1.20	0.0	0.09	0.01	0.01	0.18	0.0	0.0	31.41	1.40	0.95	0.40	-0.35	0.00428	0.0															
CHARLES ANDERSON WELL 55 11E 7ACC1	0.	32	93	95	-20	63	64	64	20	64	138	121	97	82	74	149.3	55.09	0.0	0.16	0.0	0.06	0.02	0.03	0.08	0.0	0.0	1.38	2.30	0.95	0.38	-0.35	0.00040	0.0															
<i>Franklin County</i>																																																
TREASURTON W S #1 125 40E 36ADC1S	38.	35	105	105	-10	75	227	227	304	136	197	145	156	89	86	7.5	3.70	0.42	153.97	56.63	57.10	0.27	0.57	1.52	0.00	0.66	2.17	3.32	1.13	0.57	-0.18	0.18195	25.4															
TREASURTON W S #2 125 40E 36ADB1S	38.	33	103	104	-12	73	236	236	335	143	198	145	157	90	87	6.4	3.48	0.41	178.56	56.72	64.62	0.29	0.56	1.52	0.00	0.70	2.27	3.57	1.14	0.57	-0.17	0.17751	24.3															
CLEVELAND H S #1 125 41E 31CAC1S	76.	66	110	110	-6	81	222	222	294	123	140	121	95	59	35	7.9	3.84	0.40	150.07	57.88	51.90	0.26	0.44	1.25	0.01	0.94	2.70	3.62	0.70	0.23	-0.58	0.44521	24.2															
CLEVELAND H S #2 125 41E 31CCAS	38.	56	112	112	-4	83	225	225	297	131	163	131	119	72	67	7.8	4.66	0.48	150.07	57.88	42.91	0.21	0.45	1.54	0.00	0.47	2.68	3.27	0.89	0.39	-0.40	0.25944	27.0															

CLEVELAND H S #3 125 41E 310B1S 189.	61	113	112	-3	84	226	226	300	131	155	128	118	67	62	7.7	4.51	0.46	149.51	55.68	44.41	0.22	0.47	1.56	0.01	0.88	2.71	3.33	0.82	0.33	-0.47	0.27131	26.4
MAPLE GROVE H S 135 41E 7ACA1S 76.	78	127	124	8	99	217	217	252	217	168	133	124	59	42	10.2	10.09	0.58	290.40	78.95	36.63	0.10	0.26	2.04	0.00	1.42	6.30	2.15	0.73	0.29	-0.52	0.23960	28.0
MAPLE GROVE H S 135 41E 7ACA2S 378.	72	128	125	9	100	215	215	249	131	176	137	130	65	51	10.4	9.39	0.51	292.83	79.61	40.08	0.11	0.29	2.06	0.00	1.32	6.24	2.21	0.83	0.38	-0.43	0.14033	26.2
MAPLE GROVE H S 135 41E 7ACA3S539.	60	128	125	9	101	214	214	248	132	199	146	158	76	69	10.5	9.22	0.44	313.00	77.36	44.09	0.11	0.29	2.00	0.00	1.00	6.30	2.25	1.03	0.54	-0.26	0.12159	23.5
BEN MEEK WELL 145 39E 36ADA1 0.	40	130	127	11	103	165	165	130	101	999	175	285	0	91	28.4	26.73	0.45	17.98	169.14	1.19	0.04	0.07	1.06	0.01	0.13	67.08	1.53	1.35	0.80	0.04	0.08032	23.6
ELDIN BINGHAM 155 39E 70BC1 38.	63	116	115	-1	88	252	159	253	136	161	130	173	67	114	10.2	25.06	0.191071	93	540.07	38.90	0.04	0.52	14.20	0.0	0.0	440.06	0.45	0.88	0.40	-0.41	0.79178	7.7
BATTLE CREEK H S 155 39E 880C1S 189.	82	142	136	21	115	254	154	259	254	195	144	155	63	53	9.7	31.67	0.18	468.17	456.20	13.75	0.03	0.38	12.75	0.00	1.41	405.51	0.48	0.88	0.45	-0.37	0.24452	6.4
BATTLE CREEK H S 155 39E 880C2S8176.	43	141	135	20	114	253	150	259	150	999	182	999	0	0	9.8	32.25	0.15	450.93	452.32	13.12	0.03	0.36	12.26	0.00	1.56	471.39	0.48	1.46	0.92	0.15	0.24464	5.3
BATTLE CREEK H S 155 39E 880C3S 0.	81	142	136	21	115	254	155	259	254	197	145	156	64	54	9.7	32.85	0.19	449.68	426.01	12.80	0.03	0.33	11.26	0.00	1.34	368.44	0.48	0.89	0.46	-0.35	0.42626	6.7
BATTLE CREEK H S 155 39E 880C4S 19.	84	135	131	15	108	253	154	250	253	176	137	143	57	51	10.4	33.93	0.18	583.45	400.48	15.93	0.03	0.54	19.34	0.00	1.74	571.72	0.40	0.77	0.35	-0.47	0.16304	6.5
SQUAW H S WELL 155 39E 17BCD1 435.	84	149	143	28	124	258	153	263	258	211	150	199	65	65	9.5	27.29	0.14	922.11	524.15	30.76	0.04	0.54	15.83	0.00	2.10	572.40	0.44	0.95	0.53	-0.29	0.41959	5.5
SQUAW H S 155 39E 17BCD1S 140.	69	150	143	28	125	253	150	255	144	245	161	224	77	74	10.1	26.92	0.14	857.17	498.84	29.88	0.04	0.51	14.27	0.00	1.89	689.75	0.45	1.19	0.73	-0.08	0.40100	5.6
SQUAW H S 155 39E 17BCD2S 450.	73	150	143	28	125	258	150	225	137	235	158	222	74	72	12.3	27.81	0.18	714.18	423.60	23.80	0.04	0.42	12.50	0.00	2.25	753.07	0.46	1.13	0.68	-0.13	0.33000	7.7
MYRON FONNESBECK WELL 16S 38E 24ABC1 *****	23	121	119	2	92	84	84	335	133	999	223	999	0	0	6.4	1.52	0.57	97.55	66.01	73.95	0.66	0.28	0.37	0.00	0.22	57.31	14.91	1.49	0.90	0.18	0.06322	33.8

Fremont County

DONALD TRUPP WELL 7N 41E 25CBD1 0.	32	122	120	3	94	184	184	223	150	999	169	262	0	92	12.5	6.67	0.24	2.16	0.0	1.76	0.15	0.19	0.23	0.0	0.0	2.60	6.26	1.36	0.79	0.05	0.00324	15.7
WAYNE LARSEN WELL 7N 41E 26ACC1 0.	22	133	129	13	106	184	179	215	157	999	225	999	0	0	13.2	8.53	0.23	2.11	85.30	1.27	0.12	0.12	0.20	0.0	0.0	3.30	5.38	1.63	1.04	0.32	0.00184	15.0
HENRY HARRIS WELL 7N 41E 34ADD1 0.	33	113	112	-3	84	78	78	184	126	223	154	218	89	89	17.0	4.81	0.39	2.07	44.68	2.08	0.21	0.19	0.18	0.0	0.0	2.29	8.32	1.24	0.68	-0.06	0.00593	25.4
NEWDALE CITY WELL 7N 41E 34CCD1 0.	32	118	117	0	90	81	81	204	141	259	164	228	91	90	14.4	4.11	0.34	3.31	88.35	3.13	0.24	0.20	0.21	0.0	0.0	0.0	8.76	1.31	0.74	0.00	0.00262	23.0
WALLACE LITTLE WELL 7N 41E 35CCD1 0.	36	121	119	3	93	84	84	195	136	246	160	225	89	88	15.4	4.86	0.37	2.38	0.0	2.46	0.21	0.18	0.17	0.0	0.0	1.97	7.79	1.29	0.73	-0.02	0.00359	24.3
CLAUDE HAWS WELL 7N 41E 36DDA1 0.	32	116	115	-1	88	63	63	196	123	246	160	225	91	90	15.3	3.20	0.50	2.14	0.0	3.79	0.31	0.19	0.11	0.0	0.0	2.03	12.79	1.30	0.73	-0.01	0.00683	0.0
DEAN SWINDELMAN WELL 7N 42E 8CAA1 0.	32	114	113	-3	85	48	48	297	140	235	157	222	90	90	7.8	1.01	0.61	3.75	0.0	9.01	0.99	0.28	0.12	0.0	0.0	4.31	32.18	1.27	0.70	-0.04	0.00582	0.0
REMINGTON PRODUCE WELL 7N 42E 19CCA1 0.	26	85	86	-29	52	26	26	233	131	98	95	999	82	0	11.6	0.75	0.80	5.85	0.0	7.54	1.34	0.37	0.28	0.0	0.0	2.95	45.29	0.95	0.37	-0.36	0.00185	0.0
ASHTON H S 9N 42E 23DAC1S 8.	41	142	137	21	116	91	86	105	111	999	180	999	0	0	38.3	57.06	0.15	0.71	0.0	0.24	0.02	0.02	0.05	0.0	0.0	1.67	3.35	1.46	0.91	0.15	0.00314	7.9
BIG SPRINGS 14N 44E 348BC1S*****	12	98	100	-16	68	66	66	294	136	999	307	999	0	0	7.9	4.36	0.18	0.43	0.0	0.86	0.23	0.19	0.09	0.0	0.0	2.12	19.41	1.40	0.78	0.08	0.01584	0.0

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios							Molar Ratios							Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium					
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Ca	Cl/B	Cl	Cl	Ca	Ca	Ca/CO <sub>3</sub>	Cl/CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>	Ca/Na			Quartz	Chalcedony	Amorphous Silica	PCO <sub>2</sub>	Mg **
			Δ G Quartz			Δ G Chalcedony			Δ G Amorphous			Mg																									
<u>Gem County</u>																																					
ROYSTONE H S 7N 1E 8DDA1S	76.	55	147	141	26	122	150	98	112	109	273	170	258	84	83	35.3	32.06	0.11	2.08	0.0	0.26	0.03	0.07	0.56	0.0	0.0	1.53	2.12	1.51	0.80	0.01	0.00954	7.3				
EAST ROYSTONE H S 7N 1E 9DC1S	0.	45	133	129	13	106	84	84	121	109	261	166	228	87	85	31.8	11.51	0.26	2.01	0.0	0.89	0.09	0.14	0.30	0.0	0.0	1.43	4.49	1.30	0.77	-0.01	0.00592	18.3				
<u>Gooding County</u>																																					
J. SHANNON WELL 4S 13E 28AB1	0.	47	132	128	12	105	98	98	129	97	243	161	224	85	83	28.8	17.79	0.20	0.37	0.0	0.39	0.06	0.05	0.05	0.0	0.0	1.17	3.59	1.26	0.74	-0.04	0.04091	13.4				
WHITE ARROW H S 4S 13E 30ADB1S3126.		65	135	131	15	108	112	112	43	79	202	147	160	72	64	96.7	132.21	0.0	0.29	0.0	0.05	0.01	0.01	0.07	0.0	0.0	1.19	1.58	1.01	0.54	-0.26	0.00866	0.0				
DAVE ARCHER WELL 5S 12E 3AAA1	0.	57	112	111	-5	83	70	70	9	70	152	127	110	67	57	191.3	98.06	0.10	0.24	0.0	0.04	0.01	0.03	0.11	0.0	0.0	1.20	1.61	0.97	0.43	-0.33	0.00024	7.6				
<u>Idaho County</u>																																					
BURGDORF H S 22N 4E 18DC1S 613.		45	120	118	2	91	57	57	39	57	191	143	152	78	72	104.2	37.14	0.0	0.80	0.0	0.55	0.03	0.18	0.08	0.0	0.0	0.45	3.55	1.11	0.58	-0.19	0.00017	0.0				
RIGGINS H S 24N 2E 14DB1S 189.		42	119	117	1	91	95	95	54	95	195	145	156	80	75	80.0	44.99	0.03	2.04	0.0	1.40	0.02	0.86	0.38	0.0	0.0	0.07	1.79	1.08	0.54	-0.22	0.0	2.0				
BARTH H S 25N 12E 18DD 1S 742.		61	118	116	0	89	51	51	14	51	157	129	203	63	127	170.1	54.48	0.0	0.34	0.0	0.13	0.02	0.05	0.08	0.0	0.0	1.84	2.91	0.53	0.05	-0.75	0.00002	0.0				
RED RIVER H S 28N 10E 30DD1S 132.		55	122	120	3	94	80	80	50	80	175	138	130	70	60	86.1	52.30	0.0	0.10	0.0	0.06	0.02	0.11	0.10	0.0	0.0	0.27	2.33	0.88	0.38	-0.41	0.00008	0.0				
WEIR CREEK H S 36N 11E 13BC1S 151.		48	100	101	-14	70	34	34	42	34	124	116	91	63	48	98.6	15.32	0.0	0.51	0.0	0.71	0.07	0.24	0.08	0.0	0.0	0.38	7.19	0.75	0.25	-0.55	0.00006	0.0				
JERRY JOHNSON H S 36N 13E 18ADD1S1135.		48	100	101	-14	70	33	33	18	33	124	116	91	63	48	157.3	23.89	0.12	0.64	0.0	0.80	0.04	0.17	0.07	0.0	0.0	0.21	5.10	0.70	0.18	-0.60	0.00004	0.0				
<u>Jefferson County</u>																																					
HEISE H S 4N 40E 25DDA1S 227.		49	79	83	-32	48	206	206	213	119	999	83	999	0	0	13.4	5.81	0.30	414.94	0.0	68.81	0.17	0.62	3.69	0.0	0.0	8.78	1.62	0.54	0.02	-0.76	0.24894	19.8				
<u>Jerome County</u>																																					
ROYAL CATFISH INDUSTRY 9S 17E 29DB1 *****		43	121	119	2	92	93	93	48	93	206	148	161	82	78	87.7	77.66	0.0	0.78	0.0	0.09	0.01	0.03	0.18	0.0	0.0	2.55	1.74	0.95	0.41	-0.35	0.00010	0.0				

Lemhi County

CRONKS CANYON H S 16N 21E 18ADC1S 76.	46	88	90	-25	57	165	150	144	115	124	112	75	65	42	24.7	25.36	0.21	1.99	0.0	0.74	0.04	0.05	0.13	0.0	0.0	1.07	2.38	0.70	0.17	-0.61	0.01918	12.2
SALMON H S 20N 22E 3ABD1S 549.	45	83	86	-29	52	203	203	254	112	117	107	999	64	0	11.5	14.40	0.79	14.89	0.0	6.06	0.07	0.06	0.15	0.0	0.0	3.98	2.90	0.65	0.12	-0.65	0.38936	32.7
SHARKEY H S 20N 24E 34CCC1S 30.	52	151	128	12	104	173	98	135	117	234	156	221	80	78	27.0	64.48	0.14	2.28	0.0	0.29	0.02	0.02	0.18	0.0	0.0	0.86	1.15	1.18	0.66	-0.12	0.02860	5.8
BIG CREEK H S 23N 18E 22CAD1S 284.	93	161	152	38	137	173	173	136	173	224	153	218	60	59	26.7	72.37	0.06	1.04	0.0	0.17	0.01	0.02	0.10	0.0	0.0	1.48	1.20	0.87	0.48	-0.34	0.04252	2.6

Madison County

LAVERE RICKS WELL 5N 40E 50BA1 0.	21	93	95	-20	63	36	36	257	139	273	167	257	96	96	9.9	0.92	0.58	8.25	0.0	12.40	1.08	0.30	0.19	0.0	0.0	4.92	37.20	1.18	0.58	-0.13	0.00207	0.0
MARK RICKS WELL 5N 40E 8BCC1 0.	26	101	102	-14	71	44	44	278	138	258	162	227	94	93	8.7	1.06	0.55	3.78	121.86	9.20	0.95	0.30	0.12	0.0	0.0	2.71	32.98	1.21	0.62	-0.10	0.00443	0.0
PAULINE SMITH WELL 5N 40E 9CCC1 0.	21	91	93	-22	61	30	30	276	142	254	161	227	96	95	8.8	0.66	0.67	14.29	0.0	29.23	1.52	0.30	0.14	0.0	0.0	3.94	49.89	1.15	0.55	-0.16	0.00177	0.0
GREEN CANYON H S 5N 43E 6BCA1S 0.	44	72	76	-39	40	7	7	785	150	79	80	999	51	0	1.8	0.05	0.38	0.57	0.0	41.48	20.59	1.28	0.02	0.0	0.0	0.01	348.40	0.49	-0.05	-0.81	0.03367	0.0
WALZ ENTER. INC. WELL 6N 41E 10ACC1 0.	26	114	113	-3	85	81	81	225	140	999	185	999	0	0	12.3	3.66	0.37	3.91	82.26	3.97	0.27	0.20	0.20	0.0	0.0	2.81	9.84	1.36	0.78	0.05	0.00476	24.2
WANDA WOOD WELL #1 6N 41E 10BBB1 0.	24	115	114	-2	86	78	78	221	146	999	195	999	0	0	12.7	3.38	0.36	3.68	73.12	4.47	0.30	0.21	0.17	0.0	0.0	0.0	10.31	1.40	0.81	0.08	0.00236	24.1
WANDA WOOD WELL #2 6N 41E 10DBB1 0.	27	125	122	6	97	80	80	207	133	999	198	999	0	0	14.0	3.94	0.40	2.98	58.59	3.27	0.25	0.22	0.20	0.0	0.0	2.60	9.13	1.47	0.89	0.16	0.00570	26.2

Oneida County

KENT H S 12S 34E 36BCB1S 715.	24	83	86	-29	52	35	35	352	122	999	999	999	0	0	5.9	0.47	0.56	62.53	0.0	88.49	2.14	0.38	0.26	0.0	0.0	5.27	57.29	1.00	0.41	-0.31	0.04489	0.0
MALAD W S 14S 36E 27CDA1S 167.	25	61	67	-47	29	228	228	260	133	999	999	999	0	0	9.7	8.72	0.54	2815.82	0.0	284.43	0.11	0.38	3.71	0.0	0.0	227.48	1.48	0.67	0.09	-0.64	0.26290	27.3
PLEASANTVIEW W S 15S 35E 3AAB1S*****	25	65	70	-44	33	176	176	188	114	999	999	999	0	0	16.4	4.44	0.49	359.86	0.0	74.49	0.23	0.51	2.40	0.0	0.0	11.57	4.30	0.72	0.13	-0.59	0.04960	30.4
WOODRUFF H S 16S 36E 10BBC1S 0.	27	78	81	-34	46	192	192	178	135	999	999	999	0	0	17.8	12.20	0.57	1429.24	0.0	102.71	0.08	0.44	5.97	0.0	0.0	74.70	1.44	0.88	0.30	-0.43	0.02094	29.8

Owyhee County

GIVENS H S 1N 3W 21BBD1S 0.	49	121	119	3	93	100	100	19	100	189	283	150	81	75	153.1	219.66	0.0	0.88	0.0	0.05	0.80	0.01	0.21	0.0	0.0	2.01	0.91	0.71	0.19	-0.59	0.00008	0.0
WESLEY HIGGINS WELL 1N 4W 12DBB1 1552.	36	91	93	-22	61	39	39	-35	22	81	999	999	68	0	623.6	87.17	0.0	1.90	0.0	0.13	0.01	0.02	0.22	0.0	0.0	8.82	1.55	0.91	0.36	-0.39	0.01687	0.0
EARL FOOTE WELL 1S 2W 7CCB1 640.	46	82	85	-30	50	83	83	14	83	999	999	999	0	0	170.1	110.11	0.0	0.93	0.0	0.08	0.01	0.02	0.16	0.0	0.0	1.14	1.32	0.47	-0.06	-0.83	0.00048	0.0
ALFRED HEYWOOD WELL 3S 1E 35DAC1 0.	20	106	106	-10	76	56	56	257	141	999	413	999	0	0	9.9	1.42	0.38	1.97	39.76	9.71	0.70	0.27	0.05	0.0	0.0	0.83	21.51	1.36	0.76	0.04	0.00362	0.0
WILLIAM COX WELL #1 4S 1E 25CCD1 19.	30	147	141	-26	122	186	144	176	121	999	483	999	0	0	18.2	21.62	0.19	22.33	0.0	19.75	0.05	0.04	0.04	0.0	0.0	12.31	1.85	1.68	1.10	0.37	0.05103	10.7
WILLIAM COX WELL #2 4S 1E 26ABC1 189.	27	134	130	14	107	200	178	202	200	999	464	999	0	0	14.7	33.53	0.35	11.61	5.08	10.27	0.03	0.03	0.03	0.0	0.0	9.78	1.66	0.0	0.0	0.0	0.0	14.2

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)													Atomic Ratios					Molar Ratios					Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium			
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Ca/F	Cl/B	Cl/F	Ca/Na	Ca/HCO <sub>3</sub>	Cl/CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>	Ca/Na			Quartz	Chalcedony	Amorphous Silica
			Δ G Quartz	Δ G Chalcedony	Δ G Amorphous	PCO <sub>2</sub>	Mg** Mg+Ca+K																										
<i>Owyhee County (cont'd.)</i>																																	
T. ADCOCK WELL 4S 1E 2900D1 5602.	70	127	124	7	99	77	77	4	77	167	260	125	64	50	212.6	145.28	0.0	0.54	24.54	0.05	0.01	0.03	0.17	0.0	0.0	0.83	1.26	0.29	-0.17	-0.98	0.00000	0.0	
GEORGE KING WELL 4S 1E 348AD1 0.	75	127	124	7	99	75	75	0	75	161	253	75	59	0	238.1	155.32	0.30	0.54	0.0	0.04	0.01	0.02	0.14	0.0	0.0	0.81	1.23	1.78	1.15	0.46	0.00003	18.4	
G. CHRISTENSEN WELL 4S 2E 290BC1 38.	28	137	132	16	110	175	175	149	115	999	461	999	0	0	23.4	27.40	0.54	55.38	15.26	33.18	0.04	0.03	0.05	0.0	0.0	18.66	1.59	1.60	1.02	0.29	0.04147	25.5	
R. KETTERLING WELL 4S 2E 328CC1 95.	43	142	137	21	116	160	130	126	160	999	374	999	0	0	30.0	45.09	0.20	1.05	0.0	0.32	0.02	0.02	0.08	0.0	0.0	8.85	1.84	1.28	0.74	-0.03	0.00069	10.2	
C. STEINER WELL 5S 1E 3AAB1 0.	32	147	141	26	122	192	173	197	140	999	462	999	0	0	15.2	16.79	0.08	19.29	6.86	25.60	0.06	0.05	0.04	0.0	0.0	6.77	2.30	1.64	1.07	0.33	0.01569	4.9	
E. LAWRENCE WELL #1 5S 1E 10BDD1 4542.	64	127	124	7	99	61	61	0	61	173	269	129	69	58	243.0	79.24	0.0	0.46	24.91	0.07	0.01	0.05	0.20	0.0	0.0	0.84	1.70	0.34	-0.14	-0.94	0.0	0.0	
E. JOHNSTON WELL #2 5S 1E 210BC1 1382.	65	123	120	4	94	71	71	0	71	163	256	123	66	54	243.0	134.11	0.0	0.46	23.43	0.04	0.01	0.03	0.21	0.0	0.0	0.84	1.31	0.35	-0.12	-0.92	0.00000	0.0	
E. LAWRENCE WELL #2 5S 1E 24ACD1 7646.	65	130	127	11	103	96	96	27	96	184	279	135	71	60	130.8	158.49	0.0	0.50	28.63	0.03	0.01	0.02	0.20	0.0	0.0	0.92	1.20	0.36	-0.11	-0.92	0.00001	0.0	
E. LAWRENCE WELL #3 5S 1E 24ADB1 4012.	66	126	123	7	98	77	77	4	66	170	264	127	67	55	212.6	145.28	0.14	0.50	0.0	0.04	0.01	0.02	0.16	0.0	0.0	0.78	1.26	0.86	0.39	-0.41	0.00248	9.3	
OSCAR FIELDS WELL 5S 2E 18BC1 95.	50	123	120	4	94	60	60	-1	60	191	285	152	80	75	243.8	88.19	0.0	0.57	0.0	0.05	0.01	0.06	0.26	0.0	0.0	6.10	1.74	0.14	-0.38	-1.16	0.0	0.0	
CLARENCE HOPKINS WELL 5S 2E 20DA1 38.	37	130	127	11	103	187	167	169	129	999	361	282	0	92	19.3	44.02	0.33	2.09	38.27	0.73	0.02	0.02	0.06	0.0	0.0	19.91	1.45	1.39	0.83	0.08	0.02590	13.5	
COX AND LAWRENCE WELL 5S 2E 58CD1 284.	43	142	137	21	116	149	149	105	149	999	374	999	0	0	38.1	50.29	0.35	1.25	6.16	0.29	0.02	0.04	0.11	0.0	0.0	6.69	1.73	1.02	0.49	-0.28	0.00008	17.4	
H. DRISKELL WELL #1 5S 2E 13ADA1 19.	23	142	137	21	116	197	171	192	140	999	586	999	0	0	15.8	34.87	0.33	10.72	0.0	4.11	0.03	0.03	0.07	0.0	0.0	25.39	1.59	1.72	1.13	0.41	0.01853	13.6	
N. MCKEETH WELL 5S 3E 20ADA1 0.	60	142	137	21	116	73	73	5	73	231	321	221	80	79	206.5	134.71	0.15	0.42	5.87	0.03	0.01	0.06	0.29	0.0	0.0	6.35	1.42	0.32	-0.17	-0.97	0.0	10.2	
BURGHARDT CO. WELL 5S 3E 20BBB1 19.	27	142	137	21	116	169	141	162	110	999	501	999	0	0	20.6	9.55	0.15	32.16	11.58	39.82	0.10	0.09	0.07	0.0	0.0	12.13	3.24	1.67	1.09	0.36	0.04545	11.1	
LEROY BEAMAN WELL 5S 3E 22AAD1 19.	25	156	149	34	132	170	170	148	113	999	610	999	0	0	23.6	22.94	0.29	29.10	58.18	12.87	0.04	0.04	0.09	0.0	0.0	25.73	2.00	1.84	1.25	0.53	0.03415	16.6	

COOK'S GREENHOUSE WELL # 5S 3E 26BCB1	0.	83	142	137	21	116	91	91	36	91	189	283	150	61	50	110.0	91.32	0.0	0.54	8.03	0.07	0.01	0.15	0.30	0.0	0.0	0.66	1.51	0.09	-0.34	-1.15	0.0	0.0
COOK'S GREENHOUSE WELL # 5S 3E 26HCB2	0.	67	137	132	16	110	95	71	29	95	197	293	157	72	64	124.7	127.85	0.11	0.57	8.32	0.05	0.01	0.07	0.28	0.0	0.0	0.63	1.28	0.39	-0.08	-0.88	0.0	6.8
D. BYBEE WELL #1 5S 3E 27BDB1	0.	60	117	115	0	88	76	76	19	76	152	245	130	67	75	155.1	100.87	0.12	0.46	6.25	0.03	0.01	0.03	0.28	0.0	0.0	3.84	1.68	0.22	-0.27	-1.06	0.00000	8.1
A. WHITTED WELL 5S 3E 28BCC1	0.	65	136	131	15	109	105	105	28	105	198	293	157	73	66	126.9	211.38	0.0	0.38	7.38	0.02	0.00	0.05	0.27	0.0	0.0	4.14	1.06	0.33	-0.14	-0.95	0.0	0.0
D. BYBEE WELL #2 5S 3E 35CC1	0.	72	137	132	16	110	75	75	19	75	190	285	152	68	59	154.6	79.24	0.0	0.57	8.72	0.07	0.01	0.06	0.26	0.0	0.0	0.60	1.70	0.27	-0.18	-0.99	0.0	0.0
IDAHO POWER CO WELL 5S 4E 34CCB1	0.	27	133	129	13	106	71	71	231	155	999	458	999	0	0	11.8	1.70	0.15	5.67	42.51	23.70	0.59	0.57	0.13	0.0	0.0	0.20	12.76	1.54	0.96	0.23	0.00107	12.4
CHESTER FINDALL WELL 5S 5E 33BDB1	0.	22	91	95	-22	61	62	62	98	82	75	999	999	89	0	41.9	3.45	1.26	44.66	30.95	67.95	0.29	0.31	0.20	0.0	0.0	0.30	6.26	1.15	0.35	-0.16	0.02435	0.0
CLAY ATKINS WELL 5S 5E 34DD1	0.	25	129	126	10	102	197	197	225	139	999	467	999	0	0	12.4	11.42	0.68	21.44	10.46	22.91	0.09	0.07	0.07	0.0	0.0	5.42	3.25	1.55	0.97	0.24	0.01964	31.9
LOWER BIRCH SPRING 6S 1E 32BBA1S	0.	25	96	98	-18	66	21	21	149	93	135	221	98	92	89	23.4	1.04	0.38	22.51	220.61	35.08	0.96	0.45	0.28	0.0	0.0	1.62	31.75	1.16	0.58	-0.15	0.00819	0.0
L. POST WELL #1 6S 3E 23BB1	0.	62	136	132	16	109	128	128	60	128	207	301	192	76	75	72.9	174.34	0.0	0.60	6.82	0.03	0.01	0.02	0.23	0.0	0.0	1.14	1.05	0.67	0.18	-0.62	0.00003	0.0
L. POST WELL #2 6S 3E 20CC1 2725.	0.	53	137	132	16	110	146	144	90	146	233	323	221	83	82	46.8	159.81	0.14	0.57	7.23	0.03	0.01	0.02	0.19	0.0	0.0	1.81	1.14	0.80	0.29	-0.49	0.00005	4.8
M. BUNT WELL 6S 3E 48CC1	0.	48	142	137	21	116	166	166	128	166	999	354	262	0	87	29.2	119.86	0.0	0.49	7.63	0.06	0.01	0.04	0.14	0.0	0.0	0.71	1.32	0.83	0.31	-0.47	0.0	0.0
J. AGENROAD WELL 6S 3E 5CAC1	0.	61	133	129	13	106	90	90	127	90	199	294	158	75	69	29.3	22.36	0.0	0.47	19.83	0.20	0.04	0.09	0.18	0.0	0.0	1.31	4.17	0.91	0.42	-0.37	0.00024	0.0
NIELSON & CAROTHERS WELL 6S 3E 9ACC1 6283.	0.	39	152	145	30	127	176	176	163	176	999	427	999	0	0	20.4	46.97	0.05	0.65	8.00	0.19	0.02	0.03	0.10	0.0	0.0	0.71	2.25	1.46	0.91	0.15	0.00024	2.1
TRIANGLE DAIRY WELL #1 6S 3E 110AD1	0.	34	147	141	26	122	162	87	147	162	999	444	999	0	0	24.0	26.77	0.09	0.54	8.40	0.24	0.04	0.06	0.12	0.0	0.0	0.90	3.16	1.47	0.91	0.16	0.00017	5.4
LITTLE VALLEY IRR. WELL 6S 4E 14ABC1 5602.	0.	54	156	149	34	132	143	143	102	143	999	376	999	0	0	39.8	38.35	0.03	0.42	10.74	0.10	0.03	0.38	0.34	0.0	0.0	0.79	2.33	0.83	0.33	-0.46	0.0	2.2
KENT KOHRING WELL #1 6S 4E 25BCC1 341.	0.	20	120	118	2	91	92	78	223	154	999	544	999	0	0	12.4	4.04	0.09	1.92	33.06	4.98	0.25	0.48	0.18	0.0	0.0	0.20	7.74	1.52	0.92	0.21	0.00187	7.4
DICK WARD WELL 6S 4E 35DDA1	0.	33	134	130	14	107	207	207	273	207	999	403	999	0	0	9.0	17.81	0.04	0.60	27.70	0.27	0.06	0.07	0.16	0.0	0.0	1.02	5.24	1.44	0.87	0.13	0.00032	1.8
COLYER CATTLE CO. WELL 6S 5E 10DD1 19.	0.	39	123	121	5	95	141	115	89	141	255	324	222	89	89	47.5	80.46	0.19	0.28	6.63	0.04	0.01	0.02	0.14	0.0	0.0	1.69	1.34	1.22	-0.67	-0.08	0.00075	9.3
J.R. SIMPLOT WELL #1 6S 5E 18CCB1	0.	27	147	141	26	122	169	169	150	140	999	524	999	0	0	23.3	44.70	0.04	0.82	11.30	0.14	0.02	0.06	0.29	0.0	0.0	1.04	2.27	1.71	1.13	0.40	0.00248	2.1
J.R. SIMPLOT WELL #2 6S 5E 20AAB1 19.	0.	44	109	109	-7	80	151	151	116	151	153	246	105	79	69	33.4	40.80	0.04	0.38	5.46	0.09	0.02	0.04	0.13	0.0	0.0	12.44	2.26	0.87	0.33	-0.44	0.00036	2.1
GEORGE HUTCHINSON WELL 6S 5E 24BCA1 19.	0.	34	130	127	11	103	141	141	94	141	999	379	999	0	0	44.4	58.11	0.0	0.26	6.96	0.06	0.02	0.04	0.13	0.0	0.0	1.26	1.82	1.21	0.65	-0.09	0.00009	0.0
BRUNEAU CITY WELL 6S 5E 24DDB1	0.	33	124	121	5	96	94	94	59	94	999	358	278	0	93	75.2	61.64	0.0	0.24	8.84	0.05	0.02	0.03	0.14	0.0	0.0	0.85	1.94	1.20	0.64	-0.10	0.00011	0.0
DON DAVIS WELL #1 6S 5E 29DDC1 19.	0.	33	147	141	26	122	161	155	149	161	999	453	999	0	0	23.3	21.36	0.07	0.42	11.43	0.18	0.05	0.09	0.21	0.0	0.0	0.97	3.32	1.52	0.95	0.21	0.00016	4.6
CARL & HARRY LOOS WELL 6S 5E 35CCA1	0.	22	120	118	2	91	73	73	245	73	999	474	999	0	0	10.7	2.48	0.14	0.85	33.85	2.61	0.40	0.35	0.11	0.0	0.0	0.45	13.11	1.35	0.76	0.04	0.00009	11.4

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (Continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios							Molar Ratios							Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium	
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Ca/F	Cl/B	Cl/T	Ca/Na	Ca/HCO <sub>3</sub>	Cl/CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>	Ca/Na	Quartz	Chalcedony			Amorphous Silica
			Δ G	Δ G	Δ G	Quartz	Chalcedony	Amorphous	PCO <sub>2</sub>	Mg**																							

Owyhee County (cont'd.)

IDAHO PARKS DEPT. WELL 65 6E 1200D1	0.	37	147	141	26	122	178	97	163	143	999	423	999	0	0	20.4	31.38	0.10	1.73	58.47	0.80	0.03	0.03	0.07	0.0	0.0	14.29	2.02	1.54	0.99	0.24	0.00368	5.3
MILDRED BACHMAN WELL 65 6E 1900D1	19.	38	130	126	10	102	133	133	83	133	999	353	261	0	91	51.0	54.04	0.0	0.21	8.99	0.05	0.02	0.05	0.15	0.0	0.0	0.71	2.14	1.16	0.61	-0.14	0.00007	0.0
BRUNEAU CEMENTARY WELL 65 6E 190BD1	0.	42	127	124	8	99	91	91	51	91	239	326	223	88	87	84.1	71.25	0.0	0.21	8.99	0.04	0.01	0.04	0.15	0.0	0.0	0.97	1.85	0.95	0.41	-0.36	0.00003	0.0
ACE BLACK WELL 65 6E 3280D1	95.	35	129	126	10	102	132	132	83	132	999	367	291	0	93	51.6	52.86	0.05	0.22	9.60	0.05	0.02	0.04	0.13	0.0	0.0	1.06	2.15	1.07	0.51	-0.23	0.00004	3.4
WILBUR WILSON WELL #1 65 7E 1ACB1	19.	41	120	118	2	91	138	102	78	102	208	302	194	87	86	55.3	64.75	0.14	7.55	37.78	0.75	0.02	0.02	0.17	0.0	0.0	49.38	1.17	1.18	0.64	-0.12	0.00779	8.2
WILBUR WILSON WELL #2 65 7E 10BD1	38.	33	119	117	1	91	139	139	82	104	251	336	226	93	92	51.9	53.81	0.24	13.23	26.77	1.20	0.02	0.02	0.23	0.0	0.0	59.43	1.31	1.30	0.74	-0.00	0.00657	13.9
CARL JOHNSON WELL 65 7E 200D1	19.	35	121	119	3	93	144	101	89	109	248	334	226	92	91	47.0	63.12	0.14	3.95	24.41	0.36	0.02	0.02	0.18	0.0	0.0	54.16	1.32	1.30	0.74	-0.01	0.00613	7.8
SAND DUNES FARMS WELL 65 7E BBBA1	0.	23	129	126	10	102	199	199	216	131	999	509	999	0	0	13.2	16.09	1.08	13.02	18.56	17.61	0.06	0.07	0.05	0.0	0.0	0.18	2.44	1.59	1.00	0.28	0.05057	40.1
BILL BURGHARDT WELL #2 75 3E 4ACD1	2725.	34	133	129	13	106	79	75	492	176	999	391	999	0	0	3.5	1.06	0.09	2.27	27.77	14.22	0.94	0.36	0.06	0.0	0.0	0.54	26.45	1.47	0.90	0.16	0.00996	7.3
KEITH THOMAS WELL 75 4E 1ACC1	2896.	40	127	124	7	99	182	178	213	182	246	332	225	89	88	13.5	13.39	0.05	0.48	26.46	0.34	0.07	0.13	0.08	0.0	0.0	1.37	5.69	1.21	0.66	-0.10	0.00021	3.1
PETE MERRICK WELL #1 75 4E 3ABD1	6283.	42	134	130	14	107	194	194	247	194	273	350	257	90	89	10.6	13.83	0.03	0.52	22.27	0.31	0.07	0.10	0.16	0.0	0.0	1.18	6.01	1.29	0.75	-0.01	0.00042	1.7
PETE MERRICK WELL #2 75 4E 10BD1	1874.	38	136	132	16	109	198	198	261	198	999	377	999	0	0	9.6	11.38	0.02	0.49	24.04	0.36	0.09	0.10	0.14	0.0	0.0	0.97	6.56	1.35	0.80	0.05	0.00028	1.4
FRANK MILLETT WELL #1 75 4E 11CB1	7475.	36	136	132	16	109	92	92	282	92	999	389	999	0	0	8.5	4.90	0.03	0.61	28.62	0.92	0.20	0.22	0.14	0.0	0.0	0.84	10.21	1.43	0.87	0.12	0.00064	2.3
FARIA BROTHERS WELL 75 4E 12BD1	0.	43	134	130	14	107	186	186	224	186	270	348	254	89	89	12.4	12.70	0.02	0.52	25.85	0.38	0.08	0.11	0.15	0.0	0.0	1.34	5.96	1.22	0.69	-0.08	0.00020	1.5
CLARENCE COOK WELL 75 4E 13BC1	5602.	39	134	130	14	107	193	188	245	193	999	364	286	0	92	10.7	11.70	0.05	0.48	24.62	0.38	0.09	0.12	0.14	0.0	0.0	1.08	6.33	1.19	0.64	-0.11	0.00007	2.8

DAVE LATHINEN WELL 7S 4E 130CD1 4750.	40	135	131	15	108	186	186	228	186	999	363	285	0	91	12.0	10.62	0.02	0.44	30.81	0.37	0.09	0.17	0.17	0.0	0.0	1.28	6.39	1.28	0.74	-0.02	0.00015	1.3
FRANK MILLETT WELL #2 7S 4E 14ABC1 6283.	39	134	130	14	107	196	196	258	196	999	366	289	0	92	9.8	10.90	0.02	0.72	22.64	0.57	0.09	0.11	0.13	0.0	0.0	1.22	6.85	1.32	0.77	0.01	0.00028	1.5
ROBERT BLACK WELL 7S 4E 15ACD1 *****	33	137	132	16	110	88	88	287	172	999	412	999	0	0	8.2	3.64	0.06	0.38	27.67	0.78	0.27	0.28	0.14	0.0	0.0	0.50	11.47	1.50	0.94	0.20	0.00139	4.5
BLAINE RAWLINS WELL #3 7S 4E 23CBB2 *****	39	134	130	14	107	188	188	236	188	999	366	289	0	92	11.3	8.43	0.03	0.59	0.0	0.57	0.12	0.17	0.16	0.0	0.0	0.83	6.86	1.35	0.80	0.04	0.00049	2.0
BELL BRAND RANCHES WELL 7S 4E 25ADC1 *****	37	137	132	16	110	93	93	328	93	999	385	999	0	0	6.6	6.41	0.02	0.39	28.16	0.21	0.16	0.10	0.17	0.0	0.0	1.03	11.98	1.30	0.75	-0.00	0.00012	1.6
GUTHERIES RANCH WELL 7S 4E 26BCB1 4920.	31	131	128	12	104	94	94	268	94	999	407	999	0	0	9.2	6.03	0.05	0.78	33.54	0.75	0.17	0.19	0.20	0.0	0.0	1.48	9.20	1.47	0.90	0.16	0.00070	3.7
DAVE LATHINEN WELL 7S 4E 27BC1 5261.	27	122	120	3	94	87	87	253	166	999	401	999	0	0	10.2	5.01	0.13	1.14	39.13	1.15	0.20	0.22	0.22	0.0	0.0	1.35	9.99	1.43	0.85	0.12	0.00114	9.7
ACE BLACK WELL #2 7S 5E 50BC1 95.	32	121	119	3	93	175	175	180	175	999	353	261	0	93	17.6	24.96	0.04	0.62	17.13	0.25	0.04	0.08	0.18	0.0	0.0	0.54	3.82	1.19	0.62	-0.11	0.00007	2.1
DAVIS BROTHERS WELL #1 7S 5E 7ABB1 *****	39	131	128	12	104	187	185	232	187	999	355	264	0	91	11.7	10.46	0.04	0.54	33.55	0.42	0.10	0.13	0.17	0.0	0.0	1.56	6.56	1.30	0.75	-0.00	0.00034	2.6
DAVIS BROTHERS WELL #2 7S 5E 8CC1 3066.	40	131	127	11	104	184	184	212	184	271	348	255	91	90	13.6	16.25	0.03	0.45	25.99	0.25	0.06	0.11	0.17	0.0	0.0	1.33	5.07	1.24	0.69	-0.07	0.00016	1.7
HARRY LOOS WELL 7S 5E 9DD1 3406.	40	130	127	11	103	90	46	223	90	267	346	252	90	90	12.5	7.26	0.07	0.44	46.47	0.52	0.14	0.21	0.16	0.0	0.0	1.35	7.96	1.25	0.71	-0.05	0.00022	5.1
ROY DAVIS WELL #2 7S 5E 13AAC1 1325.	25	133	129	13	106	92	92	265	92	999	487	999	0	0	9.4	4.94	0.21	0.54	25.60	0.85	0.20	0.27	0.17	0.0	0.0	0.54	9.55	1.56	0.97	0.25	0.00038	14.3
CARL STEINER WELL 7S 5E 13CBB1 0.	36	127	124	7	99	188	188	229	188	999	351	259	0	92	12.0	13.01	0.0	0.44	21.25	0.29	0.08	0.12	0.17	0.0	0.0	1.28	5.94	1.26	0.70	-0.05	0.00017	0.0
ROBERT TINDALL WELL 7S 5E 16ACD1 0.	40	131	127	11	104	181	181	209	181	271	348	255	91	90	13.9	13.79	0.02	0.33	33.55	0.20	0.07	0.10	0.16	0.0	0.0	1.33	5.61	1.24	0.69	-0.07	0.00021	1.6
BELL BRAND INC. WELL 7S 5E 19CC1 4428.	37	134	130	14	107	186	186	225	186	999	374	999	0	0	12.3	12.45	0.02	0.49	30.74	0.30	0.08	0.11	0.18	0.0	0.0	1.24	5.79	1.38	0.82	0.07	0.00046	1.4
GENE TINDALL WELL 7S 5E 28ACD1 4239.	34	133	129	13	106	199	187	262	199	999	391	999	0	0	9.6	10.92	0.06	0.46	26.55	0.36	0.09	0.13	0.17	0.0	0.0	1.07	6.36	1.39	0.83	0.09	0.00024	3.7
GEORGE TURNER WELL 7S 6E 7AAC1 0.	25	137	132	16	110	186	184	197	186	999	508	999	0	0	15.3	37.98	0.06	0.54	21.92	0.13	0.03	0.05	0.18	0.0	0.0	1.18	3.15	1.44	0.85	0.13	0.00003	2.6
COLYER CATTLE CO. WELL 3 7S 6E 9BAD1 0.	51	137	132	16	110	131	131	71	131	241	328	223	84	83	60.7	108.96	0.31	0.22	14.58	0.03	0.01	0.04	0.17	0.0	0.0	1.00	1.45	0.69	0.18	-0.61	0.0	14.0
R.L. OWENS WELL #2 7S 6E 16CC1 0.	43	125	123	6	97	91	62	188	91	223	316	218	87	86	16.3	11.54	0.09	0.54	46.47	0.39	0.09	0.11	0.15	0.0	0.0	1.35	6.38	1.16	0.62	-0.14	0.00037	6.2
HOT SPRINGS RANCH WELL 7S 6E 21DBC1 0.	43	126	123	7	98	94	56	166	94	226	318	219	87	87	20.0	15.96	0.08	0.40	39.74	0.23	0.06	0.10	0.16	0.0	0.0	1.35	5.17	1.17	0.63	-0.14	0.00034	5.7
R.L. OWENS WELL #4 7S 6E 23BBB1 0.	47	121	119	3	93	93	93	205	130	194	288	154	82	78	14.2	9.88	0.22	0.48	0.0	0.43	0.10	0.12	0.14	0.0	0.0	1.43	6.76	1.13	0.60	-0.17	0.01035	14.0
ROSE WILLIAMS WELL 7S 6E 23CAD1 0.	44	137	132	16	110	93	93	282	93	999	352	259	0	89	12.5	7.70	0.15	0.57	22.27	0.69	0.13	0.14	0.12	0.0	0.0	1.39	7.51	1.31	0.77	0.00	0.00080	10.4
R.L. OWENS WELL #7 7S 6E 26ADA1 3899.	38	126	123	7	98	81	81	275	164	255	339	227	91	89	8.9	3.92	0.29	1.49	26.46	2.45	0.25	0.18	0.11	0.0	0.0	1.55	12.76	1.30	0.75	-0.00	0.00166	19.1



Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)											Atomic Ratios						Molar Ratios						Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> (atmospheres)	R = Magnesium + Calcium + Potassium				
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	X <sub>9</sub>	X <sub>11</sub>	Na/K	Ca/Mg	Mg/Ca	Cl/F	Cl/Br	Cl/I	Ca/Na	Ca/Mg	Cl/CO <sub>3</sub>	Cl/CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>			Ca/Na	Quartz	Chalcedony	Amorphous Silica
			°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	g/g	g/g	g/g	g/g	g/g	g/g	g/g	g/g	g/g	g/g	g/g	g/g			g/g	g/g	g/g	kJ/mol
<u>Owyhee County (cont'd.)</u>																																		
JAMES PRESCOTT WELL 75 6E 27ADB1 2044.	43	127	124	8	99	87	87	216	87	233	325	221	87	87	13.2	6.97	0.15	0.85	33.16	1.05	0.14	0.14	0.11	0.0	0.0	1.37	8.29	0.93	0.39	-0.38	0.00006	10.7		
JEAN PRESCOTT H S 75 6E 34DCB1S1703.	41	127	124	7	99	99	52	184	99	241	328	223	89	88	17.0	15.47	0.08	0.55	297.88	0.35	0.06	0.09	0.14	0.0	0.0	1.32	5.20	1.02	0.48	-0.28	0.00006	5.2		
PRESCOTT W S 75 6E 3588B1S 0.	40	130	127	11	103	86	86	242	86	267	346	252	90	90	10.9	5.77	0.23	1.05	24.60	1.37	0.17	0.16	0.12	0.0	0.0	1.59	9.63	1.27	0.73	-0.03	0.00046	15.3		
INDIAN BATHTUB H S 85 6E 390D1S1699.	39	129	126	10	102	182	129	213	182	267	346	252	91	90	13.5	14.22	0.15	0.81	35.09	0.51	0.07	0.09	0.13	0.0	0.0	1.64	5.52	1.30	0.75	-0.00	0.00068	9.1		
INDIAN H S 125 7E 33C 156548.	69	121	119	3	93	61	61	4	67	152	246	40	61-26	212.6	87.17	0.0	0.32	0.0	0.05	0.01	0.03	0.13	0.0	0.0	0.95	1.88	0.74	0.28	-0.53	0.00126	0.0			
MURPHY H S 165 9E 2498B1S 265.	51	127	124	7	99	160	160	141	119	200	296	158	81	76	25.5	87.17	0.0	0.34	0.0	0.08	0.01	0.01	0.06	0.0	0.0	1.53	2.97	1.13	0.62	-0.17	0.00866	0.0		
<u>Power County</u>																																		
INDIAN SPRINGS 85 31E 180AB1S5829.	32	63	68	-46	31	71	71	173	116	999	999	999	0	0	18.7	2.52	0.41	168.45	0.0	51.47	0.40	0.46	1.47	0.0	0.0	31.36	9.10	0.56	-0.01	-0.75	0.00869	27.9		
ROCKLAND WARM SPRINGS 105 30E 130CC1S1582.	38	67	72	-43	35	72	72	504	154	999	31	999	0	0	7.5	1.17	0.59	167.49	0.0	54.52	0.85	0.88	2.65	0.0	0.0	29.44	17.77	0.51	-0.05	-0.80	0.00463	35.4		
<u>Twin Falls County</u>																																		
MIRACLE H S 85 14E 31ACB1S1325.	54	133	129	13	106	87	87	25	87	207	150	192	80	79	136.1	95.09	0.0	0.94	0.0	0.05	0.01	0.05	0.31	0.0	0.0	3.27	1.42	0.86	0.36	-0.43	0.00003	0.0		
HARRY MUTTANUS WELL #2 85 14E 33CBA1 227.	59	135	131	15	108	108	108	34	108	202	149	159	77	70	113.4	158.49	0.0	0.96	0.0	0.03	0.01	0.02	0.36	0.0	0.0	2.81	1.20	1.00	0.50	-0.29	0.00037	0.0		
EU KEHPA WELL 95 14E 9ADD1 1699.	31	102	103	-13	72	78	44	119	78	124	118	97	86	81	32.4	14.57	0.07	2.68	49.24	1.08	0.07	0.09	0.21	0.0	0.0	1.60	5.09	0.85	0.28	-0.46	0.00004	5.2		
SAM HIGH AND SONS WELL 115 19E 330DD1 7305.	33	112	112	-4	83	69	69	507	157	189	143	151	90	87	3.4	1.10	0.24	26.80	0.0	42.66	0.91	0.35	0.22	0.0	0.0	3.39	35.10	1.24	0.68	-0.07	0.03533	0.0		
T. STURGILL WELL 115 20E 34CCC1 0.	32	76	80	-35	45	51	51	618	182	999	999	999	0	0	2.5	0.45	0.34	3.83	0.0	29.12	2.24	0.35	0.05	0.0	0.0	1.04	68.46	0.76	0.19	-0.55	0.00671	0.0		
125 17E 6CBB1 7570.	37	76	80	-35	45	80	80	315	145	999	999	999	0	0	7.1	2.17	0.44	1.41	12.62	7.97	0.46	0.23	0.04	0.0	0.0	0.79	15.19	0.68	0.12	-0.63	0.01544	27.7		
NAT-500-PAH W S 125 17E 518AB1S 114.	36	61	67	-47	29	81	81	328	155	999	999	999	0	0	6.6	2.20	0.68	2.26	0.0	8.48	0.45	0.19	0.05	0.0	0.0	1.20	15.57	0.45	-0.11	-0.86	0.00804	36.8		

IDAHO STATE WELL 12S 18E 18BA1 2055.	38	115	114	-1	87	65	65	417	176	185	142	148	87	83	4.5	1.55	0.18	7.15	0.0	14.22	0.65	0.29	0.14	0.0	0.0	2.33	30.45	1.19	0.64	-0.11	0.00306	0.0
HOLLISTER VILLAGE WELL																																
13S 17E 7BAB1 946.	35	67	72	-43	35	84	84	341	148	999	999	999	0	0	6.2	2.26	0.48	1.34	12.89	7.33	0.44	0.21	0.04	0.0	0.0	0.99	15.22	0.56	0.00	-0.74	0.01891	29.1
MAGIC H S																																
16S 17E 30ACA1S1457.	46	68	73	-41	36	45	45	396	124	999	999	999	0	0	4.9	0.76	0.49	6.79	0.0	47.41	1.32	0.28	0.04	0.0	0.0	0.69	48.38	0.40	-0.13	-0.90	0.09319	0.0

Valley County

BOILING SPRINGS 12N 5E 229BC1S 625.	85	135	129	13	106	89	35	61	89	168	133	127	51	55	71.0	65.15	0.09	0.49	0.0	0.07	0.02	0.04	0.19	0.0	0.0	2.71	2.25	0.36	-0.06	-0.87	0.00011	5.6
SILVER CREEK PLUNGE																																
12N 5E 360BA1S 0.	39	104	104	-11	74	179	157	181	179	156	128	104	78	67	17.3	45.33	0.33	0.45	0.0	0.13	0.02	0.04	0.12	0.0	0.0	0.81	3.12	0.83	0.28	-0.47	0.00006	12.5
CABARTON H S																																
13N 4E 31CAB1S 265.	71	123	121	5	95	99	99	47	91	161	130	65	58	-3	89.5	102.55	0.0	2.39	0.0	0.07	0.01	0.04	0.86	0.0	0.0	2.88	1.50	0.76	0.30	-0.51	0.00283	0.0
CASCADE CITY WELL																																
14N 3E 36ABD1 0.	43	96	98	-18	66	46	46	-1	46	123	114	87	68	53	246.6	63.20	0.0	2.12	0.0	0.20	0.02	0.04	0.30	0.0	0.0	2.39	2.50	0.54	-0.00	-0.77	0.00003	0.0
VULCAN H S																																
14N 6E 118DA1S1892.	87	147	141	26	122	135	135	80	135	194	145	155	57	46	53.3	91.04	0.09	0.38	0.0	0.04	0.01	0.02	0.24	0.0	0.0	1.07	1.64	0.64	0.23	-0.59	0.00065	4.7
ARLING W S																																
15N 3E 138BC1S3020.	34	110	110	-6	81	62	62	14	62	191	143	153	85	81	170.1	80.46	0.13	3.30	0.0	0.24	0.01	0.12	0.44	0.0	0.0	2.71	2.18	0.49	-0.08	-0.82	0.0	0.0
MOLLY'S H S																																
15N 6E 14ABB1S 76.	59	129	126	10	102	83	83	54	95	192	143	153	71	64	79.4	61.02	0.0	0.32	0.0	0.06	0.02	0.06	0.22	0.0	0.0	1.59	2.32	1.03	0.54	-0.26	0.00163	0.0
SOUTH FORK PLUNGE																																
15N 6E 14CDB1S 0.	55	112	111	-5	83	62	62	55	62	149	126	109	66	55	78.5	26.15	0.12	0.40	0.0	0.16	0.04	0.10	0.19	0.0	0.0	1.74	3.83	0.37	-0.13	-0.92	0.00001	0.0
PISTOL CREEK H S																																
16N 10E 14DBC2S 13.	46	115	114	-1	87	63	63	41	54	177	138	131	76	68	100.8	28.94	0.0	0.64	0.0	0.24	0.03	0.08	0.21	0.0	0.0	0.49	3.09	1.08	0.55	-0.22	0.07220	0.0
SUNFLOWER FLAT HS																																
16N 12E 158BB1S 136.	65	126	123	7	98	77	77	55	77	173	136	129	65	52	81.8	44.75	0.05	0.04	0.0	0.01	0.02	0.09	0.19	0.0	0.0	0.59	2.58	0.66	0.18	-0.62	0.00005	4.1
RIVENSIDE H S																																
16N 12E 16CBB1S 0.	43	121	119	3	95	80	80	58	80	203	148	160	81	76	74.6	43.04	0.0	0.48	0.0	0.15	0.02	0.08	0.19	0.0	0.0	0.43	2.60	1.04	0.50	-0.27	0.00009	0.0
HOLDOVER H S																																
17N 6E 2BAA1S 95.	46	115	114	-1	87	73	73	40	73	177	138	131	76	68	102.0	65.38	0.0	0.59	59.71	0.09	0.02	0.04	0.17	0.0	0.0	2.68	2.42	0.84	0.31	-0.46	0.0	0.0
KWIKWI'S H S																																
17N 10E 118BA1S 57.	69	123	120	4	94	95	95	45	95	162	130	57	59	-7	93.5	83.38	0.0	0.60	0.0	0.06	0.01	0.04	0.30	0.0	0.0	0.70	1.58	0.59	0.12	-0.69	0.00022	0.0
MID PK INDIAN CRK HS																																
17N 11E 16ACB1S 6.	72	142	137	21	116	136	136	78	136	202	148	160	67	58	55.2	99.62	0.0	0.44	0.0	0.06	0.01	0.03	0.17	0.0	0.0	0.59	1.59	0.77	0.32	-0.49	0.00029	0.0
INDIAN CREEK H S																																
17N 11E 21B 1S.151.	88	142	137	21	116	137	137	82	137	183	140	-20	54-75	52.0	95.89	0.0	0.42	0.0	0.05	0.01	0.02	0.15	0.0	0.0	0.61	1.48	0.52	0.11	-0.71	0.00053	0.0	
SOX H S																																
17N 13E 27AAC1S 68.	55	117	115	0	88	73	73	22	73	166	133	125	69	58	142.9	77.08	0.0	0.32	0.0	0.06	0.01	0.03	0.15	0.0	0.0	0.58	1.88	0.75	0.24	-0.55	0.00014	0.0
HOSPITAL H S																																
17N 14E 50CB1S 8.	0	106	106	-10	76	69	69	34	69	999	999	999	0	0	113.8	44.61	0.0	0.58	0.0	0.12	0.02	0.03	0.16	0.0	0.0	0.88	2.43	1.67	1.03	0.33	0.00050	0.0
TEAPOT H S																																
18N 6E 9ADC1S 95.	60	117	115	0	88	72	72	47	72	159	129	168	64	99	89.3	47.75	0.0	0.34	26.98	0.11	0.02	0.05	0.11	0.0	0.0	1.40	2.76	0.61	-0.12	-0.67	0.0	0.0
HOT CREEK W S																																
18N 8E 17DA1S 0.	35	110	110	-6	81	79	79	75	79	188	142	151	84	80	59.3	36.61	0.0	0.84	0.0	0.22	0.03	0.08	0.24	0.0	0.0	0.60	3.16	1.08	0.52	-0.23	0.00011	0.0

