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***BDA “Ground Source Heat Pump Installations” Seminar***

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# The Subject Matter

- The Design Requirements for a Vertical Borehole Array and what the driller can influence;
- The impact of unannounced and unauthorised alterations to the design;
- The dissemination of design information to drillers and header installers;
- The lessons that have been learnt over time;

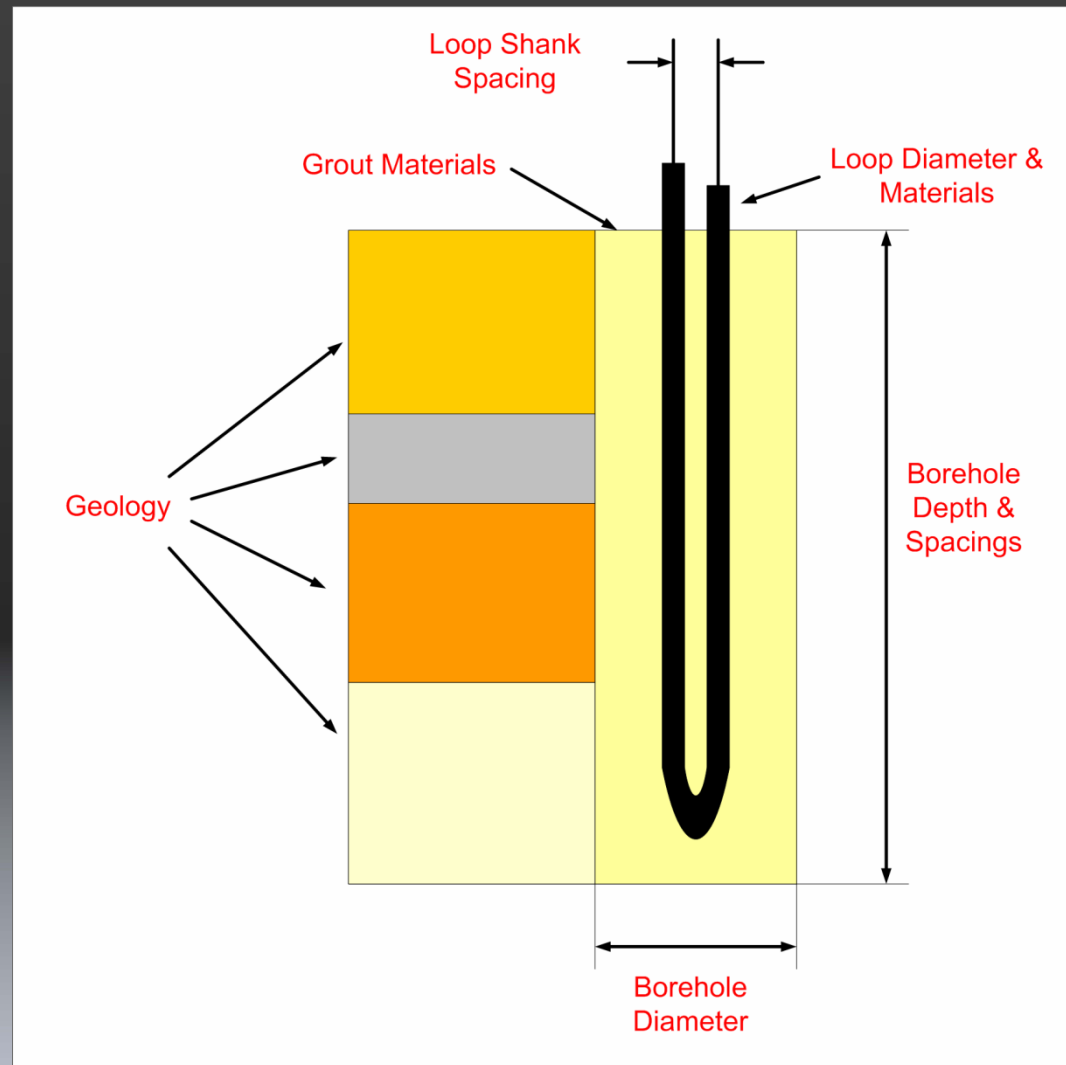


# The Influence of the Driller on the Design

- The Driller is responsible for a great number of very important aspects of design compliance.
- This process starts with test drilling, possibly even before and continues right through to the final installation, commissioning and operations and maintenance manuals.
- Clear record keeping and diligent compliance with the design must be standard practice for drilling contractors



