

## Cahalane, Daniel

---

**From:** Alberg Ranch <alberg ranch@gmail.com>  
**Sent:** Thursday, August 20, 2020 4:41 PM  
**To:** Cahalane, Daniel  
**Subject:** Re: Geothermal public hearing

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Michael Alberg  
Pyramid Associates L.P.  
800 Shale Pit Road  
Ellensburg, WA, 98926  
Phone: 509-899-0774

On Thu, Aug 20, 2020 at 2:15 PM Cahalane, Daniel <[DCahalane@washoecounty.us](mailto:DCahalane@washoecounty.us)> wrote:

Hi Michael,

You can call 311 anytime before the meeting.

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# For Immediate Assistance Dial 3.1.1 or 775.328.2003

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Regards,



**Dan Cahalane**

Planner | Community Services Department- Planning & Building Division

[dcahalane@washoecounty.us](mailto:dcahalane@washoecounty.us) | Office: 775.328.3628 | Fax: 775.328.6133

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Greetings Dan,

I have tried to call you several times in the last week and I have asked you to call me concerning the Ormat North Valley Geothermal Development Project(case number: WSUP20-0013 Ormat Geothermal). I would prefer you to call me by phone at 509-899-0774 because I have numerous questions on how to provide comments for the upcoming planning commission hearing on September 1,2020. Email is difficult because I live in a rural area. My family owns Pyramid Associates L.P. and has 1084 acres of fee land that is surrounded and adjacent to the proposed project. I have read the project application and have found no mention of our private land or the possibility of impacts to our property. I have many concerns about the impact of the project on our property and how to present them to the planning commission for the public hearing.

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Ellensburg, WA, 98926

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---

**From:** Alberg Ranch <alberg ranch@gmail.com>  
**Sent:** Wednesday, August 26, 2020 8:23 AM  
**To:** Cahalane, Daniel  
**Subject:** Hearing Testimony  
**Attachments:** RE: Geothermal public hearing - Report.eml; SAN EMIDIO RPT..pdf; WIRE TRANSFER INFORMATION.pdf

[NOTICE: This message originated outside of Washoe County -- **DO NOT CLICK** on **links** or open **attachments** unless you are sure the content is safe.]

### Testimony:



[Geothermal Testimony](#)

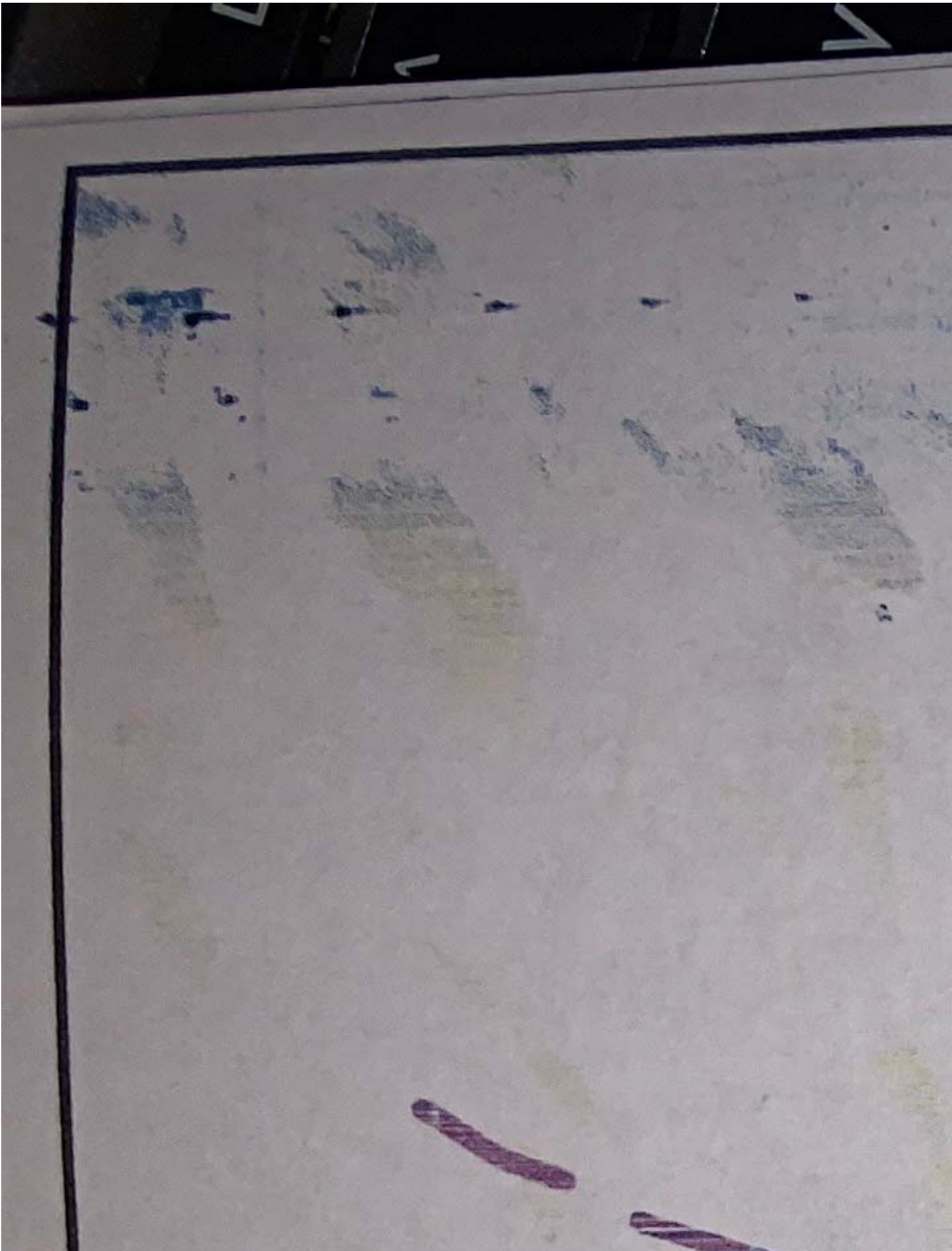
### Attachment "A"

February 2019

And Forever Plant



## Attachment "B"





**Attachment "C"**



SAN EMIDIO RPT..pdf

**Attachment "D"**

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retentæd Clavius

N K



----- Forwarded message -----

From: Randy Henkle <[georandy@charter.net](mailto:georandy@charter.net)>

To: "'Alberg Ranch'" <[albergranch@gmail.com](mailto:albergranch@gmail.com)>, michael alberg <[mjsalberg@outlook.com](mailto:mjsalberg@outlook.com)>

Cc:

Bcc:

Date: Sat, 22 Aug 2020 15:43:33 -0700

Subject: RE: Geothermal public hearing - Report

Mr. Alberg

Attached is the final report

Please send the agreed upon fee of \$ 2500.00

Either to my bank by wire transfer or to

Henkle and Assoc.

230 Finch Way

Washoe Valley, NV 89704

Thank you for the chance to work on this interesting project

Randy Henkle

**From:** Alberg Ranch [mailto:[albergranch@gmail.com](mailto:albergranch@gmail.com)]

**Sent:** Friday, August 21, 2020 10:18 AM

**To:** [georandy@charter.net](mailto:georandy@charter.net)

**Subject:** Fwd: Geothermal public hearing

----- Forwarded message -----

From: Cahalane, Daniel <[DCahalane@washoecounty.us](mailto:DCahalane@washoecounty.us)>

Date: Thu, Aug 20, 2020 at 4:59 PM  
Subject: RE: Geothermal public hearing  
To: Alberg Ranch <[albergranch@gmail.com](mailto:albergranch@gmail.com)>

Hi Michael,

Thank you for your comments. Do you want this message to be conveyed to the Planning Commission?

The order of public hearings will be as follows:

- Sept 1, Planning Commission (Use, grading, hazardous materials, requests to vary standards, project of regional significance)
- Oct ?, Board of County Commissioners (hazardous materials, project of regional significance, amend utility corridors)
- Nov ?, Regional Planning Commission (project of regional significance, amend utility corridors)
- Dec ?, Regional Plan Governing Board (project of regional significance, amend utility corridors)

The applicant did not need to identify the surrounding neighbors as the county is required to provide notice to at least 30 surrounding property owners within 1,000 ft of a hazardous material (500ft of a special use permit). We ended up noticing property owners within 21,000ft of the application in order to comply with code.

You have every right to represent yourself before the various public agencies (public comment is limited to 3 minutes) as well as file an appeal of any decision as an affected property owner taken by the Planning Commission or Board of County Commissioners.

Regards,



**Dan Cahalane**

**Planner | Community Services Department- Planning & Building Division**

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Ellensburg, WA, 98926





To: Michal Alberg  
Pyramid Assoc., LP.

8/22/2020

From: W.R. Henkle, Jr., P.Geol., P.HydroGeol.  
Henkle and Assoc.

Subj: Potential for Damage to Pyramid Assoc. Geothermal Resources - San Emidio Build Out Project

In mid - August, 2020, Henkle and Assoc. (HA) was contracted by Pyramid Assoc. to report our opinion as to whether or not the potential might exist for the planned build out expansion of the San Emidio Geothermal Power Plant to damage geothermal resources owned by Pyramid Assoc. This letter report addresses that question.

**Property Situation** - Pyramid is the owner of a 1084 Ac fee parcel (the property) located within the proposed project area (**Fig. 1**). Ormat, the developer of the project wishes to construct 25 production and injection wells, and accompanying infrastructure, to expand the electrical generation capacity of the San Emidio Plant. Seven of these wells, which are believed by Pyramid to be injection wells, are planned for construction either along the boundary of or in the near vicinity to the property boundaries.

Ormat plans to more or less continually inject up to 9240 GPM of spent fluids at 135°F (57.2°C) to an unspecified number of injection wells (at an unspecified depth) for the life of the project (BLM, 2020). Pyramid is concerned, that the cooler injection fluids may intermingle with hot geothermal brines beneath their property (measured at ~ 116 °C to 109 °C (241 °F to 228 °F) and cool down their resource. Should the subsurface geothermal brines under the Pyramid property suffer cooling; the resource could be damaged and Pyramid might suffer economically.

**Relevant Property Geology** - The property lies about 2 - 3 km to the north of the existing Geothermal Power Plant. The property is on the eastern flank of the San Emidio Desert Basin and is flanked on the east by the Lake Range and on the west by the Fox Range of mountains. The Lake Range Frontal Fault, a steeply dipping down to the west fault, forms the boundary of the San Emidio Desert Basin. The range front fault has ~ 1000 ft. of displacement and is found ~ 1 km (3300 ft.) to the east of the eastern boundary of the property.

A series of sympathetic N to NNE striking - down to the west, normal faults of variable displacement are found to the east of the Lake Range frontal fault. At least 9 major sympathetic faults and several subsidiary faults have been mapped in a 4 mile wide zone at and in the vicinity of the property (**Fig. 2**). Of note is the San Emidio Fault, which forms the footwall of the geothermal reservoir at San Emidio. The un-named fault which outcrops ~ 1/3 km (~ 0.2 mi) to the west of the San Emidio Fault forms the hanging wall of the reservoir.

**Reservoir Characteristics** - Productive zones within the reservoir are found in areas where the fracture patterns are enhanced by intersections with other faults or bends in the major fault, etc. Such a zone is found about 3 km (1.9 mi) to the south of the property. This is the wellfield production area for the existing plant, which is found at a bend in the San Emidio Fault and also at the intersection of the Empire and San Emidio Faults. Production from the well field has a fluid temperature of 152 °C (306 °F) and is found at 571m (1706ft) below ground surface. The existing plant has an 11.8 MW design capacity (BLM, 2020).

