
GEOHERMAL POWER GENERATION IN CHAFFEE COUNTY

NOVEMBER 30, 2023

**Sponsored by
Mt. Princeton
Geothermal,
LLC**



PURPOSE AND STRUCTURE OF MEETING

- Purpose of meeting – Learn about MPG geothermal plans, answer community questions
- Structure – 3x20 minute presentations, 10 minutes Q&A after each presentation.
 1. Overview, regulations.
 2. Hydrothermal vs. Enhanced Geothermal
 3. Proposed plant location

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1. Noise
 2. Visual
 3. Drilling

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1. Geology
 2. Seismic
 3. Benefits to the Community
 4. Timeline

Ground Rules

1. Participants should use Q&A to ask clarifying questions related to the topic.
2. Questions should be written.
3. Should include name and contact information of person submitting question.

- Additional Outreach Meetings covering follow-up questions and additional topics will be scheduled for February 2024.

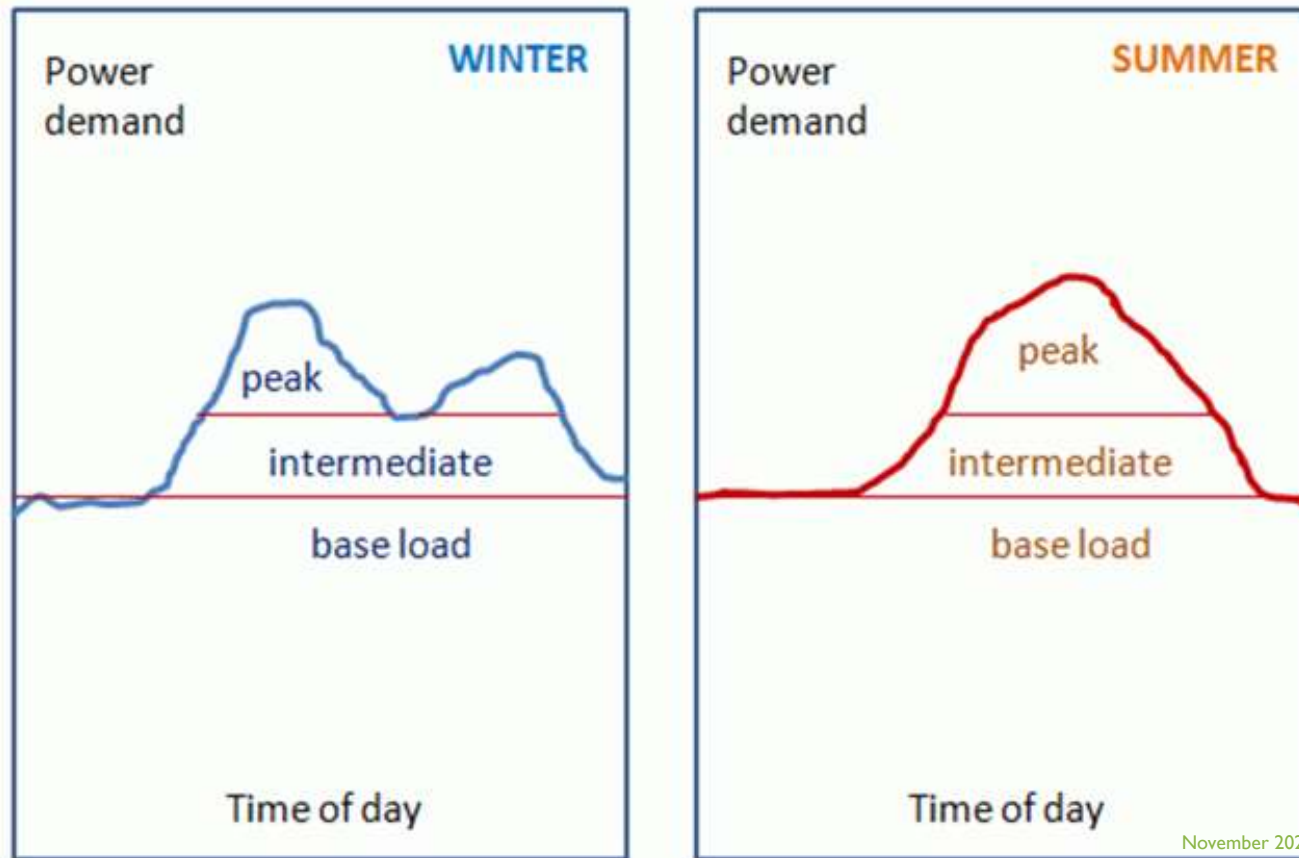
INTRODUCTIONS

- **Mt. Princeton Geothermal** was founded in 2007 as a Limited Liability Company under Colorado law. It is owned by John H. Held, with Frederick Henderson earning an equity position in exchange for his professional services.
- **John H. (Hank) Held** has a B.S., Marketing/Finance, University of Colorado; Juris Doctor (Law), University of Colorado. Employed by Citi Group, Manufacturers Hanover Overseas Capital Corporation (now a part of J.P. Morgan-Chase) and Shearson-American Express in a variety of senior management positions in South/Latin America and Asia, including the positions of President of two joint venture companies and Regional Counsel for the Asia-Pacific Basin. Held specialized in project financing.
- **Frederick Henderson** has a BS in Geology and MS in Petroleum Geology from Stanford and a Ph.D. in Economic Geology and Geochemistry from Harvard. Employed by St. Joe Lead and Kaiser Aluminum as a mining and exploration geologist in North and South America. Henderson worked on geothermal geochemistry at Lawrence Berkeley Laboratories. Henderson co-founded and was President of the Geosat Committee, Inc. supported by 150 major international petroleum, mining and engineering companies.

COMPELLING EVENTS

- **Governor Polis signed legislation into law to help Colorado achieve 100% renewable energy by 2040.**
- **Rush to find 100% base load to replace coal plants.**
- **Colorado Energy Office charged with delivering cost effective energy services and advancing innovative energy solutions for all Coloradans.**
- **Legislation determined the property right to a geothermal resource associated with nontributary groundwater is an incident of the ownership of the overlying surface.**
- **The Colorado Oil and Gas Commission is now the Colorado Energy and Carbon Management Commission increasing the agency's scope to encompass geothermal, underground natural gas storage; and carbon capture and sequestration to cut carbon dioxide emissions.**
- **The Bipartisan Infrastructure Bill and Inflation Reduction Act creates funding, programs, and incentives to accelerate the transition to a clean energy, making tax incentives for geothermal on par with solar, and provides funding to incentivize renewable energy projects**
- **Each fiscal year the federal government must consume at least 7.5% of its total electricity from renewable sources—referred to as the renewable electricity requirement.**

BASELOAD ELECTRICITY



TRI-STATE POWER AND DISTRIBUTION

Generation Portfolio (as of Dec 31, 2022)	Capacity (MW)	Percentage (%)
Coal-fired based load facilities	1,551	36
Renewables-contracts, including WAPA	1,366	31
Gas/oil-fired facilities	822	19
Other contracts, including Basin	616	14

ESTIMATED ENVIRONMENTAL BENEFITS TO CHAFFEE COUNTY

ANNUAL AVOIDED EMISSIONS (10MW)*

Offset-Grid Electricity (kWh)

(116,636,849)

Emission Reduction
(Metric Tons)

	<u>CO₂</u>	<u>NO_x</u>	<u>SO_x</u>
	(116,537)	(2)	(993)

Emissions Reduction
(Over COAL)

Combined Greenhouse Gases)

