GEOTHERMAL STUDIES IN MONTANA

QUARTERLY REPORT

J. L. Sonderegger, R. N. Bergantino,

J. J. Donovan, and M. R. Miller

Montana Bureau of Mines and Geology
Montana College of Mineral Science and Technology
Butte, Montana

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PREPARED FOR THE U.S. ENERGY RESEARCH AND
DEVELOPMENT ADMINISTRATION UNDER CONTRACT EY-76-C-06-2426

TASK AGREEMENT NO. 2

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This report is available as Montana Bureau of Mines and Geology Open-File Report No. 28.
Progress Report for Grant No. EY-76-C-06-2426
from Oct. 1, 1977 to June 11, 1978

The following items list progress made on the various research tasks since the last formal report (RLO-2426-T2-2):

(1) The hardrock study of mine-water temperatures - the study is complete, the manuscript has been edited, and galleys are currently being proofread. Because of many year-end demands upon our reproduction center, printing of the final report, as Montana Bureau of Mines and Geology Special Publication 79, will be delayed until early July. Mailings to DOE and our list of nearly 500 domestic and foreign libraries should be accomplished by the end of July, 1978.

(2) The Centennial and Madison Valley study - all chemical analyses are complete for samples collected to date. These data are included in the Appendix. The geologic mapping from last summer has been evaluated with respect to warm spring occurrences. Agreements have been made for support of an M.S. mapping thesis and an M.S. geophysical thesis in the Centennial Valley and a Ph.D. mapping thesis of basement structure on the east side of the Madison Valley.

(3) The warm spring inventory is in progress. Errors in previously existing information have been found. Considerable variation in temperature and discharge have been noted at some sites. Some of the lower temperatures can probably be attributed to increased contamination by shallow ground water during this spring runoff period.

(4) Several state and regional meetings have been attended to increase understanding of the various aspects of DOE programs and to exchange information with others working in Montana.

(5) To determine the validity or extent of departure from the SiO₂ geothermometers of waters in contact with the two volcanic units, laboratory leach simulations at 27° and 57° C were run on crushed samples of the Huckleberry Ridge and Mesa Falls tuffs for a period of 10 days. The 27° C fluid phases had silica contents between those expected for chalcedony and α-christobalite, whereas the 57° samples exceeded the silica levels for α-christobalite.
STATE: MONTANA
COUNTY: MADISON
LATITUDE-LONGITUDE: 44°42'46"N 113°16'20"W
SAMPLE LOCATION: 13S 1E 90BC
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
SAMPLE SOURCE: SPRING
GEOLOGICAL SOURCE: 112VLCC
STATION CODE: 813-CV
DRAINAGE BASIN: 41-F
BOTTLE NO.: 6715
AGENCY + SAMPLER: MBMG * WMB
ALTITUDE OF SAMPLE POINT: FT <50
DATE SAMPLED: 09-29-77
TOTAL DEPTH OF WATER: STAGE HEIGHT
TIME SAMPLED: 1730
LAB + ANALYST: MBMG * GAM
DEPTH TO SAMPLING POINT: BUCKET AND STOPW
DATE ANALYZED: 11-30-77
FLOW MEAS METHOD: 35 GPM(M)
SAMPLE HANDLING: WATER USE
METHOD SAMPLED: MULTIPLE USE
SAMPLING SITE: HIDDEN LAKE SPNG (SW OF HIDDEN LAKE)
DRAINAGE BASIN: MADISON RIVER

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<td><strong>TOTAL CATIONS</strong></td>
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<tr>
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**STANDARD DEVIATION OF ANION - CATION BALANCE 0.88 SIGMA**

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<td>TOTAL ALKALINITY AS CACO3</td>
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<tr>
<td>LANGLIER SATURATION INDEX</td>
<td>-1.8</td>
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**ADDITIONAL PARAMETERS**

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<td>ALUMINUM, DISS (mg/L-AL)</td>
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<td>BORON, DISS (mg/L AS B)</td>
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<td>LITHIUM, DISS (mg/L AS Li)</td>
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<td>ANTIMONY, DISS (mg/L AS SB)</td>
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<td>MERCURY, DISS (mg/L AS HG)</td>
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<td>URANIUM DISS (mg/L AS U)</td>
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**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT* SPECIAL LASL NO 309809

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

**PROCESSING PGM:** GWANAL (FORM 153)  
**FUND:** CG75/  
**PERCENTAGE REACTANCE VALUES**

CA MG NA K CL SO4 HCO3 CO3 N03  
65 14 12 7 20 6 72 0 2

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0380
LATITUDE-LONGITUDE: 44°42'35"N 111°39'32"W

TOPOGRAPHIC MAP: UPPER RED ROCK LAKE

GEOLOGICAL SOURCE: 112VLCC

DRAINAGE BASIN: 41A

AGENCY + SAMPLER: MBMG * WMB

DATE SAMPLED: 09-29-77

TIME Sampled: 1430

LAB + ANALYST: MBMG * GAM

DATE ANALYZED: 11-30-77

SAMPLE HANDLING: 6220

METHOD SAMPLED: GRAH

SAMPLING SITE: 0.75 FROM VABM BRIMSTONE (LOWER SPRING)

DRAINAGE BASIN: RED ROCK RIVER

CALCIUM (CA): 8.0
   MEQ/L: 0.399 BICARBONATE (HCO3) 46.0 0.754
   MG/L: 0.132 CARBONATE (CO3) 0.000
   MEQ/L: 0.148 CHLORIDE (CL) 4.0 0.113
   MG/L: 0.266 SULFATE (SO4) 2.9 0.060
   MEQ/L: 0.088 NITRATE (AS N) 115 0.008
   MG/L: 0.018 NO3+NO2 TOT (AS N) <1
   MEQ/L: FLUORIDE (F) 0.000
   SILICA (SiO2): 24.6
   MG/L: 0.088 PHOSPHATE (AS P)

TOTAL CATIONS: 1.050

TOTAL ANIONS: 0.935

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.95 SIGMA

LABORATORY PH: 5.75

FIELD TEMPERATURE: 68.8 C

TOTAL HARDNESS AS CACO3: 27.0

TOTAL ALKALINITY AS CACO3: 38.0

SODIUM ADSORPTION RATIO: 0.3

SUM OF DISS. CONSTITUENTS: 103.0

RYZNAR STABILITY INDEX: 12.3

LAB SPEC. COND. (MICROMHOS/CM): 99.3

LANGLIER SATURATION INDEX: -3.3

ADDITIONAL PARAMETERS

CNDUCTVY, FIELD MICROMHOS: 92.2

AMMONIA TOTAL (MG/L AS N): 0.05

BROMIDE TOT. REC (MG/L-BR): <1

ALUMINUM DISS (MG/L-AL): <26

LITHIUM DISS (MG/L AS Lt): <0.1

STRONTIUM DISS (MG/L-Sr): <0.05

MERCURY DISS (UG/L AS Hg): <0.3

URANIUM DISS (UG/L AS U): <0.2

TEMPERATURE, AIR (C): 8.0

H2S, LAB (MG/L AS H2S): <0.17

IODIDE TOT. REC. (MG/L-I): <0.01

BORON DISS (MG/L AS B): <0.02

ANTIMONY DISS (MG/L AS SB): <0.2

ARSENIC DISS (UG/L AS AS): <2.0

SELENIUM DISS (UG/L-SE): <2.0

REMARKS: C+G 75 CENT. GEOTHERMAL PROJECT SPECIAL LASL 309808 * WATER IS ALMOST STAGNANT * SCUMMY W/ OIL FILM

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)

PERCENTAGE REACTANCE VALUES

FUND: CG75/

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0381
STATE: MONTANA  
COUNTY: MADISON  
LATITUDE-LONGITUDE: 44°42'33"N 113°39'32"W  
SAMPLE LOCATION: 13S 1W 12DAAC01  
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE  
SAMPLE SOURCE: SPRING  
GEOLOGICAL SOURCE: 112VLCC  
STATION CODE:  
DRAINAGE BASIN: 41A  
BOTTLE NO.: 811-CV  
AGENCY + SAMPLER: MBMG * WMB  
ALTITUDE OF SAMPLE POINT: 7780.0 FT <50  
DATE SAMPLED: 09-29-77  
TOTAL DEPTH OF WATER:  
TIME SAMPLED: 1230  
STAGE HEIGHT:  
LAB + ANALYST: MBMG * GAM  
DEPTH TO SAMPLING POINT:  
DATE ANALYZED: 11-30-77  
FLOW MEAS METHOD: NOT USED  
SAMPLE HANDLING: 3220  
WATER FLOW RATE: 0.4 GPM(E)  
METHOD SAMPLED: GRAB  
WATER USE: STOCK  
SAMPLING SITE: SPNGS *75 MI S OF 2 DRINK SPRINGS  
DRAINAGE BASIN: RED ROCK RIVER  

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
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<td>BICARBONATE (HCO3)</td>
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<td>MAGNESIUM (MG)</td>
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<td>CARBONATE (CO3)</td>
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<td>SODIUM (NA)</td>
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<td>CHLORIDE (Cl)</td>
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<td>POTASSIUM (K)</td>
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<td>SULFATE (SO4)</td>
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<td>IRON (FE)</td>
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<td>NITRATE (AS N)</td>
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<tr>
<td>MANGANESE (MN)</td>
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<td>0.003</td>
<td>NO3+NO2 TOT (AS N)</td>
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<tr>
<td>ALUMINUM (AL)</td>
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<td>FLUORIDE (F)</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>28.0</td>
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<td>PHOSPHATE (AS P)</td>
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</table>

TOTAL CATIONS: 0.576  
TOTAL ANIONS: 0.522  

STANDARD DEVIATION OF ANION-CATION BALANCE: 0.45 SIGMA  

LABORATORY PH: 6.24  
FIELD TEMPERATURE: 6.3°C  
TOTAL HARDNESS AS CACO3: 19.1  
TOTAL ALKALINITY AS CACO3: 20.1  
CALCULATED DISSOLVED SOLIDS: 57.0  
SODIUM ADSORPTION RATIO: 0.2  
SUM OF DISS. CONSTITUENTS: 69.2  
RYZNAR STABILITY INDEX: 12.7  
LAB SPEC. COND. (MICROMOS/CU): 56.3  
LANGLIER SATURATION INDEX: 32.2  

ADDITIONAL PARAMETERS:  
COND. TO FIELD MICROMOS: 73.3  
TEMPERATURE, AIR (°C): 8.0  
AMMONIA TOTAL (MG/L AS N): 0.03  
H2S, LAB (MG/L AS H2S): 0.10  
BROMIDE TOT+REC (MG/L=BR): 0.1  
IODIDE TOT+REC (MB/L=I): 0.01  
ALUMINUM, DISS (MG/L=AL): 0.38  
BORON, DISS (MG/L=BO): 0.02  
LITHIUM, DISS (MG/L AS Li): 0.01  
AMONUTY, DISS (MG/L AS SB): 0.2  
STRONTIUM, DISS (MG/L=SR): 0.06  
ARSENIC, DISS (MG/L AS AS): 2.0  
MERCURY, DISS (UG/L AS HG): 0.3  
SELENIUM, DISS (UG/L=SE): 2.0  
URANIUM, DISS (UG/L AS U): 0.2  

REMARKS:  
C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT * RAINING * SPECIAL  
LASL NO 309806 * COMPOSITIVE OF 2 SPNGS * OIL FILM ON WATER  

EXPLANATION:  
MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED:  
TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M=METERS  

PROCESSING PGM: GWANAL (FORM 153)  
PERCENTAGE REACTANCE VALUES  
FUND: CG75/  
CA  MG  NA  K  CL  SO4  HCO3  CO3  NO3  
50 20 18 10 8 13 78 0 3  

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0382
STATE: MONTANA
LATITUDE-LONGITUDE: 44°34'45"N 112°52'20"W
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
GEOLOGICAL SOURCE: 112YLC
DRAINAGE BASIN: 41A
AGENCY + SAMPLER: M8MG * WMB
DATE SAMPLED: 09-29-77
TIME SAMPLED: 0936
LAB + ANALYST: M8MG * GAM
DATE ANALYZED: 11-30-77
SAMPLE HANDLING: 62C
METHOD SAMPLED: GRAB

SAMPLE LOCATION: 13S 2W 5C00A
SAMPLE SOURCE: SPRING
BOTTLE NO: 810-CV
ALTITUDE OF SAMPLE POINT: 7950 ft <50 ft
TOTAL DEPTH OF WATER: STAGE HEIGHT
FLOW MEAS METHOD: NOT USED
WATER FLOW RATE: 2.5 GPM(E)
WATER USE: STOCK

SAMPLING SITE: CAYUSE SPRING 2.5 MI N OF STAUNDEMeyer
DRAINAGE BASIN: RED ROCK RIVER

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<tr>
<th>COMPOUND</th>
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<td>MANGANESE (MN)</td>
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<td>ALUMINUM (AL)</td>
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<tr>
<td>SILICA (S1O2)</td>
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TOTAL CATIONS: 41.10
TOTAL ANIONS: 41.99

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.53 SIGMA

LABORATORY PH: 7.09
FIELD TEMPERATURE: 69°C
TOTAL HARDNESS AS CACO3: 195 ppm
TOTAL ALKALINITY AS CACO3: 184 ppm
CALCULATED DISSOLVED SOLIDS: 232 ppm
SUM OF DISS. CONSTITUENTS: 345.8 ppm
Ryznar stability index: 7.6
LANGLIER SATURATION INDEX: 0.2

ADDITIONAL PARAMETERS
- Conductivity, Field Micromhos: 34.7 µS/cm
- Temperature, Air (°C): 8.25
- Ammonia, Total (mg/L as N): < 0.03
- Boron, Total (mg/L): < 0.058
- Strontium, Diss (mg/L as Sr): < 0.27
- Mercury, Diss (ug/L as Hg): < 2.0
- Uranium, Diss (ug/L as U): < 2.0

REMARKS: C+G 75 CENTENNIAL VALLEY GEO THERMAL PROJECT SPNG DEVELOPMENT CONTACT OF TV AND TLS SPECIAL SAMPLE LASL NO 309805

EXPLANATION: MG/L = MILLIGRAMS PER LITER, MEQ/L = MILLIEQUIVALENTS PER LITER, ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT = TOTAL SUSPENDED (R) = REPORTED (E) = ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES

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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0383
**STATE** MONTANA  
**COUNTY** BEAVERHEAD  
**LATITUDE-LONGITUDE** UPP RED ROCK LAKE  
**SAMPLE LOCATION** 13S 2E 20CBB  
**TOPOGRAPHIC MAP** UPPER RED ROCK LAKE  
**SAMPLE SOURCE** SPRING  
**GEOLOGICAL SOURCE** 112VLC  
**STATION CODE**  
**DRAINAGE BASIN** 41*F  
**BOTTLE NO.** 808-CV  
**AGENCY + SAMPLER** MBMG * WMB  
**ALTITUDE OF SAMPLE POINT** 6920* FT <50  
**DATE SAMPL EDT** 09-28-77  
**TOTAL DEPTH OF WATER**  
**TIME SAMPLED** 1400  
**STAGE HEIGHT**  
**LAB + ANALYST** MBMG * GAM  
**DEPTH TO SAMPLING POINT**  
**DATE ANALYZED** 11-30-77  
**FLOW MEAS METHOD** NOT USED  
**SAMPLE HANDLING** 6220  
**WATER FLOW RATE** 15* GPM(E)  
**METHOD SAMPLED** GRAB  
**WATER USE** STOCK  

**SAMPLING SITE** 1 MI SE OF CONKLIN LAKE ORR RANCH  
**DRAINAGE BASIN** MADISON RIVER  

**CALCIUM (CA)** 20  
**MEQ/L** 0.998  
**BICARBONATE (HCO3)** 99.2  
**MG/L** 1.626  
**MAGNESIUM (Mg)** 6.4  
**MEQ/L** 0.526  
**CARBONATE (CO3)** 0  
**MG/L** 0.000  
**SODIUM (Na)** 5.3  
**MEQ/L** 0.231  
**SULFATE (SO4)** 4.5  
**MG/L** 0.121  
**POTASSIUM (K)** 5.9  
**MEQ/L** 0.023  
**FLUORIDE (F)** 0.1  
**MG/L** 0.004  
**IRON (Fe)** 10  
**MEQ/L** 0.005  
**NITRATE (AS N)** 0.178  
**MG/L** 0.013  
**MANGANESE (Mn)** 0.1  
**MEQ/L** 0.000  
**NO3+NO2 (AS N)** 0  
**MG/L** 0.000  
**ALUMINUM (Al)** 22.9  
**MEQ/L** 0  
**PHOSPHATE (AS P)** 0  

**TOTAL CATIONS** 1.784  
**TOTAL ANIONS** 1.859  

**STANDARD DEVIATION OF ANION - CATION BALANCE** 0.56 SIGMA  

**LABORATORY PH** 7.64  
**TOTAL HARDNESS AS CA CO3** 76*  
**FIELD TEMPERATURE** 10.8 C  
**TOTAL ALKALINITY AS CA CO3** 81*  
**CALCULATED DISSOLVED SOLIDS** 113.6  
**SODIUM ADSORPTION RATIO** 0.3  
**SUM OF DISS. CONSTITUENTS** 163.9  
**RYZNAR STABILITY INDEX** 8.8  
**LAB SPEC.COND. (MICROMHOS/CM)** 168.0  
**LANGLIER SATURATION INDEX** 0.6  

**ADDITIONAL PARAMETERS**  
**CNDUCTIVITY, FIELD MICROMHOS** 165*  
**TEMPERATURE, AIR (C)** 18.4  
**AMMONIA, TOTAL (MG/L AS N)** < 0.03  
**H2S, LAB (MG/L AS H2S)** < 0.17  
**BROMIDE, TOTAL (MG/L-BR)** < 0.1  
**IODIDE TOT. (MG/L-I)** < 0.01  
**ALUMINUM, DISS. (MG/L-AL)** 0.07  
**BORON, DISS. (MG/L AS B)** 0.01  
**LITHIUM, DISS. (MG/L AS Li)** 0.01  
**ANTIMONY, DISS. (MG/L AS Sb)** < 0.2  
**STRONTIUM, DISS. (MG/L- Sr)** 0.07  
**ARSENIC, DISS. (MG/L AS As)** < 2.0  
**MERCURY, DISS. (MG/L AS Hg)** < 0.2  
**SELENIUM, DISS. (MG/L-SE)** < 2.0  

**URANIUM DISS. (UG/L AS U)** < 0.2  

**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT* SPECIAL SAMPLE  
**PROC.:** THROU LASL NO. 309804< TOOK SAMPLE AFTER MOVING CATTLE  

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER  
**ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED:** TOT=TOTAL SUSP=SUSPENDED  
**TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS**  

**PROCESSING PGM:** GWANAL (FORM 153)  
**PERCENTAGE REACTANCE VALUES**  
**FUND:** CG75/  
**CA** 56  
**MG** 29  
**NA** 12  
**K** 1  
**CL** 6  
**SO4** 5  
**HCO3** 88  
**CO3** 0  
**N03** 0  

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0384
STATE: MONTANA  
LATITUDE = LONGITUDE: 44°36'01"N 111°34'33"W
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
GEOLOGICAL SOURCE: 112VLCC
DRAINAGE BASIN: 414A
AGENCY + SAMPLER: MBMG + WMB
DATE SAMPLED: 09/28/77
TIME SAMPLED: 14:45
LAB + ANALYST: MBMG + GAM
DATE ANALYZED: 11/30/77
SAMPLE HANDLING: 6226
METHOD SAMPLED: GRAB

SAMPLING SITE: SMALL SPRING E OF TOBE MORTONS 0.5 MUI
DRAINAGE BASIN: RED ROCK RIVER

CALCIUM (CA)  4.4  0.220  BICARBONATE (HC03)  21.2  0.347
MAGNESIUM (MG)  1.7  0.058  CARBONATE (CO3)  4.0  0.000
SODIUM (NA)  2.8  0.122  CHLORIDE (CL)  1.65  0.047
POTASSIUM (K)  1.1  0.028  SULFATE (SO4)  3.4  0.071
IRON (FE)  0.06  0.003  NITRATE (AS N)  0.097  0.007
MANGANESE (MN)  0.01  0.000  NO3+NO2 TOTAL (AS N)  0.000
ALUMINUM (AL)  0.01  0.000
SILICA (Si02)  21.8  0.000

TOTAL CATIONS: 0.431
TOTAL ANIONS: 0.472

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.36 SIGMA

LABORATORY PH: 6.99
FIELD TEMPERATURE: 15.0°C
TOTAL HARDNESS: 14.0
TOTAL ALKALINITY: 17.0
SODIUM ADSORPTION RATIO: 0.3
RYNZR STABILITY INDEX: 12.2
LANGLIER SATURATION INDEX: 2.6

ADDITIONAL PARAMETERS:
CONDUCTIVITY, FIELD MICROMOS 40.0
AMMONIA, TOTAL (MG/L AS N) 0.06
BROMIDE TOTAL (MG/L AS BR) 0.1
ALUMINUM, DISS. (MG/L AS AL) 0.13
LITHIUM, DISS. (MG/L AS LI) 0.01
STRONTIUM, DISS. (MG/L AS SR) 0.03
MERCURY, DISS. (UG/L AS HG) 0.3
URANIUM DISS. (UG/L AS U) 0.2

THERMAL TEMPERATURE, AIR (°C) 20.5
H2S, LAB (MG/L AS H2S) 0.01
IODIDE TOTAL (MG/L AS I) 0.01
BORON, DISS. (MG/L AS B) 0.02
ANTIMONY, DISS. (MG/L AS SB) 0.2
ARSENIC, DISS. (UG/L AS AS) 2.0
SELENIUM, DISS. (UG/L AS SE) 2.0

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT USED 7 FILTERS TO GET FILT+ SAMP+SPECIAL SAMPLE THRU LASL NO. 309803C

EXPLANATION: MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSPENDED OR TOTAL RECOVERABLE  (M)=MEASURED  (R)=REPORTED  (E)=ESTIMATED  M = METERS

PROCESSING PGM: G Wanal (FORM 153)
FUND: CG 75/0

PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HC03 CO3 NO3
51 13 28 6 10 15 74 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0385
STATE MONTANA
LATITUDE-LONGITUDE 443911N 113837W
TOPOGRAPHIC MAP UPPER RED ROCK LAKE
GEOLOGICAL SOURCE 110ALVM
DRAINAGE BASIN 41A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 09-28-77
TIME SAMPLED 0930
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 6220
METHOD SAMPLED GRAB
SAMPLING SITE ELK SPRINGS, 1 MI SW OF ELK LAKE
DRAINAGE BASIN RED ROCK RIVER
COUNTRY BEAVERHEAD
SAMPLE LOCATION 13S 1E 31DCAB
SAMPLE SOURCE SPRING
STATION CODE 806-CV
BOTTLE NO. 6640 FT < 10
ALTITUDE OF SAMPLE POINT
TOTAL DEPTH OF WATER
STAGE HEIGHT
DEPTH TO SAMPLING POINT
FLOW MEAS METHOD FLOAT AND STOPWA
WATER FLOW RATE 1.4 CFM(M)
WATER USE MULTIPLE USE

MG/L MEQ/L MG/L MEQ/L
CALCIUM (CA) 23.6 1.178 BICARBONATE(HCO3) 98.1 1.606
MAGNESIUM (Mg) 4.2 0.346 CARBONATE (CO3) 4.0 0.000
SODIUM (Na) 4.8 0.209 CHLORIDE (Cl) 4.1 0.116
POTASSIUM (K) 4.0 0.102 SULFATE (SO4) 3.2 0.067
IRON (Fe) 0.01 0.001 NITRATE(AS N) 4.04 0.029
MANGANESE (Mn) < 0.01 0.000 NO3+NO2 TOT(AS N) 4.0 0.021
ALUMINUM (AL) 34.4 FLUORIDE (F) 4.0 0.021
SILICA (SiO2) 34.4 0-PHOSPHATE(AS P) 4.0 0.021
TOTAL CATIONS 1.835 TOTAL ANIONS 1.838

STANDARD DEVIATION OF ANION - CATION BALANCE 0.02 SIGMA

LABORATORY PH 7.44 TOTAL HARDNESS AS CACO3 76
FIELD TEMPERATURE
TOTAL ALKALINITY AS CACO3 80
CALCULATED DISSOLVED SOLIDS 127.4 SODIUM ADSORPTION RATIO 0.2
SUM OF DISS. CONSTITUENTS 177.1 RYZNAR STABILITY INDEX 8.9
LAB SPEC. COND. (MICROMHOS/CM) 177.6 LANGLIER SATURATION INDEX -0.7

ADDITIONAL PARAMETERS

CNDCUTVNY, FIELD MICROMHOS 152
TEMPERATURE, AIR (C) 10.1
AMMONIA, TOTAL (MG/L AS N) < 0.03 H2S, LAB (MG/L AS H2S) < 0.1
BROMIDE TOT, RECOR(MG/L-BR) < 0.1 IODIDE TOT, RECOR(MG/L-I) < 0.01
ALUMINUM, DISS (MG/L-AL) < 0.08 BORON, DISS (MG/L AS B) < 0.03
LITHIUM, DISS (MG/L AS LI) < 0.01 ANTIMONY, DISS (MG/L AS SB) < 0.2
STRONTIUM, DISS (MG/L-SR) < 0.06 ARSENIC, DISS (MG/L AS AS) < 2.0
MERCURY, DISS (UG/L AS HG) < 3 SELENIUM, DISS (UG/L-SE) < 2.0
URANIUM DISS (UG/L AS U) 6

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT SPECIAL SAMPLE THROU LASL SAMPLE 309802

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153) PERCENTAGE REACTANCE VALUES
FUND: CG75/ CA MG NA K CL SO4 HCO3 CO3 NO3
64 18 11 5 6 3 89 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0386
STATE: MONTANA  
LATITUDE-LONGITUDE: 44°47'11"N 111°39'18"W  
TOPOGRAPHIC MAP: CLIFF LAKE  
GEOLOGICAL SOURCE: 112VLCC  
DRAINAGE BASIN: 41°F  
AGENCY + SAMPLER: MBMG * JLS  
DATE SAMPLED: 09-29-77  
TIME SAMPLED: 1300  
LAB + ANALYST: MBMG * GAM  
DATE ANALYZED: 11-30-77  
SAMPLE HANDLING: 6220  
METHOD SAMPLED: GRAB  

SAMPLING SITE: WEST FORK SWIMMING HOLE  
DRAINAGE BASIN: MADISON RIVER  

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<tr>
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<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>19</td>
<td>0.948</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>29</td>
<td>2.386</td>
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<tr>
<td>SODIUM (NA)</td>
<td>4.8</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>1.9</td>
<td>0.049</td>
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<tr>
<td>IRON (FE)</td>
<td>&lt; .01</td>
<td>0.000</td>
</tr>
<tr>
<td>MANGANESE (MN)</td>
<td>&lt; .01</td>
<td>0.000</td>
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<tr>
<td>ALUMINUM (AL)</td>
<td>13.7</td>
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<tr>
<td>SILICA (SiO2)</td>
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<tr>
<td><strong>TOTAL CATIONS</strong></td>
<td>35.91</td>
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<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HCO3)</td>
<td>194</td>
<td>3.179</td>
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<tr>
<td>CARBONATE (CO3)</td>
<td>.0</td>
<td>0.000</td>
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<tr>
<td>CHLORIDE (CL)</td>
<td>2.75</td>
<td>0.078</td>
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<tr>
<td>SULFATE (SO4)</td>
<td>11.8</td>
<td>0.246</td>
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<tr>
<td>NITRATE (AS N)</td>
<td>.099</td>
<td>0.007</td>
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<tr>
<td>NO3+NO2 TOT (AS N)</td>
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</tr>
<tr>
<td>FLUORIDE (F)</td>
<td>.4</td>
<td>0.021</td>
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<tr>
<td>P-H PHOSPHATE (AS P)</td>
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<tr>
<td><strong>TOTAL ANIONS</strong></td>
<td>3.531</td>
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STANDARD DEVIATION OF ANION - CATION BALANCE = 0.38 SIGMA

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<td>LABORATORY PH</td>
<td>7.88</td>
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<tr>
<td>FIELD TEMPERATURE</td>
<td>25.5°C</td>
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<tr>
<td>TOTAL HARDNESS AS CACO3</td>
<td>167</td>
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<tr>
<td>SODIUM ADSORPTION RATIO</td>
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<tr>
<td>RYZNAR STABILITY INDEX</td>
<td>8.1</td>
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<tr>
<td>LANGLIER SATURATION INDEX</td>
<td>0.1</td>
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ADDITIONAL PARAMETERS

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<tr>
<td>TEMPATURE, AIR (C)</td>
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<tr>
<td>H2S, LAB (MG/L AS H2S)</td>
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<tr>
<td>IODIDE TOT. REC. (MB/L-I)</td>
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<td>BORON, DISS (MG/L AS B)</td>
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<tr>
<td>ANTIMONY, DISS (MG/L AS SB)</td>
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<td>ARSENIC, DISS (UG/L AS AS)</td>
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<tr>
<td>SELENIUM, DISS (UG/L-SE)</td>
<td>2.0</td>
</tr>
<tr>
<td>CNDUCTIVITY, FIELD MICROMOH</td>
<td>322</td>
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<tr>
<td>AMMONIA, TOTAL (MG/L AS N)</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>BROMIDE TOT. REC. (MG/L- BR)</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>ALUMINUM, DISS (MG/L-AL)</td>
<td>&lt; 0.023</td>
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<tr>
<td>LITHIUM, DISS (MG/L AS LI)</td>
<td>&lt; 0.01</td>
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<tr>
<td>STRONTIUM, DISS (MG/L- SR)</td>
<td>&lt; 0.12</td>
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<tr>
<td>MERCURY, DISS (UG/L AS HG)</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>URANIUM DISS (UG/L AS U)</td>
<td>&lt; 0.6</td>
</tr>
</tbody>
</table>

REMARKS: CENT. VALLEY GEOTHERMAL  
LASL NO: 309813

EXPLANATION: MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVILENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M = METERS

PROCESSING PGM: Gawan(FORM 153)  
PERCENTAGE REACTANCE VALUES  
FUND: CA MG NA K CL SO4 HCO3 CO3 NO3  
26 66 5 1 2 7 90 0  

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0395
### Water Quality Analysis

**State**: Montana  
**County**: Madison

**Sample Location**: 125 1E 19CD  
**Sample Source**: Spring  
**Station Code**: Sloan Camp  
**Bottle No.**: 906

**Location**  
**Sampling Site**: Sloan Cow Camp Warm Spring  
**Drainage Basin**: Madison River

<table>
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<tr>
<th>Metric</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>46°46'48&quot;N</td>
</tr>
<tr>
<td>Longitude</td>
<td>111°39'27&quot;W</td>
</tr>
<tr>
<td>Topographic Map</td>
<td>Cliff Lake</td>
</tr>
<tr>
<td>Geological Source</td>
<td>112VLC</td>
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<tr>
<td>Drainage Basin</td>
<td>41*F</td>
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<tr>
<td>Agency + Sampler</td>
<td>MMG * JLS</td>
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<tr>
<td>Date Sampled</td>
<td>09-29-77</td>
</tr>
<tr>
<td>Time Sampled</td>
<td>1100</td>
</tr>
<tr>
<td>Lab + Analyst</td>
<td>MMG * GAM</td>
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<tr>
<td>Date Analyzed</td>
<td>11-30-77</td>
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<tr>
<td>Sample Handling</td>
<td>6220</td>
</tr>
<tr>
<td>Method Sampled</td>
<td>GRAB</td>
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</table>