Washington County

COVE CREEK H S 10N 3W 90CC1S 19.	74	152	145	50	127	172	172	144	129	222	157	218	72	71	24.7	27.89	0.02	35.35	12.11	2.02	0.04	0.28	4.91	0.0	0.0	2.71	1.60	1.08	0.63	-0.18	0.00851	1.0
ELVIN CRAIG WELL																																
11N 2W 16AAB1 0.	20	125	123	6	97	83	83	503	198	999	257	999	0	0	3.4	1.46	1.01	3.93	0.0	48.99	0.68	0.17	0.01	0.0	0.0	0.54	24.59	1.58	0.98	0.27	0.00259	45.4

Basic Data Table 2. Estimated Aquifer Temperatures, Atomic and Molar Ratios of Selected Chemical Constituents, Free Energies of Formation of Selected Minerals, Partial Pressures of CO<sub>2</sub> Gas and R Values from Selected Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min.)	Measured Surface Temperature (°C)	Aquifer Temperatures and Percentage of Cold Water Estimated from Geochemical Thermometers (see footnotes)														Atomic Ratios							Molar Ratios							Free Energies of Formation of			Partial Pressure of CO <sub>2</sub> Gas (atmospheres)	R = Magnesium + Calcium + Potassium
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	T <sub>11</sub>	% <sub>9</sub>	% <sub>11</sub>	Na/K	Na/Ca	Mg/Ca	Ca/Fluoride	Chloride/Boron	Chloride/Fluoride	Ca/Na	Ca/Bicarbonate	Chloride/Bicarbonate + Bicarbonate	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>	Ca/Na	Quartz	Chalcedony	Amorphous Silica				
			Na	Ca	Mg	Ca	Cl	Cl	Cl	Ca	Na	Ca	HCO <sub>3</sub>	CO <sub>3</sub> + HCO <sub>3</sub>	NH <sub>4</sub> /Cl	NH <sub>4</sub> /F	Cl/SO <sub>4</sub>	Ca/Na	ΔG Quartz	ΔG Chalcedony	ΔG Amorphous	PCO <sub>2</sub>	Mg**/Mg+Ca+K												
<i>Washington County (cont'd.)</i>																																			
CRANE CREEK H S 11N 3W 78DB1S	19.	92	172	162	49	150	163	163	137	163	248	165	225	68	64	26.5	16.83	0.03	33.50	6.09	4.30	0.06	0.22	1.68	0.0	0.0	2.17	2.21	1.00	0.60	-0.22	0.00739	2.1		
CRANE CREEK H S 11N 3W 78DB2S	19.	57	176	165	53	154	166	166	142	135	999	198	999	0	0	25.1	16.83	0.03	33.50	6.09	4.30	0.06	0.22	1.68	0.0	0.0	2.17	2.21	1.55	1.05	0.26	0.00297	2.5		
DOUGLAS MCGINNIS WELL 11N 5W 20BDD1	0.	21	105	105	-10	75	61	61	383	156	236	161	222	97	97	5.2	1.18	0.28	7.29	414.33	29.39	0.85	0.35	0.08	0.0	0.0	0.74	30.45	1.34	0.74	0.02	0.00833	0.0		
11N 6W 3DBB1	0.	24	259	231	136	254	45	45	-14	45	999	472	999	0	0	340.1	47.55	0.0	7.90	4.27	1.10	0.02	0.10	0.71	0.0	0.0	0.42	2.01	2.60	2.01	1.29	0.00004	0.0		
GLENN HILL WELL 11N 6W 3DCB1	0.	25	265	236	142	261	68	68	11	68	999	465	999	0	0	184.2	56.66	0.04	49.13	6.98	3.16	0.02	0.41	1.83	0.0	0.0	0.99	1.77	2.68	2.09	1.37	0.00046	0.0		
WEISER H S 11N 6W 10ACB1S	19.	22	80	84	-31	49	42	42	71	87	999	999	999	0	0	60.7	7.26	0.25	7.59	6.32	4.74	0.14	0.42	0.65	0.0	0.0	0.87	7.96	0.99	0.40	-0.32	0.00220	0.0		
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	0.	78	156	149	34	132	141	141	85	141	228	159	220	71	70	49.6	93.87	0.0	10.35	8.12	0.43	0.01	0.12	1.37	0.0	0.0	1.01	1.32	0.46	0.03	-0.79	0.0	0.0		
GEOSOLAR GROWERS WELL #2 11N 6W 10CCA2	0.	77	152	145	30	127	145	145	93	145	218	155	216	70	70	44.9	90.40	0.06	7.15	7.20	0.33	0.01	0.12	1.19	0.0	0.0	0.94	1.35	0.52	0.08	-0.73	0.0	3.0		
GEOSOLAR GROWERS WELL #3 11N 6W 10CCA3	0.	70	156	149	34	132	142	142	88	142	246	164	225	77	74	47.6	84.16	0.0	9.10	7.75	0.42	0.01	0.13	1.30	0.0	0.0	1.01	1.40	0.54	0.08	-0.73	0.0	0.0		
MIDVALE CITY WELL 13N 3W 80CC1	0.	28	127	124	8	99	242	144	373	216	999	193	999	0	0	5.4	14.63	0.15	2.37	0.0	5.89	0.07	0.06	0.02	0.0	0.0	0.60	4.64	1.46	0.88	0.15	0.00118	6.1		
FAIRCHILD LUMBER CO. 13N 4W 13BAC1	0.	28	120	118	2	91	51	51	5	51	999	176	280	0	95	208.9	42.84	0.09	2.45	0.0	2.37	0.02	0.03	0.03	0.0	0.0	0.62	2.50	1.36	0.78	0.05	0.00061	0.0		
LAKEY H S 14N 2W 68BA1S1631.	70	119	117	1	91	78	74	47	78	143	125	150	57	91	89.5	20.51	0.01	39.49	0.0	4.24	0.05	1.08	5.39	0.0	0.0	1.90	2.37	0.72	0.26	-0.55	0.00062	0.9			
CAMBRIDGE CITY WELL 14N 3W 3DDC1	0.	26	118	116	0	89	180	97	175	180	999	179	291	0	96	18.3	48.95	0.13	2.04	0.0	1.23	0.02	0.03	0.04	0.0	0.0	0.69	2.54	1.34	0.76	0.03	0.00030	5.1		
FAIRCHILD H S 14N 3W 19CDB1S	220.	50	106	106	-10	76	63	63	61	63	122	115	93	67	54	71.6	17.43	0.16	10.05	0.0	4.74	0.06	0.15	0.31	0.0	0.0	0.37	4.06	0.79	0.27	-0.51	0.00033	0.0		

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**BASIC DATA TABLE 3**

BASIC DATA TABLE 3  
 TRACE METAL ANALYSES OF SELECTED THERMAL WATER IN IDAHO  
 (Chemical constituents in milligrams per liter)  
 Analyses by EG&G Idaho, Inc. using  
 Neutron Activation at Idaho National Engineering Laboratory

Spring/Well Identif. Code Number & Name	Silver (Ag)	Aluminum (Al)	Arsenic (As)	Cadmium (Cd)	Barium (Ba)	Bromine (Br)	Cobalt (Co)	Copper (Cu)	Diethylamine (DEA)	Europium (Eu)	Iron (Fe)	Gasoline (Gas)	Helium (He)	Mercury (Hg)	Iodine (I)	Lanthanum (La)	Lithium (Li)	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)	Ornithine (Orn)	Radium (Ra)	Strontium (Sr)	Tantalum (Ta)	Tellurium (Te)	Vanadium (V)	Zinc (Zn)												
<u>Ada County</u>																																							
F. KOCH WELL 3N 2E 20801	0.0	0.0740	0.0	0.0	0.0	0.0	0.0	0.0071	0.012	0.0007	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0									
BEARD WELL 3N 2E 1180C1	0.0	0.0870	0.0	0.0	0.0	0.0	0.0	0.0016	0.011	0.0023	0.0	0.0	0.0	0.100	0.0	0.0022	0.0	0.0	0.0	0.0	0.0	0.007	0.0	0.0007	0.0	0.0	0.0	0.0	0.0	0.0	0.0								
DENNIS FLAKE WELL 4N 1E 2400C1	0.0010	0.2700	0.005	0.0	0.0820	0.002	0.0	0.0006	0.008	0.0001	0.0	0.0	0.0008	0.430	0.0	0.0	0.0	0.0002	0.0	0.0002	0.0	0.004	0.0	0.0007	0.0	0.0	0.0	0.0	0.0	0.0	0.008								
CARL RUSH WELL 4N 2E 480C1	0.0	0.0480	0.021	0.0	0.0	0.014	0.0	0.0010	0.010	0.0001	0.0	0.0	0.0	0.210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.0	0.0007	0.0002	0.0	0.0003	0.0004	0.0	0.002	0.0005	0.008							
EDWARD'S GREENHOUSE WELL 4N 2E 2940D1	0.0	0.2900	0.0	0.0	0.0	0.05911	0.000	0.0	0.0040	0.018	0.0	1.100	0.0	2.6000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001	0.0	0.0003	0.0	0.0	0.0001	0.0510	0.0	0.0	0.0	0.008							
SHADOW VALLEY WELL 5N 1E 2580C1	0.0	0.0580	0.0	0.0	0.0	0.016	0.0	0.0016	0.0	0.0002	0.0	0.0	0.0	0.150	0.0	0.0003	0.0	0.0003	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0090	0.0	0.0	0.0	0.0	0.005	0.0	0.710						
BEN STADLER WELL 5N 1E 2600D1	0.0	0.0350	0.027	0.0	0.0	0.0	0.0	0.0020	0.016	0.0001	0.0	0.0	0.0	0.210	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.009							
JULIUS JEKER WELL 5N 1E 3540A1	1.3000	45.0000	1.400	0.1000	0.0	0.0	0.0	2.4000	1.6000	0.0	1.7000	0.0	1.500	1.9000	0.0	0.0	1.7000	0.0	1.9000	0.0	2.100	1.8000	1.6000	0.0	0.0	5.3000	2.100	0.0	1.7000	2.0000	5.1000	1.9000	0.0	2.1000	1.8000	1.7000	1.800	3.2000	0.0
<u>Adams County</u>																																							
WHITE LICKS H S 16N 2E 3380C1S	0.0001	0.0	0.660	0.0	0.0220	0.034	0.0	0.0	0.0034	0.011	0.0600	0.0	0.0	0.170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.059	0.0	0.0054	0.0	0.0	0.0	0.8600	0.0	0.0	0.0	0.0	0.0	0.007					
KRIGBAUM H S 19N 2E 2200A1S	0.0	0.0710	0.220	0.0	0.0080	0.0	0.0	0.0024	0.010	0.0034	0.0	0.0	0.0	0.160	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.014	0.0	0.0007	0.0	0.0	0.0	0.1300	0.0	0.0	0.0	0.0	0.0	0.0	0.007				
ZIM'S RESORT 20N 1E 2600A1S	0.0	0.0	0.0	0.0	0.0	0.087	0.0	0.0020	0.010	0.0018	0.0	0.0	0.0	0.100	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0520	0.0	0.0	0.0	0.0	0.012	0.0	0.0005	0.0	0.0	0.0	0.0	0.0	0.008				
STINKY H S 21N 1E 2340A1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0043	0.018	0.0033	0.0	0.0	0.0	0.170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0042	0.0	0.0	0.0	0.0	0.011	0.0	0.0003	0.0	0.0	0.0	0.3200	0.0	0.0	0.0	0.010		
BOULDER CREEK RESORT 22N 1E 3400A1S	0.0	0.0560	0.0	0.0	0.0	0.0	0.0	0.0016	0.009	0.0001	0.0	0.0	0.0	0.110	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.008			
STARKEY H S 18N 1W 3408B1S	0.0	0.1100	0.0	0.0	0.0	0.0	0.0	0.0016	0.013	0.0002	0.0	0.0	0.0	0.110	0.0	0.0028	0.0	0.0	0.0	0.0	0.0	0.0014	0.0	0.0	0.0	0.0	0.004	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.009			
<u>Bennock County</u>																																							
ROBERT BROWN WELL #1 5S 34E 2600A1	0.0	0.0	0.0	0.0	0.0880	0.0	0.0	0.0050	0.016	0.0060	0.0	0.0	0.0	0.370	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.065	0.0	0.0	0.0	0.065	0.0	0.0015	0.0	0.0	0.0	1.1400	0.0	0.0	0.0	0.0	0.017		
DEAN MORRIS WELL 9S 38E 2100A1S	0.0	0.2100	0.0	0.0	0.1200	0.0	0.0	0.0030	0.096	0.0120	0.0	0.0	0.0	0.450	0.0	0.0006	0.0004	0.0	0.0	0.0001	0.0	0.0	0.0016	0.086	0.0	0.0	0.0	0.0	0.0	0.3600	0.0	0.0	0.0	0.0	0.0	0.017			
DOMINATA H S 12S 37E 1200D1S	0.0	0.1200	0.0	0.0	0.1300	0.0	0.0	0.0003	0.0040	0.014	0.0040	0.0	0.0	0.100	0.0	0.0001	0.0001	0.0002	0.0	0.0280	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.2200	0.0	0.0	0.0028	0.0	0.0	0.017		
<u>Bear Lake County</u>																																							
BEAR LAKE H S 15S 44E 1300A1S	0.0	0.2100	0.0	0.0	0.0	0.0	0.0	0.0030	0.011	0.0080	0.0	0.0	0.0	0.150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.062	0.0	0.0002	0.0	0.0004	0.0	4.2000	0.0	0.0	0.0	0.0	0.0	0.0	0.010				
<u>Bingham County</u>																																							
YANDELL SPRINGS 3S 37E 3108B1S	0.0	0.0280	0.0	0.0	0.0630	0.0	0.0	0.0008	0.030	0.012	0.0020	0.0	0.0	0.070	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0001	0.0011	0.0	0.0	1.2000	0.0	0.0	0.0	0.0	0.0	0.0	0.011				
ALKALI FLATS H S 4S 38E 2800D1S	0.0	2.5000	0.090	0.0	0.3600	0.070	0.0	0.0009	0.030	0.034	0.0005	0.0	0.0	0.0002	2.800	0.0	0.0003	0.0	0.0	0.0	0.0090	0.0	0.6400	0.0	0.0052	0.0	0.120	0.0	0.0240	0.0006	0.0	0.0010	0.0050	0.0	0.0001	0.0	0.003	0.0	0.182
<u>Blaine County</u>																																							
HAILEY H S 2N 18E 1808B1S	0.0	0.0910	0.0	0.0	0.0	0.0	0.0	0.0010	0.009	0.0036	0.0	0.0	0.0	0.100	0.0	0.0028	0.0	0.0	0.0	0.0	0.0	0.010	0.0	0.0040	0.0	0.0	0.0	0.0580	0.0	0.0	0.0	0.083	0.0	0.007					
CLARENDON H S 3N 17E 2700B1S	0.0	0.0770	0.0	0.0	0.0	0.0	0.0	0.0007	0.013	0.013	0.0046	0.0	0.0	0.100	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0004	0.0	0.0	0.0	0.0330	0.0	0.0	0.0	0.100	0.0	0.010					
GUYER H S 4N 17E 15A0C1S	0.0	0.0800	0.0	0.0	0.0	0.0	0.0	0.0019	0.001	0.0074	0.0	0.0	0.0	0.040	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.016	0.0	0.0002	0.0	0.0	0.0	0.1300	0.0	0.0	0.0	0.100	0.0	0.007					
WARFIELD H S 4N 17E 3188C1S	0.0	0.1040	0.0	0.0	0.0	0.0	0.0	0.0014	0.009	0.0073	0.0	0.0	0.0	0.080	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.016	0.003	0.0002	0.0	0.0	0.0	0.0630	0.0	0.0	0.0	0.0	0.0	0.0	0.007				



Basic Data Table 3. Trace Metal Analyses of Selected Thermal Water in Idaho (continued)

Spring/Well Identifi- cation Number & Name	Silver (Ag)	Aluminum (Al)	Antimony (As)	Gold (Au)	Barium (Ba)	Bromine (Br)	Cadmium (Cd)	Cerium (Ce)	Cobalt (Co)	Chromium (Cr)	Cesium (Cs)	Copper (Cu)	Hydrogen (H)	Europium (Eu)	Iron (Fe)	Gallium (Ga)	Hafnium (Hf)	Mercury (Hg)	Iodine (I)	Iridium (Ir)	Lanthanum (La)	Lutetium (Lu)	Manganese (Mn)	Neodymium (Nd)	Nickel (Ni)	Neodymium (Nd)	Platinum (Pt)	Rhenium (Re)	Rubidium (Rb)	Ruthenium (Ru)	Selenium (Se)	Selenium (Se)	Strontium (Sr)	Tantalum (Ta)	Tellurium (Te)	Tungsten (W)	Vanadium (V)	Zinc (Zn)			
<u>Custer County</u>																																									
WEST PASS H S BN 17E 328CA1S	0.0	0.1700	0.0	0.0	0.0990	0.009	0.680	0.0	0.0050	0.011	0.0310	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0004	0.0	0.0008	0.0	0.0180	0.0	0.0	0.0	0.044	0.0	0.0001	0.0	0.0	0.0	0.5100	0.0	0.0	0.0	0.057	0.0	0.011		
STANLEY H S 10N 13E 30AB1S	0.0004	0.3100	0.0	0.0	0.0	0.002	0.0	0.0	0.0020	0.009	0.0020	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0003	0.0	0.0	0.0001	0.0030	0.032	0.0	0.0020	0.003	0.0	0.0005	0.0	0.0	0.0	0.0500	0.0	0.0	0.0	0.032	0.0	0.012		
SLATE CREEK H S 10N 16E 308AD1S	0.0	0.0	0.0	0.0	0.4400	0.037	0.0	0.0	0.0020	0.014	0.0290	0.0	0.0	0.0	0.150	0.0	0.0003	0.0	0.0006	0.0	0.0	0.0	0.0700	0.0	0.0	0.042	0.017	0.0020	0.0	0.0	0.0	1.1000	0.0	0.0	0.0	0.0	0.0	0.016			
SUNBEAM H S 11N 13E 190AB1S	0.0	0.7800	0.0	0.0	0.0250	0.003	0.790	0.0	0.0040	0.014	0.0008	0.0	0.0	0.0	0.130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.025	0.0	0.0010	0.0	0.0	0.0	0.0720	0.0	0.0	0.0	0.020	0.0	0.046			
SUNBEAM H S 11N 13E 190AB1S	0.0002	0.4700	0.038	0.0	0.0	0.004	0.0	0.0	0.0010	0.012	0.0040	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.011	0.0	0.0004	0.0	0.0	0.0	0.0640	0.0	0.0	0.0	0.031	0.0	0.073			
BARNEY W S 11N 25E 230AB1S	0.0	0.0280	0.0	0.0001	0.0530	0.011	0.0	0.0003	0.0010	0.011	0.0002	0.0	0.0	0.0	0.070	0.0	0.0002	0.0001	0.0	0.0	0.0	0.0	0.0009	0.0	0.0	0.002	0.0	0.0001	0.0	0.0010	0.0	0.1000	0.0	0.0	0.0004	0.0	0.0	0.011			
BILL JOHNSTON WELL 14N 19E 340AA1	0.0	0.2400	0.0	0.0	0.0670	0.008	0.0	0.0	0.0006	0.008	0.0040	0.0	0.0	0.0	0.110	0.0	0.0	0.0006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.016	0.0	0.0	0.0007	0.0	0.0	0.0001	0.9600	0.0	0.0	0.0	0.0	0.006			
<u>Elmore County</u>																																									
CHARLES BAKER WELL 3N 10E 100BA1	0.0	0.0760	0.040	0.0	0.0	0.0	0.0	0.0	0.0015	0.013	0.0006	0.0	0.0	0.0	0.100	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0022	0.0	0.0	0.0	0.005	0.0	0.0002	0.0	0.0	0.0	0.0370	0.0	0.0	0.0	0.0	0.0	0.017		
PARADISE H S 3N 10E 33AD1S	0.0	0.0940	0.0	0.0	0.0	0.0	0.0	0.0	0.0022	0.010	0.0012	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0	0.0	0.0	0.008	0.0	0.0002	0.0	0.0	0.0	0.0650	0.0	0.0	0.0	0.0	0.0	0.010		
PARADISE RESORT WELL 3N 10E 3380B1	0.0	0.3600	0.0	0.0002	0.0	0.003	0.0	0.0	0.0080	0.012	0.0010	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0005	0.0001	0.0	0.0	0.0	0.0	0.0023	0.008	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013		
NINDMEYER H S 3N 7E 2480D1S	0.0	0.5700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0030	0.0	0.0	0.0	0.0	0.0	0.0	0.0220	0.0006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.017		
DUTCH FRANK'S H S 3N 9E 78BA1S	0.0	0.4000	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.012	0.0030	0.0	0.0	0.0	0.100	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.006	0.0	0.0002	0.0	0.0	0.0	0.0300	0.0	0.0	0.0	0.0	0.0	0.017		
LESLIE BEAM WELL #1 3S 8E 36CA1	0.0045	110.0000	1.500	0.0044	0.6500	0.0	11.000	0.0070	0.0090	0.033	0.0070	0.0	0.0	0.0070	0.0	0.0	0.0060	0.0	0.0070	0.0	0.0100	0.0078	0.0	0.0	0.0	0.0	0.005	0.0	0.0100	0.0070	0.0290	0.0073	0.3700	0.0160	0.0068	0.0	0.0	0.0100	0.0		
MAGIC WEST CO. WELL 5S 10E 3280B1	0.0	0.4000	0.0	0.0	0.0	0.032	0.0	0.0	0.0010	0.022	0.0004	0.0	0.0	0.0	0.210	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0014	0.003	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.015		
<u>Franklin County</u>																																									
CLEVELAND H S 12S 41E 310AC1S	0.0	0.0	0.0	0.0003	0.0570	0.0	0.0	0.0	0.0	0.020	0.0260	0.002	0.0	0.0	0.280	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0700	0.0	0.0	0.140	0.0	0.0004	0.0	0.0	0.0	1.8000	0.0	0.0	0.0	0.0	0.0	0.0	0.012		
MAPLE GROVE H S 13S 41E 74CA1S	0.0	0.0	0.0	0.0	0.0940	0.0	0.0	0.0	0.0020	0.024	0.0410	0.0	0.0	0.0	0.250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1300	0.0	0.0	0.150	0.0	0.0	0.0	0.0	1.5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.010	
ELDIN BINGHAM WELL 15S 39E 70BC1	0.0	0.0	0.0	0.0	4.0000	0.0	0.0	0.0	0.0100	0.120	0.3500	0.0	0.0	0.0	5.800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7800	0.0	0.0	4.200	0.0	0.0001	0.0	0.0	0.0	18.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.067		
BATTLE CREEK H S 15S 39E 880C1	0.0008	0.0	0.0	0.0	1.8000	0.0	0.0	0.0	0.0030	0.091	0.1800	0.0	0.0	0.0	0.760	0.0	0.0006	0.0009	0.0	0.0	0.0	0.0	0.0	0.0	0.0110	2.700	0.0	0.0037	0.0	0.0	0.0	9.4000	0.0001	0.0	0.0	0.0	0.0	0.0	0.033		
SQUAN H S WELL 15S 39E 178CD1	0.2500	115.0000	0.660	0.0420	38.0000	0.0	0.0	0.4600	0.3000	0.760	0.4000	0.0	0.260	0.3000	0.0	0.0	0.3500	0.0	0.3800	0.0	0.3600	0.3900	0.4000	0.0	0.3700	0.7700	0.280	0.0	0.3000	0.3000	0.9100	0.2500	0.0	0.3400	0.2900	0.2800	0.0	0.0500	0.0		
<u>Fremont County</u>																																									
NEMDALE CITY WELL 7N 41E 3400D1	0.0	0.0530	0.0	0.0	0.0800	0.0	0.0	0.0010	0.0020	0.027	0.0040	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3300	0.0	4.3000	0.0	0.0	0.031	0.0	0.0002	0.0	0.0	0.0	0.0800	0.0	0.0	0.0	0.0	0.0	0.0	0.014		
ASHTON W S 9N 42E 230AC1S	0.0	2.3000	0.080	0.0001	0.2500	0.060	0.0	0.0	0.0	0.022	0.0	0.0	0.0	0.0	7.000	0.0	0.0	0.0	0.0017	0.0	0.0080	0.0	0.6400	0.0	0.0	0.0	0.0300	0.0009	0.0	0.0009	0.0	0.0	0.0	0.0060	0.001	0.0	0.0	0.0	0.200		
BIG SPRINGS 14N 44E 348BC1S	0.0009	0.3000	0.0	0.0	0.0	0.052	0.0	0.0	0.0030	0.020	0.0	0.890	0.0	0.0	1.800	15.000	0.0	0.0020	0.0007	0.0	0.0002	0.0	0.0600	0.035	0.0	0.0	0.099	0.0	0.0002	0.0	0.0070	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.002	0.0	0.690
<u>Gen County</u>																																									
ROYSTONE H S 7N 1E 800A1	0.0	0.4700	0.013	0.0	0.0	0.010	0.0	0.0	0.0007	0.012	0.0090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0000	0.0	0.0170	0.022	0.0	0.0	0.028	0.0	0.0013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.028	0.0	0.015		
<u>Gooding County</u>																																									
J. SHANNON WELL 4S 13E 28AB1	0.0005	0.4100	0.0	0.0	0.2200	0.0	0.0	0.0004	0.0130	0.015	0.0010	0.0	0.0	0.0	0.210	0.0	0.0001	0.0003	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0084	0.021	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0060	0.0	0.0	0.018		
WHITE ARROW H S 4S 13E 30AB1S	0.0	0.1110	0.0	0.0	0.0	0.0	0.0	0.0	0.013	0.0010	0.0	0.0	0.0	0.0	0.120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0017	0.0	0.0	0.007		
DAVE ARCHER WELL #2 5S 12E 3AAA1	0.0	0.0790	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.009	0.0001	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.010		

Idaho County

BURDOORP H S 22N 4E 18DC1S	0.0	0.0910	0.0	0.0	0.0	0.0	0.0	0.0	0.0066	0.012	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0	0.0	0.0	0.008	0.0	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008	
RIGHHS H S 24N 2E 14DB1S	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0024	0.013	0.0020	0.0	0.0	0.0	0.100	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.011	0.0	0.0002	0.0	0.0	0.0	0.3100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001
WEIR CREEK H S 36N 11E 13BC1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.011	0.0007	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0290	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0680	0.0	0.0	0.0018	0.0	0.0	0.0	0.0	0.0	0.0	0.001	
COLGATE LICKS H S 36N 12E 13AB1S	0.0	0.1050	0.0	0.0	0.0030	0.002	0.0	0.0	0.0016	0.010	0.0028	0.0	0.0	0.0	0.090	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0002	0.0	0.0	0.0640	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008		
JERRY JOHNSON H S 36N 13E 18AD1S	0.0	0.0600	0.0	0.0	0.0	0.0	0.0	0.0002	0.0010	0.008	0.0	0.0	0.0	0.0	0.060	0.0	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.0060	0.0	0.0	0.0022	0.0	0.0	0.0	0.0	0.005			

Jefferson County

HEISE H S 4N 40E 250DA1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0060	0.044	0.1700	4.700	0.0	0.0	0.340	65.000	0.0	0.0	0.0	0.0	0.0	0.0	0.660	0.0	0.0001	0.0	0.0	4.9000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.031
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Lemhi County

CRONKS CANYON H S 16N 21E 18AD1S	0.0	0.1070	0.0	0.0	0.0300	0.0	0.0	0.0020	0.011	0.0200	0.0	0.0	0.0	0.180	0.0	0.0023	0.0	0.0	0.0	0.0	0.0	0.0	0.057	0.0	0.0009	0.0	0.0010	0.0	0.3300	0.0	0.0	0.0	0.0	0.0	0.0	0.009
SALMON H S 20N 22E 3AB1S	0.0	0.0	0.0	0.0	0.0250	0.0	0.0	0.0020	0.012	0.0440	0.0	0.0	0.0	0.360	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.170	0.0	0.0026	0.0	0.0	0.9800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.007
SHARKEY H S 20N 24E 340C1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0008	0.0012	0.011	0.0670	0.0	0.0	0.090	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.140	0.0	0.0028	0.0	0.0	0.0095	0.9000	0.0	0.0	0.0	0.0	0.0	0.008	
BIG CREEK H S 23N 18E 220AD1S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.014	0.0830	0.0	0.0	0.0	0.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.170	0.0	0.0005	0.0	0.0	0.0	0.2100	0.0	0.0	0.0	0.0	0.0	0.0	0.008	

Oneida County

KENT H S 12S 34E 36BC1S	0.0	0.2700	0.0	0.0	0.1100	0.043	0.0	0.0005	0.0020	0.018	0.0003	0.0	0.0	0.140	0.0	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0003	0.0	0.0006	0.0	0.2200	0.0	0.0	0.0030	0.0	0.0	0.010
MALUD H S 14S 36E 270DA1S	0.0	0.0	0.0	0.0	0.3500	0.0	0.0	0.0030	0.055	0.1400	0.0	0.0	0.0	0.300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.100	0.0	0.7700	0.0005	0.0	2.8000	0.0	0.0	0.0	0.0	0.0	0.019	
PLEASANTVIEW H S 15S 35E 34AB1S	0.0	0.0	0.0	0.0	0.0470	0.0	0.0	0.0030	0.016	0.0150	0.0	0.0	0.0	0.140	0.0	0.0006	0.0003	0.0	0.0	0.0	0.0	0.0	0.093	0.0	0.0001	0.0	0.0009	0.0	1.3000	0.0	0.0	0.0	0.0	0.017	
WOODRUFF H S 16S 36E 10BB1S	0.0	0.0	0.0	0.0	0.1700	0.0	0.0	0.0010	0.026	0.0360	0.0	0.0	0.0	0.130	0.0	0.0	0.0004	0.0	0.0	0.0	0.0	0.0	0.290	0.0	0.0003	0.0	0.0008	0.0	3.4000	0.0	0.0	0.0	0.0	0.009	

Owyhee County

EARL FOOTÉ MELL #1 15 2N 70CB1	0.0005	0.2600	0.010	0.0	0.0	0.003	0.0	0.0	0.0040	0.023	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.021	0.0	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.030	0.0	0.022
GEORGE KING MELL #1 45 1E 34BA1	0.0003	0.1100	0.0	0.0	0.0	0.0	0.0	0.0020	0.013	0.0010	0.0	0.0	0.0	0.110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.010	
R. KETTERLING MELL #1 45 2E 32BC1	0.0	0.1400	0.0	0.0	0.0	0.0	0.0	0.0020	0.012	0.0002	0.0	0.0	0.0	0.130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0090	0.0	0.0	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.110		
E. LAMERANCE MELL #3 55 1E 24DB1	0.0	0.4800	0.0	0.0	0.0	0.0	0.0	0.0020	0.013	0.0006	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0030	0.0	0.0	0.003	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008		
OSCAR FIELDS MELL #1 55 2E 16BC1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0010	0.0030	0.022	0.0003	0.0	0.0	0.190	0.0	3.5000	0.0003	0.0	0.0	0.0110	0.0	0.0	0.0	0.0	0.0	0.008	0.0002	0.0	0.0	0.0	0.0	1.6000	0.0	0.0	0.008		
COOKE'S GREENHOUSE MELL #1 55 3E 26BC1	0.0	0.1600	0.0	0.0	0.0	0.0	0.0	0.0020	0.012	0.0020	0.0	0.0	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.130	0.0	0.008		
LESLIE POST MELL #2 65 3E 20CC1	0.0	0.0660	0.0	0.0	0.0770	0.0	0.0	0.0008	0.0020	0.002	0.0006	0.0	0.0	0.130	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.008	0.0	0.0001	0.0	0.0001	0.0	0.0	0.0	0.130	0.0	0.008	
IDAHO PARKS DEPT. 65 6E 120C1	0.0	0.4200	0.0	0.0	0.0160	0.0	0.0	0.0004	0.002	0.0001	0.0	0.0	0.0	0.030	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.013		
DAVIS BROTHERS MELL #1 75 5E 7AB1	0.0	0.0870	0.0	0.0	0.0	0.0	0.0	0.0030	0.015	0.0004	0.0	0.0	0.0	0.060	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.0	0.0003	0.0	0.0	0.0	0.0	0.0	0.0	0.008		
COLYER CATTLE CO. MELL #1 75 6E 9BA1	0.0	0.0620	0.0	0.0	0.0	0.0	0.0	0.0020	0.014	0.0002	0.0	0.0	0.0	0.520	0.0	0.0	0.0	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.006	0.0	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0.008		
INDIAN BATHUR H S 85 6E 380C1S	0.0002	0.1500	0.290	0.0	0.0	0.0	0.0	0.0004	0.0030	0.017	0.0003	0.0	0.0	0.110	0.0	0.0	0.0	0.0003	0.0	0.0001	0.0	0.0	0.0010	0.011	0.0	0.0004	0.0	0.0004	0.0003	0.0	0.0	0.0	0.0030	0.0	0.0	0.014	
INDIAN H S 12S 7E 33C 1S	0.0001	0.1100	0.034	0.0	0.0	0.0	0.0	0.0020	0.010	0.0021	0.0	0.0	0.0	0.120	0.0	0.0026	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.004	0.0	0.0006	0.2000	0.0	0.0	0.0	0.0	0.008			
MURPHY H S 16S 9E 24BB1S	0.0	0.1480	0.0	0.0	0.0	0.0	0.0	0.0004	0.0030	0.012	0.0002	0.0	0.0	0.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0020	0.0	0.0	0.003	0.0	0.0002	0.0	0.0	0.0015		

Power County

INDIAN SPRINGS 8S 31E 180AB1S	0.0	0.1600	0.0	0.0	0.2100	0.0	0.0	0.0004	0.0020	0.019	3.0060	0.0	0.0	0.120	0.0	0.0001	0.0005	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.021	0.0	0.0050	0.0	0.0005	0.0	1.4000	0.0	0.0	0.0	0.017
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Twin Falls County

SAM HIGH AND SONS MELL 11S 19E 330C1	0.0	0.3100	0.0	0.0004	14.0000	1.800	0.0	0.0320	0.1500	1.500	0.0550	0.0	0.0	0.0	12.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.660
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**BASIC DATA TABLE 4**

BASIC DATA TABLE 4

LOCATION, GEOLOGIC ENVIRONMENT, PRESENT USE AND POTENTIAL USE OF THERMAL SPRINGS AND WELLS IN IDAHO

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sill-iceous	Car-bon-ates									
<u>Ada County</u>																
LILLIE COLLIAS WELL 1N 1E 1ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	146	26	48	BIODEGRADATION	LAUNDRY USES	YES	43.4543 116.2782	SAVAGE, 1958
E.L. HENNIS WELL 1N 1E 10AD1		75 PLIOECNE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	99	25		HEATING AND COOLING WITH HEAT PUMP			43.4495 116.2735	SAVAGE, 1958
AGRI-CON OF IDAHO WELL 1 1N 1E 230DA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	133	24		CATFISH FARMING			43.4034 116.3036	SAVAGE, 1958
NICHOLSON WELL #1 1N 1E 25CAA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				STOCK WATERING	140	23		HEATING AND COOLING WITH GROUNDWATER HEAT PUMP			43.3929 116.2840	LOG, 1968
NICHOLSON WELL #2 1N 1E 250BA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		REPORTED TEMPERATURE; LOCATION IS VERIFIED BY FIELD CHECK; DRILLER'S LOG AVAILABLE				IRRIGATION	161	25	45	CATFISH FARMING	MUSHROOM GROWING	YES	43.3934 116.2791	LOG, 1973
AGRI-CON OF IDAHO WELL 2 1N 1E 25BDC1		12870 PLIOECNE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	143	24		CATFISH FARMING			43.3941 116.2862	SAVAGE, 1958
AGRI-CON OF IDAHO WELL 3 1N 1E 26ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	135	25		DE-ICING ROADWAYS			43.3868 116.2859	SAVAGE, 1958
BETTY DESHAZO WELL 1N 1E 33AAD1		11355 PLIOECNE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	188	24		CATFISH FARMING			43.3835 116.3352	LOG, 1972
AGRI-CON OF IDAHO WELL 4 1N 1E 35BA1		11355 PLIOECNE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	121	23		HEATING AND COOLING WITH HEAT PUMP			43.3860 116.3034	LOG, 1969
FLOYD EDWARDS WELL 1N 1E 35BBB1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	129	22		HEATING AND COOLING WITH HEAT PUMP			43.3861 116.3129	SAVAGE, 1958

AGRI-CON OF IDAHO WELL 5 IN 1E 36AAD1	10220	PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	135 24 67	DE-ICING ROADWAY	APPLE DEHYDRATION	YES	43.3831 116.2737	SAVAGE, 1958
C.J. STEWART WELL IN 2E 6AAA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	117 32	CATFISH FARMING			43.4586 116.2538	SAVAGE, 1958
100 LAND AND BEEF WELL IN 2E 6ABA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	123 24 50	CATFISH FARMING	GREENHOUSE	YES	43.4587 116.2596	SAVAGE, 1958
JOHN COOKNELL WELL 2N 1E 210DA1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	85 23	DE-ICING HIGHWAYS			43.4919 116.3347	SAVAGE, 1958
TOM BEYANS WELL 2N 1E 220DB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	24	DE-ICING SIDEWALKS		YES	43.4921 116.3183	SAVAGE, 1958
VILES CLARK WELL 2N 1E 239AC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	117 24	DE-ICING ROADWAYS			43.5000 116.3076	SAVAGE, 1958
DAVID NEAL WELL 2N 1E 23CAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION	85 25	CATFISH FARMING			43.4953 116.3055	SAVAGE, 1958
AL CLIFFORD WELL 2N 1E 230DA1		PLIOCENE AND PLEISTOCENE SEDIMENTS	PUMP OFF; TEMPERATURE NOT VERIFIED; DRILLER'S LOG AVAILABLE	DOMESTIC	94 26	HEATING AND COOLING WITH HEAT PUMP			43.4920 116.2953	SAVAGE, 1958
KUNA EAST WATER CORP. 2N 1E 24CBA1	8005	PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	93 24	DE-ICING SIDEWALKS			43.4941 116.2887	SAVAGE, 1958
GEORGE WHITMORE WELL 2N 1E 240AD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	REPORTED TEMPERATURE; NOT IN USE	UNUSED	27	FERMENTATION		YES	43.4934 116.2740	SAVAGE, 1958
CHARLES BAIR WELL 2N 1E 26ABA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	115 27	SHRIMP AND TROPICAL FISH FARMING			43.4882 116.3008	SAVAGE, 1958

\* AQUIFER TEMPERATURE REPRESENTS A BEST ESTIMATE BASED ON AN INTERPRETATION OF THE CHEMICAL GEOTHERMOMETERS FOUND IN BASIC DATA TABLE 2.  
 \*\* USE TAKEN FROM FIGURE 4. POTENTIAL USE BASED ONLY ON SURFACE TEMPERATURE. ALL OTHER FACTORS IGNORED.  
 \*\*\* USE TAKEN FROM FIGURE 4. POTENTIAL USE BASED ONLY ON BEST ESTIMATED AQUIFER TEMPERATURE. ALL OTHER FACTORS IGNORED.

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis- charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui- fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<i>Ada County (cont'd.)</i>																
DESERT VIEW ESTATES 2N 1E 27ADA1	4163	PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	97	24		HEATING AND COOLING WITH HEAT PUMP			43.4846 116.2960	SAVAGE, 1958
ED JOHNSON WELL 2N 1E 35BCD1	5677	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	103	23		CATFISH FARMING			43.4680 116.3099	SAVAGE, 1958
RONALD YANKE WELL 2N 2E 19AAD1	7494	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	265	27		FERMENTATION			43.4998 116.2545	SAVAGE, 1958
STATE PRISON WELL #2 2N 2E 27CCC1	6624	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	184	24		BIODEGRADATION			43.4739 116.2120	SAVAGE, 1958
STATE PRISON WELL #1 2N 2E 27OBD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	224	23		FERMENTATION			43.4784 116.1990	LOG, 1969
LDS STAKE FARM WELL #1 2N 2E 29AAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	167	25		CATFISH FARMING			43.4855 116.2333	SAVAGE, 1958
LDS STAKE FARM WELL #2 2N 2E 29AAD2		PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	167	25		DE-ICING ROADWAYS			43.4853 116.2335	SAVAGE, 1958
IDU LAND AND BEEF WELL 1 2N 2E 31ODC1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	26		HEATING AND COOLING WITH HEAT PUMP			43.4597 116.2673	SAVAGE, 1958
IDU LAND AND BEEF WELL 2 2N 2E 31DCA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	134	30		STOCK WATERING			43.4619 116.2394	SAVAGE, 1958
DAVID WEISS WELL 2N 2E 33ODC1	7494	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	160	25		HEATING AND COOLING WITH HEAT PUMP			43.4592 116.2281	LOG, 1973

WARREN TOZER WELL 2N 3E 109CB1	PLIOCENE AND PLEISTOCENE SEDIMENTS		IRRIGATION AND DOMESTIC	143 20 21	FISH FARMING	CATFISH FARMING	YES 43,5263 116,0923	SAVAGE, 1958
STATE TRANS. DEPT WELL 2N 3E 28CAC1	227 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE; BLACK CREEK REST AREA	DOMESTIC	297 22 27	HEATING AND COOLING WITH HEAT PUMP	FERMENTATION	YES 43,4778 116,1062	SAVAGE, 1958
FERO KOCH WELL 3N 2E 208D1	302 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	348 90 99	GRAIN-HAY DRYING	SPACE HEATING	YES 43,6244 116,1891	SAVAGE, 1958
BSU WELL #1 3N 2E 208D1		NOT FIELD CHECKED; NOT FLOWING; COVERED	GEOHERMAL RESEARCH	86 28	DE-ICING SIDEWALKS		43,6107 116,1708	
GARDEN CITY WELL 3N 2E 50CA1	1703 PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE	PUBLIC SUPPLY	247 20			43,6208 116,2585	SAVAGE, 1958
IDAHO STATE CAPITOL WELL 3N 2E 10ABA1	1135 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC AND SPRINKLING	327 40	SPACE HEATING		43,6180 116,1984	LOG, 1962
OLD HOISE HOTEL WELL 3N 2E 10ABB1		WELL CEMENTED OVER (NO TEMPERATURE CHECK)	UNUSED	44			43,6176 116,2010	
CLARK MAGSTADT WELL 3N 2E 108DC1	2838 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	COMMERCIAL LAUNDRY	192 24	HEATING AND COOLING WITH HEAT PUMP		43,6119 116,2059	SAVAGE, 1958
BEARD WELL 3N 2E 11ABC1	567	COVERED	GEOHERMAL RESEARCH	198 56 97	SEEDLING CONIFERS	BLANCHING	YES 43,6165 116,1821	
BSU WELL #2 3N 2E 11BAB1		NOT FLOWING	GEOHERMAL RESEARCH	391 78	LAUNDRY USES		43,6181 116,1833	
BSU WELL #3 3N 2E 11BAC1		WELL HAS BEEN COVERED	GEOHERMAL RESEARCH	372 74	APPLE DEHYDRATION		43,6164 116,1857	
BOISE CITY PARK WELL 3N 2E 118BD1	2271 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	1174 90	BIODEGRADATION		43,6158 116,1890	SAVAGE, 1958

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<i>Ada County (cont'd.)</i>																
ANN SPARKS WELL 3N 2E 12B001				NOT FIELD CHECKED				DOMESTIC	143	21		FISH FARMING AND HATCHING			43.6130 116.1647	
BSU WELL #4 3N 2E 12CH81				NOT FLOWING				GEO THERMAL RESEARCH	167	35		FERMENTATION			43.6107 116.1708	
WARM SPRINGS WATER DIST. 3N 2E 12GD001	7267	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)	NORTHWEST TRENDING FAULT	WELL WATER HEATS ABOUT 200 HOMES, FLOWING WELL; SULFUR ODOR				PUBLIC SUPPLY	121	76	79	FRUIT AND VEGETABLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES	43.6046 116.1626	
WARM SPRINGS WATER DIST. 3N 2E 12GD002	7267	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)	NORTHWEST TRENDING FAULT	WATER FROM BOTH WELLS IS MIXED AT SITE PRIOR TO BEING PIPED TO DISTRICT; FLOWING WELL; SULFUR ODOR				PUBLIC SUPPLY	121	77		REFRIGERATION (LOWER TEMPERATURE RANGE)			43.6048 116.1627	
OLD PENTENTIARY WELL #1 3N 2E 13AA01	68	PLIOCENE AND PLEISTOCENE SEDIMENTS		PUMP HAS BEEN PULLED AND WELLHEAD COVERED; DRILLER'S LOG AVAILABLE				UNUSED	148	28					43.6017 116.1561	SAVAGE, 1958
OLD PENTENTIARY WELL #2 3N 2E 13AD01	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	CAPPED; DRILLER'S LOG AVAILABLE				UNUSED	265	59	67	POULTRY HATCHERY	APPLE DEHYDRATION	YES	43.5987 116.1606	SAVAGE, 1958
WARM SPRINGS MESA SUBD. 3N 2E 24ACA1	3028	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	150	31		HYDROPONICS			43.5849 116.1577	SAVAGE, 1958
BOISE WATER CORP. WELL 3N 2E 36ABC1	10977			DRILLER'S LOG AVAILABLE; ALSO KNOWN AS TERTELING WELL				PUBLIC SUPPLY	195	22		FISH FARMING AND HATCHING			43.5580 116.1597	LOG, 1972
DALLAS HARRIS WELL 3N 3E 20CAB1				NOT FIELD CHECKED				UNUSED	137	56		SPACE HEATING			43.5810 116.1272	
MORES CREEK H S 3N 4E 21GAB1S				NOT FIELD CHECKED; REPORTED IN THE IDAHO ENCYCLOPEDIA, 1938; SUBMERGED IN LUCKY PEAK RESERVOIR				UNUSED		0					43.9884 115.9876	

DENNIS FLAKE  
WELL  
4N 1E 240CC1

94

DOMESTIC 309 28 68 FERMENTATION

APPLE DEHYDRATION

YES 43.6664  
116.2821

IDAHO  
DEPT. OF TRANS.  
4N 1E 250DA1

969

INDUSTRIAL 274 24 DE-ICING HIGHWAYS

43.6521  
116.2835

CARL RUSH  
WELL  
4N 2E 480C1

DOMESTIC 76 30 43 SHRIMP FARMING

SEEDLING CONIFERS

YES 43.7135  
116.2267

LILLIAN BARNES  
WELL #1  
4N 2E 80CC1

276 PLIocene AND PLEISTOCENE  
SEDIMENTS AND BASALTIC LAVA

CAP

PEI: TEMPERATURE NOT  
VERIFIED; DRILLER'S LOG  
AVAILABLE

UNUSED 513 41 SEEDLING CONIFERS

43.6920 OG, 1969  
116.2417

LILLIAN BARNES  
WELL #2  
4N 2E 17CBA1

1133 PLIocene AND PLEISTOCENE  
SEDIMENTS AND BASALTIC LAVA

DRILLER'S LOG AVAILABLE

SWIMMING POOL 377 32 BIODEGRADATION

43.6833 LOG, 1965  
116.2502

E. VAN  
HENDRICKS WELL  
4N 2E 17CDA1

56 PLIocene AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE;  
WELL CAPPED, TEMPERATURE  
OBTAINED FROM LOG

UNUSED 210 20

43.6794 LOG, 1973  
116.2446

WILLIAM GALLOWAY  
WELL  
4N 2E 19AAB1

DOMESTIC 70 25 HEATING AND COOLING WITH  
HEAT PUMP

43.6762  
116.2568

ETHEL FICKS  
WELL  
4N 2E 19AAC1

113 PLIocene AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 68 21 HEATING AND COOLING WITH  
HEAT PUMP

43.6752 LOG, 1969  
116.2775

ED GENTHER  
WELL  
4N 2E 19AAC2

113 PLIocene AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 78 26 FISH FARMING

43.6742 LOG, 1967  
116.2574

JESS DONAH  
WELL  
4N 2E 210CA1

CAVED IN, NEVER RE-DRILLED

UNUSED 274 36 AQUACULTURE

43.6739  
116.2297

TERTELING  
H S  
4N 2E 229BA1S

37 PLIocene AND PLEISTOCENE  
SEDIMENTS (?)

STOCK WATERING 41 HYDROPONICS

43.6768  
116.2076

JOE TERTELING  
WELL #1  
4N 2E 229CB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS (?)