Metric Tons

117,532

Environmental Equivalent

25,007 CARS

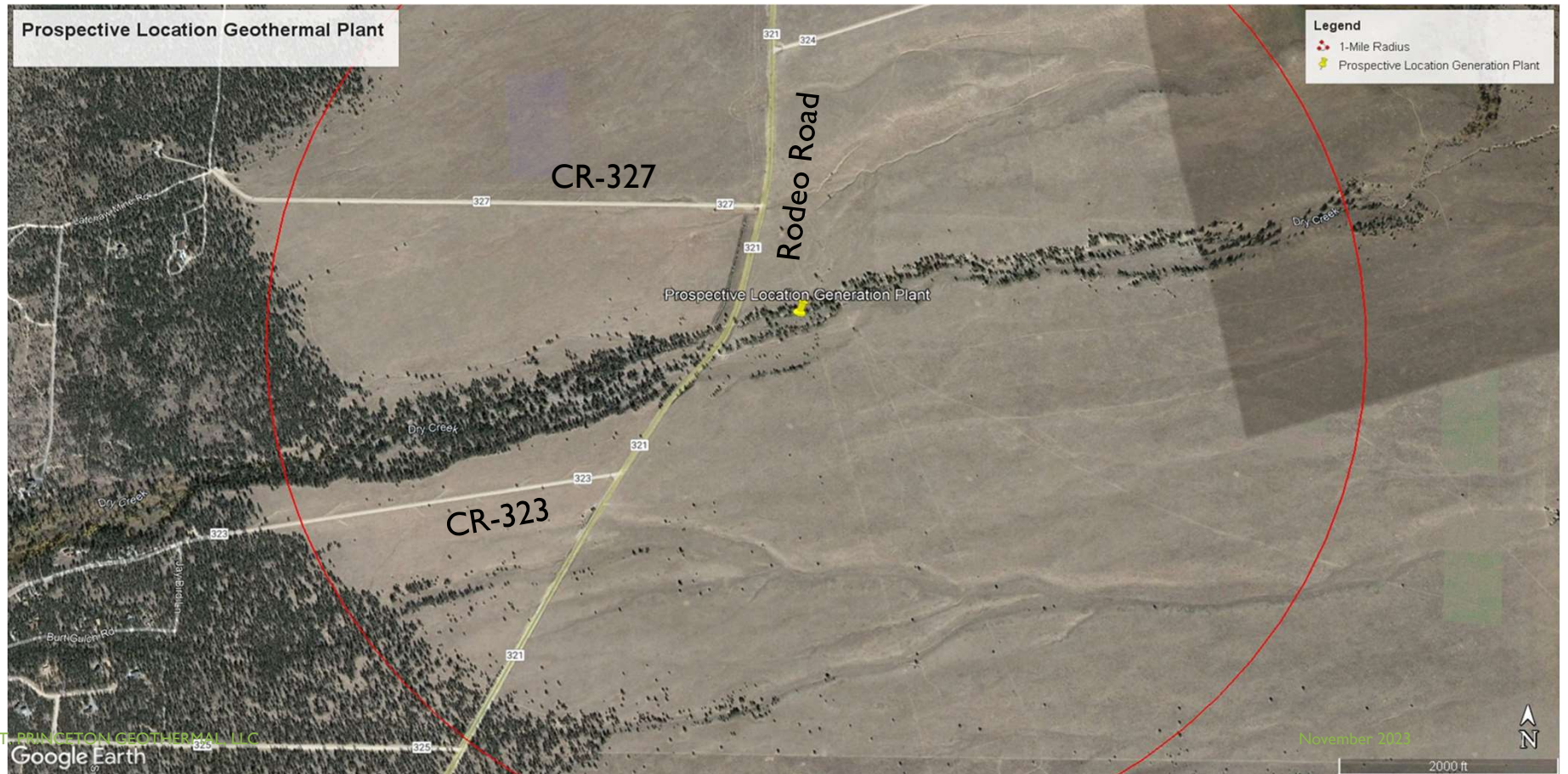
138,273 Acres of Trees

* <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

HYDROTHERMAL SYSTEMS - GEOTHERMAL AQUIFERS

- The geothermal system at Mt. Princeton is a naturally occurring hydrothermal system produced by hot water circulated in deep-seated permeable rocks or unconsolidated sediment (gravel, sand, silt, or clay) in which water may accumulate in sediments.
- The hot water can be extracted from these hydrothermal reservoirs using boreholes and, after the heat has been extracted, the cooled water is pumped back into the ground to maintain the water table and pressure.
- The Colorado Department of Water Resources (CDWR) refers to this process as “**non-consumptive Pump-and-Dump.**”

PROSPECTIVE LOCATION GEOTHERMAL PLANT

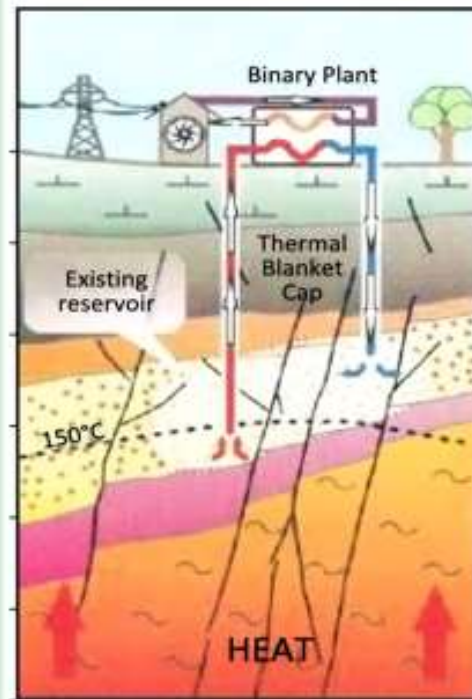


HYDROTHERMAL VS. ENHANCED GEOTHERMAL

The geothermal system at Mt. Princeton is a naturally occurring hydrothermal system produced by hot water circulated in deep-seated permeable rocks or unconsolidated sediment (gravel, sand, silt, or clay) in which water may accumulate, between layers of impermeable rock. The hot water can be extracted from these hydrothermal reservoirs using boreholes and, after the heat has been extracted, the cooled water is pumped back into the ground to maintain the water table and pressure.

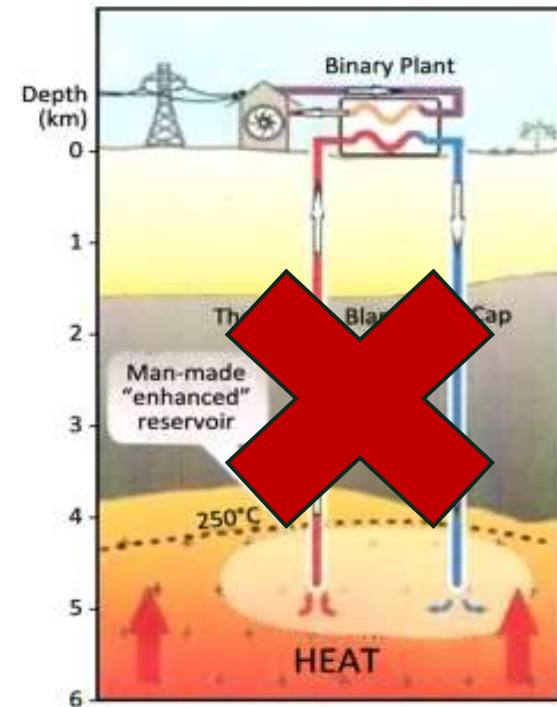
The Colorado Department of Water Resources (CDWR) refers to this process as “non-consumptive Pump-and-Dump.”

Hydrothermal



Heat carrier (steam/hot water) at depth is locally present

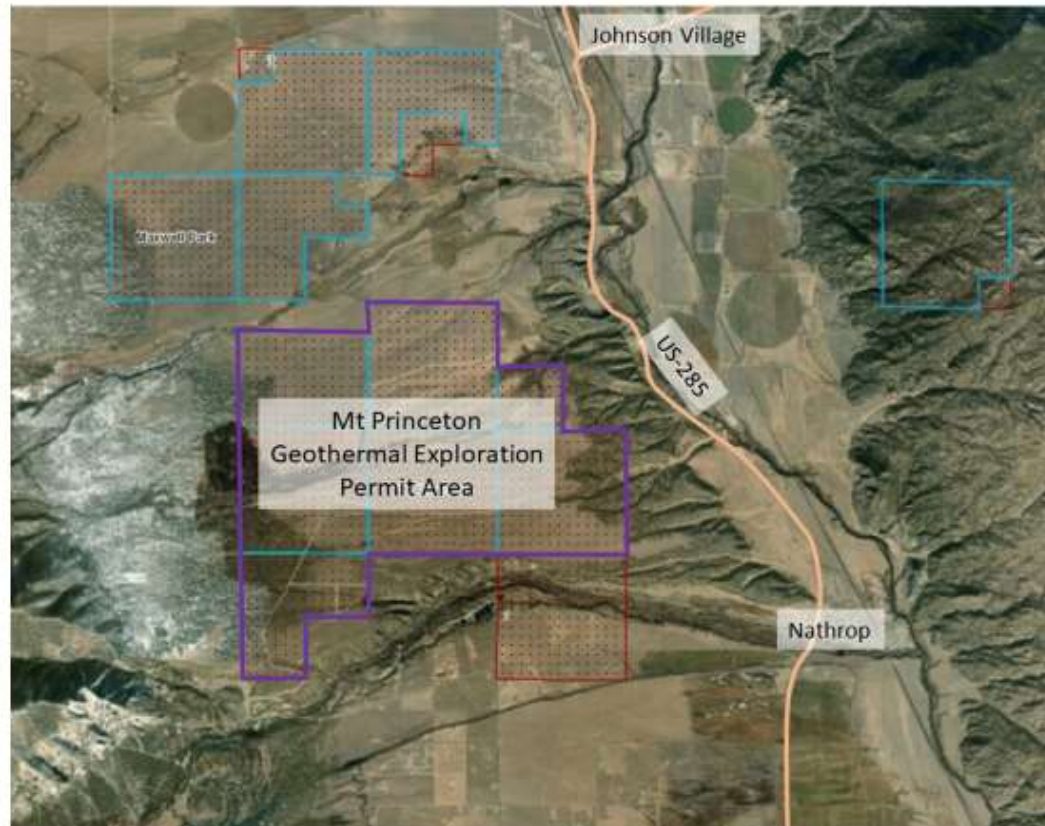
Enhanced Geothermal



Heat carrier must be artificially circulated to extract heat

CONSIDERATION: LAND USE

- State Board Land Lease – 3,692 Acres



AERIAL VIEW OF PROPOSED POWER PLANT



ARCHITECTS RENDITION OF INSTALLED POWER FACILITY



LAND USE DISTURBANCE

Projected Surface Disturbance				
Table 1.	Number	Initial Disturbance	Initial Short-Term Disturbance	Final Long-Term Disturbance
Temperature gradient boreholes	1	0.043 ac per borehole	.043 Acres	N/A
Test Wells	1	4 acres per well pad	4 acres	N/A
Production wells	2	4 acres per well pad	8 acres	2 acres
Injection wells	2	4 acres per well pad	8 acres	2 acres
Facilities	1	3 acres	3 acres	3 acres
Roads	2	3.6 acres per mile	1.5 acres	1.5 acres
Pipelines (above ground)	Unk	3 acres per mile	Unk	Unk
Transmission Lines	Unk	6.1 acres per mile	Unk	Unk
TOTAL			Short-Term Disturbance: 25.043 acres	Long-Term Disturbance: 8.5 acres