#### Sampling Site Details
- **SAMPLING SITE**: Sloan Cow Camp Warm Spring  
- **DRAINAGE BASIN**: Madison River

#### Chemical Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value (mg/L)</th>
<th>Value (meq/L)</th>
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</thead>
<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>9.9</td>
<td>0.045</td>
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<tr>
<td>Magnesium (Mg)</td>
<td>1.0</td>
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<tr>
<td>Sodium (Na)</td>
<td>88.8</td>
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<tr>
<td>Potassium (K)</td>
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<tr>
<td>Iron (Fe)</td>
<td>0.17</td>
<td>0.009</td>
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<tr>
<td>Manganese (Mn)</td>
<td>&lt;0.01</td>
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<tr>
<td>Aluminum (Al)</td>
<td>50.9</td>
<td>0.050</td>
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<tr>
<td>Silica (SiO2)</td>
<td>50.9</td>
<td>0.163</td>
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</tbody>
</table>

#### Total Cations
- **Total Cations**: 3.918 mg/L

#### Total Anions
- **Total Anions**: 3.991 meq/L

#### Deviation Analysis
- **Standard Deviation of Anion - Cation Balance**: 0.44 Sigma

#### Laboratory Parameters
- **Laboratory PH**: 9.75
- **Field Temperature**: 29.8°C
- **Total Hardness as CaCO3**: 177 mg/L
- **Sodium Adsorption Ratio**: 23.5
- **RYNZAR Stability Index**: 8.7
- **Lab Spec. Cond. (Micromhos/cm)**: 396.0

#### Additional Parameters
- **Cnductvty/Fiel Micromhos**: 410
- **Ammonia**: Total (mg/L as N) < 0.03
- **Bromide**: Tot. Rec (mg/L-BR) < 1
- **Aluminum**: Diss (mg/L-Al) < 2
- **Lithium**: Diss (mg/L as Li) < 2
- **Strontium**: Diss (mg/L-SR) < 0.1
- **Mercury**: Diss (mg/L as Hg) < 2
- **Uranium**: Diss (mg/L as U) < 2

#### Remarks
- **Remarks**: CENT. VALLEY GEOTHERMAL LASM NO. 309812

#### Explanation
- **mg/L = Milligrams Per Liter**  
**meq/L = Milliequivalents Per Liter**
- **All Constituents Dissolved (DIS) except as noted: Tot=Total Susp=Suspended**
- **Tr=Total Recoverable (M)=Measured (R)=Reported (E)=Estimated**
- **M = Meters**

#### Processing Program
- **Gwanal (Form 153)**

#### Percentage Reactance Values

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Ca</td>
<td>1.0</td>
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<tr>
<td>Mg</td>
<td>0.97</td>
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<td>Na</td>
<td>0.5</td>
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<td>K</td>
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<td>Cl</td>
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<td>HCO3</td>
<td>0.03</td>
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<tr>
<td>CO3</td>
<td>0.01</td>
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#### Note
- In correspondence related to this Analysis refer to number 78M0397
MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406)792-8321

STATE MONTANA
LATITUDE-LONGITUDE 444134N 115544W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLOGICAL SOURCE 111CLVM
DRAINAGE BASIN 41A
AGENCY + SAMPLER MMBG * JLS
DATE SAMPLED 09-28-77
TIME SAMPLED 1330
LAB + ANALYST MMBG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 6120
METHOD SAMPLED GHAH

SAMPLE LOCATION 135 3W 23RD
SAMPLE SOURCE SPRING
STATION CODE 905

ALTIMETRY OF SAMPLE POINT 6810+ FT <50
TOTAL DEPTH OF WATER
STAGE HEIGHT

FLOW MEAS METHOD
WATER FLOW RATE 20. GPM(E)
WATER USE STOCK

SAMPLING SITE SPRING 1.5 MILES WEST OF FISH CK RD JNCT
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th>Component</th>
<th>Mg/L</th>
<th>Meq/L</th>
<th>Component</th>
<th>Mg/L</th>
<th>Meq/L</th>
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<tbody>
<tr>
<td>Calcium (Ca)</td>
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<td>2.625</td>
<td>Total Cations</td>
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<td>Magnesium (Mg)</td>
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<td>Sodium (Na)</td>
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<td>Potassium (K)</td>
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<td>Iron (Fe)</td>
<td>3.02</td>
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<td>Manganese (Mn)</td>
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<td>&lt;0.000</td>
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<td>Aluminum (Al)</td>
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<td>Silica (SiO2)</td>
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<td>Bicarbonate (HCO3)</td>
<td>210+</td>
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</tr>
<tr>
<td>Chloride (Cl)</td>
<td>8.55</td>
<td>0.241</td>
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<td>Sulfate (SO4)</td>
<td>10.4</td>
<td>0.217</td>
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<td>Nitrate (As N)</td>
<td>3.12</td>
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</tr>
<tr>
<td>NO3+NO2</td>
<td>0.000</td>
<td>0.016</td>
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<tr>
<td>Fluoride (F)</td>
<td>0.3</td>
<td>0.016</td>
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<tr>
<td>Phosphorus (As P)</td>
<td>0.0</td>
<td>0.000</td>
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</tr>
</tbody>
</table>

STANDARD DEVIATION OF ANION - CATION BALANCE - 0.16 SIGMA

LABORATORY PH 7.72
FIELD TEMPERATURE 11.8 C
TOTAL HARDNESS AS CACO3 164+
TOTAL ALKALINITY AS CACO3 172+
SODIUM ADSORPTION RATIO 0.5
RYZMAR STABILITY INDEX 7.3
LANGIHER SATURATION INDEX 0.2

ADDITIONAL PARAMETERS

CONDUCTIVITY, FIELD MICROMH 357
TEMPERATURE, AIR (C) 16
H2S, LAB (Mg/L AS H2S) .25
IODIDE TOT-REC (Mg/L-I) .01
BORON DISS (Mg/L AS B) .01
ANTIMONY DISS (Mg/L AS SB) .2
ARSENIC DISS (Mg/L AS AS) 2.0
SELENIUM DISS (Mg/L-SE) 2.0
AMMONIA, TOTAL (Mg/L AS N) .03
BROMIDE TOT-REC (Mg/L-BR) .1
ALUMINUM DISS (Mg/L-AL) .09
LITHIUM DISS (Mg/L AS LI) .01
STRONIUM DISS (Mg/L-SR) .21
MERCURY DISS (Mg/L AS HG) .3
URANIUM DISS (Mg/L AS U) 3.6

REMARKS: CENT. VALLEY GEOThERMAL LASL NO. 309807

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M= METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES
CA Mg Na K Cl SO4 HCO3 CO3 NO3
66 16 14 2 6 5 88 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 780398
STATE MONTANA
LATITUDE-LONGITUDE 443622N 1115622W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLOGICAL SOURCE 122VLCC
DRAINAGE BASIN 41*A
AGENCY + SAMPLER MBMG * JLS
DATE SAMPLED 09-27-77
TIME SAMPLED 1415
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 6120
METHOD SAMPLED GRAB

SAMPLING SITE HUNTSMAN RANCH SPRING
DRAINAGE BASIN RED ROCK RIVER

Mg/L MEQ/L Mg/L MEQ/L
CALCIUM (CA) 38.4 1.916 BICARBONATE (HCO3) 223 3.655
MAGNESIUM (MG) 13.2 1.086 CARBONATE (CO3) 40 0.000
SODIUM (NA) 20.9 0.909 CHLORIDE (CL) 12.35 0.348
POTASSIUM (K) 4.8 0.123 SULFATE (SO4) 8.1 0.169
IRON (FE) <0.01 0.000 NITRATE(AS N) 0.325 0.023
MANGANESE (MN) <0.01 0.000 NO3+NO2 TOT(AS N) 0.2 0.011
ALUMINUM (AL) 0.00 0.000 FLUORIDE (F) 0.00 0.000
SILICA (SiO2) 37.2 0.000 PHOSPHATE(AS P) 0.00 0.000

TOTAL CATIONS 40.34
TOTAL ANIONS 4.205

STANDARD DEVIATION OF ANION = CATION BALANCE 1.01 SIGMA

LABORATORY PH 8.06
FIELD TEMPERATURE 9.8 C
TOTAL HARDNESS AS CACO3 150
TOTAL ALKALINITY AS CACO3 183
CALCULATED DISSOLVED SOLIDS 245.3 SODIUM ADSORPTION RATIO 0.7
SUM OF DISS. CONSTITUENTS 358.5 RYBNAR STABILITY INDEX 7.1
LAB SPEC.COND. (MICROMOS/CMI) 377.6 LANGLIER SATURATION INDEX 0.5

ADDITIONAL PARAMETERS

PH/FIELD(SU) 7.31 TEMPERATURE, AIR (C) 18.5
CNDCUVY/FIELD MICROMOS 381 AMMONIA, TOTAL (MG/L AS N) <0.03
H2S, LAB (MG/L AS H2S) 0.09 BROMIDE TOT. (RECA (MG/L-BR) <1
IODIDE TOT. (MB/L-I) <1 ALUMINUM, DISS (MG/L-AL) 0.047
BORON, DISS (MG/L AS B) 0.02 LITHIUM, DISS (MG/L AS LI) <0.01
ANTIMONY, DISS (MG/L AS Sb) <0.2 STRONTIUM, DISS (MG/L- Sr) <0.21
ARSENIC, DISS (UG/L AS AS) <2.0 MERCURY, DISS (UG/L AS HG) <0.3
SELENIUM, DISS (UG/L-SE) <2.0 URANIUM, DISS (UG/L AS U) 2.8

REMARKS: CENT: VALLEY GEOTHERMAL SAMPLES FOR BR, I, H2S, U LASL NO. 309801

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FRM 153) PERCENTAGE REACTANCE VALUES
FUND: CA MG NA K CL SO4 HCO3 CO3 NO3
47 26 22 3 8 4 87 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0402
<table>
<thead>
<tr>
<th>Parameter</th>
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<tbody>
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<tr>
<td>Magnesium (Mg)</td>
<td>4.7</td>
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<tr>
<td>Sodium (Na)</td>
<td>30.8</td>
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<td>Potassium (K)</td>
<td>3.3</td>
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<tr>
<td>Iron (Fe)</td>
<td>2.4</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>2.3</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>21.4</td>
</tr>
<tr>
<td>Silica (SiO₂)</td>
<td>21.4</td>
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<tr>
<td>Bicarbonate (HCO₃⁻)</td>
<td>1.372</td>
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<tr>
<td>Carbonate (CO₃⁻)</td>
<td>0.387</td>
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<tr>
<td>Chloride (Cl⁻)</td>
<td>1.340</td>
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<tr>
<td>Sulfate (SO₄²⁻)</td>
<td>0.087</td>
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<tr>
<td>Nitrate (NO₃⁻)</td>
<td>0.013</td>
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<tr>
<td>Manganese (Mn)</td>
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<tr>
<td>Fluoride (F⁻)</td>
<td>0.005</td>
</tr>
<tr>
<td>Phosphate (PO₄³⁻)</td>
<td>0.03</td>
</tr>
<tr>
<td>Total Cations</td>
<td>3.203</td>
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<tr>
<td>Total Anions</td>
<td>3.315</td>
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</tbody>
</table>

**Standard Deviation of Anion-Cation Balance 0.71 Sigma**

**Laboratory pH** 8.74

**Field Temperature** 11.8°C

**Calculated Dissolved Solids** 197.5

**Sum of Diss. Constituents** 258.8

**Lab Spec. Cond. (Micromhos/cm)** 299.7

**Langlier Saturation Index** 0.8

**Additional Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Conductivity, Field Micromhos</td>
<td>310.</td>
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<tr>
<td>Temperature, Air (C)</td>
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<tr>
<td>H₂S, Lab (mg/l as H₂S)</td>
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<tr>
<td>Iodide Tot. Rec. (mg/l-I)</td>
<td>0.01</td>
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<tr>
<td>Boron, Diss (mg/l as B)</td>
<td>0.02</td>
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<tr>
<td>Antimony, Diss (mg/l as Sb)</td>
<td>2.0</td>
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<tr>
<td>Arsenic, Diss (mg/l as As)</td>
<td>2.0</td>
</tr>
<tr>
<td>Selenium, Diss (ug/l-se)</td>
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<tr>
<td>Ammonia, Total (mg/l as N)</td>
<td>0.06</td>
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<tr>
<td>Bromide Tot. Rec (mg/l-br)</td>
<td>0.1</td>
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<tr>
<td>Aluminum, Diss (mg/l-al)</td>
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<tr>
<td>Lithium, Diss (mg/l as Li)</td>
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<tr>
<td>Strontium, Diss (mg/l-sr)</td>
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<tr>
<td>Mercury, Diss (ug/l as Hg)</td>
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<tr>
<td>Uranium, Diss (ug/l as U)</td>
<td>2.3</td>
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</table>

**Remarks**: Cent. Valley Geothermal Loc. NNE of Hot Spring, Just Across Fence In Next Sec. North Lasl No. 309815

**Explanation**: mg/l=Milligrams Per Liter, meq/l=Milliequivalents Per Liter, All Constituents Dissolved (Diss) Except As Noted; Tot=Total Suspended (TR=Total Recoverable (M)=Measured (R)=Reported (E)=Estimated M=Metres

**Processing Pgm**: Gwanal(Form 153)

**Percentage Reactance Values**

<table>
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<tr>
<th>Value</th>
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<td>CA</td>
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<tr>
<td>Mg</td>
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<tr>
<td>Na</td>
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<tr>
<td>K</td>
<td>2</td>
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<tr>
<td>Cl</td>
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<tr>
<td>SO₄</td>
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<tr>
<td>HCO₃</td>
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<tr>
<td>CO₃</td>
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<tr>
<td>N0₃</td>
<td>0</td>
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</tbody>
</table>

**Note**: In Correspondence Related to This Analysis Refer to Number 78M0424
MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406)792-8321

WATER QUALITY ANALYSIS
LAB NO. 78M0425

STATE: MONTANA
COUNTY: MADISON
LATITUDE-LONGITUDE: 445902N 1113656W
SAMPLE LOCATION: 1OS 1E 98BBB
TOPOGRAPHIC MAP: CLIFF LAKE
SAMPLE SOURCE: SPRING
GEOLOGICAL SOURCE: 110TRRC
STATION CODE: 913
DRAINAGE BASIN: 41F
BOTTLE NO.: 913
AGENCY + SAMPLER: MBMG * JLS
ALTITUDE OF SAMPLE POINT: 6085.5 FT <1
DATE SAMPLED: 09-30-77
TOTAL DEPTH OF WATER: 
TIME SAMPLED: 1330
STAGE HEIGHT: 
LAB + ANALYST: MBMG * GAM
DEPT OF SAMPLING POINT: 
DATE ANALYZED: 12-15-77
FLOW MEAS METHOD: 
SAMPLE HANDLING: 6220
WATER FLOW RATE: 
METHOD HANDLING: GRAB
WATER USE: STOCK

SAMPLING SITE: WOLF CREEK HOT SPRING
DRAINAGE BASIN: MADISON RIVER

<table>
<thead>
<tr>
<th>CATION/MG/L</th>
<th>CATION/MEQ/L</th>
<th>ANION/MG/L</th>
<th>ANION/MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
<td>8.6</td>
<td>0.429</td>
<td>BICARBONATE (HCO3)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>1.5</td>
<td>0.123</td>
<td>CARBONATE (CO3)</td>
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<tr>
<td>SODIUM (NA)</td>
<td>97.5</td>
<td>4.219</td>
<td>CHLORIDE (CL)</td>
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<tr>
<td>POTASSIUM (K)</td>
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<td>SULFATE (SO4)</td>
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<tr>
<td>IRON (FE)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NITRATE (N)</td>
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<tr>
<td>MANGANESE (MN)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NO3 + NO2 TOT (N)</td>
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<tr>
<td>ALUMINUM (AL)</td>
<td>50.3</td>
<td>0.000</td>
<td>FLUORIDE (F)</td>
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<tr>
<td>SILICA (SiO2)</td>
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<td></td>
<td>O-PHOSPHATE (AS P)</td>
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</table>

TOTAL CATIONS: 4.818 
TOTAL ANIONS: 4.274

STANDARD DEVIATION OF ANION - CATION BALANCE = 3.07 SIGMA

LABORATORY PH: 8.64 
FIELD TEMPERATURE: 54.5 C 
TOTAL HARDNESS AS CACO3: 28.5 
TOTAL ALKALINITY AS CACO3: 140.5 
CALCULATED DISSOLVED SOLIDS: 306.8 
SODIUM ADSORPTION RATIO: 8.0 
SUM OF DISS. CONSTITUENTS: 384.9 
RYZMAR STABILITY INDEX: 8.1 
LAB SPEC. COND. % (MICROMOS/CM): 483.3 
LANGLIER SATURATION INDEX: 0.3

ADDITIONAL PARAMETERS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
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<tr>
<td>H2S, LAB (MG/L AS H2S)</td>
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<tr>
<td>IODIDE TOT. REC. (MB/L-I)</td>
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</tr>
<tr>
<td>BORON, DISS. (MG/L AS B)</td>
<td>0.03</td>
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<tr>
<td>ANTIMONY, DISS. (MG/L AS SB)</td>
<td>2</td>
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<tr>
<td>ARSENIC, DISS. (UG/L AS AS)</td>
<td>5.0</td>
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<tr>
<td>SELENIUM, DISS. (UG/L-SE)</td>
<td>2.0</td>
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<tr>
<td>PH, FIELD(SU)</td>
<td>11.03</td>
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<tr>
<td>AMMONIA, TOT. (MG/L AS N)</td>
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<td>BROMIDE TOT. REC. (MG/L-BR)</td>
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<tr>
<td>ALUMINUM, DISS. (MG/L-AL)</td>
<td>&lt;0.039</td>
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<tr>
<td>LITHIUM, DISS. (MG/L AS LI)</td>
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<tr>
<td>STRONTIUM, DISS. (MG/L-SR)</td>
<td>0.06</td>
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<tr>
<td>MERCURY, DISS. (UG/L AS Hg)</td>
<td>&lt;0.3</td>
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<tr>
<td>URANIUM DISS. (UG/L AS U)</td>
<td>&lt;0.6</td>
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REMARKS: CENT. VALLEY GEOTHERMAL LASL NO. 309814 = POOR BALANCE MAY BE DUE TO CO2 LOSS.

EXPLANATION: MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: / CA MG NA K CL SO4 HCO3 CO3 NO3: 8 2 87 0 13 20 59 6

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0425
STATE: MONTANA
LATITUDE-LONGITUDE: 44°57'35"N 111°37'14"W
TOPOGRAPHIC MAP: CLIFF LAKE
GEOLOGICAL SOURCE: 4.14F
DRAINAGE BASIN: MBMG * JLS
AGENCY + SAMPLER: ALTIMETRY SOURCE
DATE SAMPLED: 10-01-77
TIME SAMPLED: 1200
LAB + ANALYST: MBMG * GAM
DATE ANALYZED: 11-30-77
SAMPLE HANDLING: 6220
METHOD SAMPLED: GRAB

SAMPLING SITE: SUN RANCH GUEST HOUSE WELI
GEOLOGICAL SOURCE: 4.14F

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>41.2</td>
<td>2.0356</td>
<td>BICARBONATE (HCO3)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
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<td>CARBONATE (CO3)</td>
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<td>SODIUM (NA)</td>
<td>8.7</td>
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<td>CHLORIDE (CL)</td>
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<td>POTASSIUM (K)</td>
<td>3.7</td>
<td>0.027</td>
<td>SULFATE (SO4)</td>
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<tr>
<td>IRON (FE)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NITRATE (AS N)</td>
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<tr>
<td>MANGANESE (MN)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NO3+NO2 TOT (AS N)</td>
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<tr>
<td>ALUMINUM (AL)</td>
<td>40.2</td>
<td>0.000</td>
<td>FLUORIDE (F)</td>
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<tr>
<td>SILICA (SiO2)</td>
<td>40.2</td>
<td>0.000</td>
<td>PHOSPHATE (AS P)</td>
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TOTAL CATIONS: 2.973
TOTAL ANIONS: 2.961

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.08 SIGMA

LABORATORY PH: 7.83
FIELD TEMPERATURE: 80°C
CALCULATED DISSOLVED SOLIDS: 191.8
SUM OF DISS. CONSTITUENTS: 269.4
LAB SPEC. COND. (MICROMOS/CM): 277.0

ADDITIONAL PARAMETERS

CNDFACTIVITY FIELD MICROMOS: 278.0
TEMPERATURE, AIR (C): 8.0
H2S LAB (MG/L AS H2S): .28
IODIDE TOT (RECM MG/L AS I): <.01
BORON TOT (MG/L AS B): <.02
ANTIMONY TOT (MG/L AS S): <.2
ARSENIC TOT (MG/L AS AS): <2.0
SELENIUM TOT (MG/L AS SE): <2.0
PH FIELD (SU): 8.57
AMMONIA TOT (MG/L AS N): <.03
BROMIDE TOT (MG/L BR): <.1
ALUMINUM TOT (MG/L AS AL): <.042
LITHIUM TOT (MG/L AS LI): <.01
STORNIUM TOT (MG/L SR): <.13
MERCURY TOT (MG/L AS HG): <.3
URANIUM TOT (MG/L AS U): <3.1

REMARKS: CENT. VALLEY GEOTHERMAL LASL NO: 309816

EXPLANATION: MG/L=MILLIGRAMS PER LITER
MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DSS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CA MG NA K CL S04 HCO3 CO3 NO3
69 14 12 3 7 5 86 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0429
**STATE**: MONTANA  
**COUNTY**: MADISON  
**LATITUDE-LONGITUDE**: 44°52.9N 111°32.4W  
**SAMPLE LOCATION**: 11S 1E 130DB  
**SAMPLE SOURCE**: SPRING  
**TOPOGRAPHIC MAP**: CLIFF LAKE  
**SAMPLE CODE**: 918  
**GEOLOGICAL SOURCE**: 110 TRCC  
**BOTTLE NO.**:  
**DRAINAGE BASIN**: 41*F  
**AGENCY + SAMPLER**: M8MG * JLS  
**DATE SAMPLED**: 10-01-77  
**TIME SAMPLED**: 1445  
**LAB + ANALYST**: M8MG * GAM  
**DATE ANALYZED**: 11-30-77  
**SAMPLE HANDLING**: 6220  
**METHOD SAMPLED**: GRAB  
**SAMPLING SITE**: SCHUSTERS PLACE HILLSLOPE SPRING  
**DRAINAGE BASIN**: MADISON RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (Ca)</td>
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<td>BICARBONATE (HCO3)</td>
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<td>CARBONATE (CO3)</td>
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<td>SODIUM (Na)</td>
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<td>CHLORIDE (Cl)</td>
<td>1.40</td>
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<tr>
<td>POTASSIUM (K)</td>
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<td>SULFATE (SO4)</td>
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<td>IRON (Fe)</td>
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<td>&lt;0.1</td>
<td>0.000</td>
<td>NO3+NO2 (TOT (As N)</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>19.3</td>
<td>0.01</td>
<td>FLUORIDE (F)</td>
<td>0.4</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td></td>
<td></td>
<td>O-PHOSPHATE (As P)</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL CATIONS**: 1.278  
**TOTAL ANIONS**: 1.386

**STANDARD DEVIATION OF ANION - CATION BALANCE**: 0.53 SIGMA

**LABORATORY PH**: 8.46  
**FIELD TEMPERATURE**: 9.5°C  
**CALCULATED DISSOLVED SOLIDS**: 85.2  
**SUM OF DISS. CONSTITUENTS**: 119.7  
**LAB SPEC. COND. (MICROMOS/CM)**: 123.8  

**ADDITIONAL PARAMETERS**

<table>
<thead>
<tr>
<th>PH/FIELD(SU)</th>
<th>8.10</th>
<th>TEMPERATURE, AIR (C)</th>
<th>8.0</th>
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<tr>
<td>CNDCUTTVY/FIELD MICROHONS</td>
<td>128</td>
<td>AMMONIA, TOTAL (MG/L AS N)</td>
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<tr>
<td>H2S= LAB (MG/L AS H2S)</td>
<td>&lt; 1</td>
<td>BROMIDE TOT.+REC. (MG/L-BR)</td>
<td>&lt; 1</td>
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<tr>
<td>IODIDE TOT. REC. (MB/L-I)</td>
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<td>ALUMINUM, DISS (MG/L-AL)</td>
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<tr>
<td>BORON, DISS (MG/L AS B)</td>
<td>&lt; 0.02</td>
<td>LITHIUM, DISS (MG/L AS LI)</td>
<td>&lt; 0.01</td>
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<tr>
<td>ANTIMONY, DISS (MG/L AS SB)</td>
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<td>STRONTIUM, DISS (MG/L-SR)</td>
<td>&lt; 0.6</td>
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<tr>
<td>ARSENIC, DISS (UG/L AS AS)</td>
<td>&lt; 2.0</td>
<td>MERCURY, DISS (UG/L AS Hg)</td>
<td>&lt; 3</td>
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<tr>
<td>SELENIUM, DISS (UG/L-SE)</td>
<td>&lt; 2.0</td>
<td>URANIUM DISS. (UG/L AS U)</td>
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</tbody>
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**REMARKS**: CENT-VALLEY GEOTHERMAL LASL MO. 309817

**EXPLANATION**: MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS  

**PROCESSING PGM**: GWANAL(FORM 153)  
**PERCENTAGE REACTANCE VALUES**

| FUND:  / | CA | Mg | Na | K | CL | SO4 | HCO3 | CO3 | NO3 | 61 | 20 | 16 | 2 | 3 | 6 | 87 | 3 | 3 |

**NOTE**: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0430
STATE: MONTANA
LATITUDE-LONGITUDE: 44°46'03"N 112°29'51"W
TOPOGRAPHIC MAP: CLIFF LAKES
GEOLOGICAL SOURCE: 112VLCC
DRAINAGE BASIN: 41#F
AGENCY + SAMPLER: MBSG * JLS
DATE SAMPLED: 10-02-77
TIME SAMPLED: 1700
LAB + ANALYST: MBSG * GAM
DATE ANALYZED: 11-30-77
SAMPLE HANDLING: 6220
METHOD SAMPLED: GRAB

SAMPLING SITE: HORN CREEK SPRING
DRAINAGE BASIN: MADISON RIVER
COUNTY: MADISON
SAMPLE LOCATION: 125 2E 20DDD
SAMPLE SOURCE: SPRING
STATION CODE: 925
BOTTLE NO.: 450 FT < 50
ALTITUDE OF SAMPLE POINT: TOTAL DEPTH OF WATER
STAGE HEIGHT: DEPTH TO SAMPLING POINT
FLOW MEAS METHOD: WATER FLOW RATE
WATER USE: DOMESTIC AND STD

CALCIUM (CA): 27
MAGNESIUM (MG): 14.2
SODIUM (NA): 9.6
POTASSIUM (K): 2.0
IRON (FE): < 0.01
MANGANESE (MN): < 0.01
ALUMINUM (AL): 17.3
SILICA (SI02): 0.3

BICARBONATE (HCO3): 170
CARBONATE (CO3): 0
CHLORIDE (CL): 3.65
SULFATE (SO4): 4.2
NITRATE (AS N): 5.65
FLUORIDE (F): 0.3
PHOSPHATE (AS P): 0.016

TOTAL CATIONS: 2.984
TOTAL ANIONS: 3.033

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.31 SIGMA

LABORATORY PH: 8.01
FIELD TEMPERATURE: 8.4 C
CALCULATED DISSOLVED SOLIDS: 162.6
SUM OF DISS. CONSTITUENTS: 248.8
LAB SPEC. COND. (MICROMOS/CN): 276.2

ADDITIONAL PARAMETERS

TEMPERATURE, AIR (C): 13
AMMONIA, TOTAL (MG/L AS N): < 0.03
BROMIDE, TOT, REC. (MG/L-BR): < 0.03
ALUMINUM, DISS. (MG/L-AL): < 0.03
LITHIUM, DISS. (MG/L AS LI): < 0.01
STRONTIUM; DISS. (MG/L-SR): < 0.06
MERCURY, DISS. (UG/L AS HG): < 0.3
URANIUM DISS. (UG/L AS U): < 0.4

REMARKS: CENT. VALLEY GEOThermal LASL NO: 809824

EXPLANATION: MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT = TOTAL SUSPENDED
TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
PERCENTAGE REACTANCE VALUES
Ca Mg Na K Cl SO4 HCO3 CO3 NO3
45 39 13 1 3 2 93 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0437
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°20'9"N 111°30'8"W
SAMPLE LOCATION: 13S 2W 18ADC
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
SAMPLE SOURCE: SPRING
GEOLICAL SOURCE: BOTTLE MOUNTAIN 99761
AGENCY + SAMPLER: MBBG * JLS
SAMPLE CODE: 926
DRRAINAGE BASIN: 41*A
BOTTLE No.: 926
DATE SAMPLED: 10-03-77
STAGE HEIGHT: 6840.0 FT <5(O
TIME SAMPLED: 1030
TOTAL DEPTH OF WATER: 
LAB + ANALYST: MBBG * GAM
DEPTH TO SAMPLING POINT:
DATE ANALYZED: 11-30-77
FLOW MEAS METHOD: 
SAMPLE HANDLED: 3220
WATER FLOW RATE: 2.0 CFS(E)
METHOD SAMPLED: GRAB
WATER USE: STOCK
SAMPLING SITE: JIMMY ANDERSONS SPRING NO. 1
DRAINAGE BASIN: RED ROCK RIVER

<table>
<thead>
<tr>
<th>CATION/ANION</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>66.5</td>
<td>3.318</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
<td>24</td>
<td>1.974</td>
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<tr>
<td>SODIUM (Na)</td>
<td>27.7</td>
<td>1.205</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>7.3</td>
<td>0.187</td>
</tr>
<tr>
<td>IRON (Fe)</td>
<td>&lt;.01</td>
<td>0.000</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>&lt;.01</td>
<td>0.000</td>
</tr>
<tr>
<td>ALUMINUM (Al)</td>
<td>21.4</td>
<td></td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td></td>
<td>0.089</td>
</tr>
</tbody>
</table>

TOTAL CATIONS: 6685
TOTAL ANIONS: 6771

STANDARD DEVIATION OF ANION = CATION BALANCE 0.41 SIGMA
LABORATORY pH: 7.47
FIELD TEMPERATURE: 28. C
TOTAL HARDNESS AS CAC03: 265
TOTAL VOLATILITY AS CAC03: 202
CALCULATED DISSOLVED SOLIDS: 393.5
SODIUM ADSORPTION RATIO: 0.7
SUM OF DISS. CONSTITUENTS: 518.4
RYZNAR STABILITY INDEX: 7.2
LAB SPEC.COND.(MICROMHOS/CM): 615.0
LANGLIER SATURATION INDEX: 0.1

