Groundwater

The Fowlers Gap Research Station Briefing

Never Stand Still

Connected Waters Initiative Research Centre

CONNECTED WATERS

Groundwater: facts and figures

Table 1.1: Economic value of groundwater use to Australia

Sector	Direct value range and central estimate ($ per ML)[1]	Groundwater volumes (ML)	Direct value-add ($m)	Ratio of direct to total value add	Total groundwater contribution to GDP ($m)
Agriculture - irrigation	$30-500 $200	2,050,634	$410	2.00	**$820**
Agriculture - drinking water for livestock	– –	–	$393	2.08	**$818**
Mining	$500 – 5,000 $2,750	410,615	$1,129	1.45	**$1,637**
Urban water supply	$1,000 – 3,000 $2,000	303,230	$606	1.89	**$1,146**
Households	$1,400 – 6,400 $2,500	167,638	$419	NA	**NA**
Manufacturing and other industries	$1,000 – 3,000 $2,000	588,726	$1,177	2.00	**$2,355**
TOTAL		**3,520,843**	**$4,136**		**$6,777**

Deloitte Access Economics

National Centre for Groundwater Research and Training

Economic Value of Groundwater in Australia

October 2013

Deloitte.

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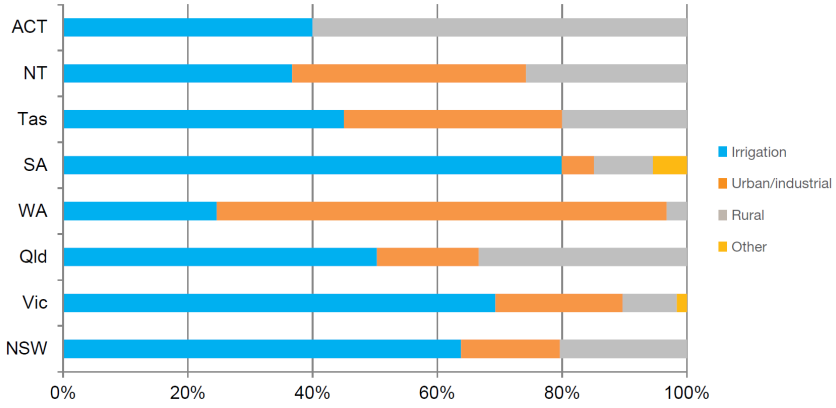
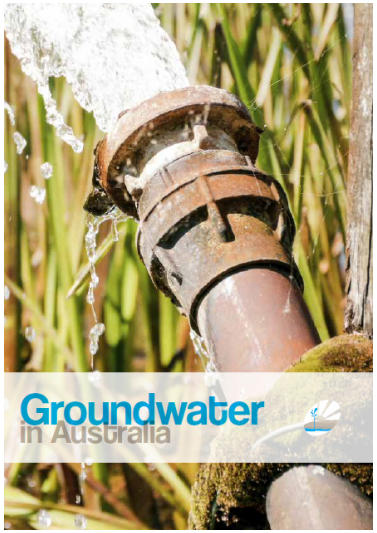
Groundwater: facts and figures



