

MV2012X0001

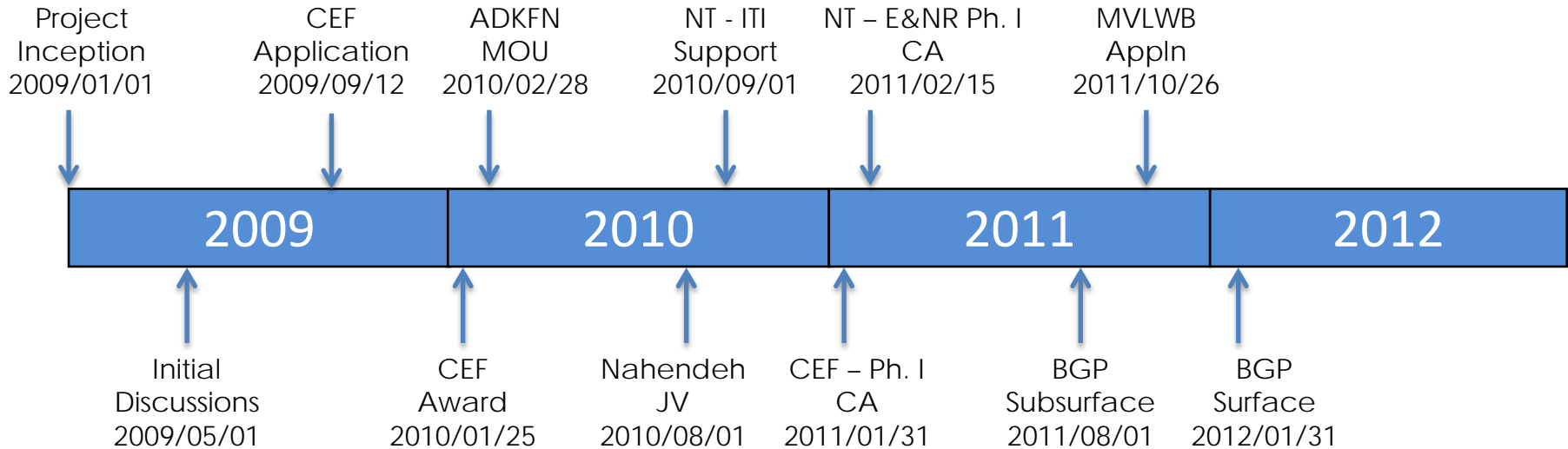
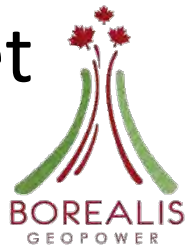


Fort Liard Geothermal Energy Project

Borealis GeoPower Inc.
www.borealisgeopower.com

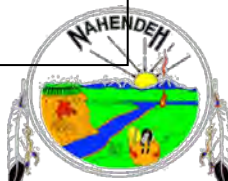


A little history: We began in 2009 and have met with almost all available government agencies



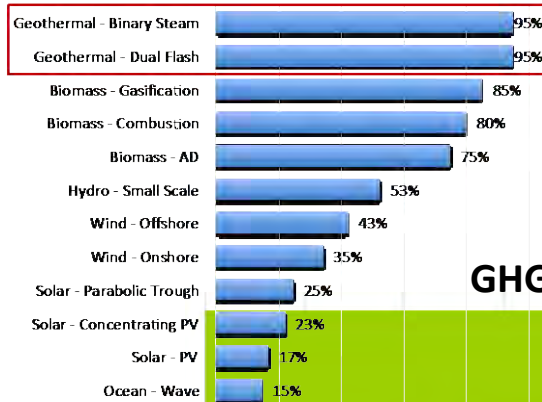
Notable Groups Consulted/Participants

- GNWT – E&NR
- GNWT – Finance
- GNWT – ITI
- GNWT – Premiers Office
- GNWT – Public Works
- AANDC (INAC) – Many Departments
- MACA – Lands
- MVLWB
- NEB
- ADKFN
- Nahendeh Enterprises
- Beaver Enterprises
- Hamlet of Fort Liard
- NTPC
- NT Hydro
- SKM
- City of Yellowknife
- Various Corporate Investors
- Various Media
- NRCAN – CEF
- Federal – PMO