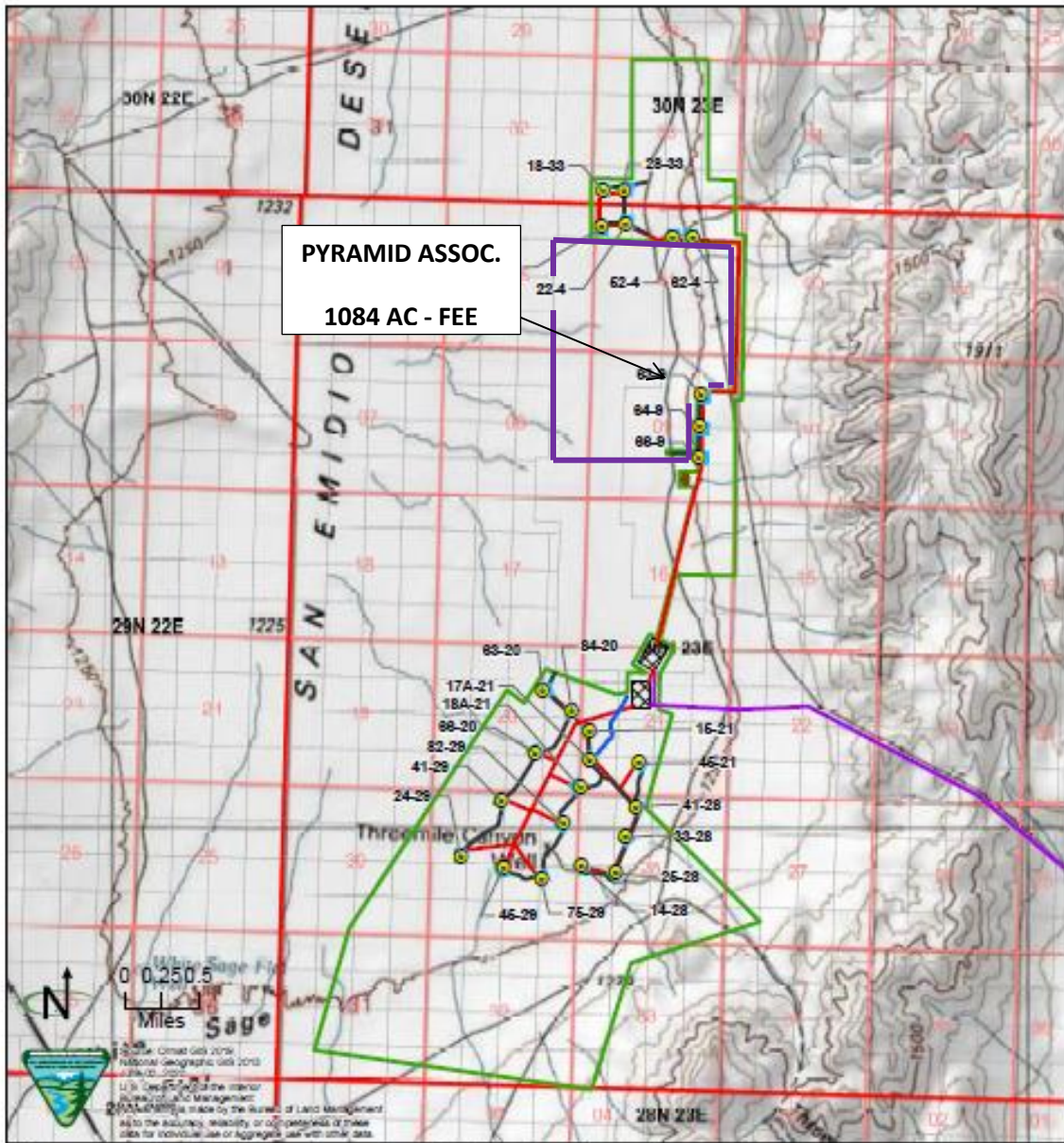
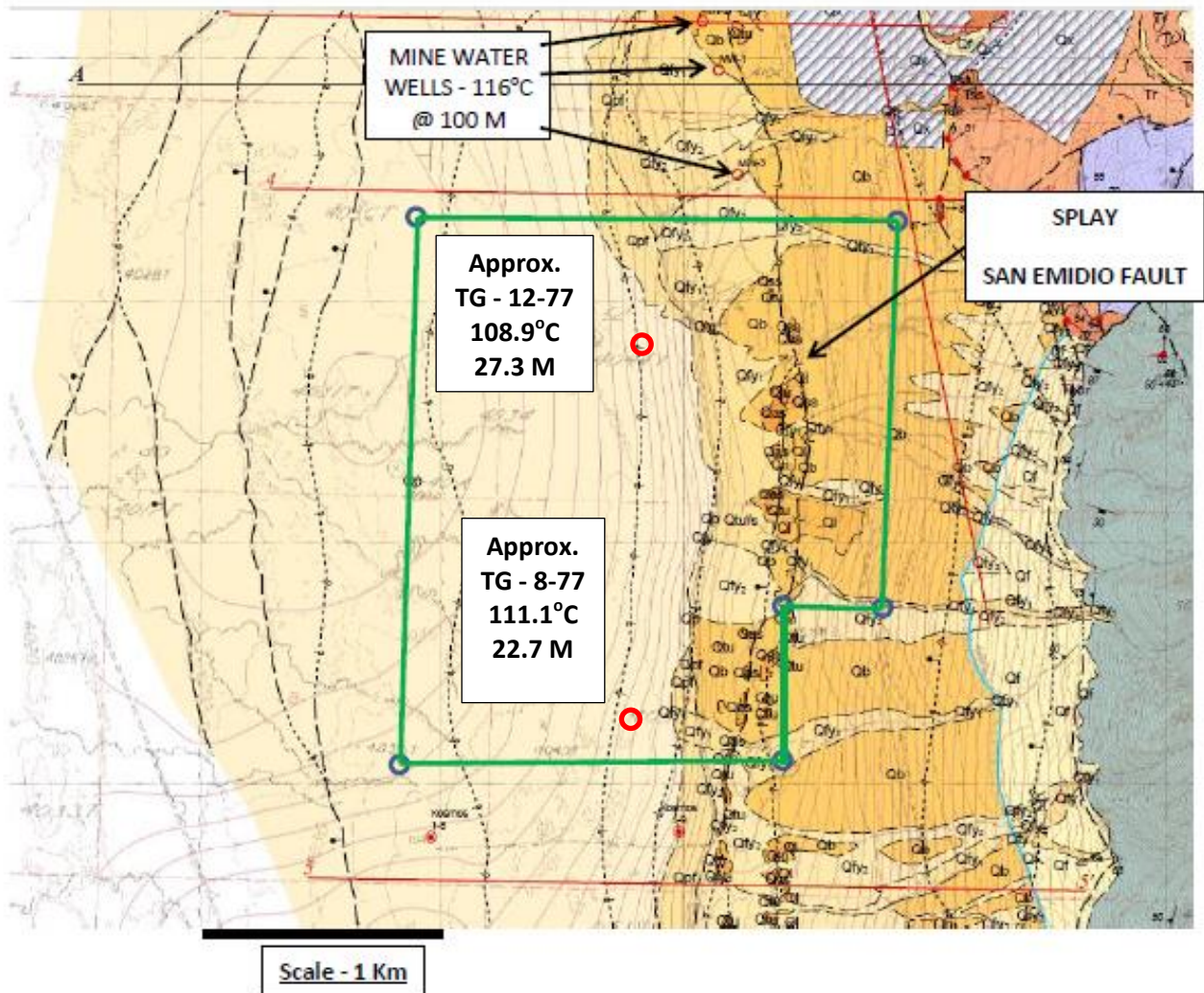


Figure A-3. Project Overview—San Emidio Geothermal Lease Unit

- ▭ Area of Interest
- ▭ Proposed gen-tie
- Power plant
- Well
- Well pad
- Aggregate pit
- Pipeline
- Road- improve
- Road- new

**Fig. 1 - Pyramid Assoc. Property Vs. Proposed Well Lay Out  
After - BLM, 2020**



**Fig.2 - Property Geology - After Rhodes, 2011**

The reservoir is known to extend northwards from the well field for at least 3 miles, to the Wind Mountain gold mine well field which encountered temperatures of 116°C (241°F) at 100 M (333 ft.) depth (Rhodes, 2011). Similar temperatures were found at similar depths in TG 8-77 and 12-77 (Pyramid Assoc. Records, 2020). Extensive hydrothermal alteration (acid - sulfate and silicification) is found along the outcrop of the San Emidio Fault (Rhodes, 2011, Folsom, et.al., 2020 and others). Proof positive of ancient hot waters flowing through and along the plane of the San Emidio Fault.

InSAR (interferometric synthetic aperture radar) from satellites was used to map surface subsidence deformation over the property using data collected from 1992 to 2001 (Rhodes, 2011). Analysis of the imagery (**Fig - 3**) shows ~ 3mm of subsidence. This indicates hydraulic linkage with the production well field about 1.5 miles to the south of the property. Some of the production from the well field came from the property. Property boundaries are approximate.

