IN THE OFFICE OF THE STATE ENGINEER

IN THE MATTER OF APPLICATIONS 49943,) 49944, 49945 and 49946 FILED BY MUNSON) GEOTHERMAL, INC. TO APPROPRIATE) UNDERGROUND WATER WITHIN THE) BRADY'S HOT SPRINGS AREA, CHURCHILL) COUNTY, NEVADA.)

RULING

GENERAL

I.

Application 49943 was filed with the State Engineer by Munson Geothermal, Inc. on June 25, 1986, to appropriate underground (geothermal) water within the SW1/4 SE1/4 of Section 1, T.22N., R.26E., M.D.B.&M. The beneficial use contemplated by this Application involves utilization of a flow rate of 1529 GPM for electric power generation purposes, and a potential related consumption of water of up to 20% of this flow rate.

Application 49944 was filed with the State Engineer by Munson Geothermal, Inc. on June 25, 1986, to appropriate underground (geothermal) water within the NW1/4 SE1/4 of Section 1, T.22N., R.26E., M.D.B.&M. The beneficial use contemplated by this Application involves utilization of a flow rate of 1529 GPM for electric power generation purposes, and a potential related consumption of water of up to 20% of this flow rate.

Application 49945 was filed with the State Engineer by Munson Geothermal, Inc. on June 25, 1986, to appropriate underground (geothermal) water within the SW1/4 SE1/4 of Section 1, T.22N., R.26E., M.D.B.&M. The beneficial use contemplated by this Application involves utilization of a flow rate of 1529 GPM for electric power generation purposes, and a potential related consumption of water of up to 20% of this flow rate.

Application 49946 was filed with the State Engineer by Munson Geothermal, Inc. on June 25, 1986, to appropriate underground (geothermal) water within the NW1/4 SE1/4 of Section 1, T.22N., R.26E., M.D.B.&M. The beneficial use contemplated by this Application involves utilization of a flow rate of 1529 GPM for electric power generation purposes, and a potential related consumption of water of up to 20% of this flow rate.

II.

Applications 49943, 49944, 49945 and 49946 were timely protested by Gilroy Foods (Hereinafter"GFP). Each protest requested the application be denied on the following grounds:

> "The granting of Application(s) (49943, 49944, 49945 and 49946) will jeopardize existing rights of Gilroy Foods. These applications and existing permits are for consumptive use of geothermal water. The Brady Geothermal System is recharged from the ground water basin that depends upon the perennial yield of the basin. This basin is already over-appropriated and the granting of additional permits well have an effect on existing rights. The transient presure analysis performed showed that Munson Geothermal, Inc. wells and Gilroy Foods' wells are interconnected. MGI-1 and Grace 1 respondence were almost identical, entirely independent of radial distance. This certainly illustrates that no large local aquifer exists. Geothermal resource is being extracted from the Brady Fault which is recharged by leakage through the fracture patterns from the valley to the west. The total consumptive use for existing permits is 4155 acre feet which far exceeds the estimated perennial yield of 2500 acre feet. For further documentation, refer to the transcript and brief in the joint hearing of

Munson Geothermal, Inc. and Gilroy Foods."

Applications 49943, 49944, 49945 and 49946 were ready for action on October 25, 1986.[1]

III.

The wells described under Applications 49943, 49944, 49945 and 49946 were the subject of a joint administrative hearing held before the Nevada Department of Minerals and the State Engineer beginning on April 17, 1986. Full opportunity was provided to all parties to supplement the record. No additional evidence or testimony were received within the time period allowed.[2]

IV.

A significant number of exhibits, published reports and analyses of well testing results, as well as other references have been reviewed by the State Engineer in rendering this determination. For brevity, this list of references and exhibits is not duplicated here and the reader is referred to the entire list of exhibits and references found in the complete hearing files in the Office of State Engineer. The State Engineer has reviewed the entire record in this matter, and has taken administrative notice of the record developed in the previous related matter of Applications 47168 - 47176 (inclusive).

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1 See Applications 49943, 49944, 49945 and 49946 filed in the office of the State Engineer.

2 The authority for this hearing is provided under NRS 534A.070(4). See also letter dated April 21, 1987, under the signature of Peter G. Morros, State Engineer, in Application File Nos. 49943, 49944, 49945 and 49946.

