

PROPOSAL EVALUATION SUMMARY NO. 015

Technical score - 244

Business score - 40

Northwest Geothermal Corporation (Profit)
 Downtown Heating District
 Lakeview, Oregon

Carl N. Petterson	\$360,900	DOE cost
March 1, 1981 (12 months)	\$401,000	Total cost

Production Well, Injection Well

Percent Geothermal: 100%	\$/10 ⁶ Btu: \$8.72
Utilization Factor: 7.5%	Btu/yr/DOE Funds: 6.1×10^4
	\$/Installed kW: \$217
Reject Temp.: 140-170°F	Annual Equiv. #2 oil: 225,000 gal

Summary

This project is to provide space- and water-heating within the Lakeview, Oregon, central business district. No exploration program is planned. The drilling plan calls for one production well with target depth to 3000 ft; bottom hole diameter 12-1/4 in. An injection well would be drilled to 800 ft with 8-5/8-in. casing set from the surface to total depth. A successful project is defined to have at the beginning is 560 gpm at 210°F with a pumping depth of 500 ft and up to 1000 gpm after the distribution system is expanded. Production will be from fractured rock. The test plan includes both a short- and long-term test. The project team consists of Northwest Geothermal Corporation.

Technical Strengths

Resource. Excellent chance for occurrence of resource.

Testing. The proposal contains a good plan to obtain reservoir data while drilling, and a reasonable well flow test plan. Background data on the reservoir and existing production and observation wells are discussed satisfactorily. The testing of the injection well is addressed.

Personnel. The qualifications of all project participants are good.

Project Management. The project plan is well thought out. The task assignments and decision points are identified. Good management techniques are evident in a well-organized and logical project management structure. Adequate geological and management expertise is included in the project team.

Drilling. Exceptionally thorough and appropriate drilling plan with more than adequate technical details which demonstrates significant engineering expertise.

Environmental. Geothermal water from an existing nearby 1820-ft well is of high quality (approximately drinking water quality). Therefore, it is reasonable to anticipate water of similar quality in the proposed well. The environmental protection aspects of the well design appear to be very adequate.

End-Use. The business district is compact and has a high demand. These are good characteristics for a district heating system. Cascaded uses are proposed.

Cost/Economics. The cost breakdowns are very complete and detailed.

General. The proposal covered the solicitation requirements very well.

Technical Weaknesses

Resource. The analysis of the resource and reservoir data is not discussed. The hydrologic data base is not sufficient to support the contention that recharge will support long-term production.

Exploration. The proposed geologic mapping is not adequate. Better detailed structural geology control is needed to pick a drill site. This information should be obtained prior to any other exploration work.

Drilling. It is proposed that potential zones of interest in both the production and injection wells be drilled with 9.4 lb/gal mud; this may result in reduction in productivity/injectivity. There is no mention of precautionary measures (low water loss mud, etc.) to be taken during drilling through the 300-ft clay zone in the injection well. The function of the two permanently installed gravel feed pipes should be defined. The proposal narrative states drilling will be done during the day only because of the location; however, the schedule is based on a 24-hour/day operation.

Testing. The configuration of the flow test setup is not defined. A pumping level of 500 ft is optimistic. A more conservative pumping level of 700-800 ft would be reasonable.

Personnel. Reservoir, drilling, and environmental consultants are not included in the project team. In particular, the drilling supervisory experience for geothermal production hole drilling is minimal or lacking. No one with environmental experience has been identified to prepare the environmental report. In addition, Hydrosience is shown as a consultant in the body of the proposal, but not on the organization chart.

Environmental. The environmental report and issues are not emphasized in the statement of work. Additional environmental factors may have to be considered before drilling can proceed. Contingency plans are not adequately outlined to deal with the possibility (although apparently remote) that the water quality will be low. The water from the flow test is to be disposed of into a storm culvert and intermittent stream that receives water from a developed hot spring. The thermal impact that the proposed increased volume of moderately high temperature water will have on the stream and associated marsh should be addressed.

Permits. Water rights may be a question since irrigation currently reduces the water supply to existing warm/hot wells; therefore, drilling a production well may contribute to groundwater interference. Land and water permits are not presented in the proposal, but are probably not a major problem since Northwest Geothermal Corp. has worked with the city before.

End-Use. The valving and flow paths for the alcohol plant must be clarified. Alternate uses should be found for the 166°F waste water. This would drop the cost per million Btu significantly (presently \$9/10⁶ Btu). If alternate uses cannot be found, the heating equipment should be redesigned to get greater temperature drops and reduce flow requirements. This will increase the present low system utilization factor. If a higher utilization of the geothermal resource could be obtained, the economics of this project would be very good.