- Short-term Disturbance of 25 acres
- Long-term Disturbance of 8.5 acres
- Both are less than 1% of the total 3,692 acres

COMPARISON WITH OTHER GEOTHERMAL PLANTS



COMPARISON WITH OTHER GEOTHERMAL PLANTS



Raft River, Idaho 10 MW

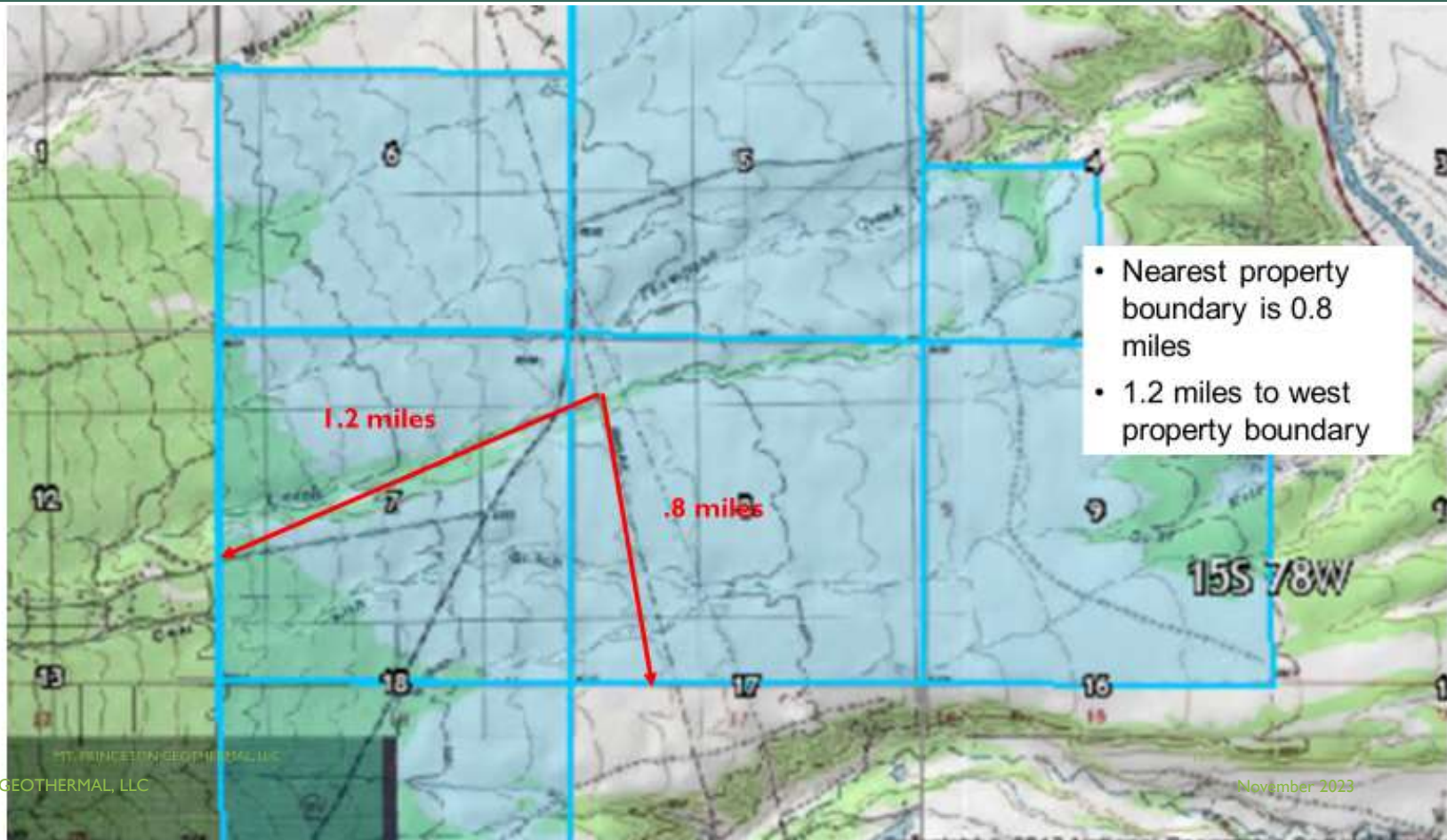


Part II

CONSIDERATION: NOISE LEVELS

- Chaffee County currently has no noise regulations.
- The Colorado Oil & Gas Commission requires that the noise level from geothermal facilities located on surface property owned, leased, or otherwise controlled by the operator shall be measured at the property line, and shall not exceed 50 dBa.
- Human speech, in a normal level at 3 feet is 60 dBa.
- MPG will establish a sound monitoring program for any subsequent power plant.

DISTANCE CALCULATIONS

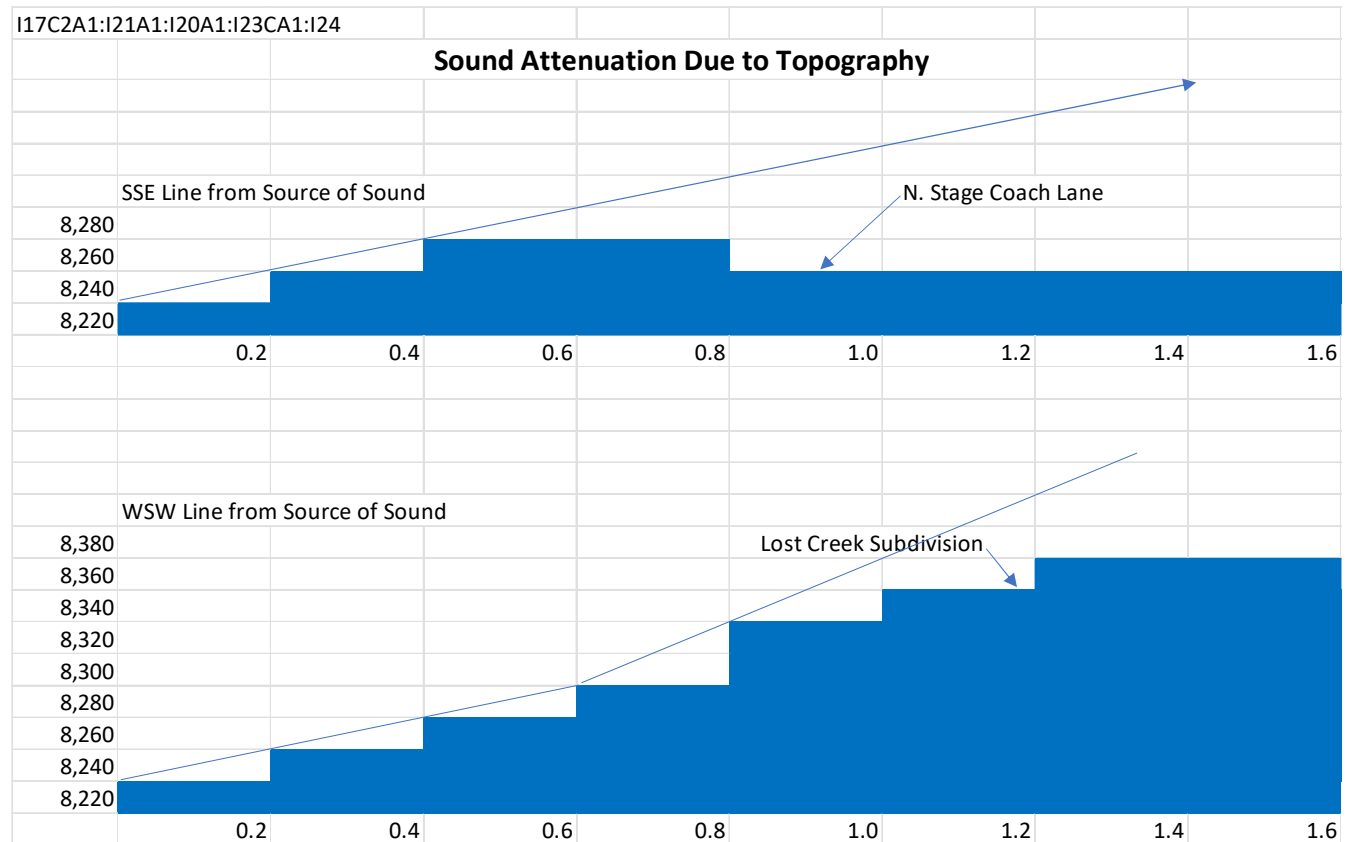


SOUND ATTENUATION DUE TO DISTANCE



TOPOGRAPHY IMPACTS ON SOUND TRAVEL

- SSE from plant – There is a 40 foot hill blocking path to N. Stage Coach Lane
- WSW from plant – At 0.8 miles from plant, there is a 100 foot rise that would deflect noise upward