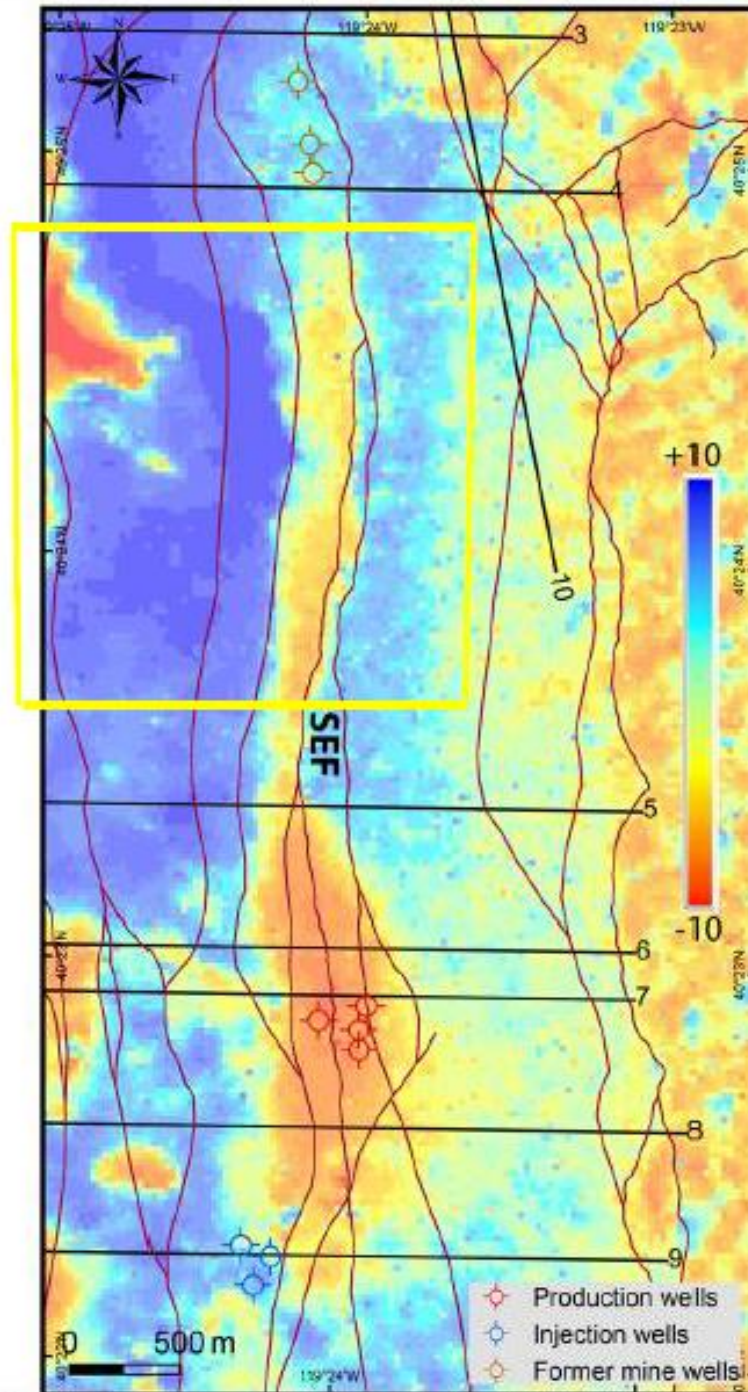


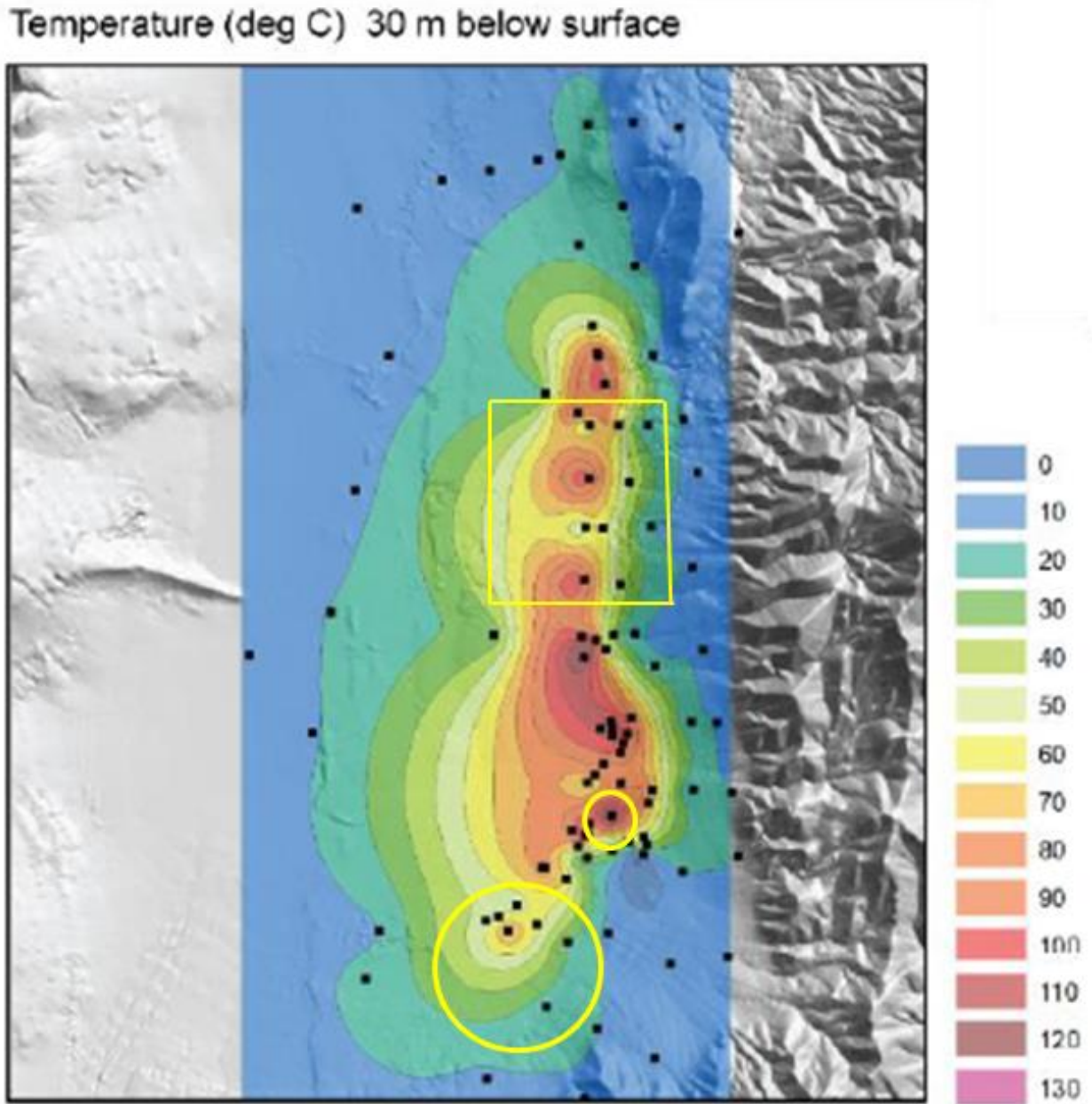
Figure 4.6 – InSAR results showing surface deformation from 1992 to 2001 with seismic reflection lines, mapped faults, wells, and the San Emidio fault zone (SEF) (modified from Eneva et al., 2011). Rates are mapped by color and shown in mm/year. Yellow to red colors indicate negative movement away from the satellite (subsidence) and green to blue colors indicate positive movement.

#### INSAR DATA - SHOWING SUBSIDENCE DUE TO PUMPING

From - Rhodes, 2011 - Fig. 4.6 - Property Boundaries - Approx.

**Fig. 3 - Reservoir Extent to North of Well Field - After Rhodes, 2011**

Additional evidence for the presence of an active geothermal system or systems at the property can be seen by inspection of **Fig. 4**, which shows Temperature Gradient Hole measurements at 100 M depth BGS.



**Fig. - 4 - Groundwater Temperature at 100 M BGS - After Folsom, et. al., 2020**

The map above shows six distinct hot spots from South to North across the Ormat project area. To the north of the Pyramid Assoc. property is the Wind Mt. Mine well field anomaly. Temperatures of + 100°C are found. The water temperature cools to 70 - 80°C, as it crosses the N. boundary of the property. It then warms to + 100°C, then cools to 60 - 70°C to form the northern property anomaly. It then cools

again to 80 - 90 °C before crossing the southern boundary of the property. This suggests the presence of two small heat anomalies at the Pyramid property.

A large anomaly that reaches + 120 °C is found just across the South property line. Oddly, this anomaly is not exploited; possibly due to lack of permeability. The anomaly within the small circle reaches +110 °C, this is the location of the present well field. The large circle to the south west encloses an anomaly that only reaches + 70 °C (at 100M). This is the location of the new well field planned for the San Emidio build out project. Wells into this anomaly are expected to produce 160 °C (320 °F) geothermal fluid from depths on the order of ~ 540 m (~ 1780 ft.) at flow rates of 4200 gpm (BLM, 2000 and Folsom, et. al., 2000).

It is interesting, that the two smallest heat anomalies at 100 M depth are the centers of production for the project. However, this is where commercial permeability was found at depth.

**Reservoir Geophysical Characteristics** - The San Emidio Project Area has also been studied using various geophysical methods. Methods employed include seismic (both active and passive), magnetics, gravity and magnetotelluric surveys. Only the gravity and magnetotelluric surveys will be discussed here.

**Gravity** - A network of 1270 gravity stations was used to survey the project area, (Folsom, et. al., 2000). The investigators produced three different gravity maps. A complete Bouger anomaly, a Gravity Horizontal Gradient Magnitude and a Gravity First Vertical Derivative map were produced. Only the First Vertical Derivative map (**Fig.- 5**) will be discussed here, as this shows reservoir related issues the best.

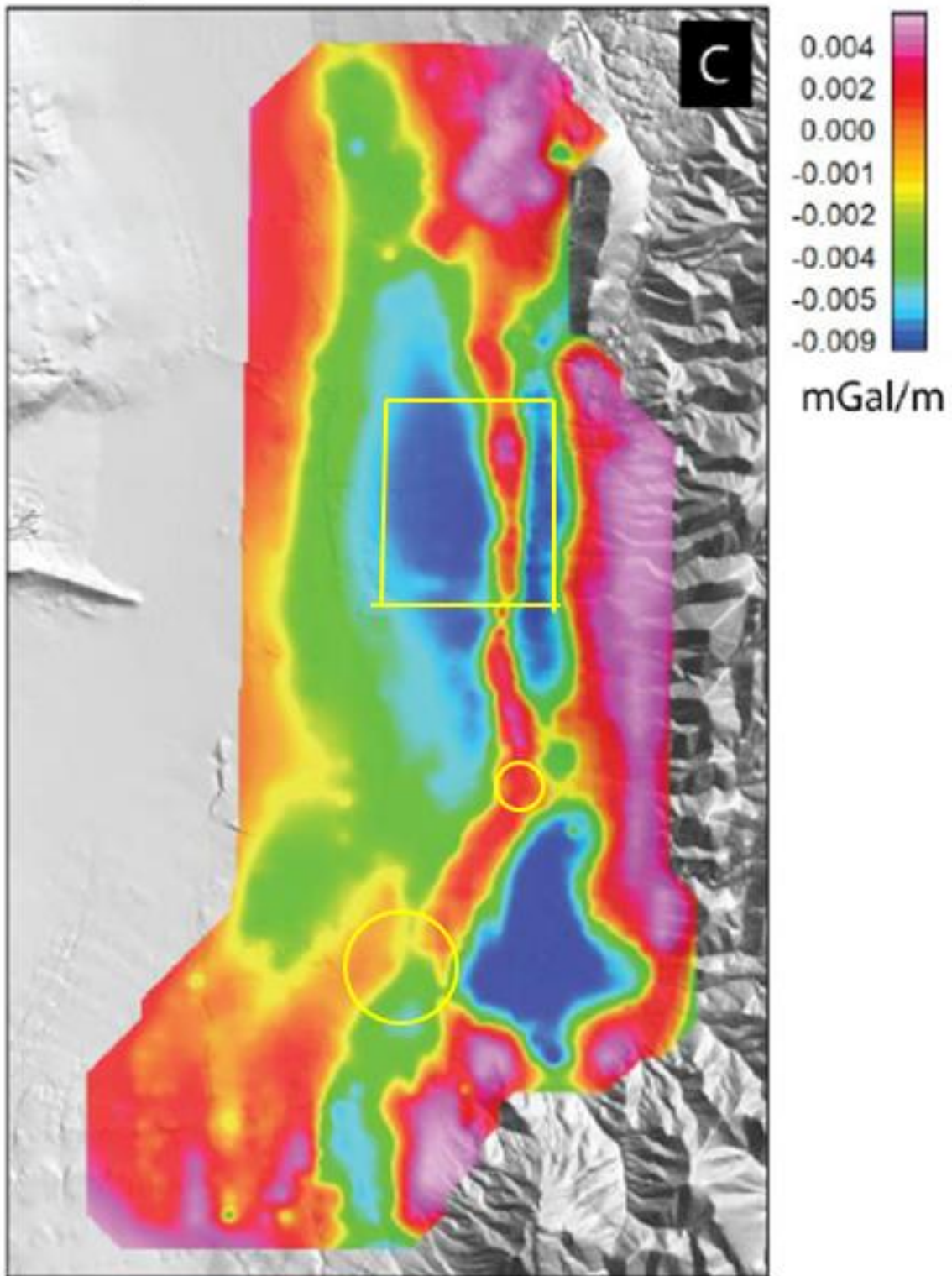
The light purple colored + .004 mGal/m anomaly is the most striking one seen on the map. The largest area with this color and it's associated colors is seen along the mountain front. This is noise and it is caused by the dense gravitational attraction of the mountains - their gravity pulls the instrument response up, since a large mass of the mountains is at a much higher altitude than the instrument down in the valley.

The blue colored -.005 and -.009 mGal/m anomalies are seen next as the view traverses towards the west. This is caused by the presence of lesser density rocks (much of it alluvial fill) found in the main part of the basin. Of note, is the ridge of 0.00 to + 0.004 anomaly seen near the center of the map. This is caused by the presence of higher density rock which happens to coincide with the outcrop of the San Emidio Fault. The rock units along the outcrop of the fault have been hydrothermally altered and silicified. It is thought, that the silicification causes the rock affected by the alteration to be considerably denser than the non-altered rock, hence this peculiar geophysical signature (Folsom, et.al., 2000).

The slice of rocks bounded by the San Emidio and the next adjacent fault to the west, acted as a conduit for the geothermal brines in the distant past. The hot fluids deposited silica in the rock mass which caused these rocks to be more brittle than the non-altered rocks. Earthquake movements over time caused these rocks to fracture and resulted in higher permeability in the zone between the two faults. The zone became, and still is a geothermal aquifer.

**Magnetotelluric survey** - The magnetotelluric (MT) method is a passive electromagnetic (EM) exploration method that measures orthogonal components of the electric and magnetic fields on the Earth's surface. Solar energy and lightning cause natural variations in the earth's magnetic field, inducing electric currents (known as telluric currents) under the Earth's surface. Different rocks, sediments and geological structures have a wide range of different electrical conductivities.

# Gravity First Vertical Derivative



**Fig.- 5 - Gravity Related Reservoir Characteristics - after Folsum, et. al, 2020**



Measuring electrical resistivity allows different materials and structures to be distinguished from one another and can improve knowledge of tectonic processes and geologic structures. Because MT surveys have relatively low resolution but excellent depth penetration, the measurements are used to help interpret regional geology.

For the San Emidio study a network of 211 broadband MT stations were used to measure the deep resistivity of the project area (Folsum, et.al., 2000). Resistivity measurements (as ohm - meters) are taken at each station. Upon completion of the survey, an inverse 3D mathematical computer model is constructed of the project area. In order to visualize the model in plan view, the model is "sliced" at various elevations to prepare a plan metric map. For the San Emidio study maps were prepared for model slices at 1150, 1000, 800 and 500 meters above sea level (MASL). Only the 500 MASL map will be discussed here (**Fig. - 6**).

