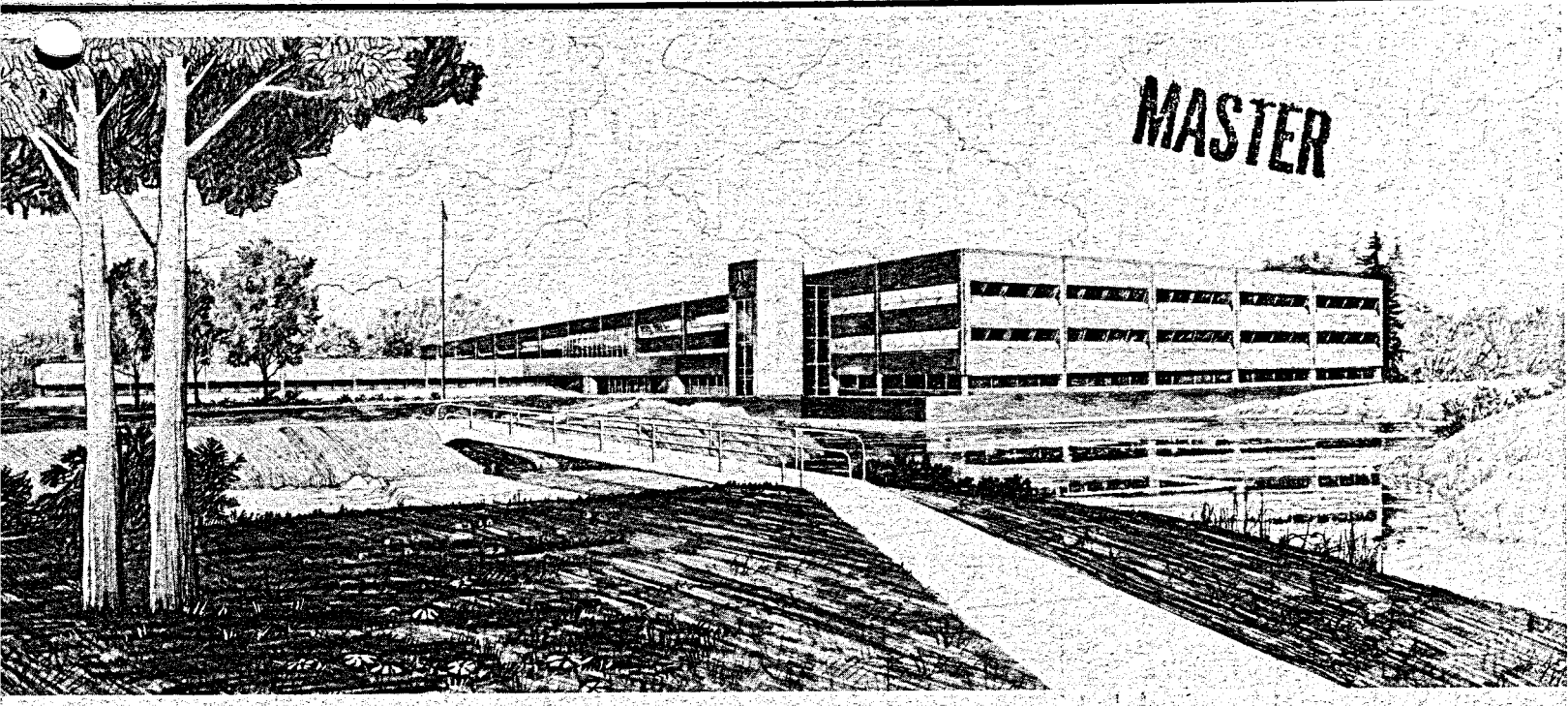


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U.S. Department of Energy

Idaho Operations Office • Idaho National Engineering Laboratory

**Utilization of Geothermal Energy-Feasibility Study
Ojo Caliente Mineral Springs Company
Ojo Caliente, New Mexico**

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Coupland, Moran & Associates

April 1982

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**UTILIZATION OF GEOTHERMAL ENERGY-
FEASIBILITY STUDY
OJO CALIENTE MINERAL SPRINGS COMPANY
OJO CALIENTE, NEW MEXICO**

**Coupland, Moran & Associates
200 Altez S.E.
Albuquerque, NM 87123** ✓

Published April 1982

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ABSTRACT

This report investigates the feasibility of a geothermal heating system at the Ojo Caliente Mineral Springs Co. The geothermal energy will be used to preheat hot water for the laundry facilities and to heat the water for a two-pipe fan coil heating system in the hotel. Present annual heating fuel costs of \$11,218 for propane will be replaced by electricity to operate fans and pump at an annual cost of \$2,547, resulting in a net savings of \$8,671. Installation costs include \$10,100 for a

well system, \$1,400 for a laundry system, and \$41,100 for a heating system. With the addition of a 10% design fee the total installation cost is \$57,860. Ignoring escalating propane fuel prices, tax credits for energy conservation equipment, and potential funding from the State of New Mexico for a geothermal demonstration project, the simple economic payback period for this project is 6.7 years.

FOREWORD

The Geothermal Technical Assistance Program was developed under the premise that the majority of groups or individuals with available geothermal resources do not have the experience or manpower necessary to do a preliminary engineering and economic feasibility evaluation for geothermal energy projects. In order to disseminate technical information and to facilitate expanded use of geothermal energy resources, assistance was provided through FY-1981 in a consulting format on a first-come, staff-and-funds-available basis. Technical assistance can relate to conceptualization; engineering; economics; water chemistry implications for environmental, disposal, and material selection considerations; and planning and development strategies. This report is one of a series adapted from consultation provided to requesters either through in-house efforts or through limited efforts subcontracted to local engineering firms. The Geothermal Technical Assistance (GTA) Reports in this series, which are listed below, will be available for purchase early in 1982 by those with interest in specific geothermal applications from the U.S. National Technical Information Service:

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| 3. | *EGG-GTH-5573 | <i>Geothermal Conversion at Veterans Hospital, Boise, Idaho</i> |
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| 8. | *EGG-2137 | <i>Geothermal Source Potential and Utilization for Methane Generation and Alcohol Production (subcontractor report)</i> |
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| <u>GTA Report Number</u> | <u>EG&G Report Number</u> | <u>Title</u> |
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| 11. | *EGG-2144 | <i>Technical Assistance Report on a Geothermal Heating Utility for Lemmon, South Dakota (subcontractor report)</i> |
| 12. | *EGG-2145 | <i>Economic Analysis for Utilization of Geothermal Energy by North Dakota Concrete Products Company (subcontractor report)</i> |
| 13. | *EGG-2146 | <i>Geothermal Feasibility Analysis II for Polo School District No. 29-2, South Dakota (subcontractor report)</i> |
| 14. | *EGG-2147 | <i>Preliminary Feasibility Study of Heating and Cooling Alternatives for Nebraska Western College, Scottsbluff, Nebraska (subcontractor report)</i> |
| 15. | *EGG-2148 | <i>Inventory of Thermal Springs and Wells Within a One-Mile Radius of Yucca Lodge, Truth or Consequences, New Mexico (subcontractor report)</i> |
| 16. | EGG-2149 | <i>Utilization of Geothermal Energy, Feasibility Study—Ojo Caliente Mineral Springs Company, Ojo Caliente, New Mexico (subcontractor report)</i> |
| 17. | *EGG-2150 | <i>Geothermal Heated Office Building at Glenwood Springs, Colorado (subcontractor report)</i> |
| 18. | EGG-2151 | <i>Final Report—Dickinson Geothermal Study, Dickinson, North Dakota (subcontractor report)</i> |
| 19. | EGG-2152 | CANCELLED |
| 20. | EGG-2153 | <i>Comparison of Two Options for Supplying Geothermal Energy to the Veterans Administration Medical Center, Marlin, Texas (subcontractor report)</i> |
| 21. | EGG-2154 | <i>Geothermal Utilization at Castle Oaks Subdivision Castle Rock, Colorado (subcontractor report)</i> |
| 22. | EGG-2155 | <i>Space Heating for Twin Lakes School Near Gallup, New Mexico (subcontractor report)</i> |
| 23. | *EGG-2156 | <i>Pumping Tests of Well Campbell et al. No. 2, Gila Hot Springs, Grant County, New Mexico (subcontractor report)</i> |
| 24. | *EGG-GTH-5739 | <i>Geothermal Deicing of Highways and Bridge structures</i> |
| 25. | *EGG-GTH-5740 | <i>Assessment of a Geothermal Application at Tucson, Arizona</i> |

| <u>GTA Report Number</u> | <u>EG&G Report Number</u> | <u>Title</u> |
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| 26. | *EGG-GTH-5741 | <i>Heat Pump Systems for Spring Creek, Montana</i> |
| 27. | EGG-GTH-5779 | <i>Pipe Selection Guide</i> |
| 28. | EGG-GTH-5804 | <i>An Overview of Engineering and Agricultural Design Considerations of the Raft River Soil-Warming and Heat-Dissipation Experiment</i> |
| 29. | EGG-GTH-5812 | <i>Design of the Glenwood Springs Downhole Heat Exchanger</i> |

*Published as of 4/1/82.

PREFACE

This report was prepared for EG&G Idaho by Coupland, Moran & Associates on Subcontract No. K-7892 under the Department of Energy's Outreach Program. It is now being reissued

without modification as an EG&G formal report in order to make it available to others that may be interested in this geothermal application.

UTILIZATION OF GEOTHERMAL ENERGY - FEASIBILITY STUDY

OJO CALIENTE MINERAL SPRINGS COMPANY

OJO CALIENTE, NEW MEXICO

Prepared for

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SUBCONTRACT NO. K-7892

Prepared by

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ALBUQUERQUE, NM 87123**

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EXECUTIVE SUMMARY

This report investigates the feasibility of a geothermal heating system at the Ojo Caliente Mineral Springs Co. The geothermal energy will be used to preheat hot water for the laundry facilities and to heat the water for a two-pipe fan coil heating system in the hotel. Present annual heating fuel costs of \$11,218 for propane will be replaced by electricity to operate fans and pump at an annual cost of \$2,547, resulting in a net savings of \$8,671. Installation costs include \$10,100 for a well system, \$1,400 for a laundry system, and \$41,100 for a heating system. With the addition of a 10% design fee the total installation cost is \$57,860. Ignoring escalating propane fuel prices, tax credits for energy conservation equipment, and potential funding from the State of New Mexico for a geothermal demonstration project, the simple economic payback period for this project is 6.7 years.

INTRODUCTION

Under the direction of the Department of Energy, E.G. & G. Idaho, Inc. has subcontracted Coupland, Moran & Associates to perform an engineering evaluation of the geothermal heating potential at the Ojo Caliente Mineral Springs, Co. site. Ojo Caliente is a small community in north central New Mexico established prior to 1735 by Spanish Colonists, and located on the Ojo Caliente River, in a valley between two mesas. In the early 1860's a health resort was established at the site of the naturally occurring hot springs. A total of five different springs with mineral waters including arsenic, iron, lithia, sodium, and soda are located within the general vicinity of the present bath houses. Further background information regarding the springs is included in Appendix A.

This study involves a well located some distance from the main springs, but within a short distance from the laundry facilities and the original hotel building. Figure 1 shows a pictorial view of the site and highlights the location of the geothermal well, laundry facilities, hotel building, and bath houses.

The initial scope of work for this project was to evaluate the potential of using the geothermal well to heat the hotel building. Because of the close proximity of the laundry facilities to the geothermal well, and the continual year around usage of propane to heat the laundry water, the scope at this study was expanded to evaluate the potential of also preheating laundry water with geothermal energy.

The remainder of this report is divided into four sections. The next section discusses the results of a well pump test on the geothermal well shown in Figure 1. The second section involves the analysis of the heating energy requirements of the hotel building. The third section evaluates the heating requirements of the laundry facilities. The last section describes the proposed geothermal heating system, and gives results and recommendations based on total life cycle cost analysis.

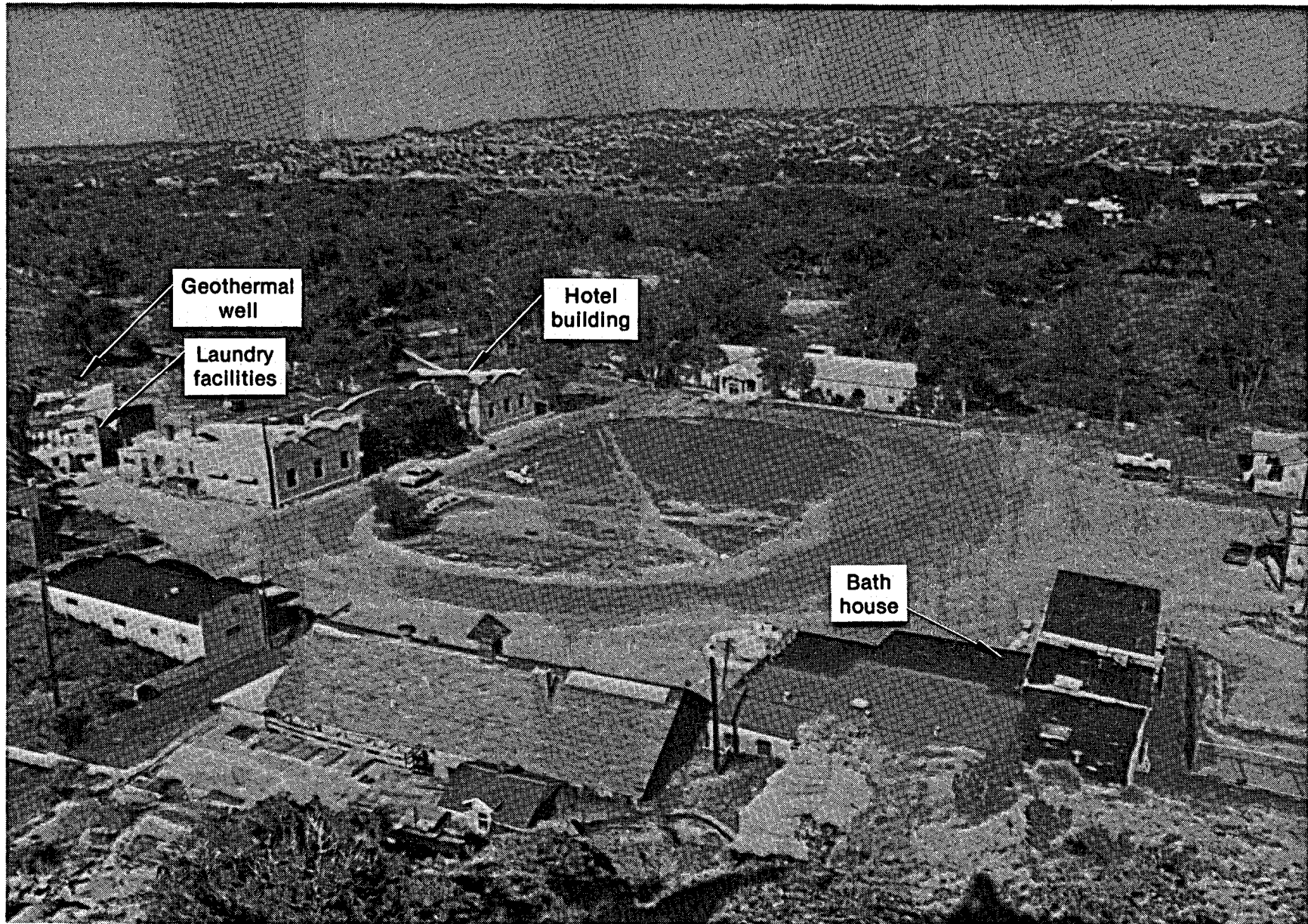


Figure 1. Aerial view of the Ojo Caliente Mineral Springs Company site.

WELL TEST

The specific geothermal well involved in this study is located at the base of the mesa to the west of the hotel and approximately 100 feet north of the hotel building (See Figure 1). The well test was performed under separate contract by Joe D. Daniels of Rio Grande Well Supply. The actual well test report and initial proposal are included in Appendix B.

On October 27, 1981 the well test was performed to determine the flow production rate possible from this well. Initial measurements indicated a well depth of 86 feet with a 7" ID casing. As a 4" OD submersible pump was being lowered for placement near the well bottom, an obstruction was discovered at a depth of 42 feet. A decision was made to go ahead and conduct the well test at the 42 foot level with no change to the proposed procedure. During the test the temperature of the discharge water was a constant 128 F. The optimal production rate of this well was determined to be 14 gallons per minute.

Before any conclusion can be made about the potential production rate a brief history of this well is needed. This well was initially drilled in hopes of finding a water source for the facilities. Another well approximately 50 feet east of this well and closer to the Ojo Caliente River was drilled and now provides cold water to the facilities. Based on the assumption that drilling was halted when the hot water was encountered at the geothermal well in question, the actual bottom of the reservoir has not yet been reached. Part of the proposed geothermal system is to drill another well and utilize the existing well as a reinjection well. This new well should be drilled to at least a 100 foot depth with another well test performed to determine the production rate at this depth. Conclusions as to the feasibility of this project are based on the assumption that a 100 foot well can achieve a larger production capacity of at least 25 gallons per minute.

HOTEL BUILDING ANALYSIS

Analysis of the hotel building is required to determine the annual fuel consumption requirements, and the design heating loads in each room of the building. Due to the age of this building no construction drawings are available. A floor plan of the building was developed as a result of field measurements, see Appendix C. The building walls consist of an exterior stucco finish, 14" adobe, and an interior plaster finish. The roof section consists of a metal deck on a wood deck with a ceiling tile interior finish. The building has uninsulated hardwood floors and single pane glass windows.

The annual energy requirements for this building were estimated by an hour by hour computer simulation program. Results of the analysis and a description of the program are also included in Appendix C. The existing heating system includes a propane fired steam boiler, a one pipe steam distribution system, and cast iron steam radiators in each room. Based on a present propane cost of \$0.77 per gallon and an overall heating system efficiency of 50%, the estimated annual heating requirements are 1147 million BTU's at a cost of \$9,246. If the thermal equivalence of a nominal 4" batt insulation material (R-11) was attached to the floor and placed in the ceiling the annual heating fuel requirement would be reduced by 34%. The effect of reducing the heating requirement on the installation cost of a new heating system, and the resulting economic analysis is presented later in this report.

Heating requirements at design conditions were calculated for each room to develop a preliminary heating system design. Results of the analysis, are included in Appendix C. The total design load for the building was estimated to be 385,667 BTUH with an interior space temperature of 68F and an outside air temperature of 7°F. If roof and floor insulation is installed the design heating load is reduced to 216,210 BTUH. The preliminary heating system design was used to develop an estimated installation cost.