DOMESTIC 50 24 SHRIMP FARMING

43.6734  
116.2113



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-ccous	Car-bon-ates									
<i>Ada County (cont'd.)</i>																
JOE TERTELING WELL #2 4N 2E 22W01		PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		FLOWING COLD WATER NEXT TO THERMAL WATER'S WELL CASING				SPACE HEATING	167	44		AQUACULTURE			43.6710 116.2083	
JOE TERTELING WELL #3 4N 2E 22W01		PLIOCENE AND PLEISTOCENE SEDIMENTS OVERLYING BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	162	43		FERMENTATION			43.6695 116.2107	LOG, 1968
CRANE CREEK GOLF COURSE 4N 2E 26W02	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	225	21		FISH HATCHING			43.6584 116.1983	LOG, 1964
CARTWRIGHT WATER DIST.#1 4N 2E 27W01				THIS SITE WAS ORIGINALLY DRILLED FOR OIL AND GAS EXPLORATION TO A DEPTH OF 915 METERS				PUBLIC SUPPLY	213	32		AQUACULTURE			43.6546 116.1994	
CARTWRIGHT WATER DIST.#2 4N 2E 27W02		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	228	32		BIODEGRADATION			43.6549 116.1994	LOG, 1976
CARTWRIGHT WATER DIST.#3 4N 2E 27W03								DOMESTIC	152	32		HEATING AND COOLING WITH HEAT PUMP			43.6549 116.1998	
VIC NIBBLER WELL 4N 2E 28W01	1022							IRRIGATION	396	48		GRAIN-HAY DRYING			43.6616 116.2212	
HUNT BROTHERS FLORAL #1 4N 2E 28W01				ALSO KNOWN AS MILSTEAD FLORAL; FLOWING WELL; SLIGHT SULFUR ODOR				GREENHOUSE	381	47		SEEDLING CONIFERS			43.6556 116.2322	
RYAN WELL 4N 2E 29W01	1430							SPACE HEATING	335	46		GRAIN-HAY DRYING			43.6614 116.2454	
EDWARD'S GREENHOUSE WELL 4N 2E 29W01	1514			FLOWING WELL; SLIGHT SULFUR ODOR				GREENHOUSE AND SPACE HEATING	364	49	78	TROPICAL FISH FARMING	PRUNE DEHYDRATION	YES	43.6577 116.2389	

WAYNE CHURCH  
WELL #1  
4N 2E 29ACD2

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

FLOWING WELL; SLIGHT SULFUR  
ODOR

SPACE HEATING 423 39

HYDROPONICS

43.6562 SAVAGE, 1958  
116.2574

WAYNE CHURCH  
WELL #2  
4N 2E 29ACD3

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 15 21

HEATING AND COOLING WITH  
HEAT PUMP

43.6562 SAVAGE, 1958  
116.2576

HUNT BROTHERS  
FLORAL #2  
4N 2E 290AA1

FLOWING WELL; SLIGHT SULFUR  
ODOR

GREENHOUSE 381 45

SOIL WARMING

43.6555  
116.2329

HUNT BROTHERS  
FLORAL #3  
4N 2E 290AA2

FLOWING WELL; SLIGHT  
SULFUR ODOR

SPACE HEATING 381 43

MUSHROOM GROWING

43.6556  
116.2328

IDAHO DEPT OF  
TRANS WELLS  
4N 2E 350CC1

1022 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE;  
ORIGINALLY DRILLED TO 351  
METERS, WATER WITHDRAWN FROM  
12 METER DEPTH DUE TO LACK  
OF WATER IN SHALE

AIR  
CONDITIONING 350 20

AIR CONDITIONING

43.6347 LOG, 1964  
116.2296

RICHARD SMITH  
WELL  
4N 2E 34CAA1

TEMPERATURE AND LOCATION  
NOT VERIFIED

UNUSED 304 21

HEATING AND COOLING WITH  
HEAT PUMP

43.6399  
116.2029

JOHN BOEHM  
WELL  
5N 1E 25ACB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DOMESTIC 60 20

FISH FARMING

43.7453 SAVAGE, 1958  
116.2828

SHADOW VALLEY  
WELL  
5N 1E 25HCC1

1703 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION 92 28 42

AQUACULTURE

SOIL WARMING

YES 43.7434 SAVAGE, 1958  
116.2917

DON SWANSON  
WELL  
5N 1E 25HCC1

151 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 95 21

HEATING AND COOLING WITH  
HEAT PUMP

43.7408 SAVAGE, 1958  
116.2903

JOHN FERGUSON WELL  
5N 1E 25CCB1

264 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 152 25

HEATING AND COOLING WITH  
HEAT PUMP

43.7376 LOG, 1972  
116.2909

D. MCARTHUR  
WELL  
5N 1E 260CC1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 18 02 300

HEATING AND COOLING WITH  
HEAT PUMP

43.7369 LOG, 1970  
116.3066

BEN STADLER  
WELL  
5N 1E 260CC1

3406 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC 209 30 56

SPACE HEATING

GRAIN-HAY DRYING

YES 43.7373 LOG, 1964  
116.2987

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<i>Ada County (cont'd.)</i>																
JOHN BURGESS WELL 5N 1E 290AA1	57	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	154	22		CATFISH FARMING			43.7413 116.3552	LOG, 1978
JULIUS JEKER WELL #1 5N 1E 35AA1	83	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL; SULFUR ODOR				IRRIGATION	16	40	87	SPACE HEATING AND RECREATION	BARLEY MALTING PROCESS	YES	43.7308 116.2998	DENMAN, 1978 (SITE INSPECTION)
JULIUS JEKER WELL #2 5N 1E 36DB1	75	PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	121	24		DE-ICING SIDEWALKS			43.7316 116.2881	DENMAN, 1978 (SITE INSPECTION)
JERRY DAVIS WELL #1 1N 1W 7ACC1		PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE; CAVED AT 180 METERS				IRRIGATION	196	21	59	CATFISH FARMING	POULTRY HATCHERY	YES	43.4374 116.5025	SAVAGE, 1958
CLAYTOR FORSGREN WELL 1N 1W 7BCC1	469	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	124	21	61	FERMENTATION	ANIMAL HUSBANDRY	YES	43.4373 116.5122	LOG, 1973
JERRY DAVIS WELL #2 1N 1W 7CBA1	6359	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	140	21		HEATING AND COOLING WITH HEAT PUMP		YES	43.4385 116.4607	LOG, 1965
1N 1W 88BB1		PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	129	20		STOCK WATERING			43.4429 116.5729	LOG, 1962
IRVIN BOEHLKE WELL #1 1N 1W 80BA1	10220	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	137	22		STOCK WATERING			43.4375 116.4787	LOG, 1963
HERB MONTIERTH WELL 1N 1W 158DC1								IRRIGATION	106	21		HEATING AND COOLING WITH HEAT PUMP			43.4231 116.4461	
HERB MONTIERTH WELL 1N 1W 158DD1								IRRIGATION	106	21		CATFISH FARMING			43.4230 116.4431	

SHANE BUES  
WELL  
1N 1W 150AA1

10598

IRRIGATION 164 21 66 CATFISH FARMING

APPLE DEHYDRATION

YES 43.4225  
116.4350

IRVIN BOEHLKE  
WELL #2  
1N 1W 17ACA1

PLIOCENE BASALTIC LAVA

DRILLER'S LOG AVAILABLE

IRRIGATION 123 22 CATFISH FARMING

43.4262 LOG, 1963  
116.4784

IRVIN BOEHLKE  
WELL #3  
1N 1W 17CAB1

IRRIGATION 22 HEATING AND COOLING WITH  
HEAT PUMP

43.4220  
116.4857

LLOYD NOE WELL  
1N 1W 190DB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DOMESTIC 118 21 HEATING AND COOLING WITH  
HEAT PUMP

43.4047 LOG, 1972  
116.4970

TERRY TLUCEK  
WELL #1  
1N 1W 22CAC1

IRRIGATION 106 21 HEATING AND COOLING WITH  
HEAT PUMP

43.4047  
116.4472

TERRY TLUCEK  
WELL #2  
1N 1W 220001

PLIOCENE BASALTIC LAVA AND  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION 106 27 57 CATFISH FARMING

GRAIN-HAY DRYING

YES 43.4019 LOG, 1964  
116.4339

HERB MONTIERTH WELL  
1N 1W 24AAD1

9587 PLIOCENE AND PLEISTOCENE  
BASALTIC LAVA AND  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION 111 24 DE-ICING ROADWAYS

43.4131 LOG, 1965  
116.3947

TERRY TLUCEK  
WELL #3  
1N 1W 27BBB1

4542 PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALTIC LAVA

DRILLER'S LOG AVAILABLE

IRRIGATION 111 23 STOCK WATERING

43.3998 LOG, 1976  
116.4526

LLOYD NOE  
WELL #2  
1N 1W 30ADA1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALTIC LAVA

DRILLER'S LOG AVAILABLE

IRRIGATION 109 22 CATFISH FARMING

43.3976 LOG, 1974  
116.4931

LLOYD NOE  
WELL #3  
1N 1W 31CAD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION 118 24 DE-ICING ROADWAYS

43.3759 SAVAGE, 1958  
116.5039

MIKE VANDENBERG  
WELL  
1N 4W 32AAB1

TEMPERATURE NOT VARIFIED

DOMESTIC 216 21 FISH FARMING

43.3845  
115.9970

KENNETH FORREY  
WELL #1  
2N 1W 34DC1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALTIC LAVA

DRILLER'S LOG AVAILABLE

DOMESTIC 106 27 BIODEGRADATION

43.4603 LOG, 1973  
116.4473

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<i>Ada County (cont'd.)</i>																
KENNETH FORREY WELL #2 2N 1W 34D01		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	107	20		CATFISH FARMING			43.4645 116.4328	LOG, 1967
SAM GABIOLA WELL #1 2N 1W 35CA01	3596	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	96	25		HEATING AND COOLING WITH HEAT PUMP			43.4622 116.4246	LOG, 1958
SAM GABIOLA WELL #2 2N 1W 35DD01								IRRIGATION	146	22		FERMENTATION			43.4660 116.4140	
BISCHOF REALTY 3N 1W 25ADD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; ABANDONED				DOMESTIC	68	21	27	CATFISH FARMING	BIODEGRADATION	YES	43.5685 116.3940	LOG, 1970
CLIFFORD SMITH WELL 5N 1W 8ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	152	28		AQUACULTURE			43.7875 116.4747	SAVAGE, 1958
DEE RACHILLA WELL 5N 1W 8ADD1	52	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	106	21		HEATING AND COOLING WITH HEAT PUMP			43.7888 116.4726	LOG, 1971
DAVID TRAYLOR WELL 5N 1W 9CAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	119	20		BIODEGRADATION			43.7826 116.3149	LOG, 1972
BILL LEACH WELL 5N 1W 9CDD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	137	29		HYDROPONICS			43.7835 116.4620	LOG, 1967
LETHA FISHER WELL 5N 1W 16CAB1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	191	21	70	GROUND-WATER HEAT PUMP FOR HEATING AND COOLING	ONION DEHYDRATION	YES	43.7701 116.4625	LOG, 1963
HARRY CHARTERS WELL 1S 1W 5ABC1	13627	PLIOCENE BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	112	26	71	CATFISH FARMING	PASTEURIZED MILK PROCESS	YES	43.3689 116.4818	LOG, 1969

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INITIAL BUTTE  
FARM WELL  
1S 1W 3688C1

PLIOCENE BASALTIC LAVA

DRILLER'S LOG AVAILABLE

DOMESTIC

167 23 68

FISH FARMING

GAME BIRD HATCHERY

YES 43.2975 LOG, 1969  
116.4126

MEL BROWN  
WELL  
2S 1E 20ABA1

PLIOCENE BASALT AND  
SILICIC VOLCANIC ROCKS

DRILLER'S LOG AVAILABLE

DOMESTIC

179 27

FERMENTATION

43.2391 LOG, 1977  
116.3551

THOMAS FLAT W S  
3S 1E 13CAA1S

3

SEEP

UNUSED

24

CATFISH FARMING

43.1614 MITCHELL, 1979  
116.3323 (SITE INSPECTION)

Adams County

COUNCIL MTN.  
H S  
15N 1E 290B1S

189 CRETACEOUS GRANITIC ROCKS FAULT

HOT FIELD CHECKED; REPORTED  
BY ROSS, 1971

68

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

44.6691 ROSS, 1971  
116.3052

WHITE LICKS H S  
16N 2E 338CC1S

113 QUATERNARY ALLUVIUM NEAR  
MIOCENE BASALT AND  
CRETACEOUS GRANITIC ROCK

NUMEROUS SPRING VENTS; GAS  
PRESENT IN SEVERAL VENTS;  
SULFUR ODOR; TEMPERATURE  
RANGE 60-68 DEGREES C;  
ALLUVIUM ABOUT 1.5 M THICK

YES YES RECREATION

60 145

HOT WATER HEATING

CORN PRODUCTS (SYRUP, OIL)

YES 44.6814 WARING, 1965  
116.2281

KRIGBAUM H S  
19N 2E 220CA1S

189 CRETACEOUS GRANITIC ROCKS  
NEAR MIOCENE BASALT

NORTHWEST  
TRENDING NORMAL  
FAULT

TWO SPRING VENTS AND  
SEVERAL SEEPS; TEMPERATURE  
RANGE 40-43 DEGREES C; PAST  
USE: RECREATION

YES UNUSED

43 95

SEEDLING CONIFERS

BLANCHING

YES 44.9714 NEWCOMB, 1970  
116.2034

DIXON H S  
20N 1E 250CA1S

189 QUATERNARY ALLUVIUM

TEMPERATURE RANGE 49-63  
DEGREES C; PAST USE:  
BATHING

UNUSED

63

ANIMAL HUSBANDRY

45.0382 GARCIA, 1978  
116.2871 (SITE INSPECTION)

DEL GEDDES WELL  
20N 1E 250CC1

162 QUATERNARY ALLUVIUM NEAR  
MIOCENE BASALT

DRILLER'S LOG AVAILABLE

UNUSED

7 70

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

45.0359 ROSS, 1971  
116.2873

GEDDES H S  
20N 1E 250CC1S

454 QUATERNARY ALLUVIUM

SEVERAL SPRING VENTS; PAST  
USE: BATHING

UNUSED

68

APPLE DEHYDRATION

45.0366 GARCIA, 1978  
116.2875 (SITE INSPECTION)

EVANS H S  
20N 1E 260AD1S

QUATERNARY ALLUVIUM NEAR  
MIOCENE BASALT

TEMPERATURE RANGE 55-66  
DEGREES C

UNUSED

60

GAME BIRD HATCHERY

45.0393 ROSS, 1971  
116.2920

ZIM'S RESORT  
20N 1E 260DA1S

757 QUATERNARY ALLUVIUM NEAR  
MIOCENE BASALT

NORTHWEST  
TRENDING NORMAL  
FAULT

SLIGHT SULFUR ODOR

YES RECREATION

62 63

ANIMAL HUSBANDRY

BARLEY MALTING PROCESS

YES 45.0385 HAMILTON, 1969  
116.2913

STINKY W S  
21N 1E 23ABA1S

37 CRETACEOUS GRANITIC ROCK

STRONG SULFUR ODOR

RECREATION

31

FERMENTATION

YES 45.1518 ROSS, 1971  
116.2962

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<u>Adams County (cont'd.)</u>																
BOULDER CREEK RESORT 22N 1E 340AD1S	18	CRETACEOUS GRANITIC ROCK		SLIGHT SULFUR ODOR; TWO SMALL POOLS				UNUSED	28			CATFISH FARMING		YES	45.2009 116.3115	GARCIA, 1978 (SITE INSPECTION)
GRAB AND THOMPSON WELL 16N 1W 11ACD1	56	QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	64	22		HEAT PUMP FOR HEATING AND COOLING			44.7390 116.4181	YOUNG AND OTHERS, 1977
BILL KAMPETER WELL 16N 1W 158AC1	113	QUATERNARY AND TERTIARY SEDIMENTS INTERBEDDED WITH MIOCENE BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	35	22		FISH FARMING AND HATCHING			44.7287 116.4453	YOUNG AND OTHERS, 1977
STARKEY W S 18N 1W 340BB1S	492	MIOCENE BASALT		SEVEN SPRING VENTS; SULFUR ODOR; SECONDARY CALCITE IN BASALT NEAR SPRING VENTS			YES	RECREATION	55	70		LAUNDRY USE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.8528 116.4421	LIVINGSTON AND LANEY, 1920
<u>Bannock County</u>																
5S 34E 258DB1				DESTROYED BY CONSTRUCTION OF INTERSTATE 15					152	32					42.9599 112.4298	
GERALD JOHNSON WELL 5S 34E 250CB1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	80	27		BIODEGRADATION			42.9563 112.4342	TRIMBLE, 1976
ROBERT BROWN WELL #1 5S 34E 260AB1	113	UPPER PLEISTOCENE SEDIMENTS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	70	25	62	HEAT PUMP FOR HEATING AND COOLING	APPLE DEHYDRATION	YES	42.9559 112.4411	TRIMBLE, 1976
ROBERT BROWN WELL #2 5S 34E 260BD1	662	PLIOCENE AND PLEISTOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS(?)		DRILLER'S LOG AVAILABLE; FLOWING WELL				SPACE HEATING	177	41	63	GREENHOUSE SPACE HEATING	GAME BIRD HATCHERY	YES	42.9543 112.4428	TRIMBLE, 1976
GWINN SIGMAIN WELL 5S 34E 260CC1	3406							IRRIGATION	60	29		CATFISH FARMING			42.9499 112.4449	
TADPOLE W S 5S 34E 27ADD1S				DRY				UNUSED	20			HEATING AND COOLING WITH HEAT PUMP			42.9573 112.4580	

FLOYD PETERSON WELL 5S 34E 398AA1	75 UPPER PLIOCENE SEDIMENTS (?)		DRILLER'S LOG AVAILABLE			85 20	FISH FARMING AND HATCHING		42.9476 112.4462	TRIMBLE, 1976	
DEAN MORRIS WELL 9S 36E 300B1					DOMESTIC	24 22 40	CATFISH FARMING	SOIL WARMING	YES 42.6642 112.2356		
LAVA H S 9S 38E 210DA1S	PALEOZOIC QUARTZITE AND YOUNGER TRAVERTINE	FAULT	NUMEROUS SPRING VENTS; EXTENSIVE TRAVERTINE DEPOSITION	YES	YES RECREATION	45 50	BALNEOLOGICAL GROWING	MUSHROOM GROWING	YES 42.6205 112.0082	STEARNS AND OTHERS, 1958	
LAVA H S 9S 38E 220CB1S	PALEOZOIC QUARTZITE				YES RECREATION	45 50	SEEDLING CONIFERS	SWIMMING POOL	YES 42.6198 112.0053	STEARNS AND OTHERS, 1958	
DOWNATA H S 12S 37E 120CD1S	1854 QUATERNARY ALLUVIUM NEAR TERTIARY SEDIMENTS			(?)	RECREATION	43 46	GRAIN-HAY DRYING	HYDROPONIC	YES 42.3877 112.0851	NORVITCH AND LARSON, 1970	
<u>Bear Lake County</u>											
PESCADERO W S 11S 43E 368DA1S	37 PALEOZOIC LIMESTONE		THREE SPRING VENTS IN QUITE EXTENSIVE TRAVERTINE DEPOSITS		STOCK WATERING	26 49	CATFISH FARMING	GRAIN-HAY DRYING	ES 42.4257 111.3778	DION, 1969	
BEAR LAKE H S 15S 44E 130CA1S	PALEOZOIC LIMESTONE	NORTH TRENDING FAULT	NUMEROUS SPRING VENTS, SLIGHT SULFUR ODOR		YES RECREATION	48 54	GRAIN-HAY DRYING	HOT BED HEATING	YES 42.1148 111.2640	DION, 1969	
<u>Bingham County</u>											
YANDELL SPRINGS W S 3S 37E 310BB1S	5677 PRE-TERTIARY LIMESTONE		TEMPERATURE RANGE 18-32 DEGREES C		IRRIGATION	32 35	AQUACULTURE	BIODEGRADATION	YES 43.1143 112.1669	ROSS, 1971	
ALKALI FLATS W S 4S 38E 380DD1S	37 TUFA IN QUATERNARY ALLUVIUM		BANNOCK-SHOSHONE TRIBE, OWNER	YES	IRRIGATION	3 40S	BIODEGRADATION	SPACE HEATING	Y 43.0377 112.0035	ROSS, 1971	
<u>Blaine County</u>											
HAILEY H S 2N 18E 180BB1S	264 PALEOZOIC LIMESTONE		NUMEROUS SPRING VENTS; ONCE USED FOR HEATING HIAMATHA HOTEL AND POOL SULFUR ODOR	YES YES	UNUSED	55 83	SEEDLING CONIFERS	PASTEURIZATION	YES 43.5056 114.3542	UMPLEBY AND OTHERS, 1950	
CLARENDON H S 3N 17E 270CB1S	378 PALEOZOIC LIMESTONE		SULFUR ODOR; NUMEROUS SPRING VENTS (CAPPED) TEMPERATURE RANGE 42-52 DEGREES C	YES	BALNEOLOGICAL BATH	52 87	SPACE HEATING	BLANCHING	YES 43.5605 114.4147	UMPLEBY AND OTHERS, 1950	



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Siliceous	Carbonates									
<i>Blaine County (cont'd.)</i>																
GUYER H S 4N 17E 15AAC1S	3785	PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT (?)	NUMEROUS SPRING VENTS; SULFUR ODOR; TEMPERATURE RANGE 55-70 DEGREES C	YES	YES	YES	COMMERCIAL SPACE HEATING	70	88		REFRIGERATION (LOWER TEMPERATURE LIMIT)	BARLEY MALTING PROCESS	YES	43.6836 114.4101	UMPLEBY AND OTHERS, 1930
WARFIELD H S 4N 17E 318BC1S		PRE-TERTIARY UNDIFFERENTIATED ROCKS		TWO SPRING VENTS		YES		UNUSED	51	85		SEEDLING CONIFERS	SPACE HEATING	YES	43.6413 114.4865	ROSS, 1971
EASLEY W S 5N 16E 10UBC1S	189	CEMENTED QUATERNARY ALLUVIUM NEAR PRE-TERTIARY UNDIFFERENTIATED ROCKS		SIX SPRING VENTS				SWIMMING POOL	38	43		HYDROPONICS	SOIL WARMING	YES	43.7795 114.5385	ROSS, 1971
RUSSIAN JOHN W S 6N 16E 35UCAT1S	3	QUATERNARY ALLUVIUM		SEEPING MORE THAN FLOWING	YES			UNUSED	38	52		AQUACULTURE	MUSHROOM GROWING	YES	43.8052 114.5850	ROSS, 1971
MAGIC H S LANDING WELL 1S 17E 25AAB1	56	QUATERNARY SEDIMENTS (?)		FLOWING WELL; SULFUR ODOR; DRILLER'S LOG AVAILABLE; ONCE USED FOR SPACE HEATING AND HOT BATHS	YES			UNUSED	79	71	174	REFRIGERATION (LOWER TEMPERATURE LIMIT)	DRY CLEANING	YES	43.3289 114.3980	SMITH, 1959
MAGIC H S 1S 17E 25AAB1S	1514	QUATERNARY ALLUVIUM (?)		PAST USE: RESORT; ALSO KNOWN AS HOT SPRINGS LANDING; X-RAY DIFFRACTION INDICATED TROMA PLUS LESSER AMOUNT OF GYPSUM	YES			UNUSED	73			BALNEOLOGICAL BATHS			43.3281 114.3987	SMITH, 1959
CHARLES LARKIN WELL 1S 20E 16UCA1	2271	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				IRRIGATION	30	38		HYDROPONICS			43.3320 114.0836	CASTELIN AND CHAPMAN, 1972
CONDIE H S 1S 21E 14DUC1S	1309	QUATERNARY ALLUVIUM NEAR PLEISTOCENE BASALT		X-RAY DIFFRACTION ANALYSIS INDICATED CALCIUM CARBONATE	YES	YES		IRRIGATION	51	89		GRAIN AND HAY DRYING	BLANCHING	YES	43.3270 113.9178	STEARNS AND OTHERS, 1938
MILFORD SWEAT H S 1S 22E 10AH1S	75	QUATERNARY ALLUVIUM NEAR HOLOCENE BASALT AND PALEOZOIC QUARTZITE		TWO SPRING VENTS	YES	YES		IRRIGATION	44	64		HYDROPONICS	APPLE DEHYDRATION	YES	43.3630 113.7794	ROSS, 1971
RUSH W S 1S 22E 60BA1S		QUATERNARY ALLUVIUM						UNUSED	22			FISH FARMING			43.3669 113.8843	BODNER AND BUSH, 1978

Boise County

TWIN SPRINGS 4N 6E 248CB1S	1892 CRETACEOUS GRANITIC ROCK	FOUR SPRING VENTS	YES YES	RECREATION & SPACE HEATING	66	APPLE DEHYDRATION	YES 43.6705 115.6958	ROSS, 1971
STOPE W S 6N 5E 33ABC1S	CRETACEOUS GRANITIC ROCK	LOCATED IN STOPE; PAST USE: MINING		UNUSED	40	AQUACULTURE	43.6192 115.8682	JOHNSON, 1978 (SITE INSPECTION)
WARM SPRINGS RESORT 6N 5E 33ADC1S	1135 CRETACEOUS GRANITIC ROCK	TWO SPRING VENTS; SOME SULFUR ODOR		RECREATION	42	HYDROPONICS	43.6162 115.8631	ROSS, 1971
DANSKIN CREEK H S 8N 5E 18CC1S	CRETACEOUS GRANITIC ROCK	X-RAY DIFFRACTION ANALYSIS INDICATED SILICIOUS SINTER WITH SOME CALCIUM CARBONATE AND AMORPHOUS MATERIAL	YES YES	IRRIGATION	41	STOCK WATERING	YES 44.0587 115.8180	ROSS, 1971
HOT SPRINGS CAMPGROUND 8N 5E 6UCH1S	56 CRETACEOUS GRANITIC ROCK	TWO SPRING VENTS; SEVERAL SEEPS	(?)	RECREATION	45	SEEDLING CONIFERS	YES 44.0540 115.9067	ROSS, 1971
GOLLER H S 8N 5E 60CC1S	1892 CRETACEOUS GRANITIC ROCK	FIVE SPRING VENTS; SEVERAL SEEPS	YES	HEAT HOUSE AND POOL	51	MUSHROOM GROWING	44.0532 115.9077	ROSS, 1971
CORDER H S 8N 5E 10ADD1S	302 CRETACEOUS GRANITIC ROCK	MIXED WITH SPRING WATER FROM 08N05E10DAA	YES	SWIMMING POOL AND IRRIGATION	55	LAUNDRY USE	44.0447 115.8420	ROSS, 1971
DONLAY RANCH H S 8N 5E 10BDD1S	757 CRETACEOUS GRANITIC ROCK	X-RAY DIFFRACTION ANALYSIS INDICATED SILICIOUS SINTER	YES	COMMERCIAL GREENHOUSE	55 74	SOIL WARMING ONION DEHYDRATION	YES 44.0439 115.8423	ROSS, 1971
GRIMES PASS H S 8N 5E 10DAA1S	5 CRETACEOUS GRANITIC ROCK	WATER PIPED ACROSS RIVER COMBINING WITH SPRING 08N05E10ADD		SPACE HEATING OF GREENHOUSE	48	SEEDLING CONIFERS	44.0439 115.8423	ROSS, 1971
DAN HODGES H S 8N 5E 11ABB1S	3 CRETACEOUS GRANITIC ROCK			HEATING OF SWIMMING POOL	15240 60	ANIMAL HUSBANDRY	44.0507 115.8286	ROSS, 1971
PINE FLAT W S 8N 6E 1ADAA1S	56 CRETACEOUS GRANITIC ROCK		YES YES	UNUSED	35	AQUACULTURE	44.0620 115.6843	ROSS, 1971
PINE FLAT H S 8N 6E 1ADB1S	454 CRETACEOUS GRANITIC ROCK	FOUR VENTS AND NUMEROUS SEEPS		RECREATION	59	GREENHOUSE	44.0610 115.6869	ROSS, 1971

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<u>Boise County (cont'd.)</u>																
DEER H S 9N 3E 29BAC1S	113	CRETACEOUS GRANITIC ROCK		STRONG SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS INDICATED AMORPHOUS MATERIAL AND SILICIOUS SINTER	YES		BATHING		80	139	POWER GENERATION	FREEZE DRYING	YES	44.0922 116.0516	ROSS, 1971	
HAYEN LODGE H S 9N 8E 31AAC1S	302	CRETACEOUS GRANITIC ROCK		TEMPERATURE REPORTED TO HAVE INCREASED 5.5 DEGREES C IN THE LAST EIGHT YEARS	YES		SPACE HEATING		64		APPLE DEHYDRATION			44.0773 115.3525	ROSS, 1971	
KIRKMAN H S 9N 8E 32CAB1S	151	TERTIARY GRANITIC ROCK		TWO MAIN SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 48-65 DEGREES C; SULFUR ODOR	YES	YES	RECREATION		65	79	ANIMAL HUSBANDRY	PEACH DEHYDRATION	YES	44.0718 115.3425	ROSS, 1971	
WARM SPRINGS CRK. H S 10N 4E 33CB1S	5677	CRETACEOUS GRANITIC ROCK		FOUR SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED AMORPHOUS MATERIAL AND SILICIOUS SINTER	YES		SPACE HEATING OF GREENHOUSES		75		REFRIGERATION (LOWER TEMPERATURE LIMIT)			44.1539 115.9929	ROSS, 1971	
BONNEVILLE H S 10N 10E 318CC1S	1374	CRETACEOUS GRANITIC ROCK, SILICIFIED IN PLACES		EIGHT SPRING VENTS AND NUMEROUS SEEPS; SLIGHT SULFUR ODOR; TEMPERATURE RANGE 68-85 DEGREES C	YES	YES	RECREATION		85	142		BET SUGAR PROCESSING	YES	44.1572 115.3140	Waring, 1965	
SACAJAWEA H S 10N 11E 31AAD1S	113	TERTIARY GRANITIC ROCK		TWO MAIN SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 52-58 DEGREES C; SULFUR ODOR			UNUSED		67		GAME BIRD HATCHERY			44.1602 115.1769	ROSS, 1971	
GRANDJEAN H S 10N 11E 32BAD1S		TERTIARY GRANITIC ROCKS (?)		TEMPERATURE NOT FIELD CHECKED			RECREATION		0					44.1598 115.1674		
<u>Bonneville County</u>																
FALL CREEK MINERAL SPG. IN 43E 80CD1S	264	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS NEAR PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	SPRING VENTS EXTENDING ALONG CREEK INTO SECTION 8 AND 17; SULFUR ODOR; TEMPERATURE RANGE 23-25 DEGREES C	YES	YES			25	42	CATFISH FARMING	SEEDLING CONIFERS	YES	43.4250 111.4140	JOHNSON AND SHROEDER, 1964	
RICHARD PIGOOT WELL 2N 39E 30ADC1							DOMESTIC		20		HEATING AND COOLING WITH HEAT PUMP			43.4761 111.9065		
BROCKMAN CREEK W S 2S 42E 260CD1S	49								35		DE-ICING HIGHWAY			43.2095 111.4945		

ALPINE W S  
2S 46E 19CAD1S

94 QUATERNARY ALLUVIUM NEAR  
TERTIARY SILICIC VOLCANICS

SPRING IS NOW UNDER  
PALISADES RESERVOIR

37 61 BIODEGRADATION

APPLE DEHYDRATION

YES 43.2265 ROSS, 1971  
111.1085

Butte County

LEWIS ROTHMELL WELL  
3N 25E 32CDC1

PLEISTOCENE BASALT

DRILLER'S LOG AVAILABLE

STOCK WATERING

109 43 76 GREENHOUSE AND SOIL  
WARMING

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

YES 43.5401 MITCHELL AND  
115.5087 YOUNG, 1973

HARVEY WALKER WELL  
3N 27E 9AAB1

NOT FIELD CHECKED

STOCK WATERING

182 40

43.6093  
115.2584

BUTTE CITY WELL  
3N 27E 9ABB1

473 PLEISTOCENE BASALT AND  
SEDIMENTS

DRILLER'S LOG AVAILABLE;  
ORIGINALLY DRILLED TO 259  
METERS IN RESEARCH OF COOLER  
WATER-TEMPERATURE  
INCREASED

PUBLIC SUPPLY

144 35 52 BIODEGRADATION

MUSHROOM GROWING

YES 43.6087 MITCHELL AND  
115.2436 YOUNG, 1973

BUTTE CITY WELL  
3N 27E 9ABB2

473 PLEISTOCENE BASALT AND  
SEDIMENTS

PUBLIC SUPPLY

152 33 FERMENTATION

43.6086 MITCHELL AND  
115.2441 YOUNG, 1973

Camas County

WARDROP H S  
1N 13E 32ABB1S

719 QUATERNARY ALLUVIUM NEAR  
PLEISTOCENE BASALT AND  
CRETACEOUS GRANITIC ROCK

NORTHWEST  
TRENDING FAULT

NUMEROUS SPRING VENTS  
TEMPERATURE RANGE 60-67  
DEGREES C; ALSO KNOWN AS  
HOT SPRINGS RANCH

YES

DOMESTIC

64 91 APPLE DEHYDRATION

PASTEURIZATION

YES 43.3832 WALTON, 1962  
114.9319

ELK CREEK H S  
1N 15E 14ADA1S

75 CRETACEOUS GRANITIC ROCKS  
NEAR CONTACT WITH OLIGOCENE  
SILICIC VOLCANIC ROCKS

FIVE SPRING VENTS AND  
NUMEROUS SEEPS;  
TEMPERATURE RANGE 44-55  
DEGREES C

YES UNUSED

52 94 BALNEOLOGICAL BATH

SAUNA

YES 43.4232 WALTON, 1962  
114.6266

BALMGARTNER H S  
3N 12E 70CC1S

75 CRETACEOUS GRANITIC ROCKS

SLIGHT SULFUR ODOR

RECREATION &  
SWIMMING POOL

44 SEEDLING CONIFERS

YES 43.6025 ROSS, 1971  
115.0704

LIGHTFOOT H S  
3N 13E 70CA1S

189 CRETACEOUS GRANITIC ROCKS

SEVERAL SPRING VENTS;  
TEMPERATURE RANGE 49-62  
DEGREES C

UNUSED

56 LAUNDRY USE

YES 43.6054 GARCIA, 1978  
114.9492 (SITE INSPECTION)

HOUSEMAN H S  
3N 13E 70CC1S

UNUSED

67 PASTEURIZING

43.6025  
114.9516

PREIS H S  
3N 14E 190DB1S

18 TERTIARY DIKES IN  
CRETACEOUS GRANITIC ROCKS

UNUSED

41 STOCK WATERING

43.5762 ROSS, 1971  
114.8299

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Siliceous	Carbonates									
<i>Camas County (cont'd.)</i>																
WORSWICK H S 3N 14E 28CAA1S	1763	CRETACEOUS GRANITIC ROCK		SEVERAL SPRING VENTS; GRANITIC ROCK SILICIFIED IN PLACES; POSSIBLE INTER- SECTION OF FAULTS		YES	YES		82	93	PASTEURIZATION	SAUNA	YES	43.5646 114.7975	UMPLEBY, 1913	
BIG SMOKEY W S 4N 14E 12BAA1S	37	CRETACEOUS GRANITIC ROCKS		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY ROSS, 1971				UNUSED		0					43.7010 114.7380	ROSS, 1971
SKILLERN H S 4N 14E 290CC1S	757							UNUSED		60		ANIMAL HUSBANDRY			43.6470 114.8156	
SHEEP H S 1S 12E 16CAB1S		QUATERNARY ALLUVIUM						UNUSED		44	73	BALNEOLOGICAL BATH	APPLE DEHYDRATION	YES	43.3338 115.0395	ROSS, 1971
WOLF H S 1S 12E 16CBA1S	196	QUATERNARY ALLUVIUM						UNUSED		45	57	BALNEOLOGICAL BATH		YES	43.3346 115.0440	ROSS, 1971
KEITH STROM WELL 1S 12E 31CB01		QUATERNARY ALLUVIUM		FLOWING WELL				UNUSED		121	25	51 FERMENTATION	GREENHOUSE	YES	43.2892 115.0850	WALTON, 1962
LEE BARRON WELL #1 1S 13E 22CC1				UNABLE TO VERIFY TEMPER- ATURE; WELL NOT IN USE AT TIME OF INSPECTION				UNUSED		57	26	92 FISH FARMING	BLANCHING	YES	43.3142 114.9084	
SUN VALLEY RANCHES WELL 1S 13E 22CC1	4542	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				IRRIGATION		140	25	DE-ICING ROADWAYS			43.3139 114.8992	LOG, 1977
LEE BARRON WELL #2 1S 13E 27CC1		QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				UNUSED		37	35	MUSHROOM GROWING		YES	43.3016 114.9092	WALTON, 1962
LEE BARRON WELL #3 1S 13E 27CC1	189	QUATERNARY ALLUVIUM		FLOWING WELL; DRILLER'S LOG AVAILABLE				UNUSED		120	45	79 SEEDLING CONIFERS	PASTEURIZED MILK PROCESS	YES	43.3011 114.9084	MITCHELL, 1976

BARRON'S H S  
1S 13E 348CB1S

75 QUATERNARY ALLUVIUM NEAR  
TERTIARY SILICIC VOLCANIC  
ROCKS

DOMESTIC

75 95 DEHYDRATION

BLANCHING

YES 43.2939 ROSS, 1971  
114.9087

LEE BARRON WELL #4  
1S 13E 348CB1

37 QUATERNARY ALLUVIUM NEAR  
TERTIARY SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE  
FLOWING WELL

HEATING  
GREENHOUSE

18 72

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

YES 43.2921 ROSS, 1971  
114.9093

FAIRFIELD CITY WELL  
1S 14E 90BA1

NOT FIELD CHECKED

65 21

YES 43.3493  
114.7963

MORMON RESERVOIR W S  
2S 14E 178BB1S

UNABLE TO VERIFY; REPORTED  
WARM; SUBMERGED IN MORMON  
RESERVOIR

0

43.2545  
114.8293

Canyon County

H. NAITO WELL  
1N 2W 3CBB1

1885 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

NORTHWEST  
TRENDING FAULT  
(?)

DRILLER'S LOG AVAILABLE

IRRIGATION

117 20 55

HEAT PUMP FOR HEATING AND  
COOLING

BALNEOLOGICAL BATHS

YES 43.4520 SAVAGE, 1958  
116.3699

GORDON TIEGS  
WELL  
1N 2W 4DBA1

4163 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION

208 22

HEATING AND COOLING WITH  
HEAT PUMP

43.4512 SAVAGE, 1958  
116.5776

LEONARD TIEGS  
WELL #1  
1N 2W 5ADD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

OBSERVATION WELL; DRILLER'S  
LOG AVAILABLE

IRRIGATION

219 22 40

FISH FARMING AND HATCHING

STOCK WATERING

YES 43.4524 SAVAGE, 1958  
116.5941

LEONARD TIEGS  
WELL #2  
1N 2W 5CBA1

3596 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION

192 25

CATFISH FARMING

43.4503 SAVAGE, 1958  
116.6069

LEONARD TIEGS  
WELL #3  
1N 2W 6ADD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

IRRIGATION

28 26

FISH FARMING AND HATCHING

43.4523 SAVAGE, 1958  
116.6140

DON TIEGS  
WELL #1  
1N 2W 8ABC1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

IRRIGATION

137 21

HEATING AND COOLING WITH  
HEAT PUMP

YES 43.4414 SAVAGE, 1958  
116.6011

DON TIEGS  
WELL #2  
1N 2W 8ACC1

3028 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

IRRIGATION

182 22 43

HEATING AND COOLING WITH  
HEAT PUMP

SEEDLING CONIFERS

YES 43.4379 SAVAGE, 1958  
116.6018

RON CASSIDY  
WELL  
1N 2W 9AAA1

75 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

SULFUR ODOR; DRILLER'S LOG  
AVAILABLE

DOMESTIC

173 22

FISH FARMING AND HATCHING

43.4444 SAVAGE, 1958  
116.5733

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<u>Canyon County (cont'd.)</u>																
MARK HARKER WELL 1N 2W 12ADD1	8706	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	152	22		HEATING AND COOLING WITH HEAT PUMP			43.4386 116.5141	SAVAGE, 1958
STEVE TIEGS WELL 1N 2W 170CC1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	20		HEATING AND COOLING WITH HEAT PUMP			43.4173 116.6000	SAVAGE, 1958
J. SHERAL JOHNSTON WELL 1N 2W 22AD1	1703	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	146	21		FISH FARMING AND HATCHING			43.4063 116.5548	SAVAGE, 1958
MELBA CITY WELL 1N 2W 36CAA1	757	PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	182	24		FISH FARMING AND HATCHING	YES		43.3780 116.5250	SAVAGE, 1958
M.O. CLEMENTS WELL #1 1N 3W 13DAB1	6132	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	185	20		HEATING AND COOLING WITH HEAT PUMP	C		43.4224 116.6359	SAVAGE, 1958
WES SCHORER WELL 2N 2W 40CA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	112	22		FISH FARMING AND HATCHING			43.5345 116.5776	SAVAGE, 1958
JOHN TUCKER WELL 2N 2W 98CA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	184	27		HEATING AND COOLING WITH HEAT PUMP			43.5281 116.5871	SAVAGE, 1958
DALE GETTER WELL 2N 2W 28DBB1								DOMESTIC	99	20		FERMENTATION			43.4809 116.5808	DENMAN, 1979 (SITE INSPECTION)
ERIC L. BOMMAN JR. WELL 2N 2W 348DA1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	SULFUR ODOR; DRILLER'S LOG AVAILABLE				IRRIGATION	96	49		BALNEOLOGICAL BATHS	YES		43.4698 116.5629	SAVAGE, 1958
JAY WEIDER WELL #1 2N 2W 34CAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (?)	DRILLER'S LOG AVAILABLE				IRRIGATION	97	29		DE-ICING ROADWAYS			43.4630 116.5637	SAVAGE, 1958

JAY NEIDER WELL #2 2N 2W 34CDB1	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (7)		IRRIGATION	109 20	FISH FARMING AND HATCHING	43.4623 116.5717	SAVAGE, 1958
JAY NEIDER WELL #3 2N 2W 34CDA1	PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT (7)	DRILLER'S LOG AVAILABLE	DOMESTIC	91 20	HEATING AND COOLING WITH HEAT PUMP	43.4622 116.5632	SAVAGE, 1958
DALE GROSS WELL 2N 2W 34DAA1	3406 PLIOCENE AND PLEISTOCENE SEDIMENTS	NORTHWEST TRENDING FAULT	DRILLER'S LOG AVAILABLE	IRRIGATION	95 29	DE-ICING ROADWAYS	43.4661 116.5536	SAVAGE, 1958
CANNON FARMS WELL #1 2N 3W 22ACD1	7570 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	136 26	CATFISH FARMING	43.4956 116.6782	SAVAGE, 1958
CANNON FARMS WELL #2 2N 3W 22BCD1	6813 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	195 31	TROPICAL FISH FARMING	43.4955 116.6872	SAVAGE, 1958
CANNON FARMS WELL #3 2N 3W 22CCD1	7570 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	223 28	CATFISH FARMING	43.4883 116.6870	SAVAGE, 1958
CANNON FARMS WELL #4 2N 3W 22DCC1	6813 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	185 30	BIODEGRADATION	43.4887 116.6808	SAVAGE, 1958
CANNON FARMS WELL #5 2N 3W 22DDC1	PLIOCENE AND PLEISTOCENE SEDIMENTS		OBSERVATION WELL	IRRIGATION	183 30	56 DE-ICING HIGHWAYS SEEDLING CONIFERS	YES 43.4884 116.6769	SAVAGE, 1958
CANNON FARMS WELL #6 2N 3W 23ACD1	PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION	29	TROPICAL FISH FARMING	43.4968 116.6575	SAVAGE, 1958
CANNON FARMS WELL #7 2N 3W 23CCD1	1816 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	110 20	HEATING AND COOLING WITH HEAT PUMP	43.4884 116.6664	SAVAGE, 1958
CANNON FARMS WELL #8 2N 3W 26AACT	PLIOCENE AND PLEISTOCENE SEDIMENTS			IRRIGATION	20	HEATING AND COOLING WITH HEAT PUMP	43.4856 116.6573	SAVAGE, 1958
CANNON FARMS WELL #9 2N 3W 27BBA1	2952 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	194 30	FISH FARMING AND HATCHING	43.4873 116.6867	SAVAGE, 1958



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						SIII-aceous	CSF-bon-ates									
<i>Canyon County (cont'd.)</i>																
DESERT SUN FARMS WELL 2N 3W 34DBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	155	29		CATFISH FARMING			43.4663 116.6784	SAVAGE, 1958
CHARLES PENTLERS WELL 2N 3W 35CBA1		PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	167	29		DE-ICING HIGHWAY			43.4657 116.6625	SAVAGE, 1958
IDAHO STATE SCHOOL-HOSP. 3N 2W 14ADA1	4088	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	170	20		HEATING AND COOLING WITH HEAT PUMP			43.6004 116.5329	SAVAGE, 1958
NANPA CITY WELL #1 3N 2W 17BCB1		PLIOCENE AND PLEISTOCENE SEDIMENTS						PUBLIC SUPPLY	198	25		FISH FARMING AND HATCHING			43.6002 116.6115	SAVAGE, 1958
NANPA CITY WELL #2 3N 2W 23BCA1	1892	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	121	31		AQUACULTURE			43.5853 116.5487	SAVAGE, 1958
SIMPLLOT FEEDLOT WELL 4N 3W 19ADC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLED FOR OIL EXPLORATION ARTESIAN FLOW				WASTE WATER	929	40		SEEDLING CONIFERS			43.6706 116.7360	SAVAGE, 1958
CALDWELL RUNC. PARK 4N 3W 28AAB1	967	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; ARTESIAN FLOW; BACK FILLED TO 67 METERS				PUBLIC USE	121	29	34	FISH FARMING AND HATCHING	SWIMMING POOL	YES	43.6624 116.6963	SAVAGE, 1958
CALDWELL CITY WELL 4N 3W 35ABD1	3028	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				PUBLIC USE	130	20	36	HEATING AND COOLING WITH HEAT PUMP	DE-ICING ROADWAYS	YES	43.6453 116.6989	SAVAGE, 1958
GEORGE WRIGHT WELL 4N 4W 40CC1	68	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	128	21		FISH FARMING AND HATCHING			43.7058 116.8209	SAVAGE, 1958
RUSSELL FIVECOLT WELL 4N 4W 50BD1		PLIOCENE AND PLEISTOCENE SEDIMENTS						DOMESTIC	153	25		FISH FARMING AND HATCHING			43.7113 116.8376	SAVAGE, 1958

PARMA CITY WELL #1 5N 5W 4DCD1	2271 PLILOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		PUBLIC USE	126	27	FISH FARMING AND HATCHING		43.7927 SAVAGE, 1958 116.9384
PARMA CITY WELL #2 5N 5W 9ADB1	4542 PLILOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		PUBLIC SUPPLY	96	20	CATFISH FARMING		43.7885 LOG, 1957 116.9342
PARMA ICE WELL 5N 5W 9CAB1	PLILOCENE AND PLEISTOCENE SEDIMENTS			COMMERCIAL	20		FISH FARMING AND HATCHING		43.7843 SAVAGE, 1958 116.9455
CLEO SWANNE WELL 15 2W 17ACA1	PLILOCENE AND PLEISTOCENE SEDIMENTS			DOMESTIC	22		FISH FARMING AND HATCHING		43.3414 SAVAGE, 1958 116.3990
<u>Caribou County</u>									
BLACKFOOT RIVER W S 3S 40E 14BCD15	3 QUATERNARY BASALT			UNUSED	26	52	BIODEGRADATION	GRAIN-HAY DRYING	YES 42.9863 MITCHELL, 1976 111.7434
WILSON LAKE W S 5S 41E 6ABB15		NOT FIELD CHECKED; REPORTED TO HAVE SEVERAL SPRING VENTS		UNUSED	30				43.0103 111.6965
BLACKFOOT RESERVOIR 6S 41E 1ADC15	567 QUATERNARY TUFA	INDIAN LAND		STOCK WATERING	22	40	HEATING AND COOLING WITH HEAT PUMP	SOIL WARMING	YES 42.9280 MITCHELL, 1976 111.3924
CORRAL CREEK WELL #1 6S 41E 19BA11	598 PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		39	42 45	BALNEOLOGICAL BATH	SEEDLING CONIFERS	YES 42.8892 MITCHELL, 1976 111.6988
CORRAL CREEK WELL #2 6S 41E 19BA11	397 PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		36	41 48	SEEDLING CONIFERS	GRAIN-HAY DRYING	YES 42.8891 MITCHELL, 1976 111.7010
CORRAL CREEK WELL #3 6S 41E 19BAC1	79 PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		56	41 48	STOCK WATERING	MUSHROOM GROWING	YES 42.8880 MITCHELL, 1976 111.7009
CORRAL CREEK WELL #4 6S 41E 19BAD1	PERMIAN PHOSPHATIC SHALE	TRAVERTINE DEPOSITS	YES		64	36 48	FERMENTATION	BALNEOLOGICAL BATHS	YES 42.8882 MITCHELL, 1976 111.6986
HENRY W S 6S 42E 80BA15	QUATERNARY TUFA			UNUSED	30				42.9106 MITCHELL, 1976 111.3957

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

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						Siliceous	Carbonates									
<u>Caribou County (cont'd.)</u>																
PORTNEUF RIVER W S 75 38E 26C8D1S		QUATERNARY BASALT (?)								34		AQUACULTURE		YES	42.7809 111.9827	MITCHELL, 1976
STEAMBOAT SPRINGS 9S 41E 10DA1S				SUBMERGED IN SODA POINT RESERVOIR						31					42.6554 111.6433	
SODA SPRINGS GEYSER 9S 41E 12AD1S	3	HOLOCENE TRAVERTINE NEAR PLEISTOCENE BASALT	NORTHWEST TRENDING THRUST FAULT		YES	YES				28	54	FERMENTATION	GRAIN-HAY DRYING	YES	42.6570 111.6040	ARMSTRONG, 1969
<u>Cassia County</u>																
J.T. ROBINSON WELL 9S 28E 33D1C1	4428	PRE-TERTIARY (?) LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION		259	25	FISH FARMING AND HATCHING			42.5961 113.1788	WALKER AND OTHERS, 1970
RAINBOW RANCH WELL #1 10S 26E 28C81	9841	QUATERNARY BASALT AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION		249	37	HYDROPONICS			42.5845 113.3917	WALKER AND OTHERS, 1970
RAINBOW RANCH WELL #2 10S 26E 28C8A1		PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION		190	24	CATFISH FARMING			42.5816 113.3999	VON LINDERN, 1978 (SITE INSPECTION)
SIX S RANCH WELL #1 11S 25E 11CC1A1	4088	PRECAMBRIAN QUARTZITE	NORTH TRENDING FAULT	DRILLER'S LOG AVAILABLE; FLOWING WELL; SULFUR ODOR	YES	YES		IRRIGATION		136	55	89 LAUNDRY USES	SAUNA	YES	42.4768 113.5068	CROSTHWAITE, 1957
MARSH CREEK H S 11S 25E 22CC1S	37	PLIOCENE SILICIC VOLCANIC ROCKS	FAULT					UNUSED		40		SOIL WARMING			42.4466 113.5254	ROSS, 1971
MARSH GULLY H S 11S 25E 22D1S	37	PLIOCENE SILICIC VOLCANIC ROCKS	FAULT					UNUSED		41		SOIL WARMING			42.4490 113.5112	ROSS, 1971
SIX S RANCH WELL #2 11S 26E 20D0D1	4220							IRRIGATION		33	49	AQUACULTURE	SEEDLING CONIFERS	YES	42.4454 113.4338	

CRITCHFIELD  
LAND & CAT.  
11S 26E 28CB1

4428 QUATERNARY BASALT AND  
ALLUVIUM

DRILLER'S LOG AVAILABLE;  
FLOWING WELL

IRRIGATION

176 37 51

DE-ICING

MUSHROOM GROWING

YES 42.4398 WALKER AND  
113.4322 OTHERS, 1970

CAY RANCH WELL #1  
11S 27E 58A1

22 QUATERNARY ALLUVIUM AND  
TERTIARY SEDIMENTARY ROCKS

IRRIGATION

100 28

BIODEGRADATION

42.5009 WALKER AND  
113.3185 OTHER, 1970

CAY RANCH WELL #2  
11S 27E 58A1

9299 QUATERNARY SEDIMENTARY  
ROCKS

PARTIAL DRILLER'S LOG  
AVAILABLE

IRRIGATION

348 27

HEAT PUMP FOR HEATING AND  
COOLING

YES 42.5017 WALKER AND  
113.3258 OTHERS, 1970

RUBY FARMS WELL  
11S 27E 340DB1

9512 QUATERNARY SEDIMENTARY  
ROCKS

IRRIGATION

351 23 75

CATFISH FARMING

FRUIT AND VEGETABLE  
DEHYDRATION

YES 42.2208 WALKER AND  
113.2970 OTHERS, 1970

STOKER WELL  
11S 27E 36ADA1

182 24

FERMENTATION

42.4255 ROSS, 1971  
113.2357

11S 28E 31DD1

IRRIGATION

24

FERMENTATION

42.4155  
113.2149

O.M. JOHNSON WELL  
11S 28E 34DD1

22 TERTIARY SEDIMENTARY ROCKS  
(?)

DRILLER'S LOG AVAILABLE

DOMESTIC AND  
STOCK WATERING

113 20

HEAT PUMP FOR HEATING AND  
COOLING

42.4882 WALKER AND  
113.2340 OTHERS, 1970

GALEN MEYERS WELL #1  
12S 19E 2AAD1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

IRRIGATION

298 35

AQUACULTURE

42.3273 ROSS, 1971  
114.1960

GALEN MEYERS WELL #2  
12S 19E 2ADD1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

IRRIGATION

237 37

HYDROPONICS

42.4101 ROSS, 1971  
114.1915

ROBERT PETERSON  
WELL #1  
12S 19E 2B8C1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

IRRIGATION

320 27

HEAT PUMP FOR HEATING AND  
COOLING

42.4150 ROSS, 1971  
114.2082

ROBERT PETERSON  
WELL #2  
12S 19E 3B8C1

ALLUVIUM ABOVE PLIOCENE  
SILICIC VOLCANIC ROCKS

IRRIGATION

274 27

BIODEGRADATION

42.4106 ROSS, 1971  
114.2285

ROBERT PETERSON  
WELL #3  
12S 19E 38DB1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

IRRIGATION

213 27

FISH FARMING AND HATCHING

42.4123 ROSS, 1971  
114.2211

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili-cesous									
<i>Cassia County (cont'd.)</i>															
ROBERT PETERSON WELL #4 12S 19E 30BB1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS					IRRIGATION	266	27		DE-ICING			42.4104 114.2169	ROSS, 1971
CREED CONCERN INC. #1 12S 19E 50BD1	2210	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS					IRRIGATION	304	36		FERMENTATION			42.4119 114.4443	ROSS, 1971
CREED CONCERN INC. #2 12S 19E 6ADD1	2555	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	304	37		AQUACULTURE			42.4109 114.2674	ROSS, 1971
CREED CONCERN INC. #3 12S 19E 6CAD1	2725	QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS					IRRIGATION	162	27		FISH FARMING AND HATCHING			42.4070 114.2768	ROSS, 1971
CLARENCE DAGGNER WELL 12S 19E 6CDC1		QUATERNARY ALLUVIUM ABOVE PLIOCENE SILICIC VOLCANIC ROCKS					IRRIGATION	335	34		DE-ICING ROADWAYS			42.4050 114.2789	ROSS, 1971
CREED CONCERN INC. #4 12S 19E 60DD1	2725	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	234	38		HYDROPONICS			42.4034 114.2681	VON LINDERN, 1978 (SITE INSPECTION)
THURMAN WILLIS WELL 12S 19E 7ACA1	3621	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE			IRRIGATION	243	34		BIODEGRADATION			42.3989 114.2724	LOG, 1960
K.C. BARLOW WELL 12S 20E 2DD1	4542	QUATERNARY BASALT AND PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	272	24		CATFISH FARMING			42.4029 114.0694	LOG, 1960
MOUNTAIN VIEW RANCH INC. 12S 20E 3CAC1	4542	PLIOCENE SEDIMENTARY ROCKS AND PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE			IRRIGATION	204	32		GRAIN-HAY DRYING			42.4068 114.1008	A. PIPER, 1923
JOE SAVAGE WELL 12S 20E 50CB1		PALEOZOIC LIMESTONE (?)		DRILLER'S LOG AVAILABLE			IRRIGATION	274	25		FISH FARMING AND HATCHING			42.4049 114.1455	LOG, 1974

COINER BROTHERS  
WELL #1  
12S 20E 68AC1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

SPACE HEATING  
AND IRRIGATION

137 41

SEEDLING CONIFERS

42,412 LOG, 1975  
114,1608

COINER BROTHERS  
WELL #2  
12S 20E 680C1

QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

IRRIGATION

198 37

BIODEGRADATION

42,4103 ROSS, 1971  
114,1685

HAROLD SAVAGE WELL  
12S 20E 60AC1

2206 QUATERNARY ALLUVIUM

IRRIGATION

257 32

MUSHROOM GROWING

42,4073 ROSS, 1971  
114,1549

MERLE WOLVERTON WELL  
12S 20E 11A0C1

QUATERNARY ALLUVIUM ABOVE  
TERTIARY SILICIC VOLCANIC  
ROCK

IRRIGATION

487 28

HEAT PUMP FOR HEATING AND  
COOLING

42,3957 ROSS, 1971  
114,0707

CLARENCE BARKES WELL  
12S 20E 120C1

870 PLIOCENE SILICIC VOLCANIC  
ROCKS AND PALEOZOIC  
SEDIMENTARY ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

357 29

CATFISH FARMING

42,3885 LOG, 1976  
114,0577

GERALD CONARD WELL  
12S 21E 1AAA1

PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

306 27

FISH FARMING AND HATCHING

42,4156 LOG, 1968  
113,9322

GOLDEN VALLEY WELL  
12S 21E 270C81

3633 PLIOCENE SILICIC VOLCANIC  
ROCKS AND PALEOZOIC  
SEDIMENTARY ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

585 39

HYDROPONICS

42,3478 LOG, 1975  
113,9894

STEVEN CLARK WELL  
12S 21E 280C81

QUATERNARY ALLUVIUM AND  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

348 21

CATFISH FARMING

42,3471 LOG, 1975  
114,0093

SIMON BAKER WELL #1  
12S 21E 320C81

6813 PALEOZOIC SEDIMENTARY ROCKS

DRILLER'S LOG AVAILABLE

STOCK AND  
IRRIGATION

76 21

HEAT PUMP FOR HEATING AND  
COOLING

42,3336 LOG, 1962  
114,0290

SUSAN BAKER WELL  
12S 21E 34A0D1

1135 QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

499 26

CATFISH FARMING

42,2555 ROSS, 1971  
113,9704

ANDERSON BROTHERS WE  
12S 22E 34ACC1

5677 QUATERNARY ALLUVIUM ABOVE  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

342 24

CATFISH FARMING

42,3370 LOG, 1957  
113,8705

WILFORD WRIGHT WELL  
12S 23E 12AAA1

QUATERNARY SEDIMENTARY  
ROCKS ABOVE PLIOCENE  
SILICIC VOLCANIC ROCKS

DRILLER'S LOG AVAILABLE

STOCK WATERING

179 22

FISH FARMING AND HATCHING

42,4009 LOG, 1962  
113,7051

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<i>Cassia County (cont'd.)</i>																
YARD CHATBURN WELL 12S 25E 48001	3482	QUATERNARY SEDIMENTARY ROCKS ABOVE PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	191	21		HEATING AND COOLING WITH HEAT PUMP			42.4087 113.5406	LOG, 1955
K.C. BARLOW WELL 13S 21E 58001	13248	QUATERNARY SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	213	25		FISH FARMING AND HATCHING			42.3245 114.0267	LOG, 1961
SIMON BAKER WELL #2 13S 21E 6A001								IRRIGATION	104	22		CATFISH FARMING			42.3269 114.0291	
LYLE DURFEE WELL 13S 25E 228081	681	QUATERNARY ALLUVIUM	FAULT (?)					IRRIGATION	156	32		AQUACULTURE		YES	42.3209 113.5300	ROSS, 1971
WARD SPRING 13S 26E 170001S	18	PRE-TERTIARY UNDIFFERENTIATED ROCKS	FAULT					IRRIGATION	20	34		CATFISH FARMING	AQUACULTURE	YES	42.2860 113.4463	ROSS, 1971
RICE SPRING 13S 26E 170081S	18	PRE-TERTIARY UNDIFFERENTIATED ROCKS						IRRIGATION		22		HEAT PUMP FOR HEATING AND COOLING			42.2867 113.4448	ROSS, 1971
LESTER THOMPSON WELL 13S 27E 2A001		PALEOZOIC SEDIMENTARY ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	336	26		FISH FARMING AND HATCHING			42.3215 113.2598	LOG, 1958
NELSON WELL 14S 21E 34A01	3406	PRE-TERTIARY UNDIFFERENTIATED ROCKS						UNUSED	299	43		STOCK WATERING			42.1687 113.9730	ROSS, 1971
14S 21E 34801	189	PLIOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL; SULFUR ODOR			YES	UNUSED	40	97		HYDROPONICS	SAUNA	YES	42.1648 113.9838	PIPER, 1925
OAKLEY H S 14S 22E 270081S	37	PRE-TERTIARY QUARTZITE		SLIGHT SULFUR ODOR	(?)			RECREATION	48	92		GRAIN-HAY DRYING	BLANCHING	YES	42.1737 113.8609	ROSS, 1971