ADDITIONAL PARAMETERS
TEMPERATURE, AIR (C): 12.0
H2S, LAB (MG/L AS H2S): <.10
IODIDE TOT,REC.(MB/L-I): .01
BORON,DISS (MG/L AS B): .20
ANTIMONY,DISS(MG/L AS SB): <.2
ARSENIC,DISS(UG/L AS AS): 13.6
SELENIUM, DISS (UG/L-SE): <.01
AMMONIA, TOTAL (MG/L AS N): <.03
BROMIDE TOT,REC(MG/L-BR): .1
ALUMINUM, DISS (MG/L-AL): .05
LITHIUM,DISS(MG/L AS Li): .05
STRONTIUM,DISS (MG/L-SR): .5
MERCURY,DISS(UG/L AS HG): <.3
URANIUM,DISS (UG/L AS U): .24

REMARKS: CENT. VALLEY GEOTHERMAL SPRING ABOVE HORSE PASTURE WHERE 3 TREES BELOW ROCK OUTCROP*LASL NO. 809818

EXPLANATION: MG/L=MILLIGRAMS PER LITER ± MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWA NAL (FORM 153)
FUND: / CA MG NA K CL SO4 HC03 CO3 NO3

PERCENTAGE REACTANCE VALUES

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0438
STATE: MONTANA  
LATITUDE-LONGITUDE: 44°21'4N 115°33'4W  
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE  
GEOLOGICAL SOURCE:  
DRAINAGE BASIN: 41*A  
AGENCY + SAMPLER: MBMG + JLS  
DATE SAMPLED: 10-03-77  
TIME SAMPLED: 1200  
LAB + ANALYST: MBMG + GAM  
DATE ANALYZED: 11-30-77  
SAMPLE HANDLING: 6220  
METHOD SAMPLED: GRAB  
SAMPLE LOCATION: JIMMY ANDERSONS SPRING NO. 2  
SAMPLE SOURCE: SPRING  
STATION CODE: 13S 2W 18BDAD  
COUNTY: BEAVERHEAD  
BOTTLE NO.: 927  
ALTITUDE OF SAMPLE POINT: 6840 ft <50  
TOTAL DEPTH OF WATER:  
STAGE HEIGHT:  
DEPTH TO SAMPLING POINT:  
FLOW MEAS METHOD:  
WATER FLOW RATE: 2 CFS(E)  
WATER USE: STOCK  
SAMPLING SITE: RED ROCK RIVER  
PARK NAME: STOCK  

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>71</td>
<td>3.543</td>
<td>BICARBONATE (HC03)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>24</td>
<td>1.974</td>
<td>CARBONATE (CO3)</td>
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<tr>
<td>SODIUM (NA)</td>
<td>26</td>
<td>1.170</td>
<td>CHLORIDE (CL)</td>
<td>9</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>7</td>
<td>0.187</td>
<td>SULFATE (SO4)</td>
<td>118</td>
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<tr>
<td>IRON (FE)</td>
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<td>NITRATE (AS N)</td>
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<tr>
<td>MANGANESE (MN)</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<tr>
<td>ALUMINUM (AL)</td>
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<td>FLUORIDE (F)</td>
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<tr>
<td>SILICA (SIO2)</td>
<td>0</td>
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<td>PHOSPHATE (AS P)</td>
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</tbody>
</table>

TOTAL CATIONS: 6.875
TOTAL ANIONS: 6.858

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.08 SIGMA

LABORATORY PH: 7.47
FIELD TEMPERATURE: 23.5°C
TOTAL HARDNESS AS CACO3: 276
TOTAL ALKALINITY AS CACO3: 203
CALCULATED DISSOLVED SOLIDS: 400.8
SODIUM ADSORPTION RATIO: 0.7
SUM OF DISS. CONSTITUENTS: 526.1
RYZNAR STABILITY INDEX: 7.1
LAB SPEC. COND. (MICROMOH/CML): 627.0
LANGLIER SATURATION INDEX: 0.2

ADDITIONAL PARAMETERS

<table>
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<tr>
<th>PROPERTY</th>
<th>VALUE</th>
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<td>PH, FIELD (SU)</td>
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<td>H2S, LAB (MG/L AS H2S)</td>
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<tr>
<td>IODIDE TOT REC (MB/L-I)</td>
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<tr>
<td>BORON DISS (MG/L AS B)</td>
<td>0.23</td>
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<tr>
<td>ANTIMONY DISS (MG/L AS SB)</td>
<td>0.2</td>
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<tr>
<td>ARSENIC DISS (UG/L AS AS)</td>
<td>15.2</td>
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<td>SELENIUM DISS (UG/L AS SE)</td>
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<td>TEMPERATURE, AIR (C)</td>
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<tr>
<td>AMMONIA, TOTAL (MG/L AS N)</td>
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<tr>
<td>BROMIDE TOT REC (MG/L-BR)</td>
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<tr>
<td>ALUMINUM DISS (MG/L-AL)</td>
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<tr>
<td>LITHIUM DISS (MG/L AS LI)</td>
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<tr>
<td>STRONTIUM DISS (MG/L-SR)</td>
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<tr>
<td>MERCURY DISS (UG/L AS HG)</td>
<td>&lt;0.3</td>
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<tr>
<td>URANUM DISS (UG/L AS U)</td>
<td>2.5</td>
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REMARKS: CENT. VALLEY GEOTHERMAL SPRINGS SHOWN ON MAP IN SEC. 18  
LASL NO. 309819

EXPLANATION: MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M=METERS

PROCESSING PGM: Gawan (FORM 153)
FUND: /  
PERCENTAGE REACTANCE VALUES

CA MG NA K CL SO4 HC03 CO3 NO3  
51 28 17 2 3 36 59 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78MO-39
STATE MONTANA
LATITUDE-LONGITUDE 44°41'56"N 111°52'41"W
COUNTY BEAVERHEAD
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
SAMPLE LOCATION 135 2W 17CBD
GEOLICAL SOURCE 112VLGC
SAMPLE SOURCE SPRING
DRAINAGE BASIN 41*A
BOTTLE NO. 928
AGENCY + SAMPLER MBG * JLS
DATE SAMPLED 10-03-77
TOTAL DEPTH OF WATER 6820. FT <10
TIME SAMPLED 1400
STAGE HEIGHT .
LAB + ANALYST MBG * GAM
DEPTH TO SAMPLING POINT .
DATE ANALYZED 11-30-77
FLOW MEAS METHOD .
SAMPLE HANDLED 6220
WATER FLOW RATE 3. CFS (E)
METHOD SAMPLING GRAB
WATER USE MULTIPLE USE

SAMPLING SITE UPPER MOST SPRING STAUDENMEYER RANCH
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>67.5</td>
<td>3.368</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>24.5</td>
<td>2.015</td>
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<td>SODIUM (NA)</td>
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<td>POTASSIUM (K)</td>
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<td>IRON (FE)</td>
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<td>ALUMINUM (AL)</td>
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<td>SILICA (SiO2)</td>
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<td>BICARBONATE (HCO3)</td>
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<td>CARBONATE (CO3)</td>
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<td>CHLORIDE (CL)</td>
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<td>FLUORIDE (F)</td>
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<td>PHOSPHATE (AS P)</td>
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TOTAL CATIONS 6.681
TOTAL ANIONS 6.733
STANDARD DEVIATION OF ANION - CATION BALANCE 0.25 SIGMA

LABORATORY PH 7.64
FIELD TEMPERATURE 28. C
TOTAL HARDNESS AS CACO3 269.5
TOTAL ALKALINITY AS CACO3 200.8
SODIUM ADSORPTION RATIO 0.7
RYZNAR STABILITY INDEX 7.0
LANGLIER SATURATION INDEX 0.3

SUM OF DISS. CONSTITUENTS 513.8
LAB SPEC. COND. (MICROMOS/C.M) 608.0

ADDITIONAL PARAMETERS

TEMPERATURE, AIR (C) 12.5
CONDUCTIVITY, FIELD MICROMOS 644.0
H2S, LAB (MG/L AS H2S) < 0.10
IODIDE TOT. REC. (MB/L = I) < 0.01
BORON, DISS (MG/L AS B) < 0.01
ANTIMONY, DISS (MG/L AS SB) < 0.02
ARSENIC, DISS (UG/L AS AS) < 0.001
SELENIUM, DISS (UG/L AS SE) < 0.002
AMMONIA, TOT (MG/L AS N) < 0.03
BROMIDE TOT. REC. (MG/L = BR) < 0.03
ALUMINUM, DISS (MG/L - AL) 0.05
LITHIUM, DISS (MG/L AS LI) 0.51
STRONTIUM, DISS (MG/L = SR) 0.51
MERCURY, DISS (UG/L AS Hg) < 0.001
URANIUM, DISS (UG/L = U) 2.2

REMARKS: CENT. VALLEY GEOTHERMAL APPROX 20 GPM OF 17DEG C WATER RUNNING IN FROM CREEK LASL NO 309820

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: Gawanl (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CA</th>
<th>MG</th>
<th>NA</th>
<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HCO3</th>
<th>C03</th>
<th>N03</th>
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<tr>
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<td>30</td>
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<td>2</td>
<td>3</td>
<td>35</td>
<td>60</td>
<td>0</td>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0440
**STATE** MONTANA  
**LATITUDE-LONGITUDE** 44°45'N 115°24'W  
**TOPOGRAPHIC MAP** LOWER RED ROCK LAKE  
**GEOLOGICAL SOURCE** 112VLCC  
**DRAINAGE BASIN** 414A  
**AGENCY + SAMPLER** MBMG * JLS  
**DATE SAMPLED** 10-03-77  
**TIME SAMPLED** 1500  
**LAB + ANALYST** MBMG * GAM  
**DATE ANALYZED** 11-30-77  
**SAMPLE HANDLING** 6220  
**METHOD SAMPLED** GRAB  
**SAMPLE LOCATION** 135 2W 17CBD  
**SAMPLE SOURCE** SPRING  
**BOTTLE NO.* 929  
**ALTITUDE OF SAMPLE POINT** 6810 FT <10  
**TOTAL DEPTH OF WATER**  
**STAGE HEIGHT**  
**DEPTH TO SAMPLING POINT**  
**FLOW MEAS METHOD** WATER FLOW RATE 1.0 CFS(E)  
**WATER USE** MULTIPLE USE  
**SAMPLING SITE** UPPER WEST SPRING-STAUDENMEYER RANCH  
**DRAINAGE BASIN** RED ROCK RIVER  

<table>
<thead>
<tr>
<th><strong>CALCIUM (CA)</strong></th>
<th><strong>MEQ/L</strong></th>
<th><strong>MG/L</strong></th>
<th><strong>MEQ/L</strong></th>
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<tr>
<td>67</td>
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<td>249</td>
<td>4.081</td>
</tr>
<tr>
<td><strong>MAGNESIUM (MG)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>24</td>
<td>1.974</td>
<td>1.0</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>SODIUM (NA)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>27.9</td>
<td>1.214</td>
<td>9.8</td>
<td>0.276</td>
</tr>
<tr>
<td><strong>POTASSIUM (K)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>7.2</td>
<td>0.184</td>
<td>11.5</td>
<td>2.373</td>
</tr>
<tr>
<td><strong>IRON (Fe)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>0.02</td>
<td>0.001</td>
<td>0.056</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>MANGANES (Mn)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>&lt;.01</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>ALUMINUM (Al)</strong></td>
<td><strong>MEQ/L</strong></td>
<td><strong>MG/L</strong></td>
<td><strong>MEQ/L</strong></td>
</tr>
<tr>
<td>20.8</td>
<td>0.8</td>
<td>1.8</td>
<td>0.095</td>
</tr>
</tbody>
</table>

**TOTAL CATIONS** 6.717  
**TOTAL ANIONS** 6.829  
**STANDARD DEVIATION OF ANION - CATION BALANCE** 0.53 SIGMA  

<table>
<thead>
<tr>
<th><strong>LABORATORY PH</strong></th>
<th><strong>FIELD TEMPERATURE</strong></th>
<th><strong>TOTAL HARDNESS AS CACO3</strong></th>
<th><strong>TOTAL ALKALINITY AS CACO3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.52</td>
<td>29 ° C</td>
<td>266</td>
<td>204</td>
</tr>
</tbody>
</table>

**CALCULATED DISSOLVED SOLIDS** 395.2  
**SUM OF DISS. CONSTITUENTS** 521.6  
**RYZNAR STABILITY INDEX** 7.1  
**LANGLIER SATURATION INDEX** 0.2  

<table>
<thead>
<tr>
<th><strong>TEMPERATURE, AIR (C)</strong></th>
<th><strong>PH, FIELD(SU)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>7.54</td>
</tr>
<tr>
<td><strong>CNDUCTIVITY, FIELD MICROMOH</strong></td>
<td><strong>AMMONIA,TOTAL(MG/L AS N)</strong></td>
</tr>
<tr>
<td>649</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td><strong>H2S, LAB (MG/L AS H2S)</strong></td>
<td><strong>ALUMINUM, DISS (MG/L AS Al)</strong></td>
</tr>
<tr>
<td>.17</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>IODIDE TOT.REC.(MB/L AS I)</strong></td>
<td><strong>LITHIUM,DISS(MG/L AS Li)</strong></td>
</tr>
<tr>
<td>&lt;0.01</td>
<td>0.53</td>
</tr>
<tr>
<td><strong>BORON,DISS (MG/L AS B)</strong></td>
<td><strong>STRONTIUM,DISS(MG/L AS Sr)</strong></td>
</tr>
<tr>
<td>.20</td>
<td>0.53</td>
</tr>
<tr>
<td><strong>ANTIMONY,DISS(MG/L AS SB)</strong></td>
<td><strong>MERCURY,DISS(Ug/L AS Hg)</strong></td>
</tr>
<tr>
<td>&lt;0.2</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>ARSENIC,DISS(Ug/L AS AS)</strong></td>
<td><strong>URANIUM,DISS(Ug/L AS U)</strong></td>
</tr>
<tr>
<td>11.8</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**REMARKS:** CENT. VALLEY GEOTHERMAL  
**LASL NO.** 309821  

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  
**ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED  
**TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
**M = METERS  

**PROCESSING PGM:** GWANAL(FORM 153)  
**FUND:** /  
**CA MG NA K CL SO4 HCO3 CO3 NO3** 49 29 18 2 4 35 60 0 0  
**PERCENTAGE REACTANCE VALUES**  
**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0441
STATES MONTANA
LATITUDE-LONGITUDE 444156N 115241W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLOGICAL SOURCE 112VLCC
DRAINAGE BASIN 41A
AGENCY + SAMPLER MBMG * JLS
DATE Sampled 10-03-77
TIME Sampled 1630
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 6220
METHOD SAMPLED GRAB

SAMPLED SITE LOWER WEST SPRINGS-STAUNDEMeyer RANCH
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>68.</td>
<td>3.393</td>
</tr>
<tr>
<td>MAGNESIUM (Mg)</td>
<td>24.</td>
<td>1.974</td>
</tr>
<tr>
<td>SODIUM (Na)</td>
<td>29.</td>
<td>1.261</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>7.7</td>
<td>0.197</td>
</tr>
<tr>
<td>IRON (Fe)</td>
<td>&lt;0.1</td>
<td>0.000</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>&lt;0.1</td>
<td>0.000</td>
</tr>
<tr>
<td>ALUMINUM (Al)</td>
<td>21.4</td>
<td>0.000</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>21.4</td>
<td>0.000</td>
</tr>
</tbody>
</table>

BICARBONATE (HCO3) |
CARBONATE (CO3) |
CHLORIDE (Cl)   |
SULFATE (SO4)  |
NITRATE (As N) |
NO3+NO2 TOT (AS N) |
FLUORIDE (F) |
PHOSPHATE (AS P) |

TOTAL CATIONS 6.826
TOTAL ANIONS 6.981

STANDARD DEVIATION OF ANION + CATION BALANCE 0.32 SIGMA

LABORATORY PH 7.44
FIELD TEMPERATURE 31.0 C
CALCULATED DISSOLVED SOLIDS 401.0
SUM OF DISS. CONSTITUENTS 528.3
LAB SPEC. COND. (MICROMOS/CMP) 625.5

ADDITIONAL PARAMETERS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>CONDUCTIVITY, FIELD MICROMOS</td>
<td>645</td>
</tr>
<tr>
<td>H2S, LAB (MG/L AS H2S)</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>IODIDE TOTAL REC (MB/L AS I)</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>BORON DISS (MG/L AS B)</td>
<td>&lt;2.3</td>
</tr>
<tr>
<td>ANTIMONY DISS (MG/L AS SB)</td>
<td>&lt;2</td>
</tr>
<tr>
<td>ARSENIC DISS (UG/L AS AS)</td>
<td>15.4</td>
</tr>
<tr>
<td>SELENIUM DISS (UG/L AS SE)</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>PH, FIELD(SU)</td>
<td>7.44</td>
</tr>
<tr>
<td>AMMONIA TOTAL (MG/L AS N)</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>BROMIDE TOT REC (MG/L AS BR)</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>ALUMINUM DISS (MG/L AS AL)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>LITHIUM DISS (MG/L AS LI)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>STRONTIUM DISS (MG/L AS SR)</td>
<td>&lt;0.55</td>
</tr>
<tr>
<td>MERCURY DISS (UG/L AS Hg)</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>URANIUM DISS (UG/L AS U)</td>
<td>&lt;2.7</td>
</tr>
</tbody>
</table>

REMARKS: CENTRAL VALLEY GEOTHERMAL
HIGH FREQUENCY OF GAS DISCHARGE
LASL NO 309822

EXPLANATION: MG/L=MILLIGRAMS PER LITER
MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES
CA Mg Na K Cl SO4 HCO3 CO3 NO3
49 28 18 2 3 35 60 0 C

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0442
**LATITUDE-LONGITUDE:** 444137N 1115146W  
**TOPOGRAPHIC MAP:** LOWER RED ROCK LAKE  
**GEOLOGICAL SOURCE:** 111ALVF  
**DRAINAGE BASIN:** 41*A  
**AGENCY + SAMPLER:** MBMG * JLS  
**DATE SAMPLED:** 10-04-77  
**TIME SAMPLED:** 1200  
**LAB + ANALYST:** MBMG * GAM  
**DATE ANALYZED:** 11-30-77  
**SAMPLE HANDLING:** 6220  
**METHOD SAMPLED:** GRAB  
**SAMPLING SITE:** JIMMY ANDERSON S STOCK WELL, N. OF HOUSE  
**GEOLOGICAL SOURCE:**  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>72.5</td>
<td>mg/L</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>11.5</td>
<td>mg/L</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>22.7</td>
<td>mg/L</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>5.0</td>
<td>mg/L</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>&lt;0.1</td>
<td>mg/L</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>&lt;0.1</td>
<td>mg/L</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>36.4</td>
<td>mg/L</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>5.679</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

**TOTAL CATIONS**: 5.679 mg/L  
**TOTAL ANIONS**: 5.735 mg/L  

**STANDARD DEVIATION OF ANION - CATION BALANCE**: 0.29 SIGMA  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Laboratory PH</td>
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</tr>
<tr>
<td>Field temperature</td>
<td>7.4 C</td>
</tr>
<tr>
<td>Calculated dissolved solids</td>
<td>347.1</td>
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<tr>
<td>Sum of diss. constituents</td>
<td>467.4</td>
</tr>
<tr>
<td>Lab Spec. Cond. (Micromhos/cm)</td>
<td>523.2</td>
</tr>
</tbody>
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**ADDITIONAL PARAMETERS**  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH Field (SU)</td>
<td>8.16</td>
</tr>
<tr>
<td>Conductivity Field Micromhos (SU)</td>
<td>528</td>
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<tr>
<td>H2S Lab (mg/L as H2S)</td>
<td>&lt;10</td>
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<tr>
<td>Iodide Total Rec (mg/L as I)</td>
<td>&lt;01</td>
</tr>
<tr>
<td>Boron Diss (mg/L as B)</td>
<td>&lt;05</td>
</tr>
<tr>
<td>Antimony Diss (mg/L as SB)</td>
<td>&lt;02</td>
</tr>
<tr>
<td>Arsenic Diss (mg/L as As)</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Selenium Diss (ug/l as Se)</td>
<td>&lt;2.0</td>
</tr>
</tbody>
</table>

**REMARKS:** CENT. VALLEY GEOHERMAL WELL N. OF RD. LASL NO. 809823  

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  
**MEQ/L=MILLIEQUIVILENTS PER LITER**  
**ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED**  
**TR=TOTAL RECOVERABLE (M) MEASURED (R) REPORTED (E) ESTIMATED M = METERS**  

**PROCESSING PGM:** GWANAL (FORM 153)  
**FUND:** /  
**PERCENTAGE REACTANCE VALUES**  

<table>
<thead>
<tr>
<th>Anion</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Ca</td>
<td>63</td>
</tr>
<tr>
<td>Mg</td>
<td>16</td>
</tr>
<tr>
<td>Na</td>
<td>17</td>
</tr>
<tr>
<td>K</td>
<td>2</td>
</tr>
<tr>
<td>Cl</td>
<td>6</td>
</tr>
<tr>
<td>SO4</td>
<td>25</td>
</tr>
<tr>
<td>HCO3</td>
<td>68</td>
</tr>
<tr>
<td>CO3</td>
<td>0</td>
</tr>
<tr>
<td>NO3</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0447
STATE: MONTANA  
LATITUDE-LONGITUDE: 44°34'2N 111°36'02W  
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE  
GEOLIGICAL SOURCE: 400MMP  
DRAINAGE BASIN: 41A  
AGENCY + SAMPLER: MMG * WMB  
DATE SAMPLED: 10-02-77  
TIME SAMPLED: 1100  
LAH + ANALYST: MMG * GAM  
DATE ANALYZED: 11-30-77  
SAMPLE HANDLING: 6220  
METHOD SAMPLED: GRAB  

SAMPLING SITE: LIMESTONE CREEK 0.5 MI NE ELK MTN  
DRAINAGE BASIN: RED ROCK RIVER

<table>
<thead>
<tr>
<th><strong>CALCIUM (CA)</strong></th>
<th>23.6</th>
<th><strong>MAGNESIUM (MG)</strong></th>
<th>11.5</th>
<th><strong>SODIUM (NA)</strong></th>
<th>2.4</th>
<th><strong>POTASSIUM (K)</strong></th>
<th>1.4</th>
<th><strong>IRON (Fe)</strong></th>
<th>&lt;0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SILICA (SiO2)</strong></td>
<td>17.8</td>
<td><strong>BICARBONATE (HCO3)</strong></td>
<td>1.178</td>
<td><strong>CARBONATE (CO3)</strong></td>
<td>0.905</td>
<td><strong>CHLORIDE (CL)</strong></td>
<td>0.104</td>
<td><strong>SULFATE (SO4)</strong></td>
<td>0.036</td>
</tr>
<tr>
<td><strong>ALUMINUM (Al)</strong></td>
<td>0.01</td>
<td><strong>NITRATE (AS N)</strong></td>
<td>0.000</td>
<td><strong>NO3+NO2 TOT (AS N)</strong></td>
<td>0.000</td>
<td><strong>FLUORIDE (F)</strong></td>
<td>0.000</td>
<td><strong>PHOSPHATE (AS P)</strong></td>
<td>0.000</td>
</tr>
</tbody>
</table>

**TOTAL CATIONS** 2.223

**STANDARD DEVIATION OF ANION - CATION BALANCE** 0.59 SIGMA

| **LABORATORY PH** | 7.71 | **TOTAL HARDNESS AS CACO3** | 104.5 |
| **FIELD TEMPERATURE** | 4.1 C | **TOTAL ALKALINITY AS CACO3** | 103.5 |
| **SUM OF DISS. CONSTITUENTS** | 127.5 | **SODIUM ADSORPTION RATIO** | 0.1 |
| **LAB SPEC. COND. (MICROMHOS/CM)** | 208.7 | **RYZNAK STABILITY INDEX** | 8.4 |

**ADDITIONAL PARAMETERS**

| **CVDCTVRY, FIELD MICROMHOS** | 185.4 | **TEMPERATURE, AIR (C)** | 9.75 |
| **AMMONIA, TOTAL (MG/L AS N)** | <0.03 | **H2S, LAB (MG/L AS H2S)** | <0.17 |
| **BROMIDE TOT,REC (MG/L-BR)** | <1.0 | **IODIDE TOT,REC (Mg/L-I)** | <0.01 |
| **ALUMINUM, DISS (MG/L-AL)** | <0.05 | **BORON, DISS (MG/L AS B)** | <0.01 |
| **LITHIUM, DISS (MG/L AS Li)** | <0.01 | **ANTIMONY, DISS (MG/L AS Sb)** | <2.0 |
| **STRONTIUM, DISS (MG/L-SR)** | <0.04 | **ARSENIC, DISS (MG/L AS AS)** | <2.0 |
| **MERCURY, DISS (UG/L AS Hg)** | <0.03 | **SELENIUM, DISS (UG/L AS SE)** | <2.0 |
| **URANIUM DISS (UG/L AS U)** | <0.07 |

**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT~SNOW ON GROUND~ SPRING FLOW THE SAME AS JULY 77~SPEC~ LASL NO. 309810

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MGW/L=MILLIEQUIVALENTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

**PROCESSING PGM:** GWAAL (FORM 153)  
**FUND:** CG75/

**PERCENTAGE REACTANCE VALUES**  
CA 52  MG 40  NA 4  K 3  CL 1  SO4 5  HCO3 90  CO3 0  NO3 1

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0465
STATE: MONTANA
LATITUDE-LONGITUDE: 44°58'18" N 111°38'24" W
TOPOGRAPHIC MAP: CLIFF LAKE
GEOLOGICAL SOURCE: 110THRCC
DRAINAGE BASIN: 41*F
AGENCY + SAMPLER: MBMG * JLS
DATE SAMPLED: 09-30-77
TIME SAMPLED: 1545
LAB + ANALYST: MBMG * GAM
DATE ANALYZED: 12-07-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB

SAMPLING SITE: SUN RANCH LOADING CORRAL WELL
GEOLOGICAL SOURCE:

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>38.9</td>
</tr>
<tr>
<td>MAGNESIUM (MG)</td>
<td>7.9</td>
</tr>
<tr>
<td>SODIUM (NA)</td>
<td>12.8</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>1.5</td>
</tr>
<tr>
<td>IRRON (Fe)</td>
<td>0.02</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>ALUMINUM (AL)</td>
<td>21.6</td>
</tr>
</tbody>
</table>

TOTAL CATIONS: 3.142

TOTAL ANIONS: 3.175

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.21 SIGMA

LABORATORY PH: 7.40
FIELD TEMPERATURE: 10.9 C
CALCULATED DISSOLVED SOLIDS: 187.3
SUM OF DISS. CONSTITUENTS: 254.8
LAB SPEC. COND. (MICROMHOS/CM): 305.0

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS: 257.6
ALUMINUM, DISS (MG/L=AL): < 0.05

REMARKS: CENT VALLEY GEOTHERMAL
SAMPLE TAKEN AT 1ST STOCK TANK, SMALL PRESSURE TANK IN LINE

EXPLANATION: MG/L=MILLIGRAMS PER LITER, MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL Susp=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED
M=METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /%

PERCENTAGE REACTANCE VALUES
CA 60
MG 20
NA 17
K 1
CL 1
SO4 14
HC03 15
C03 70
N03 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0426
**STATE**
BUTTE, MONTANA 59701 (406)792-8321

**COUNTY**
BEAVERHEAD

**TOPOGRAPHIC MAP**
44°35'55"N 111°37'53"W

**SAMPLE LOCATION**
UPPER RED ROCK LAKE

**SAMPLE SOURCE**
41A

**STATION CODE**
832-CV

**BOTTLE NO.**
148 1E 20 CAB

**SAMPLED MOUNTAIN**
SAPL.

**DATE SAMPLING**
10-06-77

**TOTAL DEPTH OF WATER**
7040 ft <50

**STAGE HEIGHT**

**DATE ANALYZED**
11-30-77

**FLOW MEAS METHOD**
NOT USED

**WATER FLOW RATE**
2.0 GPM(E)

**WATER USE**
DOMESTIC AND STOCK

**DRAINAGE BASIN**
RED ROCK RIVER

**SAMPLING SITE**
SAPL. ABOVE G. WALSH RANCH

---

<table>
<thead>
<tr>
<th>Mg/L</th>
<th>MEQ/L</th>
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</thead>
<tbody>
<tr>
<td>CA</td>
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</tr>
<tr>
<td>Mg</td>
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<td>Na</td>
<td>2.7</td>
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<tr>
<td>K</td>
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<td>Mn</td>
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<tr>
<td>Al</td>
<td>16.3</td>
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<tr>
<td>Si</td>
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</table>

**BICARBONATE (HCO3)**

**CARBONATE (CO3)**

**SULFATE (SO4)**

**NITRATE (AS N)**

**NO3+NO2 TOT (AS N)**

**FLUORIDE (F)**

**NO3 PHOSPHATE (AS P)**

**TOTAL CATIONS**

**TOTAL ANIONS**

**STANDARD DEVIATION OF ANION - CATION BALANCE**

**LABORATORY PH**

**FIELD TEMPERATURE**

**TOTAL HARDNESS AS CACO3**

**TOTAL ALKALINITY AS CACO3**

**SODIUM ADSORPTION RATIO**

**RYZMAR STABILITY INDEX**

**LANGLIER SATURATION INDEX**

**CNDUCTIVITY FIELD MICROMOHNS**

**TEMPERATURE, AIR (C)**

**AMMONIA, TOTAL (MG/L AS N)**

**IODIDE TOT RECYCLED (MG/L-1)**

**BORON DISS (MG/L AS B)**

**ANTIMONY DISS (MG/L AS SB)**

**ARSENIC DISS (UG/L AS AS)**

**SELENIUM DISS (UG/L AS SE)**

**MERCURY DISS (UG/L AS HG)**

**LITHIUM DISS (MG/L AS LI)**

**STRONTIUM DISS (MG/L AS SR)**

**ALUMINUM DISS (MG/L AS AL)**

**URANIUM DISS (UG/L AS U)**

**CALCULATED DISSOLVED SOLIDS**

**SUM OF DISS. CONSTITUENTS**

**LAB SPEC. COND. (MICROMOHNS/CM)**

**ADDITIONAL PARAMETERS**

**EXPLANATION:**
MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT = TOTAL SUSPENDED
TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED
M = METERS

**PERCENTAGE REACTANCE VALUES**

**PROCESSING PGM:**
GWANAL FORM 153

**FUND:**
CG75

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0477
APPENDIX

CHEMICAL ANALYSES
STATE: MONTANA
LATITUDE-LONGITUDE: 45130N 1113230W
TOPOGRAPHIC MAP: CLIFF LAKE
GEOLOGICAL SOURCE: 41F
DRAINAGE BASIN:
AGENCY + SAMPLER: MSU + G W
DATE SAMPLIED: 09-09-77
TIME SAMPLED: 1400
LAB + ANALYST: MBMG + GAM
DATE ANALYZED: 11-30-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB
SAMPLING SITE: CURLEW CREEK SCHUSTER'S PLACE
DRAINAGE BASIN: MADISON RIVER
COUNTY: MADISON
SAMPLE LOCATION: 11S 1E 13DBB
SAMPLE SOURCE: SPRING
STATION CODE: 90
BOTTLE NO.: 62400 FT < 10

CALCIUM (CA) 16.5
MAGNESIUM (MG) 3.5
SODIUM (NA) 5.3
POTASSIUM (K) 1.7
IRON (FE) 0.28
MANGANESE (MN) 0.12
ALUMINUM (AL) 19.0
SILICA (SiO2) 19.0

