



GRED III Phase II

May 19, 2010

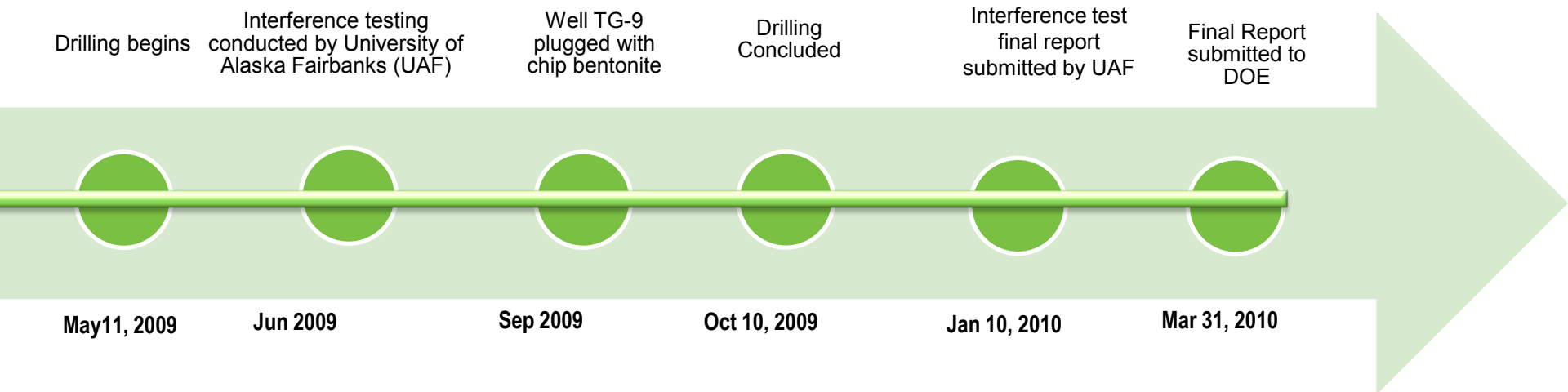
Principal Investigator
Bernie Karl

Tracks: Engineered Geothermal
Systems, Low Temp,
Exploration Demonstration Projects