SEARS SPRING  
14S 25E 688B1S

662 PRE-TERTIARY  
UNDIFFERENTIATED ROCKS

FAULT

STOCK WATERING

29

39 FISH FARMING AND HATCHING

HYDROPONICS

YES 42.2403 ROSS, 1971  
113.5675

GRIFFETH-WIGHT WELL  
14S 26E 180D1

378

DRILLED FOR GAS AND OIL  
EXPLORATION

1981

77 84 APPLE DEHYDRATION

PASTEURIZATION

YES 42.2350  
113.3649

HAROLD WIGHT WELL  
14S 26E 10DA1

63

121 ANIMAL HUSBANDRY

HIGH ENERGY PROCESSING OF  
KILN LUMBER

YES 42.2297  
113.3647

HAROLD WARD  
WELL #1  
14S 27E 180CC1

3399

24

104 DE-ICING ROADWAYS

WASHING AND DRYING OF WOOL

YES 42.1986  
113.3530

HEPWORTH WELL  
14S 27E 180CC1

11810 QUATERNARY ALLUVIUM AND  
SEDIMENTARY ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

184

27 CATFISH FARMING

42.1937 MITCHELL AND  
113.3508 YOUNG, 1973

JACK PIERCE WELL  
14S 28E 18AAA1

56 QUATERNARY ALLUVIUM AND  
SEDIMENTARY ROCKS

DRILLER'S LOG AVAILABLE

STOCK WATERING

176

21 HEAT PUMP FOR HEATING AND  
COOLING

42.1366 LOG, 1966  
113.1470

OLD OAKLEY  
CANAL WELL #1  
15S 21E 4ACB1

UNUSED

268

31 FERMENTATION

42.1540  
124.0000

OLD OAKLEY  
CANAL WELL #2  
15S 21E 4ACB2

UNUSED

259

32 AQUACULTURE

42.1540  
113.9998

OAKLEY CANAL  
CO. WELL #1  
15S 21E 13DAB1

QUATERNARY ALLUVIUM,  
TERTIARY SEDIMENTARY AND  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

356

37 HYDROPONICS

42.1192 PIPER, 1923  
113.9362

OAKLEY CANAL  
CO. WELL #2  
15S 21E 24BAA1

QUATERNARY ALLUVIUM,  
TERTIARY SEDIMENTARY AND  
PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

326

27 FISH FARMING AND HATCHING

42.1121  
113.9415

MORRIS MITCHELL  
WELL #1  
15S 21E 23CDA1

DOMESTIC AND  
SPACE HEATING

41

97 STOCK WATERING

BLANCHING

42.0869  
113.9414

MORRIS MITCHELL  
WELL #2  
15S 21E 230CC1

IRRIGATION AND  
SPACE HEATING

792

47 94 SEEDLING CONIFERS

BLANCHING

YES 42.0870  
113.9882



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sill-iceous	Car-bon-ates									
<i>Cassia County (cont'd.)</i>																
DURFEE SPRING 15S 24E 22DAC1S	189	QUATERNARY ALLUVIUM						UNUSED	39			DE-ICING			42.1015 113.6319	ROSS, 1971
HAROLD WARD WELL #2 15S 24E 22DOB1	378	QUATERNARY ALLUVIUM						DOMESTIC	152	32	47	AQUACULTURE	SEEDLING CONIFERS	YES	42.0991 113.6311	ROSS, 1971
GRAPE CREEK W S 15S 25E 29CCA1S	75			MARSH AREA				STOCK WATERING	22			FISH FARMING AND HATCHING			42.0854 113.5639	
BLM 15S 25E 29CCD1				NOT FIELD CHECKED FOR THIS REPORT					60	128		POULTRY HATCHERY	EVAPORATION AND CRYSTALLIZATION OF SALT	YES	42.0828 113.5623	
BLM 15S 26E 12ACC1		PLIOCENE SEDIMENTS		NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE				TESTING	26	30		CATFISH FARMING	ALFALFA DEHYDRATION	YES	42.1335 113.3620	LOG, 1974
EGAG THERMAL #5 15S 26E 22DDA1				RAFT RIVER PROJECT, *SURFACE TEMPERATURE IS 125 DEGREES C				TESTING	1476			CANNING AND PRESERVING			42.0993 113.5793	
BLM 15S 26E 22D0D1	1892			NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE				TESTING	442	28	103	FRUIT AND VEGETABLE DEHYDRATION	WASHING AND DRYING OF WOOL	YES	42.0971 113.3939	LOG, 1974
IVAN DARRINGTON WELL #1 15S 26E 23AAA1				SURFACE TEMPERATURE REACHES 140 DEGREES C AFTER BEING PUMPED FOR A PERIOD OF TIME					85	149		PASTEURIZATION	BET SUGAR PROCESSING	YES	42.1104 113.3737	
IVAN DARRINGTON WELL #2 15S 26E 23ABD1	208	PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	109	28		FISH FARMING AND HATCHING			42.1087 113.3782	NACE AND OTHERS, 1961
FRAZIER H S WELL 15S 26E 23BBC1	219			FLOWING WELL, SLIGHT SULFUR ODOR; NOT FIELD CHECKED FOR THIS REPORT	(?)	YES			126	93	146	BLANCHING	CORN PRODUCTS (SYRUP, OIL)	YES	42.1079 113.3910	

EG&G MAIN THERMAL WE 155 26E 23CA1		RAFT RIVER PROJECT; *SURFACE TEMPERATURE IS 146 DEGREES C	EXPERIMENTAL POWER GENERATOR	1520		CORN PRODUCTS (SYRUP, OIL)		42.1030 113.3839				
EG&G THERMAL WELL #4 155 26E 23CDA1		RAFT RIVER PROJECT	EXPERIMENTAL MONITORING WELL	1613	82	PASTEURIZATION		42.1333 113.3836				
IVAN DARRINGTON WELL #3 155 26E 2300B1	3406	PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	79	40	SOIL WARMING	42.0984 NACE AND OTHERS, 113.3775 1961				
GARY CROOK WELL 155 26E 2300C1	2271	PLEISTOCENE SEDIMENTS	FLOWING WELL; PAST USE; HARRIAT CRANK'S GREENHOUSE	(?)	YES	164	90	139	BARLEY MALTING PROCESS	POTATOE DEHYDRATION	YES	42.0970 NACE AND OTHERS, 113.3772 1961
IVAN DARRINGTON WELL #4 155 26E 2300D1		PLIOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	78	33	94	FERMENTATION	PASTEURIZATION	YES	42.0969 LOG, 1967 113.3735	
LANCE LOY WELL 155 26E 24BAD1	3399			DOMESTIC		32	94	BIODEGRADATION	FRUIT AND VEGETABLE DEHYDRATION	YES	42.1077 113.3644	
REID STUART 155 26E 24BCB1				IRRIGATION		24		FERMENTATION			42.1074 113.3725	
IVAN DARRINGTON WELL 155 26E 240CC1			NOT FIELD CHECKED FOR THIS REPORT			31	96	DE-ICING ROADWAYS	BARLEY MALTING PROCESS	YES	42.0968 113.3629	
BLM WELL 155 26E 25ACA1	832		NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE	TESTING		241	30	102	AQUACULTURE	WASHING AND DRYING OF WOOL	YES	42.0923 LOG, 1974 113.3588
EG&G THERMAL WELL 155 26E 25ADA1	378		RAFT RIVER PROJECT; *SURFACE TEMPERATURE IS 121 DEGREES C	TESTING		1158			BLANCHING			42.0920 113.3536
EG&G THERMAL WELL 155 26E 25DA1			RAFT RIVER PROJECT; *SURFACE TEMPERATURE IS 144 DEGREES C	MONITORING					CORN PRODUCTS (SYRUP, OIL)			42.0927 113.3648
THOROUGHbred W S 165 19E 28BBA1S		TERTIARY SILICIC VOLCANIC ROCKS	NOT FIELD CHECKED; REPORTED BY ROSS, 1971; SEVERAL SPRING VENTS	UNUSED		21			FISH FARMING			42.0114 ROSS, 1971 113.2392

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Sili- ceous	Car- bon- ates									
<u>Cassia County (cont'd.)</u>															
BLM WELL 16S 26E 58BA1	1514			NOT FIELD CHECKED FOR THIS REPORT; DRILLER'S LOG AVAILABLE			TESTING	85	40	94	SOIL WARMING	BLANCHING	YES	42.0671 112.4469	LOG, 1970
<u>Clark County</u>															
LIDY H S #1 9N 33E 28BC1S	946	PRE-TERTIARY LIMESTONE		PROCESSING FERTILIZER AND DOMESTIC USE; TRAVERTINE DEPOSITION NEAR SPRING VENTS			INDUSTRY	51	66		HAY DRYING	APPLE DEHYDRATION	YES	44.1438 112.5527	ROSS, 1971
WILSON BROS. WELL 9N 33E 20DC1	3785	PRE-TERTIARY LIMESTONE		PROCESSING FERTILIZER AND DOMESTIC USE; PAST USE: RECREATION			INDUSTRY	213	50		SPACE HEATING			44.1316 112.5475	ROSS, 1971
LIDY H S WELL 10N 33E 35CC1	6813	PRE-TERTIARY LIMESTONE	FAULT	PROCESSING FERTILIZER AND DOMESTIC USE			INDUSTRY	125	58	68	GREENHOUSE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44.1459 112.5532	ROSS, 1971
LIDY H S #2 10N 33E 35CC1S	189	PRE-TERTIARY LIMESTONE	FAULT	PROCESSING FERTILIZER AND DOMESTIC USE			INDUSTRY	51			LAUNDRY USES			44.1453 112.5537	ROSS, 1971
WARM SPRINGS 11N 32E 25AAC1S	3406	PRE-TERTIARY LIMESTONE		TWO SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED TRAVERTINE			YES STOCK WATERING	29	57		CATFISH FARMING	GREENHOUSE SPACE HEATING	YES	44.2565 112.6391	ROSS, 1971
BIG SPRINGS 13N 32E 15BCB1S	189	PRE-TERTIARY LIMESTONE					UNUSED		23		FISH FARMING AND HATCHING			44.4538 112.6958	ROSS, 1971
<u>Custer County</u>															
BOVERY H S 7N 17E 6ABA1S		PALEOZOIC SEDIMENTARY ROCKS		NOT FIELD CHECKED			UNUSED	43	89		SEEDLING CONIFERS	BLANCHING	YES	43.9707 114.4949	TSCHANZ AND OTHERS, 1974
PIERSON H S 8N 14E 270BD1S	416	QUARTZ MONZONITE		TEMPERATURE RANGE 37-43 DEGREES C; TWO SPRING VENTS			UNUSED	43	73		BALNEOLOGICAL BATH	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.9903 114.7999	TSCHANZ AND OTHERS, 1974

LOWER BOWERY H S 8N 17E 31DCB1S	PALEOZOIC SEDIMENTARY ROCK	SULFUR ODOR	UNUSED	54	GRAIN-HAY DRYING		43.9741 114.4986	TSCHANZ AND OTHERS, 1974				
WEST PASS H S 8N 17E 32BCA1S	PALEOZOIC SEDIMENTARY ROCK	SULFUR ODOR	STOCK WATERING	51	64 MUSHROOM GROWING	APPLE DEHYDRATION	YES 43.9818 114.4858	TSCHANZ AND OTHERS, 1974				
ROZALYS SMITH WELL #1 9N 14E 18CAD1	QUATERNARY ALLUVIUM		HEATING OF POOL AND HOUSE	37	HYDROPONICS		44.1065 114.8654	DENMAN, 1978 (SITE INSPECTION)				
ROZALYS SMITH WELL #2 9N 14E 19ABA1	QUATERNARY ALLUVIUM	CAPPED	UNUSED	50	GREENHOUSE		44.1013 114.8620	DENMAN, 1978 (SITE INSPECTION)				
ROZALYS H S 9N 14E 19BAA1S	CRETACEOUS GRANITIC ROCK	REPORTED BY ROSS; NOT FIELD CHECKED	YES UNUSED	41	STOCK WATERING		44.1010 114.8650	ROSS, 1971				
STANLEY H S 10N 13E 3CAB1S	378 QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NORTHEAST TRENDING FAULT	NUMEROUS SEEPS; TEMPERATURE RANGE 30-41 DEGREES C; SIX SPRING VENTS; SULFUR ODOR	YES	YES	UNUSED	41	47 SOIL WARMING	GRAIN-HAY DRYING	YES 44.2242 114.9285	CHOATE, 1962	
SLATE CREEK H S 10N 16E 30BAD1S	681 PALEOZOIC ARGILLITE		TEMPERATURE RANGE 32-50 DEGREES C; EIGHT SPRING VENTS; SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS INDICATED SULFATE (GYPSUM)	YES	YES	UNUSED	50	91 SPACE HEATING	BLANCHING	YES 44.1709 114.6242	ROSS, 1937	
ELKHORN H S 11N 13E 36BAA1S	757 QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		NUMEROUS SEEPS			UNUSED	58	93 GREENHOUSE	BARLEY MALTING PROCESS	YES 44.2453 114.8850	ROSS, 1971	
BASIN CREEK H S 11N 14E 21DDB1S	227 CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS	YES	YES	UNUSED	35	73 AQUACULTURE	ONION DEHYDRATION	YES 44.2637 114.8185	ROSS, 1971	
CAMPGROUND H S 11N 14E 22CCA1S	378 CRETACEOUS QUARTZ MONZONITE			YES	YES	FOREST CAMPGROUND	56	HOTBED HEATING		44.2643 114.8104	DENMAN, 1978 (SITE INSPECTION)	
MORMON BEND H S 11N 14E 29AAB1S	1135 CRETACEOUS QUARTZ MONZONITE		TEMPERATURE NOT VARIFIED			UNUSED	38	75 HYDROPONICS	PASTEURIZED MILK PROCESS	YES 44.2600 114.8383	DENMAN, 1978 (SITE INSPECTION)	
SUNBEAM H S 11N 15E 19CAB1S	1135 CRETACEOUS QUARTZ MONZONITE		TEMPERATURE RANGE 61-75 DEGREES C; NUMEROUS SPRING VENTS; SLIGHT SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS AVAILABLE	YES	YES	YES	RECREATION	76	104 REFRIGERATION (LOWER TEMPERATURE LIMIT)	CANNING AND PRESERVING	YES 44.2679 114.7478	TSCHANZ AND OTHERS, 1974

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition			Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Silic-aceous	Car-bon-ates									
<u>Custer County (cont'd.)</u>																
EAST ROBINSON BAR H S 11N 19E 26CCC1S		CRETACEOUS QUARTZ MONZONITE		FOUR SPRING VENTS; TEMPERATURE RANGE 38-42 DEGREES C					42			SEEDLING CONIFERS			44.2481 114.6730	TSCHAZ AND OTHERS, 1974
ROBINSON BAR H S 11N 15E 27DDC1S	264	CRETACEOUS QUARTZ MONZONITE		SPRING PIPED TO POOL			RECREATION		55	97		GRAIN-HAY DRYING	WASHING AND DRYING OF WOOL	YES	44.2466 114.6764	TSCHAZ AND OTHERS, 1974
WARM SPRINGS CREEK H S 11N 15E 34ADC1S	18	CRETACEOUS QUARTZ MONZONITE		SLIGHT SULFUR ODOR			UNUSED		52			BALNEOLOGICAL BATHS			44.2410 114.6782	JOHNSON, 1978 (SITE INSPECTION)
SULLIVAN H S 11N 17E 27BDD1S	757	CONTACT BETWEEN OLIGOCENE SILICIC VOLCANIC ROCKS AND PALEOZOIC DOLOMITE AND ARGILLITE		SULFUR ODOR	YES	YES	RECREATION		41	99		SEEDLING CONIFERS	PASTEURIZATION	YES	44.2541 114.4427	ROSS, 1937
BARNEY W S 11N 25E 23CAB1S	643	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCK AND PRE-TERTIARY UNDIFFERENTIATED					STOCK WATERING		28	59		AQUACULTURE	ANIMAL HUSBANDRY	YES	44.2689 113.4491	ROSS, 1971
CAPE HORN W S 12N 11E 20DB1S	37	CRETACEOUS GRANITIC ROCK		SNAKE RIVER BOY SCOUT COUNCIL CAMP; THREE SPRING VENTS			RECREATION		35			FERMENTATION			44.3979 115.1491	ROSS, 1971
LITTLE ANTELOPE FLAT W S 12N 20E 10CB01S	1135	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANICS		SEVERAL SPRING VENTS			UNUSED		34			HYDROPONICS			44.3817 114.0873	ROSS, 1971
SULPHUR CREEK H S 14N 11E 1B 1S	15	CRETACEOUS GRANITIC ROCKS		REPORTED WARM; NOT FIELD CHECKED			UNUSED		0						44.5846 115.0719	ROSS, 1971
BEARDSLEY H S 14N 19E 23DD01S	5677	PLIOCENE SILICIC VOLCANIC ROCK AND PRE-TERTIARY UNDIFFERENTIATED ROCK		SEVERAL SPRING VENTS; ALSO KNOWN AS CHALLIS HOT SPRINGS			RECREATION		43			BALNEOLOGICAL BATH			44.5230 114.1733	ROSS, 1971
BILL JOHNSTON WELL 14N 19E 34DAA1	189			FLOWING WELL; ORIGINALLY DRILLED TO APPROXIMATELY 2285 METERS, CAVED BACK TO PRESENT DEPTH			IRRIGATION		914	40	60	SOIL WARMING	GAME BIRD HATCHERY	YES	44.4994 114.1944	

OWEN CABIN H S  
15N 14E 10ADC15

94 PRE-TERTIARY  
UNDIFFERENTIATED ROCK

SULFUR ODOR

UNUSED

56 MUSHROOM GROWING

44.6516 ROSS, 1971  
114.7343

UPPER LOON CREEK H S  
15N 14E 10DCC15

18 PRE-TERTIARY  
UNDIFFERENTIATED ROCK

NUMEROUS SPRING VENTS;  
TEMPERATURE RANGE 46-63  
DEGREES C; SULFUR ODOR

UNUSED

63 GREENHOUSE

44.6447 ROSS, 1971  
114.7389

SUNFLOWER FLAT H S  
16N 12E 800B15

NOT FIELD CHECKED; REPORTED  
BY ROSS, 1971

UNUSED

43 71 SEEDLING CONIFERS

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

YES 44.7331  
115.0176

THOMAS CREEK  
RANCH H S  
16N 12E 17DAD15

257 TERTIARY GRANITIC ROCKS

NOT FIELD CHECKED; REPORTED  
BY ROSS, 1971

UNUSED

43 90 BALNEOLOGICAL BATHS

BLANCHING

YES 44.7212 ROSS, 1971  
115.0190

LOWER LOON  
CREEK H S  
17N 14E 1980B15

30 TERTIARY GRANITIC ROCKS

NOT FIELD CHECKED; REPORTED  
BY ROSS

UNUSED

49 73 SPACE HEATING

APPLE DEHYDRATION

YES 44.7988 ROSS, 1971  
114.8047

Elmore County

LAWDA H S  
2N 10E 5AAD15

TWO SPRING VENTS AND  
SEVERAL SEEPS

YES SPACE HEATING

60 GAME BIRD HATCHERY

43.5415  
115.2817

BRIDGE H S  
2N 10E 5ACA15

QUATERNARY ALLUVIUM  
OVERLAYING CRETACEOUS  
GRANITIC ROCK

SIX SPRING VENTS;  
TEMPERATURE RANGE 52-59  
DEGREES C

YES

59 GREENHOUSE

43.5398 ROSS, 1971  
115.2882

TOWNE CREEK W S  
2N 10E 19ABA15

24 HEATING AND COOLING WITH  
HEAT PUMP

43.4996  
115.3076

RATTLESNAKE H S  
3N 7E 70CA15

NOT FIELD CHECKED

UNUSED

56 GREENHOUSE

43.6053  
115.6636

CHARLES BAKER WELL  
3N 10E 10ABA1

26 CRETACEOUS GRANITIC ROCKS

DRILLER'S LOG AVAILABLE;  
WATER IS PUMPED FROM APPROX  
49 M TO 90 M WHERE IT IS  
WARMED SEVERAL DEGREES ON  
THE HOT ROCKS THEN RETURNED

SPACE HEATING

89 43 SEEDLING CONIFERS

YES 43.6160 ROSS, 1971  
115.2484

PARADISE H S  
3N 10E 33ACD15

37 QUATERNARY ALLUVIUM  
OVERLAYING CRETACEOUS  
GRANITIC ROCK

YES SPACE HEATING

52 73 LAUNDRY USE

ONION DEHYDRATION

YES 43.5527 ROSS, 1971  
115.2670

PARADISE H S WELL  
3N 10E 3380B1

75 CRETACEOUS GRANITIC ROCKS

DRILLER'S LOG AVAILABLE;  
FLOWING WELL

UNUSED

57 38 HYDROPONICS

43.5546 ROSS, 1971  
115.2740

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili-ccous									
<i>Elmore County (cont'd.)</i>															
BASSET H S 4N 7E 1AAB1S		CRETACEOUS GRANITIC ROCKS		REPORTED BY ROSS, 1971; UNABLE TO LOCATE			UNUSED		0					43.7175 115.5629	ROSS, 1971
REED H S 4N 7E 7ADC1S	18	CRETACEOUS GRANITIC ROCKS					UNUSED		41		STOCK WATERING			43.6966 115.6607	ROSS, 1971
SHEEP CREEK BRIDGE H S 4N 7E 8CBB1S	283	CRETACEOUS GRANITIC ROCKS		TWO SPRING VENTS; MINIMAL DEPOSITION OF SILICIOUS SINTER	YES		STOCK WATERING		61		GAME BIRD HATCHERY			43.6962 115.6576	ROSS, 1971
WILLOW CREEK H S 4N 11E 34DB1S		QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK WITH TERTIARY DIKES		THREE SPRING VENTS AND NUMEROUS SEEPS	YES		RECREATION		55		GREENHOUSE			43.6372 115.1295	ROSS, 1971
POOL CREEK H S 5N 7E 24AD1S	7	CRETACEOUS GRANITIC ROCKS		SOME SEEPAGE			UNUSED		42		SOIL WARMING			43.7595 115.5602	ROSS, 1971
NINEMEYER H S 5N 7E 24BD1S	1321	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 65-75 DEGREES C; THIRTEEN SPRING VENTS	YES YES		UNUSED		76	126	PASTEURIZED MILK PROCESS	SUGARBEET PULP DEHYDRATION	YES	43.7553 115.5709	WARING, 1965
VAUGHN SPRING 5N 7E 26DAB1S	378	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 58-68 DEGREES C; THREE SPRING VENTS			UNUSED		68		REFRIGERATION (LOWER TEMPERATURE LIMIT)			43.7243 115.6041	ROSS, 1971
SMITH CABIN H S 5N 7E 34CCB1S	2649	CRETACEOUS GRANITIC ROCKS		FOUR SPRING VENTS			UNUSED		59		ANIMAL HUSBANDRY			43.7242 115.6040	ROSS, 1971
LOFTUS H S 5N 7E 34DBA1S	151	CRETACEOUS GRANITIC ROCKS		TEMPERATURE RANGE 47-54 DEGREES C; TWO SPRING VENTS	YES YES		BATHING		54		GRAIN-HAY DRYING			43.7243 115.6041	ROSS, 1971
BROWN CREEK H S 5N 8E 10CCD1S	757	CRETACEOUS GRANITIC ROCK		KNOWN AS POOL CREEK H S IN ROSS REPORT; TWO SPRING VENTS AND SEVERAL SEEPS			UNUSED		50		MUSHROOM GROWING			43.7785 115.4860	BEARD, 1978 (SITE INSPECTION)

STRAIGHT CREEK H S 5N 8E 12AB01S		SEVERAL SPRING VENTS AND SEEPS; ACTIVE DEPOSITION FORMING SILICIOUS SINTER; NOT FIELD CHECKED	YES	UNUSED	62	APPLE DEHYDRATION		43,7882 115,4444
GRANITE CREEK H S 5N 9E 5ADA1S	75 CRETACEOUS GRANITIC ROCK	FOUR SPRING VENTS AND SEVERAL SEEPS	YES	UNUSED	55	GREENHOUSES		43,8033 BEARD, 1978 115,4006 (SITE INSPECTION)
DUTCH FRANK'S H S 5N 9E 78BA1S	1135 CRETACEOUS GRANITIC ROCK	NUMEROUS SPRING VENTS; TEMPERATURE RANGE 50-65 DEGREES C; ACTIVE DEPOSITION OF SILICIOUS SINTER	YES YES YES	UNUSED	65	72 APPLE DEHYDRATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES 43,7894 WARING, 1965 115,4344
WEATHERBY MILL WELL 6N 9E 35ACA1	CRETACEOUS GRANITIC ROCK	FLOWING WELL; DEPTH REPORTED BY ROSS, 1971		RECREATION	533	30 FERMENTATION		43,8170 ROSS, 1971 115,3945
WEATHERBY H S 6N 10E 300CB1S	189 CRETACEOUS GRANITIC ROCK	SEEPAGE TYPE SPRING		UNUSED	45	GRAIN-HAY DRYING		43,8259 ROSS, 1971 115,3271
QUEENS RIVER H S 6N 11E 30ADB1S		NOT FIELD CHECKED; REPORTED WARM			0			43,8314 115,1915
ATLANTA H S 6N 11E 35DAD1S	378 CRETACEOUS GRANITIC ROCK	TEMPERATURE RANGE 43-60 DEGREES C; NINE SPRING VENTS AND SEVERAL SEEPS	YES	UNUSED	60	76 REFRIGERATION (LOWER TEMPERATURE LIMIT)		43,8116 ROSS, 1971 115,1093
CHATTANOOGA H S 6N 11E 35DBB1S	37 CRETACEOUS GRANITIC ROCK	SEVERAL SPRING VENTS AND NUMEROUS SEEPS		UNUSED	50	LAUNDRY USES		43,8130 ROSS, 1971 115,1157
LEGGIT CREEK H S 6N 12E 33BCB1S	CRETACEOUS GRANITIC ROCK (?)	THIS IS AN APPROXIMATE LOCATION; REPORTED IN THE IDAHO ENCYCLOPEDIA, 1958		UNUSED	0			43,8168 115,0459
BIG D RANCH WELL 2S 4E 28BD01	9463 PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE		IRRIGATION	365	27 DE-ICING		43,2223 YOUNG, 1977 115,9866
FRED HICKEY WELL 2S 5E 11ADD1	7210 PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE		IRRIGATION	182	22 FISH FARMING		43,2663 YOUNG, 1977 115,8188
CHARLES COE WELL 2S 5E 22AAD1	967 PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	WATER TEMPERATURE FLUCTUATES BETWEEN 15-21 DEGREES C; DRILLER'S LOG AVAILABLE		DOMESTIC	132	21 HEATING AND COOLING WITH HEAT PUMP		43,2406 LOG, 1977 115,8376



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-ccous	Car-bon-ates									
<i>Elmore County (cont'd.)</i>																
JOHN MALOTA WELL 2S 5E 23B8C1	757	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	126	21	77	FISH FARMING	ONION AND CARROT DEHYDRATION	YES	43.2403 115.8368	LOG, 1977
MICHAEL JACKSON WELL 3S 6E 240CB1	90	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC		48	21	HEATING AND COOLING WITH HEAT PUMP			43.1442 115.6853	LOG, 1969
MOUNTAIN HOME CITY WELL 3S 6E 26ADC1	6056	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS						PUBLIC SUPPLY		294	23	BIODEGRADATION			43.1341 115.6989	YOUNG, 1977
RICHARD CHANDLER WELL 3S 6E 398CC1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	134	20		HEATING AND COOLING WITH			43.1198 115.7142	LOG, 1972
ROBERT FORD WELL #1 3S 7E 2ACA1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		NOT PUMPING AT TIME OF CHECK; TEMPERATURE REPORTED BY ROSS, 1971; DRILLER'S LOG AVAILABLE				IRRIGATION	158	31		CATFISH FARMING			43.1939 115.5835	YOUNG, 1977
LONG TOM RANCH WELL #1 3S 7E 1ACA1		PLEISTOCENE BASALTIC ROCK AND SEDIMENTS						DOMESTIC	53	20	58	FISH FARMING	GREENHOUSE SPACE HEATING	YES	43.1945 115.5652	YOUNG, 1977
ROBERT FORD WELL #2 3S 7E 2ACC1	37	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS						DOMESTIC	152	21		HEATING AND COOLING WITH HEAT PUMP			43.1926 115.5856	YOUNG, 1977
DEL FOSTER WELL 3S 7E 3ADD1	158	PLEISTOCENE BASALTIC ROCK AND SEDIMENTS		TEMPERATURE RANGE 29-35 DEGREES C; FLOWING WELL; DRILLER'S LOG AVAILABLE				STOCK WATERING	176	31		DE-ICING			43.1908 115.5982	LOG, 1977
LONG TOM RANCH WELL #2 3S 8E 6CBC1	7570	PLEISTOCENE BASALTIC ROCK AND SEDIMENTS						IRRIGATION	137	21		FISH FARMING AND HATCHING			43.1886 115.5372	YOUNG, 1977
HOT SPRINGS 3S 8E 16CCC1S			FAULT	DRIED UP WHEN WELL WAS DRILLED IN 03S08E06C8D				DRY		70					43.1554 115.5177	

LESLIE BEAM WELL #1 35 0E 36CAD1	2744	PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	182 67 71	APPLE DEHYDRATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.1155 115.4515	DION AND GRIFFIN, 1967
LESLIE BEAM WELL #2 35 0E 36CDA1	113	PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL	STOCK WATERING	178 36	FERMENTATION			43.1146 115.4524	DION AND GRIFFIN, 1967
COYOTE H S 35 9E 2500B1S	283	PLIOCENE SILICIC VOLCANIC ROCK		UNUSED	57	POULTRY HATCHERY			43.1292 115.3397	JOHNSON, 1978 (SITE INSPECTION)
LATTY H S 35 10E 310DB1S		PLIOCENE SILICIC VOLCANIC ROCK	COVERED AND PIPED TO NEARBY HOMESTEAD LOCATED IN 04510E068AC	IRRIGATION	62 137	ANIMAL HUSBANDRY	FREEZE DRYING	YES	43.1155 115.3054	JOHNSON, 1978 (SITE INSPECTION)
JOHN DOBARON WELL 45 4E 32ACC1	7570	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	94 21	HEATING AND COOLING WITH HEAT PUMP			43.0350 116.0061	LOG, 1976
PETE NIELSON WELL 45 5E 19ABC1	8516	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	147 20	FISH FARMING			43.0668 115.9053	YOUNG, 1977
ROBERT BRUCE WELL #1 45 5E 25B8C1		PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	OBSERVATION WELL FOR GROUND WATER LEVELS; DRILLER'S LOG AVAILABLE	IRRIGATION	161 23 47	HEATING AND COOLING WITH HEAT PUMP	SEEDLING CONIFERS	YES	43.0531 115.8150	LOG, 1967
ROBERT BRUCE WELL #2 45 5E 26AAD1	6813	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		IRRIGATION	115 24	DE-ICING			43.0518 115.8160	YOUNG, 1977
TERRY PETERMAN WELL 45 5E 26CAB1	45	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	122 21	HEATING AND COOLING WITH HEAT PUMP			43.0471 115.8293	YOUNG, 1977
TERRY PETERMAN WELL 45 5E 36CAD1	7570			IRRIGATION	24	FERMENTATION			43.0305 115.8065	
HUGH HARDEN WELL 45 6E 7CAA1	121	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	DOMESTIC	163 22	HEATING AND COOLING WITH HEAT PUMP			43.0902 115.7864	LOG, 1977
DAVE SPENCER WELL 45 6E 25BCA1	10182	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	219 24	FISH FARMING			43.0500 115.6921	LOG, 1967

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<i>Elmore County (cont'd.)</i>																
FRANK LUTZ WELL #1 4S 6E 310DD1	9084	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	149	21		HEATING AND COOLING WITH HEAT PUMP			43.0268 115.7759	LOG, 1967
FRANK LUTZ WELL #2 4S 6E 32CC1	1022	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	126	21		FISH FARMING			43.0268 115.7746	LOG, 1969
RALPH MOORE WELL 4S 6E 358D1	11280	PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	198	24		CATFISH FARMING			43.0333 115.7119	LOG, 1972
RALPH YRAZABAL WELL 4S 7E 98BA1	10220							IRRIGATION	173	24		CATFISH FARMING			43.0967 115.6339	
BEVERLY OLSON WELL 4S 7E 198DB1								IRRIGATION	184	23	63	HEATING AND COOLING WITH HEAT PUMP	APPLE DEHYDRATION	YES	43.0647 115.6698	
TOM GILL WELL 4S 8E 1DBA1	18926	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	438	58		GAME BIRD HATCHERY			43.1029 115.4465	LOG, 1961
PACIFIC NW PIPELINE WELL 4S 8E 368BA1	18	PLIOCENE AND PLEISTOCENE SEDIMENTS		USED AS COOLANT FOR TURBINE DRILLER'S LOG AVAILABLE				INDUSTRY	580	43	101	SWIMMING POOLS	WASHING AND DRYING OF WOOL	YES	43.0377 115.4576	RALSTON AND CHAPMAN, 1968
BILL DAVIS WELL 4S 9E 8ACA1	18926	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	358	60	82	GREENHOUSE	PASTEURIZATION	YES	43.0923 115.4073	RALSTON AND CHAPMAN, 1968
GARY LANSON WELL 5S 3E 14CB1	378	PLIOCENE SILICIC VOLCANIC ROCKS		SULFUR ODOR; FLOWING WELL				IRRIGATION	701	59	97	LAUNDRY USES	BLANCHING	YES	42.9894 116.0762	YOUNG, 1972
MIKE MISSEL WELL #1 5S 6E 24AD1								DOMESTIC	124	20		HEATING AND COOLING WITH HEAT PUMP			42.9786 115.6778	

MIKE WISSEL WELL #2 5S 7E 16ABD1	PLIOCENE AND PLEISTOCENE SEDIMENTS		DOMESTIC	137	20	60	FISH FARMING	POULTRY HATCHERY	YES	42.9947 115.6244	YOUNG, 1977
CHARLES BOYD WELL 5S 8E 34BDC1	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRY; REPORTED TEMPERATURE	YES			34	AQUACULTURE			42.9465 115.4934	YOUNG, 1973
RAY THOMPSON WELL 5S 10E 25ACA1	49 PLIocene AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	144	21	HEATING AND COOLING WITH HEAT PUMP			42.9625 115.2098	LOG, 1973
DANIEL HATCHER WELL 5S 10E 28BDC1	378 PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; FLOWING WELL		DOMESTIC	304	32	HYDROPONICS			42.9617 115.2770	RALSTON AND CHAPMAN, 1968
LLOYD KNIGHT WELL 5S 10E 28CAB1	75 PLEISTOCENE SEDIMENTS	TEMPERATURE RANGES FROM 28-33 DEGREES C; FLOWING WELL; DRILLER'S LOG AVAILABLE		DOMESTIC	335	30	CATFISH FARMING			42.9594 115.2763	LOG, 1969
MAGIC WEST CO. WELL 5S 10E 32BDB1	PLIOCENE AND PLEISTOCENE SEDIMENTS			RECREATION	284	38	68 HYDROPONICS	APPLE DEHYDRATION	YES	42.9479 115.2959	RALSTON AND CHAPMAN, 1968
CHARLES ANDERSON WELL 5S 11E 7AOC1				DOMESTIC	396	30	64 CATFISH FARMING	ANIMAL HUSBANDRY	YES	43.0034 115.1926	
UNION PACIFIC RR WELL 5S 11E 7CBB1	189 PLIocene AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	93	23	FISH FARMING			43.0027 115.2023	ROSS, 1971
RODNEY RUBERRY WELL 5S 11E 18BAD1	45	FLOWING WELL		DOMESTIC	132	23	HEATING AND COOLING WITH HEAT PUMP			42.9934 115.1959	
DARRELL DRAKE WELL 5S 11E 18BCB1	18 PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	73	27	CATFISH FARMING			42.9908 115.2010	LOG, 1969
ROBERT GRAHAM WELL 5S 11E 19CCA1	71 PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	130	24	FISH FARMING			42.9695 115.2001	LOG, 1974
BLACK MESA FARM WELL 6S 10E 12CAA1	75 PLIocene AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE		DOMESTIC	301	30	CATFISH FARMING			42.9147 115.2147	LOG, 1965

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-ccious	Car-bon-ates									
<u>Franklin County</u>																
MOUND VALLEY W S 12S 40E 130CD1S		QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS		NOT FIELD CHECKED						0					42.3735 111.7263	MITCHELL, 1978
TREASURETON W S 12S 40E 36ACD1S	11	QUATERNARY ALLUVIUM	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS				UNUSED		35	75	AQUACULTURE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	42.3373 111.7270	MITCHELL, 1976
CLEVELAND H S 12S 41E 31CAC1S	18	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS AND SEEPS	YES			UNUSED		66	81	FRUIT AND VEGETABLE DEHYDRATION	PASTEURIZATION	YES	42.3329 111.7147	MITCHELL, 1976
WEST BANKS W S 12S 41E 31CBD1S		QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	NUMEROUS SPRING VENTS						35		AQUACULTURE			42.3338 111.7160	MITCHELL, 1976
MAPLE GROVE H S 13S 41E 7ACA1S	1324	PALEOZOIC QUARTZITE (?) WITH TRAVERTINE DEPOSITS	NORTH TRENDING FAULT	NUMEROUS VENTS AND SEEPS; TEMPERATURE RANGE 60-78 DEGREES C; PAST USE: POWER GENERATION AND RECREATION; SULFUR ODOR	YES	YES	PELTON WHEEL (POWER)			78	104	PASTEURIZED MILK PROCESS	WASHING AND DRYING OF WOOL	YES	42.3083 111.7068	DION, 1969
BEN MEEK WELL 14S 39E 36ADA1		QUATERNARY ALLUVIUM		SLIGHT SULFUR ODOR						12	44	105 SEEDLING CONIFERS	CANNING AND PRESERVING	YES	42.1646 111.8381	DION, 1969
RAY BARRINGTON WELL 14S 40E 31BCB1	246	QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE				STOCK WATERING		22	40	SOIL WARMING			42.1651 111.8366	LOG, 1977
ELDIN BINGHAM WELL 15S 39E 7DBC1	37	QUATERNARY ALLUVIUM								63	88	ANIMAL HUSBANDRY	BLANCHING	YES	42.1296 111.9426	DION, 1969
BATTLE CREEK H S 15S 39E 8BDC1S	3406	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT	TEMPERATURE RANGE 43-84 DEGREES C; NUMEROUS SPRING VENTS; ALSO KNOWN AS WAYLAND H S	YES	YES				84	142	BLANCHING	POTATOE DEHYDRATION	YES	42.1331 111.9276	DION, 1969
SQUAW H S WELL 15S 39E 17BCD1	113	QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS	NORTHWEST TRENDING FAULT		YES	YES				6	84	149 PASTEURIZING	CORN PRODUCTS (STARCH, OIL)	YES	42.1191 111.9299	DION, 1969

SQUAN H S 135 39E 178DC15	140 QUATERNARY ALLUVIUM	NORTHWEST TRENDING FAULT	SEVERAL SPRING VENTS; TEMPERATURE RANGE 69-73 DEGREES C; ALSO KNOWN AS VINCENT H S		73 190	APPLE DEHYDRATION	BEET SUGAR PROCESSING	YES 42.1187 111.9283	YOUNG AND MITCHELL, 1973	
MYRON FONNESBECK WELL 16S 38E 24ABC1	4163 QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE	IRRIGATION	156 22 84	HEATING AND COOLING WITH HEAT PUMP	PASTEURIZATION	YES 42.0257 111.9621	LOG, 1969	
P.L. KOLLER WELL 16S 38E 248DD1	9463 QUATERNARY ALLUVIUM		DRILLER'S LOG AVAILABLE	IRRIGATION	172 21	BIODEGRADATION		42.0225 111.9635	LOG, 1969	
<u>Fremont County</u>										
KEITH JERGENSON WELL #1 7N 41E 13CAB1	PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		NOT FIELD CHECKED	IRRIGATION	213 23	HEATING AND COOLING WITH HEAT PUMP		43.9326 111.5714	LOG, 1970	
KEITH JERGENSON WELL #2 7N 41E 13CAD1	4239 PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE	IRRIGATION	213 23	HEATING AND COOLING WITH HEAT PUMP		43.9326 111.5715	LOG, 1970	
DONALD TRUPP WELL 7N 41E 25C8D1	8706 TERTIARY SILICIC VOLCANIC ROCK (?)			IRRIGATION	91 36 94	AQUACULTURE	BARLEY MALTING PROCESS	YES 43.9013 111.5735	CROSTHWAITE AND OTHERS, 1970	
WAYNE LARSON WELL 7N 41E 26ACC1			NOT FIELD CHECKED; REPORTED TEMPERATURE		22 106	HEATING AND COOLING WITH HEAT PUMP	CANNING AND PRESERVING	YES 43.9036 111.5866		
GORDEN CLARK WELL 7N 41E 33DDD1	PLEISTOCENE SEDIMENTS AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE	DOMESTIC	73 22	FISH FARMING AND HATCHING		43.8847 111.6180	STEARNS, 1939	
HENRY HARRIS WELL 7N 41E 34ADD1	TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE	IRRIGATION	83 34 78	TROPICAL FISH FARMING	APPLE DEHYDRATION	YES 43.8906 111.5980	CROSTHWAITE AND OTHERS, 1970	
NENDALE CITY WELL 7N 41E 34CCD1	2271 TERTIARY SILICIC VOLCANIC ROCK (?)			IRRIGATION	91 32 81	BIODEGRADATION	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES 43.8839 111.6032	CROSTHWAITE AND OTHERS, 1970	
7N 41E 35CCD1	TERTIARY SILICIC VOLCANIC ROCKS (?)		REPORTED TEMPERATURE; NOT FIELD CHECKED	YES	106 36 84	BIODEGRADATION	PASTEURIZING	YES 43.8842 111.5899	YOUNG AND MITCHELL, 1973	
STETER AND SWINDELMAN 7N 41E 35CCD1	TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE		100 37	AQUACULTURE OR HYDROPONICS		43.8850 111.5836	CROSTHWAITE AND OTHERS, 1970	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Siliceous	Carbonates									
<u>Fremont County (cont'd.)</u>															
CLAUDE HAWS WELL 7N 41E 36DA1		TERTIARY SILICIC VOLCANIC ROCK (?)					IRRIGATION	193	34	63	AQUACULTURE	ANIMAL HUSBANDRY	YES	43.8852 111.5569	CROSTHWAITE AND OTHERS, 1970
DEAN SWINDELMAN WELL 7N 42E 8CAA1		TERTIARY SILICIC VOLCANIC ROCK (?)					IRRIGATION		34	48	AQUACULTURE	GRAIN-HAY DRYING	YES	43.9481 111.5291	CROSTHWAITE AND OTHERS, 1970
KEITH JERGENSON WELL #3 7N 42E 17BAC1							IRRIGATION		27		HEATING AND COOLING WITH HEAT PUMP			43.9383 111.5306	
KEITH JERGENSON WELL #4 7N 42E 17BBC1							IRRIGATION		39		AQUACULTURE			43.9384 111.5374	
KEITH JERGENSON WELL #5 7N 42E 18BA1	8327	TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED			IRRIGATION	246	51		GRAIN-HAY DRYING			43.9399 111.5492	LOG, 1974
NAOMI JERGENSON WELL 7N 42E 18CAA1		TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED			IRRIGATION	201	33		BIODEGRADATION			43.9325 111.5492	LOG, 1973
REMINGTON PRODUCE WELL 7N 42E 19CCA1	1892	TERTIARY SILICIC VOLCANIC ROCK (?)		DRILLER'S LOG AVAILABLE			IRRIGATION	193	26		CATFISH FARMING		YES	43.9144 111.5540	LOG, 1969
ASHTON W S 9N 42E 23DAC1S		PLEISTOCENE BASALT		TWO SPRING VENTS			IRRIGATION	26	91		SOIL WARMING	BLANCHING	YES	44.0913 111.4579	STEARNS AND OTHERS, 1939
BIG SPRINGS 14N 44E 34BBC1S	348247	QUATERNARY OBSIDIAN (RHYOLITE)		TEMPERATURE RANGE 10-12 DEGREES C; 10 DEGREES ABOVE MEAN ANNUAL TEMPERATURE; POSSIBLE THERMAL ANOMALY; SEVERAL SPRING VENTS			UNUSED	12	66		HEATING AND COOLING WITH HEAT PUMP	APPLE DEHYDRATION	YES	44.4995 111.2545	HAMILTON, 1965
<u>Gem County</u>															
SWEET W S 7N 1E 3CAA1S	18			FLOWING INTO WATER TROUGH			STOCK WATERING	20			CATFISH FARMING			43.9719 116.3243	

ROYSTONE H S 7N 1E 80DA1S	189 QUATERNARY ALLUVIUM NEAR MIOCENE BASALT	FAULTED BASALT	SULFUR ODOR; FIVE SPRING VENTS	UNUSED	66 150	BALNEOLOGICAL BATH	SUGAR BEET PROCESSING	YES 43.9539 116.3554	NEWCOMB, 1970
EAST ROYSTONE H S 7N 1E 90DC1S	QUATERNARY ALLUVIUM NEAR PLIOCENE BASALT (?)		NOT FIELD CHECKED; REPORTED TEMPERATURE	STOCK WATERING	45 84	SEEDLING CONIFERS	PASTEURIZATION	YES 43.9529 116.3468	
HIGHLAND LAND CO. W S 6N 1W 25ADB1S	3 QUATERNARY AND TERTIARY SEDIMENTS		SEEPAGE; TEMPERATURE MAY BE LESS THAN MEASURED	STOCK WATERING	23	CATFISH FARMING		43.8313 116.3955	ROSS, 1971
DONALD JENSEN WELL #1 6N 1W 26ADA1	75 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	21 20	HEATING AND COOLING WITH HEAT PUMP		43.8325 116.4137	SAVAGE, 1973
DONALD JENSEN WELL #2 6N 1W 26ADC1	75 PLIOCENE AND PLEISTOCENE SEDIMENTS		WATER HAD MILKY APPEARANCE; DRILLER'S LOG AVAILABLE	IRRIGATION	27 20	FISH FARMING		43.8304 116.4155	SAVAGE, 1973
PAUL CRANK WELL 6N 2W 14DBC1	PLIOCENE AND PLEISTOCENE SEDIMENTS		VERY SHALLOW WELL; DRILLER'S LOG AVAILABLE	DOMESTIC	9 24	HEATING AND COOLING WITH HEAT PUMP		43.8547 116.5406	LOG, 1977
FRED SCOTT WELL 6N 2W 17DBA1	757 PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	DOMESTIC	54 24	HEATING AND COOLING WITH HEAT PUMP		43.8572 116.5970	SAVAGE, 1973
RAWLA IZATT WELL 6N 3W 12AAB1	189 PLEISTOCENE SEDIMENTS		SLIGHT SULFUR ODOR	DOMESTIC	71 21	HEATING AND COOLING WITH HEAT PUMP		43.8788 116.6359	SAVAGE, 1973
<u>Gooding County</u>									
TSCHANNE H S 4S 12E 35AAA1S	PLIOCENE BASALT		TEMPERATURE REPORTED BY ROSS	DRY	43			43.0384 114.9879	ROSS, 1971
DAVE ARCHER WELL #1 4S 12E 35CAD1	140 PLIOCENE BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE;	DOMESTIC	168 45	STOCK WATERING		43.0289 114.9980	STEARNS AND OTHERS, 1938
J. SHANNON WELL 4S 13E 28ABB1	PLEISTOCENE BASALT		FLOWING; AREA COVERED WITH SPRINGS	YES DOMESTIC AND SPACE HEATING	50 53	LAUNDRY USE		YES 43.0534 114.9160	STEARNS AND OTHERS, 1938
HOT SULFUR LAKE 4S 13E 29ADD1S	302 QUATERNARY BASALT		NO VISIBLE FLOW; SPRING IS SUBAQUEOUS	YES UNUSED	27	FISH FARMING		43.0472 114.9291	ROSS, 1971



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Silicaceous	Carbonates									
<u>Gooding County (cont'd.)</u>																
WHITE ARROW H S 45 13E 30AB15	4542	QUATERNARY ALLUVIUM		FOUR SPRING VENTS	YES	YES	GREENHOUSE AND FISH FARMING		63	108		APPLE DEHYDRATION	CANNING AND PRESERVING	YES	43.0486 114.9511	MALDE AND OTHERS, 1963
DAVE ARCHER WELL #2 55 12E 3AAA1	2725	PLIOCENE SEDIMENTS AND BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE		YES	IRRIGATION		326	57	70	GREENHOUSE	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	43.0247 115.0092	MALDE AND OTHERS, 1963
BLM 65 12E 5BDD1	83	PLEISTOCENE BASALT		DRILLER'S LOG AVAILABLE			STOCK WATERING		182	28		CATFISH FARMING			42.9307 115.0566	STEARNS AND OTHERS, 1938
<u>Idaho County</u>																
BURGDORF H S 22N 4E 18DC15	613	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS; SLIGHT SULFUR ODOR; X-RAY DIFFRACTION ANALYSIS AVAILABLE	YES	YES	RECREATION		45	57		BALNEOLOGICAL BATH	LAUNDRY USES	YES	45.2768 115.9124	WARING, 1965
RIGGINS H S 24N 2E 14DBD15	15	QUATERNARY ALLUVIUM OVERLYING PALEOZOIC AND MESOZOIC GNEISS	NORTH TRENDING NORMAL FAULT	FOUR SPRING VENTS AND NUMEROUS SEEPS	YES	YES	DOMESTIC		41	95		SEEDLING CONIFERS	BLANCHING	YES	45.4162 116.1722	HAMILTON, 1969
COW FLATS H S 24N 4E 70DA15	37	CRETACEOUS GRANITIC ROCK SLIGHTLY METAMORPHOSED		PAST USE; MINERS BATHING FACILITIES			UNUSED		59			GREENHOUSE			45.4316 116.0148	ANDERSON, 1978 (SITE INSPECTION)
BARTH H S 25N 12E 18DD 15	757	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED					60	89		AQUACULTURE	BARLEY MALTING PROCESS	YES	45.5126 115.0425	ROSS, 1971
RED RIVER H S 28N 10E 30DD15	132	CRETACEOUS GRANITIC ROCK		NINE SPRING VENTS; TEMPERATURE RANGE 37-55 DEGREES C	YES		RECREATION		55	80		GRAIN-HAY DRYING	PASTEURIZED MILK PROCESS	YES	45.7877 115.1977	WARING, 1965
RUNNING SPRINGS 29N 12E 14ABB15	264	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		FIVE SPRING VENTS			UNUSED		41			BALNEOLOGICAL BATH			45.8516 114.9372	ROSS, 1971
MARTEN H S 31N 11E 24DCD15		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED			UNUSED		0						46.0055 115.0208	ROSS, 1971

STUART H S  
32N 11E 4CAA1S

CRETACEOUS GRANITIC ROCK

NOT FIELD CHECKED

UNUSED

0

46.1382 ROSS, 1971  
115.0896

PROSPECTOR H S  
33N 14E 4A 1S

CRETACEOUS GRANITIC ROCK

NOT FIELD CHECKED

0

46.2350 ROSS, 1971  
114.7073

STANLEY H S  
34N 10E 6CAA1S

113 CRETACEOUS GRANITIC ROCK

TWO SPRING VENTS

UNUSED

49

SPACE HEATING

46.3164 ROSS, 1971  
115.2575

WEIR CREEK H S  
36N 11E 138CC1S

227 CRETACEOUS GRANITIC ROCK

SIX SPRING VENTS;  
TEMPERATURE RANGE 44-47  
DEGREES C

YES

UNUSED

47

70 LAUNDRY USE

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

YES 46.4656 WARING, 1965  
115.0350

ODGATE LICKS H S  
36N 12E 15ADB1S

189 CRETACEOUS GRANITIC ROCK

SEVERAL SPRING VENTS

41

MUSHROOM GROWING

46.4656 ROSS, 1971  
114.9388

LITTLE JERRY JOHNSON  
36N 13E 18ADB1S

CRETACEOUS GRANITIC ROCK  
(7)

TWO SPRING VENTS;  
TEMPERATURE RANGE 38-41  
DEGREES C

41

BALNEOLOGICAL BATH

46.4656  
114.8743

JERRY JOHNSON H S  
36N 13E 18ADB1S

1135 CRETACEOUS GRANITIC ROCK

TEMPERATURE RANGE 41-48  
DEGREES C; EIGHT SPRING  
VENTS

YES

48

70 SEEDLING CONIFERS

APPLE DEHYDRATION

YES 46.4629 WARING, 1965  
114.8718

Jefferson County

HEISE H S  
4N 40E 250DA1S

227 TERTIARY SILICIC VOLCANIC  
ROCK

TWO SPRING VENTS; EXTENSIVE  
TRAVERTINE DEPOSITION

YES RECREATION

49

79 GRAIN-HAY DRYING

PASTEURIZED MILK PROCESS

YES 43.6440 ROSS, 1971  
111.6867

Jerome County

ROYAL CATFISH  
INDUSTRY  
9S 17E 290AD1

10523 PLIOCENE BASALTIC LAVA

DRILLER'S LOG AVAILABLE;  
FLOWING WELL; PAST USE  
CATFISH FARMING

UNUSED

222 43

AQUACULTURE

YES 42.6133 LOG, 1970  
114.4878

Lemhi County

FOSTER RANCH H S  
15N 15E 18DC1S

18

SULFUR ODOR; NUMEROUS  
SPRING VENTS; TEMPERATURE  
RANGE 42-57 DEGREES C

UNUSED

57

GREENHOUSE

44.6610  
114.6521

SHOWER BATH  
SPRINGS  
15N 16E 150AD1S

757 TERTIARY SILICIC VOLCANIC  
ROCKS FAULT

NUMEROUS SPRING VENTS; NOT  
FIELD CHECKED; TEMPERATURE  
NOT VARIFIED

50

AQUACULTURE

44.6279 ROSS, 1971  
114.6012

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anai.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<i>Lemhi County (cont'd.)</i>																
BIG EIGHTMILE CRK W S 15N 25E 800B1S		QUATERNARY ALLUVIUM						IRRIGATION	33			SOIL WARMING			44.6399 113.5037	BUSH AND BODNER, 1978
WHITTAKER W S 15N 26E 21DBC1S	3406	QUATERNARY ALLUVIUM NEAR PRE-TERTIARY UNDIFFERENTIATED ROCK						STOCK WATERING	24			HEATING AND COOLING WITH HEAT PUMP			44.6121 113.3632	ROSS, 1971
CRONKS CANYON H S 16N 21E 18ADC1S		TERTIARY SILICIC VOLCANIC ROCK		NOT FIELD CHECKED		YES			46	57		SPACE HEATING	GREENHOUSE HOT BED HEATING	YES	44.7196 114.0159	ROSS, 1971
FORGE CREEK H S 18N 16E 14BBB1S				NOT FIELD CHECKED						0					44.8964 114.5650	
GOLDBUG H S 18N 21E 12BCD1S	662	PRECAMBRIAN QUARTZITE						RECREATION	45			GRAIN-HAY DRYING			44.9053 113.9287	MITCHELL, 1978 (SITE INSPECTION)
MORMON RANCH H S 19N 14E 260DD1S				NOT FIELD CHECKED				UNUSED		0		GREENHOUSE			44.9513 114.7040	
SNOWSHOE JOHNSON'S H S 20N 16E 200CC1S	56	PRECAMBRIAN ARGILLACEOUS QUARTZITE		SLIGHT SULFUR ODOR; TWO SPRING VENTS		YES		UNUSED		42		HYDROPONICS			45.0422 114.6160	JOHNSON, 1978 (SITE INSPECTION)
SALMON H S 20N 22E 3ACA1S	548	CONTACT BETWEEN OLIGOCENE BASALT AND OLDER TUFFACEOUS ROCK	NORTHWEST TRENDING FAULT	THREE SPRING VENTS		YES			45	52		BALNEOLOGICAL BATH	GRAIN-HAY DRYING	YES	45.0949 113.8363	FORRESTER, 1956
SHARKEY H S 20N 24E 34CC1S	757	OLIGOCENE SILICIC VOLCANIC ROCK	NORTHWEST TRENDING FAULT					UNUSED		52	104	ELECTRICAL POWER GENERATION	CANNING AND PRESERVING	YES	45.0130 113.6051	ANDERSON, 1957
OWL CREEK H S 23N 17E 10BBA1S	189	PRECAMBRIAN SCHIST		SEVERAL SPRING VENTS; NUMEROUS SEEPS; SLIGHT SULFUR ODOR; TEMPERATURE RANGE 45-50 DEGREES C		YES	YES	BATHING		50		GRAIN-HAY DRYING			45.3444 114.4627	JOHNSON, 1978 (SITE INSPECTION)