LAUNDRY FACILITIES ANALYSIS

The daily laundry requirements at Ojo Caliente Mineral Springs, Co. are a result of usage of towels and sheets in the hotel rooms and bath house. An estimation of the annual hot water requirements was determined by discussions with personnel at Ojo Caliente Mineral Springs, Co. Calculation of annual requirements are presented in Appendix D. The estimated annual hot water consumption was 234,840 gallons per year. Using a \$0.77 per gallon price for propane and assuming a 60% efficient hot water generation system the present annual fuel cost is \$2,366 to provide the laundry hot water needs. If the geothermal system can preheat the water from 50°F to 125° F (140° F water is required) then a first year savings of \$1972 will be realized.

PROPOSED GEOTHERMAL SYSTEM

The proposed geothermal heating system consists of a source well, a reinjection well, heat exchangers in the laundry room and hotel basement, and a two-pipe fan coil distribution system in the hotel. A schematic of the proposed system is given in Figure 2. This section of the report gives results of economic analysis, and discusses the design considerations of the system. Detailed cost estimates are given in Appendix E.

As indicated earlier in this report another well will be required for this system. The cost to drill and case this well, perform necessary flow tests, install a submersible pump, and piping of supply and return lines to the laundry room and hotel basement will be approximately \$10,100 (See details in Appendix E).

The laundry room system will consist of piping from the main lines to the hot water generator, and a heat exchanger. A control valve will be required to stop geothermal well water flow through the storage tank when the tank temperature is above 125 degrees F. The estimated cost of this portion of the system is \$1,400, as shown in Appendix E.

The hotel building heating system will consist of a plate type heat exchanger, a circulation pump, and a two pipe fan coil distribution system. A plate type heat exchanger can achieve a very close approach temperature, will utilize a small amount of floor space, and can be easily serviced for cleaning of scale and deposits on the plates. A schematic of a typical fan coil unit installation is given in Figure 3. Since the building is a hotel, individually controlled heating units are proposed. In order to optimize the use of low temperature geothermal energy forced air fan coils units are recommended over a radiator type system. The forced air system will require some additional electrical energy, the amount is estimated in Appendix D and taken into account for the economic analysis in Appendix E. In order to minimize the flow requirement in the system, and reduce pumping costs (See Appendix D) three and four row coils are recommended. Depending on the available flowrate from the new well, low flow rates may be necessary to make the system feasible. A preliminary design of the hotel system includes 36 fan coil units each requiring 0.5 GPM for a total system requirement of 18 GPM. Results of the cost estimate in Appendix E show the hotel heating system installation cost is \$41,100.

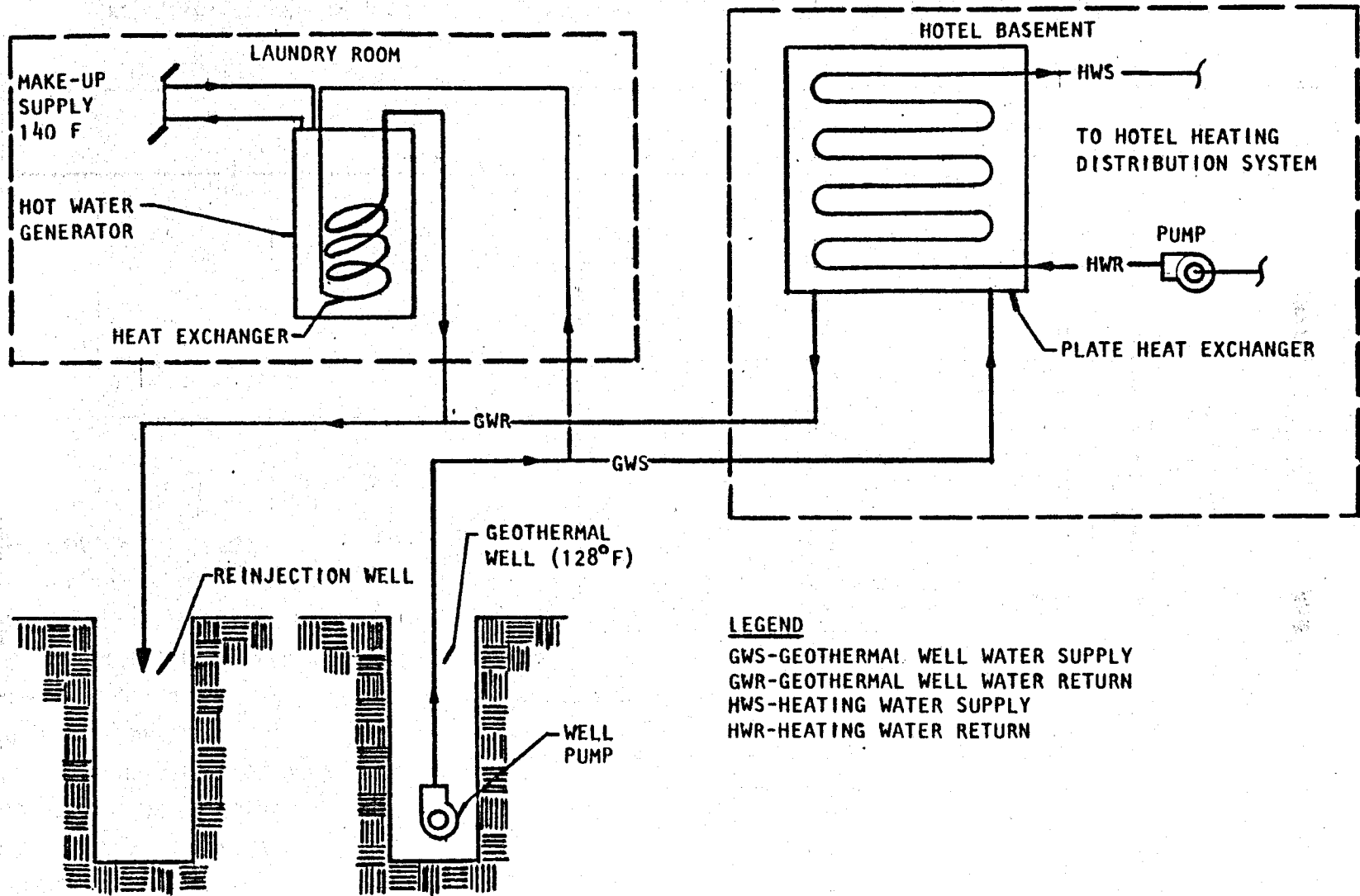
The total propane fuel savings is \$11,218, the additional electricity cost to operate fans and pumps is \$2,547 for a net fuel savings of \$8,671. The total installation cost of the geothermal system including a 10% design fee is \$57,860. The simple economic payback period for this project is 6.7 years.

If insulation is added to the existing building, the total system installation cost will be \$80,200. The estimated cost to add insulation to the building is \$24,500. The heating system installation cost is reduced by \$2,160 since the cabinet heaters can use two-row coils instead of four-row coils. For the existing system the annual heating fuel cost is reduced to \$6,113 per year, a savings of \$3,133. For the geothermal system all fan and pump requirements are essentially unchanged. Insulating the building will not reduce the purchased fuel requirements, but will reduce geothermal energy requirements.

A Life Cycle Cost Analysis was performed under the guidelines of "Life-Cycle Costing, Manual for the Federal Energy Management Program" prepared for the Office of Conservation and Solar Applications, U.S. Department of Energy, September 1979, and utilizes uniform present worth factors from Table B-6, Federal Register, Wednesday, November 18, 1981. Results for the proposed geothermal system without building insulation show the existing system has a present worth of \$169,207, and the geothermal system has a present worth of \$93,217, based on a 20 year study period. The savings to investment ratio is 2.4 for the geothermal system. If insulation is added to the building, the present worth of the existing system is \$148,718, and the present worth of the geothermal system is \$116,557, again based on a 20 year study period. The resulting savings to investment ratio is 1.6 for the geothermal system with building insulation. Although adding insulation reduces the total life cycle cost for the existing system, it increased the total life cycle cost for the geothermal system. The geothermal system total life cycle cost is increased because of the added installation cost with no reduction in annual heating fuel cost requirements.

Assuming sufficient flow can be achieved with a new well, other results of this study show the proposed geothermal system to be feasible. Ojo Caliente Mineral Springs Co. should strongly consider installation of such a system for economic reasons and increased publicity. Additional economic factors not investigated during this study include potential funding from the State of New Mexico for a geothermal demonstration project, and any savings from federal or state energy conservation equipment tax credits.

OJO CALIENTE MINERAL SPRINGS CO.



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FIGURE 2 : PROPOSED GEOTHERMAL WELL HEATING SYSTEMS

OJO CALIENTE MINERAL SPRINGS CO.

LEGEND

HWS - HOT WATER SUPPLY

HWR - HOT WATER RETURN


 - SOLENOID CONTROL VALVE


 - GATE VALVE

 - BALANCING COCK

 - TEMPERATURE & PRESSURE PORT

 - TEE

 - ELBOW

 - UNION

EXPOSED FLOOR MODEL 2-PIPE HEATING ONLY

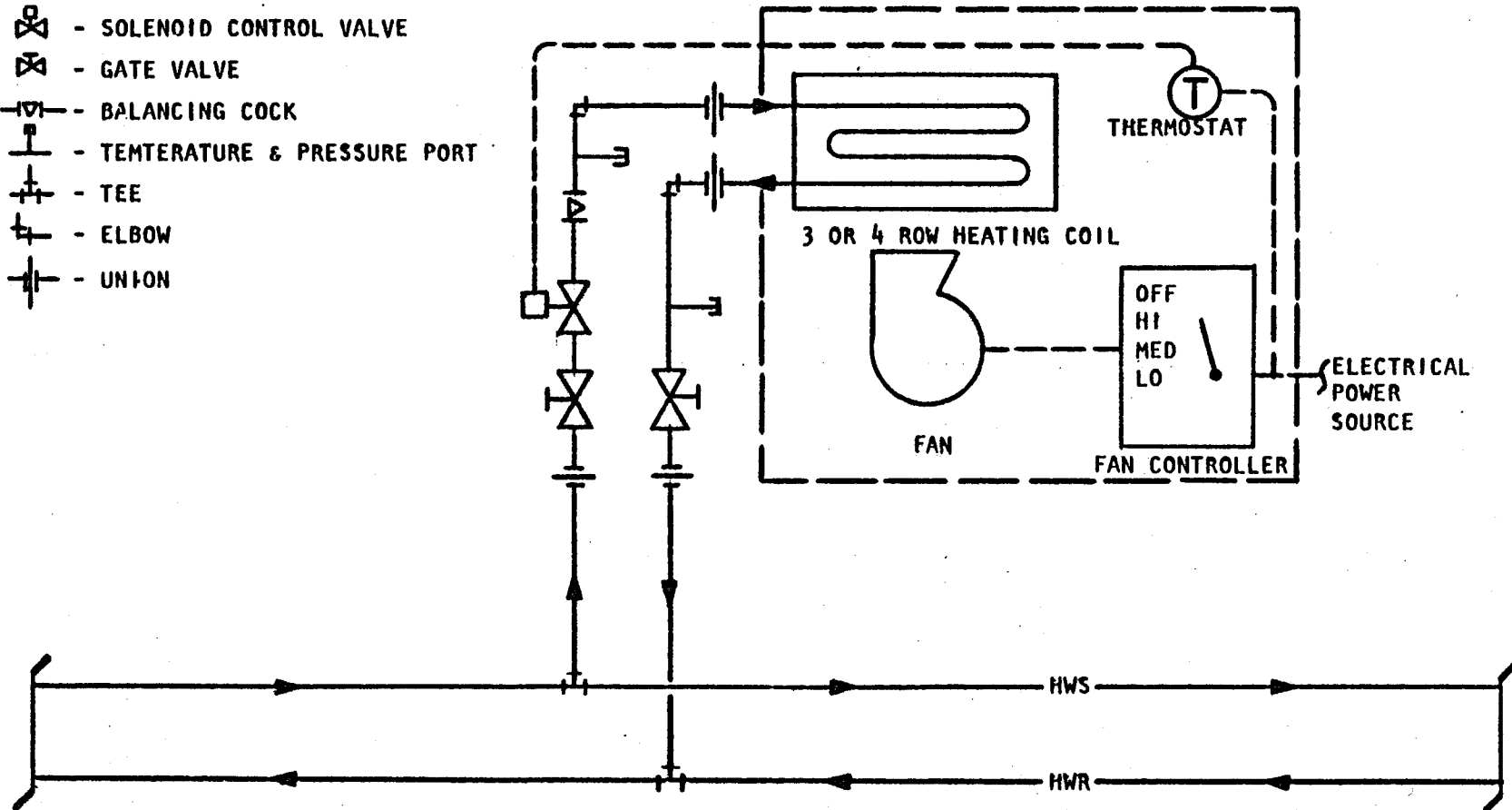


FIGURE 3: TYPICAL FAN COIL UNIT PIPING SCHEMATIC

APPENDIX A: BACKGROUND INFORMATION

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Ojo Caliente (Joseph's Hot Springs) (24N. 8E. 24. 110)

In many reports, because of the uncertainty of the location of the county line, these springs are reported to be in Rio Arriba County. A recent plat^s shows that all discharge takes place within Taos County, albeit very close to the county line.

The springs occur along the west edge of the Valley^{of} Ojo Caliente Creek, a tributary to the Chama River, at the base of a steep slope.

According to Jones (1904, p. 240) these springs were visited and named by Cabeza de Vaca, the discoverer of New Mexico, in 1534. They are shown on James S. Calhoun's map, Inhabited Places in New Mexico, 1844.

These springs have been in use as a spa for many years. They are first mentioned in the geologic literature by Gilbert (1875, p. 153), who cites "Colton's Map of New Mexico" as his source. Later in the same volume Oscar Lowe (1875a, p. 624-625) describes these springs in some detail:

"Fifteen miles northwest of Abiquiu is the Mexican village Ojo Caliente, in the valley of the creek of the same name. One mile above the village four warm springs issue from the foot of a hill. While the surrounding region consists of sand-hills, and volcanic dykes, and mesas, the hill in question is composed of gneiss, through which run veins of a very coarse-grained granite, the feldspar and quartz forming masses of several cubic feet, and the muscovite large plates several inches thick. An American, who here built a few bathhouses for visitors, stated that last summer from forty to fifty invalids were there using the waters for medicinal purposes; the majority of these suffered from rheumatism and syphilis. The waters are of good quality. Where they evaporate on the rocks, a white residue is formed, erroneously called there "borax". Three of the springs have been widened and otherwise improved."

"No. 1 has a basin 20 feet long, 9 feet wide, and a temperature of 114.5°; a reddish deposit is formed, containing a trace of iron. (Iron Spring)."

"No. 2, basin 10 feet square; temperature 108° F. (Sodium Sulphite Spring?)"

"No. 3, basin 5 feet long, 2 feet wide; temperature same as No. 2. (Soda Spring?)"

"No. 4, basin 6 feet square; unimproved; temperature same as No. 2. (Arsenic Spring?)"

"The taste of all these springs is saline and alkaline."

"In one hundred thousand parts of water are contained parts as follows"

| <u>Constituents</u> | <u>No. 1</u> | <u>No. 2</u> |
|--------------------------|--------------|--------------|
| Sodium carbonate | 196.95 | 184.29 |
| Lithium carbonate | 0.21 | 0.16 |
| Calcium carbonate | | |
| Magnesium carbonate | 6.25 | 5.40 |
| Iron carbonate | trace | trace |
| Potassium sulphate | 5.17 | 5.34 |
| Sodium sulphate | 13.60 | 19.33 |
| Sodium chloride | 38.03 | 39.78 |
| Silicic acid | <u>trace</u> | <u>trace</u> |
| Total solid constituents | 260.21 | 254.30 |

Gases: Carbonic acid."

These analyses are also in Peale (1886, p. 195) and Jones (1904, p. 293).

Cope (1875, p. 66) noted:

"The springs of Ojo Caliente number three, the most important issuing from a vertical ledge of gneiss, which is then traversed by a wide quartz vein. The temperature of the warm springs is from 116° to 120°; they contain an abundance of confervoid algae."

Peale (p. 194) reports that the springs discharge 60 gpm from 4+

outlets at temperatures ranging from 108 to 122° F. Jones (p. 293) says the temperature ranges from 90 to 122°F and the discharge is "300,000 gallons in 24 hours" (210 gpm).

Clark (1893, p. 114) gives an analysis (Table 9) made by Hillebrand which was subsequently republished by Jones (1904, p. 294); Lindgren (1910, p. 26); Lindgren, Graton, and Gordon (1910, p. 72). Clark (1924, p. 192-193) used this analysis as an example of "carbonate water".

Crook (1899, p. 335) says the springs discharge "4200 gallons hourly" (70 gpm) at temperatures ranging from 90° to 122° F. He also gives the following chemical analysis made by Prof. O. C. Marsh:

One U.S. Gallon Contains:

| <u>Solids</u> | <u>Grains</u> |
|---------------------|---------------|
| Sodium carbonate | 91.52 |
| Magnesium carbonate | 1.26 |
| Iron carbonate | 5.90 |
| Lithium carbonate | 0.12 |
| Sodium chloride | 22.18 |
| Calcium carbonate | 2.42 |
| Potassium sulphate | 3.00 |
| Sodium sulphate | 2.92 |
| Silica | <u>1.22</u> |
| Total | 135.54 |

White, Hem, and Waring (1933, p. F. 50-F. 51) use the Hillebrand analysis augmented by a partial analyses of a sample collected October 6, 1949

as an example of "Chemical analyses of thermal water closely associated with epithermal mineral deposits."

Stearns, Stearns, and Waring (1937, p. 167) and Waring (1965, p. 37) report the temperature range as 98-113° F and the discharge as 350 gpm.

Since 1947, the U.S. Geological Survey and the New Mexico State Public Health Laboratory have made 7 analyses of sample from 3 of the 5 springs and 2 nearby wells (Table 9).

Figure 21 is a geologic map of the Ojo Caliente area. It shows the distribution of the metarhyolite of Precambrian age from which the water discharges through fractures. The fractures are predominately vertical joints which strike approximately N. 10E., N. 35W., and N. 60E. A fourth set of fractures which strike N. 75° E. and dip 18° E. and give the massive metarhyolite a bedded appearance. The rock has a number of sheer zones (but no obvious faults or displacements), and is criss-crossed by numerous pegmatite dikes that strike N-S and dip 45° W.