# Important design aspects in the control of the drillers



# Geology in the control of the drillers ???

## Accurate Borehole Logs, Sampling and Strata Descriptions

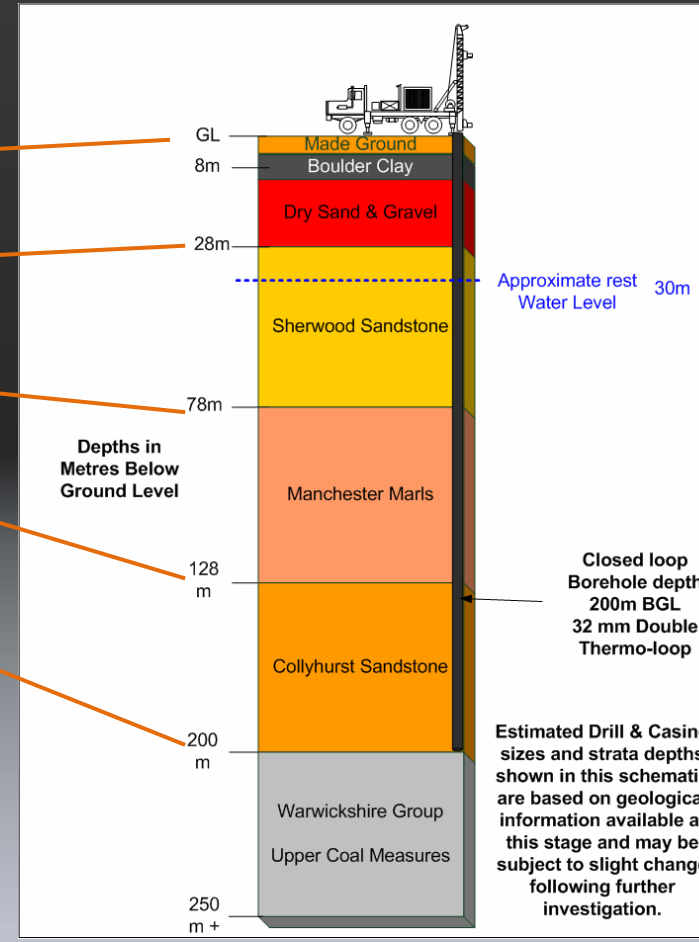
**Strata** **Thermal Conductivity**

Dry Overburden & Gravel 0.90

Partially Dry Sandstone 2.45

Mudstone 1.95

Saturated Sandstone 3.25



## Question

**Accurate Borehole Logs, Sampling and Strata Descriptions...**

**Why is this important ??**

## Answer

**Borehole Diffusivity, Specific Heat Capacity, Estimated Thermal Conductivity are all reliant on accurate geological information from the boreholes**