Why Geothermal ? It's the best renewable source of green energy

Availability



GHG Footprint

Geothermal
2.7 Megatonnes CO₂ Offset/ 500 MW Generation

Environmental Footprint

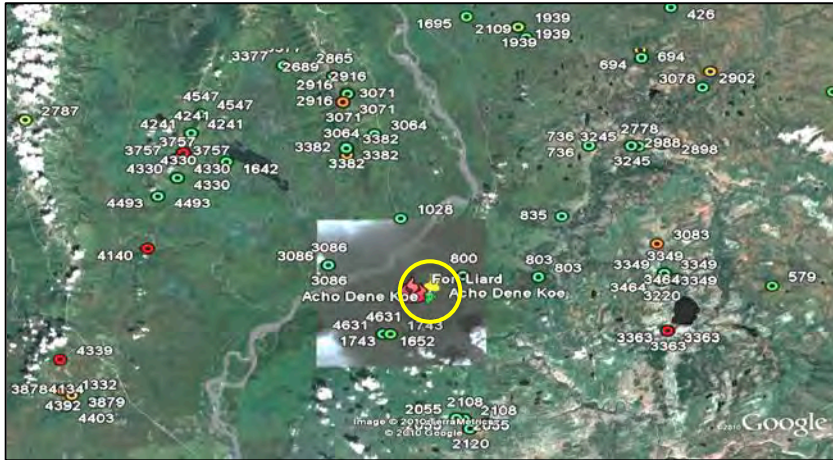


- ☀️ >25 year power supply with no fuel costs and near zero emissions
- ☀️ Smallest environmental footprint/MW capacity
- ☀️ Geothermal power plants can deliver continuous baseload (>90% availability) power
- ☀️ Preferred supply option of energy for many utilities

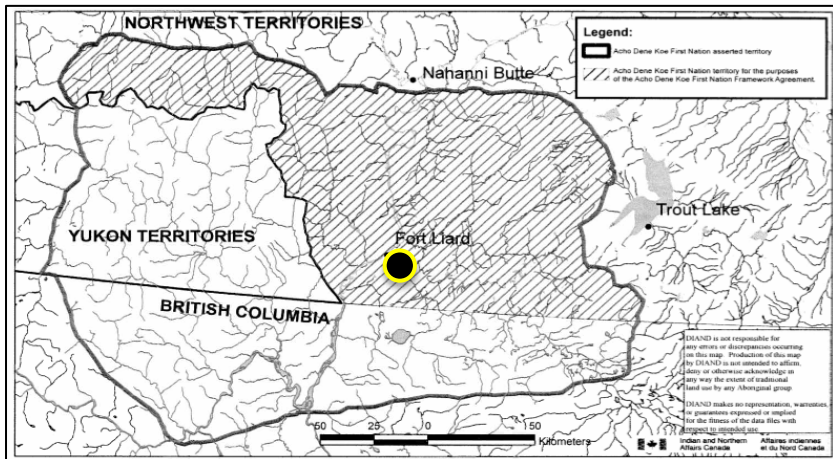
Why geothermal in Fort Liard ?



Oil & Gas Wells Drilled in the Ft. Liard Area



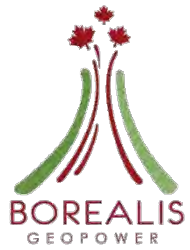
ADKFN Land Claims Area



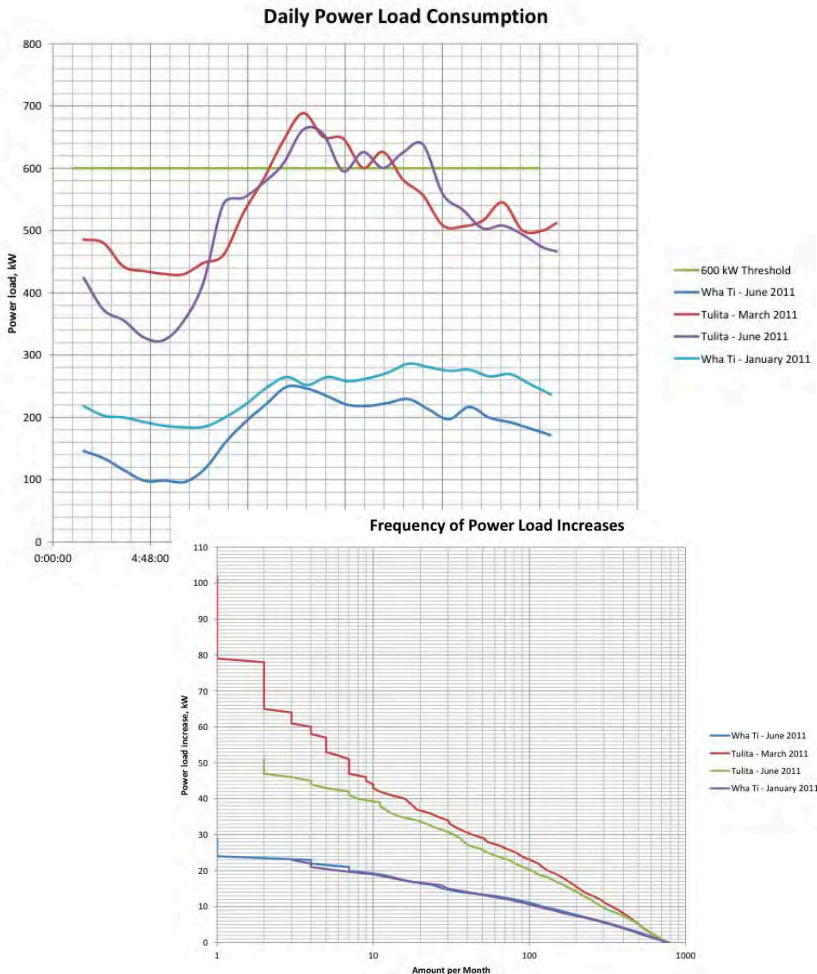
- ❁ **Good Geology**
 - Hot sedimentary aquifer (HSA) versus volcanic system
- ❁ **Good Data**
 - > 30 deep wells in the area, significant risk reduction
 - ~5km away, 1 well to 4,579m (deeper than our target zone)
- ❁ **Great Hosts**
 - ADKFN has the capacity to participate, capability to manage, and a genuine interest in developing the project



