



## ASX Announcement

Company Announcements Office  
Australian Securities Exchange

*By e-lodgement*

22 March 2011

(ASX Code GRK)

### Presentation at WA Geothermal Energy Symposium

Please find attached a presentation by Green Rock's Director of Operations at the West Australian Geothermal Energy Symposium held in Perth on 21<sup>st</sup> -22<sup>nd</sup> March 2011.

The presentation focuses on the potential for the direct use of geothermal energy in the Perth urban area.

Nigel Hodder  
Company Secretary

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# **GREEN ROCK ENERGY LIMITED**

## **CORPORATE PROFILE**

**West Australian Geothermal Energy Symposium**

**Perth, 21<sup>st</sup> March 2011**

**Adrian Larking**  
**Director of Operations**

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# Green Rock Energy Background

- Founded in 2004 to delineate & develop geothermal energy
- Public company listed in 2005 on ASX
- Around 2,475 shareholders
- 2005-2008 acquired interests in South Australia and Hungary
- Instrumental in initiating geothermal legislation for SA (1<sup>st</sup> GELs granted 2004 & WA (1<sup>st</sup> GEPs granted in 2009)
- Started with focus on EGS but now focusing on HSA
- Recently diversified into petroleum – farmed into Permit in Canning Basin & have AMI to explore for conventional & unconventional gas
- This talk will address our geothermal energy activities with our main focus on hot sedimentary aquifers

## Directors

- Richard Beresford, Managing Director  
(Energy Business Developer)
- Adrian Larking, Director of Operations  
(Geologist and Lawyer)
- Jeff Schneider, Non-Executive Chairman  
(Energy Business Developer)
- Jörg Baumgärtner, Non-Executive Director  
(Geophysicist & Geothermal Project Developer)

## Geothermal Mission

- Locating geothermal resources close to markets that can be commercialised quickly and in stages
- Requires recovering resources with sufficient temperature and water flow rate
- Commencing development with lower cost, lower risk projects, leading to larger longer life projects
- Focus on hot sedimentary aquifers in WA and Hungary
- Demonstrated capability and access to world leading geothermal experience

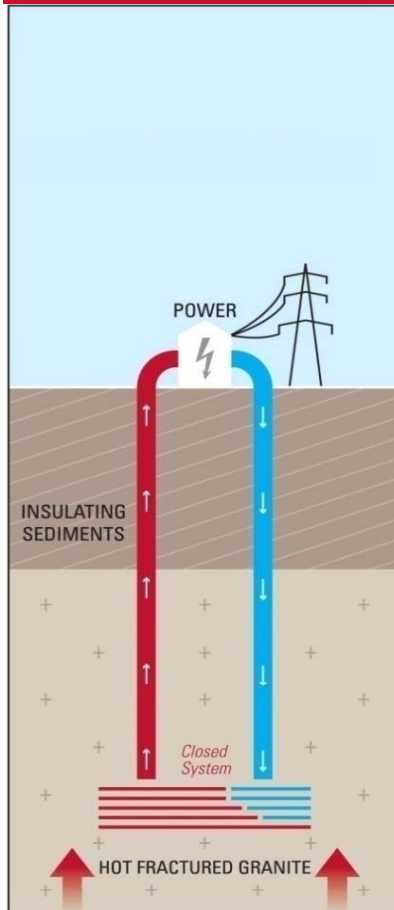
# World Class Experience: Dr Jörg Baumgärtner

- A world leading developer and producer of geothermal energy
- International experience in Europe, USA, Indonesia
- Project Manager at Soultz sous Forêts EGS R&D project in France
- Landau- German's first geothermal energy power plant, commissioned Nov. 2007 & operated by him
- Deep drilling & recovery of geothermal energy from hot sediments & granites at Landau & Soultz
- Expert in hydraulic fracture stimulation