# System Design

40 holes 152 m effective depth

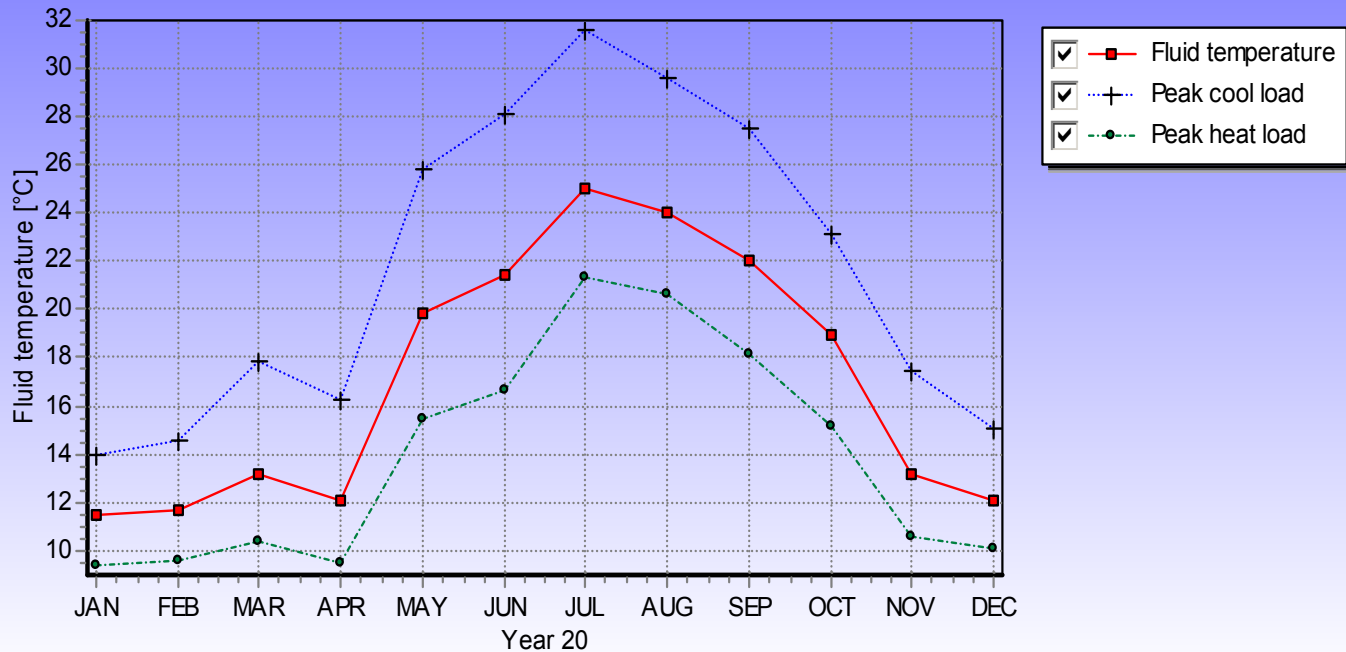
8 m spacing

2 rows of 20 boreholes

Grout Conductivity 1.78 W/mk

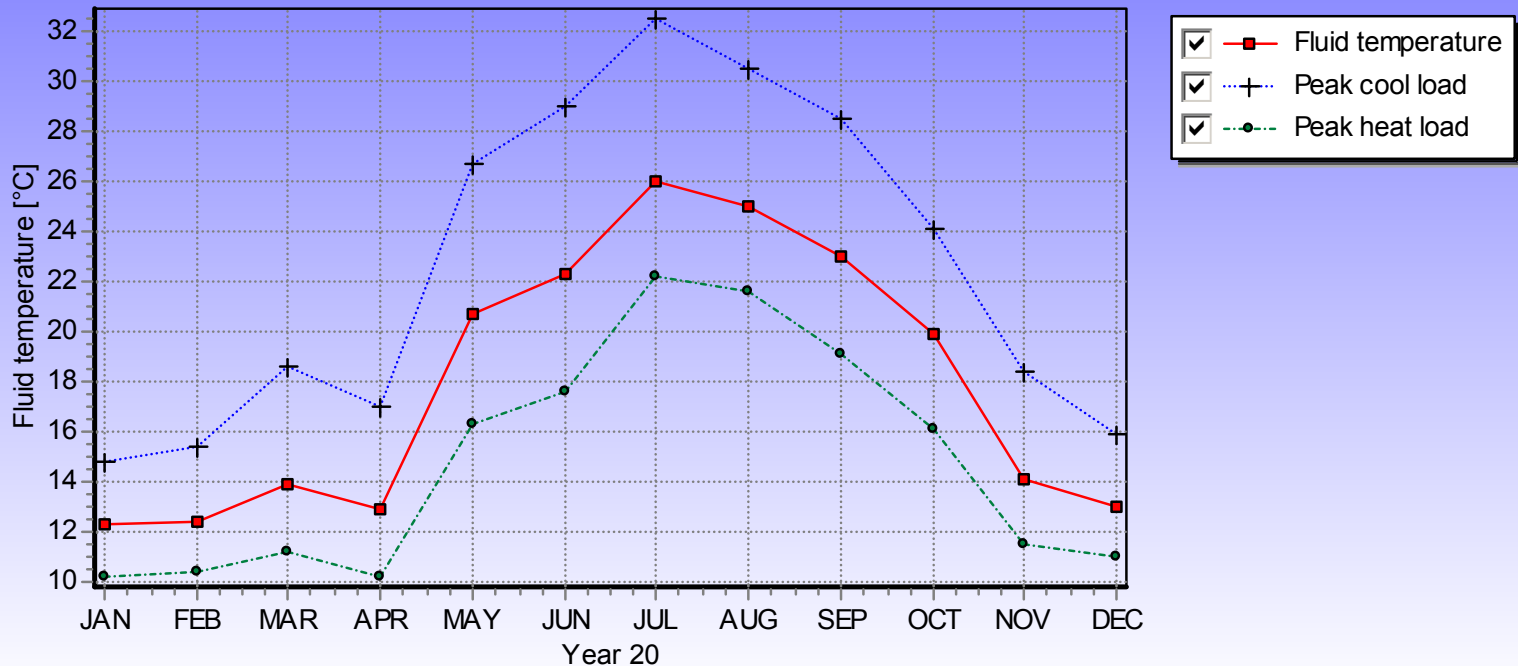