FINDINGS OF FACT

I.

Gilroy Foods, Inc. is the senior appropriator within the Brady's Hot Springs area by virtue of the earlier filing dates on its seven underground water appropriation permits, for industrial (geothermal) and domestic purposes. Gilroy Foods, Inc., (hereinafter "GFP") is the owner of record of seven (7) well permits on five (5) wells. Proof of beneficial use has been filed on Permits 29511, Certificate 10559, and on Permit 29512, Certificate 10560, for diversion rate of 1.56 c.f.s. (700 GPM) each and a total consumption of 473.31 acre-feet each for the period of June 1st to October 31 of each year. Permits 44643, 44644, 44645, 44646 and 44647 allow a diverson rate of 5.0 c.f.s. (2244 GPM) each and a consumptive use of 181.0 acre-feet annually each with the remaining 95% of water withdrawn to be returned to the source as a condition of the permits. Permits 29511 and 44646 cover the same well, commonly known as Brady No. 5. Permits 29512 and 44646 cover the well known as Brady No. 8 Permits 44643, 44644 and 44645 are filed on three (3) other existing wells. Permits 29511 and 29512 have a priority date of June 30, 1975. Permits 44643, 44644, 44645, 44646 and 44647 with a priority date of October 15, 1981, are presently in good standing with proof of beneficial use due March 1, 1988. These five (5) wells are located within the SE1/4 NW1/4 Section 12, T.22N., R.26E., M.D.B.&M.[3]

NOTE: Unless otherwise noted all footnote references to hearing transcript and exhibits will mean the transcript of the joint hearing beginning on April 17, 1986, and exhibits received into the record thereunder.

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3 See Permit file numbers 29511, 29512, 44643, 44644, 44645, 44646 and 44647 in the office of the State Engineer. See NRS 534.080(3).

II.

The State Engineer designated and described the Brady's Hot Springs area as in need of additional administration under Chapter 534 of the Nevada Revised Statutes. (See Ex. SE-3)

III.

All of the evidence, testimony, testing data and information available provides the basis for a descriptive or qualitative assessment of the Brady Hot Springs underground geothermal reservoir. The State Engineer has utilized such a conceptual model during the analysis of the quantitative information gained from geologic, geophysical, geochemical and hydrologic studies. The entire record developed in this matter supports the finding that the reservoir at Brady's is a liquid water dominated, structurally controlled and convectively heated system. The groundwater is deep circulating, heated in or near the basement rock, and the buoancy imbalance (temperature, density and viscosity differences) in effect drives the hotter fluids to near surface via a highly permeable fault zone. Thus, a large underground convection cell is visualized to exist at Brady's, a dynamic system in its natural state. This conceptual model is neither new nor unique and provides a logical explanation of why the high temperatures exist near surface without the presence of a near surface magmatic source of heat.

IV.

The up-flow of hot groundwater in the Brady fault zone is confirmed by the record. The U.S.G.S. in 1975 first noted from the water table altitude contours, the presence of "an elongate mound of thermal water" in the area of the fault, which seems to function as a "long, narrow, steeply inclined aquifer, nearly perpendicular to the gently dipping aquifers in the alluvial and lacustrine deposits".[4] This up-flowing thermal

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[4] Ex. P-4, pp. 212-213.

water then flows "out laterally east and west in the fractured zones of rock paralleling the fault".[5] The existence of these highly fractured layers is further confirmed throughout the drilling history at Brady where significant lost circulation zones were encountered, sealed and drilling continued in hard rock immediately beneath the zone. This up-flow of thermal water could very well represent a separate source of recharge to the groundwater basin, and is further confirmed in the following Findings.

V.

Multiple fractured lateral zones are known to exist between approximately 300 feet and 5050 feet below ground level at Brady's.[6] In addition to the data obtained from the drilling histories, static temperature surveys, spinner surveys and post-water injection surveys have been conducted in the existing wells, and all indicate these fractured zones have high temperatures and permeabilties, and demonstrate that intermixing occurs between the zones.[7] The isothermal zones depicted on the temperature surveys indicate fluid is circulating in the fracture system, within that interval.[8] The temperature profiles also confirm the depths at which inflows occur, i.e. the intervals where the profile peaks and goes isothermal below, especially when these depths correspond with lost circulation zones in the drilling history.[9] Since the early exploration drilling programs at Brady's were directed at finding very high temperature production zones, it appears that lost circulation zones were more of an inconvenience

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5 Ex. P-5, Appendix I pp. 1-2 and figure 1.