SITEVIEW FROM CR 321 (PLANT SITE) LOOKING EAST



SITEVIEW LOOKING SOUTH



SITEVIEW LOOKING SOUTH EAST



SITE VIEW LOOKING WEST TOWARDS LOST CREEK SUBDIVISION



SITEVIEW LOOKING NORTH FROM N. STAGE COACH ROAD



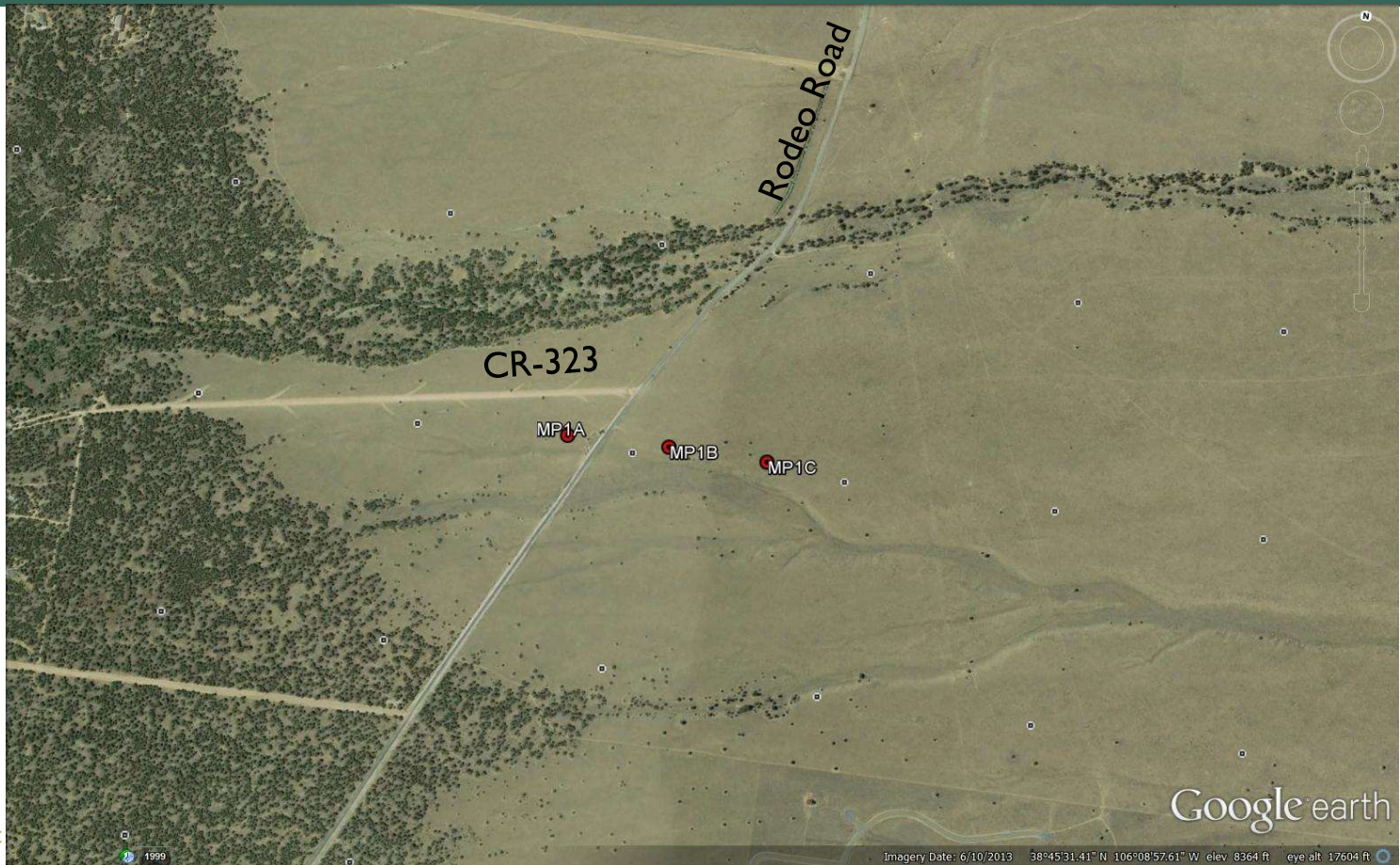
SITEVIEW LOOKING EAST FROM LOST CREEK SUBDIVISION



SITE VIEW OF PROPOSED LOCATION FROM LOST CREEK SUBDIVISION



PROPOSED WELL LOCATIONS



WELLS



- Well drilling at Neal Hot Springs

Each exploration well takes up to 3 weeks to drill.

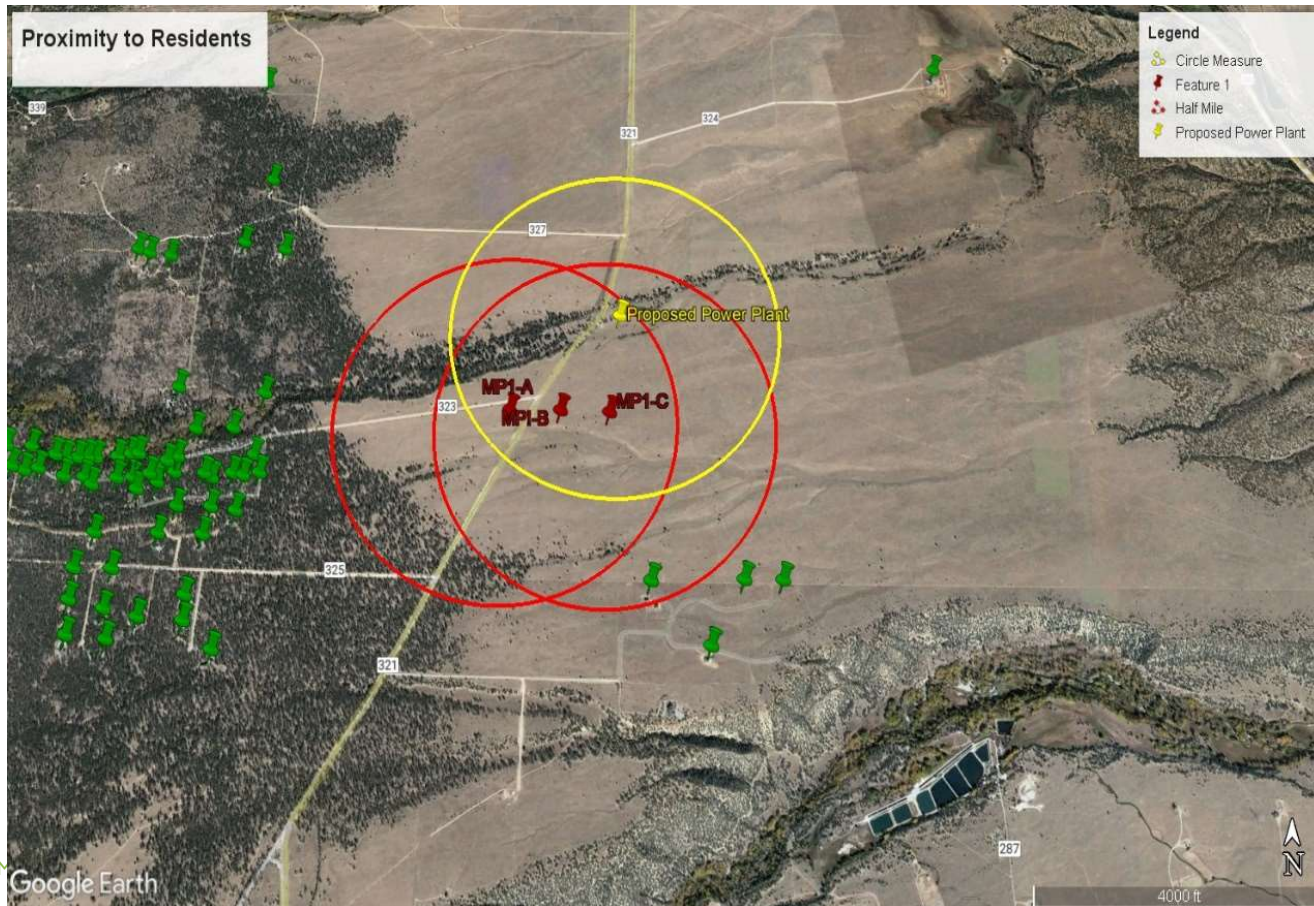
COMPLETED GEOTHERMAL WELL HEAD



WATER CONSIDERATIONS

- Any well permits require public notification within ½ mile radius.
- MPG must prove to the State Engineer that “no damage to water quality, quantity or temperature” will occur before a drilling permit is issued.
- Tapping geothermal resource at depths greater than 2,500 feet will prevent any damage to the shallow aquifer that feeds local wells and hot springs.
- The groundwater table in the area is approximately 40 feet.
- MPG will implement a water monitoring program as part of the Drill Plan and periodic County review.