Loop Shank Spacing 70 mm

Double 32 mm loop



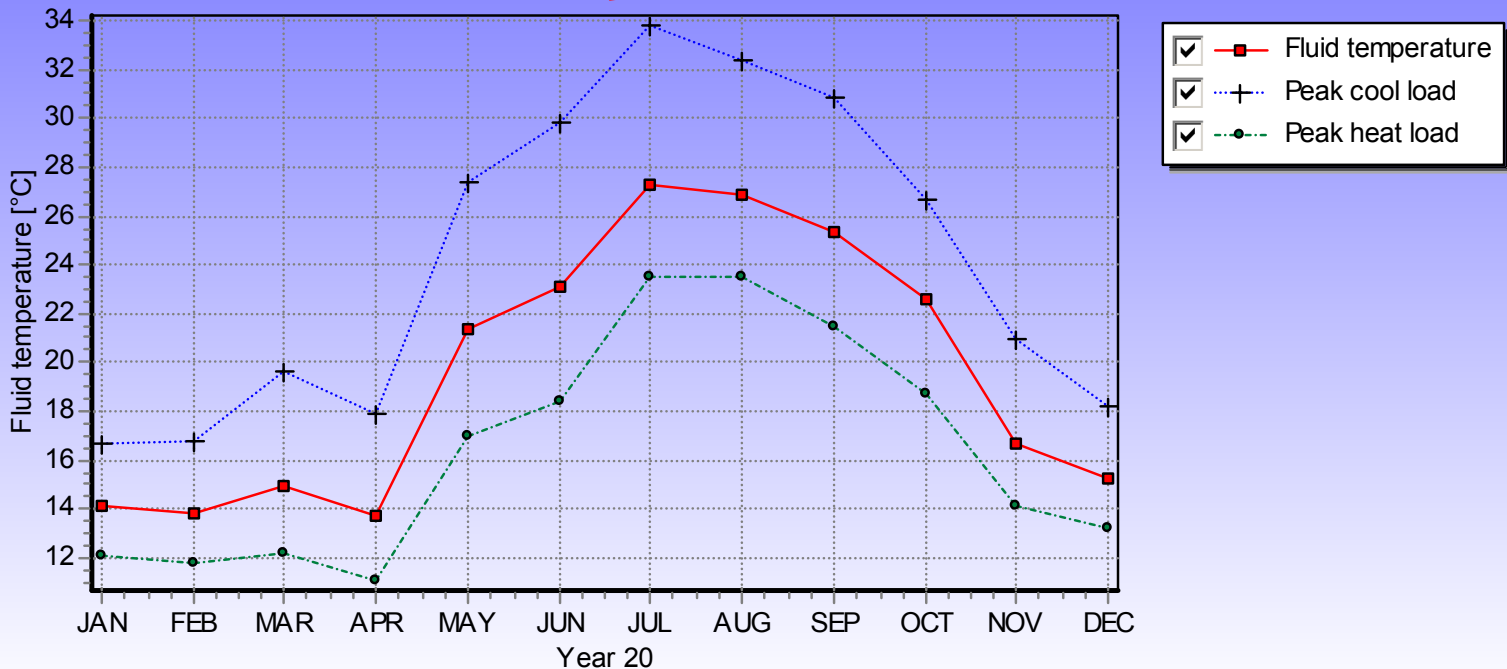
# Main Contractor says area is not available for drilling so space is made for 40 holes on a 5 x 8 grid