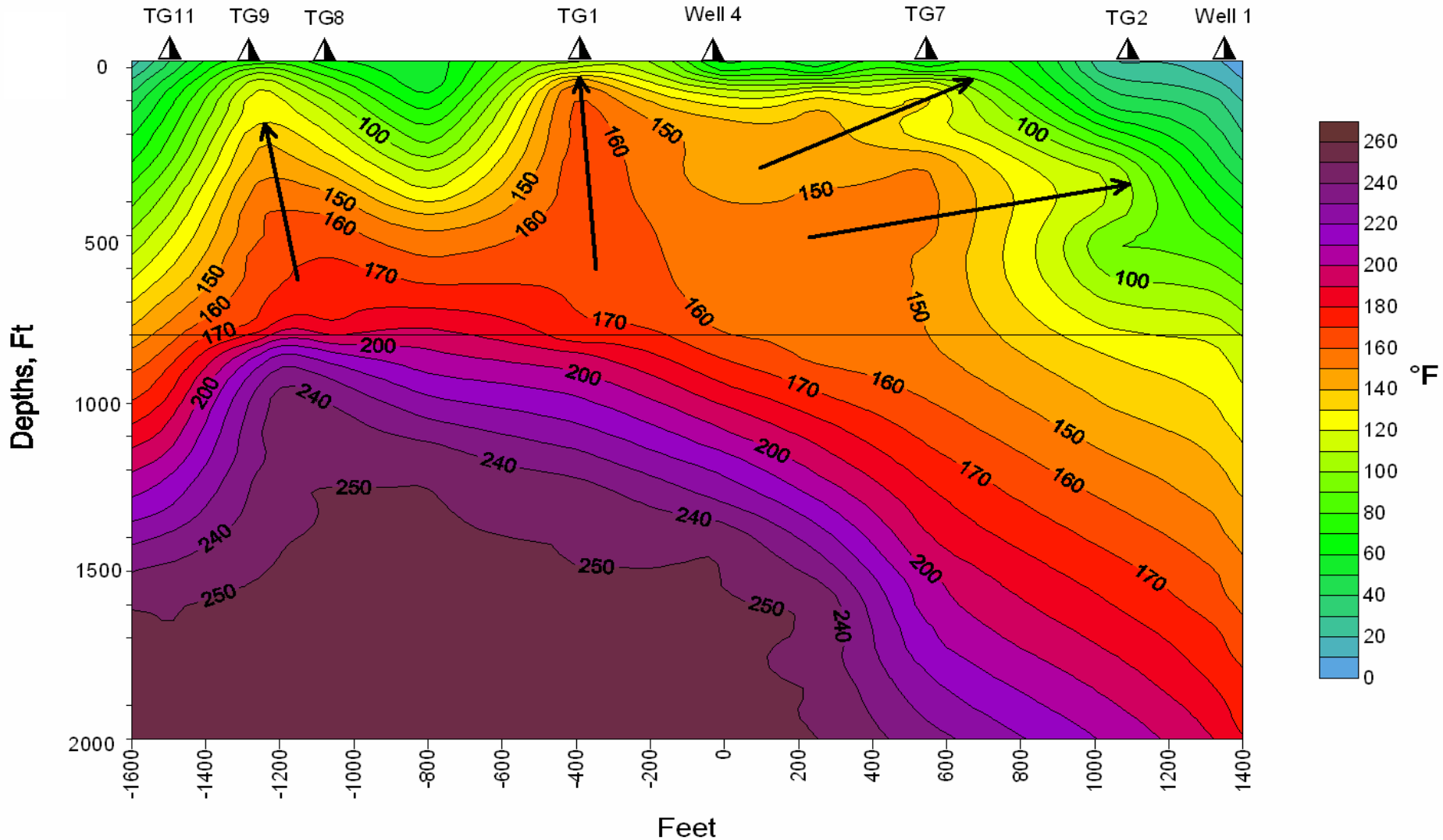
- To gain a better understanding of the geothermal reservoir at Chena Hot Springs Resort in Alaska
- Test and document the reliability of previous predictions as to the nature of the reservoir
- To find a hotter resource in order to scale up power production at Chena Hot Springs for use at Eielson Air Force base ~40 miles away

- Phase I
 - Total Project Costs
 - \$713,608
 - DOE Share
 - \$848,000
 - Awardees' Share
 - \$296,714
- Phase II
 - Total Project Costs
 - \$1,394,319
 - DOE Share
 - \$846,409
 - Awardees' Share
 - \$547,910
- The majority of costs incurred were associated with drilling expense