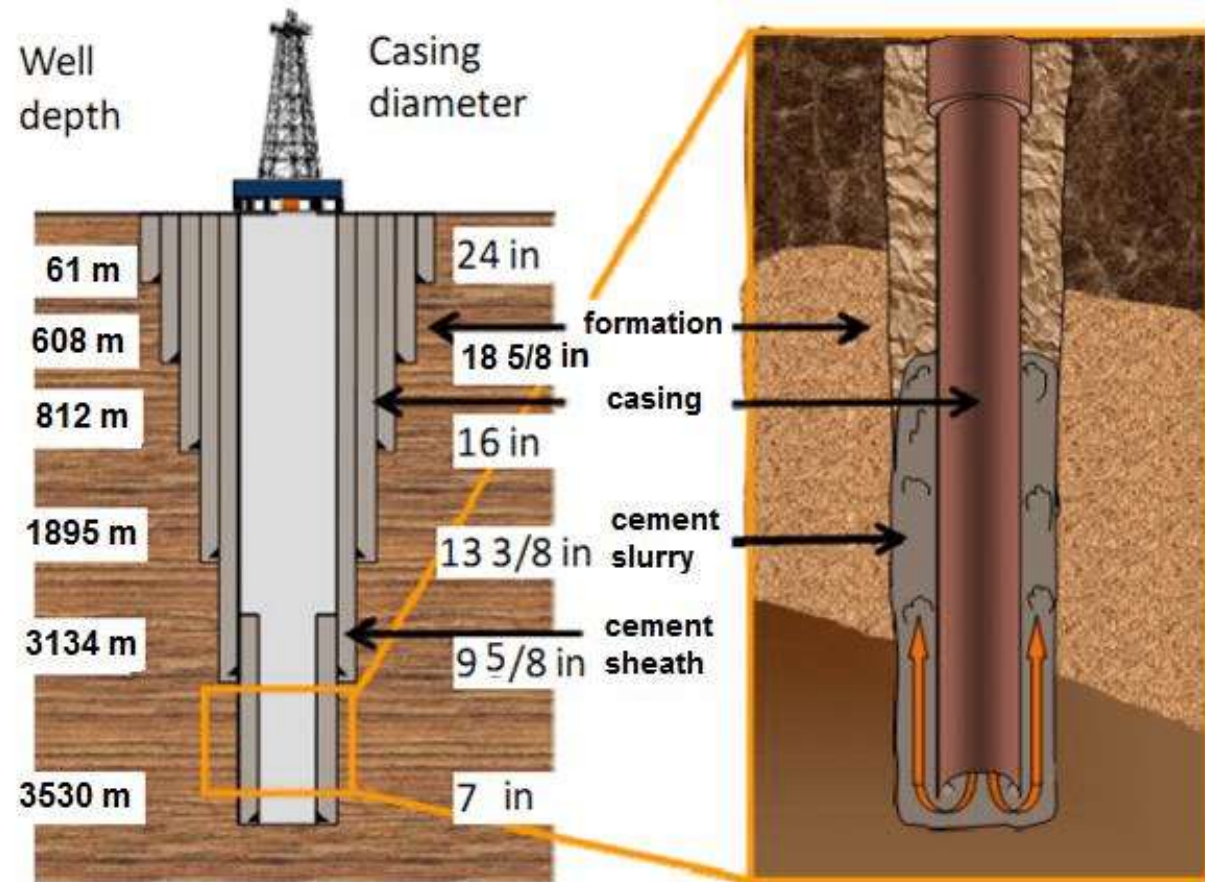
PROXIMITY TO NEIGHBORING WELLS



INSURING THERE ARE NO IMPACTS TO GROUND WATER

- To guard against fluids leaking into shallow freshwater aquifers, well casings are designed with multiple strings to provide redundant barriers between the inside of the well and the adjacent formation.
- Nevertheless, it is important to monitor wells during drilling and subsequent operation, so that any leakage through casing failures can be rapidly detected and managed.

TYPICAL WELL DESIGN





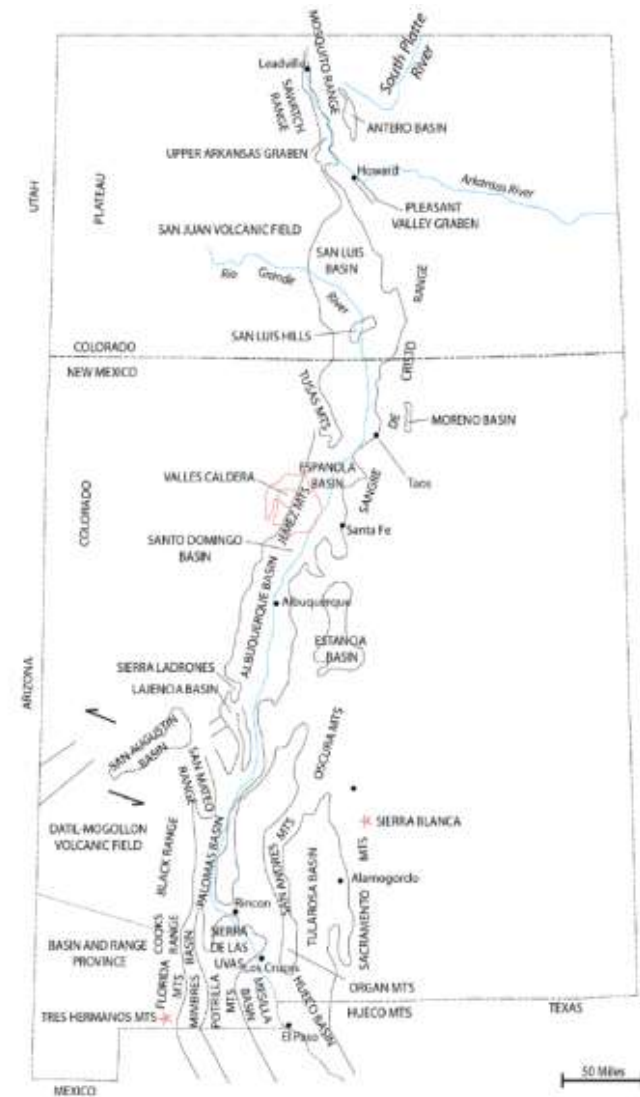
Part III

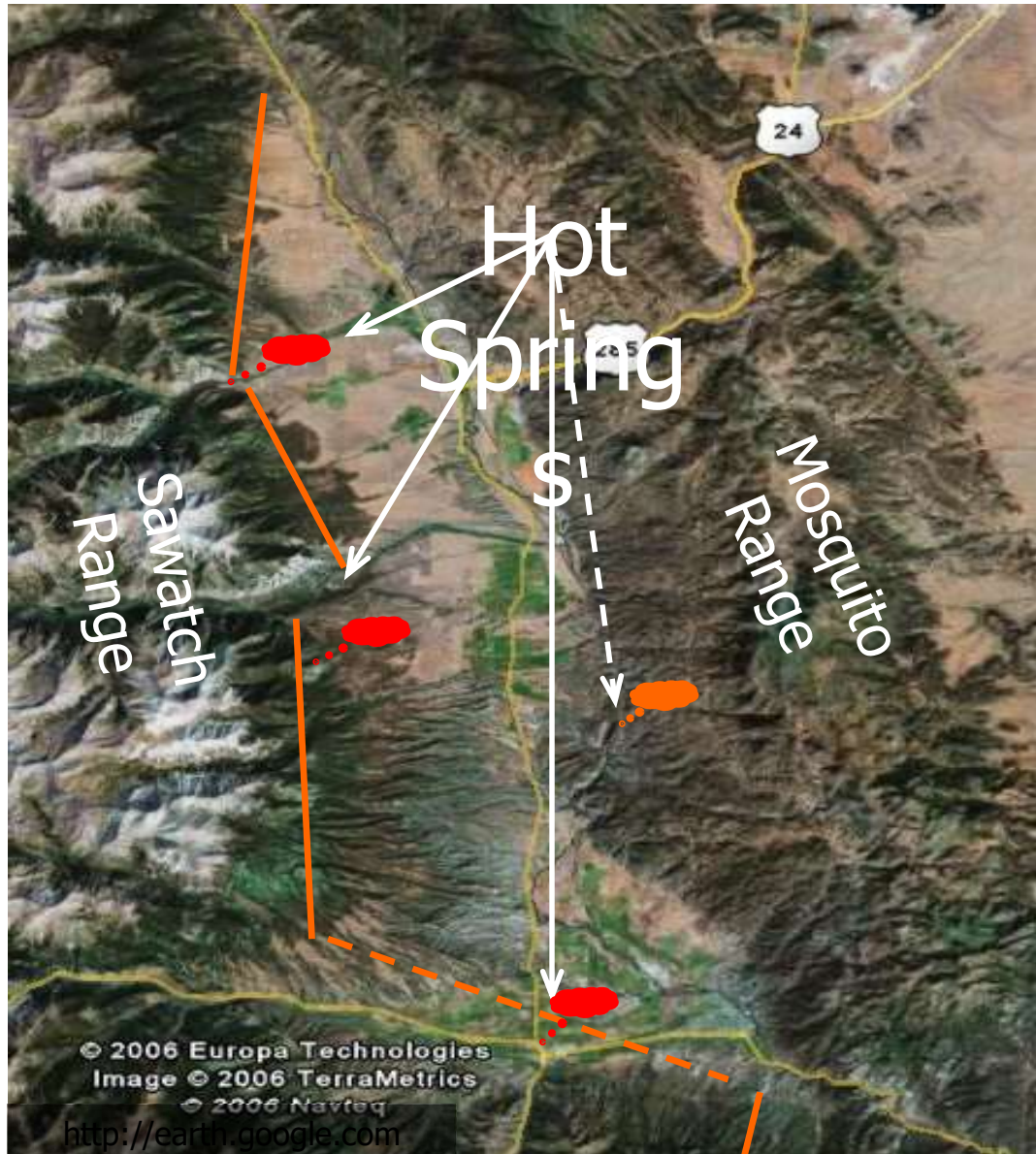
WHY WE THINK MP1 DRILL SITE WILL LEAD TO A HYDROTHERMAL RESERVOIR?