6 Ex. P-5, Appendix I, p. 2; Transcript July 1, 1986, (hereinafter "Tr." date, page, line) pp. 43-48 and p. 162.

7 Tr. 7/1, pp. 43-48; p. 120, l. 21 - p. 121, l. 6; Ex. P-5, Appendix I, Ex. A-19(1), A-20, A-20(1), A-21, A-21(1).

8 Tr. 7/1, pp. 48, l. 24 - p. 49, l. 2.

9 Tr. 7/1, p. 44, ll. 5-11 and p. 49, ll. 6-8.

than anything else.[10] Therefore, great volumes of drilling mud, drill cuttings, lost circulation material and cement were pumped into these highly permeable (but lower temperature) zones in order to re-gain circulation.[11] This process probably damaged those particular zones around those particular wells to the extent that these early deep wells (SP-1, SP-2 and EE-1) were not capable of commercially producing a large quantity of fluid nor could those zones ever be fairly tested.[12] The record supports the findings that there are probably other potentially productive zones of high temperature water at depths greater than 300 feet, and realizing that production will be a function of well depth, design and location, and is further confirmed in the following Findings.

VI.

Evidence and testimony was received addressing the limit and extent of the hot groundwater reservoir. Testimony addressed factors other than the existence of a high angle normal fault that had to be considered to explain the high convective heat flow associated with Brady's, when other similarly faulted areas in Nevada had no hot springs associated with them.[13] The occurrence of structurally raised basement rocks in the known thermal areas is also a factor common to all successful geothermal fields in Nevada.[14] These factors, together with the insulating effect of the thick blanketing of saturated tertiary sediments above the high heat flow basement rock, provide a reasonable explanation for the 400 to 450 degrees Fahrenheit temperatures at the top of

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[10] Tr. 7/1, p. 43, ll. 13-18; p. 164, ll. 1-6.

[11] Tr. 7/1, p. 46-47, pp. 126-127, p. 135.

[12] Tr. 7/1, p. 97 ll. 11-22; p. 126, l. 20 - p. 127, l. 10; p. 135, ll. 17-19; p. 162, ll. 7-11; p. 163, ll. 1-12; p. 164, ll. 1-12.

[13] Tr. 7/3, pp. 93-95 and Ex. A-56.

[14] Tr. 7/3, p. 95, ll. 7-21.

the basement rock and below the sedimentary cover.[15] The significance of the structural highs is that once the water is heated in the permeable basement rocks, it will migrate toward the structural high due to density differences.[16] The State Engineer finds the record undisputed in this interpretation of the system.

VII.

The record confirms that Brady's is fed hot water from the basement rock via the Hot Springs fault. The record also confirms the probable areal extent of this basement rock and that the geothermal wells in the Desert Peak area are producing from this fractured basement rock.[17] The size of the temperature anomaly, based on all existing data, was shown to expand in size with increasing depth, and the anomaly covers an area on the order of tens of square miles.[18]

The total reserves of thermal waters in the fractured basement rock, with a minimum areal extent of 20-30 square miles and utilizing a conservative figure for porosity, were estimated to be at least 3 million acre-feet.[19] The State Engineer finds the size of the ultimate reservoir can only be described as very large.

Two other conceptual models of the geothermal reservoir prepared for nearby Desert Peak add further confidence to the conceptual model prepared by the applicant, since they represent separate works prepared by other professionals.[20]

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[15] Tr. 7/3, p. 96, ll. 1-10.

[16] Tr. 7/3, p. 96, ll. 11-18.

[17] Tr. 7/2, p. 106, l. 13 - p. 109, l. 20, and p. 149, l. 9 - p. 150, l. 5; Tr. 7/3, p. 106, l. 8 - p. 107, l. 10; See Ex. A-61.

[18] Tr. 7/3, p. 102, l. 18 - p. 106, l. 7; See Ex. A-57, A-58, A-59, A-60, P-2 (Plate 1),P-4, p. 219.

[19] Tr. 7/3, p. 109 - p. 110, l. 4.

[20] Tr. 7/3, p. 108, ll. 9-20 and p. 122, ll. 6 - 7; Ex. A-63; Ex. P-64, p. 164).