Cost-Share. The cost-share is not reasonable with regards to pump depth (500 ft) and total dissolved solids (100 ppm).

Conclusions

It is suggested that detailed geologic mapping, perhaps aided by analysis of aerial photographs and soil mercury surveys, be undertaken prior to selecting the drill site. Because the target is a fracture-controlled reservoir at 3000 ft, drill site selection (to the nearest few tens of feet) is critical.

BUSINESS COMMITTEE SUMMARY

PROPOSAL: NORTHWEST GEOTHERMAL CORPORATION

NO. 015

Score

Criterion 7 _____
Criterion 8 _____
Criterion 9 _____

SUMMARY

This was a fairly well developed proposal by an experienced organization, demonstrating good cost estimates. Only minor lack of detail problems were observed. End use commitments were lacking.

BUSINESS STRENGTHS

1. Fully loaded labor costs for NGC personnel - \$22.89/hr.
2. Production well at 3000 ft = \$105/ft; injection well at 800 ft = \$71/ft. (7)
3. All costs in general demonstrate good balance and appear reasonable. (7)
4. NGC has received from the Town of Lakeview a franchise to exclusively distribute geothermal energy. This should serve to enhance their financing prospects with regard to the proposed project. (8)
5. Any strength in support of the specific financing plan presented would be attributed to Northwest Natural Gas Co.'s relatively strong financial wherewithal - only 25.9% of capitalization is represented by common stock - good balance for an investor-owned utility.
6. Good set of project management and support personnel credentials (9).
7. Satisfactory record of past geothermal-related performance (9).
8. Well established company/subsidiary relationship. (9)
9. NGC has worked on maintaining an existing geothermal well for a swimming pool application in Lakeview. (9)
10. NGC has an ongoing PRDA contract with DOE to perform an engineering/economic study in the Lakeview geothermal resource area.
11. Information relevant to the proposed project will be taken from Oregon Dept. of Geology and Mineral Industries PRDA which is more of a geological/hydrological treatise than the PRDA referenced above. (9)
12. NGC has already managed flow testing on several wells in Lakeview. (9)

13. NGC's overall financial health is good in general sense.

BUSINESS WEAKNESSES

1. No computation method for G&A and O/H calculations.
2. Poor labor/schedule integration. (7)
3. Relatively labor intensive. (7)
4. Financial plan is not well through through (at least not in the form presented). It is very tentative in character. (8)
5. Management/cost control plan is not well detailed. (8)
6. Alcohol plant represents roughly 4/13 of total energy load. This customer dependency is reflected in their project's overall economic evaluation. Therefore, this component should have been addressed in the overall financial plan.
7. No end-user commitments of or expressions of interest. (8)
8. NGC's current financial position is ot considered good relative to their current ratio.