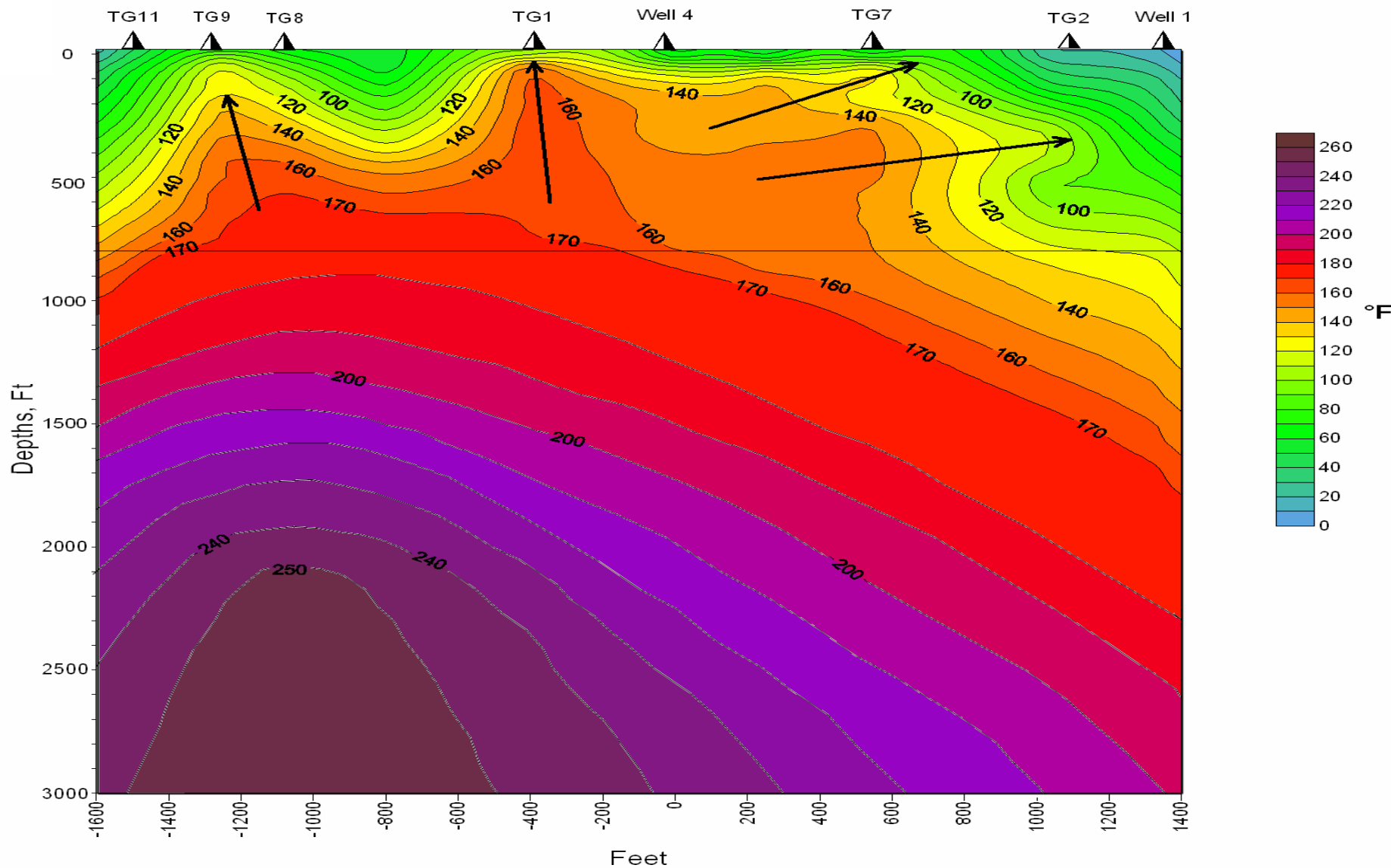
Project Overview (Timeline)