VIII.

Exhibits A-57 through A-60 and P-2 (Plate 1), compiled from the existing data and confirmed by more recent temperature surveys, provide a logical explanation for the source of the thermal waters. If the geothermal system at Brady's was only confined to a single fault zone, the temperature anomaly would appear as a localized oblong shape around the area of the upflow zone itself.[21]

IX.

The U.S.G.S., after studying another hot springs area with similar geology and within the same geological province as Brady's, found that circulation on a single fault did not explain the data they had for that system and concluded that the system is due to large, deep circulation in the basement rocks.[22]

The U.S.G.S., because of the data collected indicating high reservoir temperatures at Brady's of between 200°C and 246°C (392°F and 475°F), concluded "the thermal water must circulate to depths of several kilometers in order to attain the observed temperatures".[23]

The U.S.G.S. further described the Brady's Hot Springs area as having the electrical energy equivalent of 157 megawatts, for 30 years or more, in the form of recoverable heat energy.[24]

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[21] Tr. 7/3, p. 103, ll. 1-6 and ll. 18-20; p. 105, ll. 18-21; p. 113, ll. 15-20; p. 105, l. 23 - p. 106, l. 3.

[22] Tr. 7/3, p. 97, l. 10 - p. 98, l. 6; p. 99, ll. 14-21; p. 100, ll. 6-12; See USGS Open File Report 81-915, p. 165 and pp. 180-181.

[23] Exhibit P-4, p. 227; Exhibit A-35, p. 53.

[24] Tr. 6/30, p. 93, ll. 14-21; Tr. 7/2, p. 139, l. 1 to p. 140, l. 19; Exhibit A-35, p. 53.

X.

The well production temperatures have remained unchanged through the years of existing development in the system.[25] If the source of recharge had been solely from annual infiltration of precipitation within the basin or from groundwater at shallow depths, the reservoir probably would have cooled down hundreds of years ago.[26]

XI.

The ultimate source of the thermal water is meteoric water that fell thousands of years ago, infiltrated down to the basement rock and became heated. The area over which this infiltration occurs probably covers many hydrologic basins.[27] The State Engineer finds the source of recharge is ultimately meteoric water but must be so far removed in time and space that it ceases to be meaningful when attempting to explain the temperatures involved in this system.

XII.

One of the first known quantitative assessments of the behavior of the reservoir in response to development was reported by J.M. Rudisill in 1978. The 300 plus hour test included the continuous pumping of GFP well B-8 at 650 gpm and recording the (water level) response in three observation wells, EE-1, B-5 and B-1.[28] The drawdown data, together with 1000 hours of recovery (build up) data indicate the recharging ability of the reservoir. The rate of water level decline decreased after 150 hours into the test in Brady 5 and Brady 1, and the water level nearly stabilized through the remainder of the

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25 Tr. 6/2, p. 35, ll. 9-18.

26 Tr. 7/2, p. 153, ll. 9-14; Tr. 7/2, p. 120, ll. 11-17.

27 Tr. 7/2, p. 118, l. 2- p 120, l. 17; p. 151, l. 15 - p. 153, l. 14;

28 It should be noted here that Brady 4 in Rudisill's report is plotted at the location of Brady 5 and vice versa, indicating a mixup in the historical well nomenclature.

test. Also, the total drawdown observed in Brady 5 was only about 4 feet and in Brady 1 about 10 feet at the end of the pumping test and the water level in the producer immediately after shutdown was approxmately 20 feet.[29] The results of this test led Rudisill to conclude: (1) the Brady 8 well was obtaining production from between 610 feet and 800 feet; (2) these relatively shallow aquifers were being fed by a deeper reservoir which would cause pressure (water level) declines to slow greatly over time; and (3) the Brady reservoir is highly fractured and highly connected.[30] The record does not dispute this interpretation of the reservoir and the State Engineer finds these conclusions to be valid.

XIII.