Figure 22 is a map of the premises of the Ojo Caliente Mineral Springs Company. It shows the main features of the area including the locations of three wells for which some data are available. The following temperatures were observed in the unused well, which was drilled to 49 feet in 1951 and deepened to 87 feet in 1952:

| <u>Depth (feet)</u> | <u>Temperature</u> |
|---------------------|--------------------|
| 1 | 125.5 |
| 6 | 128.5 |
| 10 | 129.5 |

| | |
|------------------|-------|
| 12 | 130.4 |
| 15 | 130.7 |
| 19 | 131.3 |
| 25 | 131.7 |
| 31 | 131.8 |
| 37 | 131.8 |
| 43 | 131.9 |
| 50 | 131.9 |
| 62 | 132.0 |
| 68 | 132.1 |
| 74 | 132.2 |
| 80 (total depth) | 132.2 |

The hot water was reported to have been hit at 87 feet; at 49 feet the water in the aquifer was "cold".

The driller's log of well No. 1, which was drilled in 1940 and redrilled in 1954 is:

| | <u>Depth (feet)</u> |
|-----------------------------------|---------------------|
| Surface soil | 0-3 |
| Cobblestones, boulders, and water | 3-17 |
| Brown clay | 17-20 |
| Boulders | 20-30 |
| Sand and water | 30-42 |
| Clay | 42-48 |

The bottom 18 feet of casing in this well is perforated; the temperature

of the water pumped is 89.5° F.

The driller's log of well No. 2, drilled in 1962, is:

| | <u>Depth (feet)</u> |
|------------------------|---------------------|
| Topsoil | 0-2 |
| Gray sand and boulders | 2-9 |
| Gray clay and boulders | 9-22 |
| Gray sand and gravel | 22-33 |
| Yellow clay | 33-53 |

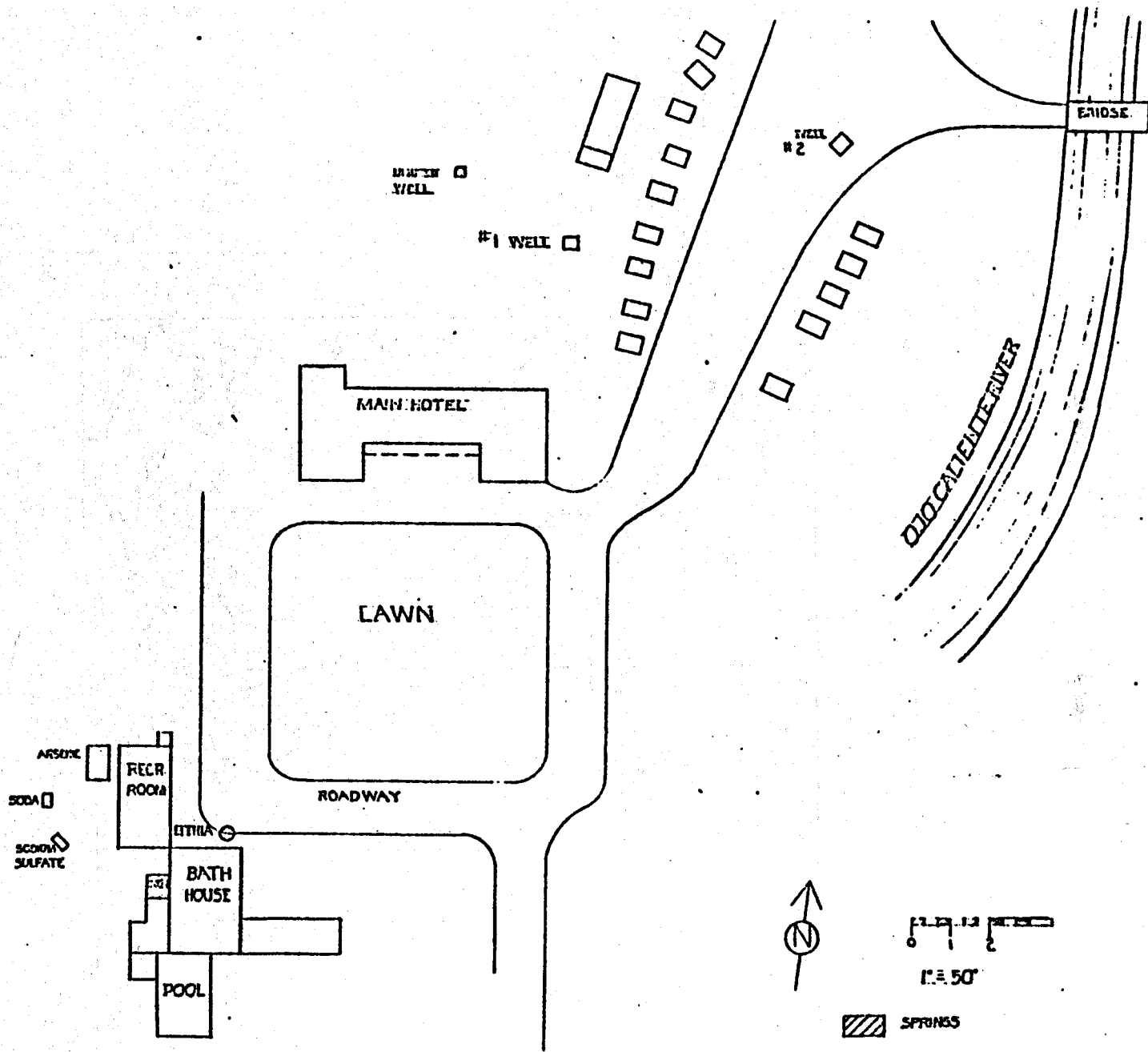
The casing in this well is perforated from 15 to 33 feet. The temperatures of the water pumped is 58.3° F.

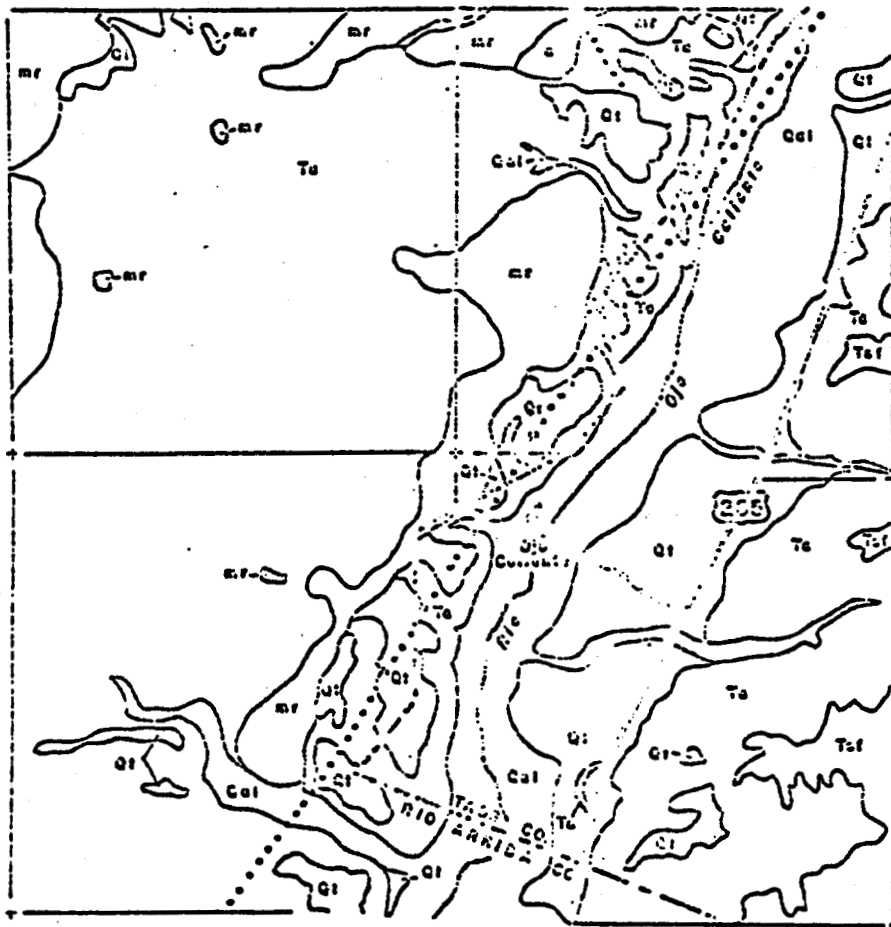
The five developed springs are called iron, arsenic, soda, sodium sulphate, and lithia springs. Some small springs and hogs also occur which discharge some thermal water. The total outflow from the developed springs was 97 gpm, December 1, 1965.

Iron Spring, the only spring looked at in any detail in the field inventory is inside the bathhouse. The water discharges from joints in the metarhyolite, collects in a small concrete trough, then cascades into a swimming pool. An iron stain covers the rocks, concrete, and pipes. Table 8 contain measurements made at the collectors and in the pool.

Table 9 contains chemical analyses that have been made of the Ojo Caliente waters, including a chemical analysis of the water collected at Iron Spring.

- A-9 -





EXPLANATION

- Cal - Alluvium
- Qt - Terrace gravels
- Tsf - Santa Fe Formation
- Tc - Abiquiu Tuff
- mr - Precambrian meta-igneous rocks

- Contact
- - - - - Fault

Table 8.

FIELD DATA FOR THE UPPER RIO GRANDE DRAINAGE

| Location | Date | Discharge (gpm) | Maximum temperature (°F) | pH | Specific conductance (micromhos) | Density (gm/ml) | H ₂ S (ppm) | NH ₃ (ppm) | SiO ₂ (ppm) | Remarks |
|---|---------|--------------------|--------------------------------|------|--|--------------------|---------------------------|--------------------------|---------------------------|-----------|
| No Name Spring south of John Dunn's Bridge (27N. 12E. 36. 411) | 12-4-65 | .5* | 95 | 10.3 | 580 | .986 | 0 | .1 | 55 | Air = 62° |
| Mamby (American) Hot Spring (26N. 11E. 1. 120) | 12-3-65 | 30 ⁺ | 100 | 9.0 | 700 | .988 | 0 | .15 | 55 | |
| Ponce de Leon Hot Spring (24N. 13E. 7. 000) | | | | | | | | | | |
| #1 # | 12-5-65 | 9.4 | 88.3 | --- | 520 | .988 | 0 | --- | --- | Air = 68° |
| 2 | 12-5-65 | 140 | 94.2 | --- | 540 | --- | 0 | 0 | 45 | |
| 3 | 12-5-65 | 4.5 | 95.3 | --- | 500 | --- | --- | --- | --- | |
| 4 | 12-5-65 | 9.4 | 94.5 | --- | 500 | --- | --- | --- | --- | |
| 5 | 12-5-65 | 50 | 91.5 | --- | --- | --- | --- | --- | --- | |
| 6 | 12-5-65 | --- | 93.3 | --- | 520 | .996 | --- | --- | --- | |
| 7 | 12-5-65 | 240 | 85.5 | --- | --- | --- | --- | --- | --- | |
| Ojo Caliente (24N. 8E. 24. 110) | | | | | | | | | | |
| Iron Spring: | | | | | | | | | | |
| Collector | 12-1-65 | --- | 109.0 | 6.9 | 3000 | --- | --- | 0.5 | 59 | |
| Pool | 12-1-65 | --- | 107.0 | 6.8 | 3100 | .990 | 0 | --- | --- | |
| Arsenic Spring | 10-6-49 | --- | 113 | --- | --- | --- | --- | --- | --- | USGS me: |
| Sodium Sulfate Spring | 10-1-47 | --- | +90 ^g | --- | --- | --- | --- | --- | --- | USGS me: |
| | 10-6-49 | --- | 105 | --- | --- | --- | --- | --- | --- | USGS me: |
| Soda Spring | 10-1-47 | --- | +95 ^g | --- | --- | --- | --- | --- | --- | USGS me: |

* estimate

+ estimate based on measurement of part of total flow.

see figure 20

g at tap

TABLE 9. CHEMICAL ANALYSIS OF WATER FROM
UPPER RIO GRANDE DRAINAGE

| Location | Ojo Caliente (Joseph's Hot Spring) (24N. 8E. 24. 110) † | | | | | |
|--|---|--------------|---------------|--------------|--------------------------|---------|
| | Hillebrand's analysis | Soda Spring | | | Sodium Sulfate Spring | |
| | | 1891-93 | 10-1-47 | 10-6-49 | 10-1-47 | 10-6-49 |
| Date | | | | | | |
| SiO ₂ | 60.2 | 60. | 66. | 56. | 63. | |
| Al | 0.5 * | | | | | |
| Fe | 1.6 * | | | | 0.02 | |
| Mn | 0 | | | | | |
| As | trace | | | | | |
| Ca | 22.8 | 28. | 25. | 28. | 24. | |
| Mg | 9.5 | 8.7 | 9.0 | 8.7 | 7.6 | |
| Na | 995.7 | 1040. | 997. | 1040. | 933. | |
| K | 31.4 | | 29. | | 34. | |
| Li | 3.4 | | | | | |
| Se | | | | | | |
| HCO ₃ | | 2200. | 2180. | 2210. | 2160. | |
| CO ₃ | 2153.5 | 0 | 0 | 0 | 0 | |
| SO ₄ | 151.0 | 168. | 162. | 165. | 156. | |
| Cl | 231.4 | 232. | 240. | 245. | 238. | |
| F | 5.2 | 16. | 16. | 16. | 16. | |
| Br | 0 | | | | | |
| I | trace | 1.6 | | | | |
| NO ₃ | trace | 1.7 | 0.9 | 1.7 | 0.5 | |
| NO ₂ | | | | | | |
| B | 4.2 * | | | 4.6 | 1.7 | |
| PO ₄ | 0.2 | | | | | |
| Dissolved Solids calculated | 3671.4 | 2640. | 2620. | 2650. | 2540. | |
| Dissolved Solids Residue | | | | | | |
| Hardness (as CaCO ₃) | | 106. | 100. | 106. | 91. | |
| Noncarbonate Hardness (as CaCO ₃) | | 0 | 0 | 0 | 0 | |
| Specific Conductance (micromhos) | | 3890. | 3910. | 3890. | 3920. | |
| pH | | | 7.2 | | 6.9 | |
| Density (gm/ml) | 1.003 | | | | | |
| Acidity (meq/l H ⁺) | | | | | | |
| Remarks | Sr = 1.4 Ba, NH ₄ = trace S = 0 | USGS 8977 | USGS 13378 | USGS 8978 | USGS 13192 | |

* Al₂O₃, Fe₂O₃, or B₄O₇

† See Figure 22 for locations

TABLE 9. CHEMICAL ANALYSIS OF WATER FROM
UPPER RIO GRANDE DRAINAGE

| Location | Ojo Caliente (Joseph's Hot Spring) (24N. 8E. 24. 110) | | | |
|--|---|----------------|-------------------|-------------------|
| | Arsenic Spring | Iron Spring | Well # 1 | Well # 2 |
| Date | 10-6-49 | 11-30-65 | 4-8-65 | 4-8-65 |
| SiO ₂ | 63. | 71. | | |
| Al | | | | |
| Fe | 0.01 | 0.57 | 0.31 | 0.38 |
| Mn | | 0.15 | 0.00 | 0.12 |
| As | | 0.06 | | |
| Ca | 25. | 6. | 40. | 80. |
| Mg | 8.9 | 7.7. | 16. | 29. |
| Na | 928. | 993. | 496. | 102. |
| K | 30. | 36. | 16. | 4.7 |
| Li | | 2.7 | | |
| Se | | 0.048 | | |
| HCO ₃ | 2160. | 200. | 907. | 274. |
| CO ₃ | 0 | 115. | 0 | 0 |
| SO ₄ | 156. | 132. | 155. | 158. |
| Cl | 238. | 246. | 149. | 83. |
| F | 16. | 3.0 | 7.5 | 0.55 |
| Br | | | | |
| I | | 0.021 | | |
| NO ₃ | 0.8 | 0 | 0 | 0 |
| NO ₂ | | 0 | | |
| B | 1.6 | 1.1 | | |
| PO ₄ | | 0.6 | | |
| Dissolved Solids calculated | 2530. | 1715. | | |
| Dissolved Solids Residue | | 2438. | 1515. | 665. |
| Hardness (as CaCO ₃) | 99. | | 165. | 318. |
| Noncarbonate Hardness (as CaCO ₃) | 0 | | | |
| Specific Conductance (micromhos) | 3930. | 3300. | 2375. | 1050. |
| pH | 7.1 | 9.09 | 7.8 | 7.8 |
| Density (gm/ml) | | 0.995 | | |
| Acidity (meq/l H ⁺) free total | | 0 | | |
| Remarks | USGS 13193 | | NMPHL 1965-524 | HMPHL 1965-523 |

| | PH | Solids | Alkalinity CaCO ₃ | Residue | Normal Carbonate | Hydride | Bicarbonate | Silica SiO ₂ | Alumina & Iron Oxide P ₂ O ₅ | Lime CaO | Magnesia | CaO | Sulphur Trioxide SO ₃ | Chloride Cl | Alkalies As Na ₂ (Calculated) | Hardness | Fe (Iron) | Manganese |
|-----------------------|------|--------|---------------------------------|---------|---------------------|---------|-------------|----------------------------|--|-------------|----------|-----|-------------------------------------|----------------|---|----------|-----------|-----------|
| Farm Well | 6.80 | 513 | 246 | 444 | 5 | 0 | 315 | 6 | 8 | 137 | 7 | 93 | 61 | 98 | 242 | 0.90 | N.I. | |
| Well # 3 | 6.80 | 726 | 342 | 678 | 0 | 0 | 417 | 10 | 26 | 218 | 13 | 86 | 23 | 103 | 387 | 1.8 | N.I. | |
| Well # 1 | 7.50 | 1521 | 937 | 1412 | 0 | 0 | 1142 | 11 | 50 | 131 | 36 | 152 | 186 | 767 | 284 | 1.5 | N.I. | |
| <u>MINERAL WATERS</u> | | | | | | | | | | | | | | | | | | |
| Iron | 7.70 | 2629 | 1819 | 2487 | 0 | 0 | 2220 | 7 | 35 | 36 | 18 | 139 | 258 | 1740 | 92 | 8.1 | N.I. | |
| Sodium Sulphate | 7.40 | 2600 | 1770 | 2442 | 0 | 0 | 2160 | 6 | 37 | 39 | 13 | 138 | 247 | 1798 | 88 | 1.3 | N.I. | |
| Lithia | 9.10 | 2518 | 356 | 2362 | 0 | 0 | 433 | 10 | 22 | 68 | 20 | 103 | 246 | 1538 | 150 | 1.08 | N.I. | |
| Soda | 7.90 | 2622 | 1836 | 2518 | 0 | 0 | 2240 | 13 | 18 | 58 | 21 | 129 | 266 | 1514 | 135 | 0.16 | N.I. | |
| Arsenic | 7.60 | 2564 | 1800 | 2509 | 0 | 0 | 2196 | 5 | 5 | 58 | 80 | 123 | 247 | 1821 | 477 | 0.12 | N.I. | |

WATER ANALYSIS
MARTIN + CARLISLE LAB.
ALBUQUERQUE, NEW MEX.