Our Target: Fort Liard's power requirements



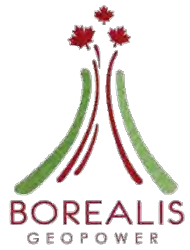
Comparative Load information



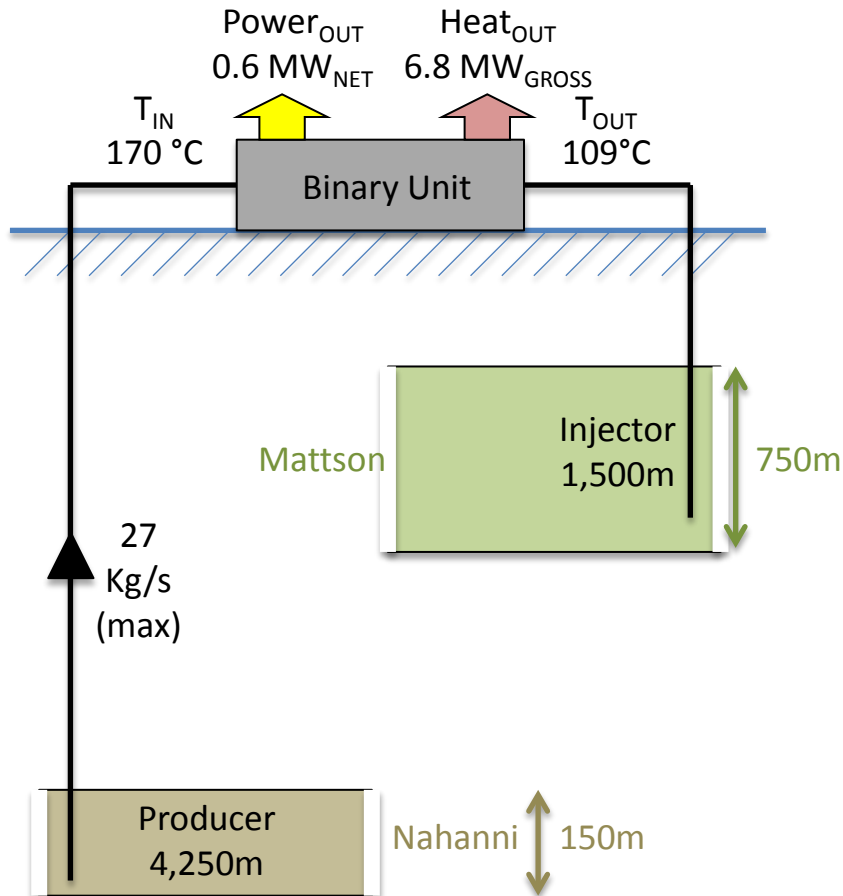
- Current generation provides:
4,160V, 3 phase power at 60 Hz
- Historic peak demand: 540 kW
Capacity (2006), current 523 kW
- Current consumption ~2.8 – 2.9
Million kWh's (61.5% load factor)
- No daily measurement – so used
Wha Ti and Tulita as proxies
- Used 'worst case' scenario for
design – summer peak, maximal
load increase



We propose to develop a HSA geothermal project for supplying Fort Liard's power



Project Schematic: Overview



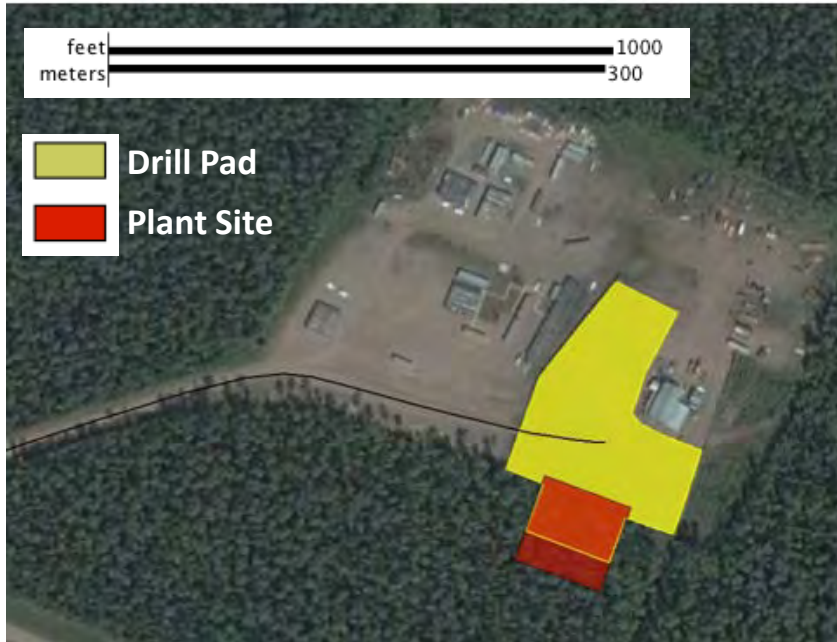
- At site, Nahanni is ~4,250m deep, implying 170 C brine at surface
- Binary technology employed to extract power
- NTPC's existing diesel units as backup
- Option for Phase II heat project(s) off the rejected heat from the binary fluid
- Brownfield location: Beaver Enterprises "Base camp"