- Deep Structural faulted basin or rift with high heat flow
- Cross structure seismic section
- Magnetotelluric Low resistivity survey
- Air-Mag cross faults for vertical permeability
- Geochemistry thumbprint: Na>Ca; HSO₄> Cl+HCO₃; Silica > 50ppm; Fluorine

RIO GRANDE RIFT

- Rio Grande Rift runs from Colorado through New Mexico
- Expands very slowly



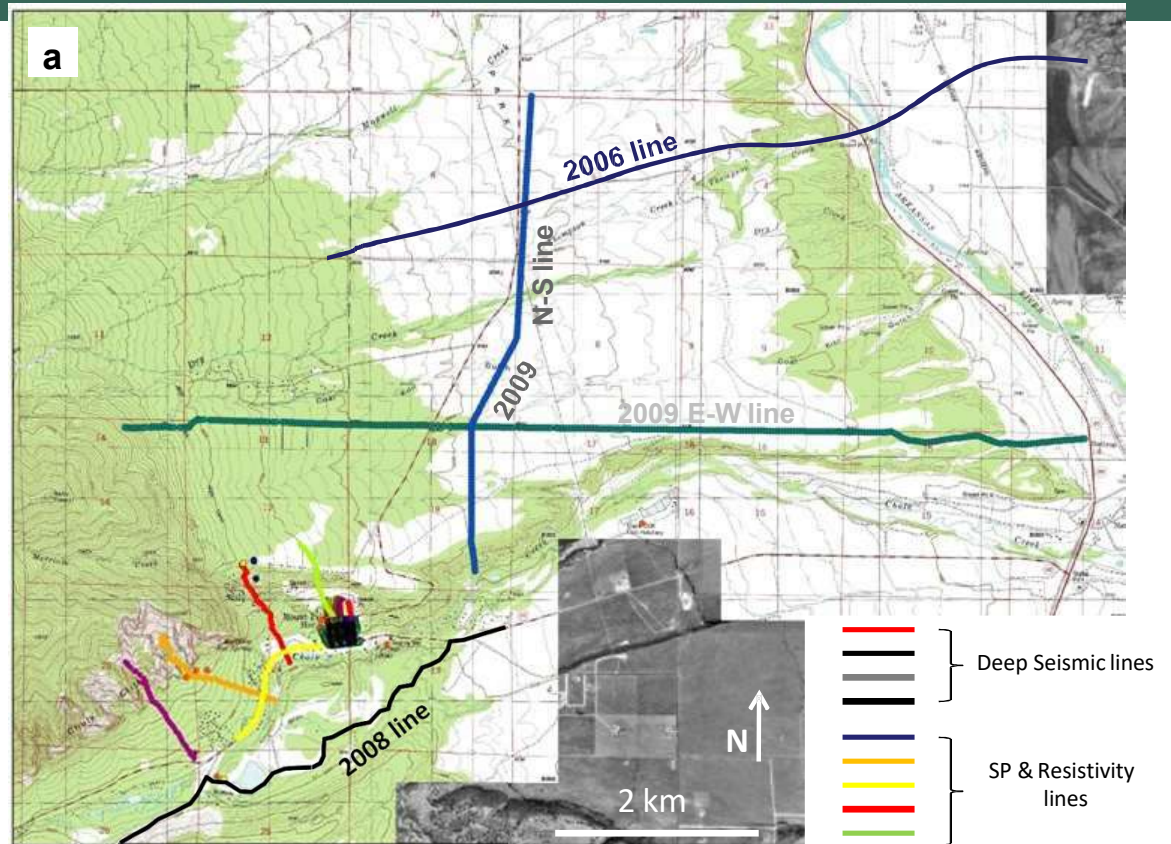


Hot Springs

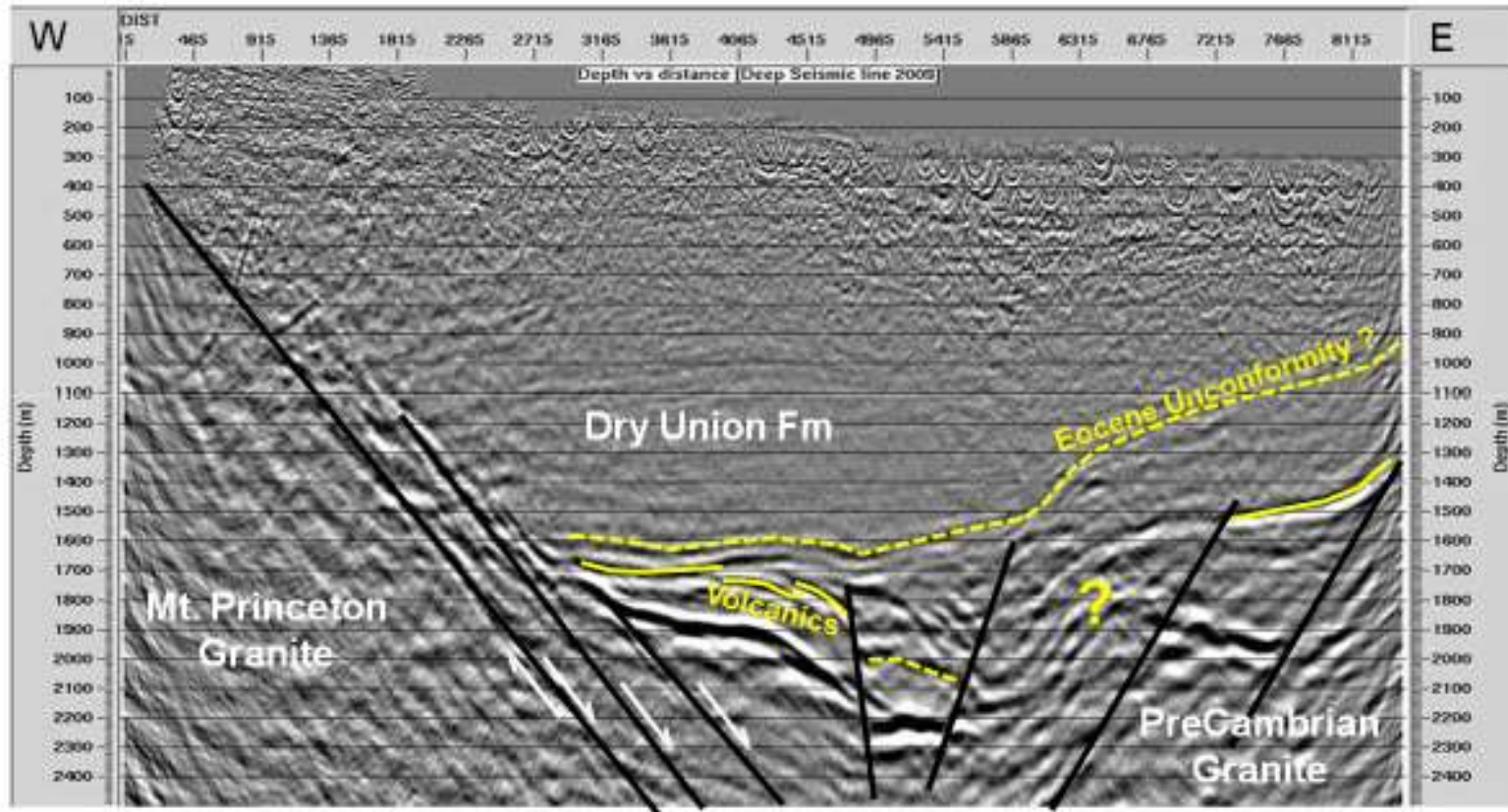
10
km

SEISMIC ACQUISITION

- Colorado School of Mines



2009 E-W SEISMIC LINE