Chemical analysis, Iron Spring, Ojo Caliente, New Mexico.
(Analysis by U.S. Geological Survey.)

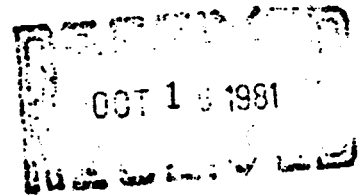
| | |
|---|--|
| Date - - - - - | December 3, 1974 |
| Silica (SiO ₂) - - - - - | 63 milligrams per litre |
| Sodium (Na) - - - - - | 890 milligrams per litre |
| Bicarbonate (HCO ₃) (field) - - - - - | 2,073 milligrams per litre |
| Chloride (Cl) - - - - - | 270 milligrams per litre |
| Bromide (Br) - - - - - | 1.4 milligrams per litre |
| Boron (B) - - - - - | 1,500 micrograms per litre |
| Lithium (Li) - - - - - | 3,300 micrograms per litre |
| pH (field) - - - - - | 6.6 micrograms per litre |
| Specific conductance (field) - - - - - | 3,900 micromhos per centimetre at 25°C. |
| Temperature - - - - - | 40°C. (104°F.) |

APPENDIX B: WELL TEST

| Contents | Page No. |
|--------------------|----------|
| Well Test Proposal | B - 2 |
| Well Test Report | B - 4 |

Grande Well Sup /

2707 CAMINO CHUECO
SANTA FE, NEW MEXICO 87501
(505) 988-5688



30 July 1981

Mr. Dennis Fedor
Geothermal Commercialization Office
P.O. Box 3-DC
New Mexico State University
Las Cruces, New Mex. 88003

Mr. Fedor:

In reply to our phone conversation 20 July 1981 concerning the testpumping of the warm water well at Ojo Caliente Mineral Springs, I am submitting the following procedure we would use to determine the quantity of water available in the well.

We would initially determine the depth of the well and then install a submersible pumping unit in the well that would by estimate remove water at a greater rate than the aquifer could recharge into the well. It is estimated that the gallons per minute production from this well would not exceed 50, so a pumping unit that is capable of producing in excess of 50 GPM with 50 foot of total head, would be installed. The pumping unit would be designed to withstand the temperature to be encountered (112 -119 F) and perform in a satisfactory manner through out the duration of the test.

After the pumping unit is installed in the well we would rig well head for flow measurement and temperature, and drawdown of the well to attain the water level of the well at all times.

Pumping of the well would be commenced at 5 GPM and this rate would be sustained until the draw down stabilizes for at least 90 minutes of pumping.

The pumping rate would then be increased to 10 GPM and the same procedure followed as with the 5 GPM production. The production would be stepped up using steps of 20, 30, 40, 50, GPM, but if specific capacity (GPM/Ft. of draw down) drops from one step to the other, then the increasing GPM steps will be halted.

At this point the pump production will be lowered 5 GPM and specific capacity determined. If the specific capacity regains its magnitude, then the production rate will be held at this reduced rate and the well will be pumped for a sustained amount of time for drawdown, temperature and to specific capacity. If the specific capacity is still low at this reduced rate, then



production will be lowered 5 GPM more.

Once the maximum pumping rate has been established the well can be pumped at this rate for any sustained length of time desired, but it is our opinion that 2 to 4 hours at this rate is all that is required if all factors remain equal.

During this pumping test the domestic water supply well closest to the well being pumped will be observed for drawdown effect and readings recorded.

At the termination of the test pumping period the recovery rate of both wells shall be determined by measuring the water surface level at 15 minutes intervals, until the static level of both wells is approximated.

The cost of test pumping this well is as follows using commercial power:

Pumping unit-----847.00
Labor to set & remove & run 8 hrs.-----453.00
Additional hrs.-----25.00/hr.

If you have any question concerning this proposal please call us at any time at 471-0166.

Joe D. Daniels
NMPE 4011

cc Geo. Maure

RIO GRANDE WELL SUPPLY
WATER SYSTEM SPECIALISTS

BOX 5438 - AIRPORT ROAD
SANTA FE, NEW MEXICO - 87501
505-471-0166

2 November 1981

E.G.&G. IDAHO INC.
P.O. Box 1625
Idaho Falls, ID. 83415

Mr. Mike Stone

REF: E.G.&G. Idaho, Inc. P.O. K-7891
30 July 1981 Dennis Fedor from Rio Grande Well Supply

ENCL: Field record of Well Test Pumping

Mr. Stone

On 27 Oct. 1981, Rio Grande Well Supply moved over the subject well at Ojo Caliente Mineral Springs and measured the depth using a lead line and found it to be 86 ft., with static water at 4 feet below the top of casing. The casing is a 7inch ID steel pipe inserted inside of a 9 inch ID steel pipe. The surface water temperature was 120 degree F. at 1435 hours and the ambient temperature was 61 degrees F.

A submersible pumping unit was installed in the well on 2" drop pipe, and was a 2 stage Grundfos pump end with a 5HP Franklin, single phase motor attached. As the unit was lowered into the well a blockage of the hole was encountered at the 45 foot level below the top of the casing. We attempted to wedge the pumping unit below this point, but with no success.

It was decided by Joe D. Daniels of Rio Grande Well Supply and Mr. Donald Swick to set the pumping unit at the 42 foot level and conduct the pumping test as prescribed.

The testing was commenced at 1435 hours as shown on the log and continued as prescribed, but when the pumping rate was advanced to 20GPM the pumping level of the well was pulled to the pump inlet in 10 minutes of pumping. The pump had to be shut down and the well allowed to recover at this point so the testing could be continued.



RED JACKET®
PUMPS

A Division of Wylair, Inc.

The testing was resumed at 1625 hours at 12 GPM and quickly increased to 15 GPM, and this rate was maintained until 1825 hours. During this pumping cycle the Sp. Cap. of the well dropped steadily from 1.0 to .86 which shows that the well was being over produced at this rate, 15 GPM.

At 1830 hours the pumping rate was lowered to 12.5 GPM and continued at this rate until 1900 hours, which showed a increase in Sp. Cap. from .86 to .89 and it was decided by Mr. Daniels and Mr. Swick that this recovery would continue at this rate of pumping, until a Sp. Cap. of around 1.0 was attained.

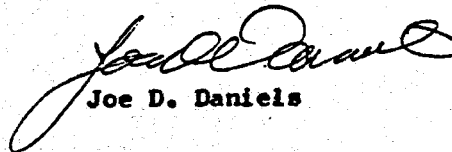
Upon plotting the Sp. Cap. vs time it was interpreted that the optimum production of the well is 14 GPM.

During the entire pumping cycle the temperature of the water remained at 128 degree F constantly.

It is our recommendation that if this source of water is to be used as a heat source supply, the well should be offset approximately 10 feet to the southwest and a new well drilled at this point. It is our assumption that the present well was being drilled as a domestic water supply well and when the hot water was encountered the drilling was stopped and the well relocated. If this is true then the well hole might only have penetrated the hot water aquifer slightly and when the new well is drilled it can be drilled completely through the depth of the hot water aquifer, which could afford a greater production capability and possibly increased latent heat.

If you have further questions, feel free to call us.

Sincerely



Joe D. Daniels

C.C.
Donald Swick
Geo. Maure
Dennis Fedor

Well Depth 86'
 Pump Set 98' 02"

OJO CALIENTA Hot Water Well

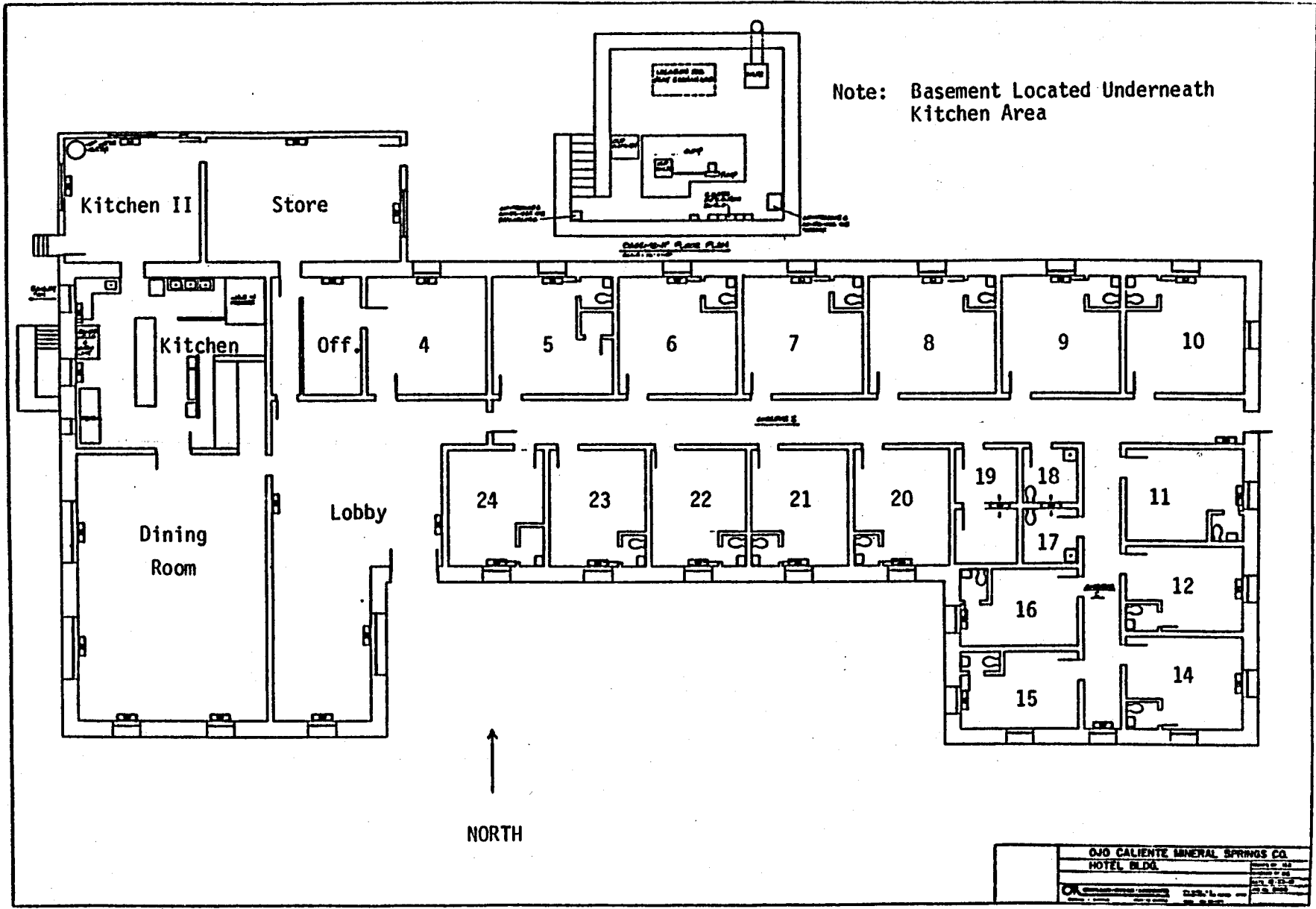
SP16-2 Grounds CREW - Miguel (G.W.) JOE
 54710 230V WATER PUMP - TOP OF CASINGS - Well Depth

| | | |
|-------------|----------|------|
| Prepared By | Initials | Date |
| Approved By | | |

| DATE | TIME | WATER LEVEL | DRAWDOWN | GPM | SP. CAP | WATER LEVEL Well #1 | DRAWDOWN Well #1 | WATER TEMP | AMB TEMP |
|-------|------|-------------|----------|------|---------|---------------------|------------------|------------|----------|
| 10 27 | 1435 | 4' | | 7.2 | | | | 120°F | 61 |
| " | 1440 | 11' | 7' | 7.2 | 102 | | | | |
| " | 1450 | 10' | 6' | 6 | 1 | | | 120°F | |
| " | 1510 | 10' | 6' | 6 | | | | | |
| " | 1515 | 14' | 10' | 11 | 7 | | | 125°F | |
| " | 1525 | 17' | 13' | 11 | | | | | |
| " | 1535 | 16.5' | 12.5' | 11 | 88 | | | 128°F | |
| " | 1545 | 16 | 12 | 11 | | | | | |
| " | 1555 | 16 | 12 | | | | | | |
| " | 1605 | 35 | | 22 | 104 | | | | 60 |
| " | 1610 | 43 | | 22 | | | | | |
| " | 1616 | 14 | | 0 | | | | | |
| " | 1625 | 12 | | 12 | | | | | |
| " | 1630 | 14 | 12 | 15 | | | | 129°F | 60 |
| " | 1635 | 18 | 12 | 15 | | | | | |
| " | 1640 | 19 | 15 | 15 | | | | | |
| " | 1655 | 17 | 15 | 15 | 1.0 | | | 128°F | |
| " | 1650 | 19.5 | 15.5 | 15 | | | | | |
| " | 1705 | 19.5 | 15.5 | 15 | | | | | |
| " | 1720 | 20 | 16 | 15 | 94 | | | | |
| " | 1735 | 20 | 16 | 15 | | | | | |
| " | 1750 | 20.5 | 16.5 | 15 | | | | 128°F | |
| " | 1805 | 21 | 17 | 15 | 88 | | | | |
| " | 1825 | 21.5 | 17.5 | 15 | 86 | | | | |
| " | 1830 | | | 16.5 | | | | | |
| " | 1845 | 15.5 | 14.5 | 11 | 86 | | | | 67 |
| " | 1900 | 18 | | 15 | 89 | | | | |
| " | 1915 | 5 | | 0 | | | | | |
| " | 1945 | 45 | | 1 | | | | | |
| " | 2000 | 45 | | 0 | | | | | |
| 10 28 | 1100 | 4 | | 0 | | | | | |

APPENDIX C: HOTEL BUILDING COMPUTER ANALYSIS

| Contents | Page No. |
|--|----------|
| Building Floor Plan | C - 2 |
| Description of Hour-by-Hour Load Profile Program | C - 3 |
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| Hour-by-Hour Results of Insulated | C - 8 |
| Design Load Calculations: | |
| Existing Building Summary | C - 9 |
| Existing Building Room Totals | C - 10 |
| Existing Building Load Breakdown by Room | C - 13 |
| Insulated Building Summary | C - 25 |
| Insulated Building Room Totals | C - 26 |



HOUR-BY-HOUR HEAT LOAD PROFILE PROGRAM

This program computes the hourly heat load profile for a building. The building design factors, size, location, compass orientation, occupancy and inside temperature range are all considered, and heat gains and losses are computed for each hour of the day. The process is performed for a typical working day (building occupied) and non-working day (building unoccupied) each month.

From an analysis of hourly heat loads, the program computes the actual heating or cooling BTUH required to maintain the desired inside temperature range. In addition, the user may specify refrigerated cooling, air-washer cooling, the presence of an OSA damper ("economizer"), or any combination of these, to be used in determining heating/cooling requirements. The air-washer and economizer contributions are considered to be "free" heating/cooling, and are totaled separately from the "system" heating/cooling.

Hourly, monthly and yearly totals of heating and cooling requirements (BTUH) are determined.

For each hourly calculations, heat gain/losses are computed for the following elements: building roof, skylight, walls, windows, doors, floor, edges, lighting, leakage (infiltration OSA damper) and occupancy. Incident solar radiation (sol-air temperature method), shading termal conductance, thermal lags, and sensible heat are all used, as appropriate for each element, to determine heat gain/loss due to that element.

Actual building heating/cooling requirements (BTUH) are computed form the total heat gain/loss and allowable indoor temperature range. System heating/cooling is minimized by varying the indoor temperature within the allowable range.

If an air-washer, economizer (OSA damper), or both are installed, an attempt is made to utilize first the economizer and then the air-washer, to produce the desired indoor temperature. If successful, the equivalent energy contributions are labeled "free heating/cooling," and are totaled separately from normal system heating/cooling.

All computations are performed for each hour of one working day (building occupied) and one non-working day (building unoccupied) each month. Totals are accumulated by the hour, month, and year.

ASSUMPTIONS AND LIMITATIONS

1. The sol-air temperature method is an approximation to the actual heat gain from incident solar radiation (ref. ASHRAE, 1977, Chapter 26). Each element of the building (wall, window, roof, etc.) is assumed to be homogeneous and described by a simple heat transfer model.

2. Weather data is only available for specific locations (Albuquerque, Socorro, Carlsbad, etc.). Wet-bulb weather data, necessary for air-washer computations, may not be available for every weather location. Hourly temperatures are computed from given daily maximum temperatures and temperature ranges, using fixed hourly temperature correction factors (same factors for all months).
3. No attempt has been made to adjust local time (which includes deviations due to longitude and daylight-savings time) to true solar time.
4. Sensible heat contributions are considered only for lighting and occupancy.
5. Infiltration effects are computed from the specific heat of air, building volume, and number of air changes per hour; however, infiltration is assumed to decrease linearly with increasing ventilation (OSA), until ventilation CFM = 1.25 x infiltration CFM. As this point and beyond, infiltration effects are ignored.
6. In computing total heating/cooling for each month, a typical work month is assumed, with 18 to 22 working days. Any arbitrary work month may be used, by changing line 3660 in the program.
7. Weather data for the 21st of each month are taken as representative of the average conditions for the entire month. In some cases, these data are based on an average of only five years.

INPUT DATA

1. Documentary Data:

JOB NAME, LOCATION, JOB NUMBER, ARCHITECT: Up to 32 characters; for documentation only - will be printed out exactly as input. WEATHER LOCATION: three character code for the nearest weather location. Choose from:

ABQ - Albuquerque
 ATS - Artesia
 ALM - Alamogordo
 CRL - Carlsbad
 CLO - Clovis
 ESZ - Estancia
 FMN - Farmington

LVS - Las Vegas
 LAS - Los Alamos
 PTS - Portales
 ROW - Roswell
 RUD - Ruidoso
 SAF - Santa Fe
 ELP - El Paso

2. Heating/Cooling Design Factors:

THERMOSTAT HIGH, LOW TEMP:

Upper and lower temperature limits when building is occupied.

NIGHT SETBACK, MAX.
 NIGHT TEMP:

Lower and upper temperature limits while building is unoccupied. The upper limit (MAX NIGHT TEMP) is usually chosen to be 100 for design.