1996-1997 data



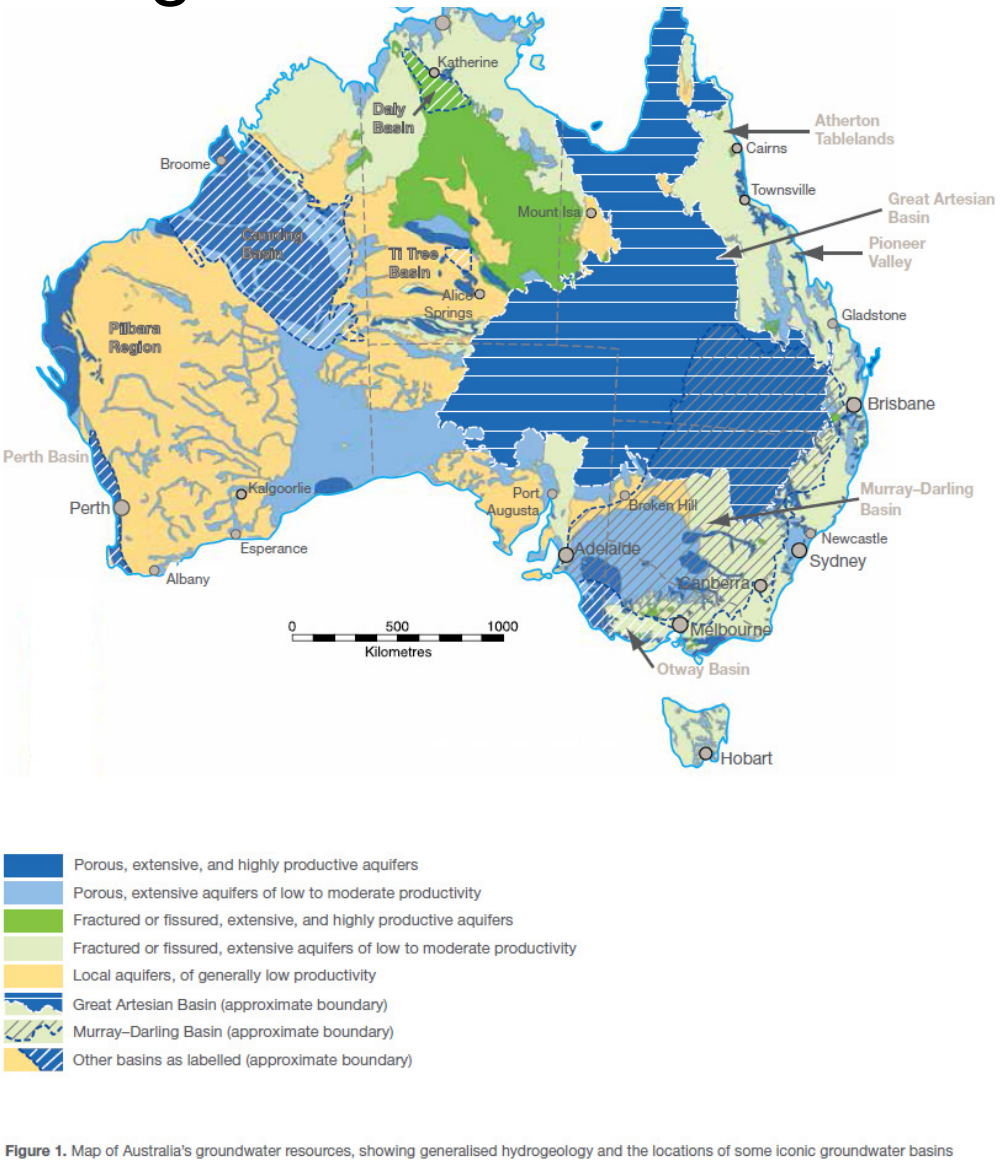


Figure 1. Map of Australia's groundwater resources, showing generalised hydrogeology and the locations of some iconic groundwater basins

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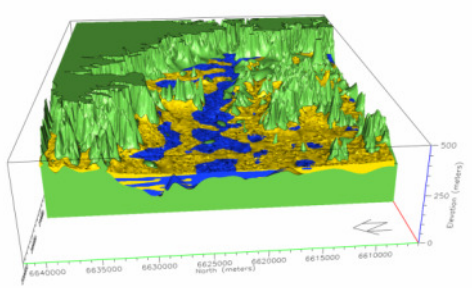
Groundwater: aquifers