BIG CREEK H S 23N 18E 22CAD1S	283	CRETACEOUS GRANITIC ROCK, ALTERED, STRONG LINEATIONS (?) SOME GYPSUM	FIFTEEN SPRING VENTS; TEMPERATURE RANGE 82-93 DEGREES C; SLIGHT SULFUR ODOR; TRAVERTINE DEPOSIT BELOW PRESENT SPRING VENTS	YES YES YES UNUSED	93 173	ELECTRICAL POWER GENERATION	HEATING AND DRYING OF DIATOMACEOUS EARTH	YES 45.3070 114.3379	WARING, 1965
HORSE CREEK H S 25N 17E 198BA1S	37	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; SEVERAL SPRING VENTS	RECREATION	43	AGRICULTURE		45.5034 114.4627	ROSS, 1971
<u>Madison County</u>									
ELKHORN W S 4N 40E 23CAD1S				UNUSED	22	FISH FARMING AND HATCHING		43.6597 111.7154	
LAVERE RICKS WELL 5N 40E 3C8A1		TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE	IRRIGATION	108 21 36	HEATING AND COOLING WITH HEAT PUMP	AQUACULTURE	YES 43.7921 111.7805	LOG, 1973
MARK RICKS WELL 5N 40E 88CC1		TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE	IRRIGATION	56 26 44	DE-ICING ROADWAYS	SEEDLING CONIFERS	YES 43.7800 111.7835	LOG, 1962
PAULINE SMITH WELL 5N 40E 90CC1	12491	TERTIARY SILICIC VOLCANIC ROCKS	TEMPERATURE NOT CONFIRMED; DRILLER'S LOG AVAILABLE	IRRIGATION	135 21 30	STOCK WATERING	FERMENTATION	YES 43.7719 111.7654	LOG, 1967
BILL WEBSTER WELL 5N 40E 368DB1	10977	TERTIARY SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	405 22	CATFISH FARMING		43.7222 111.6991	CROSTHWAITE AND OTHERS, 1970
GREEN CANYON H S 5N 43E 68CA1S		TERTIARY SILICIC VOLCANIC ROCKS	SEVERAL SPRING VENTS; ALSO KNOWN AS PINCOCK H S; TRAVERTINE DEPOSITS	YES RECREATION	44 72	SEEDLING CONIFERS	ONION DEHYDRATION	YES 43.7909 111.4348	WARING, 1965
VAL SCHMENDIMAN WELL 6N 41E 1ADD1		TERTIARY SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	201 29	BIODEGRADATION		43.8786 111.5580	CROSTHWAITE AND OTHERS, 1970
WALZ ENT. INC. WELL 6N 41E 10ACC1			TEMPERATURE NOT CONFIRMED	IRRIGATION	26 81	FERMENTATION	PASTEURIZATION	YES 43.8621 111.6069	
WANDA WOOD WELL #1 6N 41E 108BB1			TEMPERATURE NOT CONFIRMED	IRRIGATION	80 24 78	DE-ICING SIDEWALKS	FRUIT AND VEGETABLE DEHYDRATION	YES 43.8682 111.6172	
WANDA WOOD WELL #2 6N 41E 100BB1			TEMPERATURE NOT CONFIRMED	IRRIGATION	27 80	BIODEGRADATION	PASTEURIZED MILK PROCESS	YES 43.8612 111.6069	

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						Sili-aceous	Car-bon-ates									
<u>Madison County (cont'd.)</u>																
BUREAU OF RECLAMATION 7N 42E 300B01		TERTIARY SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; TETON DAM SITE				TEST WELL	200	34		HYDROPONICS			43.9027 111.5435	LOG, 1972
<u>Minidoka County</u>																
PAUL CITY WELL 9S 23E 28C0A1	7570	PLIOCENE AND PLEISTOCENE BASALTIC LAVA AND SEDIMENTS		DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	137	22		FISH FARMING			42.6078 113.7768	BROTT, 1976
<u>NezPerce County</u>																
LEWISTON CITY WELL 35N 5W 6C9C1	4542	MIOCENE BASALT		DRILLER'S LOG AVAILABLE; TEMPERATURE REPORTED BUT NOT FIELD CHECKED				EMERGENCY AND PUBLIC SUPPLY	182	20		HEATING AND COOLING WITH HEAT PUMP			46.4040 117.0217	
<u>Oneida County</u>																
KENT W S 12S 34E 368C81S	715	PALEOZOIC LIMESTONE		NUMEROUS SPRING VENTS				UNUSED	24	52		FISH FARMING	FERMENTATION	YES	42.3393 112.4361	PIPER, 1924
MALAD W S 14S 36E 27C0A1S		QUATERNARY ALLUVIUM WITH TRAVERTINE DEPOSITS		ONE SPRING VENT	YES	YES			25	29		HEATING AND COOLING WITH HEAT PUMP	FISH FARMING	YES	42.1734 112.2393	BURNHAM AND OTHERS, 1969
PLEASANTVIEW W S 13S 33E 3A8B1S	14421	QUATERNARY ALLUVIUM		NUMEROUS SPRING VENTS		YES			25	33		HYDROPONICS	AQUACULTURE	YES	42.1557 112.3486	BURNHAM AND OTHERS, 1969
WOODRUFF H S 16S 36E 108B21S		PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	NINE SPRING VENTS; TEMPERATURE RANGE 27-32 DEGREES C		YES			27	46		CATFISH FARMING	SEEDLING CONIFERS	YES	42.0562 112.2468	BURNHAM AND OTHERS, 1969
PRICES W S 16S 36E 238B01S		QUATERNARY ALLUVIUM		IN MALAD RIVER; UNABLE TO LOCATE					25						42.0253 112.2268	ROSS, 1971
<u>Owyhee County</u>																
FERRING WELL IN 3W 7A0C1		QUATERNARY SEDIMENTS AND BASALT		FLOWING WELL; GAS COLLECTOR AT TOP OF WELL; GAS WAS USED FOR COOKING				HEATING AND RECREATION	41			FISH HATCHING AND GREENHOUSE			43.4427 116.7340	NEWTON AND CORCORAN, 1963

M. GOFF WELL 1N 3W 8CDA1	1892 QUATERNARY BASALT	FLOWING WELL	DOMESTIC	156 36	SPACE HEATING			43.4338 BEARD, 1978 116.7238 (SITE INSPECTION)
NORRIS WHITE WELL 1N 3W 8CDB1	1135 QUATERNARY SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	213 36	GREENHOUSE			43.4335 LOG, 1970 116.7250
1N 3W 16CDB1	QUATERNARY BASALT	FLOWING WELL	UNUSED	36	CATFISH FARMING AND AQUACULTURE			43.4195 ROSS, 1971 116.7067
JIM AVAHAUSER WELL 1N 3W 17ADD1	QUATERNARY AND TERTIARY SEDIMENTS; QUATERNARY BASALT	FLOWING WELL	DOMESTIC	34	SPACE HEATING AND CATFISH FARMING			43.4245 ROSS, 1971 116.7130
CHARLES ELUMBAUGH WELL 1N 3W 20DAC1	302 PLIOCENE AND PLEISTOCENE SEDIMENTS (?) AND SILICIC VOLCANIC ROCK	PARTIAL DRILLER'S LOG AVAILABLE	IRRIGATION AND DOMESTIC	399 37	GREENHOUSE			43.4053 LOG, 1962 116.7157
ELDON MARSH WELL 1N 3W 21BBA1	QUATERNARY BASALT	FLOWING WELL; CAPPED	UNUSED	41	SPACE HEATING			43.4143 ROSS, 1971 116.7068
GIVENS H S 1N 3W 21BAB1S	QUATERNARY ALLUVIUM	SLIGHT SULFUR ODOR	RECREATION	47 100	BALNEOLOGICAL BATH	WASHING AND DRYING OF WOOL	YES	43.4137 ROSS, 1971 116.7065
1N 3W 28BCD1			IRRIGATION	47	SPACE HEATING			43.3953 116.6976
MARIE BRUNELL WELL 1N 4W 12ABC1	PLIOCENE SEDIMENTS AND BASALT	FLOWING WELL; SLIGHT SULFUR ODOR	DOMESTIC AND STOCK WATERING	457 40	HYDROPONICS			43.4410 NEWTON AND 116.7603 CORCORAN, 1963
ROBERT COFFELT WELL 1N 4W 12BDA1	PLIOCENE SEDIMENTS AND BASALT	WELL LOCATED IN SMALL GREEN HOUSE	DOMESTIC AND STOCK WATERING	39 27	CATFISH FARMING			43.4403 NEWTON AND 116.7626 CORCORAN, 1963
WESLEY HIGGINS WELL 1N 4W 12DBB1	946 PLIOCENE SEDIMENTS AND BASALT	WELL NOT PUMPING; PAST USE HEATING GREENHOUSE; DRILLER'S LOG AVAILABLE	IRRIGATION	195 36	AQUACULTURE		YES	43.4360 NEWTON AND 116.7596 CORCORAN, 1963
GUY FREEMAN WELL #1 1N 4W 13BAC1	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	WELL PLUGGED AT 25 METERS OWNER CLAIMS TEMPERATURE EXCEEDS 38 DEGREES C; DRILLER'S LOG AVAILABLE	UNUSED	871 39	SOIL WARMING			43.4272 NEWTON AND 116.7652 CORCORAN, 1963

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Sili-aceous	Car-bon-ates									
<i>Owyhee County (cont'd.)</i>															
GUY FREEMAN WELL #2 1N 4W 13BAD1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		SLIGHT SULFUR SMELL			DOMESTIC AND STOCK WATERING	335	29		FERMENTATION		43.4274 116.7614	NEWTON AND CORCORAN, 1963	
HOMEDALE CITY WELL #1 3N 5W 4DAC1	340	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		SLIGHT SULFUR ODOR			PUBLIC WATER SUPPLY	228	20		FISH FARMING AND HATCHING		43.6230 116.9346	NEWTON AND CORCORAN, 1963	
HOMEDALE CITY WELL #2 3N 5W 9AAB1	370	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; SLIGHT SULFUR ODOR			PUBLIC WATER SUPPLY	165	23		BIODEGRADATION		43.6165 116.9341	NEWTON AND CORCORAN, 1963	
GEORGE JOHNSTONE WELL 3N 5W 28OBC1	340	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS					STOCK, DOMESTIC AND IRRIGATION	210	21		HEAT AND COOLING WITH HEAT PUMP		43.5643 116.9487	NEWTON AND CORCORAN, 1963	
JUSTAMERE FARMS WELL #1 3N 5W 30AAA1	189	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS					STOCK AND DOMESTIC	137	20		FISH FARMING AND HATCHING		43.5740 116.9702	NEWTON AND CORCORAN, 1963	
JUSTAMERE FARMS WELL #2 3N 5W 30ADA1	136	QUATERNARY ALLUVIUM, PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE			STOCK AND DOMESTIC	126	21		HEAT AND COOLING WITH HEAT PUMP		43.5703 116.9700	NEWTON AND CORCORAN, 1963	
EARL FOOTE WELL 1S 2W 7CCB1	643	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		SLIGHT SULFUR ODOR			SPACE HEATING AND IRRIGATION	518	46		GRAIN-HAY DRYING	YES	43.3466 116.6275	ROSS, 1971	
COTNER FARM WELL 1S 2W 18CCD1		QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS					IRRIGATION AND DOMESTIC	289	30		FERMENTATION		43.3295 116.6194	ROSS, 1971	
JIM TAYLOR WELL 1S 2W 27CCD1	757	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		OWNER STATED WELL FLOWED PRIOR TO DEVELOPMENT OF NEW WELL 1 MILE S.E.			DOMESTIC	91	21		HEAT AND COOLING WITH HEAT PUMP		43.3009 116.5699	ROSS, 1971	
JACK MORGAN WELL 1S 2W 330DD1	408	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		TWO WELLS AT THIS SITE, WATER MIXED AT DEPTH AND FLOWS INTO SWIMMING AREA; SULFUR ODOR			IRRIGATION AND SWIMMING	121	28		CATFISH FARMING		43.2871 116.5724	ROSS, 1971	

ROGER QUINNEY WELL 1S 2W 34CAB1	378 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SOME SULFUR ODOR	DOMESTIC	396 20	HEAT AND COOLING WITH HEAT PUMP	43,2926 116,5645	ROSS, 1971
CEREDA RANCHES WELL #1 1S 3W 10CB1	18 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	FLOWING WELL	STOCK AND DOMESTIC	365 40	GREENHOUSE	43,3607 116,6373	ROSS, 1971
CEREDA RANCHES WELL #2 1S 3W 10CC1	94 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	FLOWING WELL	IRRIGATION	274 36	FERMENTATION	43,3585 116,6392	ROSS, 1971
JACOBSON'S FEED LOT #1 1S 3W 9ACC1	2725 QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	STOCK WATERING	182 27	BIODEGRADATION	43,3523 116,6975	LOG, 1968
JACOBSON'S FEED LOT #2 1S 3W 9BDA1	1703 QUATERNARY-TERTIARY SEDIMENTS	DRILLER'S LOG AVAILABLE	STOCK	167 37	SPACE HEATING	43,3533 116,7005	LOG, 1968
PAUL WARRICK WELL 2S 1W 23CB1	113 QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	DOMESTIC	221 30	DE-ICING HIGHWAY	43,2329 116,4323	LOG, 1968
LANNIS GIVENS WELL 2S 2W 20BD1	1135 PLIOCENE AND PLEISTOCENE SEDIMENTS AND QUATERNARY BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL		260 38	SPACE HEATING	43,2752 116,5463	LOG, 1953
GUY GIVENS WELL #1 2S 2W 3BDA1	378 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	STOCK WATERING	274 38	HYDROPONICS	43,2814 116,5624	ROSS, 1971
GUY GIVENS WELL #2 2S 2W 3BD1	757 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	STOCK WATERING	274 43	SEEDLING CONIFERS	43,2801 116,5625	ROSS, 1971
M. OHM WELL 2S 2W 3CB1	757 QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS	SULFUR ODOR; FLOWING WELL	IRRIGATION	274 36	AQUACULTURE	43,2779 116,5696	ROSS, 1971
SKYLES AND NEELEY WELL 1 2S 2W 35ABA1	QUATERNARY-TERTIARY SEDIMENTS AND QUATERNARY BASALT	BEING DRILLED AT TIME OF INSPECTION	IRRIGATION	335 25		43,2113 116,5384	BEARD, 1978 (SITE INSPECTION)
SKYLES AND NEELEY WELL 2 2S 2W 35ACD1	11355 QUATERNARY BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	361 41	SOIL WARMING AND GREENHOUSE SPACE HEATING	43,2058 116,5373	LOG, 1976



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili- ceous									
<i>Owyhee County (cont'd.)</i>															
SKYLES AND NEELEY WELL 3 25 2W 358AA1	7192	QUATERNARY BASALT		DRILLER'S LOG AVAILABLE			IRRIGATION	637	32		FERMENTATION			43.2131 116.5223	LOG, 1970
SKYLES AND NEELEY WELL 4 25 2W 360001	5602	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS		TO BE DRILLED DEEPER; WATER TEMPERATURE HIGHER WHEN FLOWING			IRRIGATION	360	23		FISH FARMING AND HATCHING			43.1997 116.5237	ROSS, 1971
OMALLEY WELL 35 2W 180B1	946	QUATERNARY BASALT AND QUATERNARY-TERTIARY SEDIMENTS					IRRIGATION	121	24		CATFISH FARMING			43.1943 116.5311	ROSS, 1971
ALFRED HEYWOOD WELL 35 1E 350AC1		PLIOCENE AND PLEISTOCENE SEDIMENTS		NOT FIELD CHECKED				91	20		HEATING AND COOLING WITH HEAT PUMP		YES	43.1176 116.2970	YOUNG AND WHITEHEAD, 1975
WAYNE SMITH WELL 45 1E 6ABB1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS		SULFUR ODOR; WELL FLOWS WHEN ADJACENT COLD WELL IS SHUT OFF			IRRIGATION	213	22		HEATING AND COOLING WITH HEAT PUMP			43.1120 116.3839	ROSS, 1971
WILLIAM COX WELL #1 45 1E 250001		PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL			STOCK WATERING		32		FERMENTATION		YES	43.0412 116.2690	YOUNG AND WHITEHEAD, 1975
WILLIAM COX WELL #2 45 1E 26ABC1	18	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL			UNUSED	518	27		CATFISH FARMING		YES	43.0521 116.3016	YOUNG AND WHITEHEAD, 1975
T. ADCOCK WELL 45 1E 290001	6813	TERTIARY SILICIC VOLCANIC ROCKS AND PLEISTOCENE SEDIMENTS		FLOWING WELL; DRILLER'S LOG AVAILABLE; PAST USE: HOG SCALDING			IRRIGATION	926	68		APPLE DEHYDRATION		YES	43.0400 116.3692	LOG, 1959
GEORGE KING WELL 45 1E 34BAD1	12112	TERTIARY SILICIC VOLCANIC ROCKS AND PLEISTOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE; SULFUR ODOR		YES	IRRIGATION	908	76		PASTEURIZED MILK PROCESS		YES	43.0374 116.3235	RALSON AND CHAPMAN, 1969
WES-COON INC. WELL 45 2E 19AC1	1268	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLEISTOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL; DRILLER'S LOG AVAILABLE			RARELY USED	938	42		SEEDLING CONIFERS			43.0636 116.2622	LOG, 1958

G. CHRISTENSEN WELL 4S 2E 29BC1	94 PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; SLIGHT SULFUR ODOR		DOMESTIC	822 28	CATFISH FARMING		YES 43.0450 116.2427	YOUNG AND WHITEHEAD, 1975
R. KETTERLING WELL 4S 2E 32BC1	PLIOCENE SEDIMENTS AND BASALT, AND TERTIARY SILICIC VOLCANIC ROCKS (?)	FLOWING WELL; SULFUR ODOR YES		DOMESTIC	824 39	HYDROPONICS		YES 43.0332 116.2528	RALSON AND CHAPMAN, 1969
CHARLES STEINER WELL 5S 1E 3AAB1	PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; REPORTED INFORMATION; NOT FIELD CHECKED			579 52	AQUACULTURE		YES 43.0247 116.3172	YOUNG AND WHITEHEAD, 1975
E. LAWRENCE WELL #1 5S 1E 10BD1	5518 TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; DRILLER'S LOG AVAILABLE		IRRIGATION	902 64	99 ANIMAL HUSBANDRY	BLANCHING	YES 43.0052 116.3242	YOUNG AND WHITEHEAD, 1975
ELMER JOHNSTON WELL #1 5S 1E 21BCA1	PLIOCENE BASALTS	INTERMITTENT FLOW		DOMESTIC	274 48	STOCK WATERING		42.9775 116.3484	YOUNG AND WHITEHEAD, 1975
ELMER JOHNSTON WELL #2 5S 1E 21CBC1	3614 PLIOCENE BASALTS	FLOWING WELL; DRILLER'S LOG AVAILABLE		IRRIGATION	201 64	REFRIGERATION (LOWER TEMPERATURE LIMIT)		YES 42.9728 116.3507	LOG, 1954
E. LAWRENCE WELL #2 5S 1E 24AD1	340 TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; SLIGHT SULFUR ODOR; DRILLER'S LOG AVAILABLE	YES	IRRIGATION	755 67	96 ANIMAL HUSBANDRY	BLANCHING	YES 42.9753 116.2799	YOUNG AND WHITEHEAD, 1975
E. LAWRENCE WELL #3 5S 1E 24ADB1	4701 TERTIARY SILICIC VOLCANIC ROCKS	FLOWING WELL; SLIGHT SULFUR ODOR; DRILLER'S LOG AVAILABLE		IRRIGATION	950 66	77. SPACE HEATING	PASTEURIZED MILK PROCESS	YES 42.9787 116.2773	RALSTON AND CHAPMAN, 1969
OSCAR FIELDS WELL 5S 2E 1BBC1	PLIOCENE BASALT (?) AND SEDIMENTS	FLOWING WELL; SULFUR ODOR YES	YES	SPACE HEATING	548 49	MUSHROOM GROWING		YES 43.0244 116.1745	RALSTON AND CHAPMAN, 1969
CLARENCE HOPKINS WELL 5S 2E 20DA1	PLIOCENE AND PLEISTOCENE SEDIMENTS	SLIGHT SULFUR ODOR; NOT FIELD CHECKED FOR THIS REPORT; FLOWING WELL; REPORTED CAVED IN; DRILLER'S LOG AVAILABLE		IRRIGATION	749 37	HYDROPONICS		YES 43.0150 116.1867	YOUNG, 1973
COX AND LAWRENCE WELL 5S 2E 5BCD1	PLIOCENE AND PLEISTOCENE SEDIMENTS	NOT FIELD CHECKED		IRRIGATION	612 43	SWIMMING POOL		YES 43.0194 116.2500	
HENRY DRISKELL WELL #1 5S 2E 13ADA1	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT	FLOWING WELL; DRILLER'S LOG AVAILABLE		DOMESTIC	532 20	FISH FARMING AND HATCHING		YES 42.9926 116.1583	YOUNG AND WHITEHEAD, 1975

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-aceous	Car-bon-ates									
<i>Owyhee County (cont'd.)</i>																
HENRY DRISKELL WELL #2 5S 2E 25ADA1		PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		WELL CAVED, ORIGINAL DEPTH WAS 920 METERS WITH A RECORDED TEMPERATURE OF 60 DEGREES C; DRILLER'S LOG AVAILABLE				DOMESTIC	45 21			ANIMAL HUSBANDRY			42.9646 116.1563	LOG, 1965
NORRIS MCKEETH WELL 5S 3E 20ADA1	1957	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		FLOWING WELL; DRILLER'S LOG AVAILABLE; SULFUR ODOR				HEATING HOME & OUTBUILDINGS	737 59			GAME BIRD HATCHING		YES	42.9973 116.1167	LOG, 1959
BURGHARDT CO. WELL 5S 3E 2088B1		7 PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL				STOCK WATERING		27		CATFISH FARMING		YES	42.9820 116.1358	YOUNG AND WHITEHEAD, 1975
HARALD SIMPER WELL #1 5S 3E 2188C1	37	TERTIARY SILICIC VOLCANIC ROCKS (?)		FLOWING WELL				DOMESTIC	609 22			HEAT AND COOLING WITH HEAT PUMP			42.9796 116.1153	
HARALD SIMPER WELL #2 5S 3E 2188C1		TERTIARY SILICIC VOLCANIC ROCKS (?)		FLOWING WELL				DOMESTIC	609 27			CATFISH FARMING			42.9782 116.1144	
LEROY BEAMAN WELL 5S 3E 22AAD1		PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL					396 25			DE-ICING ROADWAYS		YES	42.9811 116.0765	YOUNG AND WHITEHEAD, 1975
COOKE'S GREENHOUSE #1 5S 3E 268CB1	1059	PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL	YES (?)	YES	GREENHOUSE		905 85	116		BARLEY MALTING PROCESS	HIGH ENERGY PROCESSING OF KILN LUMBER	YES	42.9639 116.0756	YOUNG, 1972
COOKE'S GREENHOUSE #2 5S 3E 268CB2	1741	PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALTS (?)		FLOWING WELL	YES		IRRIGATION		905 67			REFRIGERATION (LOWER TEMPERATURE LIMIT)		YES	42.9639 116.0750	YOUNG, 1973
D. BYBEE WELL #1 5S 3E 278DD1		PLIOCENE SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL				AIR CONDITIONING	883 60			GREENHOUSE		YES	42.9619 116.0861	YOUNG AND WHITEHEAD, 1973
A. WHITTED WELL 5S 3E 288CC1		TERTIARY SILICIC VOLCANIC ROCKS AND PLIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				IRRIGATION	774 64	109		HOTBED HEATING	CANNING AND PRESERVING	YES	42.9612 116.1141	YOUNG AND WHITEHEAD, 1975

D. LAYTON  
WELL  
55 3E 340AA1

1703 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

FLOWING WELL; DRILLER'S  
LOG AVAILABLE

DOMESTIC

454 32

AQUACULTURE

42.9468 LOG, 1968  
116.0774

D. BYBEE  
WELL #2  
55 3E 350CC1

2271 SILICIC VOLCANIC ROCKS AND  
PLIOCENE BASALT

FLOWING WELL

IRRIGATION

783 72

FRUIT AND VEGETABLE  
DEHYDRATION

YES 42.9400 YOUNG, 1973  
116.0742

IDAHO POWER CO. WELL  
55 4E 340CB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

NOT FIELD CHECKED

DOMESTIC

108 27

YES 42.9425  
115.9752

CHESTER TINDALL  
WELL  
55 5E 338BD1

PLIOCENE BASALT AND  
SEDIMENTS

WATER GOES THROUGH A  
HOLDING TANK FIRST SO  
TEMPERATURE MAY NOT BE  
ACCURATE

IRRIGATION

207 25

HEATING AND COOLING WITH  
HEAT PUMP

YES 42.9507 YOUNG AND  
115.8706 WHITEHEAD, 1975

CLAY ATKINS  
WELL  
55 5E 34ADD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALT

DRILLER'S LOG AVAILABLE

IRRIGATION

269 25

CATFISH FARMING

YES 42.9398 YOUNG AND  
115.8371 WHITEHEAD, 1975

STREETER-BRADBERRY  
WELL  
55 6E 310CD1

9084 PLIOCENE BASALT AND  
SEDIMENTS

NO ACCESS TO WELL,  
REPORTED TEMPERATURE,  
DRILLER'S LOG AVAILABLE

IRRIGATION

149 21

HEATING AND COOLING WITH  
HEAT PUMP

42.9399 LOG, 1967  
115.7820

LOWER BIRCH  
SPRING  
65 1E 328BA1S

PLIOCENE SEDIMENTS

NOT FIELD CHECKED

UNUSED

25

HEATING AND COOLING WITH  
HEAT PUMP

YES 42.8648 YOUNG AND  
116.3679 WHITEHEAD, 1975

LESLIE POST WELL #1  
65 3E 20BB1

1022 PLIOCENE BASALT AND  
SEDIMENTS

FLOWING WELL; DRILLER'S LOG  
AVAILABLE

IRRIGATION

935 59

GAME BIRD HATCHERY

YES 42.9313 YOUNG AND  
116.0747 WHITEHEAD, 1975

LESLIE POST WELL #2  
65 3E 20CC1

2725 PLIOCENE BASALT AND  
SEDIMENTS

FLOWING WELL; SULFUR ODOR;  
DRILLER'S LOG AVAILABLE

YES YES IRRIGATION

591 54

HAY DRYING

YES 42.9239 RALSTON AND  
116.0754 CHAPMAN, 1969

W. BUNT WELL  
65 3E 48CC1

PLIOCENE BASALT (?) AND  
SEDIMENTS

FLOWING WELL

IRRIGATION

512 48

GREENHOUSE

YES 42.9311 YOUNG AND  
116.1153 WHITEHEAD, 1975

J. AGENBROAD WELL  
65 3E 5CAC1

7570 PLIOCENE SILICIC VOLCANIC  
ROCKS

FLOWING WELL; DRILLER'S  
LOG AVAILABLE

IRRIGATION

1097 60

HOT WATER HEATING

YES 42.9297 YOUNG AND  
116.1301 WHITEHEAD, 1975

NIELSON AND  
CAROTHERS  
65 3E 9ACD1

88576 PLIOCENE BASALT AND  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION

434 41

SOIL WARMING

YES 42.9168 YOUNG AND  
116.1042 WHITEHEAD, 1975

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquit. Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Siliceous	Carbonates									
<i>Owyhee County (cont'd.)</i>																
BOB DIRKS WELL 6S 3E 10CAA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS		PARTLY CAVED IN; DRILLER'S LOG AVAILABLE				IRRIGATION	350	30		BIODEGRADATION			42.9136 116.0881	LOG, 1969
TRIANGLE DAIRY WELL #1 6S 3E 11DAD1	605	PLIOCENE AND PLIESTOCENE SEDIMENTS AND PLIOECENE BASALT (?)		DRILLER'S LOG AVAILABLE; NO ACCESS TO WELL BEFORE HOLDING TANK				STOCK WATERING	435	34		AQUACULTURE		YES	42.9136 116.0561	YOUNG AND WHITEHEAD, 1975
TRIANGLE DAIRY WELL #2 6S 3E 14BCB1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	408	29		FERMENTATION			42.9063 116.0758	LOG, 1923
ROBERT DAVIS WELL #1 6S 3E 23QDA1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS AND BASALT (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	378	30		DE-ICING HIGHWAY			42.8821 116.0667	LOG, 1968
ROBERT DAVIS WELL #2 6S 3E 26CBC1	5961	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	256	30		FISH FARMING AND HATCHING			42.8705 116.0754	LOG, 1974
B. BURGHARDT WELL #1 6S 3E 34DCC1	2649	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)						IRRIGATION	240	29		HYDROPONICS			42.8513 116.0866	
JIM MORRISON WELL #1 6S 4E 14BDD1	5299	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	580	55		LAUNDRY USES		YES	42.9073 115.9450	YOUNG AND WHITEHEAD, 1975
JIM MORRISON WELL #2 6S 4E 14BDD2	30	PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	42	27		CATFISH FARMING			42.9051 115.9682	LOG, 1970
KENT KOHRING WELL #1 6S 4E 25BCC1	7570	PLIOCENE AND PLEISTOCENE SEDIMENTS						IRRIGATION	533	27		DE-ICING		YES	42.8740 115.9356	YOUNG AND WHITEHEAD, 1975
ANTONIO DELEON WELL #1 6S 4E 32DAB1	1022	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	362	33		FERMENTATION			42.8571 115.9978	LOG, 1971

ANTONIO DELEON WELL #2 6S 4E 33DBA1	PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	358 31	BIODEGRADATION	42.8579 115.9863	LOG, 1976
DICK WARD WELL 6S 4E 35QDA1	11923 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	291 33	AQUACULTURE	YES 42.8547 115.9463	YOUNG AND WHITEHEAD, 1975
MERRILL TALLMAN WELL #1 6S 4E 35DA1	4920 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	100 22	HEATING AND COOLING WITH HEAT PUMP	42.8576 115.9366	LOG, 1972
MERRILL TALLMAN WELL #2 6S 4E 35DBB1	9614 PLIOCENE AND PLEISTOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	272 30	DE-ICING	42.8581 115.9455	LOG, 1972
KENT KOHRING WELL #2 6S 4E 36CCC1	9463 PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	609 40	HYDROPONICS	42.8523 115.9354	LOG, 1967
KENT KOHRING WELL #3 6S 4E 36CCC2	3785 PLIOCENE BASALT (?)		IRRIGATION	152 20	CATFISH FARMING	42.8522 115.9344	
COLYER CATTLE CO. WELL 6S 5E 100001	15 PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL	STOCK WATERING	508 39	AQUACULTURE	YES 42.9117 115.8389	YOUNG, 1972
J.R. SIMPLOT WELL #1 6S 5E 18CCB1	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	DOMESTIC	902 27	CROCODILE FARMING	YES 42.8989 115.9156	LOG, 1973
J.R. SIMPLOT WELL #2 6S 5E 20ABB1	PLIOCENE BASALT	FLOWING WELL	STOCK WATERING	43	SEEDLING CONIFERS	YES 42.8950 115.8794	YOUNG, 1973
GEORGE HUTCHINSON WELL 6S 5E 24BCA1	75 PLIOCENE BASALT	SLIGHT SULFUR ODOR; FLOWING WELL; DRILLER'S LOG AVAILABLE	DOMESTIC	333 34	CATFISH FARMING	YES 42.8897 115.8113	YOUNG, 1973
BRUNEAU CITY WELL 6S 5E 240DB1	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	SLIGHT SULFUR ODOR	PUBLIC SUPPLY	590 32 96	FERMENTATION	BARLEY MALTING PROCESS YES 42.8842 115.8006	YOUNG, 1973
DON DAVIS WELL #1 6S 5E 290CC1	11 PLIOCENE AND PLEISTOCENE SEDIMENTS	FLOWING WELL; DRILLER'S LOG AVAILABLE	STOCK WATERING	475 33	BIODEGRADATION	YES 42.8667 115.8847	LOG, 1924

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Silicaceous									
CARL AND HARRY LOOS 6S 5E 350CA1		PLIOCENE AND PLEISTOCENE SEDIMENTS					IRRIGATION	140	22		HEAT AND COOLING WITH HEAT PUMP		YES	42.8547 115.8314	YOUNG, 1973
IDAHO PARKS DEPT. 6S 6E 1200D1	499	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE			IRRIGATION	301	37		AQUACULTURE		YES	42.9108 115.6939	LOG, 1968
MILDRED BACHMAN WELL 6S 6E 1900D1	151	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL; DRILLER'S LOG AVAILABLE			DOMESTIC	278	38		HYDROPONICS		YES	42.8820 115.7925	LOG, 1926
BRUNEAU CEMETARY WELL 6S 6E 190BD1		PLIOCENE FRACTURED BASALT		DRILLER'S LOG AVAILABLE; SULFUR ODOR			IRRIGATION	410	42		SWIMMING POOLS		YES	42.8856 115.7819	YOUNG, 1973
ACE BLACK WELL 6S 6E 328DB1	151	PLIOCENE FRACTURED BASALT		FLOWING WELL; SLIGHT SULFUR ODOR			STOCK WATERING	427	35		FERMENTATION		YES	42.8600 115.7683	YOUNG AND WHITEHEAD, 1975
WILBUR WILSON WELL #1 6S 7E 1ACB1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL			DOMESTIC	304	42		AQUACULTURE		YES	42.9342 115.5678	YOUNG AND WHITEHEAD, 1974
WILBUR WILSON WELL #2 6S 7E 1DBD1	34	PLIOCENE AND PLEISTOCENE SEDIMENTS		FLOWING WELL			STOCK WATERING	320	33		HYDROPONICS		YES	42.9283 115.5639	YOUNG AND WHITEHEAD, 1974
CARL JOHNSON WELL 6S 7E 200D1	11	PLIOCENE AND PLEISTOCENE SEDIMENTS					DOMESTIC	411	35		BIODEGRADATION		YES	42.9249 115.7072	YOUNG, 1973
SAND DUNES FARMS WELL 6S 7E 8BBA1	52	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE			DOMESTIC	111	23		CATFISH FARMING		YES	42.9217 115.6528	YOUNG AND WHITEHEAD, 1974
BILL BURGHARDT WELL #2 7S 3E 4ACD1	5299	PLIOCENE BASALT		DRILLER'S LOG AVAILABLE; WHEN PUMPED FROM 240 METERS DEPTH, WATER IS REPORTED TO BE 60 DEGREES C			IRRIGATION	245	29		DE-ICING HIGHWAY		YES	42.8445 116.0955	YOUNG AND WHITEHEAD, 1974

Owyhee County (cont'd.)

WILBER MASTRE WELL 7S 3E 12ACC1	7570			IRRIGATION	249 39	HYDROPONICS	42,8310 116,0402	
KEITH THOMAS WELL 7S 4E 1ACC1		PLIOCENE SILICIC VOLCANIC ROCKS	FLOWING WELL	IRRIGATION	548 40	STOCK WATERING	YES 42,8442 115,9228	YOUNG, 1973
PETE MERRICK WELL #1 7S 4E 3ABD1		PLIOCENE JOINTED BASALT		IRRIGATION	348 42	SWIMMING POOLS	YES 42,8486 115,9586	
CLARENCE MERRICK WELL #1 7S 4E 38BC1	9027	PLIOCENE SEDIMENTS	DRILLER'S LOG AVAILABLE	IRRIGATION	274 33	DE-ICING ROADWAYS	42,8486 115,9729	LOG, 1966
BOB MASTRE WELL 7S 4E 4ADB1		PLIOCENE BASALT	DRILLER'S LOG AVAILABLE		458 34	AQUACULTURE	42,8462 115,9761	LOG, 1974
DELBERT WRIGHT WELL 7S 4E 30CA1	6813	PLIOCENE JOINTED BASALT		IRRIGATION	316 30	AQUACULTURE	42,8400 116,0083	YOUNG, 1973
LES ISAAC WELL 7S 4E 50DC1	7570	PLIOCENE JOINTED BASALT (?)		IRRIGATION	277 30	DE-ICING	42,8375 115,9975	
PETE MERRICK WELL #2 7S 4E 10BDB1		PLIOCENE JOINTED BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	348 38	BIODEGRADATION	YES 42,8322 115,9681	YOUNG, 1973
CLARENCE MERRICK WELL #2 7S 4E 100BC1	10220	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PLIOCENE BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	276 35	FERMENTATION	42,8271 115,9617	LOG, 1965
PAUL GLERUM WELL 7S 4E 11ACC1	2649			IRRIGATION	349 43	SEEDLING CONIFERS	42,8295 115,9426	
FRANK MILLETT WELL #1 7S 4E 110BC1	11923	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	457 36	AQUACULTURE	YES 42,8261 115,9533	YOUNG, 1973
FARIA BROTHERS WELL 7S 4E 128DD1	9602	PLIOCENE SILICIC VOLCANIC ROCKS	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	336 43	STOCK WATERING	YES 42,8306 115,9258	YOUNG, 1973



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis- charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui- fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<i>Owyhee County (cont'd.)</i>																
WILLIAM ROBERTSON WELL 7S 4E 12CCC1	13286	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	274	43		SEEDLING CONIFERS			42.8224 115.9334	LOG, 1968
CLARENCE COOK WELL 7S 4E 13BCC1	5621	PLIOCENE SILICIC VOLCANIC ROCKS		TOTAL DEPTH IS UNKNOWN, WELL WAS DEEPENED				IRRIGATION	323	39		SOIL WARMING	YES	42.8153 115.9336	42.8153 115.9336	YOUNG, 1973
DAVE LAHTINEN WELL 7S 4E 13DCC1	3785	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	304	40		STOCK WATERING	YES	42.8081 115.9194	42.8081 115.9194	YOUNG, 1973
FRANK MILLETT WELL #2 7S 4E 14ABC1	20440	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	349	39		AQUACULTURE	YES	42.8189 115.9433	42.8189 115.9433	YOUNG, 1973
ELMO GRIFFITHS WELL 7S 4E 14DCC1	11242	PLIOCENE SILICIC VOLCANIC ROCKS (?)		DRILLER'S LOG AVAILABLE				IRRIGATION	289	29		BIODEGRADATION		42.8080 115.9479	42.8080 115.9479	LOG, 1963
ROBERT BLACK WELL 7S 4E 15ACD1	10704	PLIOCENE JOINTED BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	324	35		FERMENTATION	YES	42.8153 115.9606	42.8153 115.9606	YOUNG, 1973
BLAINE RAWLINS WELL 7S 4E 22ACB1		PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	304	38		SHRIMP FARMING		42.8028 115.9615	42.8028 115.9615	LOG, 1966
C. RUSSEL WELL 7S 4E 22BAD1	16276	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	243	41		GREENHOUSE		42.8042 115.9649	42.8042 115.9649	LOG, 1972
BLAINE RAWLINS WELL #2 7S 4E 23CBB1	151	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT		DRILLER'S LOG AVAILABLE				DOMESTIC	108	35		AQUACULTURE		42.7999 115.9510	42.7999 115.9510	YOUNG AND WHITEHEAD, 1973
BLAINE RAWLINS WELL #3 7S 4E 23CBB2	15141	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	246	39		FERMENTATION	YES	42.7994 115.9531	42.7994 115.9531	YOUNG AND WHITEHEAD, 1973

JOHN MCGUIRE WELL 7S 4E 24BC1	3785		NO LONGER A FLOWING WELL	IRRIGATION	219 32	DE-ICING ROADWAYS	42.8021 115.9286
BELL BRAND RANCHES 7S 4E 25ADC1	10220	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT		IRRIGATION	224 36	BIODEGRADATION	YES 42.7872 115.9186 YOUNG, 1973
GUTHERIES RANCH WELL 7S 4E 26BCB1	5677	PLIOCENE SILICIC VOLCANIC ROCKS AND JOINTED BASALT	DRILLER'S LOG AVAILABLE	IRRIGATION	264 31	DE-ICING HIGHWAYS	YES 42.7881 115.9528 YOUNG, 1973
DAVE LAHTINEN WELL 7S 4E 27BC1	775	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	423 27	HEATING AND COOLING WITH HEAT PUMP	YES 42.7860 115.9725 YOUNG, 1973
DON DAVIS WELL #2 7S 5E 28AA1	3			UNUSED	23	CATFISH FARMING	42.8504 115.8869
DON DAVIS WELL #3 7S 5E 28AC1				IRRIGATION	20	HEATING AND COOLING WITH HEAT PUMP	42.8484 115.8894
ACE BLACK WELL #2 7S 5E 20BC1	757	PLIOCENE JOINTED BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	733 32	AQUACULTURE	YES 42.8417 115.8828 YOUNG AND WHITEHEAD, 1975
DAVIS BROTHERS WELL #1 7S 5E 7AB1	20440	PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	493 39	HYDROPONICS	YES 42.8367 115.9044 YOUNG, 1972
MERLE BACHMAN WELL #1 7S 5E 88CC1	1892		FLOWING WELL	IRRIGATION	396 40	AQUACULTURE	42.8306 115.8928
MERLE BACHMAN WELL #2 7S 5E 88CC2	37		FLOWING WELL	IRRIGATION	213 26	FERMENTATION	42.8303 115.8934
DAVIS BROTHERS WELL #2 7S 5E 80CC1		PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	457 40	SOIL WARMING	YES 42.8239 115.8936 YOUNG, 1973
HARRY LOOS WELL 07S 5E 90DD1	13248	PLIOCENE JOINTED RHYOLITE	FLOWING WELL; DRILLER'S LOG AVAILABLE	IRRIGATION	629 40	AQUACULTURE	YES 42.8228 115.8564 YOUNG, 1973

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Silt-aceous	Car-bon-ates									
<i>Owyhee County (cont'd.)</i>																
ROY DAVIS WELL#1 7S 5E 13AAA1	4542	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		THIS WELL WAS ORIGINALLY 427 METERS DEEP, BUT HAS CAVED TO ITS PRESENT DEPTH				IRRIGATION	106	23		HEATING AND COOLING WITH HEAT PUMP			42.8207 115.7979	
ROY DAVIS WELL #2 7S 5E 13AAG1		PLIOCENE AND PLEISTOCENE SEDIMENTS		PARTIAL DRILLER'S LOG AVAILABLE				IRRIGATION	121	25		DE-ICING HIGHWAYS		YES	42.8194 115.8011	YOUNG, 1973
CARL STEINER WELL 7S 5E 13CBB1	11355	PLIOCENE FRACTURED BASALT		DRILLER'S LOG AVAILABLE				IRRIGATION	595	36		HYDROPONICS		YES	42.8147 115.8198	WHITEHEAD, 1973
ROBERT TINDALL WELL 7S 5E 16ACD1	15141	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	461	39		STOCK WATERING		YES	42.8144 115.8606	YOUNG, 1973
CHESTER SELLMAN WELL #1 7S 5E 18ABC1	378	PLIOCENE AND PLEISTOCENE SEDIMENTS (?)		FLOWING WELL				IRRIGATION		30		BIODEGRADATION			42.8186 115.9041	BEARD, 1978 (SITE INSPECTION)
CHESTER SELLMAN WELL #2 7S 5E 18ABC2	3596	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				IRRIGATION	173	34		TROPICAL FISH			42.8197 115.9034	LOG, 1967
CLARENCE MILLER WELL #1 7S 5E 18BDC1	2838	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				DOMESTIC	157	37		HYDROPONICS			42.8150 115.9076	LOG, 1951
CLARENCE MILLER WELL #2 7S 5E 18DBA1	5299	PLIOCENE AND PLEISTOCENE SEDIMENTS AND PIOCENE BASALT		DRILLER'S LOG AVAILABLE; FLOWING WELL				IRRIGATION	285	41		SOIL WARMING			42.8145 115.9016	LOG, 1976
BELL BRAND INC. WELL 7S 5E 19CCC1	4428	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	231	36		BIODEGRADATION		YES	42.7936 115.9133	GRAHAM, 1966
GENE TINDALL WELL 7S 5E 28ACD1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	305	34		FERMENTATION		YES	42.7881 115.8614	YOUNG, 1973

COLYER CATTLE  
CO. WELL 1  
7S 6E 4CAD1

378 PLIOCENE BASALT

IRRIGATION

32

BIODEGRADATION

42,8404 ROSS, 1971  
115.7489

COLYER CATTLE  
CO. WELL 2  
7S 6E 4DCC1

757 PLIOCENE BASALT

IRRIGATION

44

SEEDLING CONIFERS

42,8385 ROSS, 1971  
115.7450

RON PROW WELL  
7S 6E 6BAA1

4920 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

FLOWING WELL; WELL DRIES UP  
IN SUMMER TIME; DRILLER'S  
LOG AVAILABLE

DOMESTIC

123 22

DE-ICING ROADWAYS

42,8511 LOG, 1959  
115.7874

GEORGE TURNER WELL  
7S 6E 7AAC1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

FLOWING WELL

DOMESTIC

331 25

CATFISH FARMING

YES 42,8334 WHITEHEAD, 1973  
115.7813

ROY DAVIS  
WELL #3  
7S 6E 7CDD1

DOMESTIC

36 23

HEATING AND COOLING WITH  
HEAT PUMP

42,8225  
115.7866

COLYER CATTLE  
CO. WELL 3  
7S 6E 9BAD1

579 PLIOCENE BASALT

IRRIGATION

277 50

GRAIN-HAY DRYING

YES 42,8342 YOUNG, 1972  
115.7474

R.L. OWEN WELL #1  
7S 6E 15DAA1

18 PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE;  
FLOWING WELL

STOCK WATERING

685 27

HEATING AND COOLING WITH  
HEAT PUMP

42,8155 LOG, 1969  
115.7207

R.L. OWEN WELL #2  
7S 6E 16DDC1

9463 PLIOCENE JOINTED BASALT

FLOWING WELL; DRILLER'S  
LOG AVAILABLE

IRRIGATION

156 42

SOIL WARMING

YES 42,8081 YOUNG, 1973  
115.7514

ROY DAVIS WELL #4  
7S 6E 18BBB1

6056

IRRIGATION

121 23

FISH FARMING

42,8213  
115.7954

HOT SPRINGS  
RANCH WELL  
7S 6E 21DBCC1

PLIOCENE JOINTED BASALT

DRILLER'S LOG AVAILABLE;  
FLOWING WELL; TWO WELLS AT  
THIS SITE

IRRIGATION

231 43

SEEDLING CONIFERS

YES 42,7978 YOUNG, 1971  
115.7464

R.L. OWEN WELL #3  
7S 6E 22CAA1

7570

WELL WAS BEING DRILLED AT  
TIME OF INSPECTION AND WAS  
REPORTED TO BE COOLING WITH  
DEPTH

155 47

GRAIN-HAY DRYING

42,7949  
115.7330

PENCE H S  
7S 6E 22DAD1S

5110 QUATERNARY ALLUVIUM

WASH AREA

UNUSED

42

HYDROPONICS

42,7981 ROSS, 1971  
115.7199

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer** Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Sili- ceous	Car- bon- ates									
<i>Owyhee County (cont'd.)</i>															
BAT HOT SPRINGS 7S 6E 2208B1S	378	PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION	47			BALNEOLOGICAL BATH			42.7997 115.7267	ROSS, 1971
R.L. OWEN WELL #4 7S 6E 2388B1	7570	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL			IRRIGATION	429	45		SEEDLING CONIFERS		YES	42.8067 115.7170	YOUNG, 1973
R. L. OWEN WELL #5 7S 6E 2388B2	13248	PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION	243	41		AQUACULTURE			42.8067 115.7166	
WILLIAM ROSE WELL 7S 6E 230CA1	3406	PLIOCENE SILICIC VOLCANIC ROCKS		FLOWING WELL			IRRIGATION	396	44		SWIMMING POOLS		YES	42.7975 115.7083	YOUNG, 1973
R.L. OWEN WELL #6 7S 6E 230CA1	2271			FLOWING WELL			IRRIGATION		45		GRAIN-HAY DRYING			42.7965 115.7132	
ANGEL BILBOA WELL 7S 6E 230CB1	5677	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT (?)		FLOWING WELL; DRILLER'S LOG AVAILABLE			IRRIGATION	313	40		SOIL WARMING			42.7962 115.7070	LOG, 1966
R.L. OWEN WELL #7 7S 6E 260A1	4920	PLIOCENE SILICIC VOLCANIC ROCKS AND BASALT (?)		FLOWING WELL			IRRIGATION	304	38		HYDROPONICS		YES	42.7876 115.7006	YOUNG AND WHITEHEAD, 1975
R.L. OWEN WELL #8 7S 6E 260A1	3406	PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION		38		AQUACULTURE			42.7920 115.7084	
R.L. OWEN WELL #9 7S 6E 260A2		PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION		36		FERMENTATION			42.7919 115.7080	
R.L. OWEN WELL #10 7S 6E 260A1	340	TERTIARY SILICIC VOLCANIC ROCKS (?) AND PLIOCENE BASALT (?)		FLOWING WELL			IRRIGATION		35		BIODEGRADATION			42.7882 115.7077	

R.L. OWEN WELL #11 75 6E 268DB1		FLOWING WELL	DOMESTIC	34	DE-ICING ROADWAYS	42.7888 115.7105	
BUCKAROO H S 75 6E 260CD15	757 QUATERNARY ALLUVIUM	FOUR SPRING VENTS	UNUSED	43	GREENHOUSE	42.7804 115.7142	ROSS, 1971
JEAN LONGHURST WELL 75 6E 27AC1	2895 PLIOCENE BASALT		IRRIGATION	106 45	SPACE HEATING	42.7906 115.7216	ROSS, 1971
JAMES PRESCOTT WELL 75 6E 27AD81	PLIOCENE BASALT	FLOWING WELL	IRRIGATION	121 43	HYDROPONICS	42.7889 115.7222	YOUNG, 1973
JEAN PRESCOTT H S 75 6E 340CB15	1703 PLIOCENE JOINTED BASALT	LOCATED IN BRUNEAU CANYON; NUMEROUS SPRING VENTS	YES UNUSED	41	SOIL WARMING	42.7675 115.7269	WHITEHEAD, 1973
R.L. OWEN WELL #12 75 6E 340DA1	7570 PLIOCENE SILICIC VOLCANIC ROCKS (7)	DRILLER'S LOG AVAILABLE; FLOWING WELL	IRRIGATION	91 33	FERMENTATION	42.7680 115.7184	LOG, 1977
PRESCOTT H S 75 6E 358BB15	7	NOT FIELD CHECKED	UNUSED	40	AQUACULTURE	42.7777 115.7159	YES
LOWER INDIAN BATHTUB 85 6E 34DB15	567 TUFF CONTACT WITH TERTIARY BASALT	NUMEROUS SPRING VENTS; TEMPERATURE RANGE 38-42 DEGREES C	UNUSED	42	STOCK WATERING	42.7639 115.7300	YOUNG, 1972
INDIAN BATHTUB H S 85 6E 380D15	TUFF CONTACT WITH TERTIARY BASALT	NUMEROUS SPRING VENTS	YES RECREATION	37	HYDROPONICS	42.7617 115.7384	YOUNG, 1972
U.S. CORPS ENGINEERS 95 5E 48DA1	908 PLIOCENE AND PLEISTOCENE SEDIMENTS		UNUSED	762 52	MUSHROOM GROWING	42.6759 115.8747	SWANSON, 1977
TOM WHEELER WELL #1 95 12E 28CB81	1396 PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	238 29	DE-ICING HIGHWAYS	42.6137 115.0625	LOG, 1969
TOM WHEELER WELL #2 95 12E 28DC1	1703 PLIOCENE SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE	IRRIGATION	248 27	CATFISH FARMING	42.6084 115.0568	LOG, 1966

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili- ceous									
J. WHEELER WELL #1 9S 12E 28DBC1		PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION	248	35		AQUACULTURE			42.6125 115.0525	
J. WHEELER WELL #2 9S 12E 29AAA1	113	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	177	22		FISH FARMING			42.6210 115.0659	LOG, 1977
J. WHEELER WELL #3 9S 12E 29ADC1	8327	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	161	30		CATFISH FARMING			42.6158 115.0688	LOG, 1967
J. WHEELER WELL #4 9S 12E 29BBB1		PLIOCENE SILICIC VOLCANIC ROCKS (?)					IRRIGATION	147	28		TROPICAL FISH FARMING			42.6215 115.0815	
J. WHEELER WELL #5 9S 12E 29DBA1	6964	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	170	30		CATFISH FARMING			42.6146 115.0694	LOG, 1968
J. WHEELER WELL #6 9S 12E 29DBD1	4542	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	190	31		FERMENTATION			42.6126 115.0696	LOG, 1971
INDIAN H S 12S 7E 33C 1S		TERTIARY BASALT AND SILICIC VOLCANIC ROCKS		NOT FIELD CHECKED				71	93		REFRIGERATION (LOWER TEMPERATURE RANGE)	DRYING AND CURING OF LIGHT AGGREGATE		42.3333 115.6500	ROSS, 1971
A. KRAMER WELL 12S 10E 12DC1	5677	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	152	24		HEATING AND COOLING WITH HEAT PUMP			42.5650 114.9971	LOG, 1963
MURPHY H S 16S 9E 24BBB1S		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		TWO SPRING VENTS			IRRIGATION	52	99		MUSHROOM GROWING	BARLEY MALTING PROCESS	YES	42.0314 115.3658	ROSS, 1971
CLARANCE NYE WELL 16S 9E 24BBD1	113	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			DOMESTIC	91	25		HEATING AND COOLING WITH HEAT PUMP			42.0312 115.3655	LOG, 1973

Owyhee County (cont'd.)