For this discussion, the reader should be aware the map readings are in ohm - meters, which are resistivity units. The scale bar on the map shows values from + 100 ohm - meters (blue) to > 1.0 ohm - meters (dark red). High resistivity anomalies represent resistive rock units, low resistivity anomalies represent conductive rock units. Since hot geothermal brines are generally high in dissolved minerals, the brines usually conduct electricity. Conductive fluids in the pores and fractures of the geothermal aquifer units show up in these surveys as low resistivity conductors.

The average elevation at the Pyramid Assoc. property is ~ 1235 MASL (4050 ft. ASL); the depth slice at 500 MASL is at a depth of ~ 735 M (2411 ft.). Two conductive units can be seen of the property and environs. One in the north central and one in the southeast of the property. The conductor in the southeast is only partly on the property (boundary lines are approximate). These conductors are in the 2.0 - 1.0 ohm - meter range, these are high conductivity readings.

The small circle which is over the existing well field is off set to the south west from a conductor of ~ 1.3 ohm - meters magnitude. The existing well field produces from fracture permeability found at ~ 675 MASL, the altitude of which is well above this anomaly. Perhaps the conductive zone migrates to the southwest at higher elevations.

The circle that represents the proposed well field overlies a sizeable conductive anomaly of ~ 2.0 - 2.5 ohm - meters. This well field will produce from ~ elevation 710 MASL. The anomaly also presents well on the 1000 and 800 MASL maps. This exploration method successfully highlights the well field. The combination of gravity and MT geophysical exploration methods is apparently well suited for the San Emidio geothermal area.

**Conceptual Hydro Geologic Model** - A conceptual model of the existing well field and outflow zone to the north was prepared for the San Emidio study (Folsum, et. al., 2020) (**Fig. - 7**). The model postulates a sizeable upwell zone in the southern part of the project area. The upwell zone has been penetrated and tested by wells # 18 - 21, 17 - 21 and 25A - 21. Production from these wells of 160°C (320°F) brines at ~ 4000 gpm. Is contemplated for the proposed build out. These wells confirm that the upwell zone is definitely there and that the model is accurate for that portion of the project area.

The model also postulates an outflow zone to the north. The geothermal aquifer that transports the outflow waters is formed from highly silicified and altered sediments which are confined between the San Emidio Fault plane and the first un-named parallel fault plane that out crops ~ 0.3 to 0.5 Km to the west. Pre-production temperatures in the out flow aquifer were in the range of 110 °C (230 °F) to 130 °C

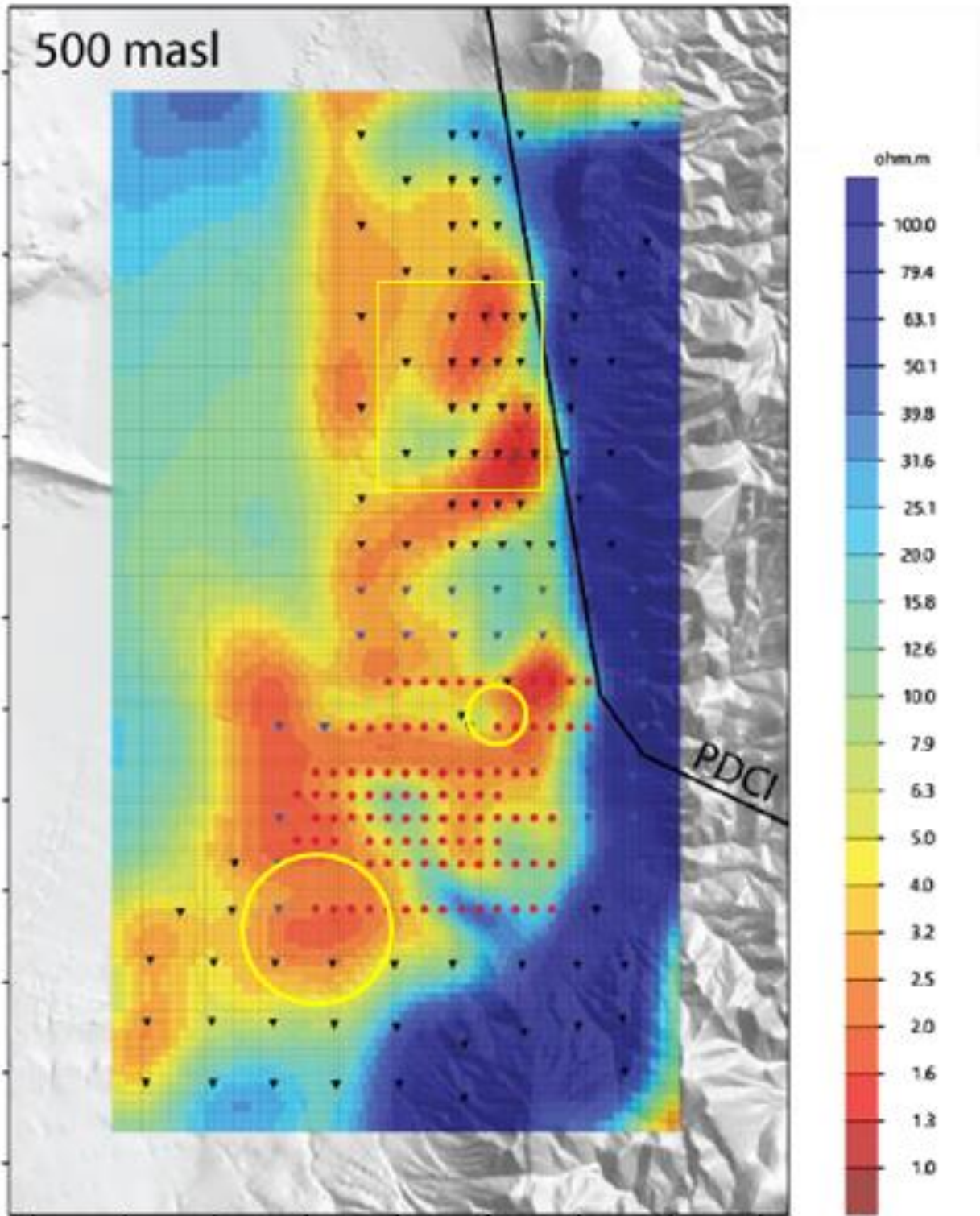


Fig. - 6 - MT Resistivity Model - @ 500 Meters ASL

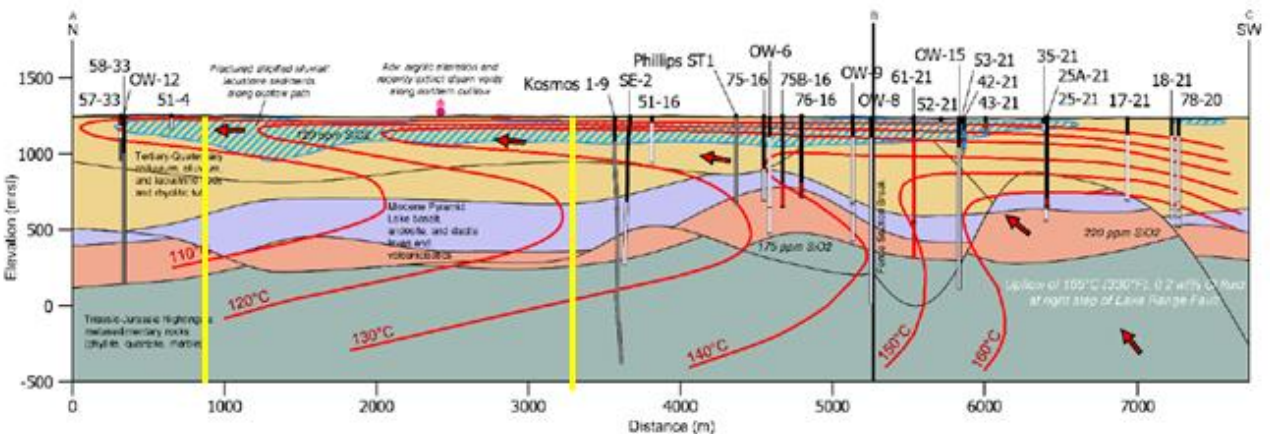


Figure 10: (A) Conceptual geologic model sliced along a fence section connecting wells in across the field. Red lines show isotherms of pre-development temperatures, indicating deep upflow in the southern portion of the field, and shallow outflow to the north along the San Emidio fault zone. Heavy silicified sediments are shown as a blue cross-hatched outline.

CONCEPTUAL HYDRO GEOLOGIC MODEL - From Folsum, et. al., 2020

Yellow lines = approx. Pyramid Assoc. LP property boundaries

Fig. - 7 - Hydro Geologic Model of Existing San Emidio Well Field and Outflow Zone

(266 °F). This interpretation is supported by considerable drill data from the area to the south of the Pyramid property. However, there is very little data to support this interpretation across the 2.5 km (1.5 mile) wide zone on the model that represents the Pyramid property. The data is also somewhat sketchy to the north of the property. What is known in this area is that the three Wind Mountain Mine wells reported temps of 116 °C (241 °F) at 100 M (333 ft.) depth (Rhodes, 2011). What is also known is that the US Geothermal well OW - 12 encountered 96.1 °C (205 °F) temperatures at 79M (260 ft.) and encountered 87.8 °C (190 °F) temperatures at 128M (420 ft.) depth (BLM, 2020).

This shows that OW - 12 encountered a shallow temperature reversal - this supports the model. This also shows that aquifer has apparently cooled about 20 °C (36 °F) since the time that the Wind Mountain Mine wells were in operation.

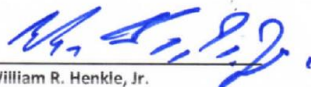
**Conclusion** - The objective of this study is to formulate an opinion as to whether or not the proposed injection wells sited along the boundaries of the Pyramid property might cool the geothermal aquifer which underlies part of the property.

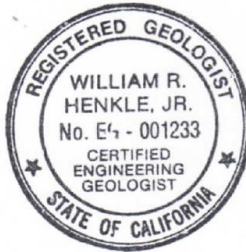
My opinion is that there is a definite possibility that injection of 57.2 °C (135 °F) fluids into the outflow aquifer that currently is at temperatures of 116 - 96.1 °C (241 - 205 °F); will most likely cool the aquifer beneath Pyramid’s property. In support of this, I offer the following observations:

1. The aquifer has been used in the past to supply water for the operation of the Wind Mountain Gold Mine. Most of the water was used to heap leach the gold ores extracted from the mine. It is well known, that hot geothermal waters speed up the heap leaching process and result in faster and more complete recovery of the microscopic gold in the ores.

2. There are many other potential direct uses of the geothermal waters carried by the outflow aquifer.
3. The size of the aquifer is substantial. It varies from ~ 100 - 300 m (330 - 1000 ft.) in thickness and has a strike length of ~ 6.5 km (3.9 miles) - the down dip extent (and temperatures at down dip depths) are unknown.
4. Exploitation of the aquifer for electricity generation at the Pyramid property is unlikely. However, as indicated by the MT survey results discussed herein - that possibility may exist.