GEOPRODUCTS TESTING REPORT

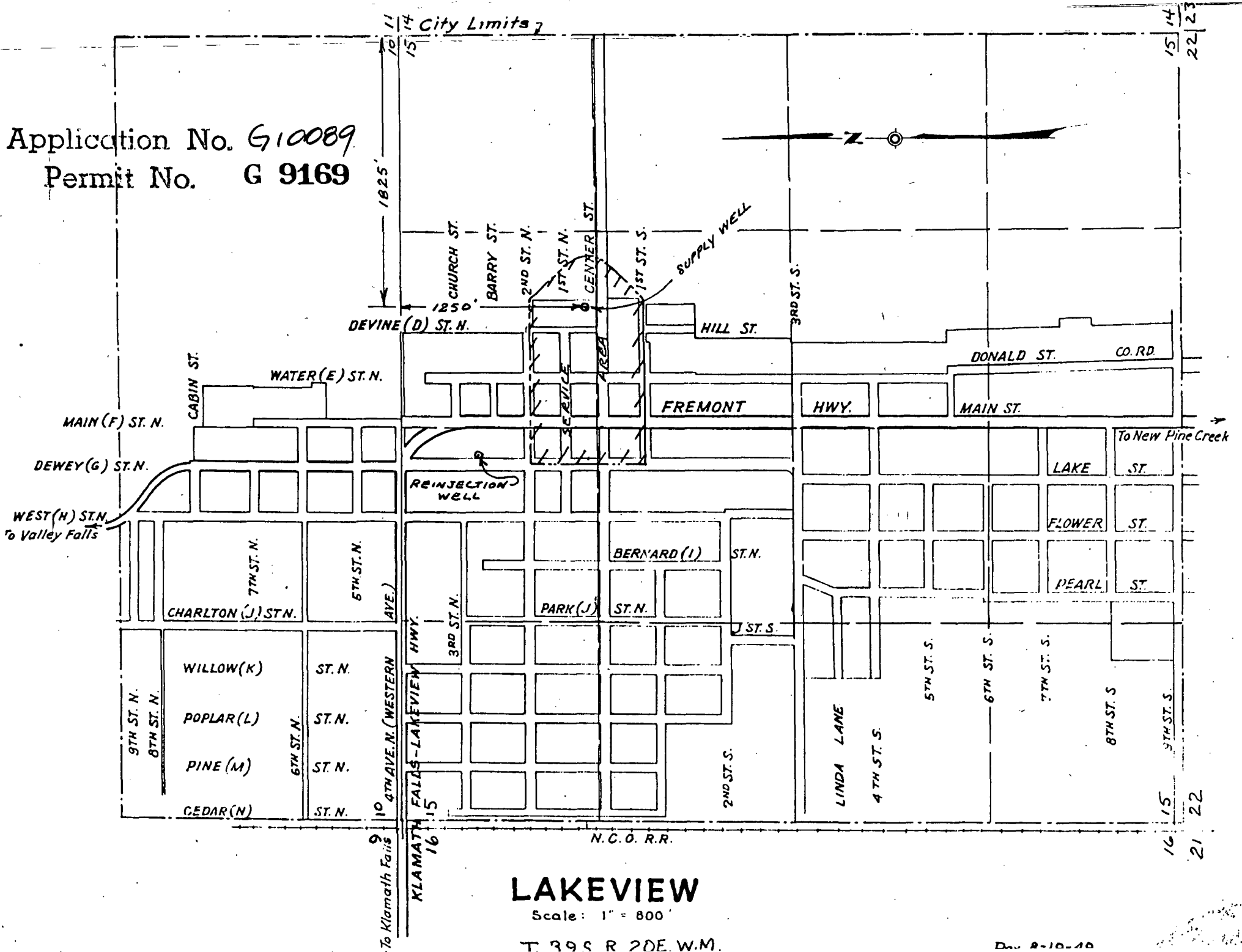
<u>DATE</u>	<u>ACTIVITY</u> (Reported Nov. 12, 1981 - 1:00 P.M.)
11/11/81	Ran the temperature probe at: 200 ft - 247°F 5300 ft - 247°F 5830 ft - 241°F (BHT) Well was shut in at time of temperature run.
11/12/81	Rigging up temperature/pressure probe and will log to bottom, and then turn the well on with probe on bottom.

Miscellaneous:

1. Will start 200 gpm pulse test today.
2. All EG&G equipment working ok.
3. Skiba, Mizell, Thompson, Gertsch, and Russell are on location.
4. Bad weather has caused muddy conditions.

Jon Strawn
Monitor Team Secretary

Application No. G10089
 Permit No. G 9169



LAKEVIEW

Scale: 1" = 800'

T. 39 S. R. 20 E. W.M.

Dec. 2-10-40

GROUND-WATER GEOLOGIST C-

Applications are being accepted from hydrogeologists for U.S. Department of Energy funded geothermal resource investigations in Colorado. Applicants must have a B.A. degree in hydrogeology or a closely related degree plus two years of experience. A Master's degree may be substituted for one year of experience. Salary: \$20,000-22,000/year.

Apply by March 15, 1981 to the

Colorado Geological Survey
1313 Sherman Street, Rm. 715
Denver, Colorado 80203
(303) 839-2611

NEVADA

PROPOSED GEOTHERMAL LEGISLATION IN NEVADA. Testimony presented recently to a State of Nevada Special Geothermal Committee by the Nevada Department of Energy and the National Conference of State Legislatures advocated the development of a district heating bill which would eliminate several problems for firms entering the geothermal direct-use market.

A Nevada law enacted in 1919 covers, among other things, the sale of heat. A conservative interpretation of the law would place the regulation of the sale of heat under the Nevada Public Service Commission (PSC), thus classifying a resource developer as a utility. If left on the books, this legislation, enacted before geothermal energy was seriously considered a major energy source, could cause problems for resource developers.

In an attempt to provide a more realistic vehicle for the development of geothermal resources for direct use, the Nevada Department of Energy has proposed, in part, that wholesale vendors of heat be separated from vendors selling heat directly to the user, i.e., a firm with five or fewer customers as opposed to a firm operating a district-heating system. The draft legislation would exempt the wholesaler from all PSC regulations and would require that the vendor for a district-heating project need only obtain an operating permit instead of a full Certificate of Public Convenience and Necessity. A Certificate of Public Convenience and Necessity involves the setting of rates and certification of the quantity and quality of the resource. A vendor of heat would *not* have the right to require that a customer be restricted only to the use of geothermal heat. This provision will allow competition and encourage the development of an energy mix. The proposed space heating bill also addresses

a variety of resource regulations and geothermal electrical generation issues.