BICARBONATE (HC03) 0.823
CARBONATE (CO3) 0.288
CHLORIDE (CL) 0.231
SULFATE (SO4) 0.044
NITRATE (AS N) 0.015
NO3+NO2 0.004
F 0.003
PHOSPHATE (AS P) 0.016

TOTAL CATIONS 14.05
TOTAL ANIONS 14.17

STANDARD DEVIATION OF ANION - CATION BALANCE 0.10 SIGMA

LABORATORY PH 7.68
FIELD TEMPERATURE 16.0 C
TOTAL HARDNESS AS CAC03 56.0
TOTAL ALKALINITY AS CAC03 65.0
SODIUM ADSORPTION RATIO 0.3
RYZNAK STABILITY INDEX 9.2
LANGLIER SATURATION INDEX 0.7

ADDITIONAL PARAMETERS
ALUMINUM DISS (MG/L - AL) < .05

REMARKS: GEOTHERMAL

GEOLOGIC SOURCE: ALLUVIUM

EXPLANATION: MG/L = MILLIGRAMS PER LITER MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT = TOTAL SUSP = SUSPENDED
TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0289
**MONTANA DEPARTMENT OF MINES AND GEOLOGY**  
**BOULDER, MONTANA 59701 (406) 792-8321**  
**WATER QUALITY ANALYSIS**  
**LAB NO 78M0290**

**STATE** MONTANA  
**LATITUDE-LONGITUDE** 44°52'22"N 113°32'42"W  
**TOPOGRAPHIC MAP** CLIFF LAKE  
**GEOLOGICAL SOURCE** DRAINAGE BASIN  
**DRAINAGE BASIN** 41°F  
**AGENCY + SAMPLER** MSU & W  
**DATE SAMPLED** 09-09-77  
**TIME SAMPLED** 1600  
**LAB + ANALYST** MIMG & CAM  
**DATE ANALYZED** 11-30-77  
**SAMPLE HANDLING** 3120  
**METHOD SAMPLED** GRAB  
**SAMEPLING SITE** CURLEW CREEK WARM SPRING  
**DRAINAGE BASIN** MADISON RIVER

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<thead>
<tr>
<th>Parameter</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (Ca)</td>
<td>12.5</td>
<td>0.624</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
<td>1.3</td>
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<td>SODIUM (Na)</td>
<td>33</td>
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<td>POTASSIUM (K)</td>
<td>1.2</td>
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<tr>
<td>IRON (Fe)</td>
<td>1.11</td>
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<td>ALUMINUM (Al)</td>
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<td>0.00</td>
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<tr>
<td>SILICA (SiO₂)</td>
<td>19.7</td>
<td>0.00</td>
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<table>
<thead>
<tr>
<th>Parameter</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HCO₃)</td>
<td>88.5</td>
<td>1.450</td>
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<td>CARBONATE (CO₃)</td>
<td>86</td>
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<tr>
<td>CHLORIDE (Cl)</td>
<td>40.5</td>
<td>0.114</td>
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<tr>
<td>SULFATE (SO₄)</td>
<td>12.3</td>
<td>0.256</td>
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<tr>
<td>NITRATE (NO₃)</td>
<td>377</td>
<td>0.027</td>
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<tr>
<td>NO₃+NO₂ TOT (AS N)</td>
<td>3.4</td>
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<tr>
<td>FLUORIDE (F)</td>
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<td>0.00</td>
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<tr>
<td>pH-PHOSPHATE (AS P)</td>
<td>6.4</td>
<td>0.337</td>
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**TOTAL CATIONS** 2.257  
**TOTAL ANIONS** 2.204

**STANDARD DEVIATION OF ANION - CATION BALANCE = 0.38 SIGMA**

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<tr>
<td>LABORATORY PH</td>
<td>8.35</td>
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<tr>
<td>FIELD TEMPERATURE</td>
<td>23°C</td>
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<tr>
<td>CALCUATED DISSOLVED SOLIDS</td>
<td>136.1</td>
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<tr>
<td>SUM OF DISS + CONSTITUENTS</td>
<td>181.0</td>
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<td>LAB SPEC GOND (MICROMhos/cm)</td>
<td>216.6</td>
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**ADDITIONAL PARAMETERS**

<table>
<thead>
<tr>
<th>Parameter</th>
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<tbody>
<tr>
<td>ALUMINUM, DISS (MG/L-AL)</td>
<td>105</td>
</tr>
<tr>
<td>O.047</td>
<td></td>
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</tbody>
</table>

**REMARKS:** GEOTHERMAL WARM SPRING IN CENTER OF MARSH

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  TR=TOTAL RECOVERABLE (TR)=MEASURED (TR)=REPORTED (T)=ESTIMATED M=METERS

**PROCESSING PGM:** GIANAL(FORM 153)  
**FUND:** /  
<table>
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<th>Ion</th>
<th>Percentage Values</th>
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<td>Na</td>
<td>65</td>
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<tr>
<td>K</td>
<td>1</td>
</tr>
<tr>
<td>Cl</td>
<td>6</td>
</tr>
<tr>
<td>SO₄</td>
<td>13</td>
</tr>
<tr>
<td>HCO₃</td>
<td>78</td>
</tr>
<tr>
<td>CO₃</td>
<td>1</td>
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</table>

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0290
STATE: MONTANA  
LATITUDE-LONGITUDE: 44°59.07'N 111°36.56'W  
COUNTY: MADISON  
TOPOGRAPHIC MAP: CLIFF LAKE  
SAMPLE LOCATION: 10S 1E 4CCC  
AGENCY + SAMPLER: MSU + G W  
SAMPLE SOURCE: SPRING  
DATE SAMPPLED: 09-13-77  
STATION CODE: 92  
TIME SAMPPLED: 1000  
BOTTLE NO.: 92  
LAB + ANALYST: MRMG + GAM  
DECOUPLING METHOD:  
DATE ANALYZED: 11-30-77  
DEPT TO SAMPLING POINT:  
SAMPLE HANDLING: 3120  
FLOW MEAS METHOD:  
METHOD SAMPLED: GRAB  
WATER FLOW RATE:  
WATER USE: UNUSED  

SAMPLING SITE: WOLF CREEK WARM SPRING  
DRAINAGE BASIN: MADISON RIVER

<table>
<thead>
<tr>
<th>Component</th>
<th>mg/l</th>
<th>meq/l</th>
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<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>14.7</td>
<td>0.734</td>
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<td>Magnesium (Mg)</td>
<td>2.0</td>
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<td>Sodium (Na)</td>
<td>58.0</td>
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<td>Potassium (K)</td>
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<tr>
<td>Iron (Fe)</td>
<td>&lt;0.1</td>
<td>0.010</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>&lt;0.01</td>
<td>0.000</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>33.8</td>
<td>1.838</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>33.8</td>
<td>1.838</td>
</tr>
<tr>
<td>Bicarbonate (HC03)</td>
<td>136.1</td>
<td>2.229</td>
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<tr>
<td>Carbonate (CO3)</td>
<td>3.8</td>
<td>0.127</td>
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<tr>
<td>Chloride (CL)</td>
<td>10.10</td>
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<td>Sulfate (SO4)</td>
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<td>Nitrate (AS N)</td>
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<td>Fluoride (F)</td>
<td>7.2</td>
<td>0.379</td>
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**TOTAL CATIONS:** 3.467  
**TOTAL ANIONS:** 3.580

**STANDARD DEVIATION OF ANION - CATION BALANCE 0.70 SIGMA**

**Laboratory PH:** 8.49  
**Field Temperature:** 31.0°C  
**CALCULATED DISSOLVED SOLIDS:** 224.6  
**SUM OF DISS. CONSTITUENTS:** 293.6  
**LAB SPEC. COND. (MICROMHS/CM):** 342.8

**ADDITIONAL PARAMETERS**

- Aluminum, Diss (mg/l-Al) < 0.05  
- Calcium, Diss (mg/l-Ca) = 0.051

**REMARKS:** GEOTHERMAL GEOL GLAC OUTWASH  
**SPRING DITCHED 10M, POND DRAINED**

**EXPLANATION:** mg/l=MILLIGRAMS PER LITER, MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

**PROCESSING PGM:** Gawanal(form 153)  
**Percentage Reactance Values**

<table>
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<th>Component</th>
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<td>Ca</td>
<td>21</td>
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<tr>
<td>Na</td>
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<tr>
<td>K</td>
<td>8</td>
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<tr>
<td>Cl</td>
<td>17</td>
</tr>
<tr>
<td>S04</td>
<td>69</td>
</tr>
<tr>
<td>HCO3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>0</td>
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**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0291
STATE: MONTANA  
LATITUDE-LONGITUDE: 445901N 1113656W  
TOPOGRAPHIC MAP: CLIFF LAKE  
GEOLOGICAL SOURCE: 41F  
DRAINAGE BASIN:  
AGENCY + SAMPLER: MSU * G W  
DATE SAMPLED: 09-13-77  
TIME SAMPLED: 1100  
LAB + ANALYST: M3M G X GAM  
DATE ANALYZED: 11-30-77  
SAMPLE HANDLING: 3120  
METHOD SAMPPLED: GRAB  

SAMPLED SITE: WOLF CREEK HOT SPRING  
DRAINAGE BASIN: MADISON RIVER  
COUNTY: MADISON  
SAMPLE LOCATION: 10S 1E 98BB  
SAMPLE SOURCE: SPRING  
STATION CODE:  
BOTTLE NO.: 93  
ALTIMETRIC TRAIL: 6080 FT C1C  
TOTAL DEPTH OF WATER  
STAGE HEIGHT:  
DEPTH TO SAMPLING POINT:  
FLOW MEAS METHOD  
WATER FLOW RATE:  
WATER USE: UNUSED  

<table>
<thead>
<tr>
<th>M/G/L</th>
<th>MEG/L</th>
<th>M/G/L</th>
<th>MEG/L</th>
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<tbody>
<tr>
<td>CALCIUM</td>
<td>8.9</td>
<td>0.444</td>
<td>BICARBONATE (HC03)</td>
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<tr>
<td>MAGNESIUM</td>
<td>1.7</td>
<td>0.140</td>
<td>CARBONATE (CO3)</td>
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<tr>
<td>SODIUM</td>
<td>96.6</td>
<td>4.176</td>
<td>CHLORIDE (CL)</td>
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<tr>
<td>POTASSIUM</td>
<td>1.8</td>
<td>0.046</td>
<td>SULFATE (SO4)</td>
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<tr>
<td>IRON</td>
<td>0.07</td>
<td>0.004</td>
<td>NITRATE (AS N)</td>
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<td>MANGANESE</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NO3+NO2</td>
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<tr>
<td>ALUMINUM</td>
<td>49.4</td>
<td>0.167</td>
<td>FLUORIDE (F)</td>
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<tr>
<td>SILICA  (SIO2)</td>
<td>49.4</td>
<td>0.167</td>
<td>O-PHOSPHATE (AS P)</td>
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TOTAL CATIONS: 4.810  
TOTAL ANIONS:  
STANDARD DEVIATION OF ANION - CATION BALANCE: 0.75 SIGMA  

LABORATORY PH: 8.50  
FIELD TEMPERATURE: 56.0  
TOTAL HARDNESS AS CACO3: 29.0  
TOTAL ALKALINITY AS CACO3: 140.0  
SODIUM ADSORPTION RATIO: 7.7  
RYZNAR STABILITY INDEX: 8.2  
LANGLIER SATURATION INDEX: 0.1  

ADDITIONAL PARAMETERS  
ALUMINUM, DISS (MG/L-AL) < 0.0001  

REMARKS: GEOTHERMAL SPRING DITCHED 5 M NW FROM PREVIOUS LOCATION, GEOL GLAC OUTWASH  
EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVILENTS PER LITER  ALL CONSITUENTS DISSOLED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS  
PROCESSING PGM: GWANAL (FORM 153)  
PERCENTAGE REACTANCE VALUES  
FUND: /  
CA MG NA K CL SO4 HCO3 CO3 NO3  
9 2 86 0 12 21 60 4 0  
NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0292
**STATE:** MONTANA  
**COUNTY:** MADISON  
**SAMPLE LOCATION:** 105 1E 7CAB  
**SAMPLE SOURCE:** SPRING  
**STATION CODE:** 94  
**BOTTLE NO.:** 5800. FT <1C  
**ALTITUDE OF SAMPLE POINT:** 5800. FT <1C  
**TOTAL DEPTH OF WATER:**  
**STAGE HEIGHT:**  
**DEPTH TO SAMPLING POINT:**  
**FLOW MEAS METHOD:**  
**WATER FLOW RATE:**  
**WATER USE:** UNUSED  

**SAMPLING SITE:** WALL CANYON WARM SPRING  
**DRAINAGE BASIN:** MADISON RIVER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
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<td>SODIUM (NA)</td>
<td>260</td>
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<td>POTASSIUM (K)</td>
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<td>IRON (FE)</td>
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<td>MANGANES (MN)</td>
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<td>ALUMINUM (AL)</td>
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<tr>
<td>SILICA (SiO2)</td>
<td>41.7</td>
<td>0.757</td>
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**TOTAL CATIONS:** 11.938  
**TOTAL ANIONS:** 11.911  
**STANDARD DEVIATION OF ANION - CATION BALANCE = 0.08 SIGMA**

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<td>TOTAL HARDNESS AS CACO3</td>
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<tr>
<td>TOTAL ALKALINITY AS CACO3</td>
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<tr>
<td>CALCULATED DISSOLVED SOLIDS</td>
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<td>SODIUM ADSORPTION RATIO</td>
<td>23.4</td>
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<td>SUM OF DISS. CONSTITUENTS</td>
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<td>RYZNAR STABILITY INDEX</td>
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<td>LAB SPEC. COND. (MICROMOS/CM)</td>
<td>1091.0</td>
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<td>LANGLIER SATURATION INDEX</td>
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**ADDITIONAL PARAMETERS**

- ALUMINUM, DISS (MG/L-AL) = 0.036

**REMARKS:** GEOTHERMAL  
MARSH, FROM UNDER RHYOLITE CLIFF

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVILIENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED:TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

**PROCESSING PGM:** GWANAL(FORM 153)  
**PERCENTAGE REACTANCE VALUES**

<table>
<thead>
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<th>Value</th>
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<td>K</td>
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<td>CL</td>
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<td>CO3</td>
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<tr>
<td>N03</td>
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</tbody>
</table>

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0293
STATE MONTANA
LATITUDE-LONGITUDE 44°58'34"N 111°39'05"W
TOPOGRAPHIC MAP CLIFF LAKE
GEOLOGICAL SOURCE 41F
DRAINAGE BASIN
AGENCY + SAMPLER MSU * G W
DATE SAMPLED 09-13-77
TIME SAMPLED 1400
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE WALL CREEK
DRAINAGE BASIN MADISON RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>33.4</td>
<td>1.667</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>8</td>
<td>0.658</td>
</tr>
<tr>
<td>SODIUM (NA)</td>
<td>8.2</td>
<td>0.357</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>2.1</td>
<td>0.054</td>
</tr>
<tr>
<td>IRON (FE)</td>
<td>0.22</td>
<td>0.012</td>
</tr>
<tr>
<td>MANGANESE (MN)</td>
<td>&lt;0.1</td>
<td>0.000</td>
</tr>
<tr>
<td>ALUMINUM (AL)</td>
<td>25.7</td>
<td>0.016</td>
</tr>
<tr>
<td>SILICA (SIO2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BICARBONATE (HCO3)    149.1
CARBONATE (CO3)       1.8
CHLORIDE (CL)         2.3
SULFATE (SO4)         4.6
NITRATE (AS N)        0.221
TODAY (AS N)          0.016
FLUORIDE (F)          0.3
PHOSPHATE (AS P)      0.016

TOTAL ANIONS 2.694

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.36 SIGMA

LABORATORY PH 8.37
FIELD TEMPERATURE 15.0 C
TOTAL HARDNESS AS CACO3 116.0
TOTAL ALKALINITY AS CACO3 125.0
SODIUM ADSORPTION RATIO 0.3
RYZNAR STABILITY INDEX 7.3
LANGLIER SATURATION INDEX 0.5

ALUMINUM, DISS (MG/L-AL) -0.05

ADDITIONAL PARAMETERS

REMARKS: GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>MG</th>
<th>NA</th>
<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HC03</th>
<th>CO3</th>
<th>NO3</th>
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<tr>
<td></td>
<td>60</td>
<td>24</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>91</td>
<td>2</td>
<td>0</td>
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</tbody>
</table>

NOTE: IN CORRESPONDECE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0294
STATE: MONTANA
COUNTY: MADISON
TOPOGRAPHIC MAP: CLIFF LAKE
SAMPLE LOCATION: 12S 1E 18DBH
SAMPLE SOURCE: SPRING
STATION CODE: TBD
BOTTLE NO.: 96
ALTIMETER: 6680 FT

DATE SAMPLED: 09-13-77
TIME SAMPLED: 1600
LAB + ANALYST: MBMG & GAM
DATE ANALYZED: 11-30-77
SAMPLE HANDLING: GRAB
METHOD SAMPLED: UNUSED

SAMPLING SITE: WEST FORK OF THE MADISON WARM SPRING
DRAINAGE BASIN: MADISON RIVER

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>18.6</td>
<td>0.928</td>
<td>BICARBONATE (HCO3)</td>
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<td>MAGNESIUM (MG)</td>
<td>28.8</td>
<td>2.369</td>
<td>CARBONATE (CO3)</td>
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<tr>
<td>SODIUM (NA)</td>
<td>4.9</td>
<td>0.213</td>
<td>CHLORIDE (Cl)</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>1.9</td>
<td>0.049</td>
<td>SULFATE (SO4)</td>
</tr>
<tr>
<td>MANGANESE (MN)</td>
<td>&lt;.01</td>
<td>0.001</td>
<td>NITRATE (AS N)</td>
</tr>
<tr>
<td>ALUMINUM (AL)</td>
<td>13.5</td>
<td>0</td>
<td>PHOSPHATE (AS P)</td>
</tr>
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TOTAL CATIONS: 3.560
TOTAL ANIONS: 3.625

STANDARD DEVIATION OF ANION - CATION BALANCE 0.40 SIGMA

LABORATORY PH: 8.71
FIELD TEMPERATURE: 29.7
TOTAL HARDNESS AS CACO3: 165
TOTAL ALKALINITY AS CACO3: 165
SODIUM ADSORPTION RATIO: 0.2
RYZNAR STABILITY INDEX: 7.2
LANGLIER SATURATION INDEX: 0.7

ADDITIONAL PARAMETERS
ALUMINUM, DISS (MG/L=AL): 0.033

REMARKS: GEOTHERMAL
          GEOL = ALLUVIUM SLUMP BLOCK
          HIGH VOL SPRING 10M IN DIAMETER

EXPLANATION: MG/L = MILLIGRAMS PER LITER
             MEQ/L = MILLIEQUIVALENTS PER LITER
             ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED:
             TOTAL = TOTAL SUSPENDED (TR)
             TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED
             M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /  CA  MG  NA  K  CL  SO4  HCO3  CO3  NO3
       26  66  5  1  1  6  80  11  0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0295
STATE       MONTANA
LATITUDE-LONGITUDE 43°37'37"N 111°31'55"W
TOPOGRAPHIC MAP   UPPER RED ROCK LAKE
GEOLOGICAL SOURCE 400MMPC
DRAINAGE BASIN    41A
AGENCY + SAMPLER  MBG * WMB
DATE SAMPLED      09-27-77
TIME SAMPLED      1640
LAB + ANALYST     MBG * GAM
DATE ANALYZED     11-30-77
SAMPLE HANDLING   3120
METHOD SAMPLED    GRAB

SAMPLING SITE 2 MI N OF RED ROCK PASS
DRAINAGE BASIN   RED ROCK RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (Ca)</td>
<td>30.4</td>
<td>1.517</td>
<td>186.0</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
<td>18.2</td>
<td>1.497</td>
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<tr>
<td>SODIUM (Na)</td>
<td>2.0</td>
<td>0.087</td>
<td>2.05</td>
<td>0.058</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>1.8</td>
<td>0.046</td>
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<td>0.052</td>
</tr>
<tr>
<td>IRON (Fe)</td>
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<td>0.002</td>
<td>210</td>
<td>0.015</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>&lt;0.1</td>
<td>0.000</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>11.1</td>
<td>0.000</td>
<td>0.000</td>
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</tr>
</tbody>
</table>

TOTAL CATIONS 3.149

STANDARD DEVIATION OF ANION = CATION BALANCE 0.15 SIGMA

LABORATORY PH 7.86
FIELD TEMPERATURE 70.0 C
CALCULATED DISSOLVED SOLIDS 160.0
SUM OF DISS. CONSTITUENTS 254.4
LAB SPECCOND. (MICROMHOS/CM) 284.4

ADDITIONAL PARAMETERS
CONDUCTIVITY FIELD MICROMHOS 252.1
ALUMINUM, DISS (MG/L=AL) .07
TEMPERATURE, AIR (C) 15.0

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PG: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HCO3 CO3 NO3
48 47 2 1 1 1 96 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0387
STATE MONTANA
LATITUDE-LONGITUDE 44°38'11"N 111°32'07"W
TOPOGRAHIC MAP UPPER RED ROCK LAKE
GEOLOGICAL SOURCE 400MPC
DRAINAGE BASIN 41A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 09-27-77
TIME SAMPLED 1545
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE 1 MI S OF LONE TREE PASS
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>Mg/L</th>
<th>MEQ/L</th>
</tr>
</thead>
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<tr>
<td>CALCIUM (Ca)</td>
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<td>1.193</td>
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<td>MAGNESIUM (Mg)</td>
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<td>SODIUM (Na)</td>
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<td>1.90</td>
<td>0.054</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>1.3</td>
<td>0.033</td>
<td>1.5</td>
<td>0.031</td>
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<td>IRON (Fe)</td>
<td>0.02</td>
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<td>0.035</td>
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<tr>
<td>MANGANESE (Mn)</td>
<td>0.01</td>
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<td>0.000</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>15.2</td>
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<tr>
<td>SILICA (SiO2)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BICARBOATNE(HCO3)</td>
<td>126.1</td>
<td>2.065</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CARBONATE (CO3)</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td></td>
<td></td>
<td>CHLORIDE (CL)</td>
<td>1.90</td>
<td>0.054</td>
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<tr>
<td></td>
<td></td>
<td>SULFATE (SO4)</td>
<td>1.5</td>
<td>0.031</td>
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<td></td>
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<td>NITRATE (AS N)</td>
<td>0.490</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FLUORIDE (F)</td>
<td>&lt;0.1</td>
<td>0.000</td>
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</table>

TOTAL CATIONS 2.154
TOTAL ANIONS 2.185

STANDARD DEVIATION OF ANION - CATION BALANCE 0.22 SIGMA

LABORATORY PH 7.57
FIELD TEMPERATURE 69.0 C
CALCULATED DISSOLVED SOLIDS 118.9
SUM OF DISS. CONSTITUENTS 182.8
LAB SPEC. COND.(MICROMOHs/CM) 204.3

ADDITONAL PARAMETERS
CNDUCTIVITY, FIELD MICROMHOS 412.1
ALUMINUM, DISS (MG/L-AL) 0.07

TEMPERATURE, AIR (C) 17.0

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*SPNG ON W FLANK OF HENRY S LAKE MTNS

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)

PERCENTAGE REACTANCE VALUES
CA Mg Na K CL SO4 HCO3 CO3 NO3
55 38 4 1 2 1 96 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0388
STATE MONTANA
LATITUDE-LONGITUDE 44°38'24"N 111°31'58"W
TOPOGRAPHIC MAP UPPER RED ROCK LAKE
GEOLICAL SOURCE 400MMPC
DRAINAGE BASIN 41*A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 09-27-77
TIME SAMPLED 1500
LAB + ANALYST MBMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE 0.5 MI SE OF LONE TREE PASS
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CALCIUM (CA)</th>
<th>MAGNESIUM (MG)</th>
<th>SODIUM (NA)</th>
<th>POTASSIUM (K)</th>
<th>IRON (FE)</th>
<th>MANGANESE (MN)</th>
<th>ALUMINUM (AL)</th>
<th>SILICA (SiO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEQ/L</td>
<td>23.0</td>
<td>9.7</td>
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<td>1.3</td>
<td>0.02</td>
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<tr>
<td>MG/L</td>
<td>1.48</td>
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<td>0.033</td>
<td>0.001</td>
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<tr>
<td>BICARBONATE(HCO3)</td>
<td>120.0</td>
<td>0.000</td>
<td>2.45</td>
<td>3.0</td>
<td>0.221</td>
<td>0.000</td>
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<tr>
<td>CARBONATE (CO3)</td>
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<td>0.069</td>
<td>0.062</td>
<td>0.016</td>
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<td>TOTAL CATIONS</td>
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<td>0.24</td>
<td>0.000</td>
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</table>

STANDARD DEVIATION OF ANION - CATION BALANCE 0.24 SIGMA

LABORATORY PH 7.54
FIELD TEMPERATURE 15.0°C
CALCULATED DISSOLVED SOLIDS 115.1
SUM OF DISS. CONSTITUENTS 176.0
LAB SPEC. COND. (MICROMHOS/CM) 195.0

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS 172.1
ALUMINUM, DISS (MG/L=AL) 0.06
TEMPERATURE, AIR (°C) 20.5

REMARKS: CG 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT MAIN SPNG DRY *
SMALL SPNG 100 YDS DOWN SLOPE DUG PIT TO SAMPLE

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CA</th>
<th>MG</th>
<th>NA</th>
<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HC03</th>
<th>CO3</th>
<th>NO3</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55</td>
<td>38</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>93</td>
<td>0</td>
<td>0</td>
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</table>

NOTE: IN CORRESPONDECE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M038
STATE: MONTANA  
COUNTY: BEAVERHEAD

LATITUDE-LONGITUDE: UPPER RED ROCK LAKE  
SAMPLE LOCATION: 13S 2E 31CADD SPRING

TOPOGRAPHIC MAP: 400MMPC  
SAMPLE SOURCE: 802-CV

GEODETICAL SOURCE: MBM* WMB  
STATION CODE: 7640.0 FT <50

DRAINAGE BASIN: 09-27-77  
STAGE HEIGHT: BUCKET AND STOPWA

AGENCY + SAMPLER: 1348  
FLOW MEAS METHOD: 0.65 GPM(M)

DATE SAMPLED: MBG * GAM  
WATER FLOW RATE: STOCK

TIME SAMPLED: 11-30-77  
METHOD SAMPLED: GRAB

SAMPLING SITE: 1 MI SE OF SADDLE MT=ON US FOREST LAND  
DRAINAGE BASIN: RUBY RIVER

<table>
<thead>
<tr>
<th>Commodity</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>3.9</td>
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<td>MAGNESIUM (MG)</td>
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<td>0.099</td>
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<tr>
<td>SODIUM (NA)</td>
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</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>3</td>
<td>0.008</td>
</tr>
<tr>
<td>IRON (FE)</td>
<td>&lt;01</td>
<td>0.001</td>
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<tr>
<td>MANGANESE (MN)</td>
<td>&lt;01</td>
<td>0.000</td>
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<tr>
<td>ALUMINUM (AL)</td>
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<td>0.378</td>
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<td>SILICA (SI02)</td>
<td>11.3</td>
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</tbody>
</table>

TOTAL CATIONS: 0.378  
TOTAL ANIONS: 0.324

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.48 SIGMA

LABORATORY PH: 6.23  
TOTAL HARDNESS AS CACO3: 15

FIELD TEMPERATURE: 9.0 C  
TOTAL ALKALINITY AS CACO3: 11

CALCULATED DISSOLVED SOLIDS: 27.7  
SODIUM ADSORPTION RATIO: 0.2

SUM OF DISS. CONSTITUENTS: 34.7  
RYZNAI STABILITY INDEX: 13.5

LAB SPEC.COND. (MICROMHOS/CM): 36.4

LANGHLER SATURATION INDEX: 3.6

ADDITIONAL PARAMETERS

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Value</th>
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<tbody>
<tr>
<td>CNDUCTVY, FIELD MICROMHOS</td>
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</tr>
<tr>
<td>ALUMINUM, DISS (MG/L=AL)</td>
<td>.25</td>
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<td>TEMPERATURE, AIR (O)</td>
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REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*SPNG DEVEL SAMPLE TAKEN AT STOCK TANK-HOSE FILLING TANK

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVILANTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)

FUND: CG75/

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>CA</td>
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</tr>
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</tr>
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<td>CL</td>
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<td>CO3</td>
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</tr>
<tr>
<td>NO3</td>
<td>2C</td>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0390
STATE            MONTANA  
LATITUDE-LONGITUDE  44°03'5N 111°35'MW  
TOPOGRAPHIC MAP    UPPентр RED ROCK LAKE  
GEOLOGICAL SOURCE  400MPC  
DRAINAGE BASIN     41A  
AGENCY + SAMPLER   MBBG * WMB  
DATE SAMPLED       09-27-77  
TIME SAMPLED       8:45 AM  
LAB + ANALYST      MBBG * GAM  
DATE ANALYZED      11-30-77  
SAMPLE HANDLING    3120  
METHOD SAMPLED     GRAB  

SAMPLING SITE       SPRING NW OF DEER MT ON US FOREST LAND  
DRAINAGE BASIN      RED ROCK RIVER  

MG/L  MEQ/L  
CALCIUM (CA)  35.4  1.766  
MAGNESIUM (MG) 12  0.987  
SODIUM (NA)  2.5  0.109  
POTASSIUM (K)  .4  0.010  
IRON (FE)  4.09  0.05  
MANGANESE (MN)  .01  0.000  
ALUMINUM (AL)  <.01  0.000  
SILICA (SI02)  15.0  0.000  

-----  -----  
BICARBONATE (HCO3)  169  2.77  
CARBONATE (CO3)  70  0.000  
CHLORIDE (CL)  1.95  0.055  
SULFATE (SO4)  3.5  0.073  
NITRATE (AS N)  312  0.022  
NO3+NO2 (AS N)  <.1  0.000  
FLUORIDE (F)  0.000  
PHOSPHATE (AS P)  

TOTAL CATIONS  2.877  
TOTAL ANIONS  2.920  

STANDARD DEVIATION OF ANION – CATION BALANCE 0.28 SIGMA  

LABORATORY PH  7.63  
FIELD TEMPERATURE  63°C  
CALCULATED DISSOLVED SOLIDS  154.5  
SUM OF DISS. CONSTITUENTS  240.3  
LAB SPEC. COND. (MICROMOH/CML)  262.8  

ADDITIONAL PARAMETERS  
CONDUCTIVITY FIELD MICROMOH  246  
ALUMINUM DISS (MG/L=AL)  < .05  
TEMPERATURE AIR (C)  13  

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT SPNG DEVEL. SAMPL ETAKEN FROM HOSE  

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS)  
TOTAL HARDNESS AS CACO3  
TOTAL ALKALINITY AS CACO3  
SODIUM ADSORPTION RATIO  
RYZNAK STABILITY INDEX  
LANGLIER SATURATION INDEX  