Dated - 8/22/20

  
 William R. Henkle, Jr.  
 California Certified Hydrogeologist # HG - 447



## REFERENCES

Folsom, M., Libbey, R., Fucht, D., Warren, I., and Garanzini, S., 2020, *Geophysical Observations and Integrated Conceptual Models of the San Emidio Geothermal Field, Nevada*, in PROCEEDINGS - Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, SGP-TR - 216

ORNI 36, LLC., 2020, UTILIZATION PLAN - North Valley Geothermal Development Project in the San Emidio Geothermal Field - from BLM Website - North Valley Project

Reinisch, E.C., Cardiff, M., Akerly, J., Warren, I., and Feigl, K.L., 2019, *Spatio-Temporal Analysis of Deformation at San Emidio Geothermal Field, Nevada, USA, Between 1992 and 2010*, Remote Sensing, 2019, Vol. 11

Rhodes, G.T., 2011, *Structural Controls of the San Emidio Geothermal System, Northwestern Nevada*, Master's Thesis, Univ. of Nevada, Reno

**Overview map of the San Emidio Geothermal area and Wind Mountain... | Download Scientific Diagra**

Vetter, O.J. and Kandarpa, V., 1982, Reinjection and Injection of Fluids in Geothermal Operations (State of the Art), [osti.gov](http://osti.gov), DOE/ET/27146 - T 17

Bureau of Land Management, 2020, *North Valley Geothermal Development Project at the San Emidio Field - Environmental Assessment - Hydrogeologic Evaluation*, Winnemucca District Office



Washoe County Planning Commission  
September 1, 2020 Public Hearing  
Special Use Permit Case Number WSUP20-0013 [Ormat Geothermal]  
Ormat North Valley Geothermal Development Project

I, Michael Alberg representing Pyramid Associates L.P., present the following testimony opposing Ormat Geothermal's Special Use Permit

My name is Michael Alberg and I am representing Pyramid Associates L.P., a family partnership of which I am a member. Pyramid Associated L.P. owns 1,084 acres of fee land (tax parcel numbers: 071-070-01, 071-070-02, 071-070-03, 071-070-04, 071-070-05, 071-070-15, 071-070-17), plus 200 acres of adjoining mining claims. Our father purchased the property as patented mining claims for their mineral resources over 60 years ago. Over the years, we have leased the property for mineral and geothermal exploration. This includes the company Chevron Resources for geothermal purposes in the 1970's and Newmont Gold Corp in the 1990's, as well as other mineral companies and geothermal companies. Our property has valuable mineral and geothermal resources. The Ormat Project could damage these valuable resources, along with our ability to explore and economically produce them. To support the potential damage to our geothermal resources W.R. Henkle Jr., a professional Geologist and a professional Hydrogeologist, has prepared a 17 page report (see attachment "C").

In Mr. Henkle's conclusion he states:

"My opinion is that there is a definite possibility that injection of 57.2°C (135°F) fluids into the outflow aquifer that currently is at temperatures of 116°C - 96.1°C (241°F - 205°F); will most likely cool the aquifer beneath Pyramid's property. In support of this, I offer the following observations:

1. The aquifer has been used in the past to supply water for the operation of the Wind Mountain Gold Mine. Most of the water was used to heap leach the gold ores extracted from the mine. It is well known that hot geothermal waters speed up the heap leaching process and result in faster and more complete recovery of the microscopic gold in the ores.
2. There are many other potential direct uses of the geothermal waters carried by the outflow aquifer.
3. The size of the aquifer is substantial. It varies from ~100-300 m (330-1000 ft.) in thickness and has a length of ~6.5 km (3.9 miles) — the down dip extent (and temperatures at down dip depths) are unknown.
4. Exploitation of the aquifer for electricity generation at the Pyramid Property is unlikely. However, as indicated by the MT survey results discussed herein—that possibility may exist."

The North Valley Geothermal Project as proposed would be adjacent to our south, east, and north boundaries. They would site seven injection wells and pipelines adjacent to our property line with two wells and 1.75 miles of pipelines located on our mining claims and Pyramid Associates property (locations are shown on Attachment "A"). The project proposes to use 1.3 miles of unimproved dirt road as their main access to the project (shown on attachment "A" location map).

*Pyramid Associates testimony in opposition to WSUP20-0013 (Ormat Geothermal)*

The applicant (Ormat Geothermal) neglects to identify in the application all adjacent private property including Pyramid Associate's property of 1,084 acres of fee and 200 acres of mining claims (refer to map Attachment "A"). The results of the applicant's omission of Pyramid's adjacent properties affects many sections of this application and the findings proposed by the applicant.

*Supplemental Information Section:*

- 2) Site Plan does not identify adjacent property (Pyramid Associates 1084+ acres).
- 4) Injection wells and adjacent Pyramid properties are not identified.
- 6) What are the negative impacts and affects your project will have on adjacent properties.

The applicant does not identify adjacent property (Pyramid's property). Therefore, they do not investigate any possible negative impacts and affects or mitigation for these impacts.

*Pyramid the adjacent property owner has identified the following negative impacts their property;*

- 1) Cooling and dilution of Pyramid's geothermal resources as described in Mr. Henke's hydrogeologic report (Attachment "C").
- 2) Seismic instability (earthquakes) caused by injection of 7,760 gallons per minute of cooled geothermal fluids into and adjacent to the faults crossing Pyramid's property (Refer to section 4 of the permit application 'Geotechnical Due Diligence Report' and Attachment "B" location map).
- 3) The injected geothermal fluids migrating into our mineral deposits would make it difficult to explore and mine them (Attachment "C").
- 4) The applicant's proposed access road crosses 1.3 miles of Pyramids private property. This road is unpaved dirt and some rock. It is a dry, dusty road in summer and muddy in winter. The road access is questionable. Pyramid the owner has never granted any easements or right of ways. Pyramid leased the road to the company Integrated Ingredients for commercial access to

their dehydration plant, but reverted back to Pyramid after they failed to make lease payments. The applicant needs to acquire the right to use the road for commercial and industrial traffic (Attachment "A").

## Findings

### *General Special Use Permit Findings*

Prior to approving an application for special use permit the Planning Commission, Board of Adjustment, or a hearing examiner shall find all of the following are true;

(b) Improvements; Adequate road improvements

*Applicants response;* minor improvements to existing roads

*Opponent's (Pyramid) response;*

1) The applicant's proposed primary access road is not adequate for heavy commercial and industrial traffic and will need major improvements. The road is dirt and rock, dusty when dry and muddy when wet.

2) 1.3 miles of this road crosses the middle of Pyramid's land. Pyramid has never provided any easements or right of ways to use this road. The applicant needs to acquire rights to use the access road for heavy commercial and industrial.

(d) Issuance Not Detrimental. Issuance of the permit will not be injurious to the property or improvements of adjacent properties;

*Applicants Response;* No mention of adjacent property

*Opponent's (Pyramid) Response;* The project will be injurious to adjacent property!

1) Pyramid's property is adjacent to the project (Attachment "A" map). The property of 1,084 acres fee land plus 200 acres of mining claims adjoining the project for 2 miles on the north, east and south sides of Pyramid's property.

2) Detrimental and injurious effects to Pyramid's property.

- 1) Pyramid has valuable geothermal resources that the projects injection wells will damage by injecting 7700+gpm of cooler geothermal fluids into them (Refer to hydrogeologic report in Attachment "C")
- 2) The project's injection of these fluids adjacent and into Pyramid's property and mining claim will make the valuable minerals more difficult to explore and mine.
- 3) Injection of these large volumes of geothermal fluids could cause seismic disturbances (earthquakes) damaging the geologic structure in Pyramid's property, because several of the injection wells are located on faults that pass through our property. Injecting on faults increases this risk (Refer to the



Geotechnical Due Diligence Report, Section 4 of this project application and Attachment "B").

## Conclusion

Pyramid Associates L.P. owns 1,084 acres fee property and 200 acres unpatented mining claims adjacent to the Ormat Geothermal project WSUP20-0013. We oppose this project as proposed, because it would be injurious to our property and it's geothermal and mineral resources. Our family has owned this property for over 60 years. It was purchased as an investment for the minerals it contains. We are trying to protect and preserve these resources for the future.

Included; Attachment "A" -area map  
Attachment "B" - fault map  
Attachment "C" - Hydrogeologic Report Potential for damage to Pyramid Assoc. Geothermal Resources by W.R. Henkle P. Hydrogeologist  
Attachment "D"- Surface temperature measured on Pyramid Associates Property

Pyramid Associates L.P.  
By: Michael Alberg  
800 Shale Pit Rd  
Ellensburg, WA, 98926

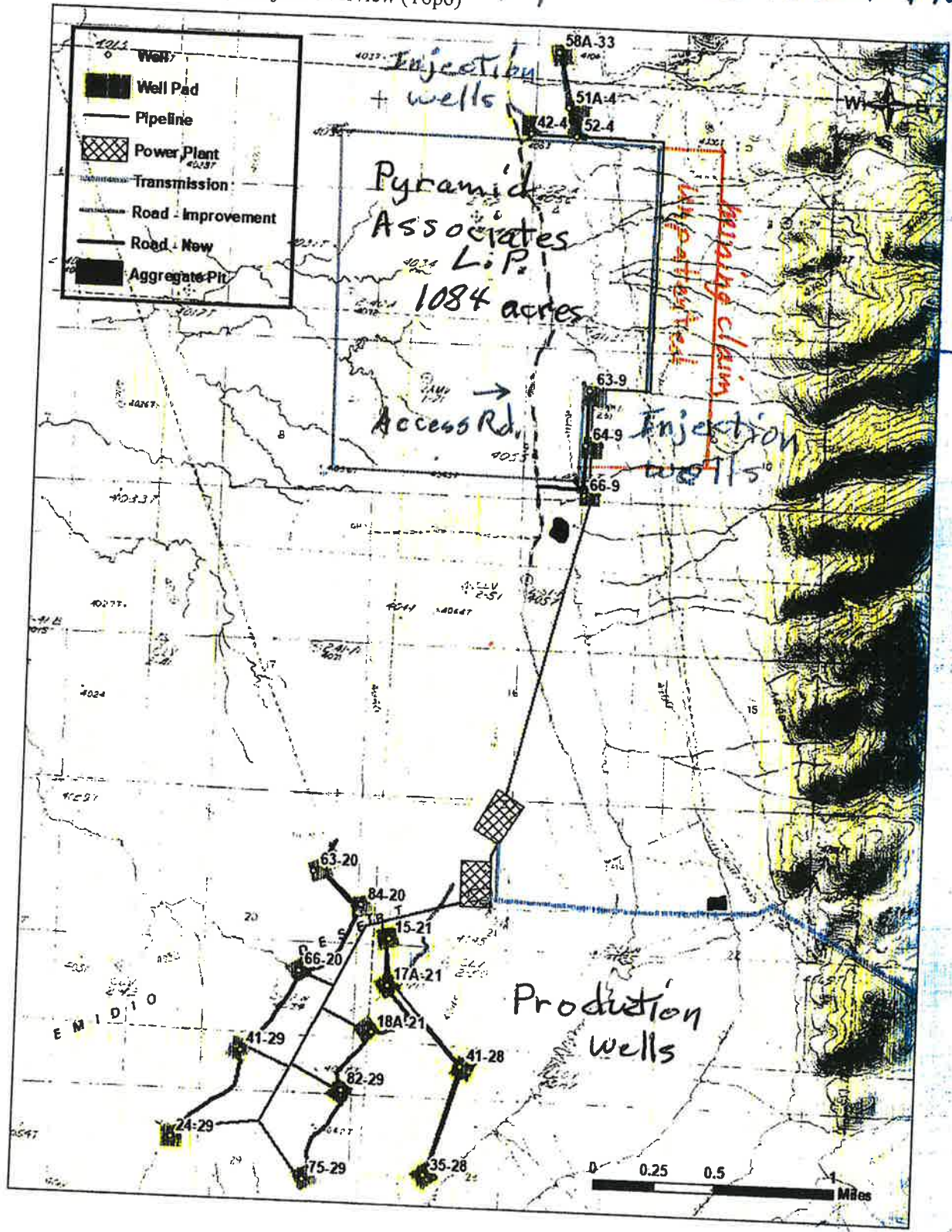
# Attachment 'A'

North Valley Geothermal Development Project Utilization Plan  
Ormat Nevada, Inc.

February 2019





## Proposed wells, pipeline and Power Plant

Figure 4: North Valley Project Overview (Topo)



Attachment 'B'

**Quaternary Faults**

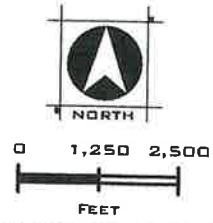
-  <1,600,000 years
-  Project Boundary
-  Well Pad
-  Power Plant

Attachment 'B'



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

**FIGURE 4 - QUATERNARY FAULT MAP**  
 ORMAT NORTH VALLEYS GEOTHERMAL PLANT  
 WASHOE COUNTY, NV  
 JUNE 2020




**WOOD RODGERS**  
 BUILDING RELATIONSHIPS ONE PROJECT AT A TIME  
 1361 Corporate Boulevard  
 Reno, NV 89502  
 Tel: 775.823.4068  
 Fax: 775.823.4066

# Attachment 2

To: Michal Alberg  
Pyramid Assoc., LP.

8/22/2020

From: W.R. Henkle, Jr., P.Geol., P.HydroGeol.  
Henkle and Assoc.