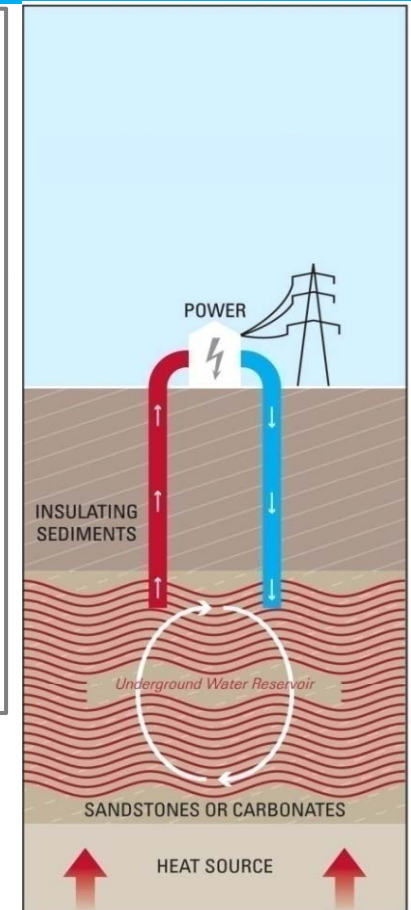
# Geothermal Resource Comparison

## Hot Dry Rocks



- Need to create underground heat exchanger
- Drilling through sediments into hot crystalline rocks
- Requires fracture stimulation
- Requires external water source
- Water must be circulated underground

## Hot Sedimentary Aquifer



- Use natural underground reservoirs
- Drilling into permeable sediments
- Fracture stimulation generally not necessary
- Water present in known aquifers
- Avoid mixing of re-injected water and produced water