Alluvial

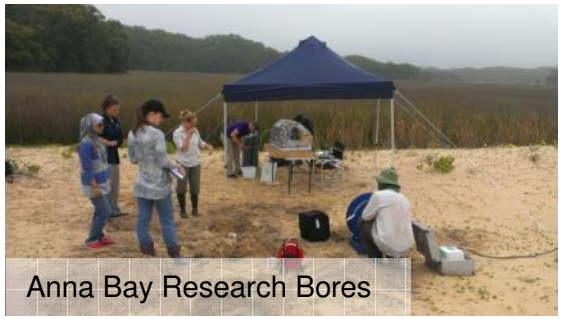
Wellington Groundwater EIF site

Sedimentary Basins



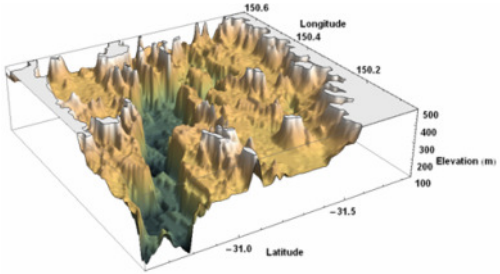
Namoi Groundwater EIF site

Coastal



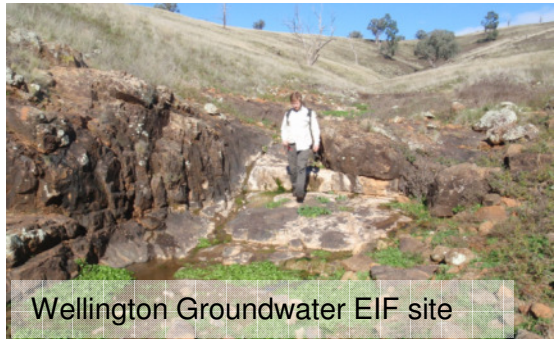
Anna Bay Research Bores

Paleovalley



Namoi Groundwater EIF site

Fractured Rock



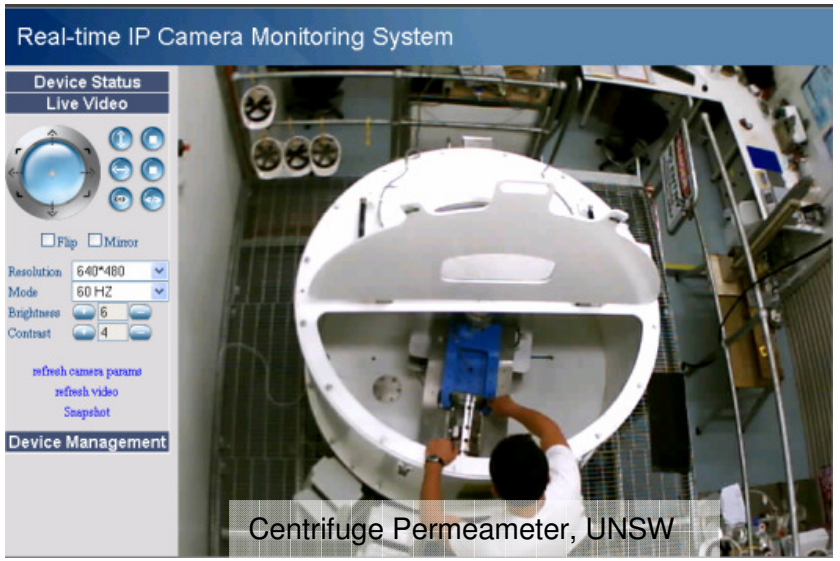
Wellington Groundwater EIF site

Karst

Wellington Groundwater EIF site

Groundwater: aquitards


Namoi Groundwater EIF site



Centrifuge Permeameter, UNSW

Aquifers are underground layers of very porous water bearing rock.

Aquitards, by contrast, are compacted layers of clay, silt or rock that retard water flow underground; that is, they act as a barrier for groundwater.

Aquitards separate aquifers and partially disconnect the flow of water underground.

Groundwater Research

Geology: expert knowledge of depositional environments and subsequent earth history.