JANACEK WELL  
16S 9E 24CAA1

PUBLIC SUPPLY

50 23

CATFISH FARMING

42.0310  
115.3657

Payette County

A.L. CHRISTENSON  
WELL  
6N 5W 128BD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION

143 23

CATFISH FARMING

43.8775 SAVAGE, 1973  
116.8900

NELSON-DEPPE WELL  
6N 5W 13CBB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC

108 22

CATFISH FARMING

43.8568 SAVAGE, 1973  
116.8923

6N 5W 248BD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

IRRIGATION

24

DE-ICING ROADWAYS

43.8495 SAVAGE, 1973  
116.8883

JAMES LIBBY WELL  
7N 5W 25JBB1

12112 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

IRRIGATION

107 20

HEAT PUMP FOR HEATING AND  
COOLING

43.9153 SAVAGE, 1973  
116.8819

MIKE MCKAGUE WELL  
7N 5W 33AAB1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DOMESTIC

60 20

CATFISH FARMING

43.9090 SAVAGE, 1973  
116.9373

JAMES MOSIER WELL  
8N 4W 70CD1

52 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC

35 20

FISH FARMING AND HATCHING

44.0402 SAVAGE, 1973  
116.8681

WALTER SMITH WELL  
9N 3W 190DA1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS

STOCK WATERING

29

FERMENTATION

44.0995 SAVAGE, 1973  
116.7310

ALBERT COATES WELL  
9N 3W 218DC1

1514 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE;  
FLOWING WELL

IRRIGATION

112 25

HEATING AND COOLING WITH  
HEAT PUMP

44.1032 SAVAGE, 1973  
116.7050

LEE REED WELL  
9N 5W 350CB1

75 PLIOCENE AND PLEISTOCENE  
SEDIMENTS

DRILLER'S LOG AVAILABLE

DOMESTIC

99 20

CATFISH FARMING

44.0700 SAVAGE, 1973  
116.9094

Power County

FALLS IRRIGATION  
DIST.  
7S 31E 11ACA1

5110 PLEISTOCENE ALLUVIUM (?)

NOT FIELD CHECKED

UNUSED

76 26

HEATING AND COOLING WITH  
HEAT PUMP

42.8294 LOG, 1954  
112.7947



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili- ceous	Car- bon- ates									
<i>Power County (cont'd.)</i>																
IDAHO POWER CO. WELL 75 31E 31A0A1	7759	PLIESTOCENE ALLUVIUM (?)		USED ONLY IN THE WINTER; DRILLER'S LOG AVAILABLE				INDUSTRIAL	182	24		DE-ICING ROADWAYS			42.7723 112.8698	LOG, 1957
EMIL MAYER WELL 85 30E 24ACA1	4239	QUATERNARY ALLUVIUM AND BASALTIC LAVA		DRILLER'S LOG AVAILABLE				IRRIGATION	187	22		HEATING AND COOLING WITH HEAT PUMP			42.7160 112.8903	LOG, 1959
MAX MAYER WELL 85 31E 17ABA1		PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	117	25		CATFISH FARMING			42.7331 112.8563	TRIMBLE AND CARR, 1976
FRED MAYER WELL 85 31E 17B0B1	5677	PALEOZOIC LIMESTONE		DRILLER'S LOG AVAILABLE				IRRIGATION	164	26		FISH FARMING AND HATCHING			42.7288 112.8563	TRIMBLE AND CARR, 1976
INDIAN SPRINGS 85 31E 180AB1S		PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	SEVEN SPRING VENTS		YES	RECREATION		32	71		BIODEGRADATION	ANIMAL HUSBANDRY	YES	42.7254 112.8722	STEARNS AND OTHERS, 1938
INDIAN W S 85 31E 180AC1S		PALEOZOIC LIMESTONE				YES	IRRIGATION		34			AQUACULTURE			42.7236 112.8712	ROSS, 1971
D.M. THORNHILL WELL 85 31E 18DAC1	1135	PALEOZOIC LIMESTONE	NORTHWEST TRENDING FAULT	FLOWING WELL				IRRIGATION		33		FERMENTATION			42.7239 112.8723	ROSS, 1971
LAKE WALCOTT W S 95 29E 19ACD1S				NOT FIELD CHECKED SUBMERGED IN LAKE WALCOTT				UNUSED		21					42.6246 113.1069	
ROCKLAND W S 105 30E 13CDC1S		PALEOZOIC LIMESTONE		NOT FIELD CHECKED; SEVERAL SPRINGS VENTS; TEMPERATURE RANGE 34-38 DEGREES C						38	72	AQUACULTURE	APPLE DEHYDRATION	YES	42.5465 112.8987	ROSS, 1971
UPPER ROCKLAND W S 105 30E 24BBA1S	1892	QUATERNARY ALLUVIUM ABOVE PRE-TERTIARY LIMESTONE		NOT FIELD CHECKED; REPORTED BY ROSS, 1971						38		SOIL WARMING			42.5438 112.9026	ROSS, 1971

ROSCO WESTON WELL  
10S 30E 2400C1

5677 PALEOZOIC LIMESTONE

DRILLER'S LOG AVAILABLE

IRRIGATION

184 38

HYDROPONICS

42.5311 LOG, 1975  
112.8948

Teton County

TAYLOR SPRINGS  
3N 43E 78A1S

946 TRIASSIC MARINE SEDIMENTS  
NEAR THRUST FAULT

IRRIGATION

20

FISH FARMING

43.6066 MITCHELL, 1978  
111.8980

O. NEELY WELL  
7N 43E 36A1C1

TRIASSIC SEDIMENTS BENEATH  
CENOZOIC BASALTS (?)

NOT FIELD CHECKED;  
TEMPERATURE RANGE 32-49  
DEGREES C; DRILLER'S LOG  
AVAILABLE

IRRIGATION

353 49

GRAIN-HAY DRYING

43.8937 LOG, 1969  
111.3223

Twin Falls County

BILL SLIGER  
WELL  
8S 14E 30ACB1

378 QUATERNARY AND TERTIARY  
SEDIMENTS

WELL WAS DRILLED NEXT TO AN  
EXISTING HOT SPRING

RECREATION

121 63

ANIMAL HUSBANDRY

42.7060 ROSS, 1971  
114.8572

SALMON FALLS H S  
8S 14E 30ACD1S

94 QUATERNARY AND TERTIARY  
SEDIMENTS

YES (?) RECREATION

67

APPLE DEHYDRATION

42.7040 ROSS, 1971  
114.8563

FENTON DONNOLLY WELL  
8S 14E 30DBA1

QUATERNARY AND TERTIARY  
SEDIMENTS

DOMESTIC

65

GREENHOUSE

42.7016 VON LINDERN, 1978  
114.8557 (SITE INSPECTION)

MIRACLE H S  
8S 14E 31ACB1S

1059 QUATERNARY ALLUVIUM NEAR  
PLIOCENE BASALT AND OLDER  
SILICIC VOLCANIC ROCKS

ALSO KNOWN AS HOT SULPHUR  
SPRINGS

YES YES RECREATION

55 87

BALNEOLOGICAL BATH

PASTEURIZATION

YES 42.6920 MALDE AND OTHERS,  
114.8592 1972

HARRY HUTTONUS  
WELL #1  
8S 14E 33BCD1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALT (?)

YES RECREATION

82 49

SEEDLING CONIFERS

42.6890 STEARNS AND  
114.8258 OTHERS, 1938

BANBURY H S  
8S 14E 33CBA1S

QUATERNARY AND TERTIARY  
SEDIMENTS

COMMERCIALY DEVELOPED

YES RECREATION

59

MUSHROOM GROWING

42.6880 ROSS, 1971  
114.8256

HARRY HUTTONUS  
WELL #2  
8S 14E 33CBA1

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALT (?)

YES RECREATION

74 57 108

LAUNDRY USES

CANNING AND PRESERVING

YES 42.6884 STEARNS AND  
114.8257 OTHERS, 1938

HARRY HUTTONUS  
WELL #3  
8S 14E 33CBA2

PLIOCENE AND PLEISTOCENE  
SEDIMENTS AND BASALT (?)

YES HEATING OF POOL  
AND HOUSE

64 57

SPACE HEATING

42.6881 STEARNS AND  
114.8262 OTHERS, 1938

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aquifer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Silicaceous									
<i>Twin Falls County (cont'd.)</i>															
DARWIN COLLIER WELL 8S 14E 33C8D1	208	QUATERNARY ALLUVIUM OVERLYING PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE; FLOWING WELL			SPACE HEATING	164	44		MUSHROOM GROWING			42.6869 114.9262	LOG, 1976
MIKE ARCHIBALD WELL 8S 14E 33C8A1	1324	PLIOCENE AND PLEISTOCENE BASALT AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL; USED TO HEAT POOL, GREENHOUSE AND HOME			COMMERCIAL	161	45		SEEDLING CONIFERS			42.6846 114.9269	STEARNS AND OTHERS, 1938
J. WOODMAN WELL 8S 14E 33C8C1	567	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS		FLOWING WELL			SPACE HEATING	146	28		FERMENTATION			42.6827 114.9286	ROSS, 1971
GEORGE ANTHONY WELL 9S 12E 34DDA1	3406	PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE			IRRIGATION	224	25		CATFISH FARMING			42.5976 115.0261	LOG, 1967
POISON SPRING 9S 13E 14DD01S				NOT FIELD CHECKED; REPORTED AS BEING WARM; SEVERAL SPRING VENTS RANGING INTO SECTION 25					0					42.6376 114.8917	
PHIL RANICK WELL 9S 13E 18AAC1							IRRIGATION	268	29		BIODEGRADATION			42.6492 114.9722	
JACK KINYON WELL 9S 13E 31DD01	8607	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE			IRRIGATION	187	26		HEATING AND COOLING WITH HEAT PUMP			42.5952 114.9732	LOG, 1965
ED JARAMELNIK WELL #1 9S 13E 338CD1	5110	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS (?)		DRILLER'S LOG AVAILABLE			IRRIGATION	262	31		HYDROPONICS			42.6017 114.9446	LOG, 1969
ED JARAMELNIK WELL #2 9S 13E 33C8B1	6813	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE			IRRIGATION	264	31		FERMENTATION			42.5999 114.9417	LOG, 1966
ROSE JARAMELNIK WELL 9S 13E 33C8A1	5583	PLIOCENE SILICIC VOLCANIC ROCKS AND SEDIMENTS		DRILLER'S LOG AVAILABLE			IRRIGATION	254	31		AGRICULTURE			42.6000 114.9442	LOG, 1966

DICK KASTER WELL 9S 14E 480C1	1135	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	DOMESTIC	114 46	GRAIN-HAY DRYING	42,6744 114,8244	LOG, 1975
LEO RAY WELL #1 9S 14E 400C1	11355	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	CATFISH FARMING	230 34	HYDROPONICS	42,6682 114,8239	LOG, 1973
LEO RAY WELL #2 9S 14E 400D1	5677	PLIOCENE BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE	CATFISH FARMING	167 57	FISH FARMING	42,6670 114,8221	LOG, 1973
ED KERPA WELL 9S 14E 9A0D1	11355	PLIOCENE SEDIMENTS, BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL	STOCK WATERING	228 33 78	SOIL WARMING PASTEURIZED MILK PROCESS	42,6602 114,8114	LOG, 1973 YES
KENNETH HARBAST WELL 9S 14E 9A0D2	2271	PLIOCENE SEDIMENTS AND BASALT	DRILLER'S LOG AVAILABLE; FLOWING WELL	DOMESTIC	161 33	AQUACULTURE	42,6606 114,8126	LOG, 1971
ROBERT LUNTEY WELL 9S 14E 9A0D3	1514	PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS	DRILLER'S LOG AVAILABLE; FLOWING WELL; OWNER HAS 35 PONDS IN OPERATION	TROPICAL FISH TEST PROJECT	259 32	SHRIMP FARMING	42,6597 114,8124	LOG, 1974
WESLEY REYNOLDS WELL 9S 14E 1080C1	3785	PLIOCENE SEDIMENTARY ROCKS	DRILLER'S LOG AVAILABLE FLOWING WELL	FISH FARMING	184 33	FERMENTATION	42,6593 114,8099	LOG, 1971
WRIGHT FUEL CO. WELL 9S 14E 248CA1	56	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE; FLOWING WELL	DOMESTIC	42 24	HEATING AND COOLING WITH HEAT PUMP	42,6333 114,7688	LOG, 1977
BUHL CITY WELL #1 9S 14E 360AC1		PLIOCENE BASALT AND SILICIC VOLCANIC ROCKS (?)		PUBLIC SUPPLY	274 30	CATFISH FARMING	42,5988 114,7560	
GREEN GIANT CANNING 9S 15E 310CB1	4186	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS	DRILLER'S LOG AVAILABLE	COMMERCIAL CANNING	196 20	HEATING AND COOLING WITH HEAT PUMP	42,6006 114,7497	LOG, 1960
BUHL CITY WELL #2 9S 15E 310CB1	2876	PLIOCENE BASALT AND OLDER SILICIC VOLCANIC ROCKS (?)	DRILLER'S LOG AVAILABLE	PUBLIC SUPPLY	322 32	BIODEGRADATION	42,5962 114,7508	LOG, 1961
CHESTER MCCLAIN WELL #1 10S 12E 1A0D1	4542	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)		IRRIGATION	152 26	FISH FARMING AND HATCHING	42,5901 114,9874	

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sili-icious	Car-bon-ates									
<i>Twin Falls County (cont'd.)</i>																
CHESTER MCCLAIN WELL #2 10S 12E 1ACB1	6813	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)						IRRIGATION	152	26		FISH FARMING			42.5896 114.9938	
CHESTER MCCLAIN WELL #3 10S 12E 1DCB1	2649	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS (?)						IRRIGATION	152	25		HEATING AND COOLING WITH HEAT PUMP			42.5810 114.9938	
CHESTER MCCLAIN WELL #4 10S 12E 10CC1	1022	QUATERNARY AND TERTIARY BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	135	25		HEATING AND COOLING WITH HEAT PUMP			42.5796 114.9933	LOG, 1955
DICK KIRBS WELL #1 10S 12E 20CA1								IRRIGATION	152	25		FISH FARMING			42.5813 115.0209	
DICK KIRBS WELL #2 10S 12E 20CA2								IRRIGATION	152	25		STOCK WATERING			42.5822 115.0199	
CHESTER MCCLAIN WELL #5 10S 12E 20DB1	7570							IRRIGATION	152	26		HEATING AND COOLING WITH HEAT PUMP			42.5812 115.0188	
DICK KIRBS WELL #3 10S 12E 110CB1	2081	PLIOCENE SILICIC VOLCANIC ROCKS		DRILLER'S LOG AVAILABLE				IRRIGATION	147	23		FISH FARMING			42.5667 115.0136	LOG, 1961
FILER CITY WELL 10S 16E 80DA1	946	PLIOCENE BASALT AND SEDIMENTS		ORIGINALLY USED BY FILER SCHOOL WHICH HAS BEEN DEMOLISHED				RECREATION	287	27		FERMENTATION			42.5675 114.6055	LOG, 1963
TWIN FALLS CO. WELL 10S 17E 14CCD1								IRRIGATION	365	29		BIODEGRADATION			42.5487 114.4381	
U.S. STEEL-HANSEN PLANT 10S 18E 269BA1		PLIOCENE BASALT AND SEDIMENTS		DRILLER'S LOG AVAILABLE				DOMESTIC	121	20		HEATING AND COOLING WITH HEAT PUMP			42.5329 114.3215	LOG, 1964

RAY STANGER & SONS  
WELL  
11S 19E 21ADD1

IRRIGATION

29

FERMENTATION

42.4532  
114.2285

STANGER BROTHERS  
WELL  
11S 19E 24ACH1

5110 PLIOCENE SILICIC VOLCANIC  
ROCKS (?)

IRRIGATION

273 25

HEATING AND COOLING WITH  
HEAT PUMP

42.4588  
114.2007

DEAN KIDD WELL #1  
11S 19E 31BDA1

1892 PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

365 27

HYDROPONICS

42.4276 LOG, 1977  
114.2762

THERMAN WILLIS WELL  
11S 19E 31DC1

QUATERNARY ALLUVIUM ABOVE  
TERTIARY SILICIC VOLCANIC  
ROCKS

IRRIGATION

350 28

BIODEGRADATION

42.4176 ROSS, 1971  
114.2775

DEAN KIDD WELL #2  
11S 19E 31DD1

QUATERNARY ALLUVIUM ABOVE  
TERTIARY SILICIC VOLCANIC  
ROCKS

IRRIGATION

156 29

HYDROPONICS

42.4177 ROSS, 1971  
114.2678

FRANK BARROWS WELL  
11S 19E 32CD1

PLIOCENE SILICIC VOLCANIC  
ROCKS (?)

IRRIGATION

28

CATFISH FARMING

42.4249 ROSS, 1971  
114.2603

J. WOODSON CREED  
WELL  
11S 19E 33CD1

PLIOCENE SILICIC VOLCANIC  
ROCKS

DRILLER'S LOG AVAILABLE

IRRIGATION

312 31

BIODEGRADATION

42.4176 LOG, 1955  
114.2583

SAM HIGH AND  
SONS WELL  
11S 19E 3300D1

7505 QUATERNARY ALLUVIUM ABOVE  
TERTIARY SILICIC VOLCANIC  
ROCKS

IRRIGATION

188 33

69 SHRIMP FARMING

REFRIGERATION (LOWER  
TEMPERATURE LIMIT)

YES 42.4176 ROSS, 1971  
114.2289

RAY STANGER &  
SONS WELL  
11S 19E 35CD1

QUATERNARY ALLUVIUM ABOVE  
TERTIARY SILICIC VOLCANIC  
ROCKS

IRRIGATION

28

FISH FARMING AND HATCHING

42.4175 ROSS, 1971  
114.2066

THEODORE STURGILL  
WELL  
11S 20E 34CC1

NOT FIELD CHECKED

32

51 AQUACULTURE

GRAIN-HAY DRYING

YES 42.4175  
114.1060

PETE SALIZER WELL  
12S 16E 36CAD1

IRRIGATION

67 34

AQUACULTURE

42.3562  
114.5246

12S 17E 6CBB1

NOT FIELD CHECKED

IRRIGATION

37

45 HYDROPONICS

SEEDLING CONIFERS

YES 42.4107  
114.5142

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Discharge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature*	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili-ces									
<i>Twin Falls County (cont'd.)</i>															
NAT-SOO-PAH W S 12S 17E 31BAB1S	113	QUATERNARY ALLUVIUM NEAR TERTIARY SILICIC VOLCANIC ROCKS			YES	RECREATION		36	81	BIODEGRADATION	PRUNE DEHYDRATION	YES	42.3374 114.5087	CROSTHWAITE, 1969	
12S 18E 1BBA1				NOT FIELD CHECKED				38	65	SOIL WARMING	APPLE DEHYDRATION	YES	42.4160 114.2996		
ROGER JONES WELL 13S 16E 12ABB1	946			FOUR WELLS ARE LOCATED IN THIS IMMEDIATE AREA				52	35	DE-ICING ROADWAYS			42.3161 114.5238		
JONES CORP. WELL #1 13S 17E 6CAB1	3785	PALEOZOIC METAMORPHOSED SEDIMENTS (?)		DRILLER'S LOG AVAILABLE		IRRIGATION		137	39	SOIL WARMING			42.3218 114.4643	LOG, 1954	
JONES CORP. WELL #2 13S 17E 6CBA1	5110	PALEOZOIC SEDIMENTARY ROCKS (?)		DRILLER'S LOG AVAILABLE		IRRIGATION		167	39	FERMENTATION			42.3231 114.5114	LOG, 1966	
JONES CORP. WELL #3 13S 17E 6CDB1	13248	PLIOCENE SILICIC VOLCANICS AND PALEOZOIC METAMORPHOSED SEDIMENTS (?)		DRILLER'S LOG AVAILABLE		IRRIGATION		182	39	STOCK WATERING			42.3325 114.5109	LOG, 1958	
HOLLISTER VILLAGE WELL 13S 17E 7BAB1	340	PALEOZOIC SEDIMENTARY ROCKS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL		DOMESTIC		131	34	SOIL WARMING		YES	42.3167 114.5085	LOG, 1967	
H-BAR-H RANCH WELL 16S 17E 30ACA1	170	QUATERNARY ALLUVIUM, PLIOCENE SEDIMENTS AND SILICIC VOLCANIC ROCKS (?)		DRILLER'S LOG AVAILABLE; FLOWING WELL		RECREATION		73	45	GRAIN-HAY DRYING			42.0131 114.5037	LOG, 1969	
MAGIC H S 16S 17E 30ACA1S		PLIOCENE SILICIC VOLCANIC ROCKS		FOUR SPRING VENTS; SLIGHT SULFUR ODOR	YES	YES	RECREATION	43	68	SEEDLING CONIFERS	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	42.0129 114.5038	ROSS, 1971	
<i>Valley County</i>															
ROCKY CANYON H S 11N 5E 29CDB1S	189	CRETACEOUS GRANITIC ROCK		TWO SPRING VENTS; TEMPERATURE RANGE 43-49 DEGREES C; X-RAY ANALYSIS INDICATED SOME CALCITE	YES	YES	UNUSED	49		SPACE HEATING			44.2526 115.8909	ROSS, 1971	

GOAT W S 12N 5E 20AC1S	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY ROSS, 1971		IRRIGATION	0				44,3999 115,8199	ROSS, 1971
DASH CREEK W S 12N 5E 100DC1S	CRETACEOUS GRANITIC ROCK		SEVERAL SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 28-59 DEGREES C	YES	IRRIGATION	59		ANIMAL HUSBANDRY		44,3819 115,8411	ROSS, 1971
GROUND HOG W S 12N 5E 118BD1S	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS		UNUSED	38		HYDROPONICS		44,3921 115,8336	ROSS, 1971
BOILING SPRINGS H S 12N 5E 229BC1S	624 CRETACEOUS GRANITIC ROCK	NORTHEAST TRENDING FAULT	TEMPERATURE RANGE 80-86 DEGREES C; NUMEROUS SPRING VENTS; X-RAY DIFFRACTION ANALYSIS INDICATED SMALL AMOUNT OF CALCITE	YES YES YES	IRRIGATION	85	89	PASTEURIZATION	BARLEY MALTING PROCESS	YES 44,3641 115,8560	WARING, 1965
SILVER CREEK PLUNGE 12N 5E 360BA1S	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; EIGHT SPRING VENTS REPORTED; REPORTED BY ROSS, 1971		IRRIGATION	39	74	SOIL WARMING	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES 44,3297 115,8021	ROSS, 1971
BELVIDERE H S 13N 3E 13AAD1S	94 QUATERNARY ALLUVIUM			YES	RECREATION	44		SPACE HEATING		44,4648 116,0368	BEARD, 1978 (SITE INSPECTION)
CABARTON H S 13N 4E 31CAB1S	227 CRETACEOUS GRANITIC ROCK	NORTHWEST TRENDING FAULT	THREE SPRING VENTS AND NUMEROUS SEEPS; TEMPERATURE RANGE 56-71 DEGREES C	YES	UNUSED	71	99	REFRIGERATION (LOWER TEMPERATURE LIMIT)	BLANCHING	YES 44,4160 116,0313	NEWCOMB, 1970
BULL CREEK H S 13N 6E 290AB1S	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; SEVERAL SPRING VENTS; REPORTED BY ROSS, 1971			0				44,4300 115,7624	ROSS, 1971
BEAR VALLEY H S 13N 10E 22DAB1S	CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971		UNUSED	0				44,4451 115,2388	ROSS, 1971
CASCADE RESERVOIR H S 14N 3E 5A 1S			NOT FIELD CHECKED; SUBMERGED IN CASCADE RESERVOIR			0				44,5829 116,1124	
CASCADE CITY WELL 14N 3E 36ABD1	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NORTHWEST TRENDING FAULT			YES PUBLIC SUPPLY	15	42	46 SEEDLING CONIFERS	SOIL WARMING	YES 44,5110 116,0352	NEWCOMB, 1970
VULCAN H S 14N 6E 118DA1S	2271 CRETACEOUS GRANITIC ROCK		SLIGHT SULFUR ODOR; NUMEROUS SPRING VENTS; TEMPERATURE RANGE 84-87 DEGREES C; X-RAY ANALYSIS AVAILABLE	YES YES YES	RECREATION	88	147	BLANCHING	BEET SUGAR PROCESSING	YES 44,5676 115,6950	WARING, 1965



Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis- charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition			Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui- fer <sup>#</sup> Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/ Trace Anal.	Latitude & Longitude	Reference
						Sili- caous	Car- bon- ates										
<i>Valley County (cont'd.)</i>																	
SULPHUR CREEK H S 14N 9E 13A 1S		CRETACEOUS GRANITIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971						0						44.5543 115.3009	ROSS, 1971
DAGGER CREEK H S 14N 10E 30C 1S		CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS--UNABLE TO CONFIRM; TEMPERATURE RANGE 37-43 DEGREES C						43		SEEDLING CONIFERS				44.5159 115.2946	ROSS, 1971
ARLING W S 15N 3E 1388C1S	227	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT AND CRETACEOUS GRANITIC ROCK		SULFUR ODOR	YES	YES	IRRIGATION			32	62	SPACE HEATING	ANIMAL HUSBANDRY	YES	44.6404 116.0448	NEWCOMB, 1970	
BADLEY W S 15N 4E 2108B1S	227	CRETACEOUS GRANITIC ROCK			YES	YES	IRRIGATION			38		AQUACULTURE			44.6209 115.9847	ROSS, 1971	
WARM LAKE SPRINGS 15N 6E 13ACA1S				SUBMERGED IN WARM LAKE; THREE SPRING VENTS REPORTED			UNUSED			0					44.6386 115.6709		
MOLLY'S H S 15N 6E 14ABB1S	283	CRETACEOUS GRANITIC ROCK		TEMPERATURE RANGE 52-59 DEGREES C; SEVERAL SPRING VENTS	YES (?)		RECREATION			59	83	GAME BIRD HATCHERY	PASTEURIZED MILK PROCESS	YES	44.6423 115.6926	WARING, 1965	
SOUTH FORK PLUNGE 15N 6E 14CDB1S				REPORTED TEMPERATURE; NOT FIELD CHECKED						54	62	MUSHROOM GROWING	ANIMAL HUSBANDRY	YES	44.6315 115.6967		
TRAIL CREEK H S 15N 6E 20AAC1S	227	CRETACEOUS GRANITIC ROCK			YES		RECREATION			50		GRAIN-HAY DRYING			44.6263 115.7492	ROSS, 1971	
SHEEPEATER H S 15N 10E 248BB1S				NOT FIELD CHECKED			UNUSED			0					44.6278 115.1968		
GOLD FORK H S 16N 4E 350CB1S	378	CRETACEOUS GRANITIC ROCK-BRECCIATED		X-RAY DIFFRACTION ANALYSIS AVAILABLE	YES	YES	YES	RECREATION		53		SEEDLING CONIFERS			44.6756 115.9427	ROSS, 1971	

DOLLAR CREEK W S 16N 6E 140CC15	18 CRETACEOUS GRANITIC ROCK		UNUSED	20	FISH FARMING		44.7173 BEARD, 1978 (SITE 115.7033 INSPECTION)
UPPER PISTOL CREEK H S 16N 10E 140DA15	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED	UNUSED	0			44.7109 ROSS, 1971 115.2097
LITTLE PISTOL CREEK 16N 10E 140BA15	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED	UNUSED	0			44.7229 ROSS, 1971 115.2054
PISTOL CREEK H S 16N 10E 140BC15	CRETACEOUS GRANITIC ROCK WITH TERTIARY DIKES	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	46	63 SOIL WARMING	ANIMAL HUSBANDRY	YES 44.7207 CARTER AND OTHERS 115.2072 1973
SUNFLOWER FLAT, H S 16N 12E 158BB15	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	65	77 APPLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES 44.7295 CARTER AND OTHERS 114.9928 1973
RIVERSIDE H S 16N 12E 16CBB15	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED TEMPERATURE	UNUSED	59	80 GAME BIRD HATCHERY	PRUNE DEHYDRATION	YES 44.7214 CARTER AND OTHERS 115.0132 1973
HOLDOVER H S 17N 6E 28AA15	37 CRETACEOUS GRANITIC ROCK		RECREATION	47	MUSHROOM GROWING		YES 44.8467 ROSS, 1971 115.6961
BILLY H S 17N 7E 31BCB15		NOT FIELD CHECKED	UNUSED	0			44.7702 115.6627
KWISKWIS H S 17N 10E 118BA15	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED BY ROSS, 1971	UNUSED	69	95 ANIMAL HUSBANDRY	BLANCHING	YES 44.8312 ROSS, 1971 115.2151
MID FK INDIAN CREEK 17N 11E 16ACB15	CRETACEOUS GRANITIC ROCK	NOT FIELD CHECKED; REPORTED INFORMATION	UNUSED	72	142 APPLE DEHYDRATION	FREEZE DRYING	YES 44.8129 ROSS, 1971 115.1229
INDIAN CREEK H S 17N 11E 21B 2S		NOT FIELD CHECKED; REPORTED INFORMATION	UNUSED	88	142 BARLEY MALTING PROCESS	POTATOE DEHYDRATION	YES 44.7988 115.1289
COX H S 17N 13E 27AAC15	TERTIARY GRANITIC ROCK	NOT FIELD CHECKED; REPORTED BY ROSS, 1971	UNUSED	55	73 GRAIN-HAY DRYING	BLANCHING	YES 44.7850 ROSS, 1971 114.8551

Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer* Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
					Gas	Sili- ceous									
<u>Valley County (cont'd.)</u>															
HOSPITAL H S 17N 14E 508C1S		TERTIARY GRANITIC ROCK		NOT FIELD CHECKED; REPORTED BY ROSS, 1971			UNUSED	46	69	SEEDLING CONIFERS	REFRIGERATION (LOWER TEMPERATURE LIMIT)	YES	44,8361 114,7904	ROSS, 1971	
TEAPOT H S 18N 6E 9ADC1S	56	CRETACEOUS GRANITIC ROCK		SULFUR ODOR			RECREATION	61		ANIMAL HUSBANDRY		YES	44,9137 115,7215	BEARD, 1978 (SITE INSPECTION)	
HOT CREEK W S 18N 8E 178DA1S	37	CRETACEOUS GRANITIC ROCK			YES		RECREATION	36	79	DE-ICING	PASTEURIZED MILK PROCESS	YES	44,8996 115,5045	ROSS, 1971	
LICK CREEK W S 20N 5E 150AB1S	15	CRETACEOUS GRANITIC ROCK					UNUSED	33		AQUACULTURE			45,0697 115,8258	ROSS, 1971	
SHEEP CREEK H S 20N 7E 35A 1S	378	QUATERNARY ALLUVIUM NEAR CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS-UNABLE TO CONFIRM; TEMPERATURE RANGE 32-58 DEGREES C				58		BALNEOLOGICAL BATHS			45,0353 115,5606	ROSS, 1971	
SECESH H S 21N 5E 110 1S	378	CRETACEOUS GRANITIC ROCK		REPORTED BY ROSS-UNABLE TO CONFIRM				0					45,1699 115,8072	ROSS, 1971	
<u>Washington County</u>															
COYE CREEK H S 10N 3W 90CC1S	1892						UNUSED	55	172	HOTBED HEATING	VISCOSE RAYON	YES	44,2112 116,7100		
ELVIN CRAIG WELL 11N 2W 16AAB1	10977	MIOCENE BASALT					IRRIGATION	134	21	83	FISH HATCHING	PASTEURIZATION	YES	44,2947 116,5762	YOUNG AND OTHERS, 1977
PHIL SOULEN WELL 11N 2W 27ADB1	757	QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE			IRRIGATION	150	25	DE-ICING			44,2628 116,5546	YOUNG AND OTHERS, 1977	
CRANE CREEK H S 11N 3W 78DB1S	189	QUATERNARY ALLUVIUM OVERLYING MIOCENE BASALT	NORTHWEST TRENDING FAULT	NUMEROUS SEEPS; TEMPERATURE RANGE 58-74 DEGREES C	YES		UNUSED	74	172	APPLE DEHYDRATION	DRYING OF FISH MEAL	YES	44,3064 116,7455	NEWCOMB, 1970	

WILLIAM BRUMMETT WELL 11N 4W 330BA1	946 QUATERNARY AND TERTIARY SEDIMENTS	NORTH TRENDING FAULT	FLOWING WELL; DRILLER'S LOG AVAILABLE; NOT FIELD CHECKED		424 38	AQUACULTURE			44.2448 116.8169	LOG, 1967
DOUGLAS MCGINNIS WELL 11N 5W 208DD1	115 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE	STOCK WATERING	59 21 61	CATFISH FARMING	ANIMAL HUSBANDRY	YES	44.2759 116.9624	LOG, 1964
11N 6W 308B1			NOT FIELD CHECKED		182 24 45		SEEDLING CONIFERS	YES	44.3177 117.0412	
GLENN HILL WELL 11N 6W 30CB1	189 PLIOCENE AND PLEISTOCENE SEDIMENTS; MIOCENE BASALT (7)			UNUSED	66 28 68	FERMENTATION	APPLE DEHYDRATION	YES	44.3143 117.0402	YOUNG AND OTHERS, 1977
WEISER H S 11N 6W 10ACB1'S	18 PLIOCENE AND PLEISTOCENE SEDIMENTS; MIOCENE BASALT		MAINLY SEEPAGE		22 42	FISH FARMING	HYDROPONICS	YES	44.3065 117.0420	YOUNG AND OTHERS, 1977
GEOSOLAR GROWERS WELL #1 11N 6W 10CCA1	5677 MIOCENE BASALT		FLOWING WELL; SULFUR ODOR; DRILLER'S LOG AVAILABLE; ALSO KNOWN AS WEISER H S WELLS	RECREATION	121 70 140	REFRIGERATION (LOWER TEMPERATURE LIMIT)	POTATOE DEHYDRATION	YES	44.2989 117.0496	NEWCOMB, 1970
GEOSOLAR GROWERS WELL #2 11N 6W 10CCA2	75 MIOCENE BASALT		FLOWING WELL; SULFUR ODOR	RECREATION	31 77 145	APPLE DEHYDRATION	CORN PRODUCTS (SYRUP, OIL)	YES	44.2995 117.0497	NEWCOMB, 1970
GEOSOLAR GROWERS WELL #3 11N 6W 10CCA3	37 MIOCENE BASALT		FLOWING WELL; SULFUR ODOR	RECREATION	27 76 156	ANIMAL HUSBANDRY	BEET SUGAR PROCESS		44.2994 117.0488	NEWCOMB, 1970
NAKAMURA BROTHERS WELL 11N 6W 150DA1	1249 PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL; SULFUR ODOR	IRRIGATION	92 30	AQUACULTURE			44.2857 117.0334	LOG, 1977
FRANK CHANDLER WELL 12N 5W 330BC1	1514 QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE	IRRIGATION	42 24	BIODEGRADATION			44.3313 116.9422	YOUNG AND OTHERS, 1970
OLD HOMESTEAD W S 12N 6W 288BB1S				UNUSED	6 0	FISH FARMING			44.3535 117.0713	
MIDVALE CITY WELL 13N 3W 80CC1	7570 MIOCENE BASALT; QUATERNARY AND TERTIARY SEDIMENTS		DRILLER'S LOG AVAILABLE; FLOWING WELL	PUBLIC SUPPLY	293 29 99	HYDROPONICS	WASHING AND DRYING OF WOOL	YES	44.4716 116.7319	WALKER, 1964

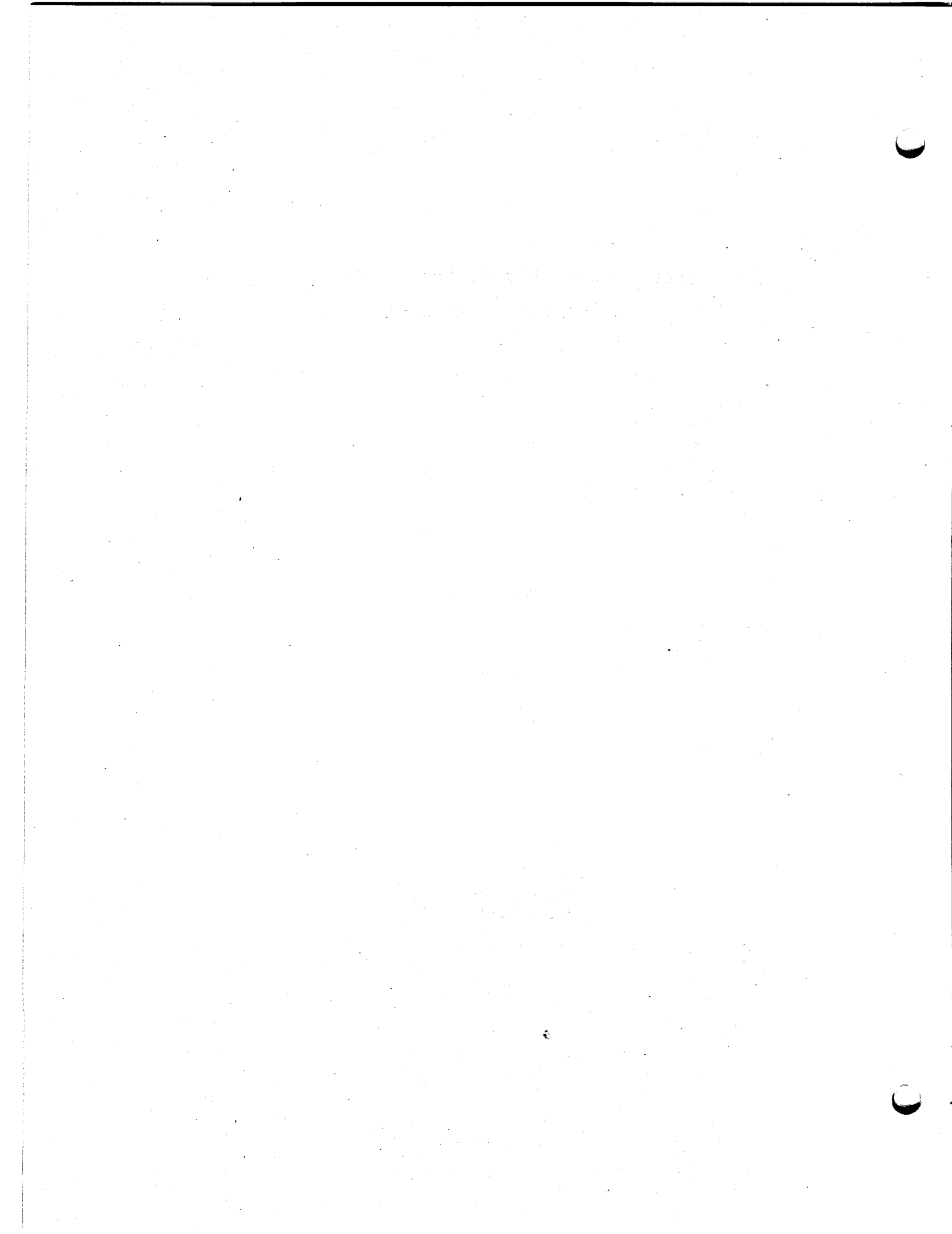
Basic Data Table 4. Location, Geologic Environment, Present Use and Potential Use of Thermal Springs and Wells in Idaho (continued)

Spring/Well Identification Number & Name	Dis-charge (l/min)	Aquifer Age and Rock Type	Geologic Structure	Remarks	Gas	Deposition		Present Use	Well Depth (m)	Surf. Temp. (°C)	Aqui-fer Temp. (°C)	Potential Use Based on Surface Temperature**	Potential Use Based on Best Estimate of Subsurface Temperature***	Chem/Trace Anal.	Latitude & Longitude	Reference
						Sill-iceous	Car-bon-ates									
<u>Washington County (cont'd.)</u>																
FAIRCHILD LUMBER CO. 13N 4W 13BAC1	151	MIOCENE BASALT		FLOWING WELL				IRRIGATION	416	25	51	FISH FARMING	GRAIN-HAY DRYING	YES	44.4660 116.7655	WALKER AND SISCO, 1964
LAKEY H S 14N 2W 68BA1S	378	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT		NUMEROUS SPRING VENTS; TEMPERATURE 63-70 DEGREES C SULFUR ODOR			YES	SPACE HEATING	70	78		APPLE DEHYDRATION	PASTEURIZED MILK PROCESS	YES	44.5860 116.6304	NEWCOMB, 1970
SALUBRIA CEMETERY WELL 14N 2W 60CB1	1135	PLIOCENE AND PLEISTOCENE SEDIMENTS		DRILLER'S LOG AVAILABLE				IRRIGATION	56	23		FISH FARMING			44.5738 116.6218	LOG, 1977
CAMBRIDGE CITY WELL 14N 3W 300C1	1514	MIOCENE BASALT		FLOWING WELL; DRILLER'S LOG AVAILABLE				PUBLIC SUPPLY	283	26				YES	44.5728 116.6778	NEWCOMB, 1970
FAIRCHILD H S 14N 3W 19CB1S	378	QUATERNARY ALLUVIUM NEAR MIOCENE BASALT					YES	UNUSED	52	63		BALNEOLOGICAL BATHS	APPLE DEHYDRATION	YES	44.5313 116.7535	NEWCOMB, 1970
KERMIT WIGGINS WELL 15N 3E 100BC1	151	PLIOCENE AND PLEISTOCENE SEDIMENTS MIOCENE E BASALT		DRILLER'S LOG AVAILABLE				DOMESTIC	91	21		FISH HATCHING			44.6477 116.6829	LOG, 1977

PRELIMINARY ENVIRONMENTAL ASSESSMENT  
IDAHO GEOTHERMAL RESOURCE AREAS

by  
S.G. Spencer  
and  
J. F. Sullivan

EG&G Idaho, Inc.  
Idaho Falls, Idaho



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## I. INTRODUCTION

This preliminary environmental assessment was prepared to address the major environmental concerns in nine areas in Idaho (figure I-1) with significant geothermal resource potential. This assessment is brief and is not intended to provide a comprehensive environmental analysis of each area; instead, it has been compiled to provide preliminary environmental information as a companion to resource data for these areas. The nine areas addressed are:

### A. COUNCIL-CAMBRIDGE

An area encompassing approximately 96,000 ha (hectares) in the Weiser River drainage of western central Idaho.

### B. BOISE-WEISER

An area approximately encompassing 460,000 ha in western Idaho, including parts of Washington, Payette, Gem, Canyon and Ada counties.

### C. BRUNEAU-GRAND VIEW

An area of approximately 186,000 ha just south of the Snake River in Owyhee County in southwest Idaho.

### D. MOUNTAIN HOME

Approximately 54,000 ha surrounding the city of Mountain Home in southwest Idaho.

### E. BLUE GULCH, TWIN FALLS, AND ARTESIAN CITY

Three areas encompassing 38,000, 13,000, and 10,000 ha, respectively, south of the Snake River in southcentral Idaho.

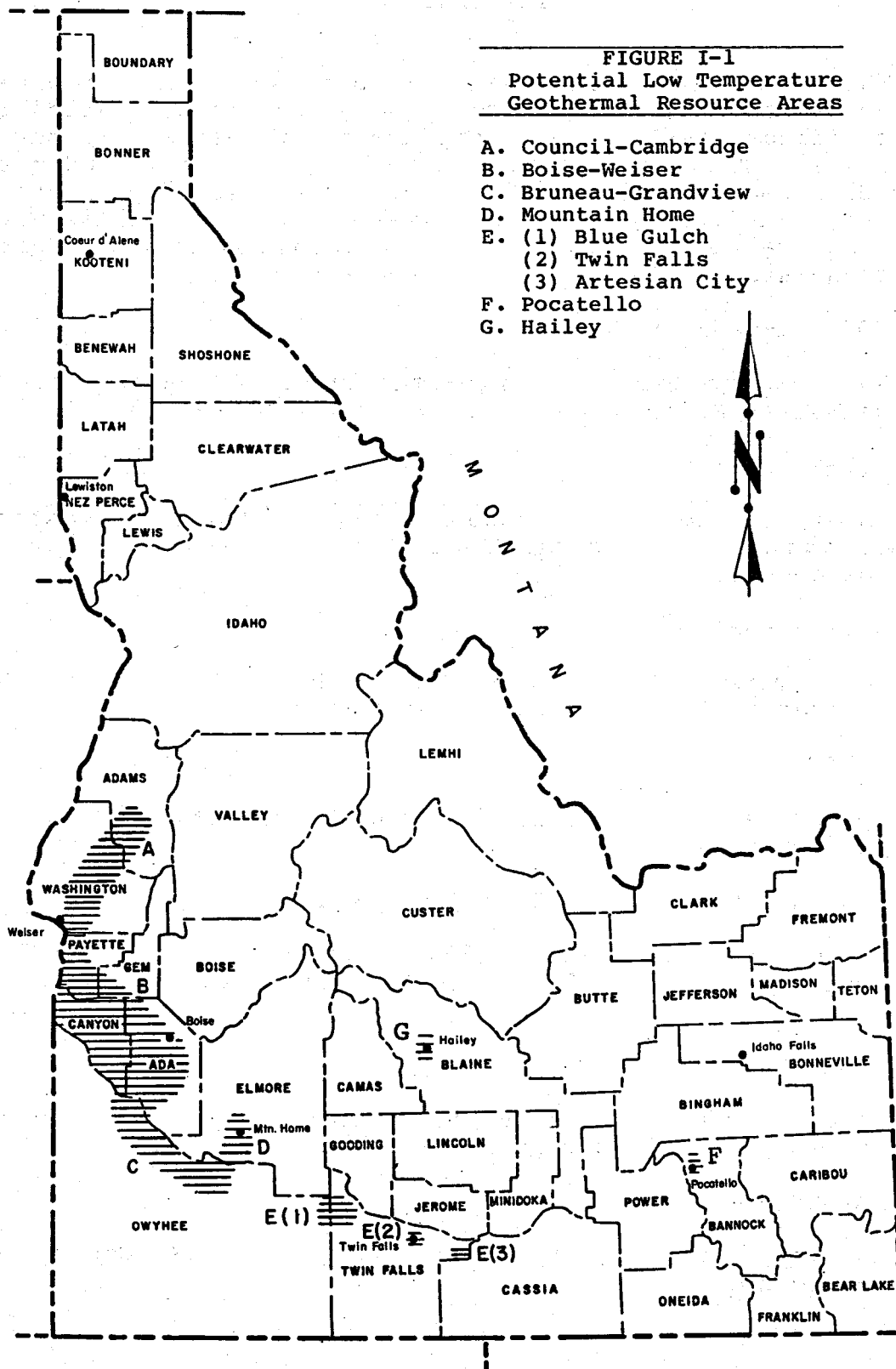
### F. POCATELLO

An area of approximately 11,000 ha north and west of the city of Pocatello in southeastern Idaho.

### G. HAILEY

An area encompassing 16,000 ha in Blaine County in central Idaho.

# STATE OF IDAHO



## II. DESCRIPTION OF POTENTIAL ACTIVITY

Geothermal developments currently underway include expansion of the space heating system in Boise and the drilling of wells in Twin Falls for space heating at the College of Southern Idaho. Development in the other areas under consideration is limited; however, enough interest has been expressed in developing the resources in these areas that it can be assumed that geothermal activity will increase.

Nearly all resources identified in the areas under consideration are low to moderate temperature resources below 50°C (Celsius). These can be developed for a variety of direct uses, including greenhouses, space heating and cooling, pasteurization, food processing, aquaculture, and animal rearing. In each of these processes, the geothermal fluid replaces the water-boiler systems or the heating systems and thus no major change in system design is required.

Wells drilled to provide geothermal fluids for direct use processes will generally range from less than 100 m (meters) in depth to over 1200 m deep, depending on the location and temperature of the resource. State regulations require that such wells be drilled by a licensed driller under a permit and that they be cased and cemented to preclude contamination of shallow groundwater supplies. Where higher temperatures may be encountered, blowout prevention equipment is required.

Less than 0.5 ha of land is generally cleared and graded for a drilling pad. Small reserve pits may be excavated to contain fluids encountered during drilling. When mud is used to drill the wells, mud tanks or lined mud pits are generally used as reservoirs for the mud circulation system. Access roads to move drilling equipment to the drill site are usually one-lane, ditched for drainage, and gravelled.

In addition to the drill rig, office trailers, equipment storage sheds, pipe racks, generators, and fuel tanks may be moved onto the site. All of these facilities are portable and are on location only during drilling and testing of the well. Portable sanitary facilities and water supply may also be provided.

Upon completion of the well, a wellhead is installed and connected to a supply pipeline or ditch. Geothermal pipelines are generally insulated and buried to prevent large heat losses during transport.

Disposal of the geothermal fluids downstream of the processes will vary. Currently used methods of disposal include injection, discharge to a surface water source (including irrigation canals) and cycling through other uses (including domestic water supply). The disposal method chosen depends on the quality of the geothermal fluids, local regulations, the type of process, and economic considerations.

### III. DESCRIPTION OF EXISTING ENVIRONMENT

#### A. COUNCIL-CAMBRIDGE

##### 1. Physical Environment

###### a. Climate

The climatic conditions of the Council-Cambridge area are generally influenced by predominant lows in the winter and highs in the summer. As a result, heavy winter snows and spring rains are usual, while summers are hot and dry. Precipitation ranges from 64 cm (centimeter) at Council in the Weiser Valley to over 115 cm in the surrounding mountains. Eight percent of the precipitation falls primarily as snow in the period from October through April. Frequent chinook storms in December and January result in rapid melting of the snowpack and subsequent erosion damage. Temperatures at Council range from -32 to 43°C with the annual temperature averaging 4°C. There are approximately 138 frost-free days annually in the valleys of the Weiser basin (USFS, 1975).

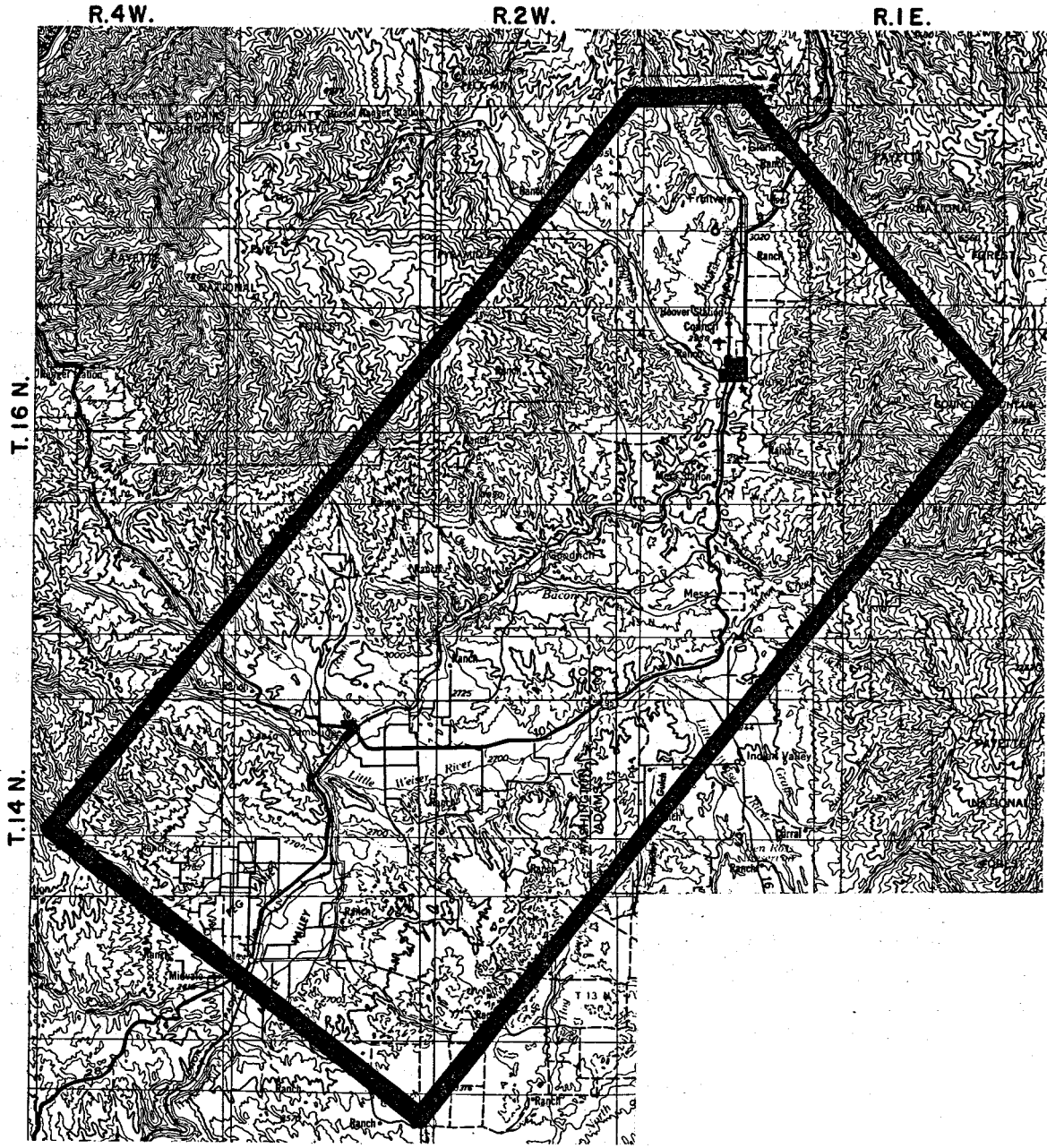
###### b. Air Quality

In general, the air quality in the area is good, with the average background level of particulates estimated at less than 15  $\mu\text{g}/\text{m}^3$  (micrograms per cubic meter). Sources of pollution include sawmills at Council, slash burning, road dust, vehicle emissions on Highway 95, rock-crushing, and campfires. In general, pollutants are readily dissipated. However, frequent inversions in the fall during slash burning combine to hold smoke in the upper valleys.

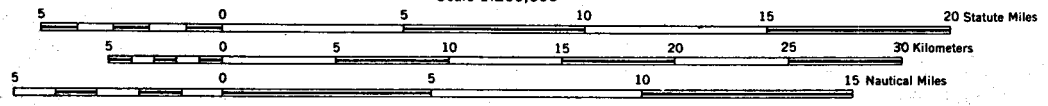
###### c. Land Resources

###### (1) Topography

The Council-Cambridge area is located in the Wallowa-Seven Devils section of the Columbia Plateau physiographic province. North-south trending block mountains and structurally-controlled landscapes are typical. The Weiser basin is very irregular with rolling profiles in the valleys. The main feature in the area of interest is the valley of the Weiser River, which trends south from the Seven Devils Mountains to the river's confluence with the Snake River at Weiser. The valley is bounded on the east by the West Mountain block. On the west, the Cuddy Mountains separate the valley from the canyon of the Snake River. Elevations range from 820 m at Midvale in the south to 2480 m on Council Mountain in the northeast corner of the area.



Scale 1:250,000



CONTOUR INTERVAL 200 FEET  
 WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS  
 TRANSVERSE MERCATOR PROJECTION

A. Council-Cambridge Study Area

## (2) Geology

Plateau basalt flows of the Columbia River formation are the most extensive rock type in the area. These basalts are usually weakly weathered and moderately to well-fractured. Granitics of the Idaho Batholith occur in scattered exposures in the area. In the valleys of the Weiser River and its tributaries, the basalts are overlain by colluvium, conglomerates, stream and lake deposits, and alluvium. A significant area of glaciation and associated glacial debris is located on Council Mountain in the northeast corner of the area. Primary faulting in the area occurs perpendicular to the Weiser Valley.

## (3) Soils

The primary parent material of soils in the Council-Cambridge area is the Columbia River basalts. These soils are generally fine to medium-textured loams and silt loams ranging in depth from 76 cm to 127 cm. Productivity is relatively high and erosion hazards are moderate to low. Soils overlying the granitics are much less extensive, coarse-textured loams and sandy loams with moderately low productivity. The erosion potential in these latter soils is moderate to high, while the basaltic soils are generally stable. Mineral fertility is high in most soils. Caliche and relatively high salinity occur in the soils overlying the lacustrine deposits on foothill slopes.

### d. Water Resources

#### (1) Surface Water

The primary stream in the area of interest is the Weiser River, which drains 1567 km<sup>2</sup> (square kilometer) above the gaging station at Cambridge. The discharge at this station averages 19 m<sup>3</sup>/s (cubic meter per second) and ranged from a maximum of 286 m<sup>3</sup>/s on 12/22/55 to a minimum of 0.23 m<sup>3</sup>/s on 11/16/58. The source of water in the basin is snowmelt. Because of the irregularity of the basin, more than 60 percent of the annual runoff is contributed by tributaries on the east-side of the basin. Warm temperatures and rainstorms produce significant runoff in the winter and spring. In the 1974-1975 water year, 80 percent of the total flow of the river occurred in the period from March through June, with an average discharge during May of nearly 80 m<sup>3</sup>/s. Total suspended solids during the same period ranged from 22 mg/l (milligram per liter) to 229 mg/l. Measurements of daily sediment discharge were 247 metric tons in February, 1316 metric tons in May, and 21 metric tons in July. The average quality of the river near Cambridge in 1974 and 1975 is shown in table A-1.



TABLE A-1  
QUALITY OF WEISER RIVER  
(mg/l)

Ca	9.9	HCO <sub>3</sub> <sup>-</sup>	56
K	1.5	SO <sub>4</sub> <sup>-</sup>	4.3
Mg	3.5	TDS	82
Na	6.4	pH	8.0
Cl	1.7	Specific Conductance	100
F	0.1		

Flow in the river is regulated to some extent by the Lost Valley Reservoir, 92 km upstream from the mouth, and by other smaller reservoirs. Diversions above Cambridge are used to irrigate about 5000 ha. Downstream, water is used for irrigation in the lower Weiser Valley and for power production on the Snake River (USFS, 1975).

(2) Groundwater

Groundwater in the upper Weiser basin occurs primarily in the Columbia River basalts under both water table and artesian conditions. Some water occurs in the thin layers of sand and gravel sediments in the valley bottoms around Cambridge. Depth to water in irrigation and domestic wells in the area ranges from 0.06 m to 34 m. The average quality of water produced from these wells is shown in table A-2. Domestic and stock water supplies are generally derived from individual wells and springs. Industrial water use is limited to the timber industry and is primarily obtained from surface water with some supplemental groundwater.