Capacity (MWth)  $\propto$  temperature, flow rate

# Sub-surface Technologies

## Drilling & Fracturing

- Drilling, logging, pumping, fracture stimulation, & safety equipment similar to petroleum
- Large rigs required to drill to depths of 2,000m to 4,000
- High temperature tools needed

## Production

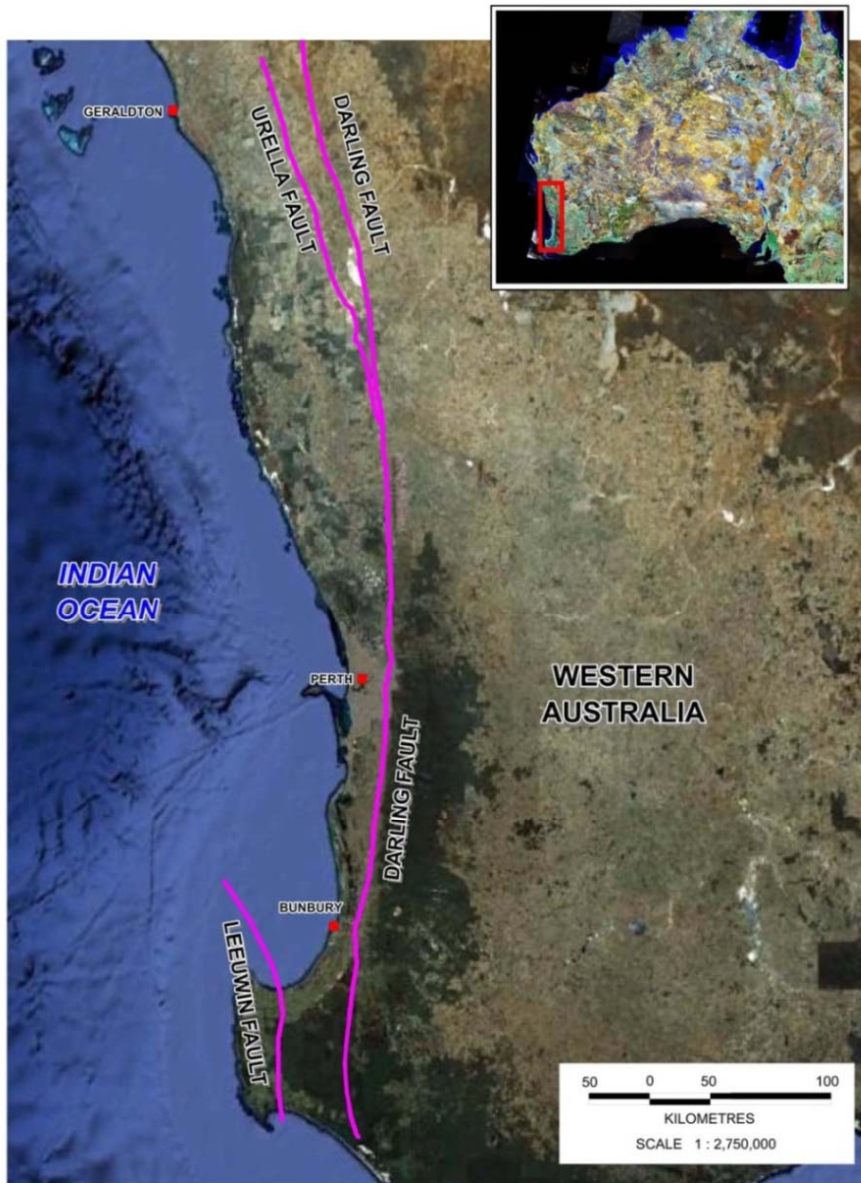
- Requires large hot water flow rates to surface heat exchangers
- High temperature large volume pumps (line shaft or submersible) using minimal power