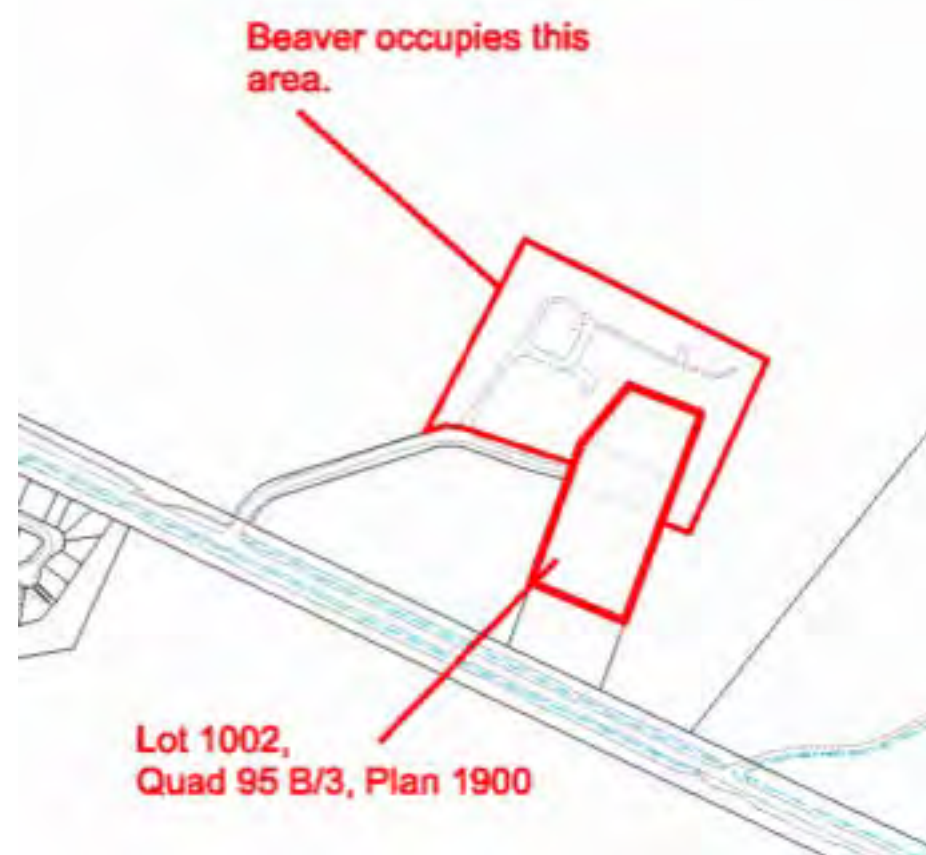
At the site, we intend to drill 2 wells and build a permanent power facility (A)



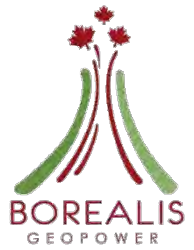
Plant Site: Overview



Land Ownership: Overview



At the site, we intend to drill 2 wells and build a permanent power facility (B)



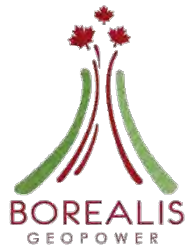
Drill Rig Layout: Overview



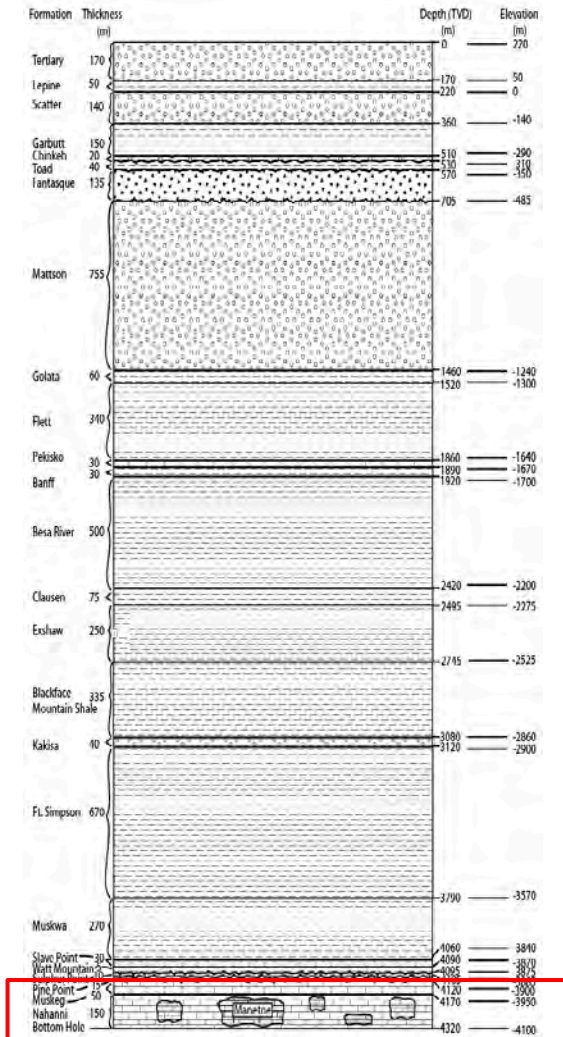
- Drill Pad
- Equipment & Pipe Storage
- Portable Office Building
- Cement
- Tank Transfer Site
- Refueling Site
- Production Well
- Injection Well
- Water Tank
- Solid Drilling Waste
- Liquid Drilling Waste
- Drilling Mud
- Diesel
- Propane
- Drilling Chemicals
- Hazardous Domestic Waste
- Grey Water and Human Waste