The next reported interference testing was also conducted for GFP by GeothermEx, Inc., in 1981. This test involved similar water level monitoring in existing wells while B-8 produced continuously since June 1980 at between 450-500 gpm and a new well (Grace-1) was produced at 1000 gpm for a 59 day period. Both wells were shut in on January 28, 1981, and build up data were recorded. The data analysis from this test led GeothermEx to conclude that the Brady reservoir consists of multiple permeable layers transmitting hot water out laterally from the upflow occuring in the Brady fault and that the reservoir is large with fairly high permeability-thickness (kh) and storage capacity (ϕch) values. This conclusion stems from the fact that no (negative) boundaries were encountered during the test and that the wells recovered to near the original (static) water levels within 6 weeks after the end of the test.[31]

It is further noted here that no evidence was presented indicating any decline of

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29 Ex. P-5, pp. 2-3 and figures 2, 3 and 4.

30 Exhibit P-5, pp. 2-3, and Appendix I, p. 2.

31 SEE EX. P-3.

the static water levels in GFP wells, and in testimony it was plainly stated that no decline in the temperature of production water has been experienced by GFP[32] even with the total production between 1978 and 1985 of nearly 1.5 billion gallons (B-8 at 600 gpm, 6 mos/year, plus testing). In view of the evidence and testimony, the State Engineer finds the Brady geothermal reservoir cannot be described as a small, bounded (closed box) reservoir, in the absence of a trend in static water level and/or temperature declines. A bounded system without recharge would have experienced a proportional static water level drop for every gallon of water produced, and that production would have been pulling the shallow cooler groundwater into the hot reservoir.

XIV.

The most recent long term pressure interference test was conducted in the spring of 1986 for the applicant Munson by GeothermEx, Inc. Two new production wells had been drilled by the applicant, "MGI-1" which was monitored and "New MGI-2" which was produced continuously for the test.[33] The duration of the test was 1450 hours (60 days) within which time New MGI-2 produced 480 gpm (total flow at reservoir conditions) for 700 hours then the rate was increased to 750 gpm for 150 hours, then shut in to record build up data for 230 hours, then produced again at 750 gpm through the end of the test.[34] Reservoir pressures in wells SP-1, SP-2, Grace-1, MGI-1 and New MGI-2 were all recorded and plotted in Exhibit A-12.[35]

The State Engineer finds that the quality of the data collected from this test was very good.[36] By trial and error, different values of flow capacity and skin effect were

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[32] Tr. 6/2, p. 35, ll. 9-18.

[33] See Ex. A-12, p. 23 for location plat.

[34] Ex. A-12, pp. 2-10.

[35] Tr. 7/2, p. 17 - p. 32, l. 6.

[36] Tr. 7/1, p. 66, l. 7 to p. 68, l. 15; 7/2, p. 14, ll. 5-8; p. 148, ll. 9-13.

used to generate a model that matched the measured pressure response for the production well New MGI-2.[37] Similarly, different values of kh and storage capacity were used (trial and error) until a computer generated model reflected the measured response in the observation wells.[38] The model which best fit the actual pressure response utilized values that are representative of the reservoir's actual characteristics.[39] The State Engineer finds the reservoir characteristics have been adequately defined.

XV.

From the analysis of the interference test, the representative values of flow capacity and storage capacity were then used in various production/injection scenarios to predict the performance of the reservoir with development over the next 30 years. The predictions used exact well locations and likely injection well locations, actual permitted and/or probable production/injection flow rates and ignored any effect from recharge.[40] On cross examination, GeothermEx confirmed that the performance predictions reflect the strong effect on where the wells are located and how much is produced (and injected).[41] These factors, together with appropriate production/injection well design (and completions), will be fundamentally important in realizing the full

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37 Tr. 7/2, p. 36, ll. 14-17; p. 38, ll. 12-19; See Ex. A-12, pp. 14-16; Tr. 7/3, p. 8, l. 21 to p. 10, l. 2; p. 11, ll. 10-23.

38 Tr. 7/2, p. 40, l. 18 - p. 45, l. 4; Ex. A-12, pp. 17-20.

39 Tr. 7/3, p. 8, l. 12 - p. 10, l. 2. This model matching method is not unlike the curve fitting techniques used in well testing analysis and found thoughout the literature in the fields of groundwater hydrology (well hydraulics) and petroleum reservoir engineering. In fact, GeothermEx utilized curve fitting to obtain very similar values for the flow capacity (kh) of the same reaservoir from the 1981 test data for GFP. (See Ex. P-3 and Tr. 7/2, p. 37, 11. 5-11.)

