

GROUNDWATER DEVELOPMENT IN MALAYSIA

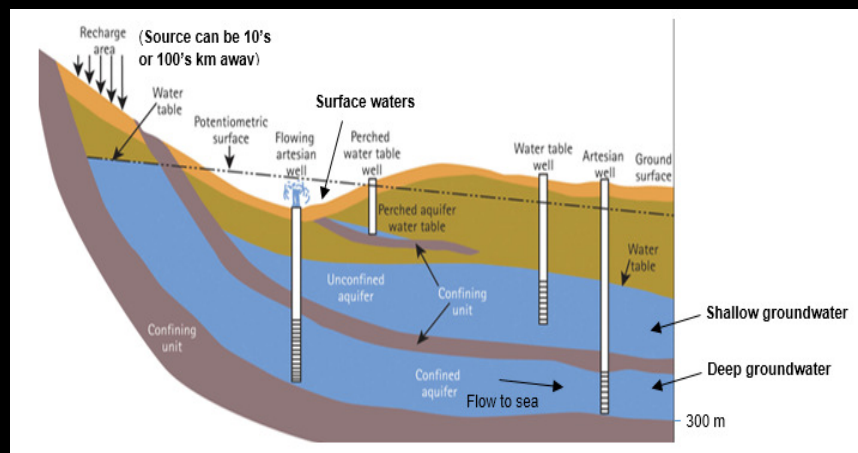
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Seet Chin Peng, P.Geol, FIGM
Magic Mirror Consulting Sdn Bhd



Groundwater Concept



Use of deep groundwater to avoid environmental issues

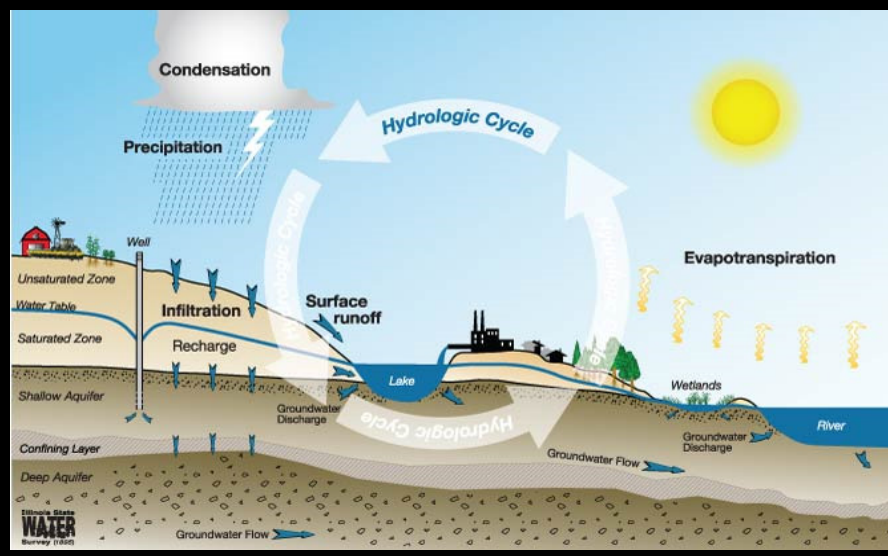
GW Abundant And Good

- Bulk of world fresh water
- 100 x more than surface water
- Renewable resource
- Continuously flowing
- Free of suspended sediments
- Good or “mineral water” quality (depends on host rock)

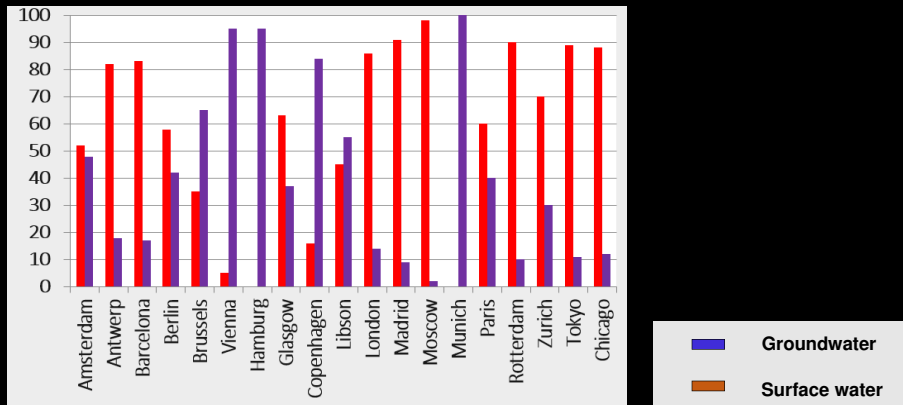


Note : Groundwater (GW)