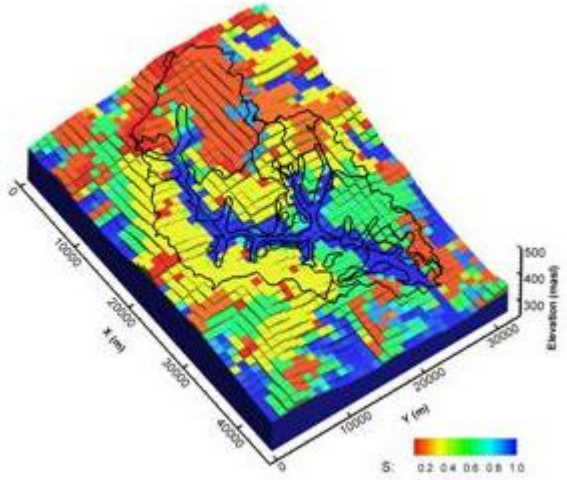
Data poor: point data available from boreholes, spatial data inferred from geophysical techniques.

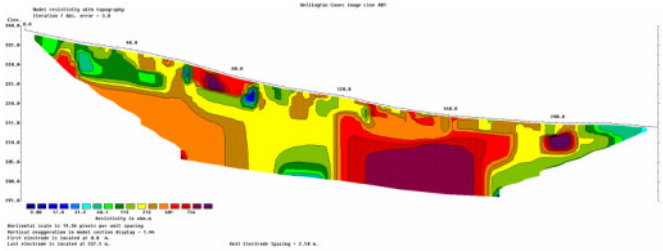
Expensive: from borehole drill costs, to geophysics surveys, water quality analyses and supercomputer time.

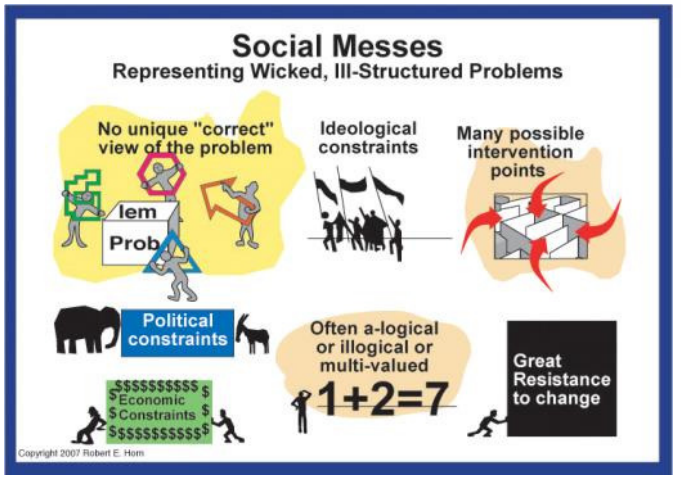
Numeracy: data paucity requires modelling approaches, computationally challenging beyond the local scale.

Complex and uncertain: geological heterogeneity, non-linear processes, quantifying recharge, etc.

Wicked: Socio-economic and legal aspects are complex, a 'wicked' problem akin to climate change



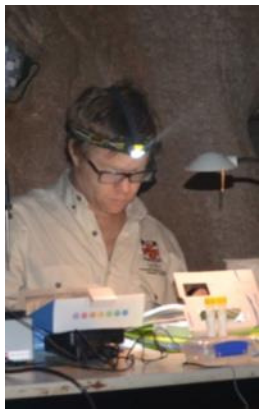




The UNSW Team

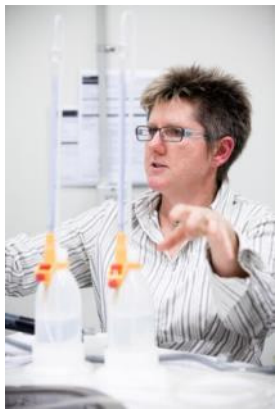
Andy Baker (BEES)

karst aquifers
water quality
paleohydrology



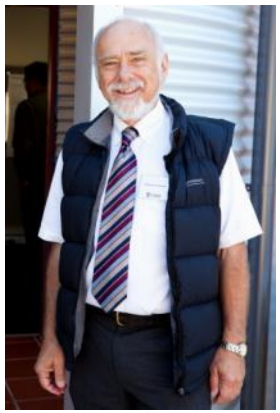
Martin Andersen (CVEN)

water quality
hydrochemical modelling
coastal aquifers
tracers



Wendy Timms (MENG)