Subj: Potential for Damage to Pyramid Assoc. Geothermal Resources - San Emidio Build Out Project

In mid - August, 2020, Henkle and Assoc. (HA) was contracted by Pyramid Assoc. to report our opinion as to whether or not the potential might exist for the planned build out expansion of the San Emidio Geothermal Power Plant to damage geothermal resources owned by Pyramid Assoc. This letter report addresses that question.

**Property Situation** - Pyramid is the owner of a 1084 Ac fee parcel (the property) located within the proposed project area (Fig. 1). Ormat, the developer of the project wishes to construct 25 production and injection wells, and accompanying infrastructure, to expand the electrical generation capacity of the San Emidio Plant. Seven of these wells, which are believed by Pyramid to be injection wells, are planned for construction either along the boundary of or in the near vicinity to the property boundaries.

Ormat plans to more or less continually inject up to 9240 GPM of spent fluids at 135°F (57.2°C) to an unspecified number of injection wells (at an unspecified depth) for the life of the project (BLM, 2020). Pyramid is concerned, that the cooler injection fluids may intermingle with hot geothermal brines beneath their property (measured at ~ 116°C to 109°C (241°F to 228°F) and cool down their resource. Should the subsurface geothermal brines under the Pyramid property suffer cooling; the resource could be damaged and Pyramid might suffer economically.

**Relevant Property Geology** - The property lies about 2 - 3 km to the north of the existing Geothermal Power Plant. The property is on the eastern flank of the San Emidio Desert Basin and is flanked on the east by the Lake Range and on the west by the Fox Range of mountains. The Lake Range Frontal Fault, a steeply dipping down to the west fault, forms the boundary of the San Emidio Desert Basin. The range front fault has ~ 1000 ft. of displacement and is found ~ 1 km (3300 ft.) to the east of the eastern boundary of the property.

A series of sympathetic N to NNE striking - down to the west, normal faults of variable displacement are found to the east of the Lake Range frontal fault. At least 9 major sympathetic faults and several subsidiary faults have been mapped in a 4 mile wide zone at and in the vicinity of the property (Fig. 2). Of note is the San Emidio Fault, which forms the footwall of the geothermal reservoir at San Emidio. The un-named fault which outcrops ~ 1/3 km (~ 0.2 mi) to the west of the San Emidio Fault forms the hanging wall of the reservoir.

**Reservoir Characteristics** - Productive zones within the reservoir are found in areas where the fracture patterns are enhanced by intersections with other faults or bends in the major fault, etc. Such a zone is found about 3 km (1.9 mi) to the south of the property. This is the wellfield production area for the existing plant, which is found at a bend in the San Emidio Fault and also at the intersection of the Empire and San Emidio Faults. Production from the well field has a fluid temperature of 152°C (306°F) and is found at 571m (1706ft) below ground surface. The existing plant has an 11.8 MW design capacity (BLM, 2020).

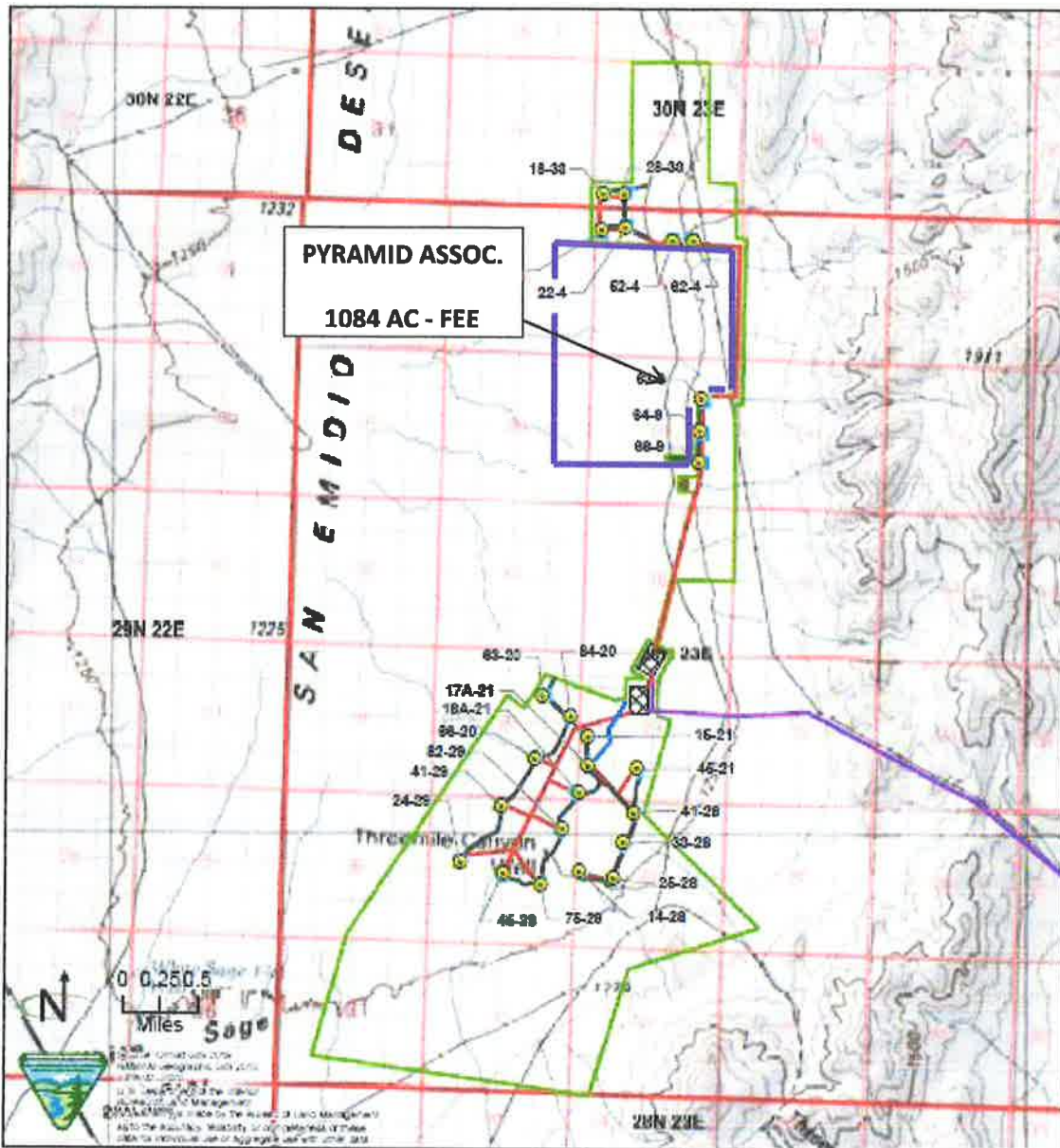
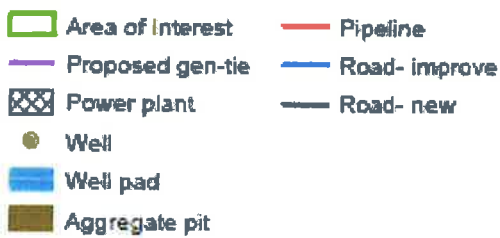
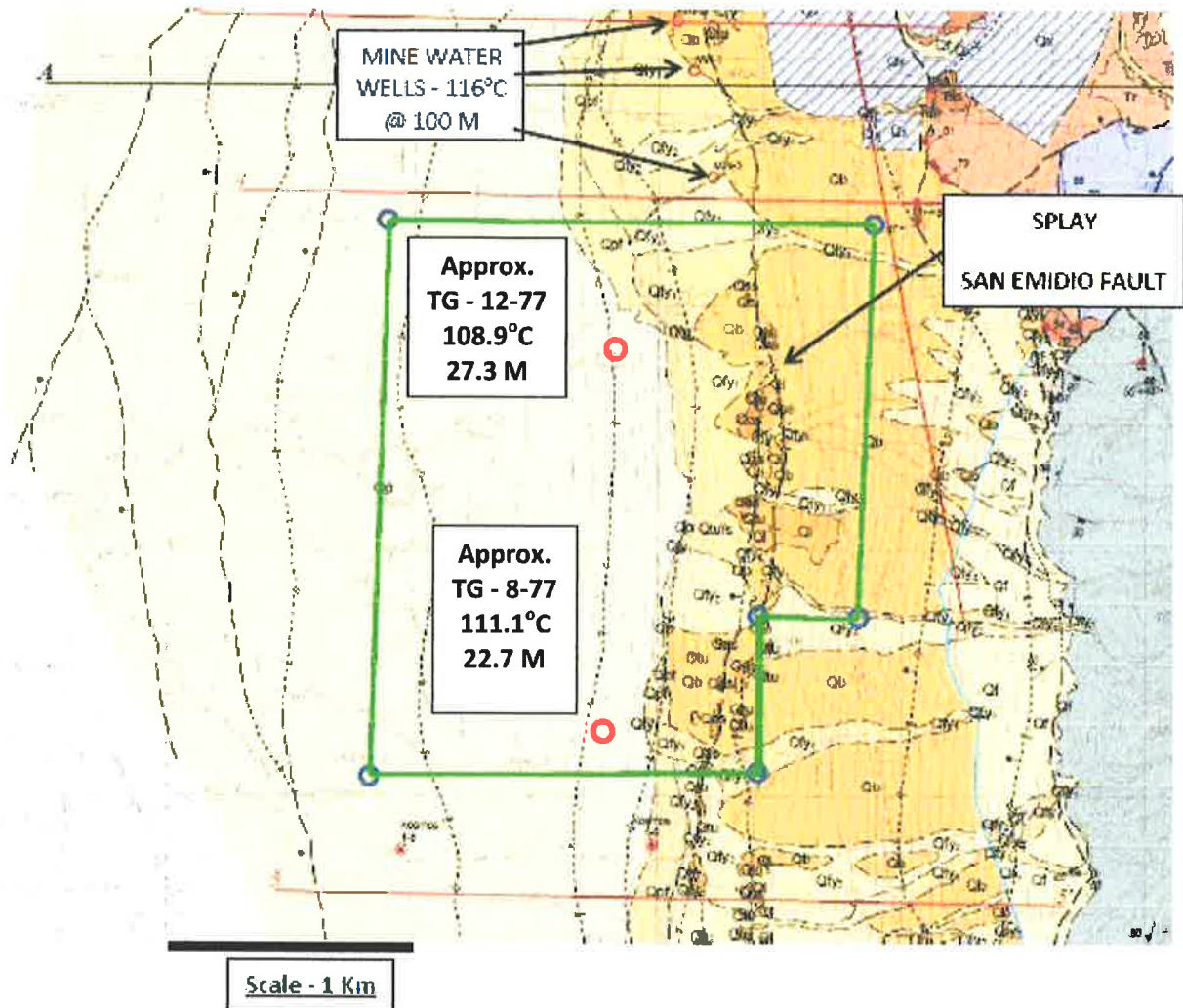


Figure A-3. Project Overview—San Emidio Geothermal Lease Unit



**Fig. 1 - Pyramid Assoc. Property Vs. Proposed Well Lay Out  
After - BLM, 2020**



**Fig.2 - Property Geology - After Rhodes, 2011**

The reservoir is known to extend northwards from the well field for at least 3 miles, to the Wind Mountain gold mine well field which encountered temperatures of 116°C (241°F) at 100 M (333 ft.) depth (Rhodes, 2011). Similar temperatures were found at similar depths in TG 8-77 and 12-77 (Pyramid Assoc. Records, 2020). Extensive hydrothermal alteration (acid - sulfate and silicification) is found along the outcrop of the San Emidio Fault (Rhodes, 2011, Folsom, et.al., 2020 and others). Proof positive of ancient hot waters flowing through and along the plane of the San Emidio Fault.

InSAR (interferometric synthetic aperture radar) from satellites was used to map surface subsidence deformation over the property using data collected from 1992 to 2001 (Rhodes, 2011). Analysis of the imagery (Fig - 3) shows ~ 3mm of subsidence. This indicates hydraulic linkage with the production well field about 1.5 miles to the south of the property. Some of the production from the well field came from the property. Property boundaries are approximate.