GW Is Sustainable



Major Cities Using GW



- Hamburg, Munich, Vienna and Copenhagen are 100% or almost 100% dependent on GW
- Amsterdam, Berlin, Glasgow, Brussel and Lisbon, GW contributes >40% of the water requirement

Large Resource, Low Usage

Potential: 5,000 trillion litres

Current Production in Million litres per day (Mld)



Business Potential

- “As is where is” - reduce cost of reticulation and loss in NRW
- One well, 1 mld, can serve 5,000 people
- Provide water security for public, manufacturers, army
- “Mineral water” quality
- Reduce treatment cost
- Less chemical to environment
- Sustainable, not affected by weather
- Small footprint, less land required
- Rapid deployment



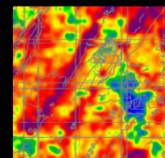
A completed well



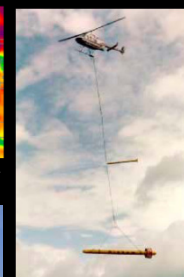
10 m³/hr treatment

Technically Challenging

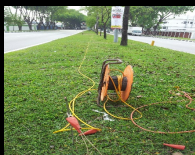
- Hidden resource, not seen
- Need geological knowledge and technical know-how
- Quantity for each well limited, need well field for water supply
- Need drilling & testing
- Some treatment



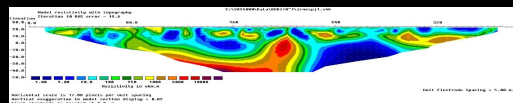
Airborne survey



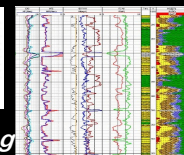
Drilling



Ground investigation



Logging



Drilling, Const & Testing



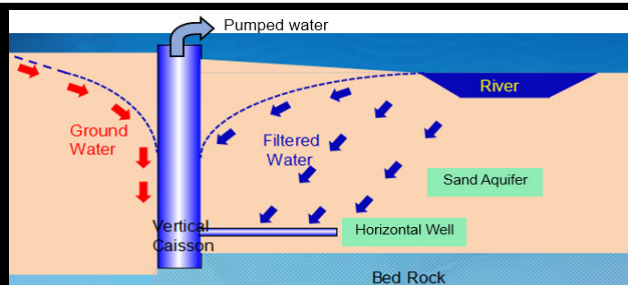
Drilling and Well Construction



Pumping Test

Completed groundwater station
(this well produces about 0.5 mld)

River Bank Filtration (RBF)



RBF in Germany



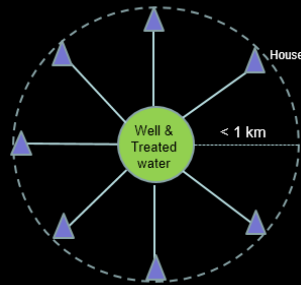
RBF in Perak



RBF in Korea

Independent GW Scheme

Note : Independent Groundwater Scheme (IGS)
Sub-Surface Desalination of groundwater (SSD)



Conceptual layout



Commercial groundwater station



JMG model

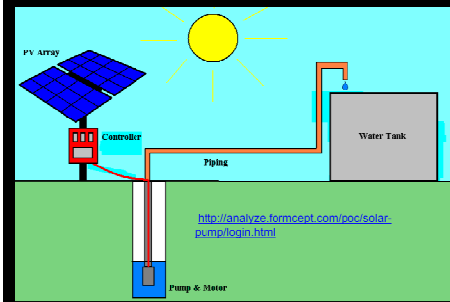


Subsurface Desalination

- SSD: an advanced technology where wells drilled into brackish water can produce fresh water
- Suitable for island and coastal water supply



Use Of Solar Power



Solar-powered water pumping system

Curtin Uni containerized solar-hybrid power system



15 kW hybrid system

Solar-powered drinking water system for remote villages



Industries Using GW

Semi-conductors & Electronics:	12
Construction & Development:	11
Steel Mills & Factories:	5
Textile & Garments:	5
Rubber Gloves:	9
Paper Mills:	5
Palm Oil Mills:	6

Industries Using GW

Food & Beverages:	10
Livestock Breeding & Abbatoirs:	8
Pharmaceuticals & Petrochemicals:	7
Recycling & Plastics:	3
Plantation & Estates	4
Rural Water Supply & Golf Clubs:	4
Special Projects:	5

Moving Forward

- RBF model - for better quality and uninterrupted water supply
- IGS model - for new development areas
- IGS model + solar power - for rural water supply
- SSD model - for island and coastal water supply (+ solar power)
- Change mindset - water security, gw substation, piping for untreated gw
- New uses - fire fighting, mini-hydro, gw streams