Optimistic Model Based on Phase I



Intermediate Model Based on Phase I



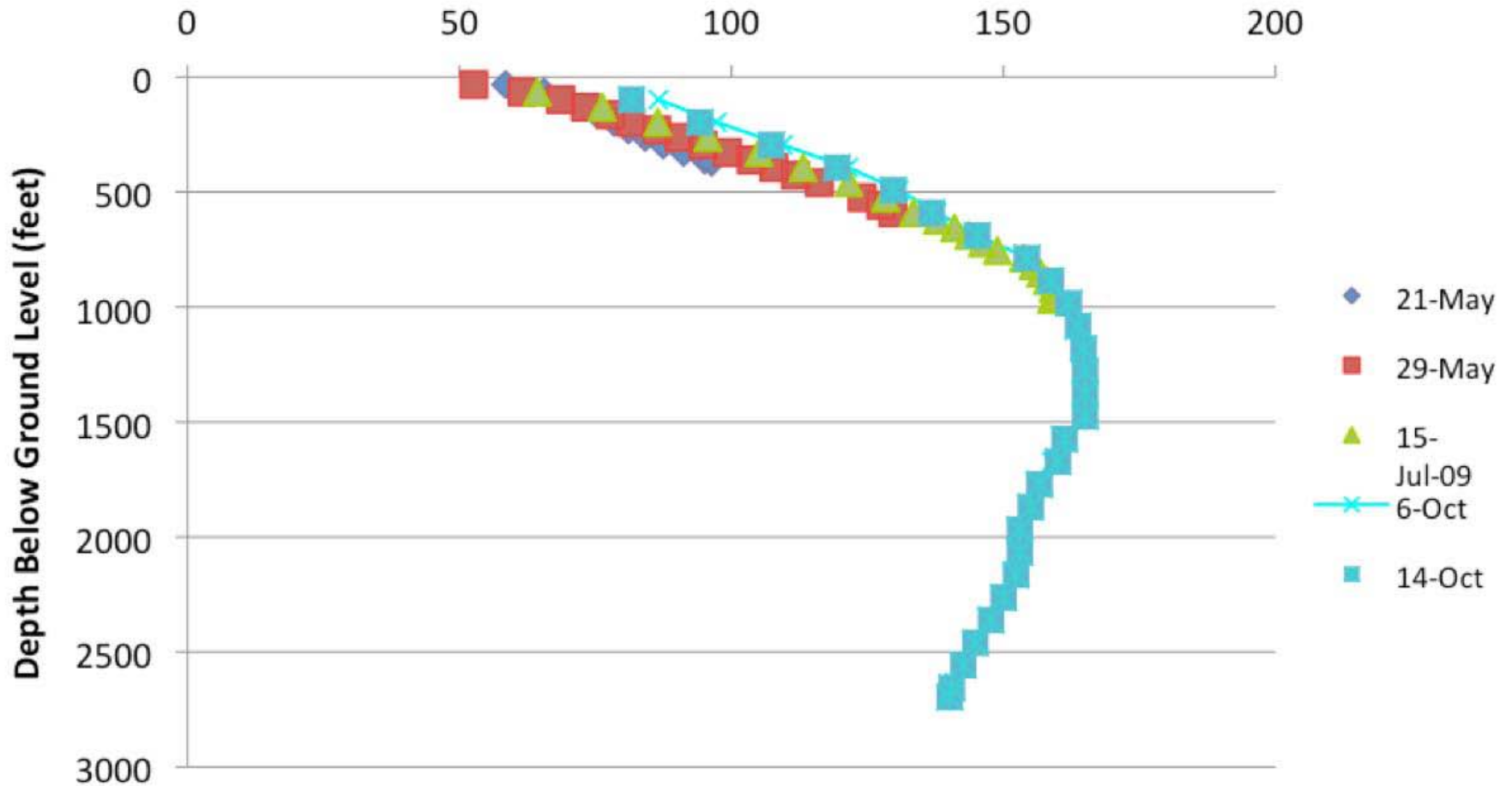
- This research is relevant in order to gain a better understanding of Chena Hot Springs' geothermal resource
- As a whole, geothermal systems in Interior Alaska have been poorly characterized and their resource potential largely overlooked. It is hoped that the ongoing exploration and power generation projects at Chena will encourage other moderate temperature sites to consider development of their resources for both direct use and power generation.

- This project has required industry coordination between the following entities:
 - U.S. Department of Energy
 - Southern Methodist University (David Blackwell, PhD)
 - Chena Hot Springs Resort, LLC
 - University of Alaska Fairbanks (Joanna Mongrain, PhD)
 - Arctic Drilling
 - Chena Power, LLC

- After conducting over two years of research during Phase I of this project, we hypothesized a conceptual model that predicted we would reach a 200° Fahrenheit or hotter resource.
- We did not find a resource at this temperature, however we believe that we now have a better conceptual model with which we can more accurately predict where the hotter resources can be found. We believe that well TG-8 is located in the immediate area where this resource is located.