Mining and groundwater
aquitards



Ian Acworth (CVEN)

Geophysical techniques
Fractured rock aquifers

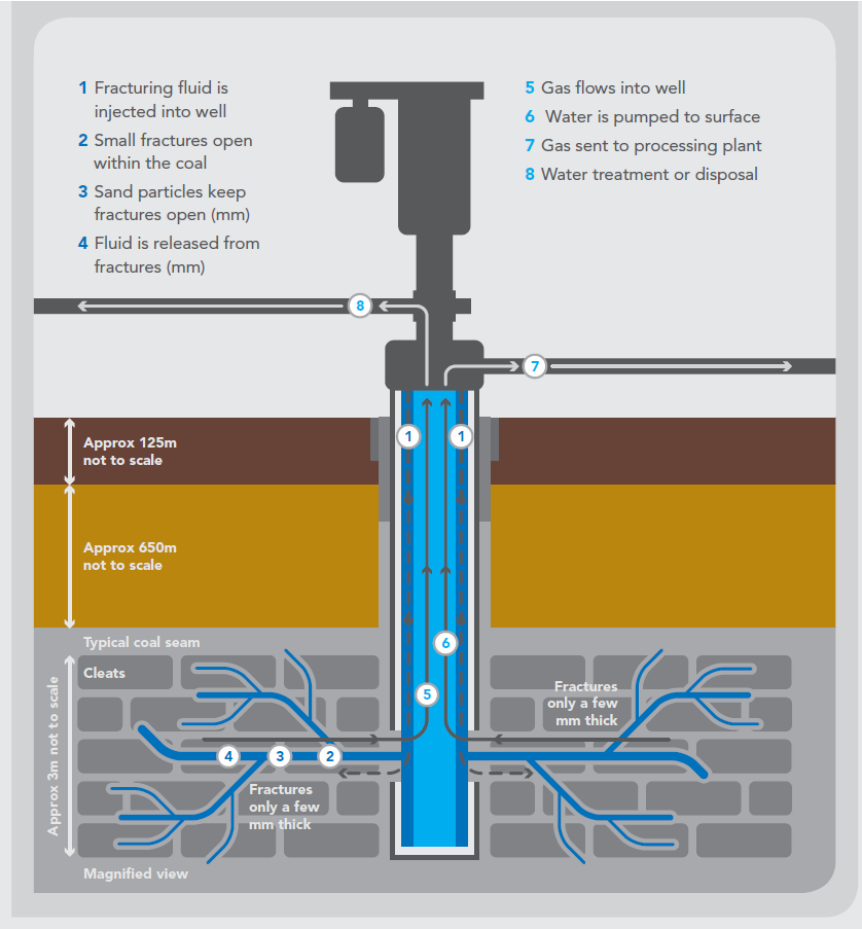
Cameron Holley (LAW)

Governance and legal
Natural resource management

Bryce Kelly (BEES)

Sedimentary basins
Alluvial aquifers
Paleovalleys
Rural water use

International Groundwater Issues: 1 Unconventional Gas



From CSG factsheet 3, see www.csg.nsw.gov.au

CSG in NSW: Permian Coals

Older (300 to 250 million years ago) and are derived from cold climate peatlands.

These peats were subsequently buried up to 2.5 kilometres below the earth's surface.

Permian coals have relatively low hydraulic conductivity.

The overlying rocks also have relatively low to moderate hydraulic conductivity.

CSG in Queensland: Jurassic Coals

The Walloon coal measures in QLD are younger (200 to 145 million years old).