PROCESSING PGM: GWANAL(FORM 153)  
FUND: CG75/  

PERCENTAGE REACTANCE VALUES  
CA  MG  NA  K  CL  S04  HCO3  CO3  NO3  
61 34 3 0 1 2 95 0 0  

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0391
STATE MONTANA
LATITUDE-LONGITUDE 445137N 1113242W
TOPOGRAPHIC MAP CLIFF LAKE
GEOLGICAL SOURCE 110TRC MCC
DRAINAGE BASIN 41F
AGENCY + SAMPLER MMG * JCS
DATE SAMPLED 09-29-77
TIME SAMPLED 1740
LAB + ANALYST MMG * GAM
DATE ANALYZED 11-30-77
SAMPLE HANDLING GRAB
METHOD SAMPLED GRAB

SAMPLING SITE MADISON RIVER LODGE-SPRING AT HIGHWAY
DRAINAGE BASIN MADISON RIVER

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>12.8</td>
<td>0.639</td>
<td>BICARBONATE (HC03)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>2.4</td>
<td>0.197</td>
<td>CARBONATE (CO3)</td>
</tr>
<tr>
<td>SODIUM (NA)</td>
<td>3.2</td>
<td>0.139</td>
<td>CHLORIDE (CL)</td>
</tr>
<tr>
<td>POTASSIUM (K)</td>
<td>1.0</td>
<td>0.026</td>
<td>SULFATE (SO4)</td>
</tr>
<tr>
<td>MANGANESE (MN)</td>
<td>&lt;0.01</td>
<td>0.001</td>
<td>NITRATE (AS N)</td>
</tr>
<tr>
<td>ALUMINUM (AL)</td>
<td>15.8</td>
<td>0.000</td>
<td>NO3+NO2 TOT (AS N)</td>
</tr>
</tbody>
</table>

---------
TOTAL CATIONS 1.001
---------
TOTAL ANIONS 1.011

STANDARD DEVIATION OF ANION - CATION BALANCE 0.07 SIGMA

LABORATORY PH 7.22
FIELD TEMPERATURE 8.2 C
CALCULATED DISSOLVED SOLIDS 66.1
SUM OF DISS. CONSTITUENTS 93.6
LAB SPEC. COND. (MICROMHOS/CM) 99.2
ADDITIONAL PARAMETERS

CONDUCTIVITY FIELD MICROMHOS 96.0
ALUMINUM DISS (MG/L = AL) 0.025

PERCENTAGE REACTANCE VALUES

CA MG NA K CL SO4 HC03 CO3 NO3
63 19 13 2 2 5 92 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0392

REMARKS: CENT. VALLEY GEOTHERMAL SPRING GOES THRU CULVERT UNDER RD.
LOCAT. BETWEEN THE 2 DRIVEWAYS

EXPLANATION: MG/L=MILLIGRAMS PER LITER
MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PROCESSING PGM: GWANAL (FORM 153)
**Sampling Site:** Highway Rest Area 1 mile S of N Fork

**Geological Source:**

<table>
<thead>
<tr>
<th>Cation</th>
<th>MG/L</th>
<th>Meq/L</th>
<th>Cation</th>
<th>MG/L</th>
<th>Meq/L</th>
</tr>
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<tbody>
<tr>
<td>Calcium (Ca)</td>
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<td>Bicarbonate (HCO3)</td>
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<td>4.114</td>
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<tr>
<td>Magnesium (Mg)</td>
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<td>0.559</td>
<td>Carbonate (CO3)</td>
<td>0.0</td>
<td>0.000</td>
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<tr>
<td>Sodium (Na)</td>
<td>28.6</td>
<td>1.218</td>
<td>Chloride (Cl)</td>
<td>6.95</td>
<td>0.196</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>7.1</td>
<td>0.182</td>
<td>Sulfate (SO4)</td>
<td>6.6</td>
<td>0.137</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.022</td>
<td>0.001</td>
<td>Nitrate (As N)</td>
<td>2.49</td>
<td>0.018</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NO3+NO2 Tot (As N)</td>
<td>1.6</td>
<td>0.084</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>43.2</td>
<td>2.082</td>
<td>Phosphate (As P)</td>
<td>0.01</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Total Cations:** 45.25 Meq/L

**Total Anions:** 4.549 Meq/L

**Standard Deviation of Anion - Cation Balance:** 0.14 Sigma

**Laboratory PH:** 7.28

**Field Temperature:** 11.3°C

**Calculated Dissolved Solids:** 275.6

**Sum of Diss. Constituents:** 402.9

**Lab Spec Cond (Micromhos/cm):** 416.2

**Additional Parameters:**

- Conductivity, Field Micromhos: 417.6
- Aluminum, Diss (MG/L-AL): 0.050

**Remarks:** Cent. Valley Geothermal Pressure Tank

**Explanation:** MG/L = Milligrams per liter, Meq/L = Milliequivalents per liter. All constituents dissolved (Diss) except as noted: Tot = Total Suspended, Tr = Total Recoverable (M) = Measured (R) = Reported (E) = Estimated M = Meters

**Processing PGM:** Gwanal (Form 153)

**Fund:** /

**Percentage Reactance Values:**

<table>
<thead>
<tr>
<th>CA</th>
<th>MG</th>
<th>Na</th>
<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HCO3</th>
<th>CO3</th>
<th>NO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>12</td>
<td>26</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>92</td>
<td>0</td>
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</tbody>
</table>

**Note:** In correspondence related to this analysis refer to number 78M0393
STATE MONTANA  
LATITUDE-LONGITUDE 445110N 11134141E  
TOPOGRAPHIC MAP CLIFF LAKE  
GEOLOGICAL SOURCE  
DRAINAGE BASIN 41F  
AGENCY + SAMPLER MBMG + JLS  
DATE SAMPLED 09-29-77  
TIME SAMPLED 1545  
LAB + ANALYST MBMG + GAM  
DATE ANALYZED 11-30-77  
SAMPLE HANDLING 3120  
METHOD SAMPLED GRAB  
SAMPLING SITE WEST FORK ABOVE SOAP AND LAKE CREEKS  
DRAINAGE BASIN MADISON RIVER  
COUNTY MADISON  
SAMPLE LOCATION 11S 1E 27AAA  
SAMPLE SOURCE STREAM  
STATION CODE BOTTLE NO. 909  
ALTITUDE OF SAMPLE POINT 6050 FT <100  
TOTAL DEPTH OF WATER  
STAGE HEIGHT  
DEPTH TO SAMPLING POINT  
FLOW MEAS METHOD  
WATER FLOW RATE  
WATER USE MULTIPLE USE  

<table>
<thead>
<tr>
<th>CONSTITUENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (Ca)</td>
<td>36.5</td>
<td>1.796</td>
<td>1.49</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
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<td>0.658</td>
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<tr>
<td>SODIUM (Na)</td>
<td>5.1</td>
<td>0.222</td>
<td>2.25</td>
<td>0.063</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>3.2</td>
<td>0.565</td>
<td>7.6</td>
<td>0.158</td>
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<tr>
<td>MANGANESE (Mn)</td>
<td>0.03</td>
<td>0.002</td>
<td>0.023</td>
<td>0.002</td>
</tr>
<tr>
<td>IRON (Fe)</td>
<td>0.01</td>
<td>0.000</td>
<td>0.002</td>
<td>0.002</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>22.0</td>
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<tr>
<td>SILICA (SiO2)</td>
<td></td>
<td></td>
<td>2.75</td>
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</table>

TOTAL CATIONS 2.734  

STANDARD DEVIATION OF ANION-CATION BALANCE 0.15 SIGMA  

LABORATORY PH 8.42  
FIELD TEMPERATURE 8.00 C  
CALCULATED DISSOLVED SOLIDS 159.2  
SUM OF DISS. CONSTITUENTS 234.8  
LAB SPEC COND. (MICROMHOS/CM) 249.0  

ADDITIONAL PARAMETERS  
CONDUCTIVITY, FIELD MICROMHOS 253.0  
ALUMINUM, DISS. (MG/L-AL) 0.034  
TEMPERATURE, AIR (C) 14.0  

REMARKS: CENT. VALLEY GEOTHERMAL SAMPLED 20 FT ABOVE RD CROSSING WEST FORK AT CAMPING PULLOFF  

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL Constituents DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M=METERS  

PROCESSING PGM: GWANAL (FORM 153)  
FUND: /  

PERCENTAGE REACTANCE VALUES  

<table>
<thead>
<tr>
<th>CONSTITUENT</th>
<th>CA</th>
<th>MG</th>
<th>NA</th>
<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HCO3</th>
<th>CO3</th>
<th>NO3</th>
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<tbody>
<tr>
<td></td>
<td>65</td>
<td>24</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>89</td>
<td>2</td>
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</table>

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0394
STATE: MONTANA
LATITUDE-LONGITUDE: 44°46'05"N 111°38'60"W
TOPOGRAPHIC MAP: CLIFF LAKE
GEOLOGICAL SOURCE: 111CLVM
DRAINAGE BASIN: 414F
AGENCY + SAMPLER: MBMG + JLS
DATE SAMPLED: 09-29-77
TIME SAMPLED: 1130
LAB + ANALYST: MBMG + GAM
DATE ANALYZED: 12-07-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB

SAMPLING SITE: SLOAN COW CAMP COLD SPRING
DRAINAGE BASIN: MADISON RIVER

CALCIUM (CA) 38.8  MEQ/L  1.936  BICARBONATE (HC03) 144  MEQ/L
MAGNESIUM (Mg) 1.6  0.132  CARBONATE (CO3)  0  0.000
SODIUM (Na) 7.6  0.331  CHLORIDE (CL)  5.8  0.164
POTASSIUM (K) 6.8  0.174  SULFATE (SO4)  5.1  0.106
IRON (Fe) <0.1  0.000  NITRATE (AS N)  4.11  0.029
MANGANESE (Mn) <0.1  0.000  NO3+NO2 TOT (AS N)  2  0.011
ALUMINUM (Al)  67.2  0.000  FLUORIDE (F)  0  0.000
SILICA (SiO2) 67.2  2.572  PHOSPHATE (AS P)  2  0.000

TOTAL CATIONS: 2.572  TOTAL ANIONS: 2.670
STANDARD DEVIATION OF ANION - CATION BALANCE: 0.66 SIGMA

LABORATORY PH: 7.79  TOTAL HARDNESS AS CAC03: 103
FIELD TEMPERATURE: 7.4 C  TOTAL ALKALINITY AS CAC03: 118
CALCULATED DISSOLVED SOLIDS: 204.5  SODIUM ADSORPTION RATIO: 0.3
SUM OF DISS. CONSTITUENTS: 277.5  RYZNAR STABILITY INDEX: 7.8
LAB SPEC. COND. (MICROMHOS/CM): 254.2  LANGLIER SATURATION INDEX: 0.0

ADDITIONAL PARAMETERS
PH, FIELD (SU): 8.6  CNDUCTVY, FIELD MICROMHOS: 254
TEMPERATURE, AIR (C): 12.5  ALUMINUM, DISS (MG/L = AL): 0.05

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /  PERCENTAGE REACTANCE VALUES
CA  75  MG  5  NA  12  K  6  CL  6  SO4  4  HC03  89  C03  0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0396
STATE: MONTANA  
LATITUDE-LONGITUDE: 443537N 1114351W  
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE  
GEOLICAL SOURCE: 111ALVP  
DRAINAGE BASIN: 41*A  
AGENCY + SAMPLER: MBMG * JLS  
DATE SAMPLED: 09-27-77  
TIME SAMPLED: 1820  
LAB + ANALYST: MBMG * GAM  
DATE ANALYZED: 12-07-77  
SAMPLE HANDLING: 3120  
METHOD SAMPLED: GRAB  
SAMPLING SITE: U.S. FISH-WILDLIFE CAMPGROUND  
DRAINAGE BASIN: RED ROCK RIVER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>46.2</td>
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<td>MAGNESIUM (MG)</td>
<td>16.5</td>
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<tr>
<td>SODIUM (NA)</td>
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<td>POTASSIUM (K)</td>
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<tr>
<td>IRON (FE)</td>
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<tr>
<td>MANGANESE (MN)</td>
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<tr>
<td>ALUMINUM (AL)</td>
<td>10.7</td>
<td>0</td>
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</table>

TOTAL CATIONS: 3899
TOTAL ANIONS: 3945

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.28 SIGMA

LABORATORY PH: 7.82  
FIELD TEMPERATURE: 7.5°C  
CALCULATED DISSOLVED SOLIDS: 199.5  
SUM OF DISS. CONSTITUENTS: 316.7  
LAB SPEC.COND. (MICROMOH/CM): 351.8

ADDITIONAL PARAMETERS:

- CONDUCTIVITY, FIELD MICROMOH: 353.7
- ALUMINUM, DISS (MG/L-AL): 0.07

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /  
PERCENTAGE REACTANCE VALUES

<table>
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<tr>
<th>Element</th>
<th>Value</th>
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<td>K</td>
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<tr>
<td>Cl</td>
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<td>SO4</td>
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<td>HC03</td>
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<td>C03</td>
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<td>NO3</td>
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<tr>
<td>PO4</td>
<td>0.1</td>
</tr>
<tr>
<td>AL</td>
<td>1.5</td>
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</tbody>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0399
STATE MONTANA
COUNTY BEAVERHEAD
LATITUDE-LONGITUDE 44°36'18"N 114°49'09"W
SAMPLE LOCATION 14S 2W 23BBC
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
SAMPLE SOURCE WELL
GEOLOGICAL SOURCE 111CLVM
STATION CODE 903
DRAINAGE BASIN 41*A
BOTTLE NO. 6780
AGENCY + SAMPLER MBMG * JLS
FT <1
DATE SAMPLED 09-27-77
DEPTH WATER ENTERS WELL
TIME SAMPLED 1715
SAMPLED SHL ABOVE (+) OR BELOW GS
LAB + ANALYST MBMG * GAM
TOTAL DEPTH OF WELL 7.3 FT
DATE ANALYZED 12-07-77
FLOW MEAS METHOD
SAMPLE HANDLING 3120
WATER FLOW RATE
METHOD SAMPLED GRAB
WATER USE STOCK

SAMPLING SITE RUSH, KEITH STOCK WELL

GEological SOURCE

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
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<tr>
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<td>13.4</td>
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<td>SODIUM (Na)</td>
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<td>POTASSIUM (K)</td>
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<tr>
<td>IRON (Fe)</td>
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<tr>
<td>MANGANESE (Mn)</td>
<td>0.02</td>
<td>0.001</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>4.4</td>
<td>0.011</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>44.1</td>
<td>0.899</td>
</tr>
<tr>
<td>BICARBONATE (HCO3)</td>
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</tr>
<tr>
<td>CARBONATE (CO3)</td>
<td>345.1</td>
<td>5.654</td>
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<tr>
<td>CHLORIDE (Cl)</td>
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<td>SULFATE (SO4)</td>
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<tr>
<td>NITRATE (AS N)</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<td>0.007</td>
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<td>FLUORIDE (F)</td>
<td>0.2</td>
<td>0.011</td>
</tr>
<tr>
<td>O-PHOSPHATE (AS P)</td>
<td>0.2</td>
<td>0.011</td>
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<tr>
<td>TOTAL CATIONS</td>
<td>5.899</td>
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<tr>
<td>TOTAL ANIONS</td>
<td>5.888</td>
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STANDARD DEVIATION OF ANION-CATION BALANCE = 0.05 SIGMA

LABORATORY PH 7.23
FIELD TEMPERATURE 4.5°C
TOTAL HARDNESS AS CACO3 261
TOTAL ALKALINITY AS CACO3 283
CALCULATED DISSOLVED SOLIDS 337.3
SODIUM ADSORPTION RATIO 0.3
SUM OF DISS. CONSTITUENTS 512.3
RYZNAR STABILITY INDEX 6.9
LAB SPEC. COND. (MICROMHOS/CM) 530.7
LANGLIER SATURATION INDEX 0.1

ADDITIONAL PARAMETERS

CNDUCTIVITY FIELD MICROMHOS 517
ALUMINUM DISS (MG/L-AL) 80.06

REMARKS: CENT. VALLEY GEOTHERMAL DISCHARG OUT PIPE 8 FT. FROM WELL
DISC. EST. 15-20 6PM NO WELL DATA

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND /

PERCENTAGE REACTANCE VALUES
CA 69 MG 18 NA 8 K 2 CL 1 SO4 1 HC03 96 CO3 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0400
**State:** Montana  
**County:** Beaverhead  
**Latitude-Longitude:** 44°36'21"N 111°48'09"W  
**Sample Location:** 14S 2W 23AA  
**Topographic Map:** Lower Red Rock Lake  
**Sample Source:** Well  
**Geological Source:** 111CLVM  
**Drainage Basin:** 41*A  
**Agency + Sampler:** MBMG * JLS  
**Date Sampled:** 09-27-77  
**Time Sampled:**  
**Lab + Analyst:** MBMG * GAM  
**Date Analyzed:** 12-07-77  
**Sample Handling:** 3120  
**Method Sampled:** Grab  
**Sampling Site:** Montgomery House Well  
**Depth Water Enters Well:** 7620 ft  
**Total Depth of Well:** 100 ft  
**Depth Water Enters Well:** 6  
**Water Flow Method:**  
**Water Use:** Domestic  

**Geological Source:**  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mass (mg/L)</th>
<th>Mass (meq/L)</th>
<th>Mass (mg/L)</th>
<th>Mass (meq/L)</th>
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<td>Sodium (Na)</td>
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<td>370</td>
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<td>Potassium (K)</td>
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<td>Manganese (Mn)</td>
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<td>Aluminum (Al)</td>
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<td>Bicarbonate (HCO3)</td>
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<td>3.196</td>
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<td>Carbonate (CO3)</td>
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<td>Chloride (Cl)</td>
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<td>Nitrate (as N)</td>
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<tr>
<td>Nitrate (as N)</td>
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<tr>
<td>NO3+NO2 TOT (as N)</td>
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<td>Fluoride (F)</td>
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<tr>
<td>Phosphate (as P)</td>
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<td><strong>Total Cations</strong></td>
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<td><strong>Total Anions</strong></td>
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</table>

**Standard Deviation of Anion - Cation Balance:** 0.20 Sigma

**Laboratory PH:** 7.84  
**Field Temperature:** 75 C  
**Calculated Dissolved Solids:** 198.3  
**Sum of Diss. Constituents:** 297.2  
**Lab Spec. Cond. (Micromhos/cm):** 301.4  
**Langelier Saturation Index:** 0.2

**Additional Parameters:**  
**Conductivity, Field Micromhos:** 300.  
**Aluminum, Diss. (mg/L - Al):** < 0.05  
**Arsenic, Diss. (mg/L - As):** < 0.0100

**Remarks:** Cent. Valley Geothermal  
**Kitch. Tap Thru Press.: Tank**

**Explanations:**  
- mg/L = Milligrams per liter  
- meq/L = Milliequivalents per liter  
- All Constituents Dissolved (Diss) Except as Noted: TOT = Total Suspended  
- TR = Total Recoverable (M) = Measured (R) = Reported (E) = Estimated  
- M = Meters

**Processing Pgm:** GWANAL (Form 153)  
**Fund:**  
**Percentage Reactance Values:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>Cl</th>
<th>SO4</th>
<th>HCO3</th>
<th>CO3</th>
<th>NO3</th>
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<tbody>
<tr>
<td>Value</td>
<td>64</td>
<td>21</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>96</td>
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**Note:** In correspondence related to this analysis refer to number 78MO401
STATE MONTANA
LATITUDE=LONGITUDE 445841N 1113856W
TOPOGRAPHIC MAP CLIFF LAKE
GEOLOGICAL SOURCE 110TRCC
DRAINAGE BASIN 41*F
AGENCY + SAMPLER MBM*JLS
DATE SAMPLED 09-30-77
TIME SAMPLED 1715
LAB + ANALYST MBM*GAM
DATE ANALYZED 12-08-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE WOLF CREEK RANCH WELL
GEOLOGICAL SOURCE

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
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<th>MG/L</th>
<th>MEQ/L</th>
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<tr>
<td>CALCIUM</td>
<td>18.9</td>
<td>0.943</td>
<td>BICARBONATE(HCO3)</td>
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<td>MAGNESIUM</td>
<td>3.8</td>
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<td>CARBONATE (CO3)</td>
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<td>SODIUM</td>
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<td>0.304</td>
<td>CHLORIDE (CL)</td>
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<td>POTASSIUM</td>
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<td>0.150</td>
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<td>IRON</td>
<td>&lt;0.01</td>
<td>0.001</td>
<td>NITRATE (AS N)</td>
<td>0.131</td>
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<td>MANGANESE</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>NO3+NO2 TOT (AS N)</td>
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<td>0.021</td>
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<td>ALUMINUM</td>
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<td>FLUORIDE (F)</td>
<td>0.4</td>
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<td>SILICA</td>
<td>10.7</td>
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<td>0-PHOSPHATE (AS P)</td>
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TOTAL CATIONS 1.586
TOTAL ANIONS 1.617

STANDARD DEVIATION OF ANION - CATION BALANCE 0.22 SIGMA

LABORATORY PH 7.22
FIELD TEMPERATURE 60 C
CALCULATED DISSOLVED SOLIDS 92.6
SUM OF DISS. CONSTITUENTS 135.4
LAB SPEC. COND. (MICROMOS/CM) 154.8

ADDITIONAL PARAMETERS
CNDUCTVY, FIELD MICROMOS 142.
ALUMINUM, DISS (MG/L=AL) < 0.05

REMARKS: CENT. VALLEY GEOF THERMAL TAKEN AT KITCHEN TAP, PRES. TANK DIRECTLY ON PUMP
EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FAUND: /

PERCENTAGE REACTANCE VALUES
CA  MG  NA  K  CL  SO4  HCO3  CO3  NO3
59  19  19  1  3  9  86  0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0427
<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<td>Calcium (Ca)</td>
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<tr>
<td>Iron (Fe)</td>
<td>0.01</td>
<td>0.001</td>
<td>633</td>
<td>0.045</td>
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<tr>
<td>Manganese (Mn)</td>
<td>&lt;0.01</td>
<td>0.000</td>
<td>1.3</td>
<td>0.016</td>
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<tr>
<td>Aluminum (Al)</td>
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<tr>
<td>Silica (SiO2)</td>
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**TOTAL CATIONS** 2.628 **TOTAL ANIONS** 2.675

**STANDARD DEVIATION OF ANION - CATION BALANCE** 0.32 SIGMA

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<tbody>
<tr>
<td>Laboratory pH</td>
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<td>Field Temperature</td>
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<td>Calculated Dissolved Solids</td>
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<td>Sum of Diss. Constituents</td>
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<tr>
<td>Lab Spec. Cond. (Micromhos/cm)</td>
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**ADDITIONAL PARAMETERS**

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<tr>
<td>Conductivity, Field Micromhos</td>
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<tr>
<td>Aluminum, Diss (mg/l-al)</td>
<td>6.4</td>
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</table>

**REMARKS:** CENT. VALLEY GEOTHERMAL KIT. TAP, PRESS. TANK IN LINE

**EXPLANATION:** MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

**PROCESSING PGM:** GWANAL (FORM 153)  
**PERCENTAGE REACTANCE VALUES**

|       | CA | Mg | Na | K  | Cl | SO4| HCO3| CO3 | NO3 | 65 | 12 | 17 | 4 | 6 | 5 | 88 | 0 |
|-------|----|----|----|----|----|----|-----|-----|-----|----|----|----|---|---|---|---|---|---|
|       |    |    |    |    |    |    |     |     |     |    |    |    |   |   |   |   |   |   |

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0428
STATE: MONTANA
LATITUDE-LONGITUDE: 44°51'50" N 113°33'00" W
TOPOGRAPHIC MAP: CLIFF LAKE
Geological source: 41°F
DRAINAGE BASIN: 11S 1E 24BDB
AGENCY + SAMPLER: MDMG * JLS
DATE SAMPLED: 10-01-77
TIME SAMPLED: 1715
LAB + ANALYST: MDMG * GAM
DATE ANALYZED: 12-08-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB

SAMPLING SITE: DEADMAN CREEK AT RD.
DRAINAGE BASIN: MADISON RIVER

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>12.2</td>
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<td>BICARBONATE (HCO3)</td>
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<td>MAGNESIUM (Mg)</td>
<td>2.2</td>
<td>0.181</td>
<td>CARBONATE (CO3)</td>
<td>0</td>
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<tr>
<td>SODIUM (Na)</td>
<td>3.3</td>
<td>0.144</td>
<td>CHLORIDE (Cl)</td>
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<td>POTASSIUM (K)</td>
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<td>SULFATE (SO4)</td>
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<td>IRON (Fe)</td>
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<td>NITRATE (AS N)</td>
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<td>MANGANESE (Mn)</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<td>ALUMINUM (Al)</td>
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<td>FLUORIDE (F)</td>
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<td>SILICA (SiO2)</td>
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<td>PHOSPHATE (AS P)</td>
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TOTAL CATIONS: 0.963
TOTAL ANIONS: 0.931

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.27 SIGMA

LABORATORY PH: 8.05
FIELD TEMPERATURE: 7.5 C
CALCULATED DISSOLVED SOLIDS: 59.9
SUM OF DISS. CONSTITUENTS: 86.5
LAB SPEC. COND. (MICROMOHRS/CM): 94.2

ADDITIONAL PARAMETERS:
CONDUCTIVITY, FIELD MICROMOHRS: 96.5
TEMPERATURE, AIR (C): 10.0
ALUMINUM, DISS (MG/L-AL): <0.05

REMARKS: CENT. VALLEY GEOTHERMAL FRED HAS DISCHARGE

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVILIENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES:
CA MG NA K CL SO4 HCO3 CO3 NO3
63 18 14 2 3 0 96 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0431
**State:** Montana  
**County:** Madison  
**Sample Location:** 11S 1E 248BD Stream  
**Sample Source:** Cliff Lake  
**Station Code:** 920  
**Bottle No.:** 5950.  
**Altitude of Sample Point:** 5950.  
**Total Depth of Water:** ft <5  
**Stage Height:**  
**Depth to Sampling Point:**  
**Flow Meas Method:**  
**Water Flow Rate:**  
**Water Use:** Multiple Use  
**Sampling Site:** Curlew Creek at Rd.  
**Drainage Basin:** Madison River

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MG/L</th>
<th>MED/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<td>Aluminum (Al)</td>
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<td>0.000</td>
<td>0.0</td>
<td>0.000</td>
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<tr>
<td>Silica (SiO2)</td>
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<td>0=Phosphate (as P)</td>
<td>1.631</td>
<td>1.631</td>
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**Total Cations:** 15.46  
**Total Anions:** 16.31

**Standard Deviation of Anion-Cation Balance:** 0.66 Sigma

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<td>Field Temperature</td>
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<td>Calculated Dissolved Solids</td>
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<td>Sum of Diss. Constituents</td>
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<td>Lab Spec Cond. (Micromhos/cm)</td>
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**Additional Parameters:**  
**Temperature, Air (C):** 10°C  
**Conductivity/Field Micromhos:** 154  
**Aluminum, Diss (mg/l-al):** 0.022

**Remarks:** Cent. Valley Geothermal Fred has discharge

**Explanation:**  
MG/L = Milligrams per liter  
MEQ/L = Milliequivalents per liter  
All Constituents Dissolved (Diss) except as noted: Tot = Total Susp = Suspended  
Tr = Total Recoverable (m) = Measured (r) = Reported (e) = Estimated  
M = Meters

**Processing Pgm:** GWANAL (form 153)  
**Fund:**  
**Percentage Reactance Values:**  
**Note:** In correspondence related to this analysis refer to number 78M0432
STATE: MONTANA
COUNTY: MADISON
LATITUDE-LONGITUDE: 44°54'51"N 111°35'60"W
SAMPLE LOCATION: 10S 1E 33DD
TOPOGRAPHIC MAP: CLIFF LAKE
SAMPLE SOURCE: WELL
GEOLOGICAL SOURCE: 110ALVF
STATION CODE: 921
DRAINAGE BASIN: 41*F
BOTTLE NO.: 5880
AGENCY + SAMPLER: MMBG * JLS
DEPT W: 5880" FT <5
DATE SAMPLED: 10-05-77
SWL ABOVE(+) OR BELOW GS:
TIME SAMPLED: 1030
FLOW MEAS METHOD:
LAB + ANALYST: MMBG * GAM
WATER FLOW RATE:
DATE ANALYZED: 12-08-77
WATER USE: DOMESTIC
SAMPLE HANDLING: 3120
METHOD SampleD: GRAB
SAMPLING SITE: SQUAW CREEK RANCH HOUSE WELL

GEOLOGICAL SOURCE

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<td>SOIL SPEC. COND. (MICROMHOS/CM)</td>
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<tr>
<td>TOTAL ANIONS</td>
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<td>STANDARD DEVIATION OF ANION - CATION BALANCE</td>
<td>-0.77 SIGMA</td>
</tr>
<tr>
<td>LABORATORY PH</td>
<td>7.12</td>
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<tr>
<td>FIELD TEMPERATURE</td>
<td>6.0 C</td>
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<tr>
<td>TOTAL HARDNESS AS CACO3</td>
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<td>TOTAL ALKALINITY AS CACO3</td>
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<td>RYZNAR STABILITY INDEX</td>
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<td>LANGLIER SATURATION INDEX</td>
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ADDITIONAL PARAMETERS

- CONDUCTIVITY, FIELD MICROMHOS: 148
- TEMPERATURE, AIR (C): 12
- ALUMINUM, DISS (MG/L-AL): 0.08
- VAC PUMP BROKE 800 ML FU SAMPLE
- HIGH IRON WATER

REMARKS:

CENT. VALLEY GEOTHERMAL

EXPLANATION:

- MG/L = MILLIGRAMS PER LITER
- MEQ/L = MILLIEQUIVILENTS PER LITER
- ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT = TOTAL SUSPENDED
- TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED
- M = METERS

PROCESSING PGM: GWANAL (FORM 153)

FUND: / 62 17 14 5 6 7 0 92 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0433
STATE MONTANA COUNTY MADISON
LATITUDE LONGITUDE 445914N 1113924W SAMPLE LOCATION 10S 1E 6CC8
TOPOGRAPHIC MAP CLIFF LAKE SAMPLE SOURCE WELL
GEOLOGICAL SOURCE 110TRCC STATION CODE
DRAINAGE BASIN 41F BOTTLE NO. 922
AGENCY + SAMPLER MBMG * JLS ALTITUDE OF SAMPLE POINT 5670 FT <50
DATE SAMPLED 10-02-77 TOTAL DEPTH OF WELL 62 FT
TIME SAMPLED 1200 DEPTH WATER ENTERS WELL 4.0 FT (R)
LAB + ANALYST MBMG * GAM SWL ABOVE (+) OR BELOW GS
DATE ANALYZED 12-08-77 FLOW MEAS METHOD
SAMPLE HANDLING 3120 WATER FLOW RATE
METHOD SAMPLED GRAB WATER USE PUBLIC SUPPLY

SAMPLING SITE N*PICNIC WELL, S* MADISON REC. AREA

GEOLOGICAL SOURCE

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>19*</td>
<td>0.948 BICARBONATE (HC03)</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>5.9</td>
<td>0.485 CARBONATE (CO3)</td>
<td>*0</td>
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<tr>
<td>SODIUM (NA)</td>
<td>21.2</td>
<td>0.922 CHLORIDE (CL)</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>1.8</td>
<td>0.046 SULFATE (SO4)</td>
<td>6.1</td>
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<tr>
<td>IRON (FE)</td>
<td>*05</td>
<td>0.003 NITRATE (AS N)</td>
<td>1.19</td>
</tr>
<tr>
<td>MANGANESE (MN)</td>
<td>*01</td>
<td>0.000 NO3+NO2 TOT (AS N)</td>
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</tr>
<tr>
<td>ALUMINUM (AL)</td>
<td>17.8</td>
<td></td>
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<tr>
<td>SILICA (SiO2)</td>
<td>17.8</td>
<td>0-PHOSPHATE (AS P)</td>
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</tr>
</tbody>
</table>