## Slight increase in Max temp



# Main Contractor says that they can't have 8 m spacing because the spoil heap is in the way 5m spacing is used !!

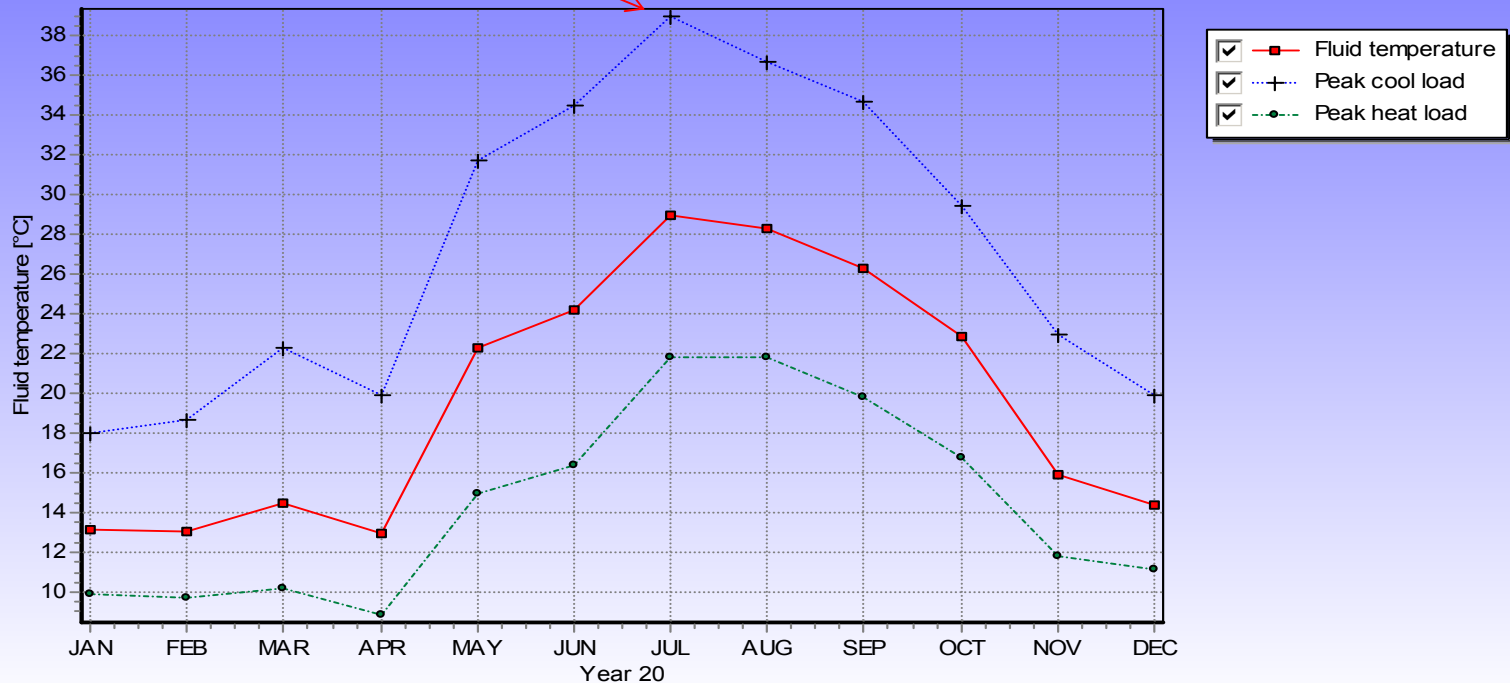
More increase in Max temp to just under 34 Deg from 32 Deg