TABLE A-2  
GROUNDWATER QUALITY  
(mg/l)

Ca	16	HCO <sub>3</sub> <sup>-</sup>	143
K	7.7	SO <sub>4</sub> <sup>-</sup>	17
Mg	6	TDS	210
Na	29	pH	7.6
Cl	2.8		
F	0.4		

## 2. Natural Environment

### a. Flora

The vegetation in the Council-Cambridge area can be divided into two basic types, based on elevation. At lower elevations there are scattered stands of ponderosa pine (*Pinus ponderosa*), with bluegrasses (*Poa secunda*), bluebunch wheatgrass (*Agropyron spicatum*), and Idaho fescue (*Festuca* sp.). Big sage (*Artemisia tridentata*) is common and primary forbs include phlox (phlox sp.), asters (*Aster* sp.), and western yarrow (*Achillea* sp.). Some rocky areas support only sparse grasses and forbs. At higher elevations in the mountains east of Council, ponderosa pine predominates. The understory is much heavier and is composed of species such as snowberry (*Symphoricarpos albus*), chokeberry (*Potentilla virginiana*), and ninebark (*Physocarpus* sp.). Forbs includes asters, horsemint (*Monarda* sp.), geranium (*Geranium* sp.), and buckwheat (*Fagopyrum* sp.). Douglas fir (*Pseudotsuga taxifolia*) is common and becomes dominant above 1500 m. Western larch (*Larix occidentalis*) is scattered amongst the douglas fir and Engelmann spruce (*Picea engelmannii*) occurs along creek bottoms in the mountains. A few whitebark pine (*Pinus* sp.) grow on top of Council Mountain (USFS, 1975).

### b. Fauna

Although detailed inventories have not been taken, surveys of fauna in the area have identified 81 species of birds, 32 species of mammals, and 15 species of reptiles and amphibians. This diversity is primarily due to the variety of cover types and the range of elevations. Although big game is not abundant, some mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and numerous black bear (*Ursus americanus*) inhabit the mountain area. In one season, 53 black bear were tagged on the Middle Fork of the Weiser. Council Mountain is the most important mule deer habitat in the area. Coyote (*Canis latrans*), red fox (*Vulpes fulva*), muskrat (*Ondatra zibethica*), badger (*Taxidea taxus*), raccoon (*Procyon lotor*), and skunk (*Mephitis mephitis*) are common. Small mammals include Columbian ground squirrel (*Citellus columbianus*), golden-mantled ground squirrel (*Citellus lateralis*), yellowpine chipmunk (*Eutamias amoenus*), and snowshoe hare (*Lepus americanus*). Common reptiles and amphibians are western rattlesnake (*Crotalus viridis*), leopard frog (*Rana pipiens*), and bullfrog (*Rana catesbeiana*). In addition to a large variety of passerines, several species of hawks (*Buteo* sp.), golden eagles (*Aquila chrysaetos*), and bald eagles (*Haliaeetus leucocephalus*) are found throughout the area. Blue grouse (*Dendragapus obscurus*) and ruffed grouse (*Bonasa umbellus*) are abundant (USFS, 1975).

### c. Aquatics

The Idaho Department of Fish and Game classes the streams in the area as good to excellent. There is a fair trout fishery in the three forks of the Weiser River and these streams are stocked several times a year. Game fish include rainbow (*Salmo gairdneri*), brook trout (*Salvelinus fontinalis*), a few cutthroat (*Salmo clarki*), and Dolly Varden (*Salvelinus malma*). A significant number of nongame fish are found in the lower Weiser River.

## 3. Cultural Environment

### a. Land Use

Nearly all land in the area of interest is privately owned. Approximately 9500 ha in the northeast corner of the area are controlled by the U.S. Forest Service, and parcels of land under the jurisdiction of the state and BLM are scattered through the area. Primary land uses include farming along the Weiser River, timber harvest, range, and recreation. The area was seriously overgrazed in the late 1800's, but careful range management and range restoration have resulted in much of the land being considered an important range resource. At one time, Council was the center of extensive apple orchards, but water shortages, low prices and increased costs have resulted in a decline.

### b. Socioeconomics and Demography

The area of interest includes parts of both Washington and Adams counties. The combined population of these counties is 11,800 (1976). The population density of Adams County is 0.9 people/km<sup>2</sup>, less than half the density of Washington County. The larger communities in the area and their 1970 populations are Council (899), Cambridge (383), and Midvale (176). The unemployment rate in Adams County in 1976 averaged 13.6 percent and that in Washington County averaged 8.6 percent. Primary contributors to the total employment in each county include farm proprietors, manufacturing, state and local, and trade. Per capita income in the area is 90 percent of the state average and 74 percent of the national average.

### c. Archaeologic and Historical

Council Valley was an important meeting place for the NezPerce and Shoshone tribes, the valleys providing a winter retreat and the mountains excellent hunting. Little is known of early occupation of the area, although the potential for prehistoric occupation in the valley areas is good. Both Council and Cambridge were settled in the 1870's. Council grew rapidly as a result of mining activity

in the Seven Devils. Cattle and sheep grazing were well established by 1880, and the subsequent overgrazing of the area resulted in heavy soil loss in the lowlands in the early 1900's.

#### d. Aesthetic Values

The study area is composed of both mountains and valleys. The mountainous regions are utilized for recreational purposes such as backpacking, hunting, and fishing, while the valleys are fairly well developed. Two national forests are touched by the area: Boise and Payette, both of great recreational value.

### B. BOISE-WEISER

#### 1. Physical Environment

##### a. Climate

Limited climatological data are available for selected sampling locations within the Weiser-Boise study area (National Oceanic Atmospheric Administration, 1977). These are summarized as follows:

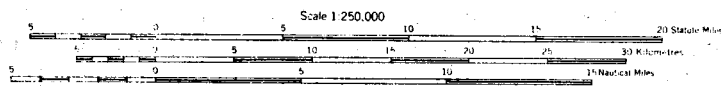
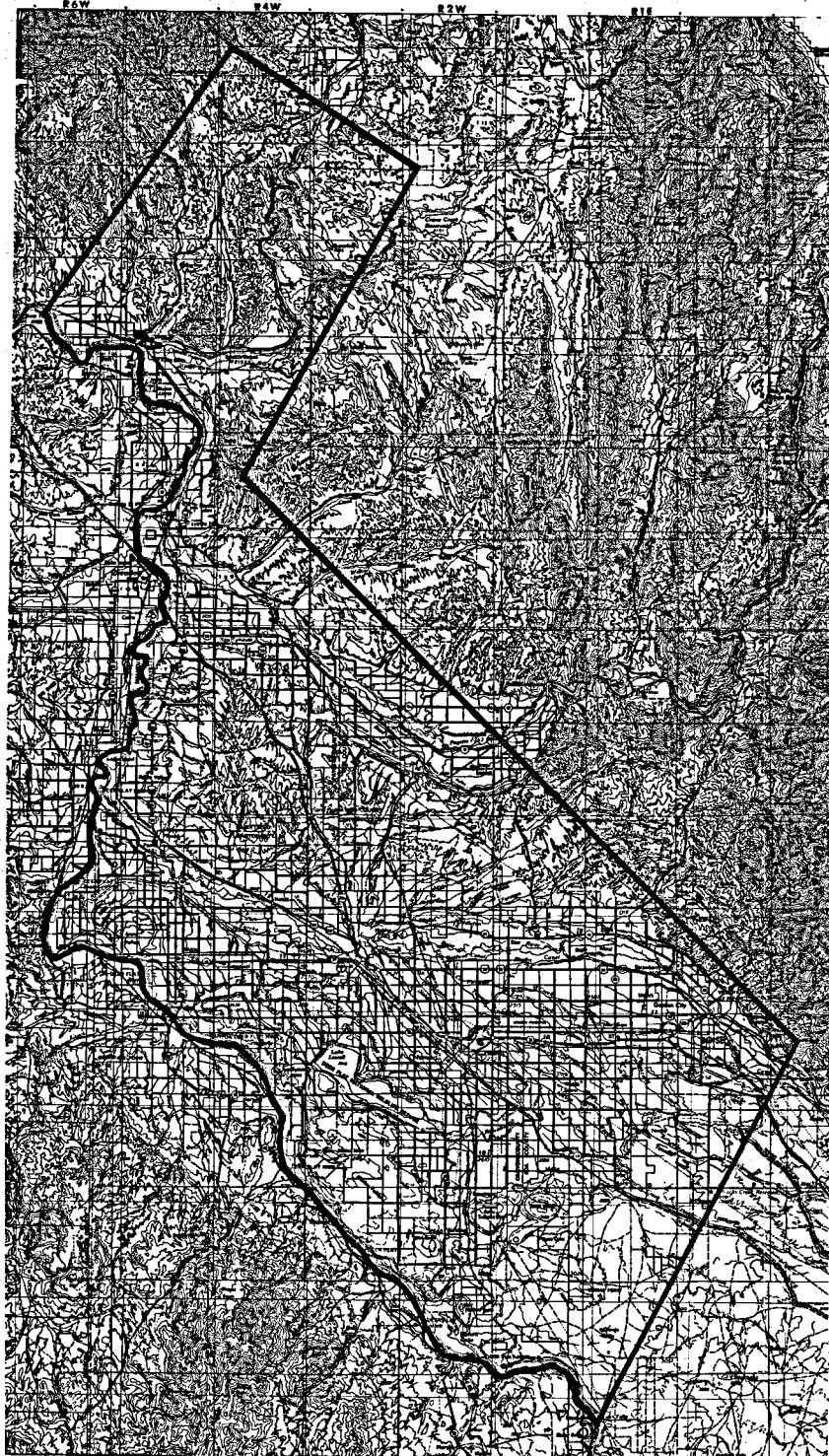
(1) Weiser - located in the uppermost part of the study region in Washington County. The average annual temperature is 10.6°C, with January and July averaging -2.5 and 23.3°C, respectively. Rainfall averages 29 cm/yr with July and January averaging 0.28 and 4.39 cm, respectively. Relative humidity peaks at 40-50 percent in summer and 70-80 percent in winter.

(2) Payette - located in the northwest of the study region in Payette County. The average annual temperature is 10.8°C, with January and July averaging -2.2 and 23.6°C, respectively. Rainfall averages 28.3 cm/yr with July and January averaging 0.33 and 3.96 cm, respectively.

(3) Caldwell - located in Canyon County in the middle of the study area. Average annual temperature is 10.7°C with January and July averaging -1.5 and 23.2°C, respectively. Rainfall averages 28.3 cm/yr with July and January averaging 0.33 and 3.96 cm, respectively.

(4) Boise - located in Ada County in the eastern portion of the study area. Average annual temperature is 10.6°C with January and July averaging -1.5 and 23.3°C, respectively. Rainfall averages 29.2 cm/yr with July and January averaging 0.38 and 3.73 cm, respectively.

The climate is therefore characterized by hot dry summers. Snowfall is a major contributor to the total precipitation,



CONTOUR INTERVAL 200 FEET  
 WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS  
 TRANSVERSE MERCATOR PROJECTION

**B. Boise-Weiser Study Area**

notably at the higher elevations. The dry grassland climate provides well-defined seasonal characteristics.

#### b. Air Quality

Air masses from the Pacific reach the study area but are considerably modified over that distance point. Their influence contributes mildly to periods of cloudy or stormy winter weather. Air pollution is not a major problem in the area as a whole, however, the Boise region experiences intermittent temperature inversions which effectively trap particulates and gasses at low levels, thus creating stagnant air masses. The Metropolitan Boise Intrastate Region (including Boise, Nampa, and Caldwell) violates secondary air quality standards for particulate matter (U.S. EPA, 1972). Sources are fuel combustion and industrial process losses, primarily asphalt and ready-mix concrete operations. Additionally, dust from agricultural lands contributes to the particulate load during certain seasons.

The Boise area is the only portion of Idaho to experience significant emissions from aircraft or automobiles. Reduced visibility is a consequence of such air quality degradation during severe temperature inversions (Ada Council of Government).

#### c. Land Resources

##### (1) Topography

The Boise-Weiser study area is located on the western border of the state and includes portions of Ada, Canyon, Gem, Payette, and Washington counties. The Boise Mountains border the east side of the region while Oregon borders the west side. The Snake River forms the southern boundary and the Council-Cambridge study area is adjacent on the northern border. Elevations in Ada County range from 822 m on the valley floor to 1890 m on the ridge crest.

The Boise-Caldwell area is of lower elevation than the eastern portion of the Snake River Plain. The topography is generally flat with thick lake and stream sediments interbedded with basalt flows. The lower Boise and Payette River basins are included in the area (BLM, 1976).

##### (2) Geology

Geological information is primarily limited to Ada County, which is mainly composed of the Idaho Batholith and the Idaho Group. The Idaho Batholith is of granitic origin and is found along the steep face and crest

of the Boise Ridge while the Idaho Group represents the valley fill materials, composed of gravel, sand, silt, and clay (Ada Council of Governments, 1973).

The general geology of the area is summarized as follows. Cenozoic flows include: 1) the Basalt flows of the Idaho and Snake River groups in the Boise area; 2) alluvial, glacial, and lake deposits in Canyon, Payette, and Gem counties; 3) sedimentary rocks of the Idaho Group, including lake and stream deposits of the Chalk Hills formation in upper Canyon and lower Payette counties; 4) sedimentary rocks associated with the Columbia River Basalt in Payette and Gem counties; and 5) Columbia River Basalt in Gem, Payette, and Washington counties. Mesozoic rocks include granite rocks of the Idaho Batholith in Ada County (BLM, 1976).

### (3) Soils

Available soil data for the entire study area are inadequate for a precise description. Soils in Ada and Canyon counties are moderately to very deep with silty subsoils on gentle to strong slopes. The frost-free season ranges from 120-160 days. Crops, including cereals, potatoes, sugar beets, beans, and hay, require irrigation. Rangeland soils include both coarse-silty and fine-silty soils. Parent materials are alluvium on the terraces and loess on the uplands. The profile depth ranges from 51-152 cm with moderate permeability. The major soil problems appear to be erosion, alkaline conditions and droughtiness. These are being mitigated by residue management, crop sequencing, irrigation, and rangeland management and cross-slope operations (BLM, 1976). Land in the Weiser area is subhumid grassland and semiarid grazing land; some is irrigated.

#### d. Water Resources

##### (1) Surface

Surface water features in the study area include the Snake River, Payette River, Weiser River, Boise River, Arrowrock and Lucky Peak reservoirs (on the middle fork of the Boise River). Spangler Reservoir in Washington County, Lowell Lake in Canyon County, and Black Canyon Reservoir on the Payette River in Gem County. Additionally, irrigation canals and drainage ditches have been constructed throughout principal irrigation areas.

Swan Falls Dam, constructed in 1901 on the Snake River south of Boise, creates a slack water pool for approximately 19 km. Otherwise, the Snake River is free flowing. The Snake River receives pollutants from agri-

cultural practices, industrial processing plants (primarily potato and sugar refining), untreated domestic sewage, and irrigation returns. Water quality of the river is degraded by input from the Owyhee, Payette, and Boise rivers (BLM, 1976).

The Boise River flows in an east to west direction through Ada County and drains about 6993 km<sup>2</sup> of mountainous terrain north and east of Ada County. Since this river receives a large part of its water from seasonal runoff and snowmelt, it is characterized by high flows in spring through early summer and low flows from late summer through winter.

Water quality data for the region is summarized in Table B-1 (USGS, 1976). Lake Lowell near Caldwell is formed by two earth embankments. Storage began in 1908, with the capacity 218 hm<sup>3</sup> (cubic hectometer). The lake receives water from the Boise River and local drainage; water is used primarily for irrigation. The maximum observed content (221 hm<sup>3</sup>) was recorded on 4/27/22 and the minimum (6.7 hm<sup>3</sup>) was observed on 10/22/24.

Lucky Peak Reservoir near Boise is formed by an earth-fill dam. Storage began in 1954. Water (capacity 378.6 hm<sup>3</sup>) is stored for flood control and irrigation of Boise valley lands. The maximum observed content (376 hm<sup>3</sup>) was recorded on 6/25/55 and the minimum (35.5 hm<sup>3</sup>) was observed 12/21/61.

Arrowrock Reservoir on the Boise River is formed by a gravity-section concrete-arch dam which was completed in 1915 and raised 1.5 m in 1937. Water (current capacity 353 hm<sup>3</sup>) is used for irrigation in Boise valley; silt deposition has decreased the storage capacity over time. The maximum content (371 hm<sup>3</sup>) was recorded 5/29/48 and the minimum occurred during several years when the gates were open and natural river flow passed through the reservoir.

The Boise River is clean as it leaves Lucky Peak Reservoir; however, the quality is degraded as the river leaves Boise. The most severe degradation occurs after the water flows by Eagle Island where the combined effluent from Meridian, Nampa, and Caldwell enter the river along with wastewater returns from vast areas of irrigated farmland (Bureau of Reclamation, 1977). The major pollutants are nitrogen, phosphorus, bacteria, and sediment.

## (2) Groundwater

Detailed groundwater data is lacking for the entire study area. However, groundwater data are



TABLE B-1  
SURFACE WATER DATA FOR THE BOISE-WEISER STUDY AREA

(Water chemistry data are for the water year 10/75 - 9/76, expressed  
as mean sample values and standard deviation [USGS, 1976])

Sampling Station	Snake River at Marsing, ID	Boise River at Lucky Peak Lake Outlet	Payette River 2.9 km south of Payette	Weiser River near Weiser
Drainage area (km <sup>2</sup> )	--	6,940	8,390	3,780
Average discharge	--	85.6 m <sup>3</sup> /s	89.2 m <sup>3</sup> /s	33.1 m <sup>3</sup> /s
Extremes for period of record (m <sup>3</sup> /s)	--	1,010 6/14/1896 (No flow when gates are closed)	875 12/14/64 5.1 10/13/35	564 12/23/55 0.4 8/07/11
Conductivity (µmhos/cm)	478 (52)	74.5 (8.5)	131 (61.4)	119 (26.0)
pH (units)	8.6 (0.23)	7.0 (0.14)	8.0 (0.57)	7.9 (1.2)
Temperature (°C)	12.3 (7.1)	9.5 (6.1)	12.5 (8.6)	11.3 (8.0)
Ca (mg/l)	46.8 (3.1)	8.5 (2.1)	12.6 (6.2)	12.4 (1.8)
Na (mg/l)	28 (5.6)	3.0 (1.3)	12.4 (7.9)	7.0 (1.4)
HCO <sub>3</sub> (mg/l)	163 (57)	39 (7.1)	67 (38.2)	75 (14.0)
TDS (mg/l)	291 (32)	49 (7)	89 (42)	97 (12)
K (mg/l)	4.4 (0.7)	0.7 (0.1)	1.6 (1.1)	1.9 (0.3)
Mg (mg/l)	17.8 (2.2)	1.2 (0.5)	2.3 (1.6)	4.7 (0.5)
Cl (mg/l)	23.3 (4.9)	0.7 (0.3)	3.1 (0.7)	2.1 (0.8)
F (mg/l)	--	0.25 (0.07)	0.35 (0.07)	0.10 (0.00)
SO <sub>4</sub> (mg/l)	47.5 (6.8)	3.8 (1.1)	7.9 (1.2)	4.3 (1.2)

available for Ada County, where ample water is available for domestic, industrial, and irrigation purposes. Water within Ada County is primarily available from deep permeable sediments of the Glens Ferry Formation, shallow alluvial or stream deposits, and Snake River Basalt lava flows (Ada Council of Governments). The Glens Ferry Formation provides the deep aquifer with both clay and sand strata. Clay beds produce 0.32 - 1.6 lps (liter per second) while sand and gravel beds produce up to 102 lps. Well yields from shallow alluvial or stream terrace deposits range from 32 to 64 lps. The Snake River basalt formation is responsible only for shallow, domestic water resources. Ada County groundwaters are mainly calcium-magnesium bicarbonate type. Total dissolved solids (TDS), however, often exceed the U.S.P.H.S. drinking water standard of 200 mg/l. Water quality problems are associated with excessive hardness, dissolved iron, and magnesium levels.

The Boise River Valley has wells that are utilized mainly for domestic purposes. Of 60 major wells monitored by CH<sub>2</sub>M Hill, 15 percent were contaminated by coliform bacteria, gram negative, nonsporulating, rod-shaped bacteria that are natural flora to the gastro-intestinal tract of warm-blooded animals.

The Boise Front is the major deep groundwater recharge system for the area, while irrigation seepage and surface water seepage and precipitation recharge the shallow aquifers.

Available information indicates that a decline in groundwater levels is not occurring and that recharge is balancing water removal from the aquifer.

The Weiser River basin drains approximately 4100 km<sup>2</sup>. The principal use of water is for irrigation, with surface waters meeting the bulk of the demand. Groundwater is supplied by two main aquifers: 1) in the basalt of the Columbia River Basalt Group and 2) in overlying Tertiary and Quaternary sedimentary rocks. Individual wells and springs supply domestic and stock supplies. Municipal water for the towns of Council, Cambridge, and Midvale are derived from seven wells open to the Columbia River Basalt Group. Weiser obtains its water from three wells open to the sedimentary-rock aquifer (Young, Harenberg, and Seitz, 1977).

Groundwater in the Weiser River basin is recharged mainly from precipitation falling within the basin. The basalt aquifers are recharged via precipitation on the surrounding uplands and mountains, with snowmelt the greatest contributor. The sedimentary rock aquifers are recharged primarily during snowmelt runoff and the irriga-

tion season, with water infiltration from streams, canals, ditches, and irrigated fields. Water levels in the various aquifers vary with snowmelt conditions.

Groundwater supplies are affected by the thermal waters known to occur in the region. Wells in the Midvale area discharge water in the 28°C range. Municipal wells at Weiser, which draw water from the shallower sedimentary rocks, have TDS concentrations in the 393-514 mg/l range, considerably harder than from the deeper basalt aquifer.

## 2. Natural Environment

### a. Flora

Species expected to occur in the valleys of Payette, Gem, Washington, and upper Canyon counties include those that are found in the Payette Forest. Examples are ponderosa pine, bluebunch wheatgrass, Idaho fescue, big sage, and western yarrow.

Adjacent to the Snake River lies a salt desert shrub plant community which boasts common stands of white sage or winterfat (*Eurotia lanata*), once common throughout the intermountain area. The sagebrush-grassland community found throughout Ada and Canyon counties has species such as big sagebrush, low sagebrush (*Artemisia arbuscula*), bluebunch wheatgrass, Idaho fescue, Indian ricegrass (*Oryzopsis hymenoides*) and cheatgrass brome (*Bromus tectorum*). Repeated fires, overgrazing, and agricultural conversion has altered this once diverse and abundant plant cover to little more than a sagebrush and/or annual grass community.

A forest community is found along the northeastern border of Ada County, comprised of yellow pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) with an associated shrub understory.

### b. Fauna

Animal species which inhabit the study region include:

#### (1) Mammals

Large mammals are limited by cover, forage, and water availability. Limited numbers of mule deer are found along the Snake River Canyon with a few migrants from the Boise drainage basin. Predator species include the coyote, bobcat (*Lynx rufus*), skunk, and short-tailed weasel (*Mustela erminea*). Rodents include the yellow-bellied mar-

mot (*Marmota flaviventris*), muskrat, Townsend's ground squirrel (*Citellus townsendi*), and Columbian ground squirrel.

## (2) Birds

Birds associated with the area total 110 species, including 40 waterfowl or aquatic species, 4 upland game birds, 22 raptors, and 44 other smaller species (Ada Council of Governments, No. 9). The birds of prey are discussed in the Bruneau-Grand View section of this report. Game species include pheasant (*Phasianus colchicus*), ruffed grouse, chuker (*Alectaris graeca*), Hungarian partridge (*Perdix perdix*), and quail (*Oreortyx pictus*). Duck species include mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), blue wing teal (*Anas discors*), ruddy (*Oxyrua jamaicensis*) and cinnamon teal (*Anas cyanoptera*).

## (3) Reptiles/Amphibians

Reptiles/amphibians occur in rocky canyons and desert lowlands where the prey base is good. Representative species are: leopard lizard (*Crotaphytus wislizenii*), western skunk (*Eumeces skiltonianus*), Great Basin gopher snake (*Pituophis melanoleucus*), and western rattlesnake.

## c. Aquatics

The Boise Front tributaries are sediment-laden from ground disturbances and contribute to an excessive sediment load in the Boise River which adversely impacts the ecosystem and has eliminated the fisheries in some portions. The only trout habitat is between Barber Dam to Middleton, a distance of 35 km. The 13 km length of the Boise River between Discovery State Park and Barber Dam is severely silted and does not support a fish community. Fish species in the river include Rocky Mountain whitefish (*Coregonus* sp.), suckers (family *Catostomidae*), carp (*Cyprinus carpio*), sculpin (*Cottus* sp.), shiners (*Notropis* sp.), and squawfish (*Ptychocheilus oregonensis*). Gamefish and invertebrate populations are severely impacted by the 7-14 day annual shutdown of Lucky Peak Dam for inspection purposes. This results in a 1:1 ratio of sewage effluent: river water below the Boise sewage treatment plant, with residual chlorine at levels toxic to trout and whitefish. Additionally insect larvae are wiped out with the drastic flow decrease and excessive siltation. It is felt that the trout fishery could be reestablished in the Boise River in both Ada and Canyon counties. (A second tunnel has been authorized by Congress and is expected to be under construction within the next two years. This will eliminate the annual shutdown of Lucky Peak flows.)

Healthy fish populations are found in the Snake River below Swan Falls Dam, including channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), and crappie (*Poxomis sp.*).

The Weiser River supports a trout fishery with supplemental stocking from the Idaho Department of Fish and Game. Game species include brook trout, rainbow trout, cutthroat trout, and Dolly Varden. Additionally, nongame species are also in the Weiser River.

### 3. Cultural Environment

#### a. Land Use

Land ownership and use in the five counties within the Boise-Weiser study area are listed in table B-2.

TABLE B-2  
LAND OWNERSHIP AND USE IN BOISE-WEISER AREA

	Ada	Canyon	Payette	Gem	Washington
% Federal Land	46.2	4.3	25.9	37.9	37.0
% State Land	6.7	0.6	3.5	6.6	6.8
% Private Land	45.9	94.9	69.8	55.0	55.9
Total Land (ha)	270,223	149,784	104,095	143,827	378,773
% Urban or built-up	4.5	2.9	1.1	0.5	0.4
% Agricultural	25.6	84.4	33.7	18.5	13.8
% Rangeland	69.0	7.7	64.0	66.3	74.6
% Forest	0.3	3.0	0.0	13.9	9.9
% Water	0.6	2.0	1.2	0.8	1.3

#### b. Socioeconomics and Demography

The study area is varied and diverse in that it includes the densest county (Ada) in the state as well as sparsely populated counties (Washington and Gem). The socioeconomic data for the area are summarized in table B-3.

Employment data are summarized in table B-4.

TABLE B-3  
SOCIOECONOMIC DATA FOR THE BOISE-WEISER AREA

	U.S. Average	Idaho Average	Ada County	Canyon County	Payette County	Gem County	Wash- ington County
Population as Percent of 1976 State Total	--	--	16.81	8.83	1.80	1.28	1.02
1975 Birth Rate	14.8	19.8	17.1	18.5	17.4	16.9	18.9
1975 Fertility Rate	66.7	92.0	76.0	87.5	91.3	84.2	100.6
1976 Percent of Unemployment	--	--	4.4	6.0	6.0	10.3	8.6
1976 Median Family Income	--	--	\$14,375	\$11,375	\$10,375	\$11,625	\$10,250
Number of Hospitals	--	--	4	3	0	1	0
Number of Persons per M.D.	--	969	627	969	4,800	2,140	2,100
Total 1976 Crimes	--	--	8,380	3,691	645	314	259
% Murder	--	--	0.12	0.16	0	0	0
% Larceny	--	--	66.	67.	56.	68.	71.
% Burglary	--	--	22.	24.	31.	27.	20.
% Rape	--	--	0.64	0.41	0.4	0	0
1975 Suicide Rate (per 1,000 persons)	--	16.4	23.3	15.1	13.9	9.3	16.4
1975 Marriage Rate (per 1,000 persons)	--	15.5	10.9	9.3	14.2	10.0	15.5
1975 Divorce Rate (per 1,000 persons)	--	6.3	8.9	6.9	8.3	8.5	6.3

TABLE B-4  
1975 EMPLOYMENT DATA FOR THE BOISE-WEISER AREA

	Ada	Canyon	Payette	Gem	Washington
% of Females in Labor Force (1970)	44.4	41.2	38.9	29.1	34.1
Total Employment	68,744	31,464	4,431	4,007	3,352
Farm Proprietors	1,664	2,619	734	637	598
Nonfarm Proprietors	5,481	2,853	667	370	455
Federal Civilian Employment	3,208	191	38	59	50
State and Local Employment	10,866	3,480	631	510	501
Manufacturing Employment	6,014	6,250	597	733	382
Trade Employment	16,143	5,581	536	498	574
Services Employment	11,062	4,563	319	377	190
Construction Employment	5,089	1,035	132	30	95
Farm Employment	511	2,581	390	644	339

#### c. Archaeological and Historical

The Oregon Trail passes through Ada and Canyon counties; additionally the Kelton Road is located in the northeast corner of Ada County. The site of the 1834 Fort Boise is located in northwestern Canyon County. Archaeological surveys in Idaho are limited; however, it is felt that the western Snake River Plain has the potential to yield data of major scientific significance (BLM, 1976). It is hypothesized that the western Snake Plain contained extensive cultural diversity during the late prehistoric and early historic periods. The valleys of the Boise, Payette, and Weiser rivers were important grounds for several distinct Indian groups, including the Northern Paiute, Nez Perce, Cayuse, Shoshoni, and Bannock tribes.

#### d. Aesthetic Values

The several large rivers and mountainous regions in the study area are utilized extensively for recreational purposes. State parks include Discovery and Lucky Peak in Ada County, Black Canyon in Gem County, Ontario in Payette County, and Mann Creek in Washington County. Several of these parks offer camping services and are therefore a valuable resource. In general, aesthetic resources in the area require preservation, since Idaho boasts some of the most pristine areas left in the country. The Birds of Prey Natural Area lies along the Snake River on the southern border of Ada County. For details see the Bruneau-Grand View section of this report.

## C. BRUNEAU-GRAND VIEW

### 1. Physical Environment

#### a. Climate

The climate of Owyhee County is moderate, ranging from 0°C in January to 27°C in July. Extremes of -33 to 46°C have been recorded for Grand View. Rainfall averages 20 to 25 cm per year along the Snake River, with May and June the heaviest precipitation months. Relative humidity is characteristically low, with moderate winds frequent. The growing season in the study approximates 140 days.

#### b. Air Quality

Prevailing wind currents are from the west-northwest and follow the Bruneau River and Snake River valleys. Wind speeds average 8-32 km/hr with infrequent gusts up to 96 km/hr. The air quality is considered very good, with agriculture the main contributor to particulate matter. Range fires also contribute smoke and ash to the particulate load during the dry season; however, air pollution on the whole is minimal. Concentration levels of CO, NO<sub>x</sub>, SO<sub>x</sub>, and hydrocarbons are unknown but are thought to be low since no major point sources exist in the study area.

#### c. Land Resources

##### (1) Topography

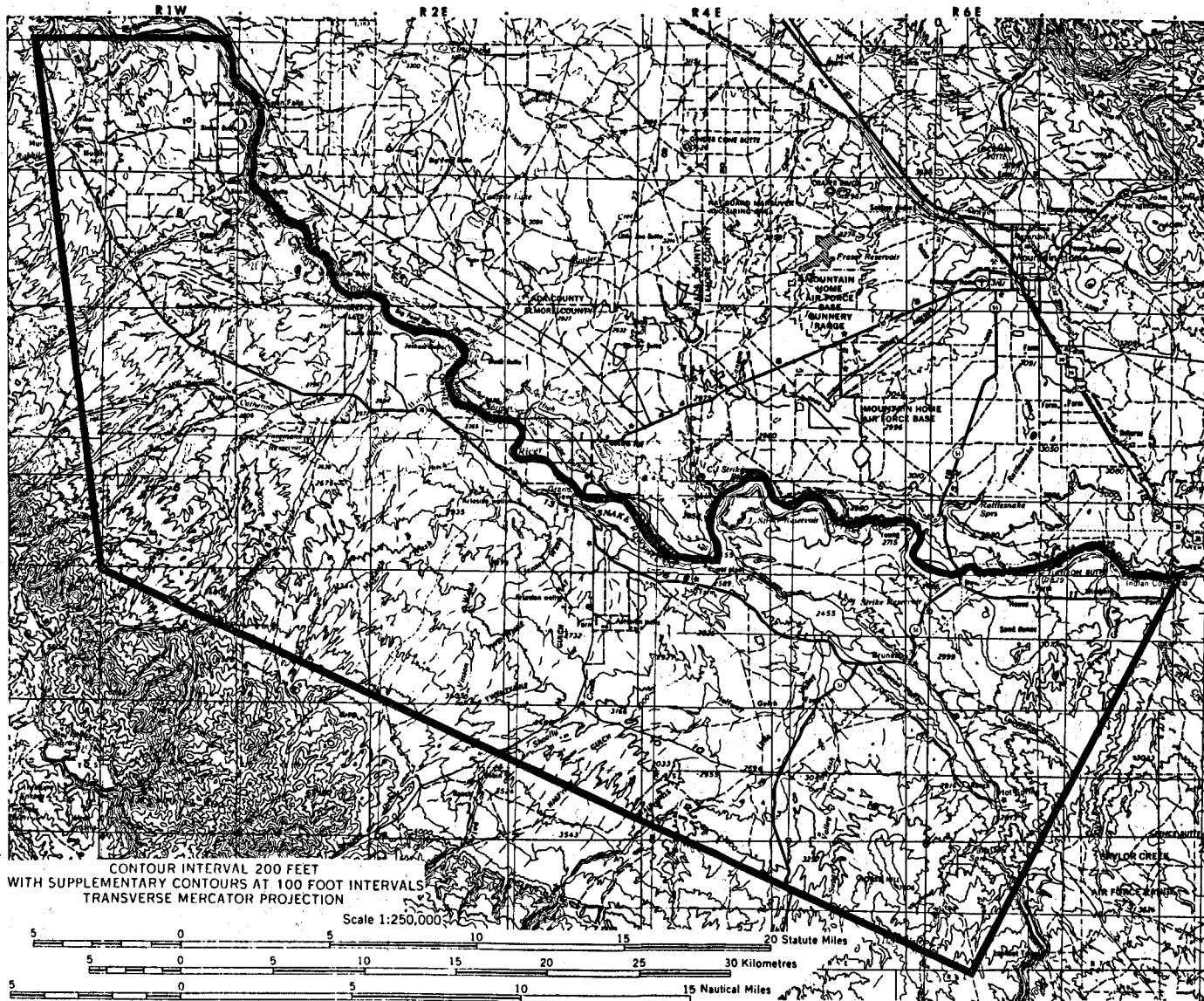
The Bruneau-Grand View area lies in the western part of the Snake River Plain east of the Owyhee Mountains. The area includes: 1) the Snake River valley ranging in altitude from 700 to 999 m; 2) the plateau ranging from 900 to 2130 m; and the 3) eastern portion of the Owyhee uplift with altitudes from 900 to 2560 m (Rightmire and others, 1976). Both the Bruneau and Snake River valleys are bordered by flat-topped bench plateaus, some of which have been dissected by steep walled canyons and ravines, thus forming buttes. Slopes range from less than 2 percent to vertical (EAR No. 11-010-5-77).

##### (2) Geology

The lithology of the area includes Cretaceous age granite rocks, Miocene age rhyolitic rocks, Pliocene age volcanic rocks, and the Idaho Group of Pliocene and Pleistocene age. The mountainous region is composed of granite core overlain by younger igneous and sedimentary rocks. Mineralized rhyolitic core, overlain by a similar sequence of rocks, characterizes the rolling upland areas. Foothill and lowland areas consist of poorly consolidated sedimentary formations interspersed with basaltic lava.



C. Bruneau-Grandview Study Area



### (3) Soils

The soils in the area of the Bruneau KGRA (known geothermal resource area) are primarily developing in mixed alluvium and lacustrine sediments on stream bottoms, alluvial fans and terrace escarpments. These soils are deep, with few areas that are shallow. Surface textures are dominated by siltloam and loam with minor areas of fine sandy loam, cobbly sandy loam, and silty clay loam. The soils of the area are nearly level to gently sloping, with few steep slopes. Mean soil temperature is approximately 9-11°C with the frost-free period greater than 120 days (BLM, 1977).

#### d. Water Resources

##### (1) Surface

The study area lies primarily in the Bruneau River drainage basin which rises in Nevada's Jarbidge Mountains and flows in a northerly direction to the Snake River in Idaho. The main water sources for agricultural purposes are groundwater and water taken from the Snake River and C.J. Strike Reservoir. Additionally, intermittent feeder streams are used for irrigation and agricultural purposes. The Snake River comprises the entire northern border of the Bruneau-Grand View study area. The Bruneau River drainage area above Hot Spring, Idaho, measures approximately 6810 km<sup>2</sup> with a mean altitude of 1710 m.

The Bruneau River gaging station near Hot Spring yields an average discharge over 38 years of 11.3 m<sup>3</sup>/s with extremes of 0.71 m<sup>3</sup>/s and 184 m<sup>3</sup>/s for 1964 and 1910, respectively. Water quality for 1975-1976 sampling season are as follows: 1) mean conductivity 198 µmhos/cm (standard deviation [s.d.] = 97); 2) mean pH 7.5 (s.d. = 1.3); 3) mean hardness 45 mg/l; 4) mean dissolved solids 121 mg/l (average of 2 sampling periods only); and 5) alkalinity 64 mg/l CaCO<sub>3</sub>. The Bruneau River is under consideration by Congress for addition to the National Wild and Scenic Rivers System, created to assure a heritage of protected waterways.

The Snake River gaging station located near Murphy in the northwestern portion of the study region yielded an average discharge over 63 years of 314.4 m<sup>3</sup>/s with extremes of 110 m<sup>3</sup>/s and 1340 m<sup>3</sup>/s recorded for 1949 and 1918, respectively. Mean water quality data for the 1975-1976 sampling season are as follows: 1) conductivity 460 µmhos/cm (s.d. = 53); 2) pH 6.4 (one sample only); 3) hardness 175 mg/l (2 samples only); 4) dissolved solids 281 mg/l (2 samples only); and 5) alkalinity 161 mg/l CaCO<sub>3</sub> (2 samples only).

## (2) Groundwater

Groundwater resources in the Murphy area have not been developed on a major scale, while both shallow and deep aquifers have been developed in the Grand View area. However, the major development has occurred in the Bruneau region where the deep aquifer has been extensively developed by irrigation wells.

The source of groundwater in the Murphy area is thought to be precipitation on the Owyhee Mountains, with local precipitation making only a small contribution to groundwater recharge. Aquifers in the Murphy area include the Poison Creek Formation, Banbury Basalt, Glens Ferry Formation, and Bruneau Basalt. Water level decline or well interference have not been reported in the area. The temperature of the groundwater ranges from 21 to 32°C. Water quality ranges from poor from the sediments to good from basalt (Ralston and Chapman, 1969).

The groundwater resources in the Grand View area have been developed for both domestic and irrigation usage. The three aquifer systems of importance in the area are: 1) a hot artesian system in the Tertiary Silicic Volcanics; 2) a warm artesian system in the sediments of the Idaho Formation; and 3) a cold water table system in the alluvium and upper portion of the Idaho Formation. The source of groundwater to the deep aquifers is primarily Owyhee Mountains precipitation while some water is recharged from streams flowing over fractured outcrops of the Banbury Basalt. Recharge to the shallow aquifer is directly from precipitation, canal seepage, and sewage and irrigation effluent (Ralston and Chapman, 1969). Wells in the Grand View area include shallow domestic, irrigation, and unused flowing wells. Shallow domestic wells along the Snake River are characteristically less than 15 m deep. It is thought that some of these wells located near Grand View may experience degradation of water quality due to sewage disposal methods. Irrigation well depth varies from 30 to 1097 m, with 50 percent of the wells penetrating the hot (52 to 66°C) artesian groundwater system. Unused flowing wells range in temperature from 27 to 38°C. Declines in water levels in wells of less than 152 m have been reported, indicating that groundwater recharge is not keeping pace with consumption of the resource. Water quality in the area varies, with TDS (total dissolved solids) content ranging from 190-334 mg/l.

The source of groundwater in the Bruneau area is thought to be recharge from the Owyhee Mountains and Owyhee Uplift. The geologic formations important as aquifers include: 1) Tertiary Silicic Volcanics; 2) Banbury Basalt; and 3) the Glens Ferry Formation. Irrigation well

depths vary from 213 to 640 m and exhibit discharges from 6 to 158 lps. Domestic well depths are less than 152 m with their prime water source the Glens Ferry Formation. Annual water level declines have been recorded from 1966 to the present in Little Valley but not in Bruneau Valley. Total dissolved solids for the area range from 200 to 400 mg/l. The thermal groundwater has excessive concentrations of fluorides (Ralston and Chapman, 1969).

In general, groundwater in the Bruneau-Grand View area is derived from Owyhee Mountains rainfall, with a portion being heated at great depths. Due to this thermal effect, higher than normal salinities render the water only fair for irrigation purposes. Soils in the area tend to be fine grained; thus leaching of salts from the soil is limited.

## 2. Natural Environment

### a. Flora

The five vegetative communities in the area include: 1) streamside; 2) sagebrush-grass; 3) shadscale-grass; 4) annual grass and 5) crested wheatgrass seedlings. It is felt that overgrazing disrupted natural sagebrush-grass ecosystems, with resultant invasion by less productive annual grasses such as cheatgrass. The ecosystem is now dominated by an overstory of big sagebrush with an understory of cheatgrass brome (*Bromus tectorum*). Other species include Indian ricegrass (*Oryzopsis* sp.), bottlebrush squirreltail (*Sitanion* sp.) and Sandberg bluegrass (*Poa secunda*). The shadscale-grass ecosystem is dominated by shadscale (*Atriplex confertifolia*) with an understory of cheatgrass. The annual grass system exists as a function of fire-altered shrub-grass ecosystems. Characteristic species include cheatgrass and tumble mustard (*Sisymbrium altissimum*). Crested wheatgrass (*Agropyron desertorum*) has been introduced following overgrazing and range fires to prevent erosion and promote livestock grazing. The streamside vegetation includes willows (*Salix* sp.), cottonwood (*Populus* sp.), wild rose (*Rosa woodsii*), golden gooseberry (*Ribes grossularia*), chokecherry, poison ivy (*Roxicodendron radicans*), elderberries (*Sambucus coerulea*), currants (*Ribes satium*), honeysuckle (*Lonicera* sp.), yellow foxtail (*Alopecurus* sp.), sagebrush, grasses, and yarrow.

### b. Fauna

A large variety of wildlife inhabits the area, including ruminants, large predators, song birds, raptors, reptiles, and waterfowl and upland game birds. Mammal species include (but are not limited to) the mule deer, pronghorn antelope (*Antilocarpa americana*), yellow bellied

marmot, coyotes, bobcats, jackrabbits (*Lepus townsendii*), ground squirrels, and mice (*Perognathus* sp., *Reithrodontomys* sp., and *Peromyscus* sp.). Numerous passeriformes are found in the area. Raptors include (but are not limited to) the bald eagle, golden eagle, prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and great horned owl (*Buteo virginianus*). Waterfowl include Canadian geese (*Branta canadensis*) and Mallard ducks. Representative game species are chukars, Hungarian partridge, and pheasant. Reptiles include numerous snakes, frogs, and lizards; rattlesnakes are very common.

Little is known of energy flow through the food web; however, the diversity and abundance of plant and animal species indicate a complex, rather stable ecosystem with all major ecological compartments well represented.

### c. Aquatics

Abundant plant and animal species occur within streams of the study area. Trout and whitefish are found in the Bruneau River. Additionally, area streams support warm water fish populations, of which largemouth bass, bluegill (*Lepomis macrochirus*), yellow perch (*Perca flavescens*) and channel catfish are representative. Insect species include caddisflies (Trichoptera), mayflies (Ephemeroptera), stone flies (Plecoptera), and snails (scientific taxa not known). Aquatic flora are abundant, including several algal species, cattail (*Typha* sp.), duckweed (*Lemna* sp.), and spike rush (*Eleocharis* sp.).

## 3. Cultural Environment

### a. Land Use

The land in the area is owned primarily by the Bureau of Land Management (BLM) which administers 77 percent of Owyhee County's 1,975,256 ha, 7 percent is state owned, and 16 percent is owned privately. Irrigated land in the area is very limited (approximately 18,650 ha) and is adjacent to the Snake River, Bruneau River, or Little Valley Creek with the major crops being potatoes, alfalfa, sugar beets, corn, and small grains. Little arable land exists in the Bruneau-Grand View area and is found only along the Snake River, Little Valley Creek, and Bruneau River. Approximately 37,300 ha east and west of Bruneau have been identified as a proposed area for new irrigation development between 1974 and 2020 (BLM, 1976). Ninety-three point five percent of Owyhee County is utilized for rangeland, 2.1 percent is forest land, and 3.9 percent is agricultural land.

## b. Socioeconomics and Demography

Owyhee County, with 7900 persons in 1976, comprises less than one percent of the state's total population. Both the birth and fertility rates exceed those for the state and nation. In 1976, 5.5 percent of the labor force was unemployed. Employment data report that 2,512 people were employed in 1975. The greatest number of people are employed as farm labor, followed by state and local government, trade, and services. Median family income in 1976 was \$7,875. A total of 235 criminal offenses was reported for 1976, 74 percent of which were attributable to larceny. Suicide rates were quite high in 1975: 165 percent of the state rate. Marriage and divorce rates are both low, only 37 percent and 19 percent of state values, respectively.

## c. Archaeological and Historical

The Oregon Trail runs through the study area south of the Snake River, with wagon wheel ruts still evident in many areas. Silver mining in the 1860's in Owyhee County was responsible for the first large-scale permanent settlement in the state, with farming, banking, and commerce responding to the population growth (BLM, 1976).

## d. Aesthetic Values

The C.J. Strike Recreation Area lies within the study region; however, no wilderness or Rare II regions have been designated. The Bruneau Dunes State Park is also located within the study area and is used for recreational purposes.

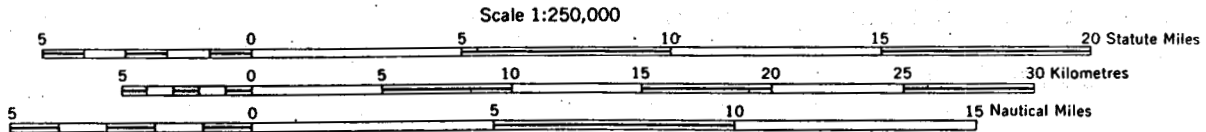
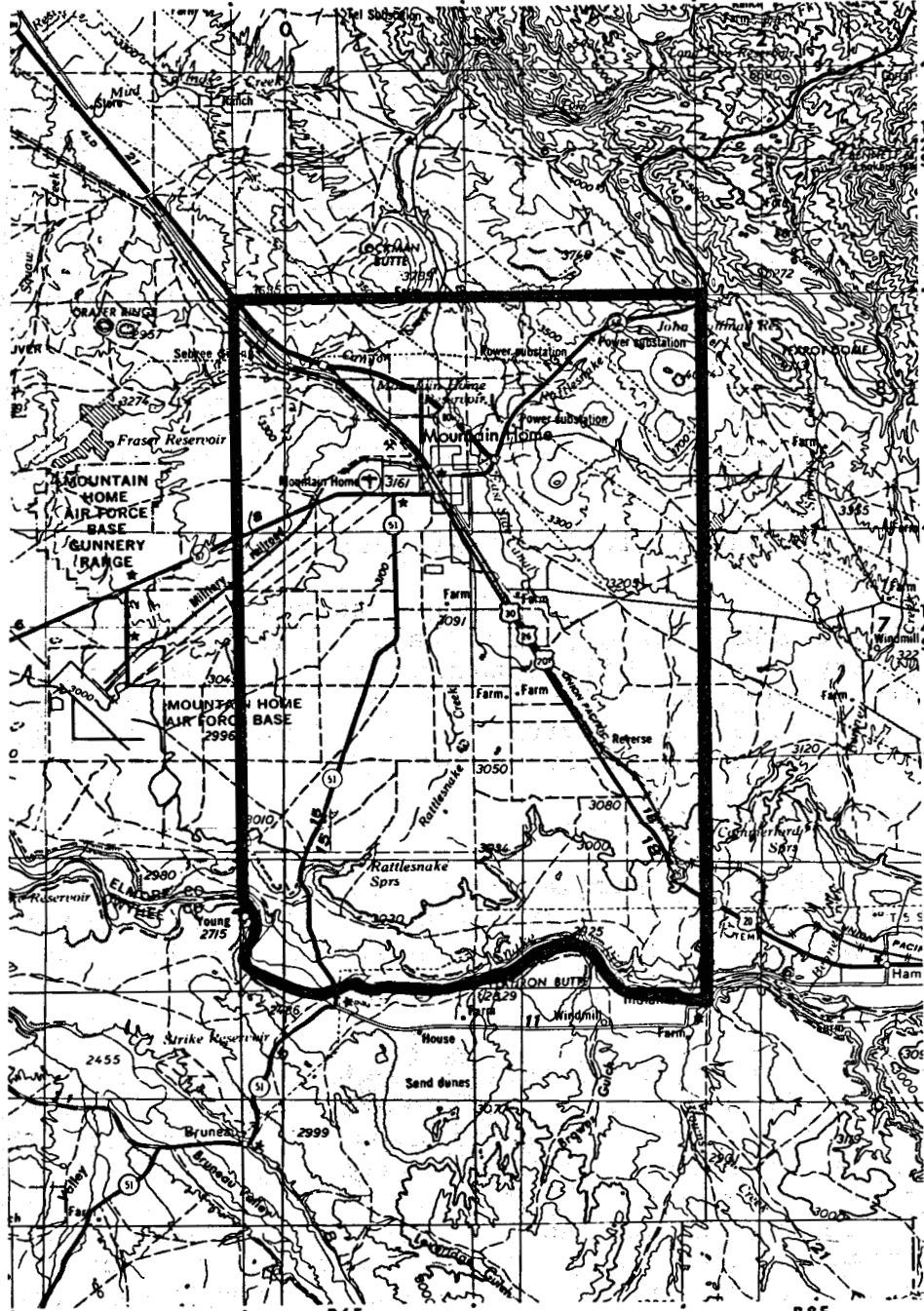
A significant feature in the study area is the Snake River Birds of Prey Natural Area (BPNA), established by the Secretary of the Interior in 1971 to protect eagles, hawks, owls, falcons, vultures, and ospreys. The BPNA encompasses 12,546 ha, 10,522 ha of which is federally owned. The excellent raptor habitat is provided by the rugged river canyon and is utilized as a recreational resource by large numbers of visitors. For the 14 species of raptors sighted at the BPNA, the BLM protects vital habitat and nesting grounds.

## D. MOUNTAIN HOME

### 1. Physical Environment

#### a. Climate

Mountain Home is located in Elmore County in southwestern Idaho in a semiarid region characterized by hot



CONTOUR INTERVAL 200 FEET  
 WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS  
 TRANSVERSE MERCATOR PROJECTION

D. Mountain Home Study Area

summers and cool winters. The average annual temperature is approximately 10°C with the mean annual precipitation estimated as 24 cm. Extreme recorded temperatures are -37 and 43°C.

#### b. Air Quality

Prevailing wind currents are from the northwest, east, or southeast. Wind speeds average less than 9.6 km/hr (kilometer per hour) 39 percent of time and 11-24 km/hr 41 percent of the time (Longyear and others, 1978). Air quality is considered very good, with agricultural particulates contributing to the ambient air load during certain seasons. No significant point sources exist for NO<sub>x</sub>, SO<sub>x</sub> hydrocarbons or CO; thus preservation of air quality is an important consideration in the area.

#### c. Land Resources

##### (1) Topography

The Mountain Home area lies north of the Snake River in the western part of the Snake River Plain. Geographic features in the area include: 1) the Mt. Bennett Hills, 2) the Mountain Home Plateau, and 3) the Snake River Canyon. The Mt. Bennett Hills are a high relief mountain range north of the city of Mountain Home, with an average elevation of 1828 m. The Plateau ranges from 1219 m adjacent to the Mt. Bennett Hills to 914 m near the Snake River. The Snake River Canyon drops 91-152 m below the plateau to the Snake River.

##### (2) Geology

The study area is located between the central Idaho Tertiary and Cretaceous granitics and the Tertiary and Quaternary rocks of the Snake River Plain to the west. Mountain Home lies on the northwest-southeast trending fault that marks the relatively abrupt transition zone northwest of the KGRA near Boise. The major hot springs in the area are controlled by faulting. The lithologic types found in the Mountain Home area are Pliocene and Pleistocene sediments, Pleistocene Basalts, and Tertiary silicic volcanics overlying Cretaceous granite. The silicic volcanics are Miocene Rhyolites. The Idavada volcanics underlying the Idaho group are considered to be the most important aquifer and the source of hot water. The Idavada volcanics are lower silicic volcanics, and generally the water produced from the complex are at significantly higher temperatures than those at nearby wells from overlying units.



### (3) Soils

Only limited, generalized soil data are available (BLM, 1976) to assess soil types and characteristics. The frost free season is approximately 120-140 days. Agricultural products include cereals, alfalfa, and potatoes, with 70 percent of such crops irrigated. Surface soils are primarily silt loam on clay or silt loam with profile depths ranging from 3 to 18 m. Parent materials include loess, a basic igneous rock (35 percent), and alluvium (45 percent). Water retention capabilities range from low on the surface to good at greater depths. Major soil problems are associated with drought, erosion, soil alkalinity, and inability of roots and water to penetrate clay subsoils. Rangeland management is currently employed to minimize problems associated with erosion.

#### d. Water Resources

##### (1) Surface Water

The Snake River comprises the entire southern boundary of the study area. An important surface water feature is Canyon Creek, which flows southwesterly from Long Tom Reservoir to the Snake River; however, no water quality data are available for either the reservoir or river. Surface runoff from the Mt. Bennett Hills is ultimately to Canyon Creek and is regulated by Long Tom Reservoir. Irrigation waters are drawn from the Mountain Home Feeder Canal, Canyon Creek, Rattlesnake Creek, Bennett Creek, Cold Springs Creek and King Hill Creek. Data for the Murphy gaging station on the Snake River are included in the Bruneau-Grand View section of this report.

##### (2) Groundwater

Groundwater resources have been developed for both domestic and irrigation purposes. Ralston and Chapman (1968) studied the hydrology of the Mountain Home area and subdivided the region into five areas based on water levels, well yield, water temperature, water quality, geologic character of the aquifer. The subdivisions are summarized as follows: 1) the Mt. Bennett Hills subarea, 2) Hot Springs, 3) Mountain Home, 4) Air Base, and 5) Glens Ferry.

The Mt. Bennett Hills region is the primary area for recharge to the Mountain Home plateau aquifers.

The Hot Springs region runs along the Mt. Bennett Hills and includes a hot artesian groundwater system. Hot Springs has an estimated natural discharge of 35 lps with a mean temperature of 66°C. Groundwater

recharge is thought to be from precipitation, irrigation seepage and streamflow; however, little of the recharge enters the warm water system. Hot water (38-71°C) has been reported at three locations at three water level elevations, indicating a series of subparallel northwest trending faults. The faults are believed to allow the downward flow of cold recharge water and the upward flow of heated water and steam. The cold groundwater system is limited in the region.

The Mountain Home area surrounds the city of Mountain Home with both domestic and irrigation water derived from the aquifer. Sources of recharge include precipitation, streamflow, irrigation seepage, and sewage effluent. The aquifer has been well developed for both irrigation and domestic purposes, with wells ranging in depth from 1.8-183 m.

The Air Base area (adjacent on the west side of the Mountain Home area) includes the groundwater system south and west of Mountain Home as well as the deep wells developed in the city of Mountain Home. Recharge to the area is limited as a function of low precipitation and the deep static water level. An estimate of well development puts the number of wells for irrigation, municipal, and domestic use at 50, ranging in depth from 122-274 m. Water temperatures are generally uniform, in the 21-24°C Range.

The Glenns Ferry area (adjacent on the east side of the Mountain Home area) is north of the Snake River and surrounds the towns of Hammett and Glenns Ferry. Groundwater recharge within the area is minimal, with streamflow, irrigation seepage, and precipitation as sources. Groundwater resources have not been extensively developed, with most wells located along the Snake River, ranging in depth from 3-439 m. Shallow wells tap the cold water aquifer while deeper wells penetrate the warm (70-100°F) aquifer system. Indications are that a deep groundwater gradient towards the Snake River exists, with aquifers discharging into the river.

In summary, the main sources of groundwater are the Bruneau and Glenns Ferry Formations with their basalts and fine-grained sediments, respectively. Available records do not indicate declines in groundwater levels; however, data are limited.