The subsurface Production target is the Nahanni formation



Estimated Depths and Lithologies

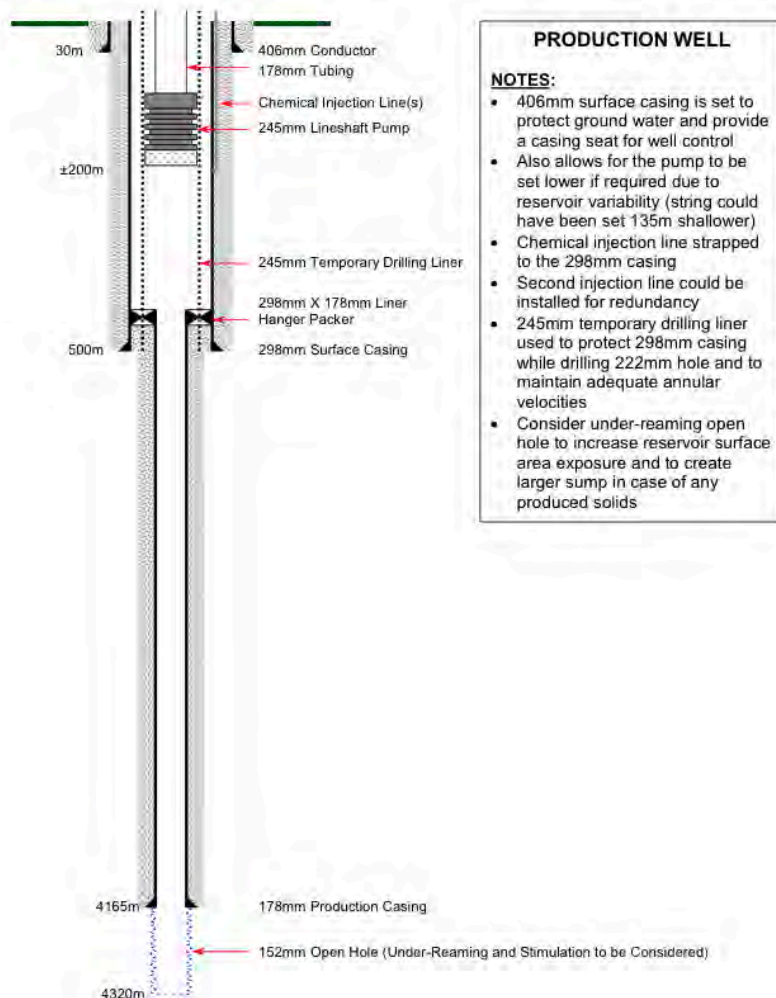


- 🍁 At site, Nahanni is ~4,250m deep and ~150m thick
- 🍁 Permeability: 50 mD
- 🍁 Porosity: ~8%
- 🍁 Significant water coning (water exits) and ~15% TDS
- 🍁 'Bottom Hole' ~175-180 °C
- 🍁 'Bottom Hole' Pressure: 43,000 kPa (initial) and 41,700 kPa after 5 years of production



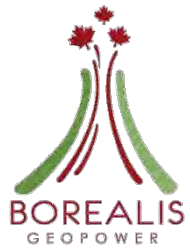
The Production well requires some pumping to bring the brine to surface