# Design asks for 1.78 W/mk grout but driller uses straight bentonite !!

More increase in Max temp to just over 38 Deg from 32 Deg

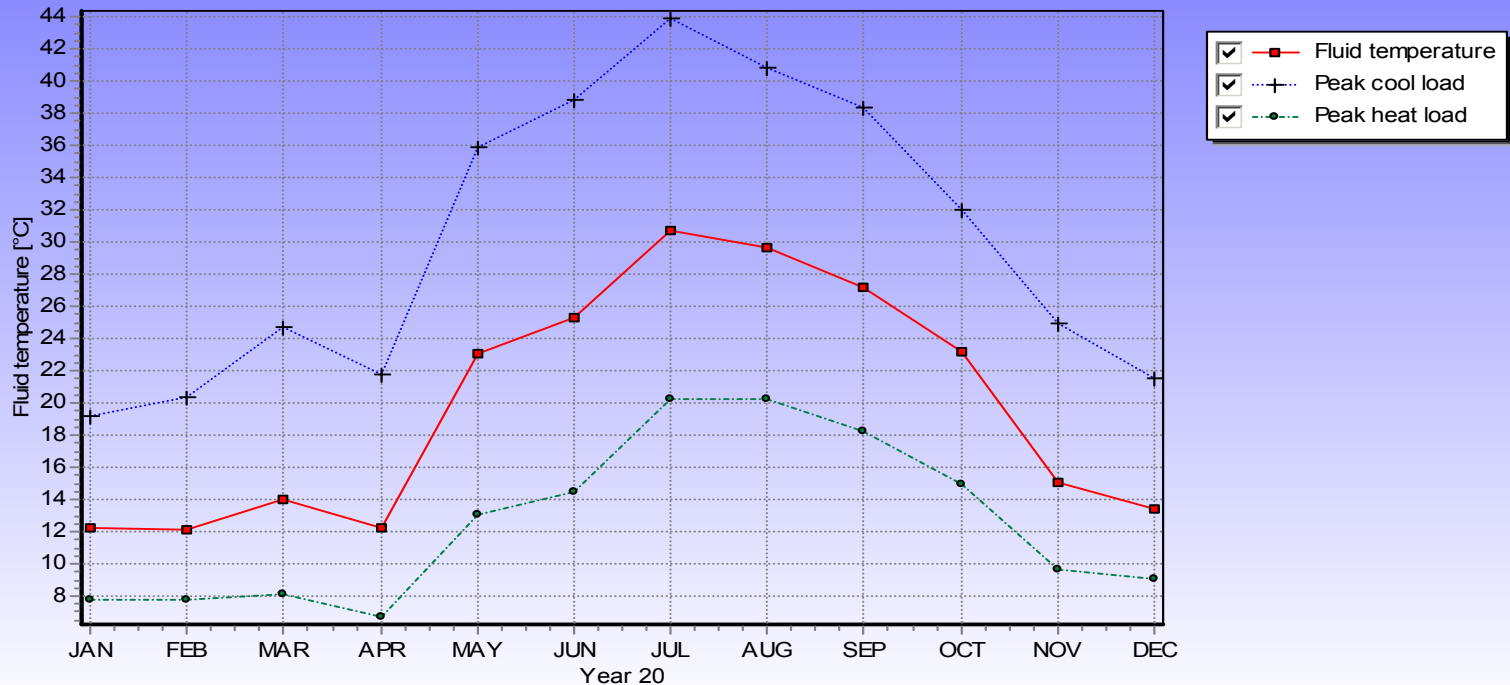
Now we're in trouble !!!