AIR FACTOR: Adjustment for altitude. (= 1)

SYSTEM CFM: Usually based on cooling CFM.

OSA DAMPER LEAKAGE: Damper leakage with damper fully closed. Expressed as a percentage of system CFM, e.g. enter 5 for 5%.

VENT REQ - PER PERSON: Ventilation, in CFM, required per person while building is occupied.

EQUIP/OTHER VENT REQ: Ventilation, in CFM, required for equipment or other reasons.

BLDG. LEAKAGE FACTOR: Number of air changes per hour due to leakage (infiltration), with OSA damper closed.

REGRIG UNIT INSTALLED: If refrigerated cooling unit is installed enter 1; otherwise, enter 0.

AIR WASHER SAT. EFF: If an air-washer is installed, enter saturation efficiency expressed as a percentage, e.g., enter 70 for 70%. If only an economizer (OSA damper) is present, enter 1. If neither is present, enter 0. A dry cooler (air washer with heat exchanger) may be approximated by entering 120 (for 120% saturation efficiency).

3. Building Parameters: Enter once for each building.

WALL "U": Wall thermal conductance-weighted average value for entire wall area, expressed in BTU/(Hr. ft . F.). Refer to ASHRAE CRP 158, "Cooling and Heating Load Calculation Manual," Chapter 3.

WALL DECUREMENT: Correction for heat/gain loss due to thermal storage in walls.

WALL TIME LAG: Wall thermal lag, in hours.

ROOF "U," ROOF DECUREMENT, ROOF TIME LAG: See "Wall" entries above.

DOOR "U," GLASS "U": Thermal conductance.

GLASS SHADING COEFF: Shading coefficient (between 0 and 1) due to type of glass, tint, films, etc. Weighted average for entire building.

SKYLIGHT "U," SKYLIGHT SHADING COEFF: See "Glass" entries above.

EDGE FACTOR: For edge gain calculations (BTU/Linear Foot/ F). If 0, calculated from floor area.

LIGHTING FACTOR: 3.413 BTU/Watt

PEOPLE SENS HEAT: Sensible heat, per person (BTUE).

FLOOR HEAT LOSS/SQ. FT.: For exposed floors, BTU/Hr./Ft .

OCCUPANCY START TIME: 1-12 AM; enter 25 if unoccupied.

OCCUPANCY END TIME: 1-12 PM; enter 0 if unoccupied.

ROOM LENGTH, WIDTH, INDOOR CEILING HEIGHT: In feet.

NO. OF EXPOSED WALLS: Up to 20. Size and orientation data will be entered separately for each wall.

NUMBER OF PEOPLE: During occupied hours.

SKYLIGHT LENGTH, WIDTH: In feet.

LIGHTING SENSIBLE: Sensible heat due to lighting (watts/square foot).

4. Wall data: Enter this group of data for each wall (number of walls is specified above):

EXPOSURE: Compass orientation in 45 degree increments. 91 = North, 2 = NE, 8 = NW).

LENGTH, HEIGHT OF WALL: In feet.

WINDOW LENGTH, HEIGHT: In feet, length = total for wall.

RIGHT MULLION, LEFT MULLION, TRANSOM: In feet.

DOOR LENGTH: If feet, total for wall.

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO. - GEOTHERMAL STUDY
 LOCATION: OJO CALIENTE, NEW MEXICO
 JOB NO. : 81100
 ARCHITECT: NONE

BLDG NAME: HOTEL

EXISTING BUILDING, WALL R=5.3, ROOF R=4.6, FLOOR R=3.3
 SINGLE GLAZING, LIGHTING 0.8 W/SF, 1.5 AC/HR, 78 CLG, 68 HTG

RUN DATE: 11/17/81 HR BY HR - REV.06E

YEARLY SUMMARY

BUILDING ENERGY REQUIREMENTS - MILLIONS OF BTU (MMBTU)

| | SYSTEM | | FREE AIR | | AIR WASHER |
|--------------|---------|---------|----------|---------|------------|
| | HEATING | COOLING | HEATING | COOLING | |
| JANUARY | 104 | 0 | 0 | 0 | 0 |
| FEBRUARY | 82 | 0 | 0 | 0 | 0 |
| MARCH | 65 | 0 | 0 | 0 | 0 |
| APRIL | 42 | 0 | 0 | 1 | 1 |
| MAY | 22 | 0 | 0 | 0 | 8 |
| JUNE | 8 | 0 | 0 | 0 | 19 |
| JULY | 7 | 0 | 0 | 0 | 20 |
| AUGUST | 9 | 0 | 0 | 0 | 19 |
| SEPTEMBER | 15 | 0 | 0 | 0 | 14 |
| OCTOBER | 39 | 0 | 0 | 0 | 5 |
| NOVEMBER | 75 | 0 | 0 | 0 | 0 |
| DECEMBER | 100 | 0 | 0 | 0 | 0 |
| TOTALS | 573 | 0 | 0 | 5 | 90 |
| FAN TIME HRS | 5753 | 389 | 0 | 1321 | 1297 |

TOTAL HEATING SYSTEM FUEL CONSUMPTION = 1147 MMBTU (50% EFFICIENCY)
 HEATING FUEL UNIT COST = \$8.06/MMBTU, HEATING FUEL TOTAL COST = \$9246

TOTAL COOLING SYSTEM FUEL CONSUMPTION = 0 MMBTU (C.O.P. = 1.00)
 COOLING FUEL UNIT COST = \$20.51/MMBTU, COOLING FUEL TOTAL COST = \$0

| | | | |
|----------------------|----------|--------------------------|------|
| SYSTEM HEATING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| SYSTEM COOLING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| FREE AIR HEATING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| FREE AIR COOLING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| AIR WASHER FAN | 1.0 KW : | 1297 KWH @ \$0.070/KWH = | \$90 |

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO. - GEOTHERMAL STUDY
 LOCATION: OJO CALIENTE, NEW MEXICO
 JOB NO. : 81100
 ARCHITECT: NONE
 BLDG NAME: HOTEL

INSULATED BUILDING, WALL R=5.3, ROOF R=15.6, FLOOR R=14.3
 SINGLE GLAZING, LIGHTING 0.8 W/SF, 1.5 AC/HR, 78 CLG, 68 HTG

RUN DATE: 12/18/81 HR BY HR - REV.06E

YEARLY SUMMARY

BUILDING ENERGY REQUIREMENTS - MILLIONS OF BTU (MMBTU)

| | SYSTEM | | FREE AIR | | AIR WASHER |
|--------------|---------|---------|----------|---------|------------|
| | HEATING | COOLING | HEATING | COOLING | |
| JANUARY | 71 | 0 | 0 | 0 | 0 |
| FEBRUARY | 56 | 0 | 0 | 0 | 0 |
| MARCH | 43 | 0 | 0 | 0 | 0 |
| APRIL | 27 | 0 | 0 | 2 | 0 |
| MAY | 13 | 0 | 0 | 0 | 4 |
| JUNE | 4 | 0 | 0 | 0 | 13 |
| JULY | 3 | 0 | 0 | 0 | 14 |
| AUGUST | 4 | 0 | 0 | 0 | 14 |
| SEPTEMBER | 8 | 0 | 0 | 0 | 12 |
| OCTOBER | 25 | 0 | 0 | 0 | 4 |
| NOVEMBER | 50 | 0 | 0 | 0 | 0 |
| DECEMBER | 68 | 0 | 0 | 0 | 0 |
| TOTALS | 379 | 0 | 0 | 5 | 64 |
| FAN TIME HRS | 5383 | 450 | 0 | 1693 | 1234 |

TOTAL HEATING SYSTEM FUEL CONSUMPTION = 758 MMBTU (50 % EFFICIENCY)
 HEATING FUEL UNIT COST = \$8.06/MMBTU, HEATING FUEL TOTAL COST = \$6113

TOTAL COOLING SYSTEM FUEL CONSUMPTION = 0 MMBTU (C.O.P. = 1.00)
 COOLING FUEL UNIT COST = \$20.51/MMBTU, COOLING FUEL TOTAL COST = \$0

| | | | |
|----------------------|----------|--------------------------|------|
| SYSTEM HEATING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| SYSTEM COOLING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| FREE AIR HEATING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| FREE AIR COOLING FAN | 0.0 KW : | 0 KWH @ \$0.070/KWH = | \$0 |
| AIR WASHER FAN | 1.0 KW : | 1234 KWH @ \$0.070/KWH = | \$86 |

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO
LOCATION: OJO CALIENTE, NEW MEXICO
JOB NO. : 81100
ARCHITECT: NONE
DATE: MARCH 3 TIME: 3:45 P.M.

OUTSIDE CONDITIONS

SUMMER: 88 F DB 63 F WB
WINTER: 7 F DB
ELEVATION: 6500 FT.
AIR FACTOR: .85
DAILY TEMPERATURE RANGE: 30

INSIDE CONDITIONS

SUMMER: 78 F DB
WINTER: 68 F DB
SPACE TD: 10 F DB

TOTALS

=====

TOTAL AREA = 7018 SQ FT
TOTAL OCCUPANCY = 51 PEOPLE
LATENT LOAD (PEOPLE) = 10200 BTU/HR
TOTAL COOLING LOAD, 9 AM = 107612 BTU/HR
TOTAL COOLING LOAD, 12 NOON = 146120 BTU/HR
TOTAL COOLING LOAD, 3 PM = 178057 BTU/HR
TOTAL INFILTRATION COOLING LOAD = 11615 BTU/HR
TOTAL INFILTRATION HEATING LOAD = 70849 BTU/HR
TOTAL HEAT LOSS = 385667 BTU/HR
SENSIBLE HEAT GAIN RATIO = .95
TOTAL SUPPLY AIR = 24526 CFM

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO
 LOCATION: OJO CALIENTE, NEW MEXICO
 JOB NO. : 81100
 ARCHITECT: NONE

EXISTING BUILDING, WALL R=5.3, ROOF R=4.6
 FLOOR R=3.3

DATE: MARCH 3 TIME: 3:45 P.M.

OUTSIDE CONDITIONS

SUMMER: 88 F DB 63 F WB
 WINTER: 7 F DB
 ELEVATION: 6500 FT.
 AIR FACTOR: .85
 DAILY TEMPERATURE RANGE: 30

INSIDE CONDITIONS

SUMMER: 78 F DB
 WINTER: 68 F DB
 SPACE TD: 10 F DB

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|------------|------|-------------------------------|-------|-------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| LOBBY | 620 | 12590 | 13809 | 14605 | 2295 | 3.70 | 40114 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 20.56 F |
| DINING | 828 | 15731 | 23063 | 31060 | 3890 | 4.69 | 47482 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 14.35 F |
| KITCHEN | 528 | 6364 | 9961 | 19050 | 2241 | 4.24 | 28357 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 14.88 F |
| KITCHEN II | 255 | 2820 | 4501 | 7103 | 846 | 3.32 | 16929 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 23.52 F |
| STORE | 384 | 5265 | 5828 | 7039 | 1057 | 2.75 | 22635 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 25.18 F |
| OFFICE | 165 | 1357 | 2337 | 2791 | 328 | 1.99 | 5974 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 21.40 F |
| ROOM 4 | 225 | 2459 | 3917 | 4455 | 539 | 2.39 | 11168 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 24.36 F |
| ROOM 5 | 225 | 2318 | 3772 | 4340 | 525 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 F |
| ROOM 6 | 225 | 2318 | 3772 | 4340 | 525 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 F |
| ROOM 7 | 225 | 2318 | 3772 | 4340 | 525 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 F |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|-------------|------|-------------------------------|------|------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ROOM 8 | 225 | 2318 | 3772 | 4340 | 525 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 F |
| ROOM 9 | 225 | 2318 | 3772 | 4340 | 525 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 F |
| ROOM 10 | 225 | 6281 | 4941 | 5450 | 1024 | 4.55 | 14358 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 16.49 F |
| ROOM 11 | 172 | 5280 | 3474 | 3852 | 821 | 4.76 | 9220 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.21 F |
| ROOM 12 | 165 | 5229 | 3374 | 3725 | 806 | 4.88 | 8867 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.93 F |
| ROOM 14 | 180 | 6533 | 5783 | 5335 | 1113 | 6.18 | 12241 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.92 F |
| CORRIDOR | 561 | 3375 | 6736 | 8309 | 977 | 1.74 | 26281 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 31.62 F |
| CORRIDOR II | 166 | 2298 | 4293 | 3774 | 562 | 3.37 | 8249 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 17.25 F |
| ROOM 15 | 150 | 3397 | 5468 | 8008 | 1060 | 7.07 | 11413 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.66 F |
| ROOM 16 | 150 | 2038 | 3103 | 6495 | 764 | 5.09 | 8161 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.56 F |
| ROOM 17 | 49 | 629 | 920 | 1054 | 124 | 2.53 | 1774 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 16.81 F |
| ROOM 18 | 49 | 629 | 920 | 1054 | 124 | 2.53 | 1774 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 16.81 F |
| ROOM 19 | 120 | 805 | 1518 | 1848 | 217 | 1.81 | 4345 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 23.50 F |
| ROOM 20 | 180 | 2585 | 4660 | 4267 | 620 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 F |
| ROOM 21 | 180 | 2585 | 4660 | 4267 | 620 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 F |
| ROOM 22 | 180 | 2585 | 4660 | 4267 | 620 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 F |
| ROOM 23 | 180 | 2585 | 4660 | 4267 | 620 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 F |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|------------|------|-------------------------------|------|------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ROOM 24 | 180 | 2585 | 4660 | 4267 | 620 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 F |

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO
 LOCATION: OJO CALIENTE, NEW MEXICO
 JOB NO. : 81100
 ARCHITECT: NONE

EXISTING BUILDING, WALL R=5.3, ROOF R=4.6
 FLOOR R=3.3

DATE: MARCH 3 TIME: 3:45 P.M.

OUTSIDE CONDITIONS

SUMMER: 88 F DB 63 F WB
 WINTER: 7 F DB
 ELEVATION: 6500 FT.
 AIR FACTOR: .85
 DAILY TEMPERATURE RANGE: 30

INSIDE CONDITIONS

SUMMER: 78 F DB
 WINTER: 68 F DB
 SPACE TD: 10 F DB

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS | |
|-------------------------|------|--------------------|-------|-------|--------|---------------|---|-------|
| | | 9 AM | 12 N | 3 PM | | | | |
| LOBBY | | | | | | | | |
| ROOF | 620 | 1227 | 4910 | 6615 | 778.2 | 1.25 | 8320 | |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (| |
| LIGHTS | | 2115 | 2115 | 2115 | 248.8 | 0.40 | (| |
| PEOPLE (3) | | 750 | 750 | 750 | 88.2 | 0.14 | (| |
| FLOOR | 620 | 0 | 0 | 0 | 0 | 0 | 11718 | |
| INFILTRATION 2.50 AC/HR | | 1976 | 1976 | 1976 | 232.5 | 0.37 | 12059 | |
| E-EXPOSURE | | | | | | | | |
| GLASS | 24 | 4831 | 1183 | 932 | 568.3 | 0.91 | 1654 | |
| WALL | 156 | 118 | 296 | 489 | 57.5 | 0.09 | 1808 | |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (| |
| EDGE | 20 | 0 | 0 | 0 | 0 | 0 | (| |
| S-EXPOSURE | | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 0.42 | 1326 | |
| WALL | 116 | 22 | 22 | 177 | 20.8 | 0.03 | 1353 | |
| DOOR | 35 | 308 | 308 | 308 | 36.2 | 0.05 | 1878 | |
| EDGE | 19 | 0 | 0 | 0 | 0 | 0 | (| |
| TOTALS | 620 | 12590 | 13809 | 14605 | 2295.3 | 3.70 | 40114 | |
| | | | | | | | HEATING COIL TEMPERATURE DROP AT DESIGN CFM | 20.56 |

| ROOM | AREA | SENSIBLE | HEAT | GAIN | CFM | CFM/ | HEAT |
|-------------------------|------|----------|-------|-------|---|-------|-------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| DINING | | | | | | | |
| ROOF | 828 | 1639 | 6557 | 8834 | 1039.3 | 1.25 | 11111 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 1977 | 1977 | 1977 | 232.6 | 0.28 | 0 |
| PEOPLE (24) | | 6000 | 6000 | 6000 | 705.8 | 0.85 | 0 |
| FLOOR | 828 | 0 | 0 | 0 | 0 | 0 | 15649 |
| INFILTRATION 1.50 AC/HR | | 1583 | 1583 | 1583 | 186.3 | 0.22 | 9659 |
| S-EXPOSURE | | | | | | | |
| GLASS | 38 | 2483 | 4494 | 2483 | 528.8 | 0.63 | 2653 |
| WALL | 177 | 33 | 33 | 269 | 31.7 | 0.03 | 2057 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| W-EXPOSURE | | | | | | | |
| GLASS | 48 | 1864 | 2366 | 9662 | 1136.7 | 1.37 | 3308 |
| WALL | 262 | 149 | 49 | 249 | 29.3 | 0.03 | 3042 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 34 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 828 | 15731 | 23063 | 31060 | 3890.8 | 4.69 | 47482 |
| | | | | | HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | 14.35 |

| | | | | | | | |
|-------------------------|-----|------|------|-------|---|------|-------|
| KITCHEN | | | | | | | |
| ROOF | 528 | 1045 | 4181 | 5633 | 662.7 | 1.25 | 7085 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 1801 | 1801 | 1801 | 211.9 | 0.40 | 0 |
| PEOPLE (2) | | 500 | 500 | 500 | 58.8 | 0.11 | 0 |
| FLOOR | 528 | 0 | 0 | 0 | 0 | 0 | 9979 |
| INFILTRATION 1.50 AC/HR | | 1009 | 1009 | 1009 | 118.8 | 0.22 | 6159 |
| W-EXPOSURE | | | | | | | |
| GLASS | 49 | 1923 | 2440 | 9964 | 1172.2 | 2.22 | 3412 |
| WALL | 148 | 84 | 28 | 141 | 16.5 | 0.03 | 1721 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 528 | 6364 | 9961 | 19050 | 2241.2 | 4.24 | 28357 |
| | | | | | HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | 14.88 |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|--|------------|--------------------|-------------|-------------|--------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| KITCHEN II | | | | | | | |
| ROOF | 255 | 504 | 2019 | 2720 | 320.1 | 1.25 | 3422 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 522 | 522 | 522 | 61.4 | 0.24 | 0 |
| PEOPLE (0) | | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| FLOOR | 255 | 0 | 0 | 0 | 0 | 0 | 4819 |
| INFILTRATION 1.50 AC/HR | | 487 | 487 | 487 | 57.3 | 0.22 | 2974 |
| N-EXPOSURE | | | | | | | |
| GLASS | 14 | 557 | 650 | 557 | 76.5 | 0.30 | 965 |
| WALL | 139 | 39 | 26 | 118 | 13.9 | 0.05 | 1611 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| W-EXPOSURE | | | | | | | |
| GLASS | 12 | 466 | 591 | 2415 | 284.1 | 1.11 | 827 |
| WALL | 102 | 58 | 19 | 96 | 11.4 | 0.04 | 1182 |
| DOOR | 21 | 184 | 184 | 184 | 21.7 | 0.08 | 1127 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 255 | 2820 | 4501 | 7103 | 846.7 | 3.32 | 16929 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | | | | | | 23.52 |