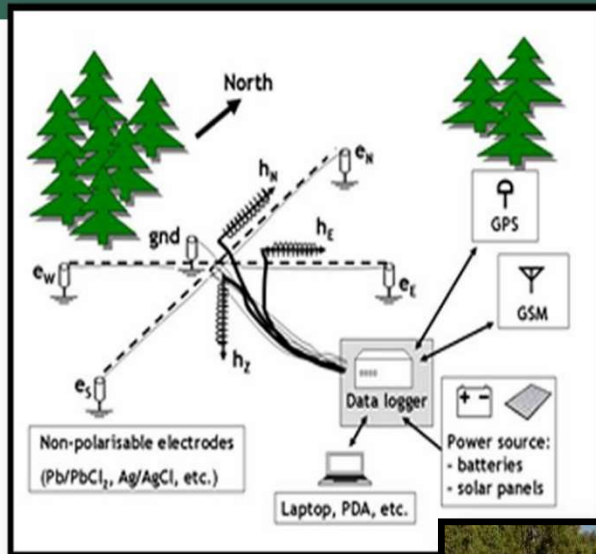


MT. PRINCETON GEOTHERMAL, LLC

NOVEMBER 2023

Mt. Princeton Geothermal, LLC

MAGNETOTELLURIC ACQUISITION

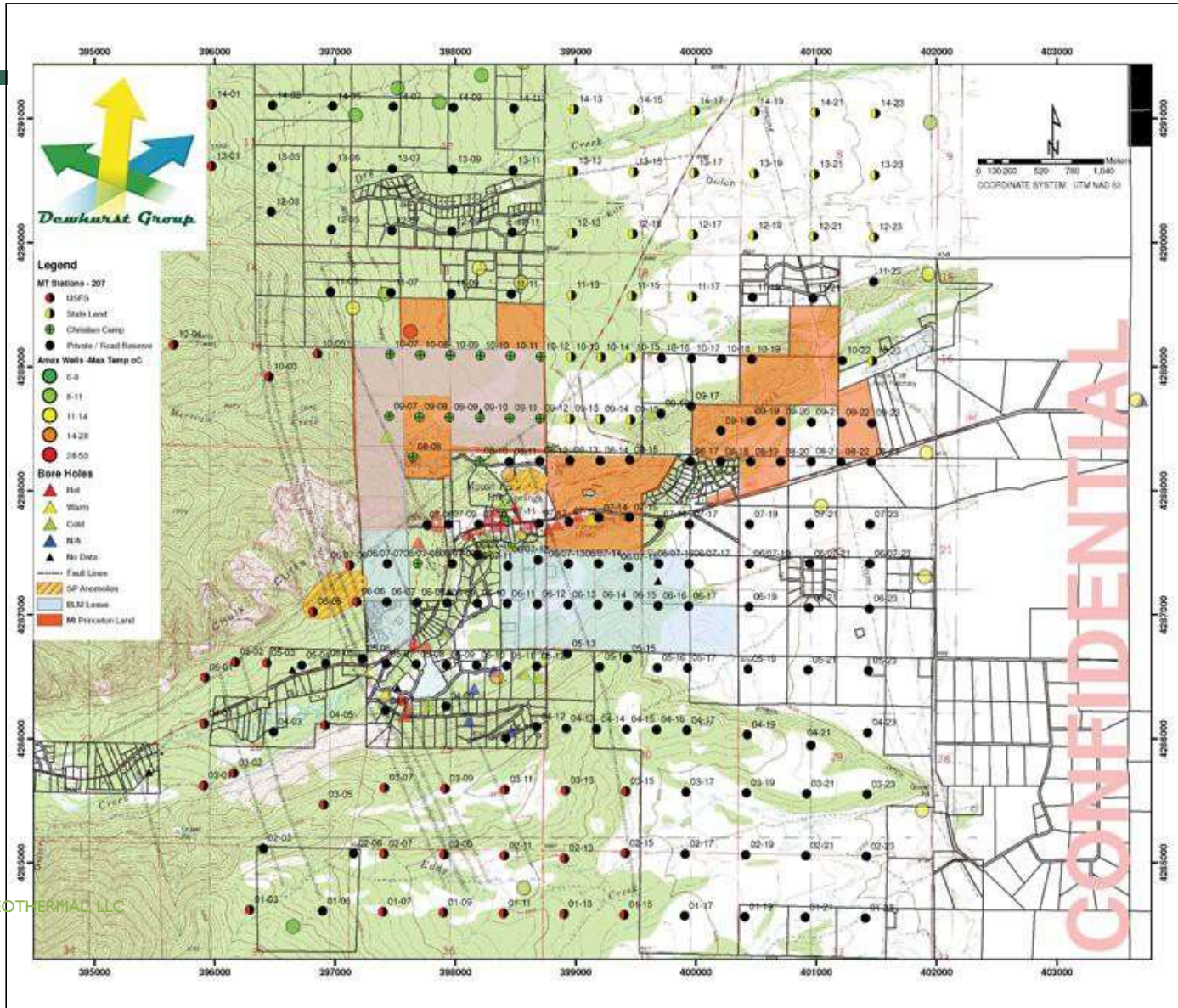


- Using electromagnetic signals to image subsurface resistivity

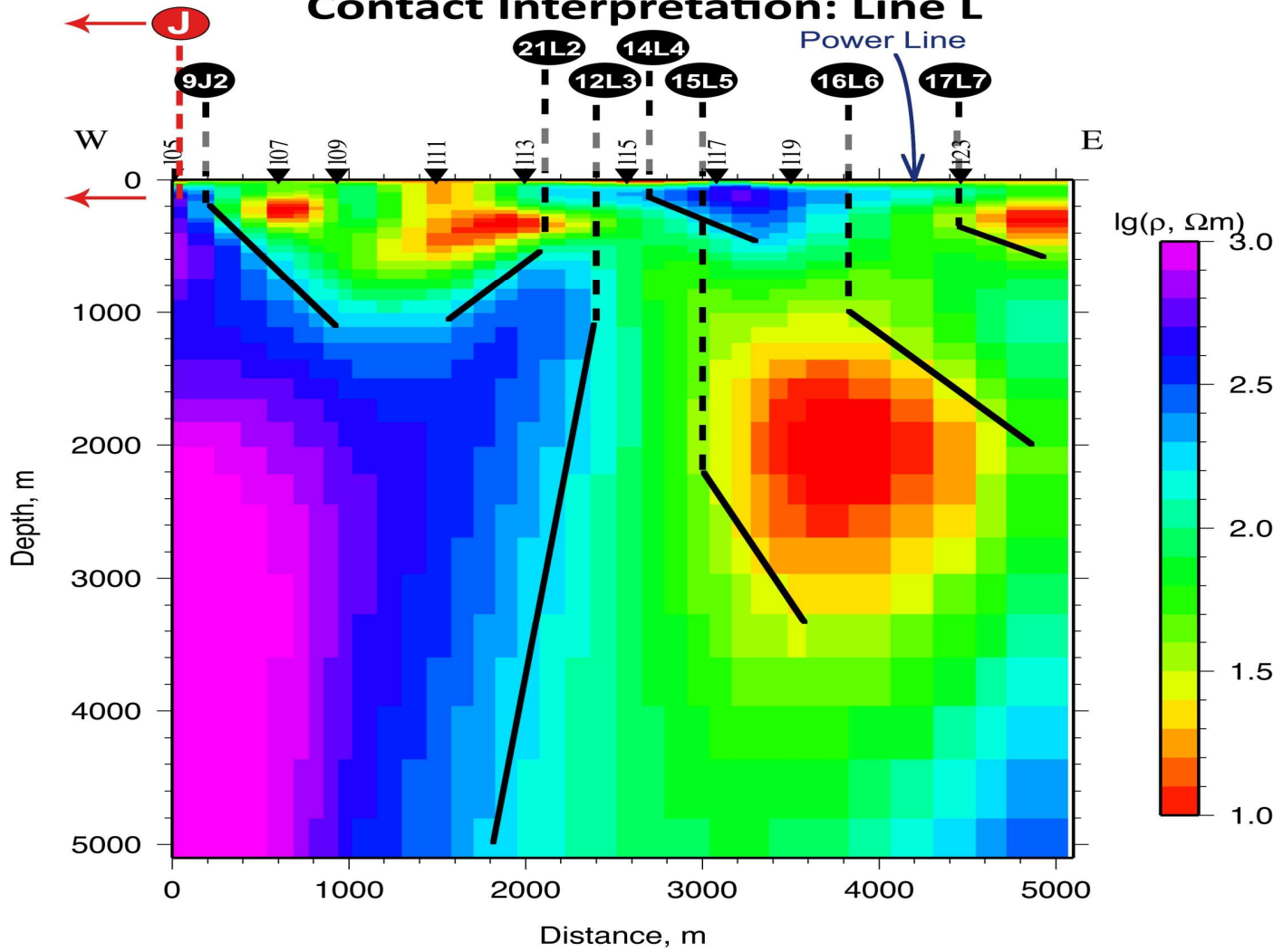


November 2023

MT. PRINCETON GEOTHERMAL, LLC
Figure 8. Typical BMT station layout and equipment.



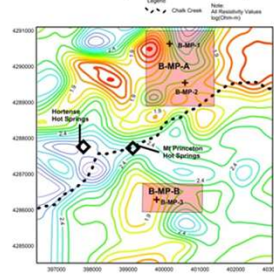
Mt. Princeton 2-D BMT Profile Inversion Contact Interpretation: Line L