# Driller struggles to install the loop so he tapes the loop together to make it easier !!

More increase in Max temp to just over 44 Deg from 32 Deg

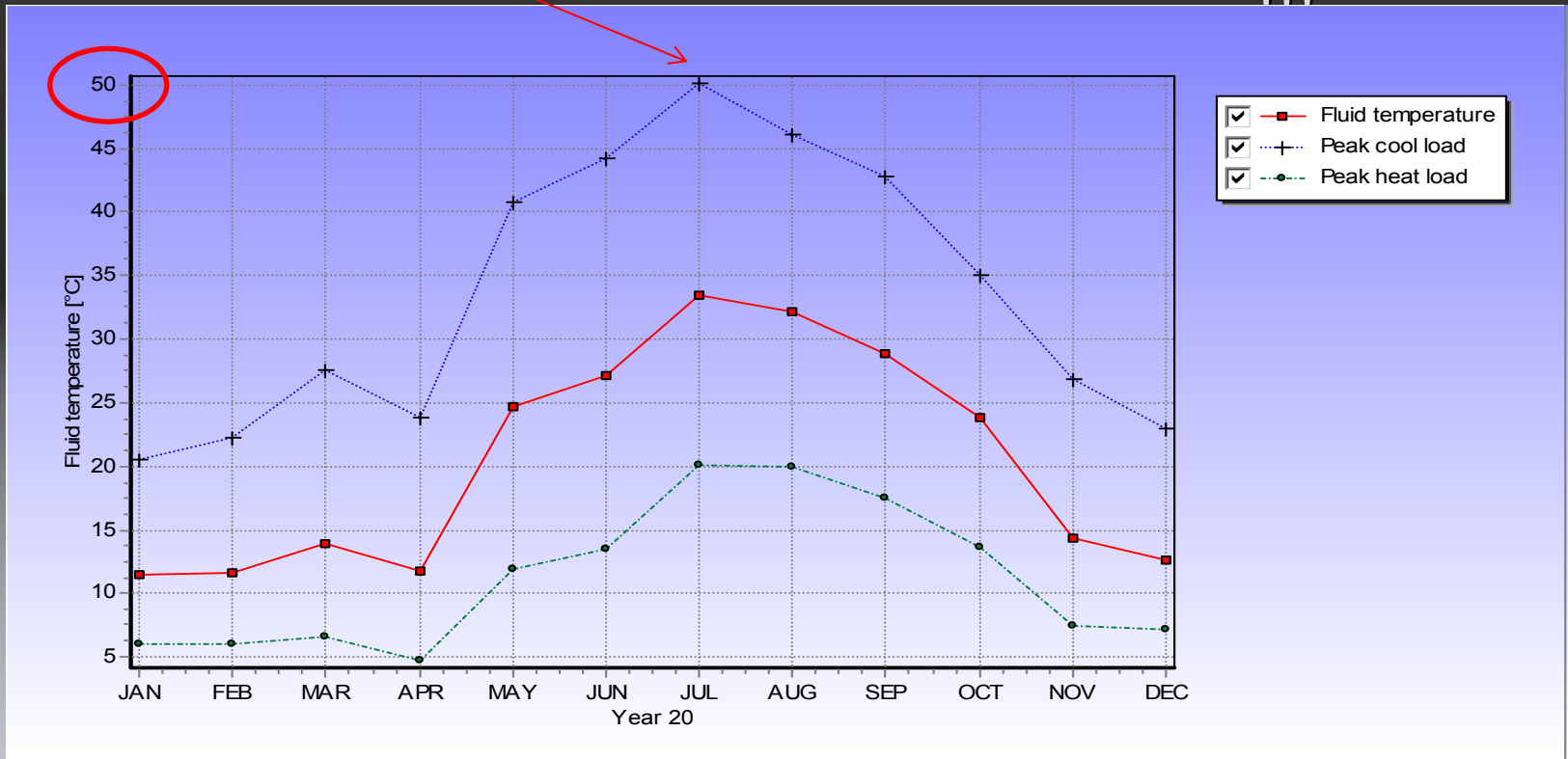
Now we're in court !!!



