Directional Drilling – A Novel Site Characterisation Method

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Thanks to Ravensdown Limited for allowing us to present this project undertaken on their site.

Contents

- The Context
- Conceptual site model
- Drivers for the Investigation
- Technique and how it works
- Problems and pitfalls
- Health and safety considerations
- Results
- Key Takeaways

Fluorosilicic Acid Ponds

- Context – Fertiliser Plant in Christchurch

The problem

- Fluorosilicic acid (FSA) byproduct of manufacturing superphosphate
- Concrete lined ponds are aging infrastructure (built early 90s) - need to be decommissioned
- Potential for leaks
- Fluoride and dissolved aluminium identified in groundwater in site monitoring wells

Conceptual Site Model

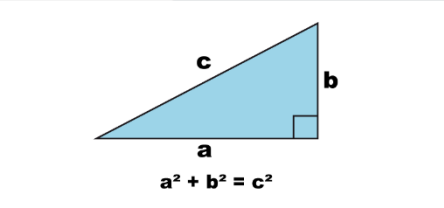
- Back to basics: Source – Pathway – Receptor
- Contaminant source (fluorosilicic acid ponds),
- Pathway (underlying permeable sandy gravels),
- Receptors (unconfined aquifer, potable supply wells and surface waterways)

Drivers for the Investigation

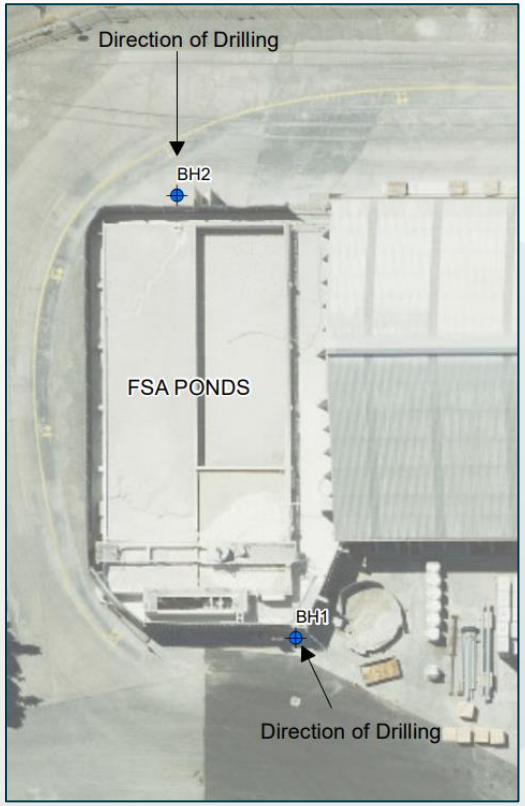
- Obtaining contaminant data in the soil without disturbing the ponds (still required for production)
- Looking to understand underlying legacy of contamination – groundwater fluctuation
- Evidence for requirement to obtain passive discharge consent from Environment Canterbury

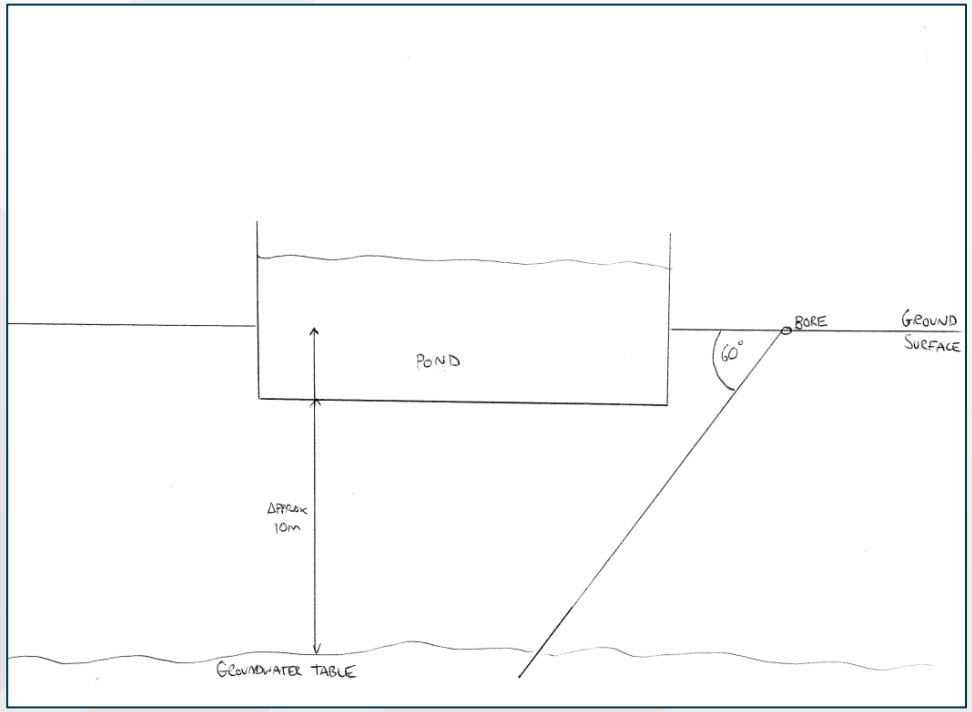
Technique and how it works

- Select your bore locations
- Choose the correct angle of drilling
- School trig (Pythagoras)



- Target depths?
- Choose your drilling method i.e. direct push or sonic? What is your geology? (more on that later)





Problems and pitfalls

- Distance from target area (greater angle and less samples)
- Drilling method selection – angled drilling = less effective/powerful
- Underlying geology – extremely dense/hard (maybe related to seepage from the ponds)
- Sonic drilling the preferred method
- Considerations for backfilling the holes (bentonite slurry)

Health and Safety

- Service location (angle calculation) not just vertical
- Dependent on contaminant - for us - working round potentially extremely low pH soils and high levels of fluoride
- Lots of flush water during sonic drilling – potentially low pH

Results

- We were able to get soil samples and therefore results from the water table (target depths)
- Potential evidence of acidic impacts in the rock
- Elevated levels of fluoride and dissolved aluminium suggesting soil and groundwater impacts from the pond (totals and SPLP)
- Pond is due to be decommissioned later this year, intensive groundwater monitoring regime and monitoring of nearby downgradient stream

Key Takeaways

- Definitely more complex than vertical drilling so avoid it if you can, didn't help with strata
- Useful method for investigating under existing infrastructure – timber treatment, fuel or chemical storage etc.
- Try and anticipate the geology (if possible) so you get the right equipment for the job
- Be ready to do lots of Pythagoras calculations to work out a true depth (https://www.omnicalculator.com)
- Can be successful but some important considerations (and caveats to the results) especially if using sonic drilling

Any Questions?