40 Tr. 7/2, p. 58 - p. 59, l. 5; p. 219, l. 2 - p. 225, l. 19.

41 Tr. 7/2, p. 196, l. 11-20)

production potential of the system.

XVI.

The State Engineer finds the performance predictions generated by GeothermEx utilized a very standard methodology[42] involving the two reservoir parameters, flow capacity and storage capacity and the infinite acting nature of the reservoir, all derived from state of the art solution techniques widely recognized for solving the basic diffusivity equation that describes fluid flow in porous media, and further finds the predictions made could be reproduced by other experts using the same or similar solution techniques.[43]

XVII.

The interference effects (drawdown) caused by further development and predicted at GFP well B-5, as indicated in Exhibit A-12, p. 26 (case 6) and in Exhibit A-26 (case 9), utilized the most representative values of actual permitted and/or proposed production/injection rates. The test data indicate radial flow conditions are experienced after the (early time) fracture dominated flow and that no negative boundaries have been encountered.[44] However, the effect of no negative boundaries incorporated in the extrapolations of drawdown by GeothermEx, if and when it appears in the data, will likely be offset by the positive effect of recharge which was also not incoporated into the long term extrapolations of drawdowns. The State Engineer finds that the model

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42 The methodology used is a very standard one utilized world-wide for the purposes of insuring that enough production capacity and reserve will be available over the years. (Tr. 7/2, p. 102, l. 11 - p. 106, l. 11.)

43 Tr. 7/2, p. 202, l. 5-16, p. 203, l. 5 to p. 204, l. 25; p. 206 to p. 207, l. 13; p. 208, ll. 11-15; p. 211, ll. 15-19; p. 215, ll 14-25; p. 217, ll. 4-24; p. 219, ll. 12-16; p. 223, l. 13 to p. 225, l. 4; p. 51, l. 17.

44 Tr. 7/7 Eve., pp. 131-132.

extrapolations made by GeothermEx, though not completely accurate in the presence of boundaries, provide reasonable estimates of how the reservoir will respond to development, especially since these predictions did incorporate injection rates and well locations into the model. The State Engineer further finds these drawdowns will probably be less due to the recharge of thermal water that will occur from the Brady fault.[45]

XIII.

Evidence and testimony was received related to geochemical studies conducted at Brady's in an effort to establish the sink/source relationship between the cold groundwater basin and the thermal waters of the Hot Springs Fault area. Much of the information was directly from a recently published report that examined the chemistry and stable isotope data aquired from samples obtained from shallow monitor wells in and near the area of the fault.[46] GFP collected and analyzed additional samples from some of the same wells used in the USGS paper. GFP argued that the chemical and isotope data indicated a marked similarity in the hot and cold groundwaters in the area, and the hydraulic gradients were such that there could be flow from the groundwater basin into the thermal area.[47]

However, the State Engineer finds that the hydraulic gradient of the groundwater in the area clearly is from the thermal area to the groundwater to the west, and other testimony and evidence presented consistently describe the thermal waters of the fault zone as leaking out into the shallow groundwater aquifers to the west. GFP's argument is further found to be invalid since the cold water samples used as a baseline were actually cooled thermal waters and GFP's argument does not adequately explain how the waters

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45 Tr. 7/2, p. 76, ll. 2-11; Ex. P-7, p.8; See Applications 49943, 49944, 49945 and 49946 filed in the office of the State Engineer; Tr. 6/2, p. 73, l. 5 - p. 75, l.6; Tr. 7/2, p. 79, l. 3 - p. 84 l. 1; p. 51, l. 25 - p.53, l. 3; See Ex P-5, pp 2-3.

46 See Ex. P. 40.

47 Tr. 6/3, p. 130, ll. 8-23.

become heated.[48]

XIX.

Based on the record, the State Engineer finds the upflow and discharge of thermal water to the groundwater basin represents essentially a contributing source of recharge. The State Engineer further finds this geothermal source is not fully appropriated.

XX.

The State Engineer finds the proposed monitoring plan outlined by MGI in Exhibit A-11 is a necessary condition that must be implemented to insure the protection of the rights of all holders of prior appropriations in the subject area, as well as to provide the data base necessary for judicious placement and operation of wells and to diligently pursue an effort toward maximum injection of excess thermal waters during full operation of the field.[49]

CONCLUSIONS

I.