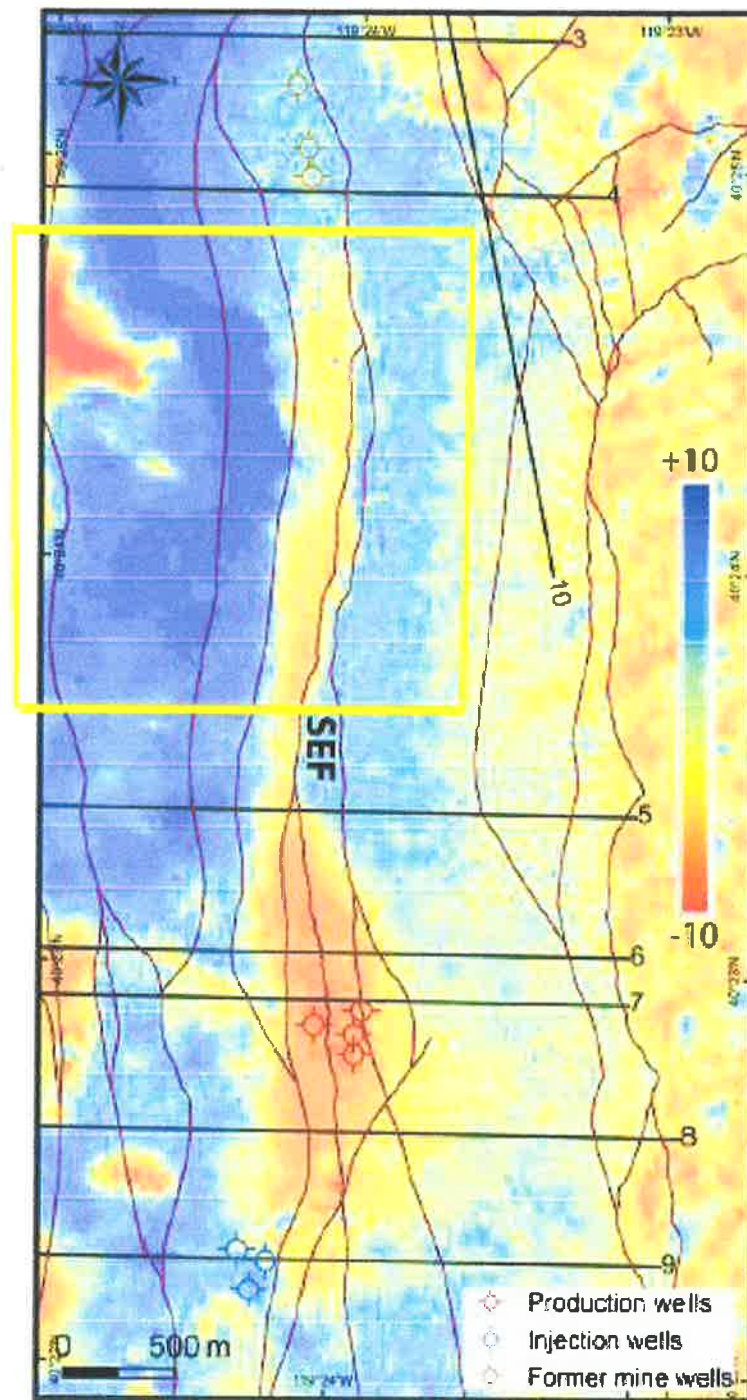


Figure 4.6 – InSAR results showing surface deformation from 1992 to 2001 with seismic reflection lines, mapped faults, wells, and the San Emidio fault zone (SEF) (modified from Eneva et al., 2011). Rates are mapped by color and shown in mm/year. Yellow to red colors indicate negative movement away from the satellite (subsidence) and green to blue colors indicate positive movement.

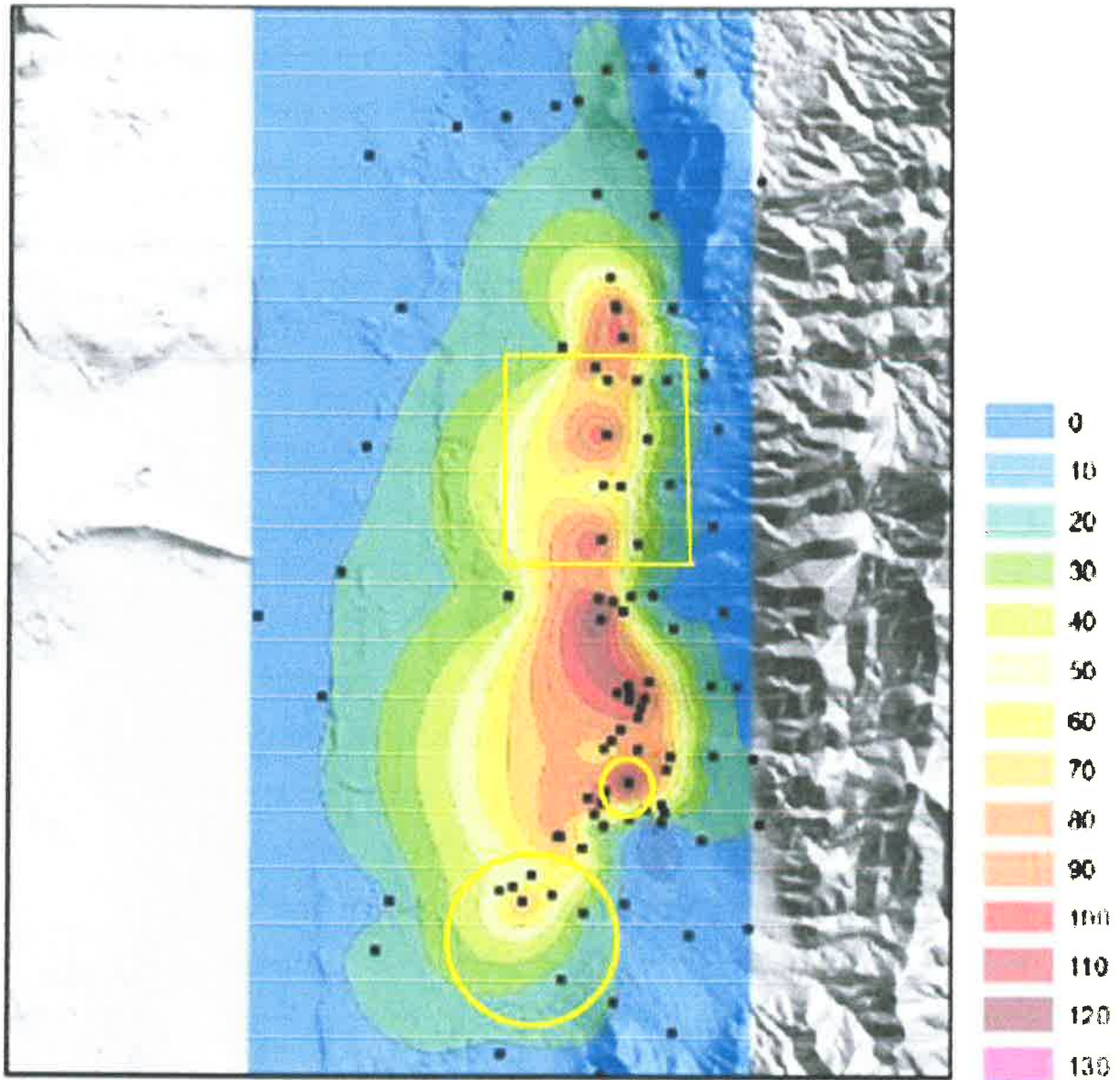
**INSAR DATA - SHOWING SUBSIDENCE DUE TO PUMPING**

From - Rhodes, 2011 - Fig. 4.6 - Property Boundaries - Approx.

**Fig. 3 - Reservoir Extent to North of Well Field - After Rhodes, 2011**

Additional evidence for the presence of an active geothermal system or systems at the property can be seen by inspection of Fig. 4, which shows Temperature Gradient Hole measurements at 100 M depth BGS.

### Temperature (deg C) 30 m below surface



**Fig. - 4 - Groundwater Temperature at 100 M BGS - After Folsom, et. al., 2020**

The map above shows six distinct hot spots from South to North across the Ormat project area. To the north of the Pyramid Assoc. property is the Wind Mt. Mine well field anomaly. Temperatures of + 100°C are found. The water temperature cools to 70 - 80 °C, as it crosses the N. boundary of the property. It then warms to + 100°C, then cools to 60 - 70 °C to form the northern property anomaly. It then cools



again to 80 - 90 °C before crossing the southern boundary of the property. This suggests the presence of two small heat anomalies at the Pyramid property.

A large anomaly that reaches + 120 °C is found just across the South property line. Oddly, this anomaly is not exploited; possibly due to lack of permeability. The anomaly within the small circle reaches +110 °C, this is the location of the present well field. The large circle to the south west encloses an anomaly that only reaches + 70 °C (at 100M). This is the location of the new well field planned for the San Emidio build out project. Wells into this anomaly are expected to produce 160 °C (320 °F) geothermal fluid from depths on the order of ~ 540 m (~ 1780 ft.) at flow rates of 4200 gpm (BLM, 2000 and Folsom, et. al., 2000).

It is interesting, that the two smallest heat anomalies at 100 M depth are the centers of production for the project. However, this is where commercial permeability was found at depth.

**Reservoir Geophysical Characteristics** - The San Emidio Project Area has also been studied using various geophysical methods. Methods employed include seismic (both active and passive), magnetics, gravity and magnetotelluric surveys. Only the gravity and magnetotelluric surveys will be discussed here.

**Gravity** - A network of 1270 gravity stations was used to survey the project area, (Folsom, et. al., 2000). The investigators produced three different gravity maps. A complete Bouger anomaly, a Gravity Horizontal Gradient Magnitude and a Gravity First Vertical Derivative map were produced. Only the First Vertical Derivative map (Fig.- 5) will be discussed here, as this shows reservoir related issues the best.

The light purple colored + .004 mGal/m anomaly is the most striking one seen on the map. The largest area with this color and it's associated colors is seen along the mountain front. This is noise and it is caused by the dense gravitational attraction of the mountains - their gravity pulls the instrument response up, since a large mass of the mountains is at a much higher altitude than the instrument down in the valley.

The blue colored -.005 and -.009 mGal/m anomalies are seen next as the view traverses towards the west. This is caused by the presence of lesser density rocks (much of it alluvial fill) found in the main part of the basin. Of note, is the ridge of 0.00 to + 0.004 anomaly seen near the center of the map. This is caused by the presence of higher density rock which happens to coincide with the outcrop of the San Emidio Fault. The rock units along the outcrop of the fault have been hydrothermally altered and silicified. It is thought, that the silicification causes the rock affected by the alteration to be considerably denser than the non-altered rock, hence this peculiar geophysical signature (Folsom, et.al., 2000).

The slice of rocks bounded by the San Emidio and the next adjacent fault to the west, acted as a conduit for the geothermal brines in the distant past. The hot fluids deposited silica in the rock mass which caused these rocks to be more brittle than the non-altered rocks. Earthquake movements over time caused these rocks to fracture and resulted in higher permeability in the zone between the two faults. The zone became, and still is a geothermal aquifer.

**Magnetotelluric survey** - The magnetotelluric (MT) method is a passive electromagnetic (EM) exploration method that measures orthogonal components of the electric and magnetic fields on the Earth's surface. Solar energy and lightning cause natural variations in the earth's magnetic field, inducing electric currents (known as telluric currents) under the Earth's surface. Different rocks, sediments and geological structures have a wide range of different electrical conductivities.

