Addressing the limitations of federated groundwater bore data

(another challenge for the 21st Century)

Dr Peter Dahlhaus
Senior Research Fellow

Dr Helen Thompson
Director, Centre for eCommerce and Communication

Mr Andrew Macleod
Director, Centre for eCommerce and Communication

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The 21st Century Context

*e*Research challenges

- **Ubiquitous high-speed broadband** being rolled out.
- **The Petabyte Age**… >50% of the world's data is being collected each year – how do we utilise it?.
- **Open data policies**… raw data is more accessible, but how to interpret it?.
- **Mobile technologies**… everyone is spatially enabled and spatially aware – we want to know about here and now.
- **3d visualisation technology** is more commonplace than ever before - television, cinema, printers…

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The 21st Century Context

eResearch questions:

- **How do we provide access to big and complex data in a way that people can use easily… but without biasing the data?**
- **How do we incorporate qualitative data with quantitative data into models to improve accuracy?**
- **How can we harness Citizen Science and use crowd-sourced data to improve our hydrogeologic science**?
- **Can we use digital technologies to ensure that we don't keep repeating the same science?**

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VVG Visualising Victoria's Groundwater

A collaboration of 17 partner organisations

CeCC Centre for eCommerce and Communications

Ressources naturelles Canada — Natural Resources Canada

State Government Victoria — Department of Environment and Primary Industries

ANU The Australian National University — iCAM

CSIRO

QUT Queensland University of Technology

State Government Victoria — Department of State Development Business and Innovation

VeRSI

Goulburn-Murray Water

Southern Rural Water — Managing Water. Serving Communities.

Thiess services

crc•si

Victorian Mineral Water Committee

senversa

An interoperative spatial information portal that federates groundwater data from disparate sources.

Primarily for research and investigation.

Non-government portal (unique?).