This legislation currently exists only in draft form and could be amended prior to its submittal to the Nevada Legislature, probably in late February 1981.

NORNAV TO MAKE POWER PLANT TESTS. Sierra Pacific Power Company of Reno, Nevada; one of five utilities which make up the Northern Nevada Utility Group (NORNAV), is completing construction of a portable power plant test unit for installation at a northern Nevada geothermal field.

The test unit features two full-scale loops or passes which duplicate piping configuration of the 10 MW binary type power plant proposed for eventual installation by NORNAV (BULLETIN, No. 9, Vol. 8, September 1980). One of the loops will be used as a baseline data system and the other for various on-line experiments, i.e., injection of chemicals, variation of flow rates, etc. In addition, each test loop will be equipped with a test heat exchanger and a power fluid loop. The power fluid systems for each test loop will be filled with a hydrocarbon fluid. Costs of the test unit are being divided by NORNAV and Electric Power Research Institute (EPRI) of Palo Alto, California.

Plans are to have the test unit in operation on an actual well, probably at either Beowawe or Dixie Valley by late January 1981. A third field, Steamboat Springs, is also being considered; however, an agreement with the operator (Phillips Petroleum Company) may not be possible within the critical time frame. Experimental power plant permitting procedures are under way for all three fields.

START-UP AT NEVADA'S WABUSKA ETHANOL PLANT. The Wabuska ethanol plant (rated at 400,000 gal/year) near Yerington, Nevada (BULLETIN, Vol. 9, No. 9, October 1980) is now in the start-up phase. Developed and funded through Tad's Enterprises of Oakland, California, the plant will use geothermal heat to produce ethanol from corn shipped from the midwest. The plant's fermentation tanks are reported to be at capacity although the still has not yet reached its full design capacity.

Energy is supplied by a 350-ft geothermal well producing water at 220°F and flowing artesian at 176 gpm. A pump has been installed on the well increasing its capacity to 400 gpm. Plans are to double the existing operation as soon as the first plant is fully operational.

Ethanol from the Wabuska plant will be sold through an existing contract to the Western Mountain Oil Company of Sparks, Nevada and it is hoped that the slops, which are high in protein, can be marketed locally as cattle feed.

GREENHOUSES PLANNED AT WABUSKA. Alexander Dawson, Inc. (ADI) of Las Vegas, Nevada is proposing to construct geothermal greenhouses near the town of Wabuska, Nevada. A groundbreaking date has not yet been set, although the cost estimates, feasibility study, and environmental impact reports should be completed by May 1981. Project designer is Resource Concepts of Carson City, Nevada.

ADI's greenhouses will be constructed on a 3.5-acre parcel tapping heat from two or three wells near the area. A decision regarding whether the greenhouses will produce florals or vegetables awaits further study on the economic feasibility of the surrounding market.

NEVADA CASINO CONVERTS TO GEOTHERMAL HEATING. The El Capitan Casino in Hawthorne, Nevada is converting its present heating system to geothermal in order to conserve energy and cut costs. The geothermal heating system will be supplied by a well located one and a half miles from the casino and one mile southwest of the Hawthorne city limits (Sec.33,T8N,R30E,MBD&M). Completed in August 1980 the 650-ft well produces 210°F water at a pumped rate greater than 700 gpm. The water has a high mineral content and contains a slight amount of arsenic. Delivered to the casino through a pre-insulated Fiberglas pipe system, the temperature of the water is expected to drop only about five degrees. Anticipated completion date of the project is in Winter 1981 at an estimated cost of \$1.5-2.0 million.

GEOTHERMAL POTENTIAL STUDIED IN NEVADA COUNTY. Mineral County, Nevada has recently become the site of a variety of studies aimed at locating and developing geothermal resources for space heating and other possible direct uses. In the city of Hawthorne, Chilton Engineering (Reno, NV) and the Oregon Institute of Technology are looking into the possibility of retrofitting municipal buildings, schools and a hospital for geothermal heating. Studies are currently being performed for Hawthorne's Public Safety Building, the County Courthouse, the Mineral County Library, and Mount Grant Hospital. Chilton Engineering is also performing a general district-heating evaluation for the city. Geothermal Development Associates (Reno, NV) is developing site-specific studies for the cities of Hawthorne and Gabb Under contract to the Nevada Department of Energy (BULLETIN, Vol. 9, No. 10, November 1980). In addition, the Nevada Bureau of Mines is conducting exploration of the entire Walker Lake Valley to determine its geothermal potential.