Production Well Design

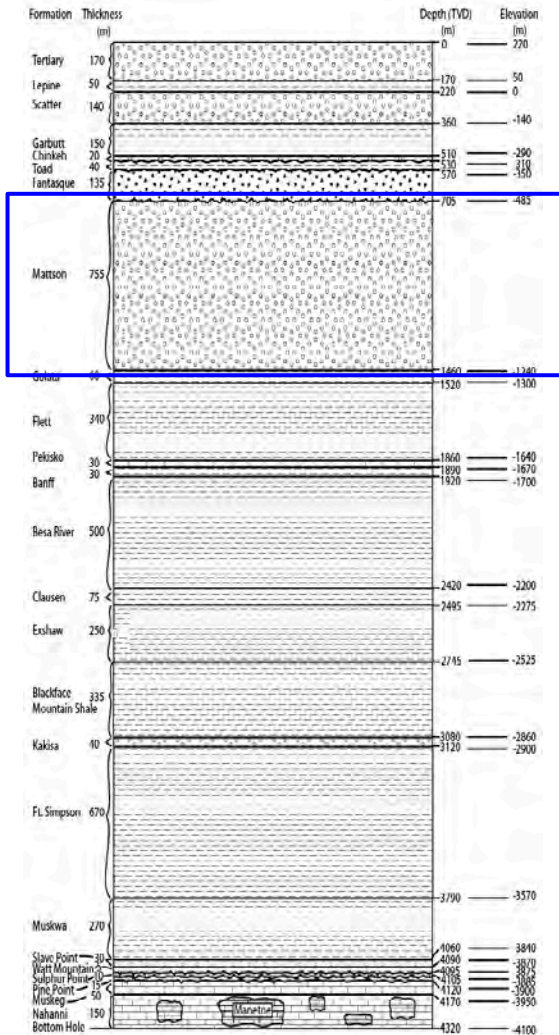


- Fully cased hole
- Casing diameters from 406mm to 178mm
- Groundwater protected by cemented casing and production tubing
- Lineshaft pump at ~ 200m
- Anticorrosion bleed below pump
- Specialty steel

The subsurface Injection target is the Mattson formation



Estimated Depths and Lithologies

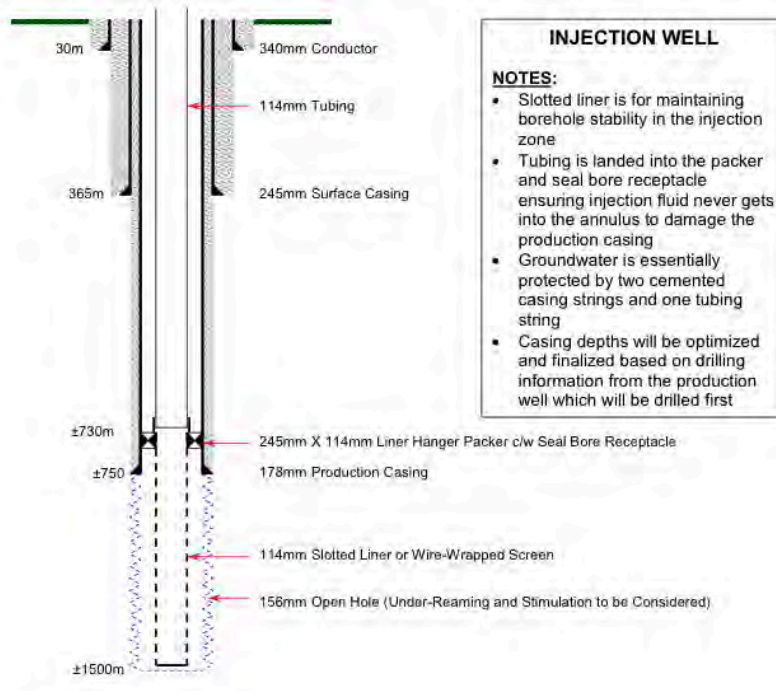


- 🍁 At site, Nahanni is ~1,500m deep and ~750m thick
- 🍁 Permeability: > 1,000 mD
- 🍁 Porosity: 5 - >20%
- 🍁 'Bottom Hole' Pressure: < 20,000 kPa
- 🍁 Shale cap: Fantasque (~118m) & Garbutt (~140m)
- 🍁 Previously approved for Oil & Gas reinjection by the NEB