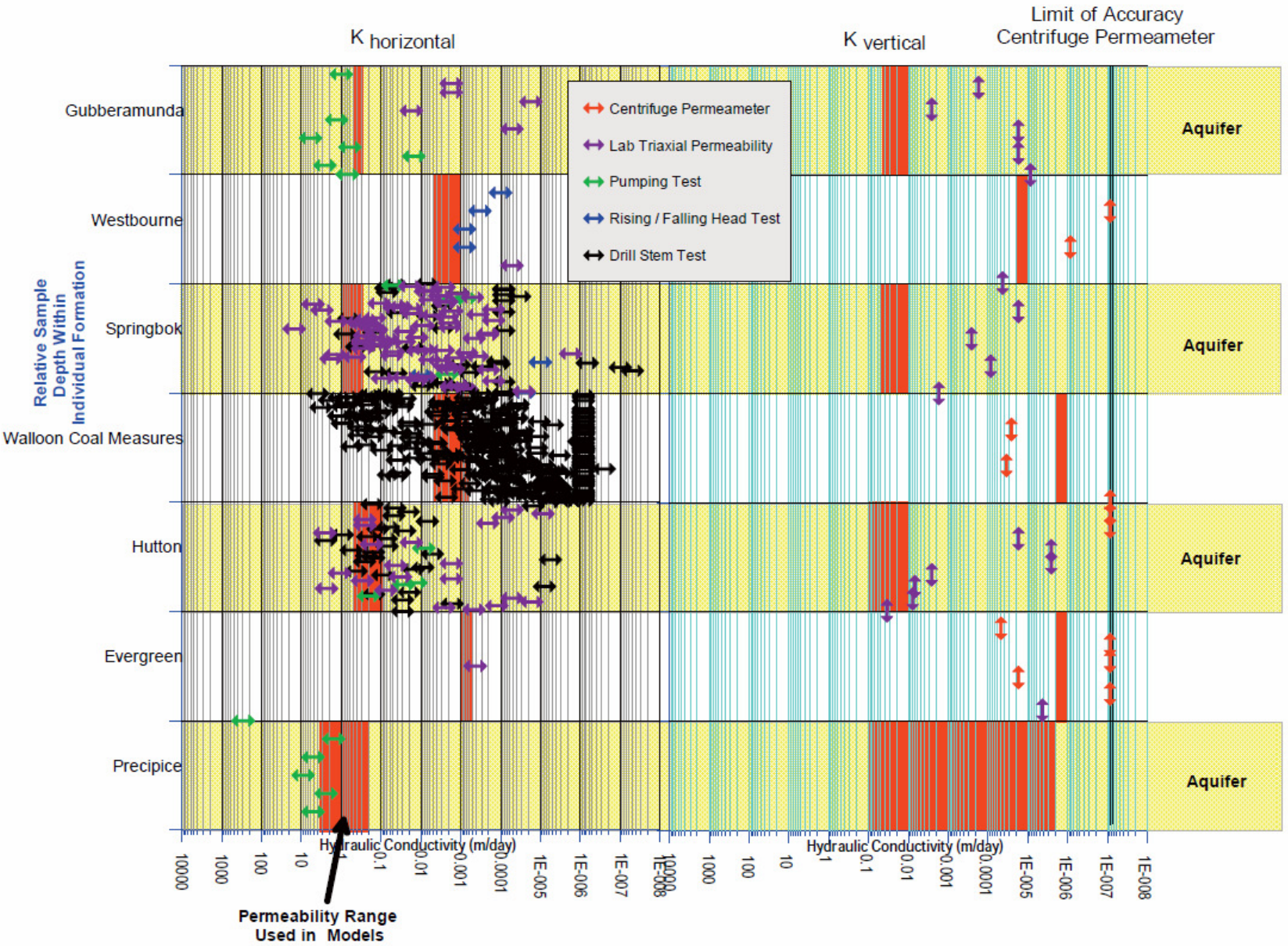
The peats formed in lakes surrounded by humid tropical forests.

Fourteen discontinuous seams have been mapped.

Many of the sandstones that overly the coal seams have a relatively moderate hydraulic conductivity.

There are numerous shale and claystone beds in the overlying formations, but they are not continuous.

Teaching slide from GEOS1211, Andy Baker



Bouzalakos et al., 2013. Procs. IMWA, 1193-1198.