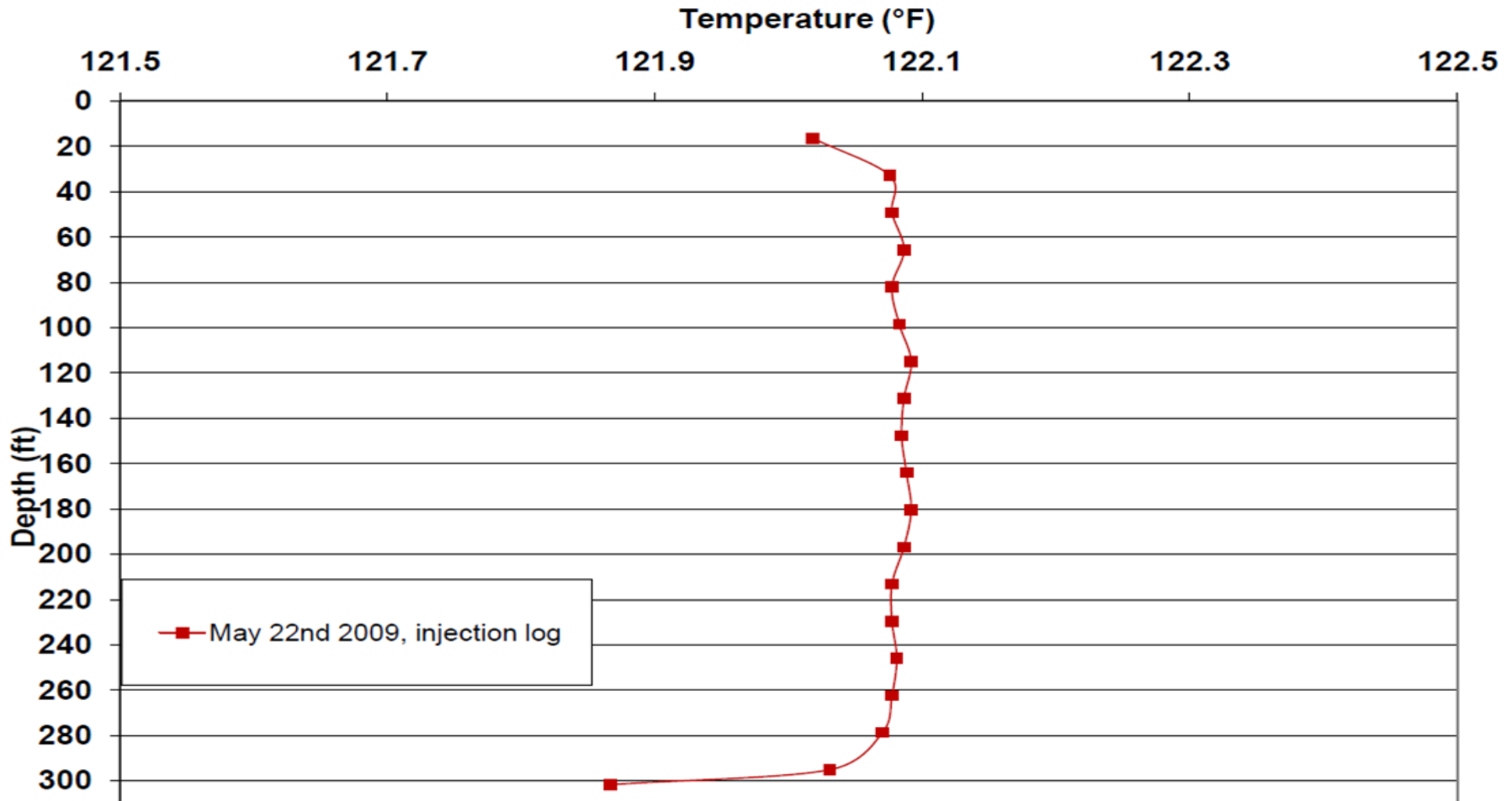
TG-12 All Temperature Logs

Temperature (F)