The protestant Gilroy Foods, Inc., (GFP) holds existing rights and is first in time by virtue of the earlier filing dates on their seven permits.[50]

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48 See Ex. P-40, p. 19 and pp. 23-24; Ex. P-4, pp. 213-214; Ex. P-5, pp 1-3 and Appendix I, p. 1 and Figure I; Ex. P-3, p.21; Tr. 7/7, day, p. 89, ll. 5-9; Tr. 7/7, eve, p.136, l. 1- p. 137, l.3.

49 See Ex. A-11, pp. 1-2; Tr. 7/1, p. 73, l. 22 - p, 76, l. 25; Tr. 7/2, p. 127 - p. 129, l. 13.

50 NRS 534.080(3).

II.

As provided under NRS 533.370, the State Engineer shall approve an application submitted in proper form which contemplates the application of water to beneficial use unless (NRS 533.370(3)):

1. There is no unappropriated water in the proposed source of supply,
2. The proposed use conflicts with existing rights, or
3. The proposed use threatens to prove detrimental to the public interest.

III.

Protestant GFP attempted to describe the Brady system as very shallow, limited in size and as being recharged from the infiltration of precipitation to the groundwater basin annually. If this is a correct model, GFP provided insufficient evidence to explain why the high temperature is seen at Brady's, or why there has been no decline in the temperature of producing wells at Bradys. These fundamental questions remain unanswered in GFP's interpretation of the reservoir, the result of which tends to grant additional weight to the evidence and testimony presented by the applicant, Munson. The source of recharge is ultimately meteoric water but must be so far removed in time and space that it ceases to be meaningful when attempting to explain the temperatures involved in this system.

IV.

NRS 534.110(4) provides, as an express condition of each appropriation of groundwater aquired pursuant to Chapters 533 and 534, that the right of the appropriator shall relate to a specific quantity of water and that such right must allow for a reasonable lowering of the static water level at the appropriator's point of diversion.

GFP argued the "resource would be destroyed" if interference effects of other wells in the field caused a water level drop such that they could not pump well B-8 from 200 feet below ground level when, (1.) B-8 is 3,469 feet deep, (2.) the static water level in B-8 is less than 5 feet below ground level, (3.) there are known production zones to depths in excess of 5,000 feet, and (4.) the pump in B-8 has been historically set as deep as 500 feet. The State Engineer concludes that GFP's claim of unreasonable interference caused by new wells producing from the field is not supported by substantial evidence.

V.

NRS 534.110(5) authorizes the State Engineer to issue permits in (designated) areas to applicants later in time, even when such later appropriations may cause the water level to be lowered at the point of diversion of the prior appropriator, so long as the rights of holders of existing appropriations can be satisfied under such express conditions. The proposed new appropriations under applications 49943, 49944, 49945 and 49946 will not cause an unreasonable lowering of the static water table in the senior appropriators points of diversion such that the rights of the holders of the senior appropriations cannot be satisfied.

VI.

The issuance of the subject permits, with proper monitoring requirements through developement stages, up to and including full scale operations or more specifically described in Ex. A-11, will not tend to conflict with existing rights to the extent they cannot be satisfied.

VII.

The entire record provides substantial evidence to support the Finding that there is unappropriated thermal underground water in the proposed source of supply under Applications 49943 - 49946 inclusive.

RULING

The protests to the granting of permits under Applications 49943, 49944, 49945 and 49946 are herewith overruled based on substantial evidence that there is unappropriated geothermal water in the proposed source of supply, the proposed use will not conflict with existing rights nor prove detrimental to the public interest. Permits will be granted subject to existing rights and further subject to the following conditions:

1. Immediate implementation of the reservoir monitoring program described in Exhibit A-11.

2. A written status report on the implementation of this monitoring program must be submitted within 60 days of this date.

3. A clear, definitive injection program and timetable for implementation must be submitted within six (6) months of this date.

4. Permits 49943, 49944, 49945 and 49946 are limited to a diversion rate of 1529 GPM (3.41 cfs) each, and the consumption of thermal water at the surface shall not exceed 20% of the diversion rate. The State Engineer retains the authority to regulate the consumption of thermal water if he deems it necessary to protect existing rights and the resource.

Respectfully submitted,

PETER G. MORROS
State Engineer

PGM/TKG/jjk

Dated this 22nd day of

October, 1987.