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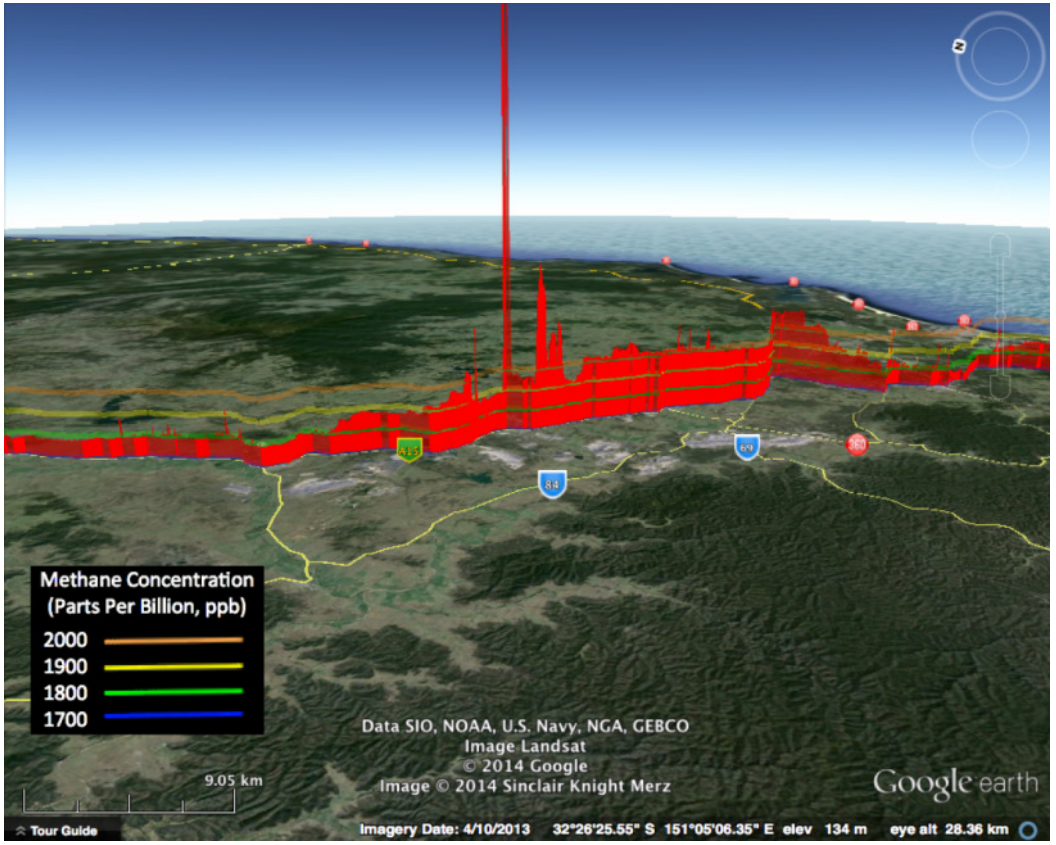
Ground water quality and atmospheric methane research in proposed CSG production zones



Bryce Kelly, Cotton RDC Project. 2014-2016

International Groundwater Issues: 2 Compliance, Enforcement and Good Water Planning

ARC DECRA and Linkage funded social research on groundwater compliance, enforcement and planning.

Responds to national needs:

‘Implementation [of plans] has often proved difficult. Only a portion of the potential economic and environmental benefits have been harvested. There is a need to improve the way communities are engaged in water planning and the implementation of plans’

“Knowledge gaps remain in the measurement of irregular extractions ... the development of basic compliance information; sharing of best practice in water enforcement and research into the indicators or precursors of water theft’.

National Water Commission (NWC)

Cameron Holley, ARC DECRA and Linkage Projects, 2013-2016

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International Groundwater Issues: 3 Climate change and groundwater

Groundwater Infrastructure (GEIF / CRIS / NCRIS 2013)

2009-2013: $15 million to establish groundwater monitoring sites across Australia to support climate change research.
2013-: ongoing support of EIF sites from NCRIS 2013