# Driller struggles to install the loop to 152 m and short loops by 10%, nobody will know !!

More increase in Max temp to just over 50 Deg from 32 Deg

Now somebody's paying

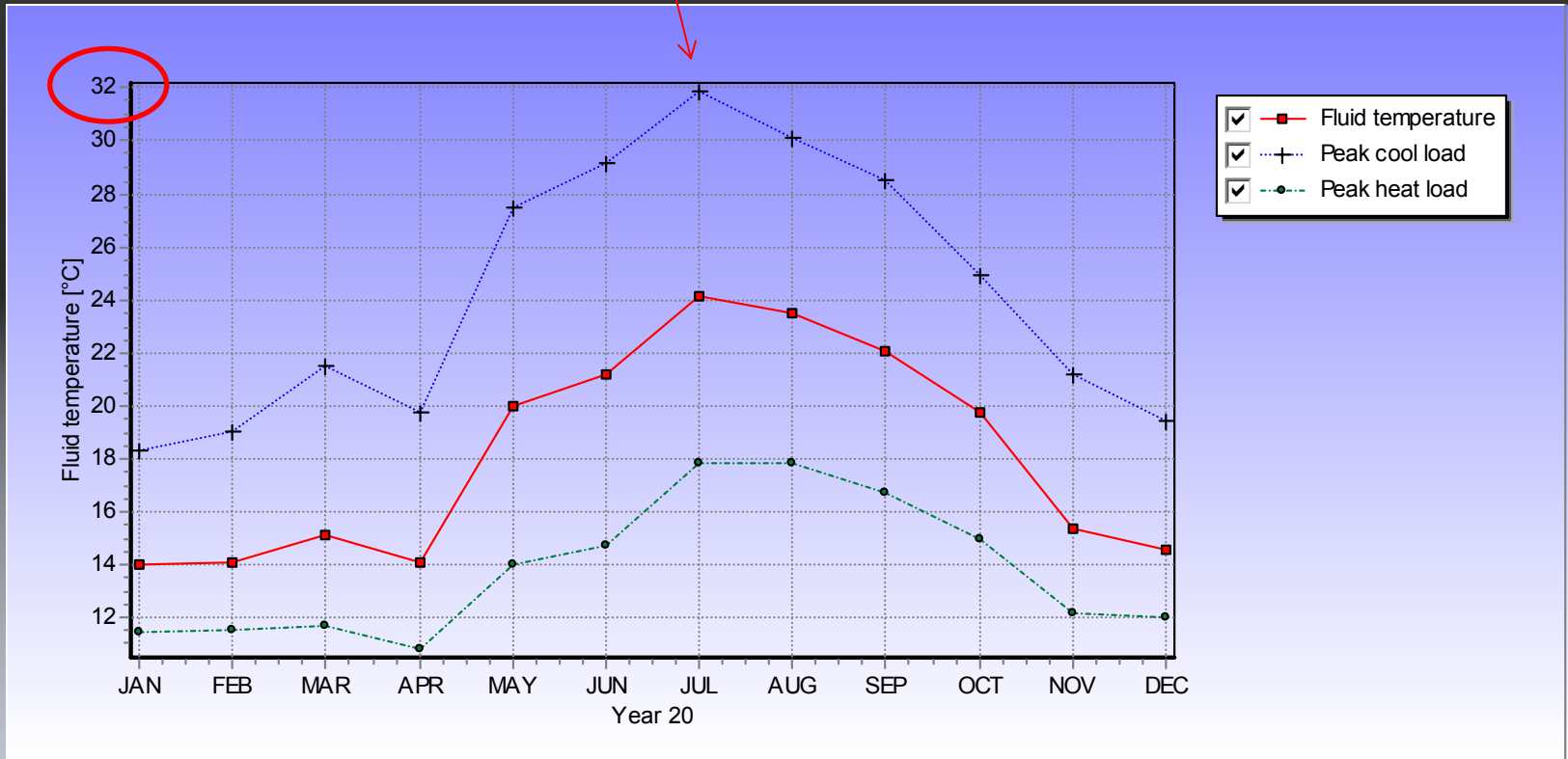


## Question

How do we now get from  
30 Deg back to 32 Deg max  
temperature

## Answer

We drill 88 boreholes 135 m  
in depth almost twice as  
much loop field required !!



# The Lessons Learnt

- Design information must be accurate and must be fully documented with drawings and specifications.
- The drillers need to be provided with all of the information they need, well in advance of starting on site.
- There needs to be total compliance with the design or any amendments made only with the designers input
- As built information must be accurately recorded such as borehole locations, depth of each borehole, depth of the installed loop, loop diameter, grout details including samples, pressure and flow test data.



# The Lessons Learnt

- **Select drillers carefully. They are not all the same !!**
- **Check the drillers credentials... have they got the Geotherma Drilling Certification, BDA Blue Card etc?**
- **Don't tie the drillers hands behind their backs... be flexible with the design where possible if problems are encountered on site.**
- **Record everything for prosperity and the O & M's... at some point somebody will want the information !!**
- **Don't just let the drillers "get on with it"... have a presence on site so that complications or difficulties can be sorted out quickly without short cuts being taken that the designer knows nothing about !!**



# The Drillers need to play their part

- If the design alters on a whim, ask questions, outline consequences try and make everybody involved aware... you may be working with an inexperienced designer who may not know how much he doesn't know.
- If the main contractor or the Quantity Surveyor makes design decisions of their own volition try and point out the consequences again.
- Plan the works to arrive on time, hit the programme and leave with the installation complete.
- Also be flexible... work with the designer to make your works as fast as possible while maintaining the design.
- Finally, step up to the plate with Geothermal Drilling Certification



**Thank you for listening**

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