# Gravity First Vertical Derivative

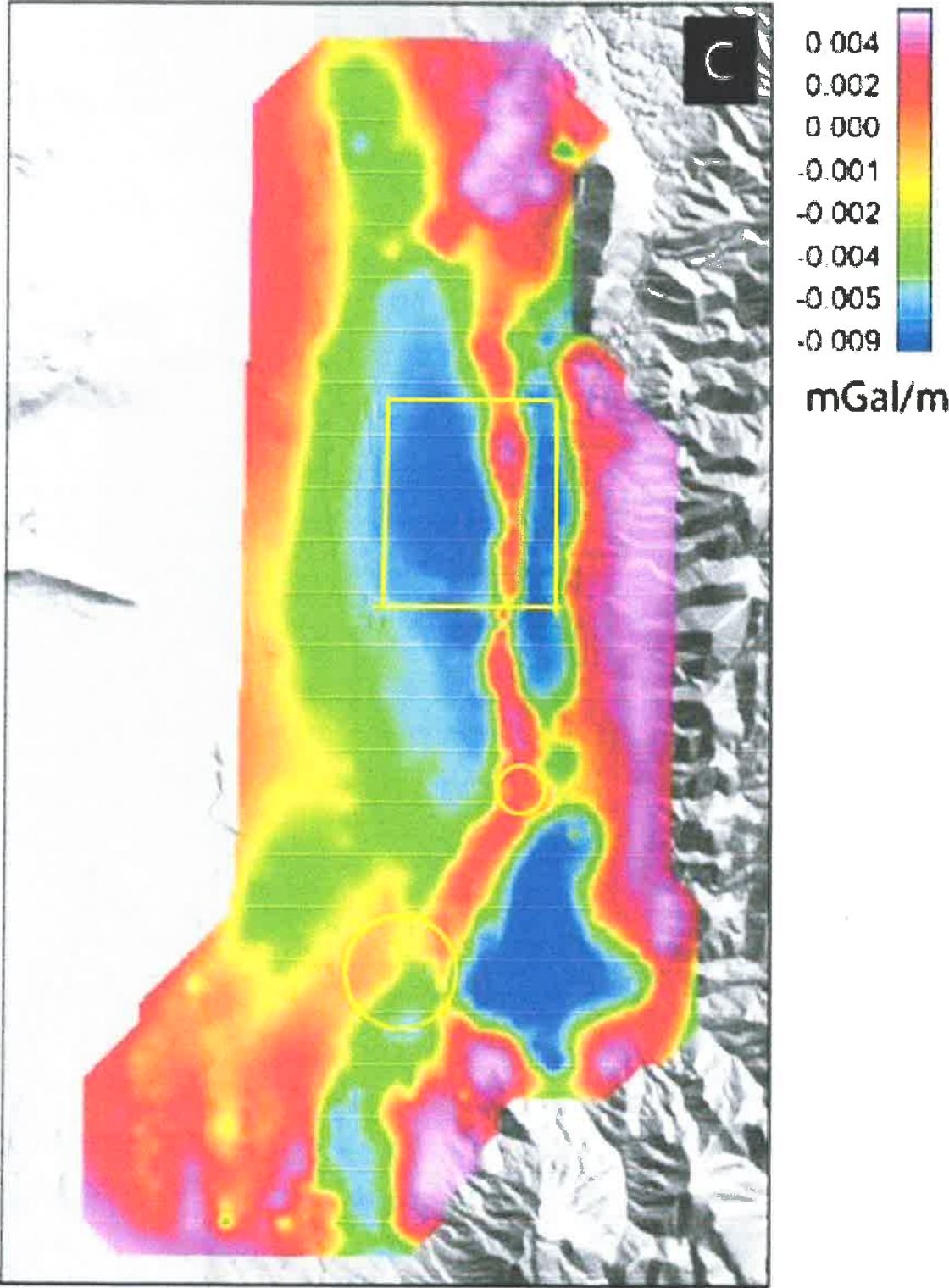


Fig.- 5 - Gravity Related Reservoir Characteristics - after Folsum, et. al, 2020

Measuring electrical resistivity allows different materials and structures to be distinguished from one another and can improve knowledge of tectonic processes and geologic structures. Because MT surveys have relatively low resolution but excellent depth penetration, the measurements are used to help interpret regional geology.

For the San Emidio study a network of 211 broadband MT stations were used to measure the deep resistivity of the project area (Folsum, et.al., 2000). Resistivity measurements (as ohm - meters) are taken at each station. Upon completion of the survey, an inverse 3D mathematical computer model is constructed of the project area. In order to visualize the model in plan view, the model is "sliced" at various elevations to prepare a plan metric map. For the San Emidio study maps were prepared for model slices at 1150, 1000, 800 and 500 meters above sea level (MASL). Only the 500 MASL map will be discussed here (Fig. - 6).

For this discussion, the reader should be aware the map readings are in ohm - meters, which are resistivity units. The scale bar on the map shows values from + 100 ohm - meters (blue) to > 1.0 ohm - meters (dark red). High resistivity anomalies represent resistive rock units, low resistivity anomalies represent conductive rock units. Since hot geothermal brines are generally high in dissolved minerals, the brines usually conduct electricity. Conductive fluids in the pores and fractures of the geothermal aquifer units show up in these surveys as low resistivity conductors.

The average elevation at the Pyramid Assoc. property is ~ 1235 MASL (4050 ft. ASL); the depth slice at 500 MASL is at a depth of ~ 735 M (2411 ft.). Two conductive units can be seen of the property and environs. One in the north central and one in the southeast of the property. The conductor in the southeast is only partly on the property (boundary lines are approximate). These conductors are in the 2.0 - 1.0 ohm - meter range, these are high conductivity readings.

The small circle which is over the existing well field is off set to the south west from a conductor of ~ 1.3 ohm - meters magnitude. The existing well field produces from fracture permeability found at ~ 675 MASL, the altitude of which is well above this anomaly. Perhaps the conductive zone migrates to the southwest at higher elevations.

The circle that represents the proposed well field overlies a sizeable conductive anomaly of ~ 2.0 - 2.5 ohm - meters. This well field will produce from ~ elevation 710 MASL. The anomaly also presents well on the 1000 and 800 MASL maps. This exploration method successfully highlights the well field. The combination of gravity and MT geophysical exploration methods is apparently well suited for the San Emidio geothermal area.

**Conceptual Hydro Geologic Model** - A conceptual model of the existing well field and outflow zone to the north was prepared for the San Emidio study (Folsum, et. al., 2020) (Fig. - 7). The model postulates a sizeable upwell zone in the southern part of the project area. The upwell zone has been penetrated and tested by wells # 18 - 21, 17 - 21 and 25A - 21. Production from these wells of 160°C (320°F) brines at ~ 4000 gpm. Is contemplated for the proposed build out. These wells confirm that the upwell zone is definitely there and that the model is accurate for that portion of the project area.

The model also postulates an outflow zone to the north. The geothermal aquifer that transports the outflow waters is formed from highly silicified and altered sediments which are confined between the San Emidio Fault plane and the first un-named parallel fault plane that out crops ~ 0.3 to 0.5 Km to the west. Pre-production temperatures in the out flow aquifer were in the range of 110 °C (230 °F) to 130 °C

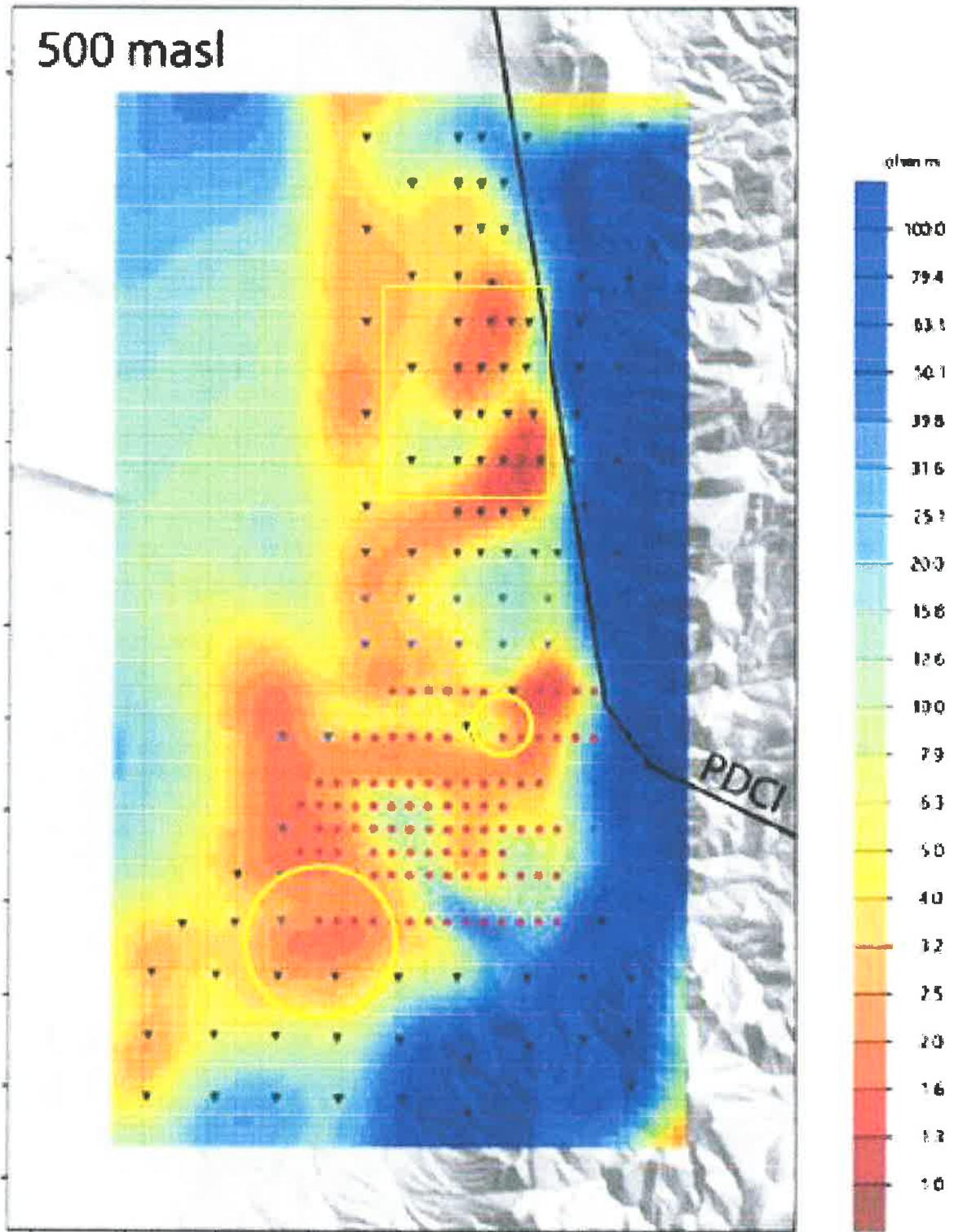



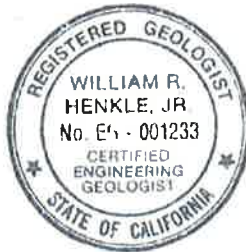
Fig. - 6 - MT Resistivity Model - @ 500 Meters ASL



2. There are many other potential direct uses of the geothermal waters carried by the outflow aquifer.
3. The size of the aquifer is substantial. It varies from ~ 100 - 300 m (330 - 1000 ft.) in thickness and has a strike length of ~ 6.5 km (3.9 miles) - the down dip extent (and temperatures at down dip depths) are unknown.
4. Exploitation of the aquifer for electricity generation at the Pyramid property is unlikely. However, as indicated by the MT survey results discussed herein - that possibility may exist.

Dated - 8/22/20

  
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## REFERENCES

Folsom, M., Libbey, R., Fucht, D., Warren, I., and Garanzini, S., 2020, *Geophysical Observations and Integrated Conceptual Models of the San Emidio Geothermal Field, Nevada*, in PROCEEDINGS - Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, SGP-TR - 216

ORNI 36, LLC., 2020, UTILIZATION PLAN - North Valley Geothermal Development Project in the San Emidio Geothermal Field - from BLM Website - North Valley Project

Reinisch, E.C., Cardiff, M., Akerly, J., Warren, I., and Feigl, K.L., 2019, *Spatio-Temporal Analysis of Deformation at San Emidio Geothermal Field, Nevada, USA, Between 1992 and 2010*, Remote Sensing, 2019, Vol. 11

Rhodes, G.T., 2011, *Structural Controls of the San Emidio Geothermal System, Northwestern Nevada*, Master's Thesis, Univ. of Nevada, Reno

**Overview map of the San Emidio Geothermal area and Wind Mountain... | Download Scientific Diagra**

Vetter, O.J. and Kandarpa, V., 1982, Reinjection and Injection of Fluids in Geothermal Operations (State of the Art), [osti.gov](http://osti.gov), DOE/ET/27146 - T 17

Bureau of Land Management, 2020, *North Valley Geothermal Development Project at the San Emidio Field - Environmental Assessment - Hydrogeologic Evaluation*, Winnemucca District Office

Attachment B San Emidio Desert Nevada  
Attachment D  
Δ Pyramid Associates, L.P. Patented Claims

← Wind Mountain Mine

N  
↑



Azufre claim - south end along road east side

180°F  
→  
6  
Inch  
depth