## Western Australia – Market Drivers

- Electricity and gas prices are sharply higher
- Major users facing supply uncertainty
- Geothermal is needed for WA to meet its 20/20 target
- Geothermal delivers around the clock
- Displacing peak summer demand has major value
- Studies show geothermal has long term commercial advantages over other renewable technologies

# Why the Perth Basin?

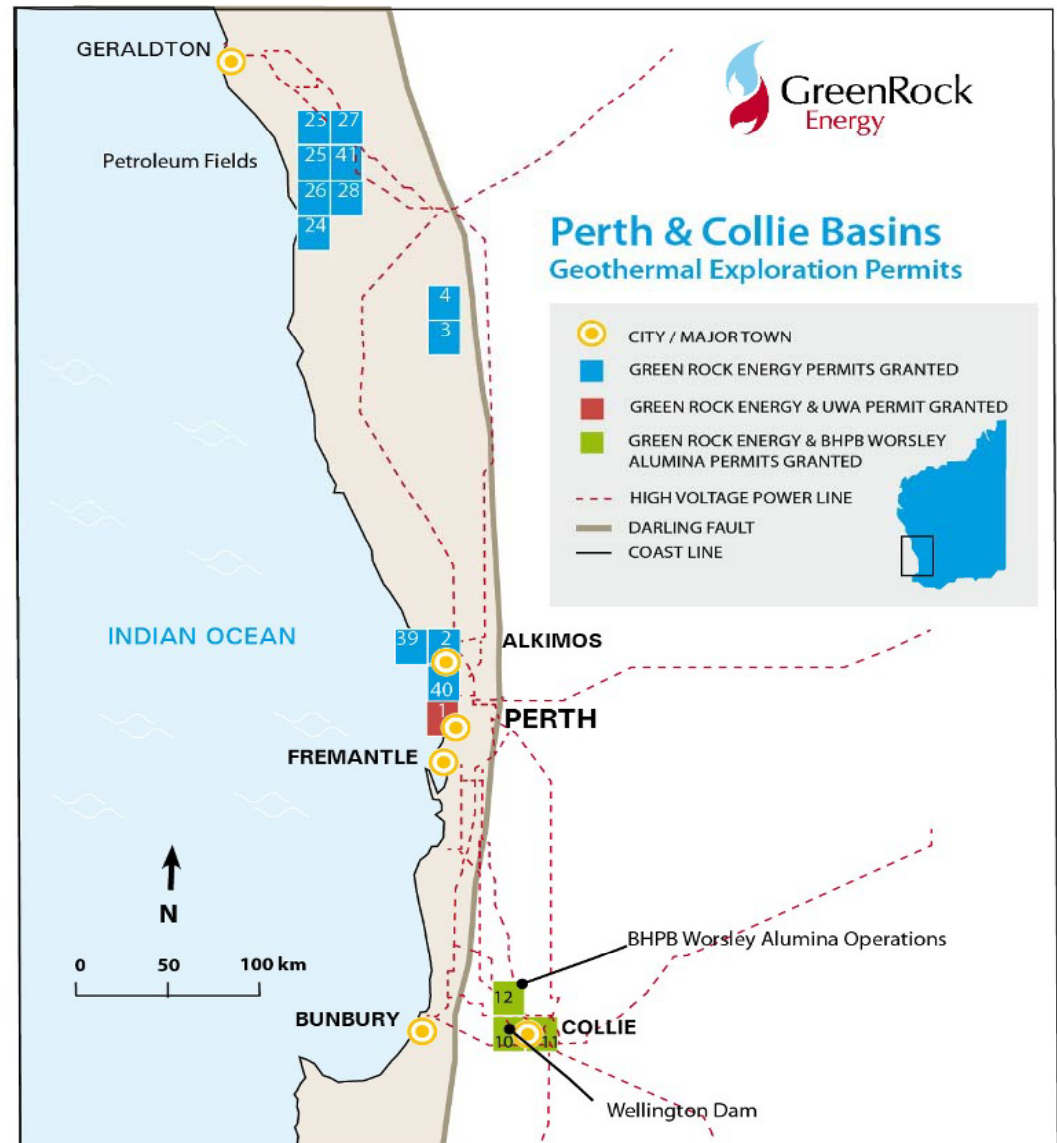


- Close to population & markets
- Existing infrastructure
- Logistical centre for petroleum & mining industries
- Existing wells & seismic data
  - wells = over 250 onshore
  - seismic: 2D = 23,985 km: 3D=2,838 km<sup>2</sup>
- Geothermal energy is used in Perth now (heating pools)
- Extensional rift basin, 15km sediments
- Good sandstone aquifers known
- Normally pressured
- Uncomplicated drilling history