TOTAL CATIONS 2.405 TOTAL ANIONS 2.539

STANDARD DEVIATION OF ANION - CATION BALANCE 0.93 SIGMA

LABORATORY PH 7.88 TOTAL HARDNESS AS CACO3 72*
FIELD TEMPERATURE 8.5 C TOTAL ALKALINITY AS CACO3 99*
CALCULATED DISSOLVED SOLIDS 145.4 SODIUM ADSORPTION RATIO 1.1
SUM OF DISS. CONSTITUENTS 206.8 RYZNAR STABILITY INDEX 8.5
LAB SPEC. COND. (MICROMOS/CM) 236.5 LANGLIER SATURATION INDEX 0.3

ADDITIONAL PARAMETERS

TEMPERATURE, AIR (C) 12* CNDUCTVY, FIELD MICROMOS 234*
ALUMINUM, DISS (MG/L-AL) < .05

REMARKS: CENT. VALLEY GEOTHERMAL PITCHER PUMP, HIGH IRON

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL (FORM 153) PERCENTAGE REACTANCE VALUES
FUND: / CA MG NA K CL SO4 HC03 C03 NO3 39 20 38 1 14 5 80 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0434
STATE: MONTANA  
COUNTY: MADISON  
LATITUDE-LONGITUDE: 44°49'44"N 111°30'09"W  
SAMPLE LOCATION: 11S 2E 32DBD  
TOPOGRAPHIC MAP: CLIFF LAKE  
SAMPLE SOURCE: SPRING  
GEOLOGICAL SOURCE: 110THRCC  
STATION CODE:  
DRAINAGE BASIN: 41*F  
BOTTLE NO.: 923  
AGENCY + SAMPLER: MBSG * JLS  
ALTITUDE OF SAMPLE POINT: 6120. FT <5  
DATE SAMPLED: 10=27=71  
TOTAL DEPTH OF WATER:  
TIME SAMPLED: 400  
STAGE HEIGHT:  
LAB + ANALYST: MBSG * GAM  
DEPTH TO SAMPLING POINT:  
DATE ANALYZED: 12=08=77  
FLOW MEAS METHOD:  
SAMPLE HANDLING: 3120  
WATER FLOW RATE: 1 CFS(E):  
METHOD SAMPLED: GRAB  
WATER USE: MULTIPLE USE  
SAMPLING SITE: CLIFF LAKE TOWN SPRING  
DRAINAGE BASIN: MADISON RIVER

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CALCIUM (CA)</strong></td>
<td>29.2</td>
<td><strong>1.457 BICARBONATE (HC03)</strong></td>
<td>181</td>
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<tr>
<td><strong>MAGNESIUM (MG)</strong></td>
<td>17.2</td>
<td><strong>1.415 CARBONATE (CO3)</strong></td>
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<tr>
<td><strong>SODIUM (NA)</strong></td>
<td>4.6</td>
<td>0.200 CHLORIDE (CL)</td>
<td>1.75</td>
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<tr>
<td><strong>POTASSIUM (K)</strong></td>
<td>1.7</td>
<td>0.044 SULFATE (SO4)</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>IRON (FE)</strong></td>
<td>0.02</td>
<td>0.001 NITRATE (N)</td>
<td>4.92</td>
</tr>
<tr>
<td><strong>MANGANESE (MN)</strong></td>
<td>&lt;0.01</td>
<td>0.000 NO3+NO2 TOT (N)</td>
<td>1</td>
</tr>
<tr>
<td><strong>ALUMINUM (AL)</strong></td>
<td>11.6</td>
<td>0=PHOSPHATE (AS P)</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL CATIONS: 3.117  
TOTAL ANIONS: 3.146

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.19 SIGMA

LABORATORY PH: 8.30  
FIELD TEMPERATURE: 8.7 C  
TOTAL HARDNESS AS CACO3: 144  
TOTAL ALKALINITY AS CACO3: 148  
CALCULATED DISSOLVED SOLIDS: 160.1  
SODIUM ADSORPTION RATIO: 0.2  
SUM OF DISS. CONSTITUENTS: 252.0  
RYZNAR STABILITY INDEX: 7.3  
LAB SPEC. COND. (MICROMHOS/CM): 283.4  
LANGLIER SATURATION INDEX: 0.5

ADDITIONAL PARAMETERS

| TEMPERATURE, AIR (C) | 18  |
| CNDUCTVY, FIELD MICROMHOS | 285 |
| ALUMINUM, DISS (MG/L-AL) | <0.05 |

REMARKS: CENTRAL VALLEY GEOTHERMAL

EXPLANATION: MG/L = MILLIGRAMS PER LITER  
MEQ/L = MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M = METERS

PROCESSING PGM: GWANAL (FORM 153)  
PERCENTAGE REACTANCE VALUES  
FUND: /  
CA 46  
MG 45  
NA 6  
K 1  
CL 1  
SO4 2  
HC03 95  
CO3 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0435
STATE: MONTANA  
LATITUDE=LONGITUDE: 44°48′13″N 111°33′28″W  
TOPOGRAPHIC MAP: CLIFF LAKE  
GEODETIC SOURCE: 112VLLCC  
DRAINAGE BASIN: 41°F  
AGENCY + SAMPLER: MBG * JLS  
DATE SAMPLED: 10-02-77  
TIME SAMPLED: 1500  
LAB + ANALYST: MBG * GAM  
DATE ANALYZED: 12-08-77  
SAMPLE HANDLING: 3120  
METHOD SAMPLED: GRAB  

SAMPLING SITE: WADE LAKE SPRING  
DRAINAGE BASIN: MADISON RIVER  

MG/L  MEQ/L  MG/L  MEQ/L  
CALCIUM (CA)  23.3  1.163  BICARBONATE (HC03)  139  2.278  
MAGNESIUM (MG)  11.5  0.946  CARBONATE (CO3)  0  0.000  
SODIUM (NA)  5.2  0.226  CHLORIDE (CL)  2.30  0.065  
POTASSIUM (K)  1.7  0.044  SULFATE (SO4)  2.0  0.042  
IRON (FE)  0.1  0.000  NITRATE (AS N)  0.237  0.017  
MANGANESE (MN)  0.1  0.000  NO3+NO2 TOT (AS N)  0  0.021  
ALUMINUM (AL)  13.3  0.000  FLUORIDE (F)  4  0.021  
SILICA (SI02)  TOTAL CATIONS  2.378  TOTAL ANIONS  2.423  

STANDARD DEVIATION OF ANION = CATION BALANCE  0.31 SIGMA  

LABORATORY PH  7.93  TOTAL HARDNESS AS CACO3  106  
FIELD TEMPERATURE  64.4°C  TOTAL ALKALINITY AS CACO3  114  
CALCULATED DISSOLVED SOLIDS  128.4  SODIUM ADSORPTION RATIO  0.2  
SUM OF DISS. CONSTITUENTS  199.0  RYZNAR STABILITY INDEX  8.1  
LAB SPEC. COND. (MICROMOHRS/CM)  223.4  LANGELIER SATURATION INDEX  -0.1  

ADDITIONAL PARAMETERS  
CONDUCTIVITY, FIELD MICROMOHRS  223.4  TEMPERATURE, AIR (C)  10.7  
ALUMINUM, DISS (MG/L=AL)  0.08  

REMARKS: CENT. VALLEY GEOTHERMAL  

EXPLANATION: MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M = METERS  

PROCESSING PGM: GWANAL (FORM 153)  
FUND:  

PERCENTAGE REACTANCE VALUES  
CA  MG  NA  K  CL  SO4  HC03  CO3  NO3  48  39  9  1  2  1  95  0  

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0436
STATE: MONTANA  
COUNTY: BEAVERHEAD  
LATITUDE-LONGITUDE: 44°05'1N 114°17'0W  
SAMPLE LOCATION: LOWER RED ROCK LAKE  
TOPOGRAPHIC MAP: 112WDBL  
SAMPLE SOURCE: STATION CODE:  
DRAINAGE BASIN: 414A  
SAMPLE HANDLING: 12-08-77  
AGENCY + SAMPLER: MBG * JLS  
DATE SAMPLED: 10-03-77  
DATE ANALYZED: 12-08-77  
LAB + ANALYST: MBG * GAM  
TIME SAMPLED: 1800  
SWL ABOVE(+)/OR BELOW GS:  
LAB + ANALYST: 3120  
METHOD SAMPLED: GRAB  
FLOOR MEAS METHODS: WATER FLOW RATE  
وصلات Suicide site: STAUBENMEYER S WELL NEXT TO ROAD  
WATER USE: STOCK  
GEOLOGICAL SOURCE:  

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration (mg/l)</th>
<th>Concentration (meq/l)</th>
<th>Concentration (mg/l)</th>
<th>Concentration (meq/l)</th>
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<td>1.717</td>
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<td>Manganese</td>
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<td>Aluminum</td>
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<td>Silica</td>
<td>30.8</td>
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<tr>
<td>Total Cations</td>
<td>3.114</td>
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<td>3.130</td>
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<tr>
<td>Standard Deviation of Anion = Cation Balance 0.10 Sigma</td>
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<tr>
<td>Laboratory pH</td>
<td>7.91</td>
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<tr>
<td>Field Temperature</td>
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<tr>
<td>Calculated Dissolved Solids</td>
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<td>Sum of Diss. Constituents</td>
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<td>Lab Spec. Cond. (Micromhos/cm)</td>
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</table>

Additional parameters:

ALUMINUM, DISS (mg/l=AL) < 0.05

Remarks: CENT. VALLEY GEOTHERMAL

Explanation: mg/l=milligrams per liter, meq/l=milliequivalents per liter. All constituents dissolved (diss) except as noted: tot=total suspended (susp) = suspended. Tr=total recoverable (M)=measured (R)=reported (E)=estimated. m = meters

Processing PGM: GWAHIAL (FORM 153)

Fund: /  

Percentage Reactance Values:  
<table>
<thead>
<tr>
<th></th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>Cl</th>
<th>S04</th>
<th>HCO3</th>
<th>CO3</th>
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<tbody>
<tr>
<td>Percent</td>
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<td>20</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>92</td>
<td>0</td>
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Note: In correspondence related to this analysis refer to number 78M0443
State: Montana  
County: Beaverhead  
Latitude-Longitude: 444156N 1151241W  
Sample Location: 135 2W 17C6B  
Topographic Map: Lower Red Rock Lake  
Sample Source: Spring  
Geological Source: 112VLCC  
Station Code: 932  
Drainage Basin: 41*A  
Bottle No.:  
Agency + Sampler: M3MG * JLS  
Sample Date: 10-04-77  
Altitude of Sample Point: 6810* FT <5<  
Time Sampled: 915  
Total Depth of Water: 38 FT  
Date Sampled: 12-08-77  
Stage Height: 10* FT (R)  
Lab + Analyst: M8MG * GAM  
Flow Meas Method:  
Date Analyzed:  
Depth to Sampling Point:  
Sample Handling: 3120  
Flow Rate:  
Method Sampled: Grab  
Water Use: Multiple Use  

**Sampling Site:** Upper-East Spring-Staudenmeyer Ranch  
**Drainage Basin:** Red Rock River

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>69*</td>
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<td>Magnesium (Mg)</td>
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<td>Sodium (Na)</td>
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<td>Potassium (K)</td>
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</tr>
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<td>Iron (Fe)</td>
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<td>mg/L</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>&lt;•01</td>
<td>mg/L</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>22•7</td>
<td>mg/L</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>-</td>
<td>mg/L</td>
</tr>
<tr>
<td>Bicarbonate (HCO3)</td>
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<tr>
<td>Carbonate (CO3)</td>
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<td>meq/l</td>
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<tr>
<td>Chloride (Cl)</td>
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<td>Sulfate (SO4)</td>
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<td>Nitrate (NO)</td>
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<td>Nitrate (AS N)</td>
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<td>Nitrate (AS N)</td>
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<td>Fluoride (F)</td>
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<tr>
<td>Phosphate (AS P)</td>
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<tr>
<td><strong>Total Cations</strong></td>
<td>6.928</td>
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<tr>
<td><strong>Total Anions</strong></td>
<td>6.871</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

Standard Deviation of Anion - Cation Balance: ±0.26 Sigma

Laboratory pH: 7.52  
Field Temperature: 29•C  
Total Hardness as CaCO3: 276•  
Total Alkalinity as CaCO3: 205•  
Calculated Dissolved Solids: 402.4  
Sodium Adsorption Ratio: 0.7  
Sum of Diss. Constituents: 529.3  
Ryznar Stability Index: 7.1  
Lab Spec. Cond. (Micromhos/cm): 629.4  
Langlier Saturation Index: 0.2

**Additional Parameters:**  
Conductivity / Field Micromhos: 659•  
Temperature, Air (C): 3•  
Aluminum, Diss (mg/l-AL): 0.10

**Remarks:**  
Cent. Valley Geothermal

**Explanation:** mg/l = milligrams per liter  
meq/l = milliequivalents per liter  
All constituents dissolved (diss) except as noted; tot = total suspended  
tr = total recoverable (m) = measured (r) = reported (e) = estimated  
m = meters

**Processing Pgm:** GWANAL(Form 153)  
**Percentage Reactance Values:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>49</td>
</tr>
<tr>
<td>Mg</td>
<td>29</td>
</tr>
<tr>
<td>Na</td>
<td>17</td>
</tr>
<tr>
<td>K</td>
<td>2</td>
</tr>
<tr>
<td>Cl</td>
<td>4</td>
</tr>
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<td>S04</td>
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<tr>
<td>HCO3</td>
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<tr>
<td>CO3</td>
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</tr>
<tr>
<td>NO3</td>
<td>0</td>
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</table>

**Note:** In correspondence related to this analysis refer to number 78M0444
STATE: MONTANA
LATITUDE-LONGITUDE: 44°41'56"N 115°24'1"W
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
GEOLOGICAL SOURCE: 112VLC
DRAINAGE BASIN: 41-A
AGENCY + SAMPLER: MBG * JLS
DATE SAMPLED: 10-04-77
TIME SAMPLED: 1100
LAB + ANALYST: MBG * GAM
DATE ANALYZED: 12-08-77
SAMPLE HANDLING METHOD SAMPLED: GRAB
SAMPLING SITE: LOWER EAST SPRING-STAUDENMEYER RANCH
DRAINAGE BASIN: RED ROCK RIVER

CALCIUM (CA) 68
MAGNESIUM (MG) 24.6
SODIUM (NA) 27.8
POTASSIUM (K) 7.4
IRON (FE) < 0.1
MANGANESE (MN) < 0.1
ALUMINUM (AL) 273
SILICA (SIO2) 23.3

MEG/L 3.393 BICARBONATE (HCO3)
MG/L 2.024 CARBONATE (CO3)
MEQ/L 1.209 CHLORIDE (CL)
MG/L 0.189 SULFATE (SO4)
MEQ/L 0.000 NITRATE (AS N)
MG/L 0.000 NO3+NO2 TOT (AS N)
MEQ/L 1.8 FLUORIDE (F)

TOTAL CATIONS 6.816
TOTAL ANIONS 6.860

STANDARD DEVIATION OF ANION - CATION BALANCE 0.21 SIGMA

LABORATORY pH 7.48
FIELD TEMPERATURE 28.4 C
CALCULATED DISSOLVED SOLIDS 400.4
SUM OF DISS. CONSTITUENTS 527.7
LAB SPEC. COND. (MICROMHOS/CM) 628.3

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS 681.
ALUMINUM, DISS (MG/L = AL) < .05

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (K)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: / PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HC03 CO3 N03
49 29 17 2 4 35 60 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0445
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
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<tr>
<td>Magnesium (Mg)</td>
<td>0.000 meq/L</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>14.0 mg/L</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>2.790 mg/L</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.000 meq/L</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>0.000 mg/L</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>0.000 mg/L</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>0.000 mg/L</td>
</tr>
<tr>
<td>Total Cations</td>
<td>9.049 mg/L</td>
</tr>
<tr>
<td>Total Anions</td>
<td>8.935 mg/L</td>
</tr>
<tr>
<td>Laboratory PH</td>
<td>7.55</td>
</tr>
<tr>
<td>Field Temperature</td>
<td>10.2 °C</td>
</tr>
<tr>
<td>Calculated Dissolved Solids</td>
<td>519.0 mg/L</td>
</tr>
<tr>
<td>Sum of Diss. Constituents</td>
<td>692.5 mg/L</td>
</tr>
<tr>
<td>Lab Spec. Cond. (micromhos/cm)</td>
<td>798.8</td>
</tr>
<tr>
<td>Conductivity, Field Micromhos</td>
<td>786.0</td>
</tr>
<tr>
<td>Temperature, Air (°C)</td>
<td>6.0</td>
</tr>
<tr>
<td>Aluminum, Diss (mg/L=AL)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**Remarks:** CENT. VALLEY GEOTHERMAL  VERY HI GAS CONTENT LIKE FILTERING 7-UP

**Explanation:** mg/L = milligrams per liter  meq/L = milliequivalents per liter  all constituents dissolved (diss) except as noted: tot=total susp=suspended tr=total recoverable (m)=measured (r)=reported (e)=estimated M=meters

**Processing Pgm:** GWANAL(form 153)

<table>
<thead>
<tr>
<th>Fund</th>
<th>Percentage Reactance Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>mg</td>
</tr>
<tr>
<td>48</td>
<td>30</td>
</tr>
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</table>

**Note:** In Correspondence Related to this Analysis Refer to Number 78M0446
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°12'44"N 111°51'55"W
SAMPLE LOCATION: 13S 2W 20ABD
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
SAMPLE SOURCE: WELL
GEOLOGICAL SOURCE: 110ALVM
STATION CODE: 936
DRAINAGE BASIN: 41*A
BOTTLE NO.: 6680
AGENCY + SAMPLER: MBMG * JLS
ALTITUDE OF SAMPLE POINT: FT <5
DATE SAMPLED: 10-04-77
TOTAL DEPTH OF WELL: *
TIME SAMPLED: 1300
DEPTH WATER ENTERS WELL: *
LAB + ANALYST: MBMG * GAM
SWL ABOVE (+) OR BELOW GS: *
DATE ANALYZED: 12-08-77
FLOW MEAS METHOD: *
SAMPLE HANDLING: 3120
WATER FLOW RATE: *
METHOD SAMPLED: GRAB
WATER USE: DOMESTIC AND ST

SAMPLING SITE: JIMMY ANDERSON HOUSE, WELL EAST OF HOUSE
GEOLOGICAL SOURCE:

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>MEASUREMENT</th>
<th>UNITS</th>
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<tbody>
<tr>
<td>Calcium (Ca)</td>
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<tr>
<td>Magnesium (Mg)</td>
<td>13.1</td>
<td>mg/L</td>
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<tr>
<td>Sodium (Na)</td>
<td>21.1</td>
<td>mg/L</td>
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<tr>
<td>Potassium (K)</td>
<td>5.0</td>
<td>mg/L</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.09</td>
<td>mg/L</td>
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<tr>
<td>Manganese (Mn)</td>
<td>0.01</td>
<td>mg/L</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>34.7</td>
<td>mg/L</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td></td>
<td>mg/L</td>
</tr>
</tbody>
</table>

Bicarbonate (HCO3^-) | 4.092 mg/L
Carbonate (CO3^-)    | 1.078 mg/L
 Chloride (Cl^-)      | 0.918 mg/L
 Sulfate (SO4^-)      | 0.128 mg/L
 Nitrate (NO3^-)       | 0.001 mg/L
 Fluoride (F^-)        | 0.000 mg/L
 Phosphate (PO4^-)     | 0.000 mg/L

TOTAL CATIONS: 6.217 mg/L
TOTAL ANIONS: 6.253 mg/L

STANDARD DEVIATION OF ANION = CATION BALANCE 0.18 SIGMA

LABORATORY PH: 7.98
FIELD TEMPERATURE: 6.9°C
CALCULATED DISSOLVED SOLIDS: 376.2 mg/L
SUM OF DISS. CONSTITUENTS: 507.1 mg/L
LAB SPEC COND. (MICROMhos/CM): 568.5

ADDITIONAL PARAMETERS:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Temperature, Air (C)</td>
<td>13°C</td>
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<tr>
<td>Conductivity Field Micromhos</td>
<td>483*</td>
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</table>

ALUMINUM, DISS (mg/L-AL) < 0.05

REMARKS: CENT. VALLEY GEOTHERMAL HIGH IRON CONTENT

EXPLANATION: mg/l=milligrams per liter meq/l=milliequivalents per liter
All constituents dissolved (diss) except as noted: tot=total susp=suspended
TR=total recoverable (m)=measured (r)=reported (e)=estimated M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES:

<table>
<thead>
<tr>
<th>Element</th>
<th>Reactance</th>
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<tr>
<td>Ca</td>
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<tr>
<td>Mg</td>
<td>17</td>
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<tr>
<td>Na</td>
<td>14</td>
</tr>
<tr>
<td>K</td>
<td>2</td>
</tr>
<tr>
<td>Cl</td>
<td>3</td>
</tr>
<tr>
<td>SO4</td>
<td>28</td>
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<tr>
<td>HCO3</td>
<td>68</td>
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<td>CO3</td>
<td>0</td>
</tr>
<tr>
<td>NO3</td>
<td>0</td>
</tr>
</tbody>
</table>

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0448
STATE MONTANA
LATITUDE-LONGITUDE 44°03'00" W 111°44'18" W
TOPOGRAPHIC MAP UPPPER RED ROCK LAKE
GEOLoGICAL SOURCE 112WDBL
DRAINAGE BASIN 41*4
AGENCY + SAMPLER MMG * JLS
DATE SAMPLED 10-04-77
TIME SAMPLED 1500
LAB + ANALYST MMG * GAM
DATE ANALYZED 12-08-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE STANLEY SMITH WELL AT BOX CAR
GEOLOGICAL SOURCE

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA)</td>
<td>33*</td>
<td>1.647</td>
<td>147*</td>
<td>2.409</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
<td>5.7</td>
<td>0.469</td>
<td>0</td>
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<tr>
<td>SODIUM (Na)</td>
<td>3.6</td>
<td>0.157</td>
<td>3</td>
<td>0.085</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>2.9</td>
<td>0.074</td>
<td>2</td>
<td>0.004</td>
</tr>
<tr>
<td>IRON (Fe)</td>
<td>0.07</td>
<td>0.004</td>
<td>&lt;0.023</td>
<td>0.000</td>
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<tr>
<td>MANGANESE (Mn)</td>
<td>0.21</td>
<td>0.008 NO3+NO2-TOT</td>
<td>1</td>
<td>0.005</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>0.8</td>
<td>0-PHOSPHATE</td>
<td>0-PHOSPHATE</td>
<td>0-PHOSPHATE</td>
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</table>

TOTAL CATIONS 2.358
TOTAL ANIONS 2.503

STANDARD DEVIATION OF ANION - CATION BALANCE 1.00 SIGMA

LABORATORY PH 8.09
FIELD TEMPERATURE 7.7°C
CALCULATED DISSOLVED SOLIDS 128.0
SUM OF DISS. CONSTITUENTS 202.6
LAB SPEC. COND. (MICROMHOS/CM) 234.3

ADDITIONAL PARAMETERS
TEMPERATURE, AIR (°C) 13.4
PH, FIELD(SU) 7.8

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PERCENTAGE REACTANCE VALUES
CA 70
MG 19
NA 6
K 3
CL 3
SO4 96
HC03 0
CO3 0
NO3 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0449
STATE: MONTANA  
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°39'58"N 111°43'14"W  
SAMPLE LOCATION: 13S 1W 28DDD WELL
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
SAMPLE SOURCE:  
GEOLOGICAL SOURCE: 110ALVM
STATION CODE: 938
DRAINAGE BASIN: 414A
BOTTLE NO.: 938
AGENCY + SAMPLER: MBMG * JLS  
ALTIMETRY OF SAMPLE POINT: 6445.00 FT <5
DATE SAMPLED: 10-04-77  
TOTAL DEPTH OF WELL: 13.00 FT
TIME SAMPLED: 1600  
DEPTH WATER ENTERS WELL: 10.00 FT
LAB + ANALYST: MBMG * GAM  
SWL ABOVE (+) OR BELOW GS: 4.40 FT
DATE ANALYZED: 12-08-77  
FLOW MEAS METHOD:  
SAMPLE HANDLING: 3120  
WATER FLOW RATE:  
METHOD SAMPLED: GRAB  
WATER USE: STOCK

SAMPLING SITE: SMITH'S STOCK WELL

GEOLOGICAL SOURCE

<table>
<thead>
<tr>
<th>aida</th>
<th>mg/l</th>
<th>meq/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (Ca)</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
<td>22.50</td>
<td>1.892</td>
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<td>SODIUM (Na)</td>
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<td>0.326</td>
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<tr>
<td>POTASSIUM (K)</td>
<td>4.40</td>
<td>0.113</td>
</tr>
<tr>
<td>IRON (Fe)</td>
<td>0.02</td>
<td>0.001</td>
</tr>
<tr>
<td>MANGANES (Mn)</td>
<td>0.74</td>
<td>0.027</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>15.0</td>
<td>0.000</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>12.30</td>
<td>0.000</td>
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</table>

TOTAL CATIONS: 53.03  
TOTAL ANIONS: 53.73

STANDARD DEVIATION OF ANION - CATION BALANCE 0.38 SIGMA

LABORATORY PH: 7.88  
TOTAL HARDNESS AS CACO3: 242.00
FIELD TEMPERATURE: 93.00C  
TOTAL ALKALINITY AS CACO3: 249.00
CALCULATED DISSOLVED SOLIDS: 271.20  
SODIUM ADSORPTION RATIO: 0.20
SUM OF DISS. CONSTITUENTS: 425.00  
RYZNAR STABILITY INDEX: 6.70
LAB SPEC. COND. (MICROMOH/cm): 471.50
LANGLIER SATURATION INDEX: 0.60

ADDITIONAL PARAMETERS

TEMPERATURE, AIR (C): 14.00  
CNDUCTIVITY, FIELD MICROMOH: 474.00
ALUMINUM, DISS (MG/L-AL): < 0.05

Remarks: CENT. VALLEY GEOTHERMAL

EXPLANATION: mg/l = milligrams per liter  
meq/l = milliequivalents per liter  
All constituents dissolved (diss) except as noted: tot = total suspended  
tr = total recoverable (m) = measured (r) = reported (e) = estimated m = meters

PROCESSING PGM: GWANAL (FORM 153)
FUND: N/A

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>Cl</th>
<th>SO4</th>
<th>HCO3</th>
<th>CO3</th>
<th>NO3</th>
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<tbody>
<tr>
<td>55</td>
<td>35</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>95</td>
<td>0</td>
<td>2</td>
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</tbody>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0450
STATE MONTANA
COUNTY BEAVERHEAD
LATITUDE-LONGITUDE 44° 12' 30" N 114° 46' 28" W
SAMPLE LOCATION 13S 1W 198DB
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
SAMPLE SOURCE WELL
GEOLOGICAL SOURCE 112 WDBL
STATION CODE 939
DRAINAGE BASIN 41*A
BOTTLE NO. 939
AGENCY + SAMPLER MBMG * JLS
DEPTH WATER ENTERS WELL 105 FT
DATE SAMPLED 10-04-77
SWL ABOVE(+) OR BELOW GS 22.0 FT
TIME SAMPLED 1700
FLOW MEAS METHOD
LAB + ANALYST MBMG * GAM
WATER FLOW RATE 
DATE ANALYZED 12-08-77
WATER USE STOCK
SAMPLE HANDLING 3120
SAMPLING SITE STAUDENMEYER WELL 3/4 M. N. OF RD.
METHOD SAMPLED GRAB
GEOLOGICAL SOURCE

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
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</thead>
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<tr>
<td>CALCIUM (CA)</td>
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<td>MAGNESIUM (MG)</td>
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<td>SODIUM (Na)</td>
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<td>POTASSIUM (K)</td>
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<td>IRON (Fe)</td>
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<td>0.001</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
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</tr>
<tr>
<td>ALUMINUM (Al)</td>
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</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>31.9</td>
<td>0.000</td>
</tr>
</tbody>
</table>

BICARBONATE (HCO3) 192.0 3.147
CARBONATE (CO3) 192.0 3.147
CHLORIDE (CL) 4.10 0.116
SULFATE (SO4) 4.1 0.085
NITRATE (AS N) 971 0.069
NO3+NO2 TOT (AS N) 971 0.069
FLUORIDE (F) 2.0 0.011
0-PHOSPHATE (AS P) 2.0 0.011

TOTAL CATIONS 3.378
TOTAL ANIONS 3.428

STANDARD DEVIATION OF ANION - CATION BALANCE 0.31 SIGMA

LABORATORY PH 7.99
FIELD TEMPERATURE 7.8 C
TOTAL HARDNESS AS CACO3 154
CALCULATED DISSOLVED SOLIDS 201.1
TOTAL ALKALINITY AS CACO3 157
SUM OF DISS. CONSTITUENTS 298.5
SODIUM ADSORPTION RATIO 0.2
LAB SPEC. COND. (MICROMHOS/CM) 309.9
RYZNAR STABILITY INDEX 7.1
LANGLIER SATURATION INDEX 0.4

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS 327.
TEMPERATURE, AIR (°C) 8
ALUMINUM, DISS (MG/L=AL) 0.05

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER
MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGm: GWANAL (FORM 153)
PERCENTAGE REACTANCE VALUES
CA 73
MG 17
NA 6
K 2
CL 3
SO4 29
HC03 93
CO3 0
NO3 2

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0451
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°01'7"N 114°06'37"W
SAMPLE LOCATION: 13S 1W 30CR
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
SAMPLE SOURCE: WELL
 GEOLOGICAL SOURCE: 110ALVM
DRAINAGE BASIN: 41A
AGENCY + SAMPLER: MBMG & JLS
DATE SAMPLED: 10-04-77
TOTAL DEPTH OF WELL: 1715
TIME SAMPLED: 1715
DEPTH WATER ENTERS WELL: 6645.5 FT
LAB + ANALYST: MBMG & GAM
SWL ABOVE (+) OR BELOW GS: .
DATE ANALYZED: 12-08-77
FLOW MEAS METHOD: .
SAMPLE HANDLING: 3120
WATER FLOW RATE: .
METHOD SAMPLED: GRAB
WATER USE STOCK: .

SAMPLING SITE: STAUDENMEYERS SOUTH PASTURE WELL ON EAST

CALCIUM (CA) 45.4 MG/L 2.265 BICARBONATE (HC03) 183.6 MEQ/L 2.999 MEQ/L
MAGNESIUM (MG) 6.7 MG/L 0.551 CARBONATE (CO3) .0 MEQ/L 0.000 MEQ/L
SODIUM (NA) 3.6 MG/L 0.157 CHLORIDE (CL) 2.25 MG/L 0.063 MG/L
POTASSIUM (K) 1.7 MG/L 0.044 SULFATE (SO4) .00 MEQ/L 0.000 MEQ/L
IRON (FE) .01 MG/L 0.001 NITRATE (AS N) 678.0 MG/L 0.048 MG/L
MANGANESE (MN) <.01 MG/L 0.000 NO3+NO2 (AS N) 1.0 MEQ/L 0.005 MEQ/L
ALUMINUM (AL) 0.1 MG/L FLUORIDE (F) 3.116 MG/L
SILICA (SIO2) 25.7 MG/L 0.05 PHOSPHATE (AS P) .