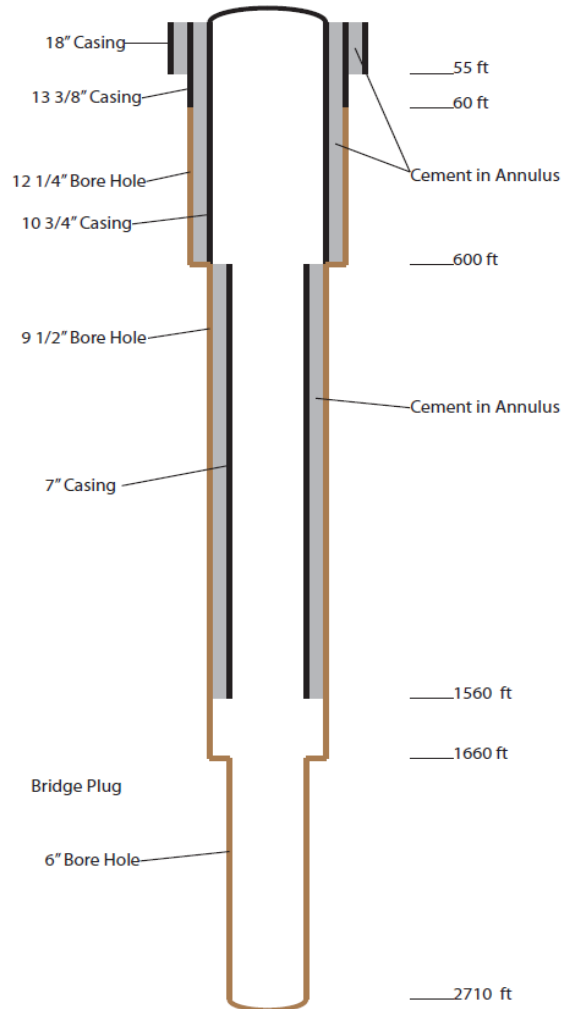
Reinjection Well

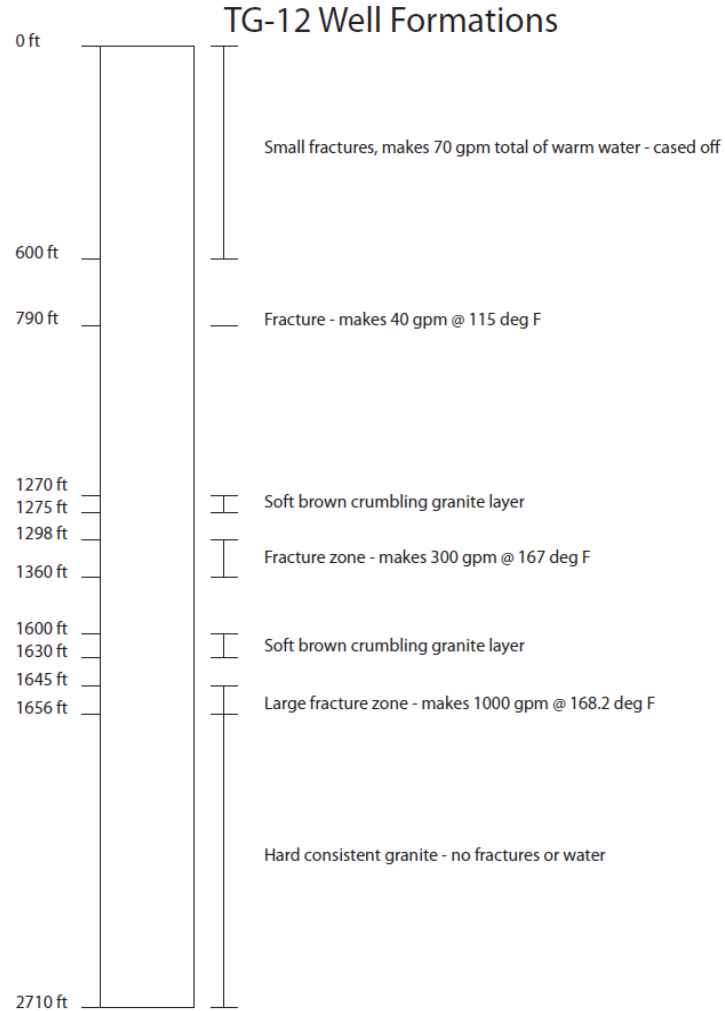
Injection Temperature Log for Well 1



Well Diagram

TG-12 Well Diagram





- May 15, 2010 – September 15, 2010
 - Further drilling and exploration
 - Deepen wells, production Well TG-8 and injection Well 1
 - Plug non-producing wells with chipped bentonite
 - Update reservoir model

- When drilling Well TG-12 we observed that when water was pumped into TG-12, Well TG-8 increased in temperature from 168° Fahrenheit to 172° Fahrenheit. It has since been logged at temperature as high as 176° Fahrenheit
- Chipped bentonite prevented cold water intrusion from occurring in from Well TG-9 to Well 7
- Well 1's injectivity is less than Well TG-7

- Chena Hot Springs Resort successfully generates electrical power from the lowest temperature geothermal resource in Alaska, and the entire world.
- 2006 Project of the Year Award in renewable energy from *Power Engineering Magazine*
- 2007 R & D 100 Award from R & D magazine
- 2007 Green Power Leadership Award from DOE and EPA
- 2007 Northern Alaska Environmental Center Business of the Year
- 2010 University of Alaska Business Leader of the Year
- Research and Development Team Qualifications
 - Extensive Project Management Experience
 - Design Capability
 - Fabrication
 - Assembly
 - Resource Management
 - Systems Analysis

- Located source of hotter resource under Well TG-8
- Gained a better understanding of our resource
- Based on information gathered we have developed a plan for resource optimization
- We were able to refine information gathered in Phase I