Search on this site
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BENCHMARK SURVEY
Project benchmarking
Please take some time to compl
online benchmarking su
issues
receiving some
e quality of some
expected). Users are reminded that data cleaning is something that has been scheduled for the next 18 months (a...Read here
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Centre for eCommerce and Communications
University of Ballarat
Suite 15 Greenhill Enterprise Centre
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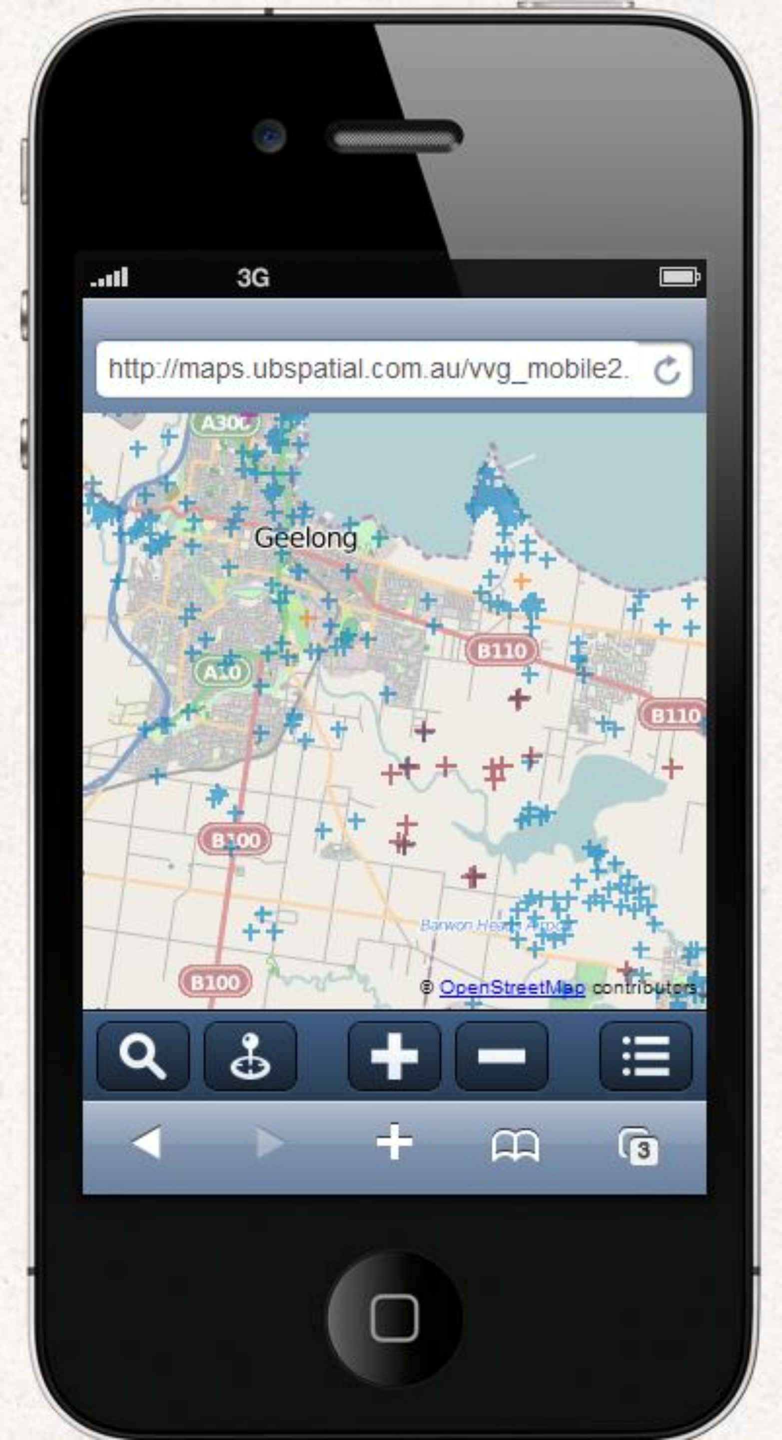
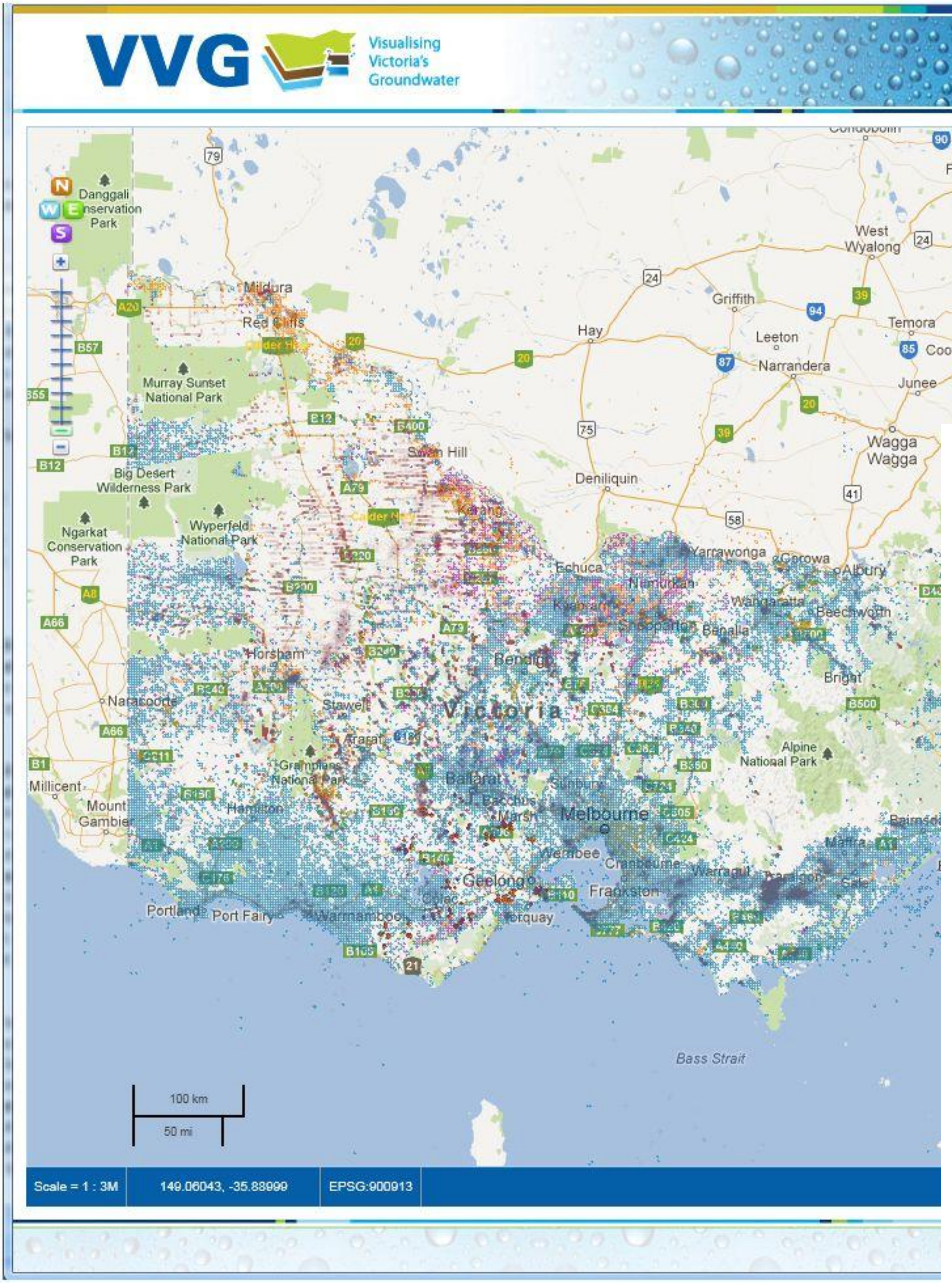
VVG Visualising Victoria's Groundwater