# Western Australia Strategy

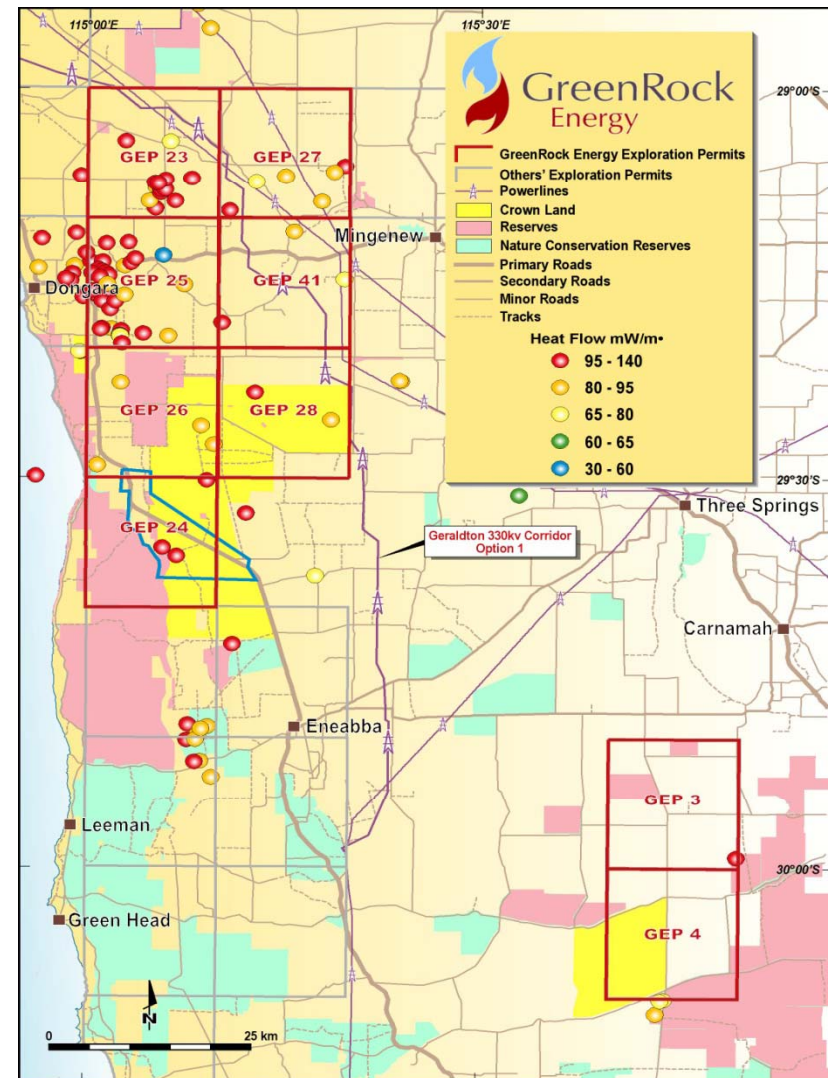


- North Perth Basin (100%)
  - Electricity generation potential
  - Heat flows above 100mW/m<sup>2</sup>
- Perth Urban Area (100%)
  - Heat flows insufficient for commercial power generation
  - Cooling / heating & water purification/desalination
- Collie Basin Area
  - Industrial use / desalination / power generation (JV with BHPB Worsley Alumina)
  - Definition of heat sources and market potential underway



# North Perth Basin Power generation

- Targeting naturally permeable sediments in known hot spots near access to markets
- Permits held 100% and cover 2600km<sup>2</sup>
- Substantial MWe potential close to rapidly growing Mid-West markets and infrastructure
- Inferred Geothermal Resource report by HDRPL indicates huge potential (refer ASX release of 28/10/2010)
- Aim to bring in JV partner(s) to share costs & access power development capability
- Define best drilling target in mid-2011



# Direct Use for cooling & heating

- Resource must be located close to the consumers
- More energy efficient than electricity use
  - Higher ratio of cooling/heating output in relation to energy consumed
  - Require lower geothermal temperatures than electricity
  - Less heat to be rejected
- Electricity replacement technologies
  - Distillation - desalination & water purification by – uses 25% of electrical power of reverse osmosis, not sensitive to water quality
  - Air-Conditioning – absorption chillers require 80°C+
  - Process heat or pre-heating for industrial production operations
  - Drying coal for burning in power stations
- Each project has a unique demand profile & marketing challenges