TOTAL CATIONS 3.017
TOTAL ANIONS 3.116
STANDARD DEVIATION OF ANION = CATION BALANCE 0.64 SIGMA

LABORATORY PH 7.93
FIELD TEMPERATURE 7.0 C
TOTAL HARDNESS AS CACO3 141.0 MG/L
TOTAL ALKALINITY AS CACO3 150.0 MG/L
CALCULATED DISSOLVED SOLIDS 176.3 MG/L
SODIUM ADSORPTION RATIO 0.1
SUM OF DISS. CONSTITUENTS 269.1 MG/L
RYZNAR STABILITY INDEX 7.3
LAB SPEC. COND. (MICROMOHS/CM) 294.4
LANGLIER SATURATION INDEX 0.3

ADDITIONAL PARAMETERS
TEMPERATURE, AIR (C) 7.0
CNDUCTIVITY FIELD MICROMOHS 319.0
ALUMINUM, DISS (MG/L=AL) <.05

REMARKS: CENT. VALLEY GEOTHERMAL
EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: Gwanal (FORM 153)
FUNO: / 

PERCENTAGE REACTANCE VALUES
CA  MG  NA  K  CL  SO4  HC03  CO3  NO3
75  18  5  1  2  0  97  0  1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0452
STATE MONTANA
COUNTY BEAVERHEAD
LATITUDE-LONGITUDE 444003N 1114829W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLICAL SOURCE 110ALVM
DRAINAGE BASIN 414A
REMARKS: CENT. VALLEY GEOTHERMAL
AGENCY + SAMPLER MBMG & JLS
SAMPLE SOURCE WELL
DATE SAMPLED 10-04-77
TIME SAMPLED 1815
LAB + ANALYST MBMG & GAM
DATE ANALYZED 12-08-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE STAUDENMEYERS SOUTH PASTURE WELL ON WEST
GEOLOGICAL SOURCE

---

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCIUM (CA) 654</td>
<td>3268</td>
<td>BICARBONATE (HCO3) 263</td>
<td>4310</td>
</tr>
<tr>
<td>MAGNESIUM (MG) 124</td>
<td>1020</td>
<td>CARBONATE (CO3) 0</td>
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<tr>
<td>SODIUM (NA) 138</td>
<td>6000</td>
<td>CHLORIDE (CL) 2585</td>
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<td>POTASSIUM (K) 73</td>
<td>187</td>
<td>SULFATE (SO4) 36</td>
<td>0075</td>
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<td>IRON (FE) 122</td>
<td>663</td>
<td>NITRATE (AS N) 1536</td>
<td>0110</td>
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<td>MANGANESE (MN) 54</td>
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<td>NO3+NO2 TOT (AS N) 13</td>
<td>0016</td>
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<td>ALUMINUM (AL) 518</td>
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<td>FLUORIDE (F) 3</td>
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<td>SILICA (SiO2) 518</td>
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<td>O-PHOSPHATE (AS P) 0</td>
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</tbody>
</table>

---

TOTAL CATIONS 5161
TOTAL ANIONS 5240
STANDARD DEVIATION OF ANION - CATION BALANCE 0.42 SIGMA

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LABORATORY PH 7.47
FIELD TEMPERATURE 65 C
TOTAL HARDNESS AS CACO3 215
TOTAL ALKALINITY AS CACO3 216
SODIUM ADSORPTION RATIO 0.4
RYZNAR STABILITY INDEX 7.1
LAB SPEC. COND. (MICROMOH/CM) 486
LANGLER SATURATION INDEX 0.2

---

ADDITIONAL PARAMETERS
TEMPERATURE, AIR (C) 5
ALUMINUM, DISS (MG/L=AL) 0.05

---

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES
CA 100
MG NA 1
K 16
CL 54
SO4 42
HCO3 8
CO3 4
NO3 2

---

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0453
STATE MONTANA  
COUNTY BEAVERHEAD  
LATITUDE-LONGITUDE 44 36 00N 111 37 53W  
SAMPLE LOCATION 14S 1E 17BD  
TOPOGRAPHIC MAP UPPER RED ROCK LAKE  
SAMPLE SOURCE WEL  
 GEOLOGICAL SOURCE 110ALVM  
 STATION CODE WELL  
 DRAINAGE BASIN 414A  
 BOTTLE NO. 942  
 AGENCY + SAMPLER MBMG * JLS  
 ALTITUDE OF SAMPLE POINT 6680 + ft  
 DATE SAMPLED 10-05-77  
 DEPTH WATER ENTERS WELL 29 FT  
 TIME SAMPLED 915  
 SWL ABOVE(+) OR BELOW GS 10.2 FT  
 LAB + ANALYST MBMG * GAM  
 FLOW MEAS METHOD  
 DATE ANALYZED 12-15-77  
 WATER FLOW RATE  
 SAMPLE HANDLED 3120  
 WATER USE UNUSED  
 METHOD SAMPLED GRAB  

SAMPLING SITE HANSON RANCH WELL  

GEOLOGICAL SOURCE  

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<tr>
<th>Component</th>
<th>mg/l</th>
<th>meq/l</th>
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<tr>
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<td>Sodium (Na)</td>
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<td>Potassium (K)</td>
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<td>Iron (Fe)</td>
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<td>Manganese (Mn)</td>
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<tr>
<td>Aluminum (Al)</td>
<td>12.2</td>
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<tr>
<th>Component</th>
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<td>Bicarbonate (HCO3)</td>
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<td>Carbonate (CO3)</td>
<td>0.0</td>
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<tr>
<td>Chloride (Cl)</td>
<td>1.10</td>
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<td>Sulfate (SO4)</td>
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<td>Nitrate (As N)</td>
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<td>Nitrate (N)</td>
<td>1.005</td>
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---

**TOTAL CATIONS** 3.402  
**TOTAL ANIONS** 3.264  

**STANDARD DEVIATION OF ANION - CATION BALANCE** 0.87 SIGMA  

**LABORATORY PH** 7.40  
**FIELD TEMPERATURE** 65 C  
**TOTAL HARDNESS AS CACO3** 160  
**TOTAL ALKALINITY AS CACO3** 157  
**SODIUM ADSORPTION RATIO** 0.1  
**RYZMAR STABILITY INDEX** 7.9  
**LANGLIER SATURATION INDEX** 0.3  

**CALCULATED DISSOLVED SOLIDS** 170.9  
**SUM OF DISS. CONSTITUENTS** 268.3  
**LAB SPEC. COND. (MICROMHOSES/CM)** 314.2  
**CONDUCTIVITY, FIELD MICROMHOSES** 326.1  
**ALUMINUM, DISS (MG/L=AL)** < 0.05  
**TEMPERATURE, AIR (C)** 8.0  

**ADDITIONAL PARAMETERS**  

---

**REMARKS:** CENT. VALLEY GEOTHERMAL SMELLS HORRIBLE - PROB. POLLUTED, HI FE  

**EXPLANATION:** MG/L = MILLIGRAMS PER LITER  
MEQ/L = MILLIEQUIVILENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT = TOTAL SUSP = SUSPENDED  
TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED  
M = METERS  

**PROCESSING PGM:** GWANAL (FORM 153)  
**PERCENTAGE REACTANCE VALUES**  
CA  58  
Mg  37  
K  3  
Cl  1  
SO4  0  
HCO3  2  
CO3  96  
N3  0  

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0454
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°41'3N 111°47'29W
SAMPLE LOCATION: 13S 2W 1BAA
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
SAMPLE SOURCE: SPRING
GEOPHYSICAL SOURCE: 120TRTR
STATION CODE: 943
DRAINAGE BASIN: 41A
BOTTLE No.: 7420-1 FT
AGENCY + SAMPLER: MBMG * JLS
DEPTH TO SAMPLING POINT:
DATE SAMPLED: 10-05-77
FLOW MEAS METHOD: BUCKET AND STOP
TIME SAMPLED: 1215
WATER FLOW RATE: 0.2 GPM/MI
LAB + ANALYST: MBMG * GAM
WATER USE: STOCK
DATE ANALYZED: 12-08-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB
SAMPLING SITE: SORINGFOR STOCK TANK
DRAINAGE BASIN: RED ROCK RIVER

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<tr>
<th>ANION</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HCO3)</td>
<td>2.904</td>
<td>2.904</td>
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<tr>
<td>CARBONATE (CO3)</td>
<td>1.341</td>
<td>1.341</td>
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<td>CHLORIDE (CL)</td>
<td>0.287</td>
<td>0.287</td>
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<tr>
<td>SULFATE (SO4)</td>
<td>0.092</td>
<td>0.092</td>
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<tr>
<td>NITRATE (N)</td>
<td>0.001</td>
<td>0.001</td>
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<tr>
<td>FLUORIDE (F)</td>
<td>0.003</td>
<td>0.003</td>
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<td>PHOSPHATE (P)</td>
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<td>0.016</td>
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<tr>
<th>CATION</th>
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<th>MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
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<td>58.2</td>
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<tr>
<td>MAGNESIUM (MG)</td>
<td>16.3</td>
<td>16.3</td>
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<tr>
<td>SODIUM (NA)</td>
<td>6.6</td>
<td>6.6</td>
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<td>POTASSIUM (K)</td>
<td>3.6</td>
<td>3.6</td>
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<tr>
<td>IRON (FE)</td>
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<td>0.02</td>
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<td>MANGANESE (MN)</td>
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<tr>
<td>ALUMINUM (AL)</td>
<td>31.0</td>
<td>31.0</td>
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TOTAL CATIONS: 4.626
TOTAL ANIONS: 4.643

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.10 SIGMA

LABORATORY PH: 7.86
FIELD TEMPERATURE: 4.7°C
CALCULATED DISSOLVED SOLIDS: 258.1
SUM OF DISS. CONSTITUENTS: 385.5
LAB SPEC.COND. (MICROMOH/CM): 417.0

ADDITIONAL PARAMETERS:
CNDUCTIV, FIELD MICROMOH 439.4
ALUMINUM, DISS (MG/L-AL) < 0.5
TEMPERATURE, AIR (°C): 15.0

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L = MILLIGRAMS PER LITER  MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED;TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: / PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HCO3 CO3 NO3
62 28 6 1 7 2 90 0 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0455
STATE MONTANA
LATITUDE-LONGITUDE 44°00'11"N 114°05'00"W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLOGICAL SOURCE 112WDBL
DRAINAGE BASIN 41*A
AGENCY + SAMPLER MBMG * JLS
DATE SAMPLED 10-05-77
TIME SAMPLED 1500
LAB + ANALYST MBMG * GAM
DATE ANALYZED 12-08-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMING SITE REFUGE STOCK WELL
GEOLOGICAL SOURCE

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<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
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<th>MG/L</th>
<th>MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
<td>27</td>
<td>1.347</td>
<td>BICARBONATE (HCO3)</td>
<td>96</td>
<td>1.573</td>
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<td>MAGNESIUM (Mg)</td>
<td>3.9</td>
<td>0.321</td>
<td>CARBONATE (CO3)</td>
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<td>SODIUM (Na)</td>
<td>5.3</td>
<td>0.231</td>
<td>CHLORIDE (Cl)</td>
<td>6.65</td>
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<td>POTASSIUM (K)</td>
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<td>0.067</td>
<td>SULFATE (SO4)</td>
<td>3.2</td>
<td>0.067</td>
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<td>IRON (Fe)</td>
<td>13</td>
<td>0.007</td>
<td>NITRATE (AS N)</td>
<td>1.898</td>
<td>0.136</td>
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<tr>
<td>MANGANESE (Mn)</td>
<td>3</td>
<td>0.001</td>
<td>NO3+NO2 TOT (AS N)</td>
<td>4</td>
<td>0.021</td>
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<td>ALUMINUM (Al)</td>
<td>37.0</td>
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<td>PHOSPHATE (AS P)</td>
<td>0.4</td>
<td>0.021</td>
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TOTAL CATIONS 1.973
TOTAL ANIONS 1.984

STANDARD DEVIATION OF ANION = CATION BALANCE 0.08 SIGMA

LABORATORY PH 7.25
FIELD TEMPERATURE 6.5°C
CALCULATED DISSOLVED SOLIDS 135.4
SUM OF DISS. CONSTITUENTS 184.1
LAB SPEC. COND. (MICROMHOS/CM) 198.0

ADDITIONAL PARAMETERS
CONDUCTIVITY FIELD MICROMHOS 236.4
ALUMINUM DISS (MG/L-AL) M 0.28

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES
CA Mg Na K Cl SO4 HCO3 CO3 NO3
68 16 11 3 10 3 86 0 7

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0456
STATE: MONTANA  
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44°36'01.5"N 111°43'37.6"W  
SAMPLING LOCATION: 145 2W 23
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE  
SAMPLE SOURCE: WELL
GEOLOGICAL SOURCE: 111ALVF  
STATION CODE: MBBG * JLS
DRAINAGE BASIN: 414A
ALTITUDE OF SAMPLE POINT: 6690.0 FT <5
AGENCY & SAMPLER: MBBG * JLS
TOTAL DEPTH OF WEL: 6690.0 FT <5
DATE SAMPLED: 10-05-77
DEPTH WATER ENTERS WELL:
TIME SAMPLED: 1610
SWL ABOVE(+); OR BELOW GS:
LAB & ANALYST: MBBG * GAM
FLOW MEAS METHOD:
DATE ANALYZED: 12-08-77
WATER FLOW RATE:
SAMPLE HANDLING: 3120
WATER USE: DOMESTIC
METHOD SAMPLED: GRAB
SAMPLING SITE: OLD SCHOOL HOUSE, LAKEVIEW

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<th>GEOLOGICAL SOURCE</th>
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<tr>
<th>MG/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HC03)</td>
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<td>CARBONATE (CO3)</td>
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<td>CHLORIDE (CL)</td>
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<td>SULFATE (SO4)</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<td>FLUORIDE (F)</td>
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<tr>
<td>D=PHOSPHATE (AS P)</td>
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| TOTAL CATIONS | 4.306 | TOTAL ANIONS | 4.348 |

STANDARD DEVIATION OF ANION-CATION BALANCE 0.24 SIGMA

LABORATORY PH       7.42  TOTAL HARDNESS AS CACO3 190.0
FIELD TEMPERATURE   7.7  TOTAL ALKALINITY AS CACO3 203.0
CALCULATED DISSOLVED SOLIDS 247.5  SODIUM ADSORPTION RATIO 0.3
SUM OF DISS. CONSTITUENTS 372.9  RYZNAR STABILITY INDEX 7.3
LAB SPEC.COND. (MICROMHOS/CM) 400.5  LANGLIER SATURATION INDEX 0.1

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS 404.0  ALUMINUM, DISS (MG/L=AL) < 0.05

REMARKS: CENT. VALLEY GEOTHERMAL

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /  PERCENTAGE REACTANCE VALUES
       CA  Mg  Na  K  CL  SO4  HC03  CO3  NO3
       69  18  8  3  3  3  93  0  0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0457
**STATE** MONTANA  
**COUNTY** BEAVERHEAD  
**LATITUDE-LONGITUDE** 43°37'20"N 111°37'16"W  
**SAMPLE LOCATION** 14S 1E 8DACC SPRING  
**TOPOGRAPHIC MAP** UPPER RED ROCK LAKE  
**SAMPLE SOURCE** 400MPMC  
**DRAINAGE BASIN** 41A  
**STATION CODE**  
**AGENCY + SAMPLER** MBMG & WMB  
**BOTTLE NO.** 809-CV  
**DATE SAMPLED** 09-28-77  
**ALITUDE OF SAMPLE POINT** 6680 FT 5  
**TIME SAMPLED** 1800  
**TOTAL DEPTH OF WATER**  
**LAB + ANALYST** MBMG & GAM  
**STAGE HEIGHT**  
**DATE ANALYZED** 12-08-77  
**DEPTH TO SAMPLING POINT**  
**SAMPLE HANDLING** 3120  
**FLOW MEAS METHOD** NOT USED  
**METHOD SAMPLED** GRAB  
**WATER FLOW RATE** 25 GPM  
**WATER USE** MULTIPLE USE  

**SAMPLING SITE** CULVER SPRINGS 2.5 MI S. OF ELK LAKE CAMP  
**DRAINAGE BASIN** RED ROCK RIVER  

<table>
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<th>Meas.</th>
<th>Value</th>
<th>Meas.</th>
<th>Value</th>
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<tbody>
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<td>1M647 BICARBONATE (HC03)</td>
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<td>1.119 CARBONATE (CO3)</td>
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<td>SODIUM (Na)</td>
<td>2.3</td>
<td>0.100 CHLORIDE (Cl)</td>
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<td>POTASSIUM (K)</td>
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<td>0.028 SULFATE (SO4)</td>
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<td>0.000 NITRATE (AS N)</td>
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<tr>
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<td>MANGANESE (Mn)</td>
<td>&lt;.01</td>
<td>0.000 NO3+NO2 TOT (AS N)</td>
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<td>ALUMINUM (Al)</td>
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<td>FLUORIDE (F)</td>
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<td>SILICA (Si02)</td>
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<td>D-PHOSPHATE (AS P)</td>
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**TOTAL CATIONS** 2.894  
**TOTAL ANIONS** 2.888  

**STANDARD DEVIATION OF ANION - CATION BALANCE = 0.04 SIGMA**

**LABORATORY PH** 7.92  
**FIELD TEMPERATURE** 7.0 C  
**TOTAL HARDNESS AS CAC03** 138.0  
**TOTAL ALKALINITY AS CAC03** 140.0  
**CALCULATED DISSOLVED SOLIDS** 153.9  
**SODIUM ADSORPTION RATIO** 0.1  
**SUM OF DISS. CONSTITUENTS** 240.7  
**RYZNAR STABILITY INDEX** 7.6  
**LAB SPEC. COND. (MICROMHOS/CM)** 262.7  
**LANGLIER SATURATION INDEX** 0.1  

**ADDITIONAL PARAMETERS**

- **CNDUCTVY, FIELD MICROMHOS** 229.2  
- **ALUMINUM, DISS (MG/L=AL)** .11  

**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT WATER FLOW IS IMPOSSIBLE  

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  
**ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED:** TOT=TOTAL SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS  

**PROCESSING PGM:** GWANAL (FORM 153)  
**PERCENTAGE REACTANCE VALUES:**  

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<th>Value</th>
<th>Meas.</th>
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<tr>
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<td>MG</td>
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56 38 3 0 1 1 97 0 0  

**FUND:** CG75/  
**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0458
STATE MONTANA  
COUNTY BEAVERHEAD  
LATITUDE=LONGITUDE 44°06.00N 111°57.42W  
SAMPLE LOCATION 135° 3W 22°05.0C  
TOPOGRAPHIC MAP LOWER RED ROCK LAKE  
SAMPLE SOURCE SPRING  
GEOLGICAL SOURCE 112YVLC  
STATION CODE 814-CV  
DRAINAGE BASIN 414A  
BOTTLE NO. 6840 FT <5  
AGENCY + SAMPLER MBG & WMB  
DEPTH TO SAMPLING POINT FLOAT AND STOP.  
DATE SAMPLED 09-30-77  
TOTAL DEPTH OF WATER 1.0 CFS/M  
TIME SAMPLED 1000  
WATER USE STOCK  
LAB + ANALYST MBG & GAM  
DATE ANALYZED 12-08-77  
FLOW MEAS METHOD 1.0 CFS/M  
SAMPLE HANDLING GRAB  
WATER FLOW RATE  
METHOD SAMPLED  
SAMPLING SITE LOUSY SPRING 2.5 MILE OF BRUNDAGE BRIDGE  
DRAINAGE BASIN RED ROCK RIVER  

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<tr>
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<td>CALCIUM (Ca)</td>
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<td>MAGNESIUM (Mg)</td>
<td>10+3</td>
<td>0.847</td>
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<td>SODIUM (Na)</td>
<td>8+4</td>
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<td>POTASSIUM (K)</td>
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<td>0.028</td>
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<tr>
<td>IRON (Fe)</td>
<td>&lt;0.01</td>
<td>0.000</td>
</tr>
<tr>
<td>MANGANESE (Mn)</td>
<td>&lt;0.01</td>
<td>0.000</td>
</tr>
<tr>
<td>ALUMINUM (Al)</td>
<td>19+3</td>
<td>0.000</td>
</tr>
<tr>
<td>SILICA (SiO2)</td>
<td>19+3</td>
<td>0.000</td>
</tr>
</tbody>
</table>

TOTAL CATIONS 3.636

TOTAL ANIONS 3.613

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.14 SIGMA

LABORATORY PH 7.58
FIELD TEMPERATURE 68.6 C
CALCULATED DISSOLVED SOLIDS 196.9
SUM OF DISS. CONSTITUENTS 300.9
LAB SPEC. COND. (MICROMHOS/CM) 333.9

ADDITIONAL PARAMETERS

CONDUCTIVITY FIELD MICROMHOS 278.1
ALUMINUM, DISS (MG/L=AL) < .05
TEMPERATURE, AIR (C) 0.5

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*SNOVING DURING SAMPLING 0.5 IN TODAY*

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  M = METERS

PROCESSING PGM: GWANAL (FORM 153)

PERCENTAGE REACTANCE VALUES

FUND: CG75/

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0459
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 44416N 115639W
SAMPLE LOCATION: 135 3W 22DAAB
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE
SAMPLE SOURCE: SPRING
GEOLOGICAL SOURCE: 112VLCC
STATION CODE: 815-CV
DRAINAGE BASIN: 41-A
BOTTLE NO.: 6875 FT <10
AGENCY + SAMPLER: MBMG * WMB
TOTAL DEPTH OF WATER: 125714
DATE SAMPLED: 09-29-77
STAGE HEIGHT: 0.18 CFS(M)
TIME SAMPLED: 1049
FLOW MEAS METHOD: FLOAT AND STOPWA
LAB + ANALYST: MBMG * GAM
WATER FLOW RATE: 0.18 CFS(M)
DATE ANALYZED: 12-30-77
WATER USE STOCK:
SAMPLE HANDLING: 3120
SMALL SPNG 1MI ENE OF LOUSY SPRING
METHOD SAMPLED: GRAB
DRAINAGE BASIN: RED ROCK RIVER

| **CALCIUM (CA)** | 50.8 | 2.535 | **BICARBONATE (HCO3)** | 212.2 | 3.474 |
| **MAGNESIUM (MG)** | 12.3 | 1.012 | **CARBONATE (CO3)** | 0.0 | 0.000 |
| **SODIUM (NA)** | 12.7 | 0.552 | **CHLORIDE (CL)** | 19.15 | 0.540 |
| **POTASSIUM (K)** | 1.8 | 0.046 | **SULFATE (SO4)** | 5.2 | 0.108 |
| **IRON (Fe)** | 0.04 | 0.002 | **NITRATE (AS N)** | 587 | 0.042 |
| **MANGANESE (Mn)** | <.01 | 0.000 | **NO3+NO2 TOT (AS N)** | .2 | 0.011 |
| **ALUMINUM (Al)** | 21.0 | 0- | **PHOSPHATE (AS P)** | 4.147 | 4.175 |

**TOTAL CATIONS**

**TOTAL ANIONS**

| **Filtered Sample Laboratory pH** | 7.76 | **TOTAL HARDNESS AS CACO3** | 177.1 |
| **FIELD TEMPERATURE** | 7.0°C | **TOTAL ALKALINITY AS CACO3** | 174.7 |
| **CALCULATED DISSOLVED SOLIDS** | 228.2 | **SODIUM ADSORPTION RATIO** | 0.4 |
| **SUM OF DISS. CONSTITUENTS** | 335.8 | **RYZNAR STABILITY INDEX** | 7.2 |
| **LAB SPEC. COND. (MICROMOS/CM)** | 317.6 | **LANGLIER SATURATION INDEX** | 0.3 |

**ADDITIONAL PARAMETERS**

- CNDCUTIVITY, FIELD MICROMOS: 323.9
- TEMPERATURE, AIR (°C): 8.25
- ALUMINUM, DISS (MG/L-Al) < .05

**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT-SNOWING DURING SAMPLING (RGC. 0.5 IN TODAY) ANALYSIS BASED ON FILTERED ONLY

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

**PROCESSING PGM:** GWANAL(FORM 153)
**PERCENTAGE REACTANCE VALUES**
**FUND:** CG75/

| **CA** | 61 | **MG** | 24 | **NA** | 13 | **K** | 13 | **CL** | 2 | **SO4** | 84 | **HC03** | 0 | **CO3** | 1 |

**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0460
STATE MONTANA
LATITUDE-LONGITUDE 44°11'16"N 111°56'39"W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEological SOURCE 112VLCC
DRAINAGE BASIN 4.1*A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 09-29-77
TIME SAMPLED 10:49
LAB + ANALYST MBMG * GAM
DATE ANALYZED 12-30-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE SMALL SPRING 1MI ENE OF LOUSY SPRING
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.0</td>
<td>1.647</td>
</tr>
<tr>
<td>12.3</td>
<td>1.012</td>
</tr>
<tr>
<td>12.7</td>
<td>0.552</td>
</tr>
<tr>
<td>1.8</td>
<td>0.046</td>
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<td>0.04</td>
<td>0.002</td>
</tr>
<tr>
<td>&lt;0.01</td>
<td>0.000</td>
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<tr>
<td>21.0</td>
<td>0</td>
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</table>

TOTAL CATIONS 3.259
TOTAL ANIONS 3.628

STANDARD DEVIATION OF ANION - CATION BALANCE 2.31 SIGMA

LABORATORY PH 8.59
FIELD TEMPERATURE
CALCULATED DISSOLVED SOLIDS 192.0
SUM OF DISS. CONSTITUENTS 283.8
LAB SPEC. COND. (MICROMOH/S/CM) 317.6

ADDITIONAL PARAMETERS
ALUMINUM, DISS. (MG/L-AL) < 0.05

Ca 50.8-33.3 = 2.635-1.647 = 4.888 meq/l
HCO3 21.2-18.1 = 3.474-2.966 = 0.508 meq/l
Cl 15-14 = 0.500-0.480 = 0.360 meq/l
CO3 9.6-0 = A = -3.20 meq/l

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT
CL, ALK, AND CA RUN ON RAW SAMPLE CAUSE OF BAD SIGMA

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOTAL=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M= METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: CG75/
PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HCO3 C03 NO3
50 31 16 15 3 82 8 1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0460
STATE MONTANA
LATITUDE=LONGITUDE 44°43’N 111°43’W
TOPOGRAPHIC MAP UPPER RED ROCK LAKE
GEOLICAL SOURCE 112VLCC
DRAINAGE BASIN 41*A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 09-30-77
TIME SAMPLED 1336
LAB + ANALYST MBMG * GAM
DATE ANALYZED 12-08-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE 1.5 MI SW OF SNOWSHOE PASS
DRAINAGE BASIN RED ROCK RIVER

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<thead>
<tr>
<th>ELEMENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (Ca)</td>
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<td>MAGNESIUM (Mg)</td>
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<td>SODIUM (Na)</td>
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<td>POTASSIUM (K)</td>
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<td>IRON (Fe)</td>
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<td>MANGANESE (Mn)</td>
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<tr>
<td>ALUMINUM (Al)</td>
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<td>1.411</td>
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<tr>
<td>SILICA (SiO2)</td>
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<td>1.411</td>
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TOTAL CATIONS 1.441

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<tr>
<th>ELEMENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HCO3)</td>
<td>70.5</td>
<td>1.155</td>
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<tr>
<td>CARBONATE (CO3)</td>
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<td>CHLORIDE (Cl)</td>
<td>5.60</td>
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<td>SULFATE (SO4)</td>
<td>1.2</td>
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<td>NITRATE (As N)</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<tr>
<td>PHOSPHATE (As P)</td>
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<td>0.011</td>
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</table>

TOTAL ANIONS 1.418

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.18 SIGMA

LABORATORY PH 6.91
FIELD TEMPERATURE 7.3°C
TOTAL HARDNESS AS CACO3 55.0
TOTAL ALKALINITY AS CACO3 58.0
SODIUM ADSORPTION RATIO 0.3
RYZMAR STABILITY INDEX 10.1
LANGLIER SATURATION INDEX 1.6

ADDITIONAL PARAMETERS

CONDUCTIVITY, FIELD MICROMHOS 139.7
ALUMINUM, DISS (MG/L=AL) 16
TEMPERATURE, AIR (C) 6.0

REMARKS: C+G 75 CENTENNIAL VALLEY GEOThERMAL PROJECT STOPED SNOWING IS NOW MELTING WATER SAMPLE CONTAINS A DILUTE MIXTURE.