The Injection well disperses the brine over a large open hole area

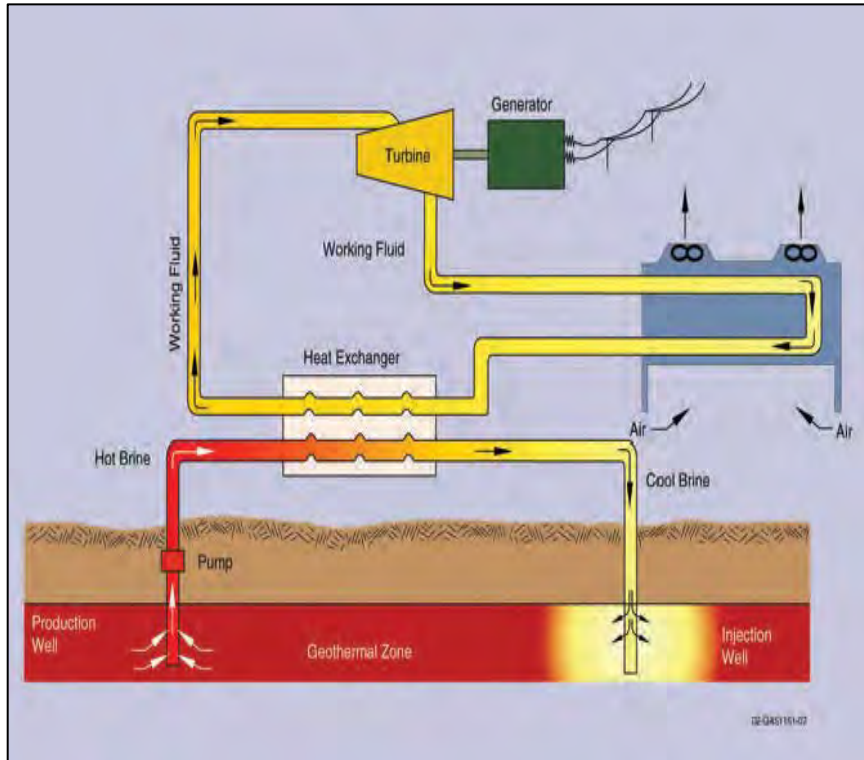
Injection Well Design



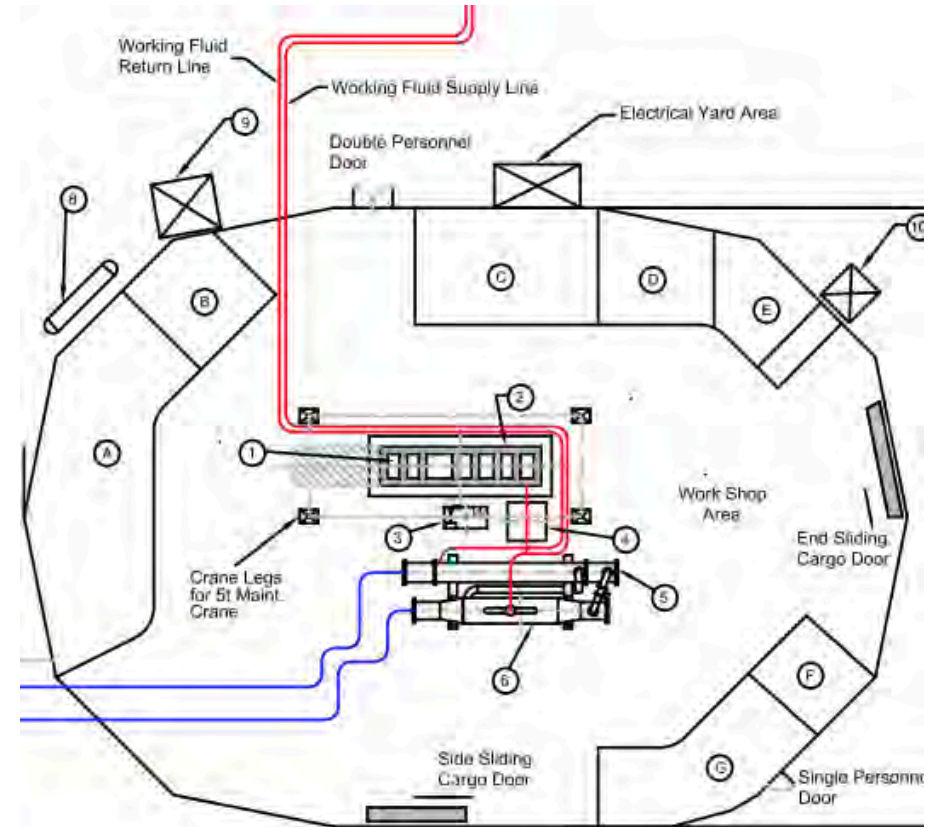
- Fully cased hole to 750m
- Groundwater protected by cemented casing and production tubing
- Slotted liner supporting formation in re-injection zone (~750m)
- Specialty steel

On the surface, we proposed to construct a binary power plant (A)