| | | | | | | | |
|--|------------|-------------|-------------|-------------|---------------|-------------|--------------|
| STORE | | | | | | | |
| ROOF | 384 | 760 | 3041 | 4097 | 482.0 | 1.25 | 5152 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 524 | 524 | 524 | 61.6 | 0.16 | 0 |
| PEOPLE (2) | | 500 | 500 | 500 | 58.8 | 0.15 | 0 |
| FLOOR | 384 | 0 | 0 | 0 | 0 | 0 | 7257 |
| INFILTRATION 1.50 AC/HR | | 734 | 734 | 734 | 86.4 | 0.22 | 4479 |
| N-EXPOSURE | | | | | | | |
| GLASS | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| WALL | 216 | 61 | 41 | 184 | 21.7 | 0.05 | 2503 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| E-EXPOSURE | | | | | | | |
| GLASS | 12 | 2415 | 591 | 466 | 284.1 | 0.74 | 827 |
| WALL | 111 | 84 | 210 | 347 | 40.9 | 0.10 | 1286 |
| DOOR | 21 | 184 | 184 | 184 | 21.7 | 0.05 | 1127 |
| EDGE | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 384 | 5265 | 5828 | 7039 | 1057.5 | 2.75 | 22635 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | | | | | | 25.18 |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|--|------------|--------------------|-------------|-------------|--------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| OFFICE | | | | | | | |
| ROOF | 165 | 326 | 1306 | 1760 | 207.1 | 1.25 | 2214 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 675 | 675 | 675 | 79.4 | 0.48 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.17 | 0 |
| FLOOR | 165 | 0 | 0 | 0 | 0 | 0 | 3118 |
| INFILTRATION 0.50 AC/HR | | 105 | 105 | 105 | 12.3 | 0.07 | 643 |
| TOTALS | 165 | 1357 | 2337 | 2791 | 328.3 | 1.99 | 5974 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | | | | | | 21.40 |

| | | | | | | | |
|--|------------|-------------|-------------|-------------|--------------|-------------|--------------|
| ROOM 4 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 690 | 690 | 690 | 81.2 | 0.36 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | 0 |
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1749 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 70 | 20 | 13 | 60 | 7.1 | 0.03 | 819 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 225 | 2459 | 3917 | 4455 | 539.2 | 2.39 | 11168 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | | | | | | 24.36 |

| | | | | | | | |
|--|------------|-------------|-------------|-------------|--------------|-------------|--------------|
| ROOM 5 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | 0 |
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1749 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.5 | 0.05 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 225 | 2318 | 3772 | 4340 | 525.6 | 2.33 | 11690 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM | | | | | | | 26.16 |

| ROOM | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ | HEAT |
|-------------------------|------|-------------------------------|------|------|---------------|-------|-------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| ===== | | | | | | | |
| ROOM 6 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | (|
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | (|
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1742 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.6 | 0.05 | 1342 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | (|
| TOTALS | 225 | 2318 | 3772 | 4340 | 525.6 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 |

| | | | | | | | |
|-------------------------|-----|-------------------------------|------|------|---------------|------|-------|
| ROOM 7 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | (|
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | (|
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1742 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.6 | 0.05 | 1342 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | (|
| TOTALS | 225 | 2318 | 3772 | 4340 | 525.6 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 |

| | | | | | | | |
|-------------------------|-----|-------------------------------|------|------|---------------|------|-------|
| ROOM 8 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | (|
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | (|
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1742 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.6 | 0.05 | 1342 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | (|
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | (|
| TOTALS | 225 | 2318 | 3772 | 4340 | 525.6 | 2.33 | 11690 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 26.16 |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|---|------|--------------------|------|------|-------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ROOM 9 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | 0 |
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1749 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.6 | 0.05 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 225 | 2318 | 3772 | 4340 | 525.6 | 2.33 | 11690 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 26.16 | | | | | | | |

| | | | | | | | |
|---|-----|------|------|------|--------|------|-------|
| ROOM 10 | | | | | | | |
| ROOF | 225 | 445 | 1782 | 2400 | 282.4 | 1.25 | 3019 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 537 | 537 | 537 | 63.2 | 0.28 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.13 | 0 |
| FLOOR | 225 | 0 | 0 | 0 | 0 | 0 | 4252 |
| INFILTRATION 1.00 AC/HR | | 286 | 286 | 286 | 33.7 | 0.15 | 1749 |
| N-EXPOSURE | | | | | | | |
| GLASS | 19 | 766 | 894 | 766 | 105.1 | 0.46 | 1326 |
| WALL | 115 | 32 | 21 | 98 | 11.6 | 0.05 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| E-EXPOSURE | | | | | | | |
| GLASS | 19 | 3875 | 949 | 747 | 455.8 | 2.02 | 1326 |
| WALL | 115 | 87 | 219 | 362 | 42.6 | 0.18 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 225 | 6281 | 4941 | 5450 | 1024.2 | 4.55 | 14358 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 16.49 | | | | | | | |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|-------------------------|------|-------------------------------|------|------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ===== | | | | | | | |
| ROOM 11 | | | | | | | |
| ROOF | 172 | 341 | 1366 | 1840 | 216.5 | 1.25 | 2314 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 529 | 529 | 529 | 62.3 | 0.36 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.17 | 0 |
| FLOOR | 172 | 0 | 0 | 0 | 0 | 0 | 3260 |
| INFILTRATION 1.00 AC/HR | | 219 | 219 | 219 | 25.8 | 0.15 | 1341 |
| E-EXPOSURE | | | | | | | |
| GLASS | 19 | 3875 | 949 | 747 | 455.8 | 2.64 | 1326 |
| WALL | 84 | 64 | 160 | 264 | 31.0 | 0.18 | 976 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 172 | 5280 | 3474 | 3852 | 821.1 | 4.76 | 9220 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.21 |

| | | | | | | | |
|-------------------------|-----|-------------------------------|------|------|---------------|------|-------|
| ROOM 12 | | | | | | | |
| ROOF | 165 | 326 | 1306 | 1760 | 207.1 | 1.25 | 2214 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 506 | 506 | 506 | 59.6 | 0.36 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.17 | 0 |
| FLOOR | 165 | 0 | 0 | 0 | 0 | 0 | 3118 |
| INFILTRATION 1.00 AC/HR | | 210 | 210 | 210 | 24.7 | 0.15 | 1283 |
| E-EXPOSURE | | | | | | | |
| GLASS | 19 | 3875 | 949 | 747 | 455.8 | 2.76 | 1326 |
| WALL | 79 | 60 | 151 | 250 | 29.4 | 0.17 | 924 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 165 | 5229 | 3374 | 3725 | 806.1 | 4.88 | 8867 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.93 |

| ROOM | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ | HEAT |
|---|------|--------------------|------|------|--------|-------|-------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| ROOM 14 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| E-EXPOSURE | | | | | | | |
| GLASS | 19 | 3875 | 949 | 747 | 455.8 | 2.53 | 1326 |
| WALL | 88 | 67 | 168 | 278 | 32.7 | 0.18 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 115 | 21 | 21 | 175 | 20.6 | 0.11 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 6533 | 5783 | 5335 | 1113.8 | 6.18 | 12241 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 12.92 | | | | | | | |

| | | | | | | | |
|---|-----|------|------|------|-------|------|-------|
| CORRIDOR | | | | | | | |
| ROOF | 561 | 1110 | 4443 | 5985 | 704.2 | 1.25 | 7528 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 957 | 957 | 957 | 112.5 | 0.20 | 0 |
| PEOPLE (0) | | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| FLOOR | 561 | 0 | 0 | 0 | 0 | 0 | 10602 |
| INFILTRATION 1.50 AC/HR | | 1072 | 1072 | 1072 | 126.2 | 0.22 | 6544 |
| E-EXPOSURE | | | | | | | |
| GLASS | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| WALL | 25 | 19 | 47 | 78 | 9.2 | 0.01 | 289 |
| DOOR | 24 | 215 | 215 | 215 | 25.3 | 0.04 | 1315 |
| EDGE | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 561 | 3375 | 6736 | 8309 | 977.6 | 1.74 | 26281 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 31.62 | | | | | | | |

| ROOM | AREA | SENSIBLE | HEAT | GAIN | CFM | CFM/ | HEAT |
|-------------------------|------|-------------------------------|------|------|---------------|-------|---------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| ===== | | | | | | | |
| CORRIDOR II | | | | | | | |
| ROOF | 166 | 329 | 1318 | 1776 | 209.0 | 1.25 | 2234 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 511 | 511 | 511 | 60.1 | 0.36 | 0 |
| PEOPLE (0) | | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| FLOOR | 166 | 0 | 0 | 0 | 0 | 0 | 3146 |
| INFILTRATION 1.00 AC/HR | | 212 | 212 | 212 | 24.9 | 0.15 | 1294 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.58 | 1326 |
| WALL | 21 | 4 | 4 | 32 | 3.8 | 0.02 | 246 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 166 | 2298 | 4293 | 3774 | 562.3 | 3.37 | 8249 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 17.25 |
| | | | | | | | |
| ROOM 15 | | | | | | | |
| ROOF | 150 | 297 | 1188 | 1600 | 188.2 | 1.25 | 2013 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 511 | 511 | 511 | 60.2 | 0.40 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.19 | 0 |
| FLOOR | 150 | 0 | 0 | 0 | 0 | 0 | 2835 |
| INFILTRATION 1.50 AC/HR | | 286 | 286 | 286 | 33.7 | 0.22 | 1749 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.76 | 1326 |
| WALL | 115 | 21 | 21 | 175 | 20.6 | 0.13 | 1341 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| W-EXPOSURE | | | | | | | |
| GLASS | 19 | 747 | 949 | 3875 | 455.8 | 3.03 | 1326 |
| WALL | 70 | 40 | 13 | 67 | 7.9 | 0.05 | 819 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 150 | 3397 | 5468 | 8008 | 1060.5 | 7.07 | 11413 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.66 F |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|---|------|--------------------|------|------|-------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ===== | | | | | | | |
| ROOM 16 | | | | | | | |
| ROOF | 150 | 297 | 1188 | 1600 | 188.2 | 1.25 | 2013 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 511 | 511 | 511 | 60.2 | 0.40 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.19 | 0 |
| FLOOR | 150 | 0 | 0 | 0 | 0 | 0 | 2835 |
| INFILTRATION 1.00 AC/HR | | 191 | 191 | 191 | 22.5 | 0.15 | 1166 |
| W-EXPOSURE | | | | | | | |
| GLASS | 19 | 747 | 949 | 3875 | 455.8 | 3.03 | 1326 |
| WALL | 70 | 40 | 13 | 67 | 7.9 | 0.05 | 819 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 150 | 2038 | 3103 | 6495 | 764.2 | 5.09 | 8161 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 12.56 | | | | | | | |
| ROOM 17 | | | | | | | |
| ROOF | 49 | 97 | 388 | 522 | 61.5 | 1.25 | 657 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 250 | 250 | 250 | 29.5 | 0.60 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.60 | 0 |
| FLOOR | 49 | 0 | 0 | 0 | 0 | 0 | 926 |
| INFILTRATION 0.50 AC/HR | | 31 | 31 | 31 | 3.6 | 0.07 | 190 |
| TOTALS | 49 | 629 | 920 | 1054 | 124.0 | 2.53 | 1774 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 16.81 | | | | | | | |
| ROOM 18 | | | | | | | |
| ROOF | 49 | 97 | 388 | 522 | 61.5 | 1.25 | 657 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 250 | 250 | 250 | 29.5 | 0.60 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.60 | 0 |
| FLOOR | 49 | 0 | 0 | 0 | 0 | 0 | 926 |
| INFILTRATION 0.50 AC/HR | | 31 | 31 | 31 | 3.6 | 0.07 | 190 |
| TOTALS | 49 | 629 | 920 | 1054 | 124.0 | 2.53 | 1774 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 16.81 | | | | | | | |
| ROOM 19 | | | | | | | |
| ROOF | 120 | 237 | 950 | 1280 | 150.6 | 1.25 | 1610 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.48 | 0 |
| PEOPLE (0) | | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| FLOOR | 120 | 0 | 0 | 0 | 0 | 0 | 2268 |
| INFILTRATION 0.50 AC/HR | | 76 | 76 | 76 | 9.0 | 0.07 | 466 |
| TOTALS | 120 | 805 | 1518 | 1848 | 217.4 | 1.81 | 4345 |
| HEATING COIL TEMPERATURE DROP AT DESIGN CFM 23.50 | | | | | | | |

| ROOM | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ | HEAT |
|-------------------------|------|-------------------------------|------|------|---------------|-------|-------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| ===== | | | | | | | |
| ROOM 20 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 88 | 16 | 16 | 134 | 15.8 | 0.08 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 2585 | 4660 | 4267 | 620.4 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 |
| | | | | | | | |
| ROOM 21 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 88 | 16 | 16 | 134 | 15.8 | 0.08 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 2585 | 4660 | 4267 | 620.4 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 |
| | | | | | | | |
| ROOM 22 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 88 | 16 | 16 | 134 | 15.8 | 0.08 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 2585 | 4660 | 4267 | 620.4 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|-------------------------|------|-------------------------------|------|------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| ===== | | | | | | | |
| ROOM 23 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 88 | 16 | 16 | 134 | 15.8 | 0.08 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 2585 | 4660 | 4267 | 620.4 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 |

| | | | | | | | |
|-------------------------|-----|-------------------------------|------|------|---------------|------|-------|
| ROOM 24 | | | | | | | |
| ROOF | 180 | 356 | 1425 | 1920 | 225.9 | 1.25 | 2415 |
| S-L | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| LIGHTS | | 491 | 491 | 491 | 57.8 | 0.32 | 0 |
| PEOPLE (1) | | 250 | 250 | 250 | 29.4 | 0.16 | 0 |
| FLOOR | 180 | 0 | 0 | 0 | 0 | 0 | 3402 |
| INFILTRATION 1.00 AC/HR | | 229 | 229 | 229 | 27.0 | 0.15 | 1399 |
| S-EXPOSURE | | | | | | | |
| GLASS | 19 | 1241 | 2247 | 1241 | 264.4 | 1.46 | 1326 |
| WALL | 88 | 16 | 16 | 134 | 15.8 | 0.08 | 1028 |
| DOOR | 0 | 0 | 0 | 0 | 0.0 | 0.00 | 0 |
| EDGE | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 180 | 2585 | 4660 | 4267 | 620.4 | 3.44 | 9573 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 18.15 |

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: OJO CALIENTE MINERALS SPRINGS CO
LOCATION: OJO CALIENTE, NEW MEXICO
JOB NO. : 81100
ARCHITECT: NONE
DATE: 3/4/82 TIME:

OUTSIDE CONDITIONS

SUMMER: 88 F DB 63 F WB
WINTER: 7 F DB
ELEVATION: 6500 FT.
AIR FACTOR: .85
DAILY TEMPERATURE RANGE: 30

INSIDE CONDITIONS

SUMMER: 78 F DB
WINTER: 68 F DB
SPACE TD: 10 F DB

TOTALS

=====

TOTAL AREA = 7018 SQ FT
TOTAL OCCUPANCY = 51 PEOPLE
LATENT LOAD (PEOPLE) = 10200 BTU/HR
TOTAL COOLING LOAD, 9 AM = 97758 BTU/HR
TOTAL COOLING LOAD, 12 NOON = 106707 BTU/HR
TOTAL COOLING LOAD, 3 PM = 124959 BTU/HR
TOTAL INFILTRATION COOLING LOAD = 11615 BTU/HR
TOTAL INFILTRATION HEATING LOAD = 70849 BTU/HR
TOTAL HEAT LOSS = 216210 BTU/HR
SENSIBLE HEAT GAIN RATIO = .94
TOTAL SUPPLY AIR = 18279 CFM

COUPLAND MORAN AND ASSOCIATES
MECHANICAL - ELECTRICAL CONSULTANTS

JOB NAME: QJO CALIENTE MINERALS SPRINGS CO
 LOCATION: QJO CALIENTE, NEW MEXICO
 JOB NO. : 81100
 ARCHITECT: NONE

INSULATED BUILDING, WALL R=5.3, ROOF R=15.6
 FLOOR R=14.3

DATE: 3/4/82 TIME:

DATE: 3/4/82 TIME:

OUTSIDE CONDITIONS

SUMMER: 88 F DB 63 F WB
 WINTER: 7 F DB
 ELEVATION: 6500 FT.
 AIR FACTOR: .85
 DAILY TEMPERATURE RANGE: 30

INSIDE CONDITIONS

SUMMER: 78 F DB
 WINTER: 68 F DB
 SPACE TD: 10 F DB

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|------------|------|-------------------------------|-------|-------|---------------|---------------|--------------|
| | | 9 AM | 12 N | 3 PM | | | |
| LOBBY | 620 | 11720 | 10327 | 9914 | 1743 | 2.81 | 25144 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 16.96 |
| DINING | 828 | 14569 | 18413 | 24796 | 3153 | 3.80 | 27489 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 10.25 |
| KITCHEN | 528 | 5623 | 6996 | 15055 | 1771 | 3.35 | 15608 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 10.36 |
| KITCHEN II | 255 | 2462 | 3069 | 5174 | 619 | 2.43 | 10771 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 20.44 |
| STORE | 384 | 4725 | 3671 | 4134 | 715 | 1.86 | 13363 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 21.96 |
| OFFICE | 165 | 1125 | 1410 | 1542 | 181 | 1.10 | 1990 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.89 |
| ROOM 4 | 225 | 2143 | 2653 | 2752 | 338 | 1.50 | 5735 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 19.91 |
| ROOM 5 | 225 | 2003 | 2508 | 2637 | 325 | 1.44 | 6257 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 22.62 |
| ROOM 6 | 225 | 2003 | 2508 | 2637 | 325 | 1.44 | 6257 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 22.62 |
| ROOM 7 | 225 | 2003 | 2508 | 2637 | 325 | 1.44 | 6257 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 22.62 |

| ROOM ID | AREA | SENSIBLE HEAT GAIN | | | CFM | CFM/ SQ FT | HEAT LOSS |
|-------------|------|-------------------------------|------|------|---------------|---------------|-----------|
| | | 9 AM | 12 N | 3 PM | | | |
| ROOM 8 | 225 | 2003 | 2508 | 2637 | 325 | 1.44 | 6257 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 22.62 F |
| ROOM 9 | 225 | 2003 | 2508 | 2637 | 325 | 1.44 | 6257 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 22.62 F |
| ROOM 10 | 225 | 5965 | 3677 | 3748 | 823 | 3.66 | 8925 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.74 F |
| ROOM 11 | 172 | 5038 | 2506 | 2547 | 667 | 3.86 | 5054 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 8.90 F |
| ROOM 12 | 165 | 4997 | 2447 | 2477 | 659 | 3.99 | 4883 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 8.71 F |
| ROOM 14 | 180 | 6280 | 4772 | 3973 | 953 | 5.29 | 7895 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 9.73 F |
| CORRIDOR | 561 | 2587 | 3585 | 4065 | 478 | 0.85 | 12735 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 31.32 F |
| CORRIDOR II | 166 | 2065 | 3358 | 2514 | 414 | 2.48 | 4229 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 12.01 F |
| ROOM 15 | 150 | 3186 | 4626 | 6874 | 927 | 6.18 | 7791 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 9.88 F |
| ROOM 16 | 150 | 1827 | 2261 | 5360 | 630 | 4.20 | 4539 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 8.46 F |
| ROOM 17 | 49 | 560 | 644 | 684 | 80 | 1.64 | 591 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 8.63 F |
| ROOM 18 | 49 | 560 | 644 | 684 | 80 | 1.64 | 591 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 8.63 F |
| ROOM 19 | 120 | 636 | 844 | 940 | 110 | 0.92 | 1447 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 15.39 F |
| ROOM 20 | 180 | 2332 | 3649 | 2906 | 460 | 2.55 | 5226 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.36 F |
| ROOM 21 | 180 | 2332 | 3649 | 2906 | 460 | 2.55 | 5226 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.36 F |
| ROOM 22 | 180 | 2332 | 3649 | 2906 | 460 | 2.55 | 5226 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.36 F |
| ROOM 23 | 180 | 2332 | 3649 | 2906 | 460 | 2.55 | 5226 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.36 F |

| ROOM | AREA | SENSIBLE | HEAT | GAIN | CFM | CFM/ | HEAT |
|---------|------|-------------------------------|------|------|---------------|-------|-------|
| ID | | 9 AM | 12 N | 3 PM | | SQ FT | LOSS |
| ROOM 24 | 180 | 2332 | 3649 | 2906 | 460 | 2.55 | 5226 |
| | | HEATING COIL TEMPERATURE DROP | | | AT DESIGN CFM | | 13.36 |

APPENDIX D: ENERGY CALCULATIONS

| Contents | Page No. |
|--|----------|
| Estimated Laundry Hot Water Requirements | D - 2 |
| Proposed System Electrical Requirements | D - 4 |

ESTIMATED LAUNDRY HOT WATER REQUIREMENTS

ASSUMPTIONS:

1. 9 WASH LOADS PER BUSY DAY
2. 5 WASH LOADS PER SLOW DAY
3. 120 BUSY DAYS PER YEAR
4. 240 SLOW DAYS PER YEAR
5. 50°F GROUND WATER TEMPERATURE

FACTS:

1. WASHING MACHINE: ABWASCATOR (SWEDEN)
TYPE F1-45
DAN SHANKLIN @ TIPPS EQUIP (ALBQ) 243-5651
CONSUME 103 GALLONS PER CYCLE
2. HOT WATER HEATER TO 140°F (SETTING OF HWH)

CONSUMPTION - WATER:

$$120 \times 9 + 240 \times 5 = 2280 \text{ LOADS/YR}$$
$$2280 \text{ LOADS/YR} \times 103 \text{ GALLON/LOAD} = 234,840 \text{ GALLONS/YR}$$

FUEL CONSUMPTION:

$$234,840 \frac{\text{GALLONS}}{\text{YR}} \times 1.0 \frac{\text{BTU}}{\text{LB}^\circ\text{F}} \times 8.33 \frac{\text{LB}}{\text{GALLON}} \times (140-50)^\circ\text{F}$$

$$= 176,000,000 \text{ BTU/YR} - \text{LOAD}$$

$$176,000,000 \text{ BTU/YR} \div 60\% \text{ EFF} = 293,400,000 \text{ BTU/YR CONSUMED}$$
$$293,400,000 \div 95,475 \text{ BTU/GALLON PROPANE} = 3,073 \text{ GALLONS/YR}$$
$$3,073 \text{ GALLONS/YR} \times \$0.77/\text{GALLON} = \$2,366/\text{YR}$$

ESTIMATED LAUNDRY HOT WATER REQUIREMENTS (cont.)

POTENTIAL SAVINGS:

$$234,840 \frac{\text{GALLONS}}{\text{YR}} \times 1.0 \frac{\text{BTU}}{\text{LB}^\circ\text{F}} \times 8.33 \frac{\text{LB}}{\text{GALLON}} \times (125-50)^\circ\text{F}$$

$$= 146,700,000 \text{ BTU/YR}$$

$$146,700,000 \text{ BTU/YR} \div 60\% \text{ EF} = 244,500,000 \text{ BTU/YR}$$

$$244,500,000 \text{ BTU/YR} \div 95,475 \text{ BTU/GALLON} = 2,561 \text{ GALLONS/YR}$$

$$2,561 \text{ GALLONS/YR} \times \$0.77/\text{GALLON} = \$1,972/\text{YR}$$

PROPOSED SYSTEM ELECTRICAL REQUIREMENTS:

FANS:

36 UNITS X 0.11 KW X 5733 HOURS/YR = 22,782 KWH/YR
22,782 KWH/YR X \$0.07/KWH = \$1,595/YR

PUMPS:

HEATING LOOP: 1 HP X .746 KW/HP X 5,753 HOURS/YR = 4,291 KWH/YR
4,291 KWH/YR X \$0.07 = \$300/YR

WELL RUN TIME: 185 DAYS X 24 HR/DAY + 180 DAY X 10 HR/DAY = 6,240 HOURS

2 HP X .746 KW/HP X 6,240 HOURS/YR = 9,310 KWH/YR

9,310 KWH/YR X \$0.07 = \$652/YR

TOTAL ANNUAL COST = \$1,595 + \$300 + \$652 = \$2,547

TOTAL ANNUAL ENERGY = 22,782 + 4,291 + 9,310 = 36,383 KWH

APPENDIX E: ECONOMIC ANALYSIS

| Contents | Page No. |
|--|----------|
| Cost Estimate Summary | E - 2 |
| Fuel Savings Summary | E - 3 |
| Total Life Cycle Cost Analysis Summary | E - 4 |
| Typical Fan Coil Unit | E - 6 |
| Heating System | E - 7 |
| Well System | E - 8 |
| Life Cycle Cost Analysis Calculations | E - 9 |

COST ESTIMATE SUMMARY

A. Geothermal System

| | |
|-------------------|----------|
| 1. Well System | \$10,100 |
| 2. Heating System | 41,000 |
| 3. Laundry System | 1,400 |
| Subtotal | 52,600 |
| 10% Design Fee | 5,260 |
| Grand total | \$57,860 |

B. Insulation of Roof & Floor

| | |
|--|----------|
| 1. Geothermal System | \$57,860 |
| 2. Reduction of Geothermal System Cost w/Insulation | 2,160 |
| 3. Net Geothermal System Cost | 55,700 |
| 4. Insulation Costs | 24,500 |
| Grand Total | \$80,200 |

FUEL SAVINGS SUMMARY

I. Without Floor & Roof Insulation

| | |
|--------------------------------|----------|
| A. Heating Savings (Propane) | \$ 9,246 |
| B. Laundry Savings (Propane) | 1,972 |
| C. Total Savings (Propane) | 11,218 |
| D. New Fuel Cost (Electricity) | 2,547 |
| E. Net Savings | 8,671 |

II. With Floor & Roof Insulation

| | |
|--------------------------------|----------|
| A. Heating Savings (Propane) | \$ 6,113 |
| B. Laundry Savings (Propane) | \$ 1,972 |
| C. Total Savings (Propane) | 8,085 |
| D. New Fuel Cost (Electricity) | 2,547 |
| E. Net Savings | 5,538 |

TOTAL LIFE CYCLE COST ANALYSIS SUMMARY

I. Without Floor and Roof Insulation

A. Present System

| | |
|---|----------|
| 1. Present Annual Fuel Cost | \$11,218 |
| 2. Installation Cost | 0 |
| 3. Annual Maintenance Cost | 500 |
| 4. Non-Annual Replacement Cost (New Steam Boiler - 10 Years) | 10,000 |

B. Geothermal System

| | |
|--|----------|
| 1. Present Annual Fuel Cost | \$ 2,547 |
| 2. Installation Cost | 57,860 |
| 3. Annual Maintenance Cost | 200 |
| 4. Non-Annual Replacement Cost (Circulation Pump Motors - 10 Years) | 2,000 |

C. Results

| | |
|---------------------------------------|----------|
| 1. First Year Fuel Savings | \$ 8,671 |
| 2. Simple Payback Period | 6.7 |
| 3. Present Worth of Existing System | 169,207 |
| 4. Present Worth of Geothermal System | 93,217 |
| 5. SIR (Savings, Investment Ratio) | 2.4 |

II. With Floor and Roof Insulation

A. Present System

| | |
|---|----------|
| 1. Present Annual Fuel Cost | \$ 8,085 |
| 2. Installation Cost | 24,500 |
| 3. Annual Maintenance Cost | 500 |
| 4. Non-Annual Replacement Cost (New Steam Boiler - 10 Years) | 10,000 |

B. Geothermal System

| | |
|--|----------|
| 1. Present Annual Fuel Cost | \$ 2,547 |
| 2. Installation Cost | 80,200 |
| 3. Annual Maintenance Cost | 200 |
| 4. Non-Annual Replacement Cost (Circulation Pump Motors - 10 Years) | 2,000 |

C. Results

| | |
|---------------------------------------|----------|
| 1. First Year Fuel Savings | \$ 5,538 |
| 2. Simple Payback Period | 10.0 |
| 3. Present Worth of Existing System | 148,718 |
| 4. Present Worth of Geothermal System | 116,557 |
| 5. SIR (Savings, Investment Ratio) | 1.6 |

COUPLAND MORAN & ASSOC.
 Albuquerque, NM (505)296-5573
 El Paso, TX (915) 778-6401

**ELECTRICAL-MECHANICAL
 CONSULTING ENGINEERS**

PROJECT Ojo Caliente - Geothermal Project

SHEET NO. 2 OF 3 JOB NO. 81100

ESTIMATOR DS DATE 12/10/81

CHECKED BY _____ DATE _____

BASIS FOR ESTIMATE

- NO DESIGN COMPLETED
- PRELIMINARY DESIGN
- FINAL DESIGN

| SUMMARY | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|-----------------------------|-----------|------------|----------|----------|----------|----------|-------------|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| Heating System | | | | | | | |
| Plate Heat Exchanger | 1 | ea. | 100.0 | 100.00 | 830.0 | 830.00 | 930.00 |
| Circulation Pump (1/2 HP) | 1 | ea. | 50.0 | 50.00 | 430.0 | 430.00 | 480.00 |
| 3/4" Copper Pipe & Insul. | 700 | LF | 4.22 | 2,954.00 | 2.38 | 1,666.00 | 4,620.00 |
| 1" Copper Pipe & Insul. | 250 | LF | 4.98 | 1,245.00 | 3.10 | 775.00 | 2,020.00 |
| 1 1/2" Copper Pipe & Insul. | 10 | LF | 5.97 | 59.70 | 3.42 | 34.20 | 93.90 |
| 1 1/2" Copper Pipe | 10 | LF | 6.31 | 63.10 | 4.89 | 48.90 | 112.00 |
| Subtotal | | | | | | | \$ 8,255.90 |
| Add 25% O & P | | | | | | | 2,063.97 |
| Total | | | | | | | \$10,319.87 |
| Laundry System | | | | | | | |
| Heat Exchanger | 1 | ea. | 42.0 | 42.00 | 540.0 | 540.00 | 582.00 |
| 3/4" Copper Pipe & Insul. | 50 | LF | 4.22 | 211.00 | 2.38 | 119.00 | 211.00 |
| 3/4" Bronze Gate Valves | 4 | ea. | 7.00 | 28.00 | 14.40 | 57.60 | 85.60 |
| 3/4" Copper Unions | 4 | ea. | 7.75 | 31.00 | 2.13 | 8.52 | 39.52 |
| Controls or Pump | 1 | ea. | --- | --- | --- | --- | \$ 200.00 |
| Subtotal | | | | | | | \$ 1,118.12 |
| Add 25% O & P | | | | | | | \$ 279.53 |
| Total | | | | | | | \$ 1,397.65 |
| - E-7 - | | | | | | | |

RETROFIT WORKSHEET 1 (RW1)

Life-Cycle Cost Evaluation of the Existing Building System

I. Identifying Information

- A. Name of Agency: Ojo Caliente Mineral Springs Co.
- B. Existing Building System Description: Hotel, One Pipe Steam Convectors
- C. Location: Ojo Caliente, NM
- D. Gross Floor Area Affected: 7019
- E. Expected Life of Existing System: 10-20 years
- F. Expected Life of Building: 40 yrs
- G. Study Period: 20 yrs

II. Calculating the Present Value of Energy Costs with the Existing System
 (See the text, Section 4.1.1, for special cases when this section may not be adequate for calculating the present value of energy costs.)

| | (1) Annual Units of Energy Measured Bldg/Facility Boundary | (2) Base Year Energy Price (Appendix Table C-1 or C-2) | (3) Base Year Energy Costs (3)=(1)x(2) | (4) UPW* Factor from Appen- dix B for Appropriate Fuel Type, Sector, Region, and Study Period | (5) Present Value Energy Cost over the Study Period (5)=(3)x(4) |
|----|--|---|---|---|---|
| A. | <u>Electricity</u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| B. | <u>Natural Gas</u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| C. | <u>14,569</u> | <u>0.77</u> | <u>\$11,218</u> | <u>14.36</u> | <u>\$161,090</u> |
| | Propane | \$ Per Unit Gallon | | | |
| D. | <u> </u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| E. | Total Present Value of Energy Costs with the Existing System: | | | | <u><u>\$161,090</u></u> |

(RW1 continued)

III. Calculating Investment Costs for the Existing System

$$\text{Base-Year Salvage Value} = \frac{0}{(\text{Base Year } \$)}$$

(Note: The investment cost of an existing system is equal to the current salvage value of the system plus any investment costs required to make it functional.)

IV. Calculating Non-Fuel Operation and Maintenance Costs for the Existing System

A. Annually Recurring Non-Fuel Operation and Maintenance Costs

| (1) | (2) | (3) |
|---------------------------------|---|---|
| Base-Year Annual Recurring Cost | UPW Factor from Appendix Table B-2 for the Project Study Period | Present Value of Recurring Costs (3)=(1)x(2) |
| \$500.00 | 8.514 | <u>\$4,257</u> |

B. Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

| (1) | (2) | (3) | (4) |
|---|-------------------------------------|--|--------------------------------------|
| Year in Which Cost is Expected to Occur | Amount of Cost (In Base-Year \$) | SPW Factors from Appendix Table B-1 for the Year the Cost Occurs | Present Value of Non-Recurring Costs |

(5) Total present value of Non-Annually Recurring costs: 0

C. Total Present Value of Annually and Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

$$\begin{aligned} A(3) + B(5) &= C \\ \$4,257 + 0 &= \underline{\underline{\$4,257}} \end{aligned}$$

(RWI continued)

V. Calculating Future Replacement Costs and Salvage Values

| (1) Year in Which Amount is Expected to Occur | (2) Replace- ment Cost (In Base- Year \$) | (3) Salvage Value (In Base- Year \$) | (4) SPW Factor from Appen- dix Table B-1 for the Year Amount Occurs | (5) Present Value of Replacement (5)=(2)x(4) | (6) Present Value of Salvage (6)=(3)x(4) |
|---|---|--|--|---|---|
|---|---|--|--|---|---|

| | | | | | |
|----|----------|-----|-------|---------|-----|
| 10 | \$10,000 | --- | 0.386 | \$3,860 | --- |
|----|----------|-----|-------|---------|-----|

A. Total Present Value of Replacement Costs \$3,860

B. Total Present Value of Salvage Values 0

VI. Calculating the Total Life-Cycle Cost (TLCC) of the Existing System

A. Present Value Energy Cost \$161,090
(RWI, Part II, Item E)

(plus)

B. Present Value Investment Cost 0
(RWI, Part III)

(plus)

C. Present Value Non-Fuel Operation \$ 4,257
and Maintenance Costs (RWI, Part IV, Item C)

(plus)

D. Present Value Replacement Cost \$ 3,860
(RWI, Part V, Item A)

(minus)

E. Present Value Salvage Value 0
(RWI, Part V, Item B)

(equals)

F. TLCC for the Existing System \$169,207

RETROFIT WORKSHEET 2 (RW2)

Life-Cycle Cost Evaluation of the Retrofit Building System

I. Identifying Information

- A. Alternative Building System Description: Geothermal System
- B. Expected Life of Alternative System: 30 years
- C. Expected Life of Building: 40 years
- D. Study Period: 20 years

II. Calculating the Present Value of Energy Costs with the Retrofit System

(See the text, Section 4.1.1, for special cases when this section may not be adequate for calculating the present value of energy costs.)

| | (1) Annual Units of Energy Measured Bldg/Facility Boundary | (2) Base Year Energy Price (Appendix Table C-1 or C-2) | (3) Base Year Energy Costs (3)=(1)x(2) | (4) UPW* Factor from Appen- dix B for Appropriate Fuel Type, Section, Region and Study Period | (5) Present Value Energy Costs over the Study Period (5)=(3)x(4) |
|----|--|---|---|---|--|
| A. | <u>36383 KWH</u> Electricity | <u>0.07</u> \$ Per Unit | <u>\$2,547</u> | <u>12.91</u> | <u>\$32,882</u> |
| B. | _____ | _____ | _____ | _____ | _____ |
| | a. | \$Per Unit | | | |
| C. | _____ | _____ | _____ | _____ | _____ |
| | | \$ Per Unit | | | |
| D. | _____ | _____ | _____ | _____ | _____ |
| | | \$ Per Unit | | | |
| E. | Total Present Value of Energy Costs with the Retrofit: | | | | <u><u>\$32,882</u></u> |