# Perth Urban Geothermal Project Commercial Demonstration



- Replacing electricity to air-condition UWA

- Two geothermal wells required

  - Access hot aquifers under Perth

  - One production – one reinjection

  - 2 km to 3 km depth

- Absorption Chiller

  - Commercially available

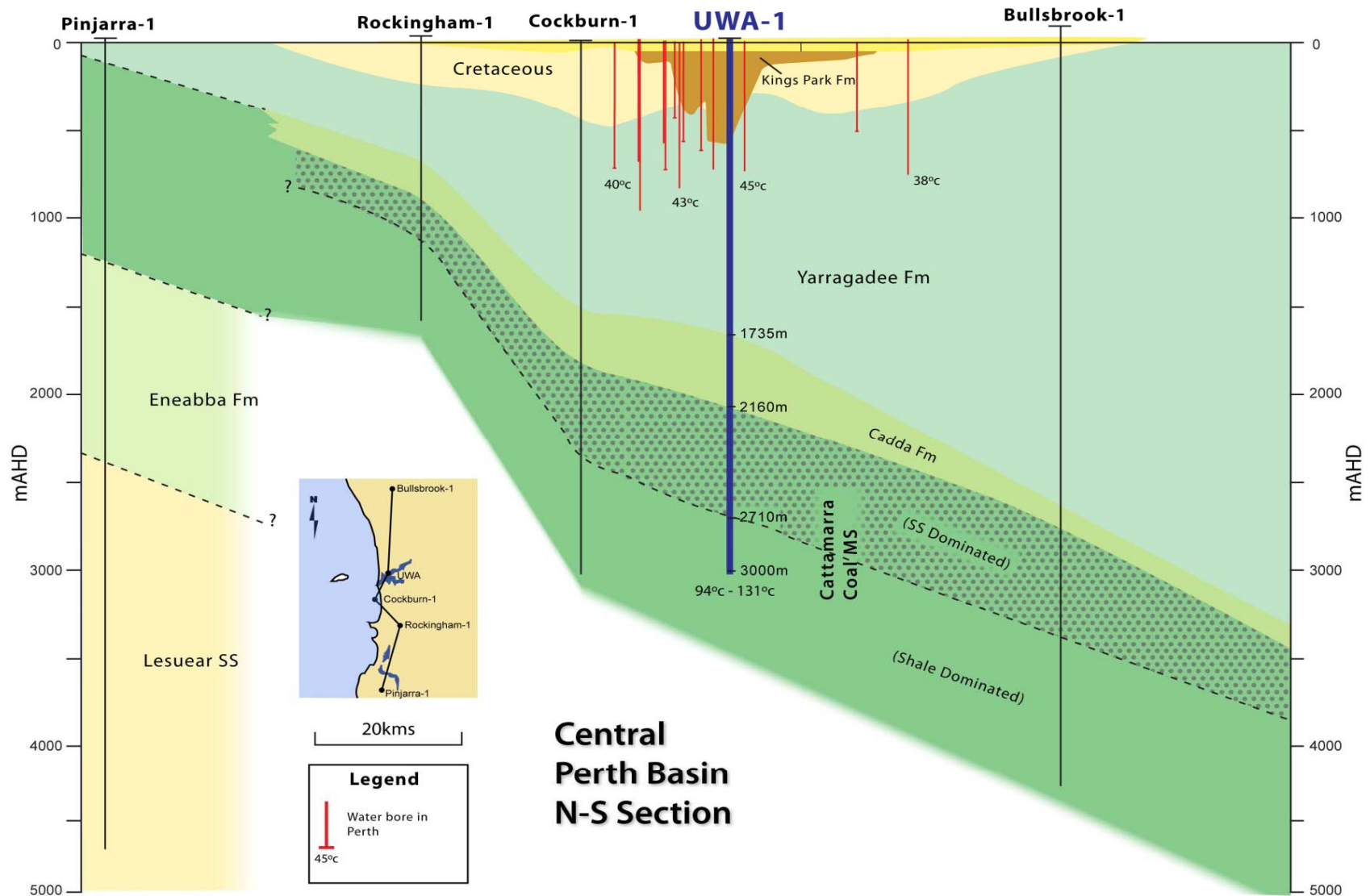
  - Produces chilled water for air-conditioning