Notional Binary Power Plant Schematic

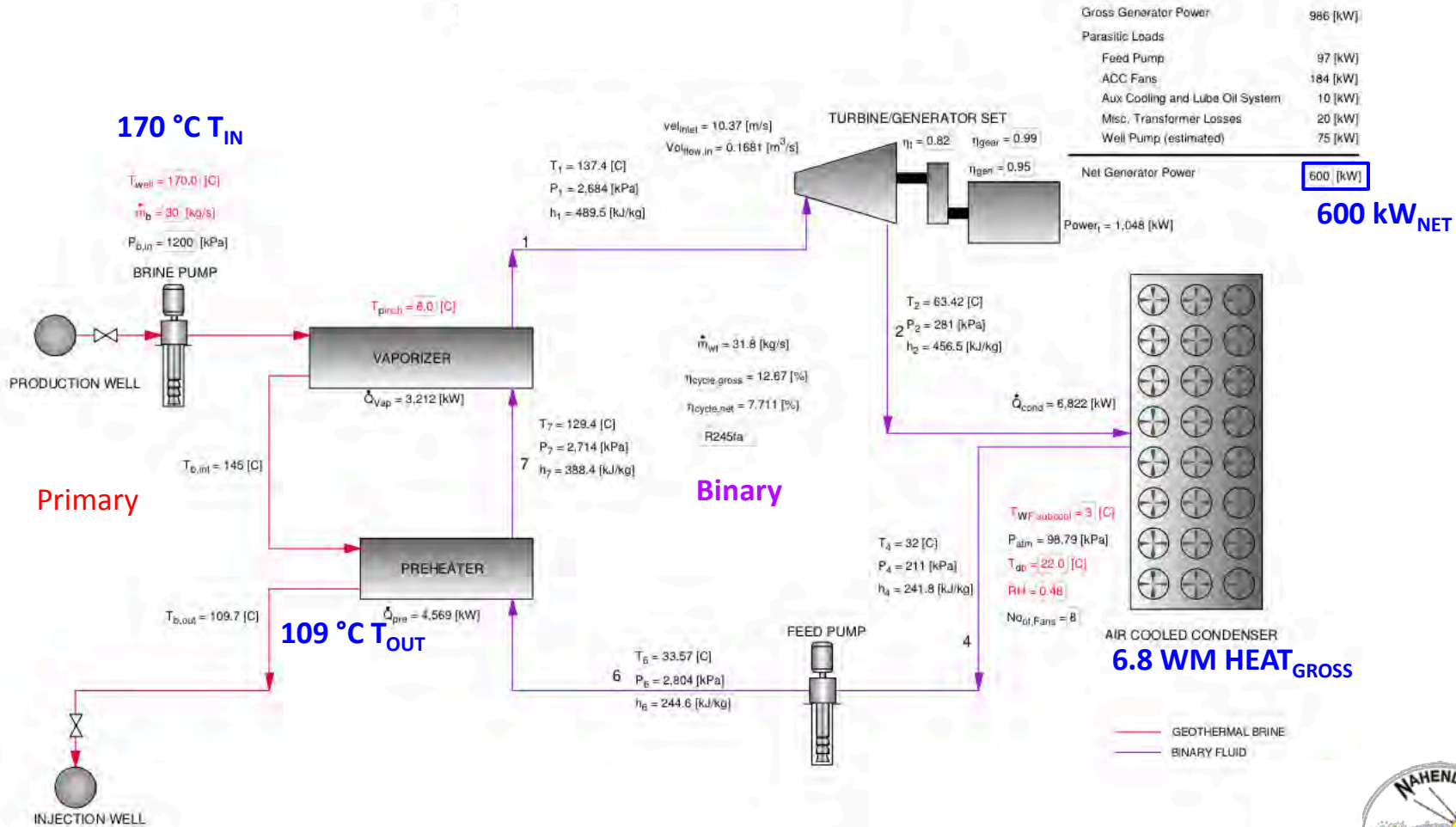


Surface Plant Layout (partial)



On the surface, we proposed to construct a binary power plant (B)

Binary Power Plant: Process Flow Diagram



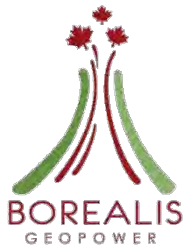
In a later Phase II, there will likely be one or more direct heat projects



- ❁ 6.8 MW Gross @ ~ 70 °C (Binary) + large heat @ 109 °C (Primary)
- ❁ Even utilizing only 1.0 MW would be sufficient heat for ~140 homes or a large commercial operation
- ❁ The binary heat is effectively free and using a 'heat sink' will reduce air cooling loads and increase overall power production
- ❁ Common applications
 - Household heat
 - Green House
 - Fish Farming
 - Drying (lumber, pellets, crop)
 - Water systems, et al



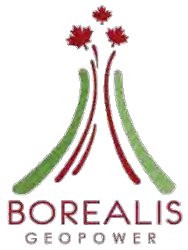
The project schedule has significant slack built into it



- Drill, test, and complete wells – Summer/Fall 2012
- Order long lead items – post-test in Summer 2012
- Clear final site – Winter 2012/2013
- Construction – 60 days – Summer 2013
- Commissioning – 30 days – Fall 2013
- Conservative online date – January 1, 2014



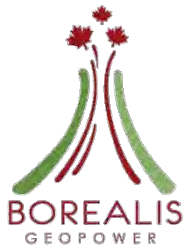
Despite a regulatory vacuum, we are ensuring safety & environmental responsibility



- Drill Plan (TBD – w/ operator & meeting COGOA)
- Equipment (casing, cement, tubing, BOP, safety gear)
- Training (repeated review)
- ERP (repeated review)
- SCP
- WMP



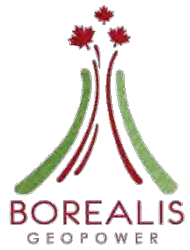
The economic benefits are overwhelmingly positive



- Net investment to GNWT = ~7.3 MM
- Versus diesel, but using diesel as backup, NPV >\$30MM in cost savings
- Reduced commodity price volatility
- Build capacity to extend geothermal to other applicable communities in the North (power and direct heat)
- Very low cost heat for a Phase II



Further, there are significant social benefits



- ❁ GHG reduction in Fort Liard
- ❁ Noise Reduction in Fort Liard
- ❁ First Nation ownership stake = long term income stream
- ❁ One time construction jobs
- ❁ Long term jobs available with Phase II direct heat applications
- ❁ Creation of a regulatory environment recognizing geothermal power/heat = future projects





Questions ?

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Canoe Reach Geothermal Power Project

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