## 2. Natural Environment

### a. Flora

The study region is characterized by modified sagebrush-grass communities, typically found along unculti-

vated portions of the Snake River Plain. Annual grasses found with sagebrush include Western cheatgrass, filagree (*Erodium cicutarium*), balsamroot (*Balsamorhiza hookeri*). Shadscale is found on saline or heavier soils. Crested wheatgrass is common. Information indicates that three plants on the endangered or threatened list have been found in the western portion of the Snake River Plain: Henderson's desert parsley (*Lomatium hendersonii*), loco weed (*Astroagalus comptopus*) and pepper grass (*Lepidium montanum*), however, it is not known if these species are in the Mountain Home study area. Juniper (*Juniperus* sp.) trees are found within the Snake River canyon. Greasewood and rabbitbrush are found adjacent to streams, ponds, and river.

#### b. Fauna

Examples of animal species that inhabit the sagebrush-grass communities include Richardson's ground squirrel (*Citellus richardsonii*), kangaroo rat (*Dipodomys* sp.), sagebrush vole (*Lagurus curtatus*), jackrabbit, mule deer, pronghorn antelope, golden eagle, Swainson's hawk (*Buteo swainsoni*), and sparrow hawk (*Falco sparverius*). Game birds include sage grouse (*Centrocercus urophasianus*), chukar, pheasant, and mourning dove (*Zenaidura macroura*). Reptiles include sagebrush lizard (*Sceloporus graciosus*) and striped whipsnake (*Masticophis taeniatus*).

#### c. Aquatics

The variety in habitat types renders the area suitable to diverse and abundant aquatic communities. Both native and introduced fish species are found in the Snake River. Native species include rainbow trout, cutthroat trout, and mountain whitefish. Introduced species include brown trout (*Salmo trutta*), largemouth bass, bluegill, channel catfish, carp, and suckers. Freshwater clams and molluscs are expected to occur in the Snake River since a diverse variety of habitats are available. Insect species include mayflies, midges (Piptera), caddisflies, and beetles (Coleoptera).

### 3. Cultural Environment

#### a. Land Use

Land in the Mountain Home study area comprises approximately 55,944 ha, of which 18,648 ha is federally owned (BLM), 9,324 ha is state owned, and 27,972 ha is under private ownership. The area was heavily grazed by sheep prior to the advent of high lift pump irrigation practices which rendered such ventures profitable. Land use within Elmore County in 1976 was as follows: 66 percent rangeland, 26 percent forest land, 7 percent agricultural land, 1 percent water, and 0.6 percent urban or built-up.

## b. Socioeconomics and Demography

The Mountain Home study area is located entirely within Elmore County, with socioeconomic data available only on a county-wide basis. The population of Elmore County was 19,500 people in 1976, or 2.34 percent of Idaho's total. The population density increased from 5.7 km<sup>2</sup> in 1950 to 16.6/km<sup>2</sup> in 1976. The birth rate for the county was 28.0 in 1975, as compared with a state rate of 19.8. The fertility rate is quite high, 127.9 in 1975 as compared to Idaho and U.S. rates of 92.0 and 66.7, respectively.

Unemployment is steadily rising; the 1970 average was 3.9 percent and rose to 7.4 percent in 1976. Wage and salary employment indicate the greatest number of people are employed by the military (Mountain Home Air Force Base employed 3,935 people in 1975); followed by federal civilians (1,027); trade (808); state and local government (786); farm (636) and services (389); trade, commerce and public utilities (276); and finance, insurance and real estate (203). The 1976 HUD (Housing and Urban Development) estimate for the median family income was \$10,125.

Health care in the county is comparatively poor. The average number of persons per medical doctor was 4,950 in Elmore County for 1975, as compared to 969 for the state average. Two hospitals are located in the county with 77 acute care beds.

Criminal offenses rose from 464 in 1973 to 555 in 1976. In both years, larceny was the prime offense and rose from 63 to 71 percent of the total offenses. No murders were reported in 1973 with two committed in 1976. The suicide rate of 15.2/100,000 persons in 1975 was very close to the state rate of 16.4/100,000.

## c. Archaeological and Historical

Both the Oregon Trail and Kelton Road are historical markers of importance in the Mountain Home study area and run through the northeast portion of the region. There is no archaeological survey recorded; however, the probability of archaeological sites is very high and likely cover a time span ranging from prehistoric times to the present.

## d. Aesthetic Values

A rural and open space atmosphere predominates in the study area. Mountains to the north and the Snake River Plain to the south and east comprise the scenery. Island Crossing State Park is located within the region and has facilities for overnight camping. No wilderness or Rare II lands are found within the Mountain Home area of concern.

## E. BLUE GULCH, TWIN FALLS, AND ARTESIAN CITY

### 1. Physical Environment

#### a. Climate

Normal annual precipitation ranges from 20 cm in the Blue Gulch area to 30 cm near Artesian City. With only 20 cm of precipitation, the Blue Gulch area is one of the driest parts of the Snake River Plain. Most of the precipitation in the area falls as snow during the winter months. The source of this precipitation is storms originating off the Pacific Coast; as a result, rain and snowfall patterns are erratic. Summers are generally warm and dry, with mean temperatures of 21°C and ranges of -6 to 36°C. Although local wind patterns are affected by topography, winter winds are generally southeast winds, while summer winds generally trend from the northwest.

#### b. Air Quality

Air quality in this part of the Snake River Plain is good, although particulates are sometimes high in a general area north and east of Blue Gulch. There are no large point sources of significant air pollution in the area, even near Twin Falls. The annual geometric mean particulate level at two stations in Twin Falls in the period from 1971 to 1974 averaged 94  $\mu\text{g}/\text{m}^3$  during the same period.

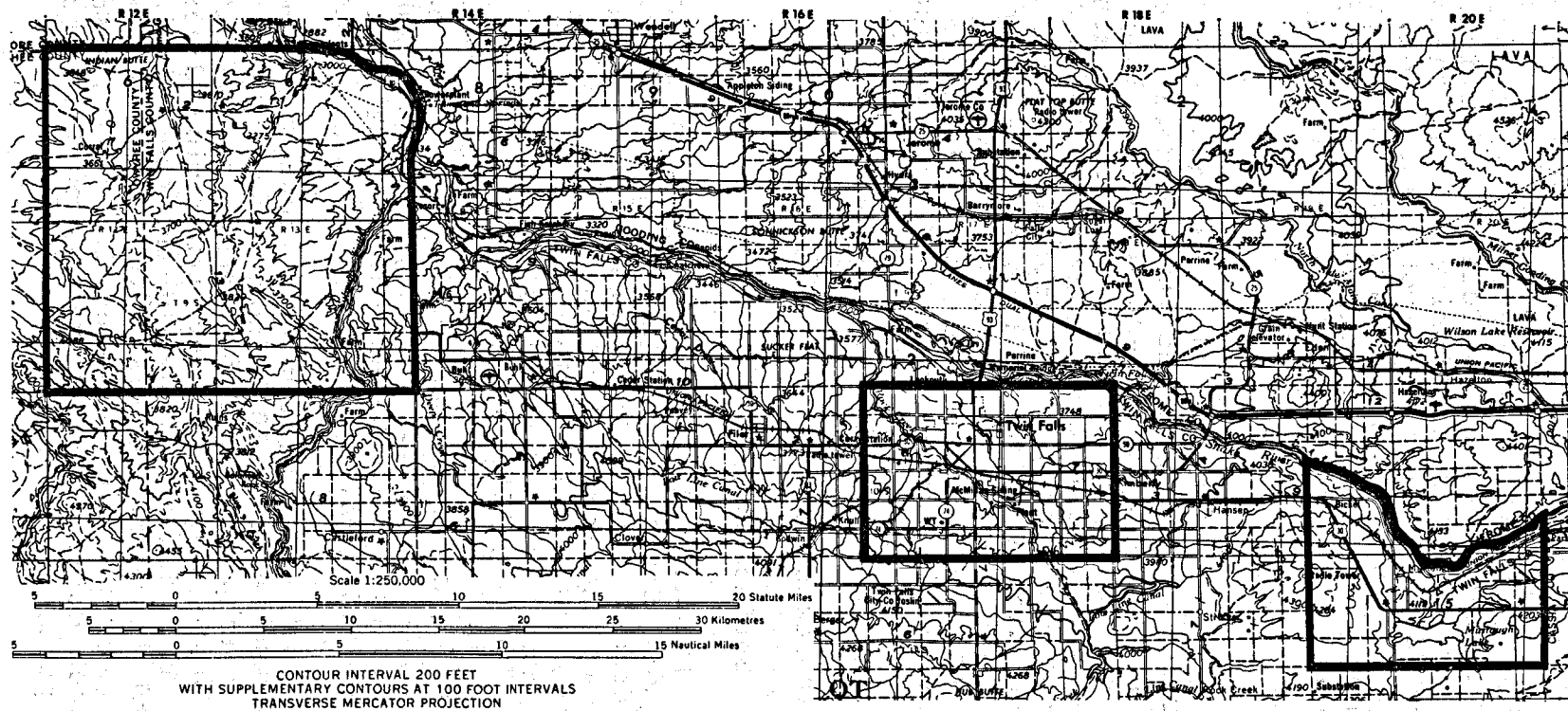
#### c. Land Resources

##### (1) Topography

The three areas under consideration lie on the southern edge of the Snake River Plain and are bounded on the north by the canyon of the Snake River. Elevations range from 880 m at the mouth of Salmon Falls Creek to 1275 m at Artesian City. The Blue Gulch and Twin Falls areas are relatively flat with gradients of approximately 12 m/km. Artesian City lies at the base of the foothills of the Rock Creek Hills. Monument Peak, 32 km south of Artesian City, has an elevation of 2400 m.

##### (2) Geology

Blue Gulch, Twin Falls, and Artesian City lie in the eastern Snake River Plain geomorphic province. This area is geologically unique, characterized by horizontal flows of basalt. The surface of the plain is a youthful lava plateau partially covered with loess. Basalt flows on the plain can be classified in two age groups: older Miocene-Pliocene and younger Pliocene-Recent. Surface flows



E. Blue Gulch, Twin Falls, and Artesian City Study Areas

through most of the area consist of lower Pleistocene to Pliocene basalts and associated tuffs. A small area of Pliocene olivine basalts occurs along the canyon of the Snake River from Twin Falls to the mouth of Salmon Falls Creek. Some Pleistocene and Pliocene colluvium, fan-glomerate, and stream and lake deposits overlie the basalts northwest of the lower portion of Salmon Falls Creek. Major faults occur in two locations: parallel to the Snake River across the Salmon Falls Creek Canyon and trending north and northwest along the northern edge of the Rock Creek Hills.

### (3) Soils

Soils throughout the area consist primarily of loess of varying depths over basalts. Mineral fertility is generally high but organic content is low. Along stream valleys, alluvial deposits overlie alluvial outwash from mountains to the south. Siltloams, ranging in depth from 25 cm to 150 cm, overlie bedrock on gentle to moderate slopes in both the Blue Gulch and Twin Falls areas. Forty percent of soils in the Artesian City area are a fine-loamy mixed soil while 20 percent are a fine montmorillonitic soil. These soils range in depth from 40 cm to 100 cm. Permeabilities in all soils range from slow to moderate and the most significant soil problem is erosion.

#### d. Water Resources

##### (1) Surface Water

Primary streams in the areas under consideration include: Snake River, Salmon Falls Creek, Rock Creek, and Dry Creek. Salmon Falls Creek flows through the Blue Gulch area to the Snake River and drains an estimated 5490 km<sup>2</sup> of Idaho and Nevada. Flow in the creek is regulated at the Salmon Creek Reservoir 71 km upstream from the mouth. Except for significant leakage all of the water supply above this dam is diverted for irrigation. Diversions below the dam are used to irrigate land outside the drainage basin. Average discharge at the mouth of Salmon Falls Creek is 4.87 m<sup>3</sup>/s and extremes at this point are 0.34 m<sup>3</sup>/s and 38.5 m<sup>3</sup>/s.

Rock Creek drains an estimated 483 km<sup>2</sup> and discharges to the Snake River 10 km northwest of Twin Falls. Flow in the creek is partially regulated by a fish hatchery and irrigation waste flow and many irrigation diversions exist upstream. The mean discharge for the creek during the period of record (1 year) is 6.6 m<sup>3</sup>/s, and the extremes during this period were 2.6 m<sup>3</sup>/s and 13.5 m<sup>3</sup>/s. Monthly flows in the creek during that year differed from the mean by less than 50 percent.

During low flow years, all flow is topped in the Snake River at Milner Dam, 19 km northeast of Artesian City. The largest inflow below the dam is Thousand Springs which contributes an estimated 184 m<sup>3</sup>/s to the river as inflow from the Snake River Plain aquifer. The water quality of the Snake River declines gradually as it flows west through the area receiving pollutants from agricultural activity, industrial processing plants, and untreated domestic water return. Twin Falls has been listed by the EPA as needing improved waste treatment facilities. Nitrate and phosphate in the river from natural and manmade sources contribute to periodic excessive algal and weed growth. The only lake occurring in the area is Murtaugh Lake in the Artesian City area. This manmade lake is on Dry Creek and has a surface area of approximately 250 ha. Surface water quality for streams in the area is shown in Table E-1.

TABLE E-1  
SURFACE WATER QUALITY  
(mg/l)

	Salmon Falls Creek	Snake River (Kimberly)	Snake River (King Hill)
Ca	70	45	47
K	7.8	5.2	4.5
Mg	23	19	18
Na	53	31	27
Cl <sup>-</sup>	41	24	23
F <sup>-</sup>	0.9	0.5	0.7
HCO <sub>3</sub> <sup>-</sup>	239	200	187
SO <sub>4</sub> <sup>-2</sup>	111	47	45
TDS	480	289	298
TSS (Total Suspended Solids)	103	--	27
pH	8.6	8.7	8.5
Specific Conductance	766	468	434

## (2) Groundwater

Groundwater occurs in the basalts and alluvial deposits throughout the area. Depths to water range from 24 m in the Rock Creek Basin to 40 m at Artesian City, to 50 m near Kimberly, and as much as 240 m in the Blue Gulch area. The few functioning irrigation wells in the Salmon Falls Creek basin are near the Salmon Falls Reservoir. Groundwater outflow at Thousand Springs provides water from one of the world's most extensive aquaculture programs. Water from the springs has significantly better quality than surface water or groundwater on the south side of the Snake River.



Because of limited water supply and extensive use of groundwater for irrigation, three areas have been designated critical groundwater areas by the Idaho Department of Water Resources. This designation effectively closes these areas to further applications to appropriate groundwater. The three areas included are:

Artesian City - 14,500 ha (est.) including land in T. 11 and 12 S., R. 19 and 20 E., B.M. Nearly all land included in the geothermal area of interest is included in the critical groundwater designation.

Cottonwood - 16,000 ha (est.) adjacent to the Artesian City area on the south.

Blue Gulch - 76,000 ha (est.) on the west side of Salmon Falls Creek. All but approximately 2000 ha of the Blue Gulch geothermal area is included in this designation.

## 2. Natural Environment

### a. Flora

Native vegetation in undisturbed areas is classified in the sagebrush association. Primary species found in the area are big sagebrush and cheatgrass. Early records indicate that much of the area was once covered with bunchgrasses and some sagebrush. Heavy use of the area by livestock led to the establishment of the present native species. A small stand of pinion-juniper is located just southeast of Artesian City. Where native vegetation has been disturbed, areas have been reseeded with crested wheatgrass. Much of the land in the areas of interest is currently cultivated.

### b. Fauna

Major habitat areas that have been identified include: deer habitat along the lower 10 km of Salmon Falls Creek, birds of prey habitat along the canyon of the Snake River, a curlew habitat area southwest of Twin Falls, and a high density of rough-legged hawks and chukar partridge in the Salmon Falls Creek Canyon. Animals well adapted to the sagebrush habitat include the Richardson ground squirrel, Great Basin kangaroo rat, sage grouse, vesper sparrow, and sagebrush lizard. Year-round residents of the area include the coyote, ground squirrel, blacktail jackrabbit, golden eagle, sparrow hawk, pheasant, house finch, and horned lark. Snakes, particularly the western rattlesnake, the pygmy rabbit and the Ord kangaroo rat are declining as native habitats are converted to cropland.

### c. Aquatics

Aquatic plants, including duckweed, cattail, sedge (*Carex*), and a common reed (*Phragmites*), are common in streams throughout the area. The Snake River has annual extensive algal blooms. Construction of dams on the Snake river has replaced free-flowing habitat preferred by cold-water game fish with lake-like situations. Small numbers of rainbow and cutthroat trout are native in this stretch of the river. Suckers and squawfish thrive in the reservoirs. Sixteen species of fish have been identified by the Idaho Fish and Game Department in the Snake River below Shoshone Falls and eleven species have been identified above. Trout occur in both sections, while coho salmon (*Oncorhynchus kisutch*) occur only in the upper section. Sunfish (*Lepomis* sp.), catfish, and sucker are common in the lower section.

### 3. Cultural Environment

#### a. Land Use

Arable land occurs on both sides of the Snake River and along its tributaries. The Salmon Falls Creek drainage contains an estimated 82,000 ha of arable land. Cultivation of these lands is limited by availability of water. Approximately 80 percent of the croplands in the area are irrigated. Most of the Artesian City area, acreage south of Twin Falls, and the western part of the Blue Gulch area are included in proposed areas for new irrigation development in the next 30 years.

Most of the land being considered is privately owned and used for grazing and crop production. Intermittent areas of private ownership are generally associated with the livestock industry, mining, and recreation. Approximately 37,300 ha of BLM land, 1550 ha of state land (school endowment), and 4150 ha of private land occur in the Blue Gulch area. No nonprivate land occurs in either the Artesian City or the Twin Falls area. The metropolitan area of Twin Falls includes about 1500 ha.

#### b. Socioeconomics and Demography

The three areas under consideration are in Twin Falls County, which has a population of 47,300 (1976). Towns included in these areas are Twin Falls (1970 population 21,194), Kimberly (1970 population 1,557), and Murtaugh (1970 population 124). The population density of the area is nine people/km<sup>2</sup>. The birthrate and fertility rate for the county are 20.6 and 98.8, respectively, and compare to values of 19.8 and 92.0 for the state and 14.8 and 66.7 for the United States. The number of new housing units authorized annually increased from 85 in 1971 to 221 in 1976

in Twin Falls and from 1 to 23 in Kimberly during the same period. The unemployment in the county in 1976 was 6.2 percent, an increase of 1.6 percent over the 1970 value. The main employers in the county are trade, services, non-farm proprietors, and manufacturing. Larceny and burglary accounted for 84 percent of all crimes in 1976.

#### c. Archaeological and Historical

This area of Idaho contained great cultural diversity during the late prehistoric and early historic periods. Several distinct Indian groups inhabited the Snake River Plain in the recent past. Although only limited archaeological surveys have been conducted in the area, indications are that the western Snake River Plain is exceptional in its potential to yield archaeological data of major scientific significance.

Fur trappers were the first white people in the area in any number. Immigration in the 1840's, 1850's, and 1860's brought thousands of people through the area, however, permanent settlements were slow in developing. Farming began in the late 19th century. Historical areas are generally associated with the immigrant trails, and a segment of the Oregon Trail at the mouth of Salmon Falls Creek is being considered for historical status. The only other historic or natural area in this region is the Hagerman Fossil Natural Area established by the BLM in the Blue Gulch area.

#### d. Aesthetic Values

Recreational and/or aesthetic sites in the three study regions are diverse. Balance Rock is a scenic anomaly located on Salmon Falls Creek Canyon near Blue Gulch and is quite unusual and picturesque. The Snake River Canyon through Twin Falls plunges with sheer cliffs and dropoffs and is quite magnificent. Murtaugh Lake located near Artesian City is utilized for recreational purposes. As is true for most of Idaho, the open, rolling land and clean, fast rivers afford the viewer a sense of solitude and freedom in an area not yet overpopulated with resultant industrial development and environmental degradation.

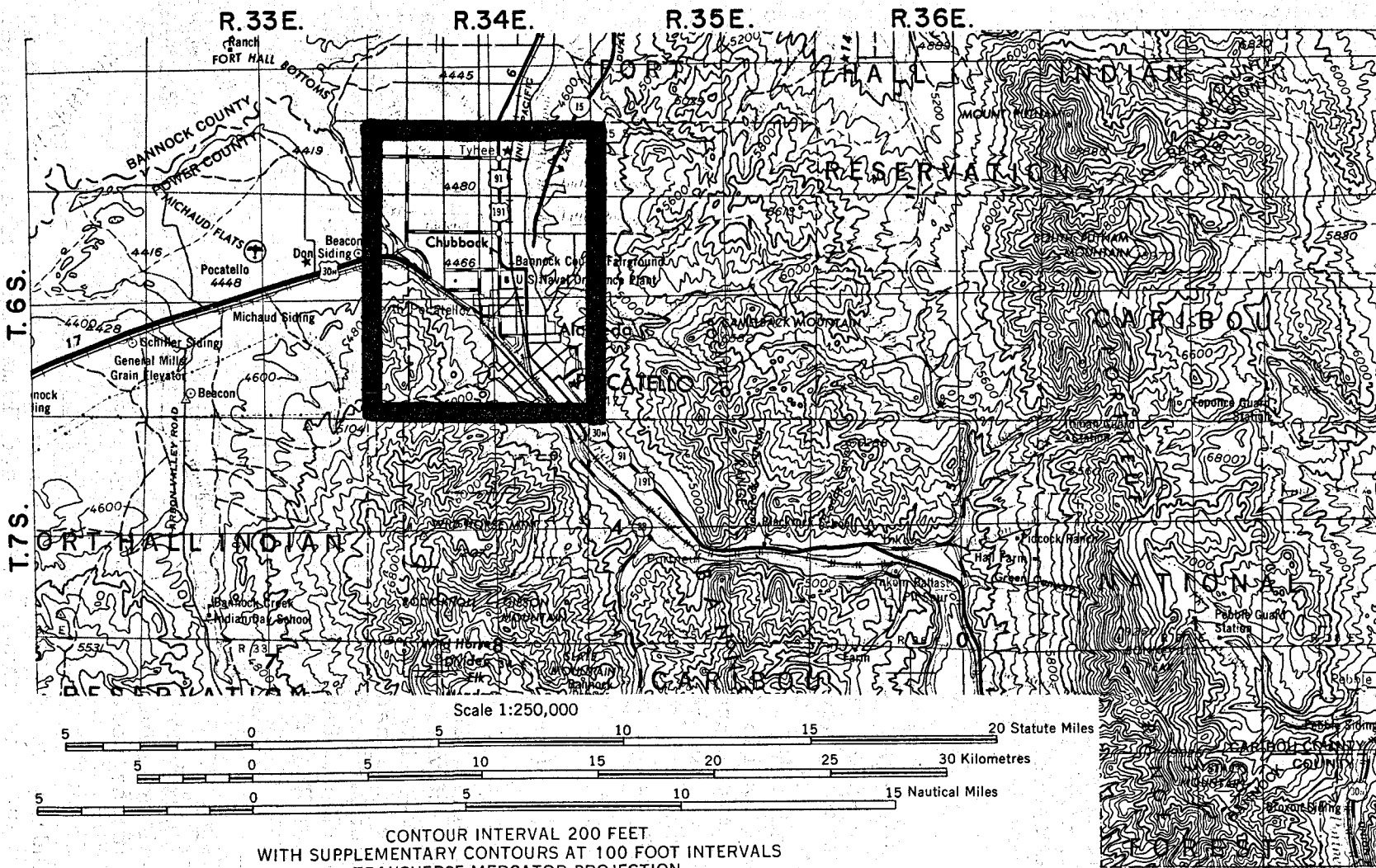
### F. POCATELLO

#### 1. Physical Environment

##### a. Climate

Pocatello is located in the southeast corner of the Snake River Plain where the climate is a middle-latitude steppe type. Spring months are the wettest and windiest,

-379-



F. Pocatello Study Area

while cool nights and warm days predominate during the summer. Percent of possible sunshine averages over 80 percent in July, August, and September. General snowcover begins in December and freezing temperatures occur until May. Mean monthly temperatures range from  $-4^{\circ}\text{C}$  in January to  $23^{\circ}\text{C}$  in July. Maximum and minimum recorded temperatures are 40 and  $-34^{\circ}\text{C}$ . Wind directions reflect the orientation of nearby mountain ranges, with over 50 percent of the winds originating in the southwest quadrant. Thirty percent of wind speeds are less than 2 m/s, while 5 percent occur within the 2 m/s to 6 m/s range. Relative humidity exceeds 30 percent only a third of the time during July and only a half of the time in January. Average potential evapotranspiration exceeds the average precipitation all months except November, December, January, and February (USFS, 1977).

#### b. Air Quality

The primary sources for air pollution in the Pocatello area are the phosphate and elemental phosphorus plants west of the city. Air quality measurements that have been taken have been directed at characterizing the effluents from these plants. The annual geometric mean of suspended particulates from four Pocatello stations ranged from 41 to  $145\ \mu\text{g}/\text{m}^3$  during the period from 1971 to 1974. The primary and secondary standards for suspended particulates are exceeded at 1 km from the plants. During a ten-month period in 1972 and 1973, the 24-hour standard for sulfates was exceeded 14 times.

#### c. Land Resources

##### (1) Topography

Elevations in the area of interest range from 1700 m in the southwest to 1340 m along the lower Portneuf River near its confluence with American Falls Reservoir. The city of Pocatello has an elevation of 1360 m. Here the canyon of the Portneuf River meets the southeast boundary of the Snake River Plain. The foothills of the Bannock Range are southwest of the city and the Pocatello Range is to the east.

##### (2) Geology

Pocatello lies within the margin of the middle Rocky Mountain Province typified by complexly folded and faulted ranges of the extreme southeastern Snake River Plain of the Columbia Intermountain Province.

Beginning in the Precambrian, the area surrounding Pocatello lay within a geosyncline into which vast amounts of sand, shale, and limestone were deposited.

These sediments underwent metamorphism to produce quartzites, argillites, and marbles now exposed in the ranges southeast of Pocatello. During early Paleozoic era a geosyncline reappeared collecting sand shales and limestones. The relative coarseness of these sediments exposed suggest that the Paleo shoreline was very near the Pocatello area.

Beginning in late Cretaceous, major folding and faulting (including thrust faulting) warped and broke great thicknesses of sediments in southeastern Idaho, moving rock units from west to east. The most noticeable in the area is the Bannock Overthrust extending from Idaho Falls southward near Pocatello to the Idaho-Utah border. Subsequently, basin and range structures developed, related to those of the Great Basin in Utah and Nevada.

At the same time, the introduction of felsic and basaltic lava began on the Snake River Plain. The tunnel of the newly forming Snake River Plain cut across the northwest trending landforms developed from Laramide and Basin and Range Structures and is now the most prominent physiographic element in the area. By late Pliocene, pediment fans began to encroach on the newly developed basins. Concurrently, tension faults allowed lava to again spread across the countryside. The most notable in the area are those flows now exposed at Ross Park in Pocatello. The distribution of these flows with the forthcoming glacial activity prompted damming of the major drainages including the Snake River and the outlet of Pluvial Lake Bonneville. Numerous lake bed deposits are identified northwest of Pocatello in the area where American Falls Reservoir is now located. To the south, Lake Bonneville was filling due to the increased precipitation and decreased evaporation until the water level overlapped Red Rock Pass. Enormous volumes of water swept down Marsh Creek and the Portneuf River to the Snake River. As the flood waters entered the Snake River Plain, their energy decreased leaving large boulder and gravel deposits which now skirt the foothills and mountains flanking Pocatello.

### (3) Soils

Soils in the Pocatello area are generally loess deposited on bedrock of Snake River Basalt and the Salt Lake Formation. Slopes of the foothills are moderately stable and depth to bedrock usually exceeds 3 m throughout the area. Surface soils are primarily silt loams and subsoils range from silty clay loams to heavy silt loams. Natural vegetation occurring on these soils include sagebrush, grasses, and mountain brush. Soils near the processing plants west of Pocatello show increased concentrations of trace elements.

d. Water Resources

(1) Surface Water

The Portneuf River is the primary stream in the area, draining approximately 3300 km<sup>2</sup>. It rises on the Ft. Hall Indian Reservation approximately 38 km northeast of Pocatello and flows south to Lava Hot Springs. Here, it turns west through a gap in the Portneuf Range, then flows north for 18 km. At its confluence with Marsh Creek, the main tributary of the Portneuf, the river turns to the northwest and empties into the American Falls Reservoir. Flows in the river are regulated by the Portneuf Reservoir and the Chesterfield Reservoir. Diversions from the river are used to irrigate an estimated 17,000 ha upstream from Pocatello. The average flow of the Portneuf at Pocatello is 7.6 m<sup>3</sup>/s and the extremes during the 63-year period of record are 84.7 and 0.01 m<sup>3</sup>/s. In the 1976 water year, 42 percent of the total flow of the river occurred in April and May. Streams draining the Pocatello Range flow into the Fort Hall Main Canal, from which a series of laterals run to the west across the area of interest. Uses of surface water include municipal, industrial, irrigation, domestic use, stock watering, recreational use and power generation. Patterns of streamflow are affected by regulation of supply for these uses.

Quality of the Portneuf River in the area of interest is shown in table F-1. Sources of inflow in this section of the river include an oil separation plant, elemental phosphorus and fertilizer plant effluent, sewage treatment plant, springs, and a fish hatchery. The estimated flow from these sources is 0.5 m<sup>3</sup>/s.

TABLE F-1  
WATER QUALITY OF PORTNEUF RIVER  
(3 locations - mg/l)

Fe	0.02	0.01	0.03
K	7.4	11	7.4
Na	37	43	33
Cl <sup>-</sup>	8.0	10	6.0
F <sup>-</sup>	0.4	0.1	0.6
HCO <sub>3</sub> <sup>-</sup>	281	232	283
NO <sub>3</sub> <sup>-</sup>	0.8	0.5	5.6
PO <sub>4</sub> <sup>=</sup>	0.28	0.19	0.86
TDS	480	412	440
Specific Conductance (µmhos)	610	512	590
pH	6.2	8.2	8.1
T (°C)	15.5	15.5	14.0
DO	13	13	--

## (2) Groundwater

Groundwater in the Pocatello area occurs in alluvium and alluvial-fan deposits and in the underlying volcanics which range in depth from 30 m to 120 m. Wells in the alluvium north and northwest of Pocatello have yields ranging from 0.06 to 0.19 m<sup>3</sup>/s with less than 30 m of drawdown. Recharge in the flatlands northwest of the city comes from precipitation and underflow from the surrounding hills. There is significant groundwater outflow to the Portneuf River in the Pocatello area. The combined discharge of these springs is approximately 9 m<sup>3</sup>/s.

Uses of groundwater include municipal, industrial, irrigation, private residence, and stock supplies. Municipal uses account for withdrawals of about 0.4 m<sup>3</sup>/s, while withdrawals for the phosphorus and phosphate plants average 0.5 m<sup>3</sup>/s. Groundwater quality from three wells in the Pocatello area is shown in table F-2. The source of the nitrate in the city wells is unclear, since these wells are several kilometers upstream from the processing plants. In many wells, the total dissolved solids content is higher than the drinking water standard of 500 mg/l.

TABLE F-2  
GROUNDWATER QUALITY  
(mg/l)

Well	Date	Dis- solved Solids	Cal- cium	Ni- trate as NO <sub>3</sub>	Phos- phate, as PO <sub>4</sub>	Fluo- ride
80 Acres No. 1	4-27-65	360	104	6.6	--	0.05
Do	5-20-66	750	90	38	--	0.32
Pocatello No. 3	1-04-61	320	58	5.3	0.02	0.22
Do	8-31-66	440	72	27	0.00	0.53
Pocatello No. 23	10-21-64	700	75	58	--	0.35
Do	8-31-66	750	123	345	0.12	0.44

## 2. Natural Environment

### a. Flora

Regional flora is transitional between the Great Basin vegetation to the south and the Rocky Mountain vegetation on the north. Two primary native cover classifications have been identified in the area:

Mountain/brush - dominated by species such as bitterbrush (*Purshia tridentata*), serviceberry (*Amalanchier*



alnifolia), and juniper. Sagebrush is almost always present.

Sagebrush/grass - dominated by sagebrush, bitterbrush, bluegrass, and Indian ricegrass.

The mountain-brush association occurs on all aspects at lower elevations, but is generally confined to south and west slopes at higher elevations. The sagebrush-grass association occurs at lower elevations on less productive soils. No plant species included on the 1974 Smithsonian Institute plant list are known to occur in the area.

#### b. Fauna

Elk and mule deer winter in the mountains south of Pocatello. Other game species which occur in the area include sage/grouse, sharptailed grouse (*Pedioecetes phasianellus*), Hungarian partridge, and chukar partridge. Small mammals which are found in all cover types include whitetail jackrabbit (*Lepus townsendi*), cottontail (*Sylvilagus nuttalli*), and pygmy.

Mourning doves are found in the area in the summer and are associated with the sagebrush-grass, mountain-brush, and agricultural cover types. The area is located in the Pacific waterfowl flyway and a large number of ducks and geese concentrate at the American Falls Reservoir before moving south. The most common insectivorous birds in the area include the western meadowlark (*Sturnella neglecta*), swallows (*Hirundinidae*), and nighthawks (*Chordeiles minor*). Several species of reptiles and amphibians inhabit the area, including western toad (*Bufo boreas*), leopard frog, gopher snake, and western rattlesnake.

#### c. Aquatics

Rainbow trout are stocked in the Portneuf River; other species found in the river include brook trout and brown trout. The upper Portneuf and its tributary, Marsh Creek, are classed as Class IV streams by the Idaho Department of Fish and Game, and fishing pressure is moderate to intense in some areas.

### 3. Cultural Environment

#### a. Land Use

All land in the area of interest is privately owned. The Fort Hall Indian Reservation, which was established in 1868, borders the area on the west and north, and Caribou National Forest lands lie to the south.

Approximately 3880 ha of land is included with the metropolitan area of Pocatello. Additional land uses include grazing, dry and irrigated farming, and phosphate processing. The Simplot plant, a completely integrated fertilizer complex, was established in 1945 and processes about 750,000 tons of phosphate rock annually. The FMC elemental phosphorus plant, established in 1949, has an annual production capacity of 127,000 metric tons.

#### b. Socioeconomics and Demography

The population (1970) of Pocatello is 40,000, about 77 percent of the population of Bannock County. The population has steadily increased and forecasts (some controversial) indicate that the population of the city may increase by 30,000 by 1980. The projected increase is primarily based on growth of the Bucyrus-Erie plant. The birth rate and fertility rate for the county in 1975 were 23.3 and 101.5, respectively. They compare to respective values of 19.1 and 92.0 for Idaho and 14.8 and 66.7 for the United States as a whole. Eighty-three new housing units were authorized in Pocatello in 1970; in 1976, 1104 were authorized. Primary employers in the county in 1975 were trade (5,065), state and local (4,547), services (3,437), transportation and utilities (2,859), and manufacturing (2,653). The percent of the labor force unemployed in 1970 was 5.7 percent; in 1976 it had dropped to 4.9 percent. Ten percent of families were below the poverty level in 1969, and an average of 1,400 persons utilized welfare in 1975. Larceny offenses accounted for 66 percent of all crime in the county in 1976, while murder accounted for less than 0.1 percent.

#### c. Archaeological and Historical

The Pocatello area was an area of extensive travel by fur traders and immigrants in the early 1800's. The Oregon Trail, its south alternate, and the Lander Road all entered Idaho east of Pocatello. The latter two trails met the Oregon Trail on what is now the Fort Hall Indian Reservation, 40 km northeast of Pocatello. They continued west to the Snake River, then followed its course to the southwest. The California Trail took off from the Oregon Trail at Soda Springs and traversed the area south of Pocatello. By 1860, permanent settlements were underway.

Southeast Idaho is part of the Great Basin ethnographic culture area. The natives were hunters and gatherers. Because of their seasonal treks, there is no large accumulation of artifacts in any one area.

#### d. Aesthetic Values

Poor air quality is a major problem in the Pocatello area and impacts the recreational value of the region. The main recreational asset of the area is American Falls Reservoir, which lies outside the Pocatello study area. Pocatello is located at the foot of rather picturesque mountains, which affords some aesthetic value to the local residents.

### G. HAILEY

#### 1. Physical Environment

##### a. Climate

The Hailey area is characterized by long, cold winters and short, dry summers. Average monthly temperatures range from  $-7^{\circ}\text{C}$  in January to  $20^{\circ}\text{C}$  in July. The normal annual precipitation ranges from 38 cm at Hailey in the Wood River valley to over 48 cm in the nearby foothills. Nearly 50 percent of the annual precipitation falls as snow from December through February. The snow depth peaks in March at 113 cm (1890 m elevation). The maximum snow depth recorded at this station is 183 cm. Wind patterns are determined almost entirely by topography and vary significantly over the area.

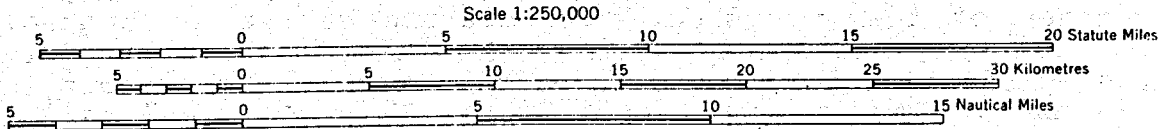
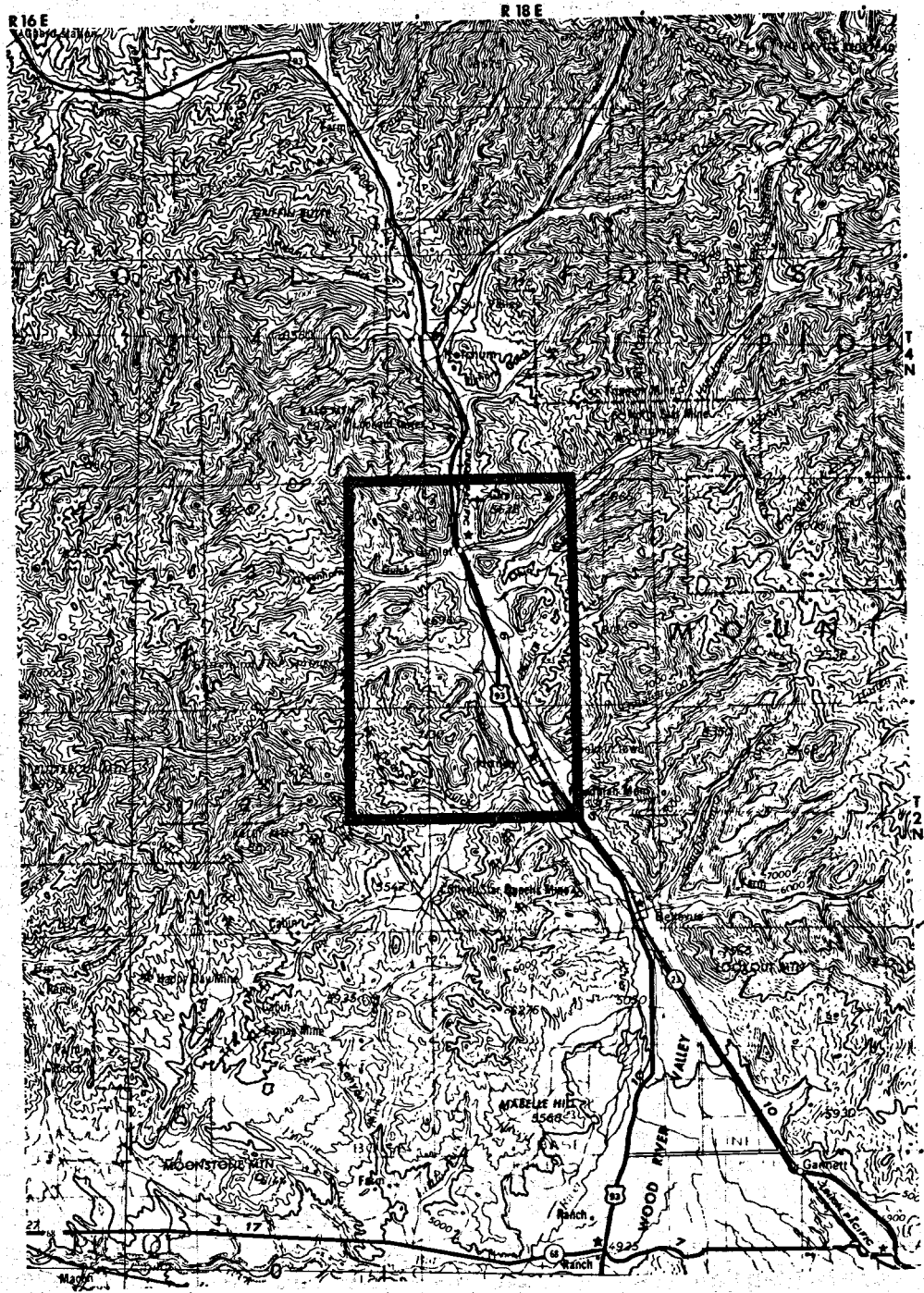
##### b. Air Quality

There are no major air-polluting industries in the central Idaho region; as a result, the air quality of the Hailey area is extremely good. There are two air quality stations in the region, one 110 km south on the southern Snake River Plain and one at Craters of the Moon National Monument, 80 km to the east. The normal suspended particulate concentrations at these two stations are  $40\ \mu\text{g}/\text{m}^3$  and less than  $10\ \mu\text{g}/\text{m}^3$ , respectively. Estimates of the particulate levels around Hailey indicate that normal concentrations approximate those at Craters of the Moon.

##### c. Land Resources

###### (1) Topography

The general topography of the area is steep and rough and exhibits the effects of both extensive glaciation and stream erosion. Elevations in the area of interest range from 1630 m at Hailey to 2700 m on Kelly Mountain. Elevations in the main Sawtooth Mountains to the northwest exceed 3150 m. The valley of the Wood River, which forms the eastern boundary of the area, opens onto the Snake River Plain 24 km south of Hailey. East-west trending



Scale 1:250,000  
 CONTOUR INTERVAL 200 FEET  
 WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS  
 TRANSVERSE MERCATOR PROJECTION

G. Hailey Study Area

ridges and valleys dissect the area, resulting in the steep slopes and high relief characteristic of the region.

## (2) Geology

The geology of the Hailey area reflects uplift, intrusion, glaciation, vulcanism, and stream erosion, all of which have played a major role in the structure of the area. Hailey is located at the boundary of the Idaho Batholith and the Snake River Plain. As a result, both the granitics of the Batholith and volcanic flows and debris predominate. Glacial deposits and alluvium overlie volcanic debris, marine detritus, and quartzite in the normal-faulted Wood River valley. In addition to the faults bounding the valley, a major northeast-southwest trending thrust-block boundary fault is evident along Deer Creek canyon extending into the Pioneer Mountains to the east of the valley. Like the Snake River Plain, the Hailey area seems aseismic, although a large number of earthquakes occur in the Sawtooth Mountains north of Stanley.

## (3) Soils

Soils range from deep and productive in the valley bottoms to shallow and unproductive on the steep south slopes. Much of the area is characterized by fluvial slopes with soils formed from underlying granitics, sandstone, volcanic rhyolites, and metamorphosed sediments. Soils derived from the granitics of the Batholith are generally gravelly, sandy loams or loamy sands. The profile is not well developed and ranges in depth from 25 cm to 90 cm. Sedimentary soils are moderately deep clays or clayloams over well-fractured bedrock. Soils whose parent material is volcanic are loams or clay loams with shallow to moderately deep profiles. The soils of the Batholith are highly erosive, while the sedimentary and volcanic soils are very cohesive and much less erosive.

## d. Water Resources

### (1) Surface Water

The primary stream in the area is the Big Wood River, which is fed largely by snowmelt in the upper reaches of the watershed. Temperature variations control the stream discharge during the high spring runoff. Precipitation rarely contributes directly to high runoff in the basin. The Big Wood River drains over 1660 km<sup>2</sup> of the Boulder, Pioneer, and southern Sawtooth Mountains. The river empties into the Magic Reservoir which provides irrigation water supply for Lincoln and Gooding counties, 25 km south of Hailey. Diversions above Hailey are used to irrigate an average of 4000 ha. The average discharge of the

river at Hailey is 10.8 m<sup>3</sup>/s, with recorded extremes of 141 m<sup>3</sup>/s and 0 m<sup>3</sup>/s. Forty-seven percent of the total flow of the river in the 1976 water year occurred in May and June. Average water quality of the river in 1975 and 1976 just south of Hailey is shown in table G-1. Irrigators are generally short of water each year. Decreed water rights on the river above the Magic Reservoir total approximately 28 m<sup>3</sup>/s.

TABLE G-1  
WATER QUALITY OF THE BIG WOOD RIVER, 1975 AND 1976  
(mg/l)

Ca	39	HCO <sub>3</sub> <sup>-</sup>	140
K	1.1	SO <sub>4</sub> <sup>-2</sup>	15
Mg	7.6	TDS	149
Na	3.3	Specific Conductance	290
Cl <sup>-</sup>	1.4		
F <sup>-</sup>	0.3	pH	8.3

## (2) Groundwater

The Wood River aquifer is unconfined fluvio-glacial sedimentary deposit underlying the valley to depths of more than 90 m. Beds of sand and gravel interbedded with clays and silt yield large supplies of water to wells up to 30 m deep in the valley. The water table, which has an average gradient of 7.6 m/km, is deepest in late winter and shallowest in June. The groundwater is of uniformly good quality, although it ranges from moderately hard to hard. Groundwater outflow from the upper Big Wood Basin totals about 6000 hm<sup>3</sup> annually.

## 2. Natural Environment

### a. Flora

The dominant vegetation types around Hailey and in the mountains to the west are conifer timber and sagebrush-grass. Lodgepole pine (*Pinus contorta*) and Douglas fir occur primarily on the north and east slopes, while mountain big sagebrush, bitterbrush, blue bunch wheatgrass, and chokecherry generally occur on the south and west slopes. Associated vegetation types found in the valley bottoms include grassland, meadow, aspen, and riparian. Slopes along the north side of upper Deer Creek are highly sensitive and difficult to revegetate. Although vegetation types throughout the area are well-established, forest fires and timber harvests result in local short-term changes.

## b. Fauna

Primary large mammals in the area include mule deer, elk, black bear, and mountain goats (*Oreamnos americanus*). Predators include bear, mountain lion (*Felis concolor*), lynx (*Lynx canadensis*), bobcat, and coyote. Common rodents include the Columbian ground squirrel, red squirrel (*Tamiasciurus hudsonicus*), chipmunk (*Eutamias* sp.), deer mouse (*Peromyscus maniculatus*), and snowshoe rabbit. Forest grouse (*Tetraonidae*) are common in the timbered areas, while passerine species including fox sparrow (*Passerella iliaca*), song sparrow (*Melospiza melodia*), and yellowthroat (*Geothlypis trichas*) are found throughout the area. Beaver (*Castoridae*), muskrat, snipe (*Scolopacidae*), blackbirds (*Corvidae*), frogs, and garter snakes (*Thamnophis sirtalis*) are common in the marshy valley bottoms. Summer range for deer and elk is abundant. Extremely valuable winter range is located in Deer Creek canyon, on Buttercup Mountain to the west, and along Willow Creek to the south. Approximately 100 elk and 300 deer winter along the sagebrush-covered south slopes of Deer Creek canyon. Cow Creek canyon in the northern part of the area is vegetated with aspen and provides good elk forage during calving in May and June. From 40 to 60 elk can be found in the area during this period.

## c. Aquatics

Fish found in the major streams of the region include rainbow, cutthroat, eastern brook trout, and whitefish. Dolly Varden trout and kokanee salmon (*Oncorhynchus nerka*) are found in the South Fork of the Boise River just west of the area of interest. Fisheries capability is low throughout the tributaries of the Big Wood River. These streams do contain some native rainbow trout. Several times a year, fish are planted in Soldier Creek, Willow Creek, and Deer Creek.

## 3. Cultural Environment

### a. Land Use

Of the 30,600 ha in the area of interest, an estimated 11,700 ha are under the jurisdiction of the Sawtooth National Forest, 9800 ha are controlled by the Bureau of Land Management, 1500 ha belong to the State of Idaho, and the remainder is private land. Land uses on the USFS and BLM in the western half of the area of interest include snowmobiling, hunting, cross-country skiing, scenic travel, and summer recreation, mining (16 lead and silver mines are located in the area), and cattle and sheep grazing. Recreational facilities at Clarendon Hot Springs are the only geothermal development in the area. The

eastern half of the area is used for grazing, farming, a travel corridor, and residential.

b. Socioeconomics and Demography

All of the area of interest is located in Blaine County, which had a population in 1976 of 7900. The population density in the county in that year was 1.7 people/km<sup>2</sup>. Eighteen percent of the county population is classed as rural-farm, while 82 percent is classed as rural-nonfarm. Hailey, the county seat, had a population in 1970 of 1425. The county population increased 38 percent in the six years from 1970 to 1976, compared to a 16.5 percent population increase in the State of Idaho during the same period. Migration accounted for 79 percent of the county's population increase.

The unemployment rate in the county in 1976 was 14.4 percent, ranging from 10.6 percent in September to 22 percent in May at the end of the ski season. Services as a group employ the largest number of people (27 percent of total), with trade, state and local, and nonfarm proprietors together accounting for an additional 40 percent. Per capita income in 1970 was 114 percent of the state average.

c. Archaeological and Historical

Archaeological surveys in the region indicate that primitive man inhabited the area; however, no extensive archaeological studies have been conducted which yield specific data for the area. The first white man in the area was a trapper traversing the mountains to Boise in 1824. A gold discovery in 1863 led to the founding of Hailey and Ketchum. Many of the mining towns established during the subsequent 30 years are now ghost towns. Homesteading flourished in the 1880's and sheep grazing was extensive until the Sawtooth National Forest was established in 1905. The Union Pacific Railroad began construction of the Sun Valley Resort in 1936, marking the advent of recreation as a major industry in the area.

d. Aesthetic Values

The Hailey area is highly prized for both its abundant wildlife and near-pristine wilderness. Located on the edge of the Sawtooth National Recreation Area, the only road into the region is heavily utilized by recreational travelers. The study area receives heavy use in summer by backpackers and campers and in winter by skiers, who frequent the area from all parts of the world. Preservation of the environment in this area would be a major concern to potential developers.



#### IV. POTENTIAL ENVIRONMENTAL IMPACTS

The environmental impacts that may result from the development of geothermal resources in the areas under consideration will vary significantly. In general, the developments will be on a relatively small scale, so that cumulative impacts in any one area will be minor.

##### A. AIR QUALITY

Sources of air pollution from geothermal development include dust from cleared areas and roads, vehicle emissions, dissolved gasses in the geothermal fluids, and emissions from industrial processes. Dust can be controlled to a certain extent by gravelling, watering, or oiling roads and sites. The dissolved gas content (especially hydrogen sulfide) in most geothermal resources in Idaho is very low. Geothermal systems will be a closed cycle unit in most processes, resulting in no release of dissolved gasses to the environment. Where this is not the case, gas emissions can be reduced through the use of scrubbing units. Emissions from industrial processes will vary and can be controlled, if necessary, to meet state and federal regulations.

##### B. NOISE

Noise levels during geothermal development will generally be highest during well drilling. Noise levels from drill rigs range from less than 50 dBA at 6 m for cable tool rigs to higher than 70 dBA at 6 m for oil rigs. Drill rigs may operate for 24 hours a day where the noise does not cause disruption. The noise from open water discharge lines from a geothermal well rarely exceeds 70 dBA at 1.5 m. Any of these noise levels should be reduced to less than 60 dBA at 300 m.

##### C. SOILS

The primary environmental impacts of geothermal development on soils will be increased erosion on cleared land and instabilities on steep slopes. To a great extent, these impacts can be reduced through careful siting of well and plant sites. The hills surrounding Pocatello and the canyons in the Hailey area are especially susceptible to soil stability problems.

##### D. WATER RESOURCES

The impact of geothermal resources on water quality and supply is one of the major concerns in the State of Idaho.

Water contamination can result from casing leaks, seepage from holding ponds, uncontrolled discharge from wells, and improper disposal of the geothermal fluids. Regulations require that geothermal wells be cased and cemented through shallow groundwater aquifers to reduce the chance of geothermal fluids leaking into these aquifers through the wellbore. Drilling muds help to reduce the seepage from holding ponds; however, if seepage of poor quality fluids is high, the holding ponds can be lined. Proper design of wells, wellheads, piping systems, and discharge systems should reduce the chances of water contamination from these sources. Samples from thermal wells and springs across the state indicate total dissolved solids ranging from 180 to 13,000 mg/l, with a mean of 630 mg/l. The quality of some geothermal fluids, then, can be expected to be compatible with surface and shallow groundwaters. Indications are that geothermal systems in Idaho are not completely separated from other groundwater aquifers. As a result, production of geothermal fluids may interfere with groundwater supplies in some places.

#### E. SEISMICITY

Geothermal areas have been associated with areas of significant seismic activity. Production and injection of geothermal fluids may increase the activity in some areas. The Snake River Plain in Idaho is considered very aseismic and background levels of seismic activity in the areas under consideration are low. Depending on the amount of faulting and the imbalance created by production and injection in these areas, microseismic activity may or may not increase.

#### F. SUBSIDENCE

Whenever large quantities of fluids are withdrawn from unconsolidated sediments or when declining reservoir pressures reduce the support for overburden, subsidence may result. In some areas in Idaho, subsidence due to the withdrawal of water for irrigation has been documented. The adverse impacts of subsidence depend on the location. Significant subsidence in a city may result in structural damage to many buildings. The same amount of subsidence in an undeveloped or agricultural area may not result in any damage.

#### G. FLORA

The major impact to flora generally results from the clearing of land for roads, drill sites, and process facilities. If those disturbed lands are revegetated with native species following development, the impact can be reduced. If not, soil erosion may increase and a significant invasion of noxious species such as halogeton

(*Halogeton glomeratus*) may result. Reestablishment of native vegetation on unstable slopes is difficult and in areas with low moisture availability, this reestablishment may take decades.

#### H. FAUNA

The impact on local fauna in developed agricultural or metropolitan areas will be minimal. The prime species displaced by development in those areas will be small mammals. In the undeveloped areas of Hailey, Blue Gulch, and Bruneau-Grand View, development may result in major impacts to fauna. Each of these areas is prime habitat for elk, mule deer, and raptors. Nesting and calving areas are particularly vulnerable in the spring and early summer and development in these areas should be avoided. Aquatic species may be impacted as a result of increased erosion or discharge of poor quality geothermal fluids to streams. In most cases, design of facilities will reduce this impact.

#### I. SOCIOECONOMICS

If major development occurs in sparsely populated areas, the population influx may result in significant social and economic impacts. These impacts would include lack of housing, strain on utilities and service, especially water supply and medical services. If development occurs in an orderly manner, there may be an opportunity for planning early in the development phase which could reduce many of the adverse impacts. The kinds of development that can be expected in the areas under consideration are either retrofitting existing processes to utilize geothermal fluids or small-scale new processes. These developments should result in few adverse socioeconomic impacts.

#### J. ARCHAEOLOGICAL AND HISTORICAL

All of the areas under consideration are known to or are expected to have significant heritage resources. Where these resources have been documented (e.g., the route to the Oregon Trail), they should be protected during development. Archaeological curves should be conducted in undisturbed areas where no data exist. If archaeological resources are uncovered during development, state archaeologists will be consulted.

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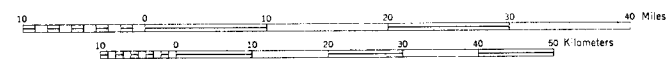
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**FIGURE 9. THERMAL SPRING AND WELL LOCATION MAP OF IDAHO SHOWING THEIR APPROXIMATE SURFACE TEMPERATURES, RELATIONS TO CURVILINEAR ZONES, LINEAR, AND CIRCULAR FEATURES.**



BASE BY  
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
**STATE OF IDAHO**



DEPARTMENT OF WATER RESOURCES  
BASE BY  
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
**STATE OF IDAHO**

LEGEND  
State Capital  
County Seat

POPULATION KEY  
BOISE  
TWIN FALLS  
MADISON  
IDAHO FALLS  
More than 10,000  
5,000 to 10,000  
1,000 to 5,000  
500 to 1,000  
Less than 500

**SURFACE TEMPERATURE RANGE**  
Degree C

Temperature	Unknown
20.00	29.99
30.00	39.99
40.00	49.99
50.00	59.99
60.00	69.99
70.00	79.99
80.00	89.99
90.00	100.00

— Arcuate Zones  
— Lineaments modified from Day (1974).  
⊙ Circular features modified from Haskett (1974).