  - Requires – geothermal water above 80°C at surface

  - Need base load demand for good economics

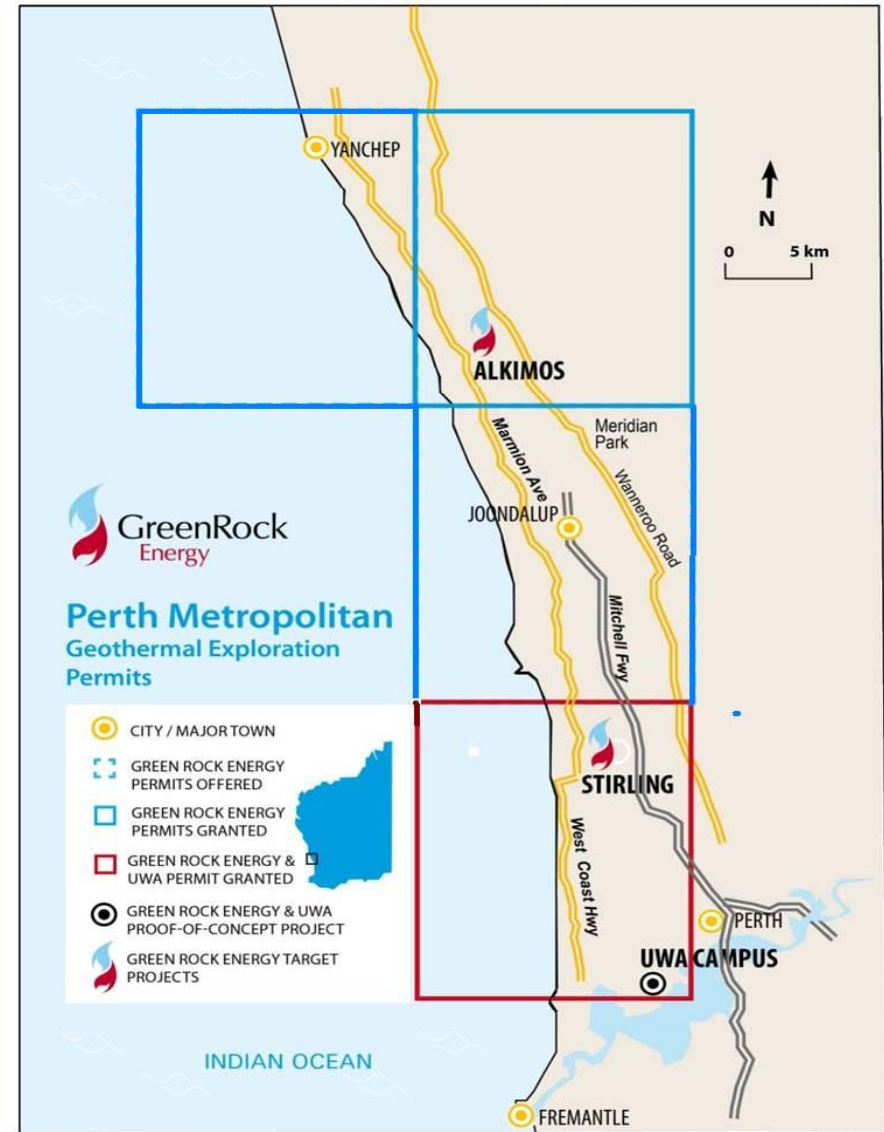


# Cross Section (south to north) showing Wells & Bores



# Perth Metropolitan Area

- \$7m Commonwealth Government funding secured for UWA Project
- Requires funding upfront for 2 wells
- Agreement for \$5.4 m WA LEED funding being finalised
- RECs needed for direct use geothermal replacing electricity
- Need to bring in JV partner to share funding
- Working with State, CSIRO & other companies to source rig



# Challenges for Direct Use Geothermal in Perth Urban Area

- Paucity of deep seismic & drilling data
- Approvals for exploration surveys
- Area required for large drilling rigs for deep drilling
- Mobilising the drilling rigs
- Approvals for drilling
- Community concerns – the need to drill round the clock
- Peaky demand curves for cooling & heating – getting peakier with building codes requiring increasing energy efficiency
- Heat rejection – large footprint for air cooling
- Currently no RECs for electricity displacement by direct use geothermal

## Achievements in 2010-2011

- Relationship with Cygnet Capital brings capital raising and strategic support
- Agreements for \$7m GDP (Commonwealth) funding signed and \$5.4m LEED (WA) funding being finalised for Perth Urban area direct use Project
- Alkimos and North Perth Basin – Inferred Geothermal Resource reports confirm major potential (refer ASX releases dated 6/8/2010 & 28/10/2010 respectively)
- Worsley / Collie Area – initial field surveys to map heat sources conducted; forward program being reviewed with BHPB Worsley Alumina
- North Perth Basin - mapping of temperature, permeability in hottest known regions; discussions progressing with potential JV partners, target to drill in 2012
- Hungary JV well data acquisition completed and evaluation continuing, with target of first revenue in 2012

..... **Thank you**

**Green Rock Energy Limited**  
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