III. Calculating Investment Costs for the Retrofit System

Initial Investment Cost \$57,860
(Base Year \$)

(RW2 continued)

IV. Calculating Non-Fuel Operation and Maintenance Costs for the Retrofit System

A. Annually Recurring Non-Fuel Operating and Maintenance Cost

| (1) Base-Year Annual Recurring Cost | (2) UPW Factor from Appen- dix Table B-2 for the Project Study Period | (3) Present Value of Recurring Costs (3)=(1)x(2) |
|---|--|---|
| 200 | 8.514 | <u>\$1,703</u> |

B. Non Annually Recurring Non-Fuel Operating and Maintenance Cost

| (1) Year in Which Cost is Expected to Occur | (2) Amount of Cost (In Base-Year \$) | (3) SPW Factors from Appendix Table B-1 for the Year the Cost Occurs | (4) Present Value of Non- Recurring Costs |
|--|--|--|--|
| | | | |

(5) Total present value of Non-Annually recurring costs: 0

C. Total Present Value of Annually and Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

$$A(3) + B(5) = C$$

$$\$1,703 + 0 = \underline{\underline{\$1,703}}$$

V. Calculating Future Replacement Costs and Salvage Values

| (1) Year in Which Amount is Expected to Occur | (2) Replace- ment Cost (In Base- Year \$) | (3) Salvage Value (In Base- Year \$) | (4) SPW Factor from Appen- dix Table B-1 for the Year Amount Occurs | (5) Present Value of Replacement (5)=(2)x(4) | (6) Present Value of Salvage (6)=(3)x(4) |
|---|---|--|--|---|---|
| 10 | \$2,000 | --- | 0.386 | \$772 | --- |
| A. Total Present Value of Replacement Costs | | | | <u>\$772</u> | |
| B. Total Present Value of Salvage Values | | | | | <u>0</u> |

(RW2 continued)

VI. Calculating the Total Life-Cycle Cost (TLCC) of the Retrofit System

| | | |
|---|----------|------------------------|
| A. Present Value Energy Costs (RW2, Part II, Item E) | | <u>\$32,882</u> |
| | (plus) | |
| B. Present Value Investment Costs (RW2, Part III) | | <u>\$57,860</u> |
| | (plus) | |
| C. Present Value Non-Fuel Operation and Maintenance Costs (RW2, Part IV, Item C) | | <u>\$ 1,703</u> |
| | (plus) | |
| D. Present Value Replacement Cost (RW2, Part V, Item A) | | <u>\$ 772</u> |
| | (minus) | |
| E. Present Value Salvage Value (RW2, Part V, Item B) | | <u>0</u> |
| | (equals) | |
| F. TLCC for the Retrofit System | | <u><u>\$93,217</u></u> |

RETROFIT WORKSHEET 3 (RW3)

Calculating the SIR for Ranking the Retrofit Project

I. SIR Denominator

A. Calculating the Change in Investment Cost Attributable to the Retrofit Project

| | | |
|---|----------|------------------|
| (1) Retrofit Investment Cost (RW2, Part III) | | \$ 57,860 |
| | (minus) | |
| (2) Existing System Investment Cost (RW1, Part III) | | 0 |
| | (equals) | |
| (3) Net Investment Cost of Retrofit Project | | <u>\$ 57,860</u> |

B. Calculating the Change in Salvage Value Attributable to the Retrofit Project

| | | |
|---|----------|----------|
| (1) Retrofit System Salvage Value (RW2, Part V, Item B) | | 0 |
| | (minus) | |
| (2) Existing System Salvage Value (RW1, Part V, Item B) | | 0 |
| | (equals) | |
| (3) Net Salvage Value of Retrofit Project | | <u>0</u> |

C. Calculating the Change in Replacement Costs Attributable to the Retrofit Project

| | | |
|---|----------|-------------------|
| (1) Retrofit System Replacement Costs (RW2, Part V, Item A) | | \$ 772 |
| | (minus) | |
| (2) Existing System Replacement Cost (RW1, Part V, Item A) | | \$ 3,860 |
| | (equals) | |
| (3) Net Replacement Cost of Retrofit Project | | <u>- \$ 3,088</u> |

D. Calculating the SIR Denominator

| | | |
|--|----------|------------------|
| (1) Net Retrofit Investment Cost (RW3, Part I, Item A(3)) | | \$ 57,860 |
| | (minus) | |
| (2) Net Retrofit Salvage Value (RW3, Part I, Item B(3)) | | 0 |
| | (plus) | - 3,088 |
| (3) Net Retrofit Replacement Cost (RW3, Part I, Item C(3)) | | |
| | (equals) | |
| (4) SIR Denominator | | <u>\$ 54,772</u> |

II. SIR Numerator

A. Calculating the Change in Energy Costs Attributable to the Retrofit Project

| | | |
|--|----------|------------------|
| (1) Existing System Energy Cost (RW1, Part II, Item E) | | \$161,090 |
| | (minus) | |
| (2) Retrofit System Energy Cost (RW2, Part II, Item E) | | 32,882 |
| | (equals) | |
| (3) Retrofit Energy Savings | | <u>\$128,208</u> |

(RW3 continued)

B. Calculating the Change in Non-Fuel Operation and Maintenance Costs Attributable to the Retrofit Project

| | | |
|--|----------|------------------|
| (1) Retrofit System Non-Fuel Operation and Maintenance Cost (RW2, Part IV, Item C) | | \$ 1,703 |
| | (minus) | |
| (2) Existing System Non-Fuel Operation and Maintenance Cost (RW1, Part IV, Item C) | | \$ 4,257 |
| | (equals) | |
| (3) Net Change in Non-Fuel Operation and Maintenance Cost | | <u>-\$ 2,554</u> |

C. Calculating the SIR Numerator

| | | |
|---|----------|------------------|
| (1) Retrofit Energy Savings (RW3, Part II, Item A(3)) | | \$128,208 |
| | (minus) | |
| (2) Net Change in Non-Fuel Operation and Maintenance Cost (RW3, Part II, Item B(3)) | | -\$ 2,554 |
| | (equals) | |
| (3) SIR Numerator | | <u>\$130,762</u> |

III. SIR

A. Calculating SIR

| | | |
|---|--------------|------------|
| (1) SIR Numerator (RW3, Part II, Item C(3)) | | \$130,762 |
| | (Divided by) | |
| (2) SIR Denominator (RW3, Part I, Item D (4)) | | \$ 54,772 |
| | (equals) | |
| (3) SIR | | <u>2.4</u> |

RETROFIT WORKSHEET 1 (RW1)

Life-Cycle Cost Evaluation of the Existing Building System

I. Identifying Information

- A. Name of Agency: Ojo Caliente Mineral Springs Co.
- B. Existing Building System Description: Hotel Building w/insulation
- C. Location: Ojo Caliente, NM
- D. Gross Floor Area Affected: 7019
- E. Expected Life of Existing System: 10-20 years
- F. Expected Life of Building: 40 years
- G. Study Period: 20 years

II. Calculating the Present Value of Energy Costs with the Existing System

(See the text, Section 4.1.1, for special cases when this section may not be adequate for calculating the present value of energy costs.)

| | (1) Annual Units of Energy Measured Bldg/Facility Boundary | (2) Base Year Energy Price (Appendix Table C-1 or C-2) | (3) Base Year Energy Costs (3)=(1)x(2) | (4) UPW* Factor from Appen- dix B for Appropriate Fuel Type, Sector, Region, and Study Period | (5) Present Value Energy Costs over the Study Period (5)=(3)x(4) |
|----|--|---|---|---|--|
| A. | <u>Electricity</u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| B. | <u>Natural Gas</u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| C. | <u>10,500</u> PROPANE | <u>0.77</u> \$ Per Unit | <u>\$8,085</u> | <u>14.36</u> | <u>\$116,101</u> |
| D. | <u> </u> | <u>\$ Per Unit</u> | <u> </u> | <u> </u> | <u> </u> |
| E. | Total Present Value of Energy Costs with the Existing System: <u>\$116,101</u> | | | | |

(RWI continued)

W/INSULATION

III. Calculating Investment Costs for the Existing System

Base-Year Salvage Value = \$24,500
(Base Year \$)

(Note: The investment cost of an existing system is equal to the current salvage value of the system plus any investment costs required to make it functional.)

IV. Calculating Non-Fuel Operation and Maintenance Costs for the Existing System

A. Annually Recurring Non-Fuel Operation and Maintenance Costs

| (1) | (2) | (3) |
|------------------------------------|---|--|
| Base-Year Annual Recurring Cost | UPW Factor from Appen- dix Table B-2 for the Project Study Period | Present Value of Recurring Costs (3)=(1)x(2) |
| \$500 | 8.514 | <u>\$4.257</u> |

B. Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

| (1) | (2) | (3) | (4) |
|---|-------------------------------------|---|---|
| Year in Which Cost is Expected to Occur | Amount of Cost (In Base-Year \$) | SPW Factors from Appendix Table B-1 for the Year the Cost Occurs | Present Value of Non- Recurring Costs |

(5) Total present value of Non-Annually Recurring costs: 0

C. Total Present Value of Annually and Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

$$A(3) + B(5) = C$$

$$\$4257 + 0 = \underline{\underline{\$4257.00}}$$

(RW1 continued)

W/INSULATION

V. Calculating Future Replacement Costs and Salvage Values

| (1) Year in Which Amount is Expected to Occur | (2) Replace- ment Cost (In Base- Year \$) | (3) Salvage Value (In Base- Year \$) | (4) SPW Factor from Appen- dix Table B-1 for the Year Amount Occurs | (5) Present Value of Replacement (5)=(2)x(4) | (6) Present Value of Salvage (6)=(3)x(4) |
|---|---|--|--|---|---|
| 10 | \$10,000 | --- | 0.386 | \$3,860 | --- |

A. Total Present Value of Replacement Costs \$3,860

B. Total Present Value of Salvage Values 0

VI. Calculating the Total Life-Cycle Cost (TLCC) of the Existing System

| | |
|---|------------------|
| A. Present Value Energy Cost (RW1, Part II, Item E) | <u>\$116,101</u> |
| (plus) | |
| B. Present Value Investment Cost (RW1, Part III) | <u>\$ 24,500</u> |
| (plus) | |
| C. Present Value Non-Fuel Operation and Maintenance Costs (RW1, Part IV, Item C) | <u>\$ 4,257</u> |
| (plus) | |
| D. Present Value Replacement Cost (RW1, Part V, Item A) | <u>\$ 3,860</u> |
| (minus) | |
| E. Present Value Salvage Value (RW1, Part V, Item B) | <u>0</u> |
| (equals) | |
| F. TLCC for the Existing System | <u>\$148,718</u> |

RETROFIT WORKSHEET 2 (RW2)

Life-Cycle Cost Evaluation of the Retrofit Building System

I. Identifying Information

- A. Alternative Building System Description: Geothermal System w/insulation
- B. Expected Life of Alternative System: 30 years
- C. Expected Life of Building: 40 years
- D. Study Period: 20 years

II. Calculating the Present Value of Energy Costs with the Retrofit System

(See the text, Section 4.1.1, for special cases when this section may not be adequate for calculating the present value of energy costs.)

| | (1) Annual Units of Energy Measured Bldg/Facility Boundary | (2) Base Year Energy Price (Appendix Table C-1 or C-2) | (3) Base Year Energy Costs (3)=(1)x(2) | (4) UPW* Factor from Appen- dix B for Appropriate Fuel Type, Section, Region and Study Period | (5) Present Value Energy Costs over the Study Period (5)=(3)x(4) |
|----|--|---|---|---|--|
| A. | <u>36,383</u> Electricity | <u>0.07</u> \$ Per Unit | <u>\$2,547</u> | <u>12.91</u> | <u>\$32,882</u> |
| B. | _____ | _____ | _____ | _____ | _____ |
| | a. | \$ Per Unit | | | |
| C. | _____ | _____ | _____ | _____ | _____ |
| | | \$ Per Unit | | | |
| D. | _____ | _____ | _____ | _____ | _____ |
| | | \$ Per Unit | | | |
| E. | Total Present Value of Energy Costs with the Retrofit: | | | | <u><u>\$32,882</u></u> |

III. Calculating Investment Costs for the Retrofit System

| | |
|-------------------------|------------------------|
| Initial Investment Cost | <u><u>\$80,200</u></u> |
| | (Base Year \$) |

(RW2 continued)

W/INSULATION

IV. Calculating Non-Fuel Operation and Maintenance Costs for the Retrofit System

A. Annually Recurring Non-Fuel Operating and Maintenance Cost

| (1) | (2) | (3) |
|---------------------------------|---|---|
| Base-Year Annual Recurring Cost | UPW Factor from Appendix Table B-2 for the Project Study Period | Present Value of Recurring Costs (3)=(1)x(2) |
| 200 | 8.514 | <u>\$1,703</u> |

B. Non Annually Recurring Non-Fuel Operating and Maintenance Cost

| (1) | (2) | (3) | (4) |
|---|----------------------------------|--|--------------------------------------|
| Year in Which Cost is Expected to Occur | Amount of Cost (In Base-Year \$) | SPW Factors from Appendix Table B-1 for the Year the Cost Occurs | Present Value of Non-Recurring Costs |

(5) Total present value of Non-Annually recurring costs: 0

C. Total Present Value of Annually and Non-Annually Recurring Non-Fuel Operation and Maintenance Costs

$$A(3) + B(5) = C$$

$$\$1,703 + 0 = \underline{\underline{\$1,703}}$$

V. Calculating Future Replacement Costs and Salvage Values

| (1) | (2) | (3) | (4) | (5) | (6) |
|---|------------------------------------|---------------------------------|---|--|--------------------------------------|
| Year in Which Amount is Expected to Occur | Replacement Cost (In Base-Year \$) | Salvage Value (In Base-Year \$) | SPW Factor from Appendix Table B-1 for the Year Amount Occurs | Present Value of Replacement (5)=(2)x(4) | Present Value of Salvage (6)=(3)x(4) |
| 10 | \$2,000 | --- | 0.386 | \$772 | --- |
| A. Total Present Value of Replacement Costs | | | | <u>\$772</u> | |
| B. Total Present Value of Salvage Values | | | | | <u>0</u> |

(RW2 continued)

W/INSULATION

VI. Calculating the Total Life-Cycle Cost (TLCC) of the Retrofit System

| | |
|---|------------------|
| A. Present Value Energy Costs (RW2, Part II, Item E) | \$32,882 |
| | (plus) |
| B. Present Value Investment Costs (RW2, Part III) | \$80,200 |
| | (plus) |
| C. Present Value Non-Fuel Operation and Maintenance Costs (RW2, Part IV, Item C) | \$ 1,703 |
| | (plus) |
| D. Present Value Replacement Cost (RW2, Part V, Item A) | \$ 1,772 |
| | (minus) |
| E. Present Value Salvage Value (RW2, Part V, Item B) | _____ |
| | (equals) |
| F. TLCC for the Retrofit System | <u>\$116,557</u> |

RETROFIT WORKSHEET 3 (RW3)

Calculating the SIR for Ranking the Retrofit Project

I. SIR DenominatorA. Calculating the Change in Investment Cost Attributable to the Retrofit Project

| | | |
|---|----------|------------------|
| (1) Retrofit Investment Cost (RW2, Part III) | | \$180,200 |
| (2) Existing System Investment Cost (RW1, Part III) | (minus) | 24,500 |
| (3) Net Investment Cost of Retrofit Project | (equals) | <u>\$ 55,700</u> |

B. Calculating the Change in Salvage Value Attributable to the Retrofit Project

| | | |
|---|----------|----------|
| (1) Retrofit System Salvage Value (RW2, Part V, Item B) | | 0 |
| (2) Existing System Salvage Value (RW1, Part V, Item B) | (minus) | 0 |
| (3) Net Salvage Value of Retrofit Project | (equals) | <u>0</u> |

C. Calculating the Change in Replacement Costs Attributable to the Retrofit Project

| | | |
|---|----------|------------------|
| (1) Retrofit System Replacement Costs (RW2, Part V, Item A) | | \$ 772 |
| (2) Existing System Replacement Cost (RW1, Part V, Item A) | (minus) | \$ 3,860 |
| (3) Net Replacement Cost of Retrofit Project | (equals) | <u>-\$ 3,088</u> |

D. Calculating the SIR Denominator

| | | |
|--|----------|-----------------|
| (1) Net Retrofit Investment Cost (RW3, Part I, Item A(3)) | | \$55,700 |
| (2) Net Retrofit Salvage Value (RW3, Part I, Item B(3)) | (minus) | 0 |
| (3) Net Retrofit Replacement Cost (RW3, Part I, Item C(3)) | (plus) | -\$ 3,088 |
| (4) SIR Denominator | (equals) | <u>\$52,612</u> |

II. SIR NumeratorA. Calculating the Change in Energy Costs Attributable to the Retrofit Project

| | | |
|--|----------|------------------|
| (1) Existing System Energy Cost (RW1, Part II, Item E) | | \$116,101 |
| (2) Retrofit System Energy Cost (RW2, Part II, Item E) | (minus) | \$ 32,882 |
| (3) Retrofit Energy Savings | (equals) | <u>\$ 83,219</u> |

(RW3 continued)

W/INSULATION

B. Calculating the Change in Non-Fuel Operation and Maintenance Costs Attributable to the Retrofit Project

| | | |
|--|----------|------------------|
| (1) Retrofit System Non-Fuel Operation and Maintenance Cost (RW2, Part IV, Item C) | | \$ 1,703 |
| | (minus) | |
| (2) Existing System Non-Fuel Operation and Maintenance Cost (RW1, Part IV, Item C) | | \$ 4,257 |
| | (equals) | |
| (3) Net Change in Non-Fuel Operation and Maintenance Cost | | <u>-\$ 2,554</u> |

C. Calculating the SIR Numerator

| | | |
|---|----------|-----------------|
| (1) Retrofit Energy Savings (RW3, Part II, Item A(3)) | | \$83,219 |
| | (minus) | |
| (2) Net Change in Non-Fuel Operation and Maintenance Cost (RW3, Part II, Item B(3)) | | -\$ 2,554 |
| | (equals) | |
| (3) SIR Numerator | | <u>\$85,773</u> |

III. SIR

A. Calculating SIR

| | | |
|---|--------------|------------|
| (1) SIR Numerator (RW3, Part II, Item C(3)) | | \$85,773 |
| | (Divided by) | |
| (2) SIR Denominator (RW3, Part I, Item D (4)) | | \$52,612 |
| | (equals) | |
| (3) SIR | | <u>1.6</u> |