EXPLANATION: MG/L= MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

<table>
<thead>
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<th>ELEMENTS</th>
<th>PERCENTAGE</th>
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<td>MG</td>
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<tr>
<td>NA</td>
<td>13</td>
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<tr>
<td>K</td>
<td>9</td>
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<tr>
<td>CL</td>
<td>11</td>
</tr>
<tr>
<td>SO4</td>
<td>86</td>
</tr>
<tr>
<td>HCO3</td>
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</tr>
<tr>
<td>CO3</td>
<td>5</td>
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</tbody>
</table>

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0461
STATE: MONTANA
LATITUDE-LONGITUDE: 43°3509N 111°3725W
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
GEOLICAL SOURCE: DRAINAGE BASIN: 41* A
AGENCY + SAMPLER: MBG + WMB
DATE SAMPLED: 10-01-77
TIME SAMPLED: 1304
LAB + ANALYST: MBG + GAM
DATE ANALYZED: 12-08-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB
SAMPLING SITE: 1/2 MI SE OF WALSH RANCH
DRAINAGE BASIN: RED ROCK RIVER

COUNTY: BEAVERHEAD
SAMPLE LOCATION: 14S 1E 29ACD STREAM
STATION CODE: 817-CV
BOTTLE NO.: 7120+ FT <5

MG/L MEQ/L MG/L MEQ/L
CALCIUM (CA) 42+2 2+106 BICARBONATE(HCO3) 184+ 3+016
MAGNESIUM (MG) 13+ 1+069 CARBONATE (CO3) 3+8 0+127
SODIUM (NA) 1+4 0+061 CHLORIDE (CL) 8+0 0+023
POTASSIUM (K) 8+ 0+020 SULFATE (SO4) 5+2 0+108
IRON (FE) 0+02 0+001 NITRATE (AS N) 0+43 0+003
MANGANESE (MN) <0+1 0+000 NO3+NO2 TOT (AS N) <0+1 0+000
ALUMINUM (Al) 9+0 FLUORIDE (F) 0=PHOSPHATE (AS P)
SILICA (SiO2) 0

TOTAL CATIONS 3+258 TOTAL ANIONS 3+276

STANDARD DEVIATION OF ANION - CATION BALANCE 0+13 SIGMA

LABORATORY PH 8+47
FIELD TEMPERATURE 6+5 C
TOTAL HARDNESS AS CaCO3 159+6
TOTAL ALKALINITY AS CaCO3 157+6
CALCULATED DISSOLVED SOLIDS 167+0
SUM OF DISS. CONSTITUENTS 260+4
LAB SPEC. COND. (MICROMhos/CM) 292+8
RYZNAR STABILITY INDEX 6+8
LANGLIER SATURATION INDEX 0+8

ADDITIONAL PARAMETERS

CNDUCTVY, FIELD MICROMhos 261+7
ALUMINUM, DISS (MG/L=AL) < .05

TEMPERATURE, AIR (C) 12+25

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*TD#0.3*MADISON LS 15 IN FLOAT W/ MINOR SCHIST

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL(FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>Cl</th>
<th>SO4</th>
<th>HCO3</th>
<th>CO3</th>
<th>N03</th>
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<tr>
<td></td>
<td>64</td>
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<td>0</td>
<td>392</td>
<td>3</td>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0462
### Sampling Site and Drainage Basin

- **Sampling Site:** 1.5 miles southeast of Walsh Ranch
- **Drainage Basin:** Red Rock River

### Water Quality Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calcium (Ca)</strong></td>
<td>mg/L</td>
<td>13.2</td>
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<tr>
<td><strong>Magnesium (Mg)</strong></td>
<td>mg/L</td>
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<tr>
<td><strong>Sodium (Na)</strong></td>
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</tr>
<tr>
<td><strong>Potassium (K)</strong></td>
<td>mg/L</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Iron (Fe)</strong></td>
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<tr>
<td><strong>Manganese (Mn)</strong></td>
<td>mg/L</td>
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</tr>
<tr>
<td><strong>Aluminum (Al)</strong></td>
<td>mg/L</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Silica (SiO2)</strong></td>
<td>mg/L</td>
<td>13.0</td>
</tr>
</tbody>
</table>

### Anion Balance

<table>
<thead>
<tr>
<th>Anion</th>
<th>Meq/L</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicarbonate (HCO3)</td>
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<td>0.659</td>
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<tr>
<td>Carbonate (CO3)</td>
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<td>0.197</td>
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<td>Chloride (Cl)</td>
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<td>Sulfate (SO4)</td>
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</tr>
<tr>
<td>Nitrate (N)</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>NO3+NO2 TOT(N)</td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>Fluoride (F)</td>
<td></td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Phosphate (As P)</td>
<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

### Cation Balance

- **Total Cations:** 0.985

### Standard Deviation of Anion-Cation Balance

- Standard Deviation: 0.06 Sigma

### Additional Parameters

- **Laboratory PH:** 7.48
- **Field Temperature:** 4.3°C
- **Calculated Dissolved Solids:** 63.2 lb
- **Sum of Dissolved Constituents:** 91.1 lb
- **Lab Spec Cond (Micromhos/cm):** 98.6
- **Conductivity, Field Micromhos:** 97.1
- **Aluminum, Diss (mg/l-AL):** <0.05
- **Temperature, Air (°C):** 13.0

### Remarks

- C+G 75 Centennial Valley Geothermal Project
- Spring is down from July

### Explanation

- **mg/L = Milligrams per liter**
- **Meq/L = Milliequivalents per liter**
- All constituents dissolved (Diss) except as noted: TOT=Total Susp=Suspended
- TR=Total Recoverable (M)=Measured (R)=Reported (E) = Estimated
- M = Meters

### Processing PGM:

- Gwanal (Form 153)

### Fund:

- CG75/

### Percentage Reactance Values

<table>
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<tr>
<th>Element</th>
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<tbody>
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<td>Ca</td>
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</tr>
<tr>
<td>Mg</td>
<td>20</td>
</tr>
<tr>
<td>Na</td>
<td>10</td>
</tr>
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<td>K</td>
<td>2</td>
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<td>Cl</td>
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<td>N03</td>
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### Note

- In correspondence related to this analysis refer to number 78M0463
STATE: MONTANA
COUNTY: BEAVERHEAD
LATITUDE-LONGITUDE: 4436134N 1113509W
SAMPLE LOCATION: 145 1E 22ABCC
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
SAMPLE SOURCE: STATION CODE: 819-CV
GEOLGICAL SOURCE: DRAINAGE BASIN: 41-A
BOTTLE NO.: 819-CV
AGENCY + SAMPLER: MBG * WMB
SAMPLE HANDLING: GRAB
DATE SAMPLED: 10-01-77
LAB + ANALYST: MBG * GAM
SAMPLED: TOTAL DEPTH OF WATER: 2 FT
TIME SAMPLED: 1530
DEPTH TO SAMPLING POINT: 6775. FT <5
LAB + ANALYST: 12-15-77
FLOOR MEAS METHOD: FLOAT AND STOP
DATE ANALYZED: 3120
WATER FLOW RATE: 2.76 CFS/MI
SAMPLE HANDLING: WATER USE: MULTIPLE USE
DRAINAGE BASIN: CORRAL CK AT TORE MORTON RANCH
DRAINAGE BASIN: RED ROCK RIVER

CALCIUM (CA) MG/L 27.6 MEQ/L 1.377 BICARBONATE (HC03) 136.3 2.229
MAGNESIUM (MG) 12.4 1.020 CARBONATE (CO3) 5.0 0.167
SODIUM (NA) 1.3 0.057 CHLORIDE (CL) 40.0 0.011
POTASSIUM (K) 0.5 0.013 SULFATE (SO4) 6.0 0.125
MANGANESE (MN) 0.01 0.000 NITRATE (AS N) 0.023 0.002
IRON (FE) <0.01 0.000 NO3+NO2 TOT (AS N) <0.1 0.000
ALUMINUM (AL) <0.01 FLUORIDE (F) 0.000
SILICA (SI02) 10.9 0-PHOSPHATE (AS P)

TOTAL CATIONS 2.467
TOTAL ANIONS 2.333

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.46 SIGMA

LABORATORY PH 8.48
FIELD TEMPERATURE 6.1 C
TOTAL HARDNESS AS CACO3 120.
CALCULATED DISSOLVED SOLIDS 131.2
SODIUM ADSORPTION RATIO 0.1
SUM OF DISS. CONSTITUENTS 200.2
RYZNAR STABILITY INDEX 7.4
LAB SPEC. COND. (MICROMOH/CM) 222.7
LANGILIEN SATURATION INDEX 0.5

ADDITIONAL PARAMETERS:
CONDCTVY, FIELD MICROMOH 200.3 TEMPERATURE, AIR (C) 5.5
ALUMINUM, DISS (MG/L-AL) 0.07

REMARKS: C*G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*MORTONS USE WATER
FOR DOMESTIC STOCK

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: C675/

PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HC03 CO3 NO3
55 41 2 0 0 4 88 6 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0464
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<td>Longitude</td>
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<td>Topographic Map</td>
<td>Upper Red Rock Lake</td>
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<td>Geologic Source</td>
<td>400MMPC</td>
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<tr>
<td>Drainage Basin</td>
<td>41*F</td>
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<td>Agency + Sampler</td>
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<td>12-08-77</td>
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<tr>
<td>Method Sampled</td>
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</tr>
<tr>
<td>Sampling Site</td>
<td>SPNG Head of Lone Tree Creek</td>
</tr>
<tr>
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<tr>
<td>Magnesium (Mg)</td>
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</tr>
<tr>
<td>Sodium (Na)</td>
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</tr>
<tr>
<td>Potassium (K)</td>
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<td>NO3 + NO2</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Lab Spec. Cond. (micromhos/cm)</td>
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Remarks: C+G 75 Centennial Valley Geothermal Project*Fine Brown Silt on Bottom

Explanation: mg/l = milligrams per liter; meq/l = milli-equivalents per liter
All constituents dissolved (diss) except as noted: tot = total suspended tr = total recoverable (m) = measured (r) = reported (e) = estimated m = meters

Processing Pgm: GWANAL(form 153)

Note: In correspondence related to this analysis refer to number 78M0466
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<tr>
<td>Bicarbonate (HC03)</td>
<td>mg/L</td>
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<td>Carbonate (CO3)</td>
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<td>Chloride (CL)</td>
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<td>Sulfate (SO4)</td>
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<tr>
<td>Nitrate (AS N)</td>
<td>mg/L</td>
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</tr>
<tr>
<td>Fluoride (F)</td>
<td>mg/L</td>
<td>1.1</td>
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<tr>
<td>NO3+NO2 TOT (AS N)</td>
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<td>Aluminum, Diss (mg/L=Al)</td>
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**Additional Parameters**

- Temperature, Air (°C): 9.0
- Cation Analysis: Ca, Mg, Na, K, Cl, SO4, HCO3, CO3, N03
- Cation Balance: 0.18 Sigma

**Remarks:** C+G 75 Centennial Valley Geothermal Project. Water is coming out from under a pine tree.

**Explanation:** mg/L = milligrams per liter, meq/L = milliequivalents per liter. All constituents dissolved (Diss) except as noted: TOT = Total Suspended. TR = Total Recoverable (M) = Measured (R) = Reported (E) = Estimated. M = Meters.
STATE: MONTANA  
COUNTY: BEAVERHEAD  
LATITUDE-LONGITUDE: 44°35'56"N 114°21'11"W  
SAMPLE LOCATION: 14S 1W 22DA  
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE  
SAMPLE SOURCE: SPRING  
GEODETICAL SOURCE: 110ALVM  
STATION CODE: 823-CV  
DRAINAGE BASIN: 41-A  
BOTTLE NO.:  
AGENCY + SAMPLER: MBGM * WMB  
ALTITUDE OF SAMPLE POINT: 6640+ FT <1  
DATE SAMPLED: 10-03-77  
TOTAL DEPTH OF WATER: 2 FT  
TIME SAMPLED: 1137  
STAGE HEIGHT:  
LAB + ANALYST: MBGM * GAM  
DEPTH TO SAMPLING POINT:  
DATE ANALYZED: 12-08-77  
FLOW MEAS METHOD: FLOAT AND STOPW  
SAMPLE HANDLING: 3120  
WATER FLOW RATE: 2.0 CFS  
METHOD SAMPLED: GRAB  
WATER USE: MULTIPLE USE  

SAMPLING SITE: 1.25 MI E OF UPPER RED RK LK CAMPGROUND  
DRAINAGE BASIN: RED ROCK RIVER  

<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
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<td>MAGNESIUM (MG)</td>
<td>16.9</td>
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<td>SODIUM (NA)</td>
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<td>IRON (FE)</td>
<td>&lt;9</td>
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<td>MANGANESE (MN)</td>
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<td>ALUMINUM (AL)</td>
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<td>SILICA (SIO2)</td>
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<table>
<thead>
<tr>
<th></th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>BICARBONATE (HC03)</td>
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<tr>
<td>CARBONATE (CO3)</td>
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<tr>
<td>CHLORIDE (CL)</td>
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<tr>
<td>SULFATE (SO4)</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>NITRATE (AS N)</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>NO3+NO2 TOT (AS N)</td>
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<td>FLUORIDE (F)</td>
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<td>0-PHOSPHATE (AS P)</td>
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TOTAL CATIONS: 3.912  
TOTAL ANIONS: 3.865  
STANDARD DEVIATION OF ANION = CATION BALANCE - 0.28 SIGMA

LABORATORY PH: 7.95  
FIELD TEMPERATURE: 70 C  
TOTAL HARDNESS AS CAC03: 191  
TOTAL ALKALINITY AS CAC03: 187  
CALCULATED DISSOLVED SOLIDS: 192.4  
SODIUM ADSORPTION RATIO: 0.0  
SUM OF DISS. CONSTITUENTS: 308.1  
RYZNAR STABILITY INDEX: 7.0  
LAB SPEC. COND. (MICROMOS/M) | 346.5  
LANGLIER SATURATION INDEX | 0.5

ADDITIONAL PARAMETERS

CONDUCTIVITY, FIELD MICROMOH: 308.7  
ALUMINUM, DISS (MG/L-AL) < .05

REMARKS: C+G 75 CENTENNIAL VALLEY GEOHERMAL PROJECT SPRING FIELD W/ MANY SPRINGS

EXPLANATION: MG/L=MILLIGRAMS PER LITER  MEQ/L=MILLIEQUIVALENTS PER LITER  ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED  TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PG: GWANAL (FORM 153)  
PERCENTAGE REACTANCE VALUES

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<tr>
<th></th>
<th>CA</th>
<th>MG</th>
<th>NA</th>
<th>K</th>
<th>CL</th>
<th>S04</th>
<th>HC03</th>
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<th>NO3</th>
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<tr>
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<td>35</td>
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<td>0</td>
<td>2</td>
<td>97</td>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0468
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<td>GRAB</td>
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<th>Parameter</th>
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</tr>
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<td><strong>Manganese (Mn)</strong></td>
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<th>Parameter</th>
<th>Unit(s)</th>
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<tr>
<td><strong>bicarbonate (HC03)</strong></td>
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<td><strong>carbonate (CO3)</strong></td>
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**REMARKS:** C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*SEND COPY TO E·HUNTSMAN DELL MT*

**EXPLANATION:** MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

**PROCESSING PGM:** GWANAL(FORM 153)  **PERCENTAGE REACTANCE VALUES**

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<td>K</td>
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</tr>
<tr>
<td>CL</td>
<td>1</td>
</tr>
<tr>
<td>SO4</td>
<td>9</td>
</tr>
<tr>
<td>HC03</td>
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<td>CO3</td>
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**NOTE:** IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0469
STATE: MONTANA
LATITUDE-LONGITUDE: 43°55'6" N 114°10'7" W
TOPOGRAPHIC MAP: UPPER RED ROCK LAKE
GEOLOGICAL SOURCE: 110ALVM
DRAINAGE BASIN: 41*A
AGENCY + SAMPLER: MMBG * WMB
DATE SAMPLED: 10-03-77
TIME SAMPLED: 1500
LAB + ANALYST: MMBG * GAM
DATE ANALYZED: 12-06-77
SAMPLE HANDLING: 3120
METHOD SAMPLED: GRAB

SAMPLING SITE: 2 MI E OF UPPER RED RK LAKE CAMPGROUND
DRAINAGE BASIN: RED ROCK RIVER

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
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<td>4.523</td>
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<td>0.000</td>
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<td>&lt;.01</td>
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<td>269</td>
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<td>MANGANESE (Mn)</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>10.3</td>
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<tr>
<td>SILICA (SiO2)</td>
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<td></td>
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</tr>
</tbody>
</table>

TOTAL CATIONS: 4.737
TOTAL ANIONS: 4.700

STANDARD DEVIATION OF ANION - CATION BALANCE = 0.21 SIGMA

LABORATORY PH: 8.12
FIELD TEMPERATURE: 16.8°C
CALCULATED DISSOLVED SOLIDS: 237.1
SUM OF DISS. CONSTITUENTS: 377.2
LAB SPEC. COND. (MICROMOHNS/CM): 412.5

ADDITIONAL PARAMETERS

CNDUCTIVITYFIELD MICROMHOS: 397.1
ALUMINUM, DISS (MG/L-AL): .06

TEMPERATURE, AIR (C): 17.5

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT SOURCE IS MORE OF A BOG THEN SPRNG TOOK SCDFM ATTRECK

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CA</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>Cl</th>
<th>S04</th>
<th>HC03</th>
<th>CO3</th>
<th>NO3</th>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0470
STATE MONTANA
LATITUDE=LONGITUDE 43°34'44"N 115°33'55"W
TOPOGRAPHIC MAP LOWER RED ROCK LAKE
GEOLGICAL SOURCE
DRAINAGE BASIN *1*A
AGENCY + SAMPLER MBG * WMB
DATE SAMPLED 10-04-77
TIME SAMPLED 0930
LAB + ANALYST MBG * GAM
DATE ANALYZED 12-09-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB
SAMPLING SITE LOWER RED ROCK LAKE DAM
DRAINAGE BASIN RED ROCK RIVER

CALCIUM (Ca) 21.1 1.053 BICARBONATE (HCO3) 139.1 2.278
MAGNESIUM (Mg) 13.5 1.111 CARBONATE (CO3) 0.0 0.000
SODIUM (Na) 6.1 0.265 CHLORIDE (Cl) 2.90 0.082
POTASSIUM (K) 1.8 0.046 SULFATE (SO4) 5.3 0.110
IRON (Fe) 0.10 0.005 NITRATE (AS N) 0.077 0.005
MANGANESE (Mn) <0.01 0.000 NO3+NO2 TOT (AS N) 0.011
ALUMINUM (Al) 0.01 0.000 FLUORIDE (F) 0.0
SILICA (SiO2) 10.1 0.000 PHOSPHATE (AS P) 0.0

TOTAL CATIONS 2.480
TOTAL ANIONS 2.486

STANDARD DEVIATION OF ANION - CATION BALANCE 0.04 SIGMA

LABORATORY PH 7.93
FIELD TEMPERATURE 6.2 C
CALCULATED DISSOLVED SOLIDS 129.7
SUM OF DISS. CONSTITUENTS 200.2
LAB SPEC. COND. (MICROMHOS/CM) 225.4

ADDITIONAL PARAMETERS
CNDUCTVY, FIELD MICROMHOS 187.3
ALUMINUM, DISS (MG/L-AL) 0.06

TEMPERATURE, AIR (C) 1.50

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*WATER IS MURKY *
NORMAL WATER LEVEL

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: /

PERCENTAGE REACTANCE VALUES

CA MG NA K CL SO4 HCO3 CO3 NO3
42 44 10 1 3 4 92 0 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0471
BURLE, MONTANA  59701   (406) 792-8821   LAB NO  78M0472

STATE MONTANA       COUNTY BEAVERHEAD
LATITUDE=LONGITUDE  443558 N 1114841 W   SAMPLE LOCATION 14S 2W 23CAA
TOPOGRAPHIC MAP LOWER RED ROCK LAKE   SAMPLE SOURCE WELL
GEOLICAL SOURCE 111CLVM   STATION CODE
DRAINAGE BASIN 41*A   BOTTLE NO. 827-CV
AGENCY + SAMPLER MBMG * WMB   ALTITUDE OF SAMPLE POINT 6720+ FT <50
DATE SAMPLED 10-04-77   TOTAL DEPTH OF WELL 50 FT
TIME SAMPLED 1135   DEPTH WATER ENTERS WELL
LAB + ANALYST MBMG * GAM   SWL ABOVE (+) OR BELOW GS
DATE ANALYZED 12-09-77   FLOW MEAS METHOD NOT USED
SAMPLE HANDLING 3120   WATER FLOW RATE 20+ FT (F)
METHOD SAMPLED GRAB   WATER USE DOMESTIC

SAMPLING SITE US FISH AND WILDLIFE WELL LAKEVIEW MT

GEOLOGICAL SOURCE

<table>
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<tr>
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<th>MG/L</th>
<th>MEQ/L</th>
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<tr>
<td>CALCIUM (CA)</td>
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<tr>
<td>MAGNESIUM (Mg)</td>
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<td>SODIUM (Na)</td>
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<td>POTASSIUM (K)</td>
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<td>ION (Fe)</td>
<td>&lt;0.1</td>
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<td>MANGANESE (Mn)</td>
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<tr>
<td>ALUMINUM (Al)</td>
<td>24.4</td>
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<tr>
<td>SILICA (SiO2)</td>
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</table>

-----

TOTAL CATIONS 2.916

-----

TOTAL ANIONS 2.991

STANDARD DEVIATION OF ANION - CATION BALANCE 0.49 SIGMA

LABORATORY PH 7.97
FIELD TEMPERATURE 8.3 C
CALCULATED DISSOLVED SOLIDS 171.3
SUM OF DISS. CONSTITUENTS 259.1
LAB SPEC.COND. (MICROMHOS/CM) 268.0

ADDITIONAL PARAMETERS

CANCCTIVITY, FIELD MICROMHOS 239.1
ALUMINUM, DISS (MG/L-AL) 0.06

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT WELL APPROP ON FILE AT MBMG

EXPLANATION: MG/L=MILLIGRAMS PER LITER    MEQ/L=MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES

CA  MG  NA  K  CL  SO4  HCO3  CO3  NO3
72  18  6  2  0  3  95  0  1

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0472
STATE: MONTANA  
COUNTY: BEAVERHEAD  
LATITUDE-LONGITUDE: 443605N 1114841W  
SAMPLE LOCATION: 14S 2W 23BD  
TOPOGRAPHIC MAP: LOWER RED ROCK LAKE  
SAMPLE SOURCE: STREAM  
GEOLOGICAL SOURCE:  
STATION CODE:  
DRAINAGE BASIN: 41A  
BOTTLE NO.: 828-CV  
AGENCY + SAMPLER: MMBG * WMB  
ALTITUDE OF SAMPLE POINT: 6710+ FT <50  
DATE SAMPLED: 10-04-77  
TOTAL DEPTH OF WATER: 1 FT  
TIME SAMPLED: 1205  
STAGE HEIGHT:  
LAB + ANALYST: MMBG * GAM  
DEPTH TO SAMPLING POINT:  
DATE ANALYZED: 12-09-77  
FLOW MEAS METHOD: GURLEY METER  
SAMPLE HANDLING: 3120  
WATER FLOW RATE: 5.7 CFS(M)  
METHOD SAMPLED: GRAB  
WATER USE: MULTIPLE USE  
SAMPLING SITE: SHAMBOCK Ck BELOW SCPTIC TANK*LAKEVIEW MT  
DRAINAGE BASIN: RED ROCK RIVER  

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
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<td>MAGNESIUM (Mg)</td>
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<td>POTASSIUM (K)</td>
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<td>SILICA (SiO2)</td>
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<tr>
<td>BICARBONATE</td>
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<td>CARBONATE (CO3)</td>
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<tr>
<td>CHLORIDE (Cl)</td>
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<td>SULFATE (SO4)</td>
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<tr>
<td>NITRATE (AS N)</td>
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<td>0.008</td>
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<td>NO3+NO2 TOT (AS N)</td>
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<td>FLUORIDE (F)</td>
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<td>TOTAL CATIONS</td>
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<td>TOTAL ANIONS</td>
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<td>STANDARD DEVIATION OF ANION - CATION BALANCE</td>
<td>0.25 SIGMA</td>
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LABORATORY PH: 8.20  
FIELD TEMPERATURE: 3.8 C  
CALCULATED DISSOLVED SOLIDS: 132.9  
SUM OF DISS. CONSTITUENTS: 196.9  
LAB SPEC. COND. (MICROMHOS/CM): 199.7  
LANGLIER SATURATION INDEX: 0.2

ADDITIONAL PARAMETERS  
CONDUCTIVITY FIELD MICROMHOS: 182.0  
TEMPERATURE, AIR (C): 14.0  
ALUMINUM, DISS (MG/L=AL): < .05

REMARKS: CG 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT * WOB SENT LETTER  
STATING NOT POTABLE WATER

EXPLANATION: MG/L=MILLIGRAMS PER LITER  
MEQ/L=MILLIEQUIVALENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED; TOT=TOTAL SUSP=SUSPENDED  
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED  
M = METERS

PROCESSING PGM: GWANAL (FORM 153)  
FUND: CG75/  
PERCENTAGE REACTANCE VALUES

CA  MG  NA  K  CL  SO4  HCO3  CO3  NO3  
71  17  8  2  1  3  95  0  0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0473
STATE MONTANA
LATITUDE=LONGITUDE 44°38'30"N 111°35'34"W
TOPOGRAPHIC MAP UPPER RED ROCK LAKE
GEOLICAL SOURCE 400MMPC
DRAINAGE BASIN 41*A
AGENCY + SAMPLER MBMG * WMB
DATE SAMPLED 10-04-77
TIME SAMPLED 1748
LAB + ANALYST MBMG * GAM
DATE ANALYZED 12-09-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB
SAMPLING SITE HUNTSMAN SPRING 1.5 MI SE OF ELK MTN
DRAINAGE BASIN RED ROCK RIVER

<table>
<thead>
<tr>
<th>Component</th>
<th>MG/L</th>
<th>MEQ/L</th>
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<tbody>
<tr>
<td>CALCIUM (CA)</td>
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<td>MAGNESIUM (MG)</td>
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<td>SODIUM (NA)</td>
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<td>POTASSIUM (K)</td>
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<td>0.041</td>
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<td>IRON (FE)</td>
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<td>MANGANESE (MN)</td>
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<td>0.000</td>
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<tr>
<td>ALUMINUM (AL)</td>
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<tr>
<td>SILICA (SI02)</td>
<td>10.7</td>
<td>0.004</td>
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</tbody>
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BICARBONATE (HCO3) 1.053 MEQ/L
CARBONATE (CO3) 0.716 MEQ/L
CHLORIDE (CL) 0.17 MEQ/L
SULFATE (SO4) 0.041 MEQ/L
NITRATE (AS N) 0.003 MEQ/L
NO3+NO2 0.000 MEQ/L
TOTAL CATIONS 1.930
TOTAL ANIONS 1.987

STANDARD DEVIATION OF ANION - CATION BALANCE 0.42 SIGMA

LABORATORY PH 8.52
FIELD TEMPERATURE 13.0 C
TOTAL HARDNESS AS CACO3 88*
TOTAL ALKALINITY AS CACO3 87*
SODIUM ADSORPTION RATIO 0.1
RYZMAR STABILITY INDEX 7.8
LAB SPEC:COND. (MICROMHOS/CM) 184.1
FLUORIDE (F) 0.2
PHOSPHATE (AS P) 0.011

ADDITIONAL PARAMETERS
CONDUTIVITY, FIELD MICROMHOS 170.2
ALUMINUM, DISS (MG/L=AL) 0.08
TEMPERATURE, AIR (C) 16.25

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT*SPNG FEEDS DITCH*
THIS IS W. MOST SPNG

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES
CA MG NA K CL SO4 HC03 CO3 NO3
54 37 6 2 3 8 79 9 0

NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0474
STATE MONTANA
LATITUDE-LONGITUDE 44°43'00"N 111°42'55"W
TOPOGRAPHIC MAP UPPER RED ROCK LAKE
GEOLICAL SOURCE DRAINAGE BASIN 41#A
AGENCY + SAMPLER MBMG * WMW
DATE SAMPLED 10-05-77
TIME SAMPLED 1305
LAB + ANALYST MBMG * GAM
DATE ANALYZED 12-09-77
SAMPLE HANDLING 3120
METHOD SAMPLED GRAB

SAMPLING SITE TEPEE Ck SPRING 1 MI S OF SNOWSHOE PASS
DRAINAGE BASIN RED ROCK RIVER

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<td>POTASSIUM (K)</td>
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TOTAL CATIONS 1.626

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<td>CHLORIDE (CL)</td>
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<td>FLUORIDE (F)</td>
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TOTAL ANIONS 1.644

STANDARD DEVIATION OF ANION - CATION BALANCE: 0.14 SIGMA

LABORATORY PH 7.69
FIELD TEMPERATURE 90 C
CALCULATED DISSOLVED SOLIDS 127.3
SUM OF DISS. CONSTITUENTS 172.0
LAB SPEC. COND. (MICROMHOS/CM) 158.1

ADDITIONAL PARAMETERS
CONDUCTIVITY, FIELD MICROMHOS 141.9
ALUMINUM, DISS (MG/L=AL) .05
TEMPERATURE, AIR (C) 19.5
RYZMAR STABILITY INDEX 8.8
LANGEILIER SATURATION INDEX .06

REMARKS: C+G 75 CENTENNIAL VALLEY GEOTHERMAL PROJECT, LIVESTOCK IN AREA

EXPLANATION: MG/L = MILLIGRAMS PER LITER, MEQ/L = MILLIEQUIVALENTS PER LITER
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED: TOT = TOTAL SUSPENDED
TR = TOTAL RECOVERABLE (M) = MEASURED (R) = REPORTED (E) = ESTIMATED
M = METERS

PROCESSING PGM: GWANAL (FORM 153)
FUND: CG75/

PERCENTAGE REACTANCE VALUES
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<th>CA</th>
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<th>K</th>
<th>CL</th>
<th>SO4</th>
<th>HC03</th>
<th>CO3</th>
<th>NO3</th>
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<td>16</td>
<td>11</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>89</td>
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NOTE: IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 78M0475
**State:** Montana  
**County:** Beaverhead  
**Sample Location:** 13S 1E 29CAB  
**Station Code:** 431-CV  
**Bottle No.:**  
**Altitude of Sample Point:** 6710 ft <50  
**Total Depth of Water:**  
**Stage Height:**  
**Flow Measure Method:** Not Used  
**Water Flow Rate:** 30 gpm(e)  
**Water Use:** Domestic  

**Sampling Site:** Elk Lake Camp Water Supply  
**Drainage Basin:** Red Rock River

<table>
<thead>
<tr>
<th>Component</th>
<th>MG/L</th>
<th>MEQ/L</th>
<th>MG/L</th>
<th>MEQ/L</th>
</tr>
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<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>20</td>
<td>0.998</td>
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<td>Magnesium (Mg)</td>
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<td>0.247</td>
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<td>3.65</td>
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<tr>
<td>Potassium (K)</td>
<td>3.1</td>
<td>0.092</td>
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<td>0.046</td>
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<td>Iron (Fe)</td>
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<td>Manganese (Mn)</td>
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<tr>
<td>Silica (SiO2)</td>
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</tbody>
</table>

**Total Cations:** 1.521  
**Total Anions:** 1.500  

**Standard Deviation of Anion - Cation Balance:** ±0.16 Sigma

**Laboratory pH:** 7.89  
**Field Temperature:** 9.0°C  
**Total Hardness as CaCO3:** 62°  
**Total Alkalinity as CaCO3:** 65°  
**Calculated Dissolved Solids (Diss):** 124.9  
**Sodium Adsorption Ratio:** 0.2  
**Sum of Diss. Constituents:** 165.2  
**Lynzar Stability Index:** 8.8  
**Lab Spec. Cond. (Micromhos/cm):** 147.1  
**Langlier Saturation Index:** ±0.4

**Additional Parameters:**  
**Conductivity (Field Micromhos):** 113.7  
**Temperature, Air (C):** 16.25  
**Aluminum, Diss (mg/l-Al):** 0.05

**Remarks:** C+G 75 Centennial Valley Geothermal Project H2O Taken From Tap Outside Cabin 3*SPNG Developed W/ RAM-ROD PUMP

**Explanation:** MG/L = Milligrams Per Liter  
**MEQ/L = Milliequivalents Per Liter**  
**All Constituents Dissolved (Diss) Except As Noted; Tot=Total Susp=Suspended Tr=Total Recoverable (M)=Measured (N)=Reported (E)=Estimated M = Meters

**Processing PGM:** Gwanal(Form 153)  
**Percentage Reactance Values:**  
**Fund:** CG75/

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage Values</th>
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</thead>
<tbody>
<tr>
<td>Ca</td>
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<tr>
<td>Mg</td>
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**Note:** In Correspondence Related to This Analysis Refer to Number 78MO476
Personnel changes since the last report consist of Wes Bermel leaving the project and the Bureau to accept a position with industry.

Work schedules through September 30, 1978, includes:

(1) Printing and distribution of the Hardrock report.

(2) Field work in the Centennial and Madison Valleys. Primary emphasis will be hydrologic measurement and geologic mapping.

(3) Finishing the initial warm spring inventory and submitting the coded forms to the U.S.G.S. by July 1, 1978.

(4) Geophysical investigations in the Deer Lodge Valley and elsewhere to increase knowledge of hot spring areas and to promote drilling to better define the nature of the resource.

(5) Investigate warm wells and areas that may contain warm springs, which could not be included in the work due by July 1 because of the short time available.