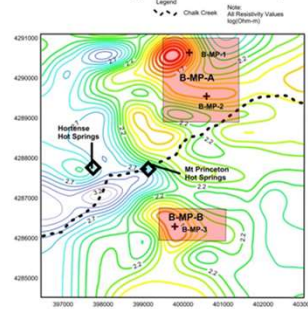


BMT Target Areas

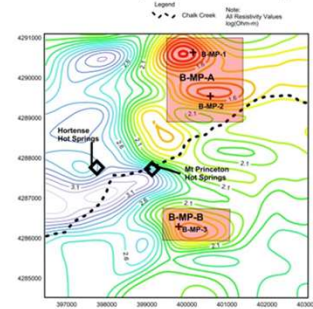
Iso-Resistivity Map at 500m Depth



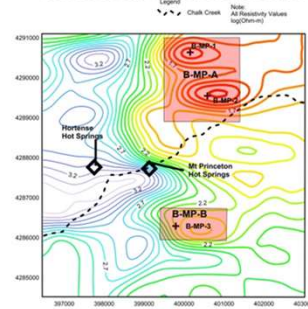
Iso-Resistivity Map at 1000m Depth



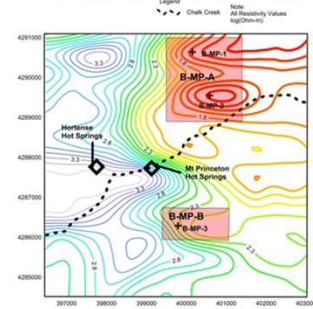
Iso-Resistivity Map at 1500m Depth

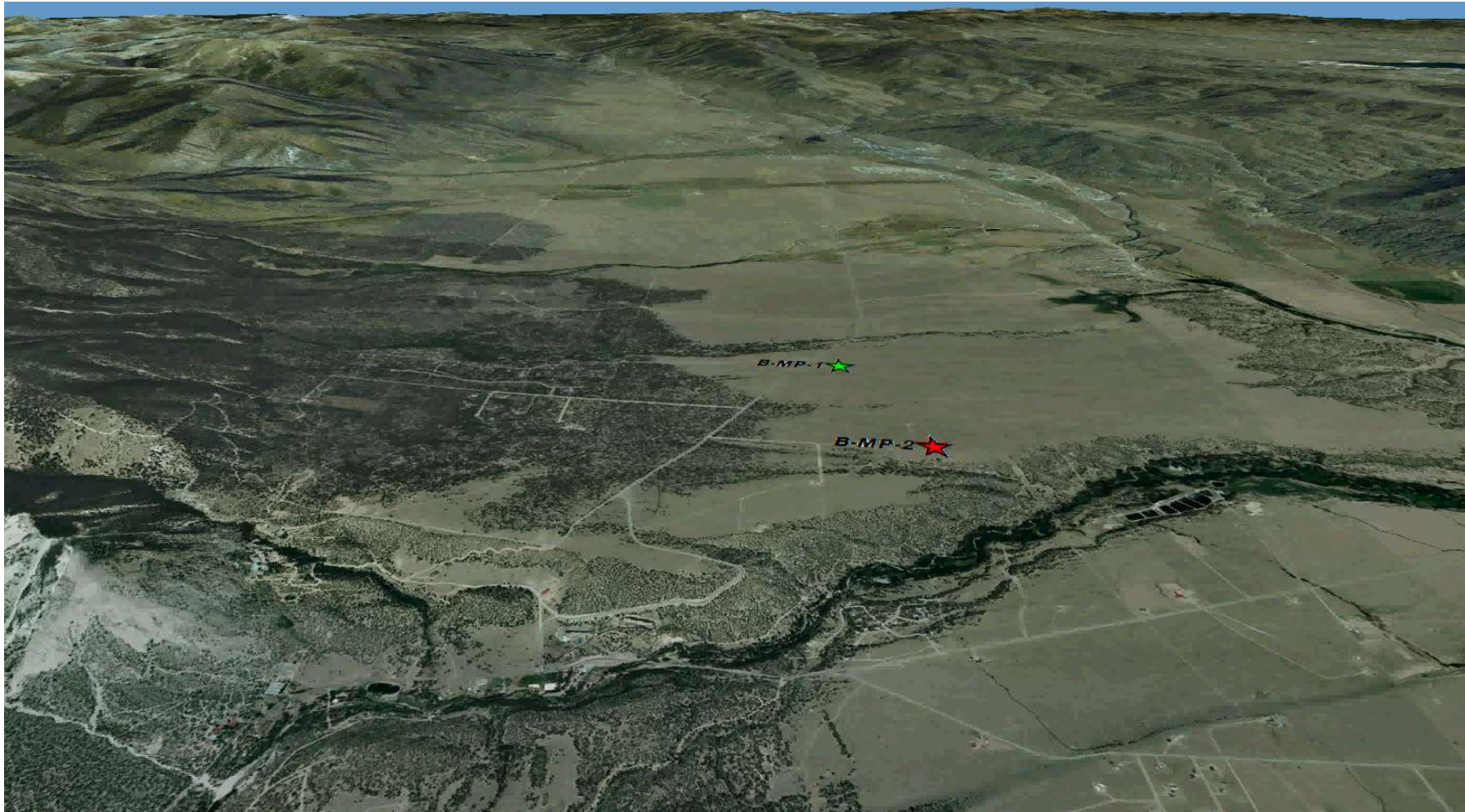


Iso-Resistivity Map at 2000m Depth

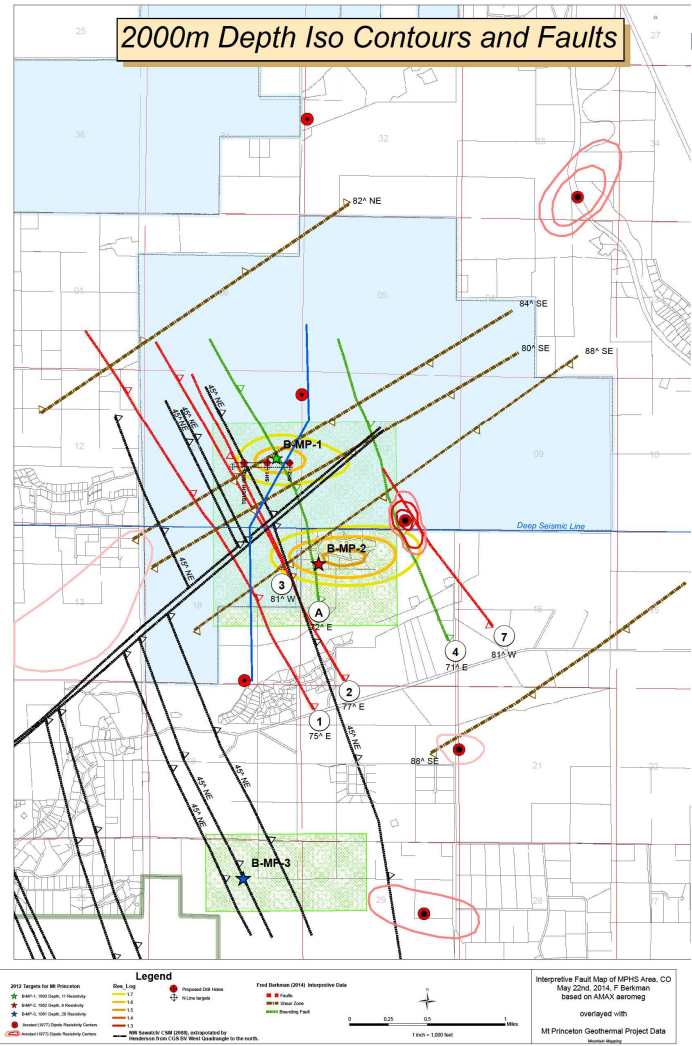


Iso-Resistivity Map at 2500m Depth





2000m Depth Iso Contours and Faults



LOCAL ECONOMIC IMPACTS-SUMMARY RESULTS

JEDI Model (Courtesy Natl. Renewable Energy Laboratory)

Estimated Local Economic Impacts-Summary Results

<u>Project Construction and Onsite Labor Impacts</u>		<u>Local Spending</u>	
During Construction Period	Jobs (FTE)		\$13,522,524
Construction Labor	72		
Construction Related Services	8		
Turbine & Supply Chain Impacts	53		
Induced Impacts	<u>34</u>		
Total	167		
During Operating Years (annually)		Annually	
Onsite Labor Impacts	8	Royalties-Colo K-12 Education	\$216,000
Local Revenue and Supply Chain Impacts	3	County Property Taxes	\$552,406
Induced Impacts	<u>4</u>	(School Share-64%)	(\$353,540)
Total	15	Operating & Maintenance	\$892,733

LOCAL BENEFITS OF GEOTHERMAL POWER

1. Economic impact.
2. Environmental impact.
3. 100% Baseload electric power, 24/7.
4. Improve quality of local electricity.
5. Help SDCEA with line loss.
6. Lower cost of electric power?????

1041 REGULATIONS

GUIDELINES AND REGULATIONS FOR THE USE OF GEOTHERMAL RESOURCES FOR COMMERCIAL PRODUCTION OF ELECTRICITY (CHAFFEE COUNTY)

Article 1 General Provisions

10-101 Title and Citation . These Regulations are entitled "Guidelines and Regulations for the Use of Geothermal Resources for Commercial Production of Electricity," or "Regulations."

10-102 Applicability . These Regulations shall apply to the use of geothermal resources for the commercial production of electricity ("Commercial Use of Geothermal Resources") on public or private lands, located wholly or partially within the unincorporated areas of Chaffee County .

10-103 (3) Use of Geothermal Resources for the Commercial Production of Electricity or Commercial Use of Geothermal Resources means the siting, drilling, deepening, reworking, closure or abandonment of a geothermal well; siting of power production facilities and operations; and all construction, site preparation, reclamation and related activities associated with the development of geothermal resources for the commercial production of electricity. Transmission lines and related facilities are not included within this definition.

ESTIMATED PROJECT TIMELINE

Mt. Princeton Geothermal	Estimated Timeline															
	2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Preliminary Survey	█	█	█													
Exploration				█	█	█										
Test Drilling						█	█									
Project Review and Planning							█	█								
Apply for Chaffee County 1041 Permits							█	█								
Field Development and Production Drilling									█	█						
Construction											█	█	█	█		
Start Up and Commissioning															█	

ADDITIONAL QUESTIONS FROM THE COMMUNITY

- Please address additional questions to:
- Hheld@mtprincetongeothermal.com