Mobile version

- ✓ Data on the nearest bores
- ✓ Sink a virtual borehole
- ✓ Interrogate the groundwater systems under foot



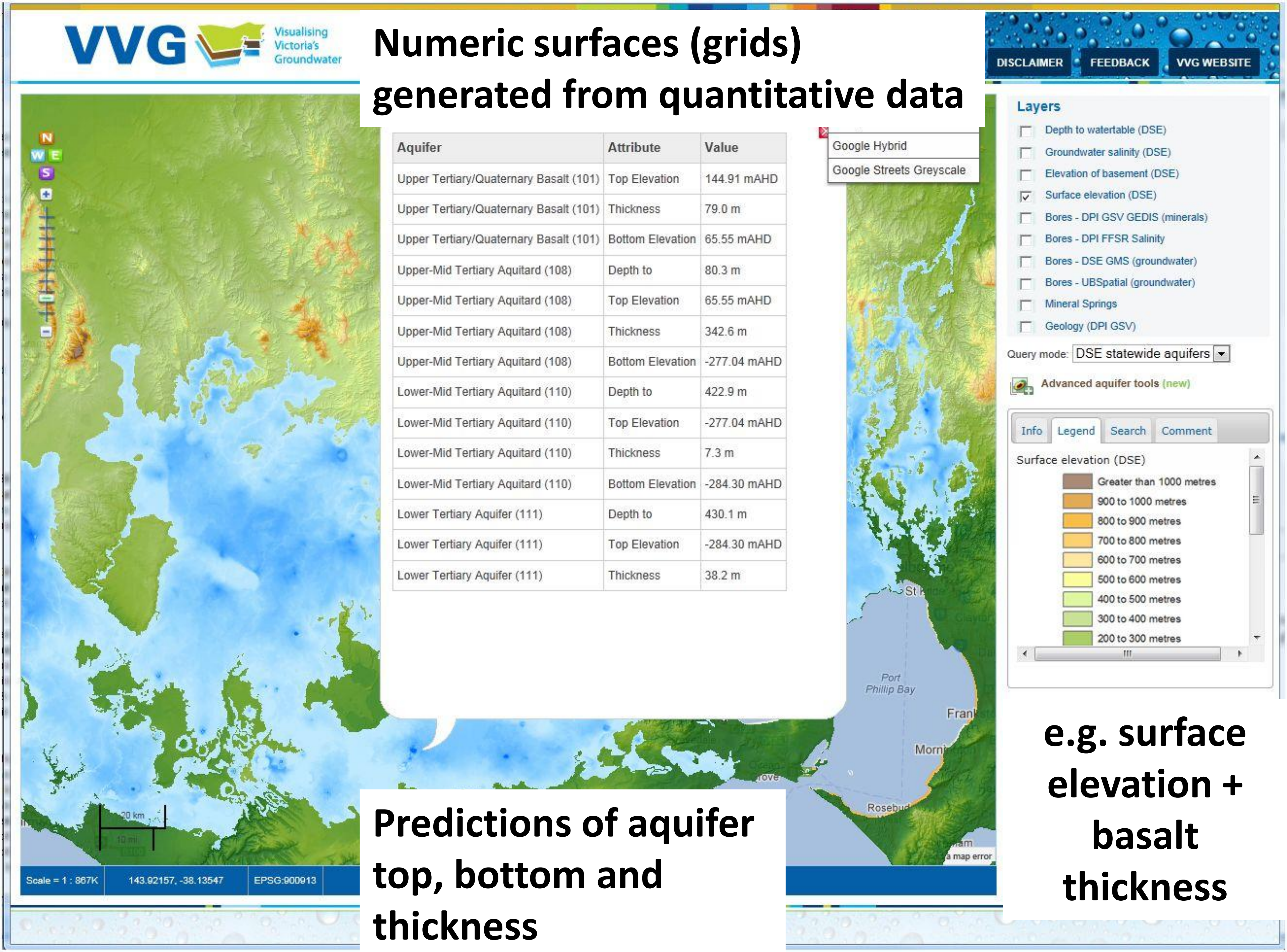


Bore data from four different databases + springs

Examples include elevations, waterlevels, heads, gradients, aquifer parameters, bore construction measurements, chemistry, isotopes, pumping data and extraction volumes.

Time-series monitoring data is particularly useful to understand the dynamic behaviour of groundwater systems.

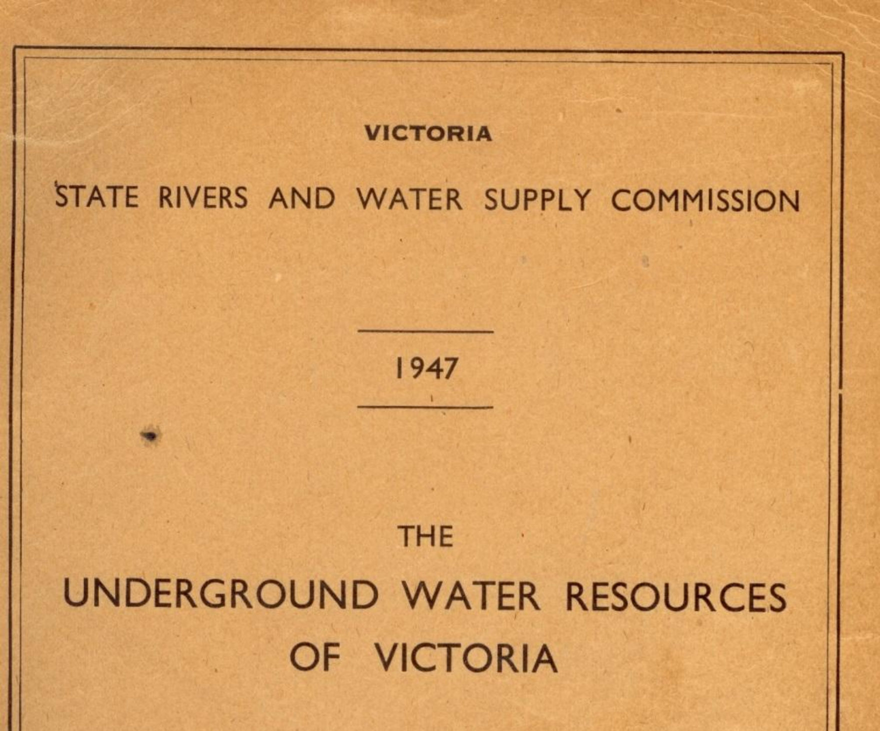
Numeric surfaces (grids) generated from quantitative data

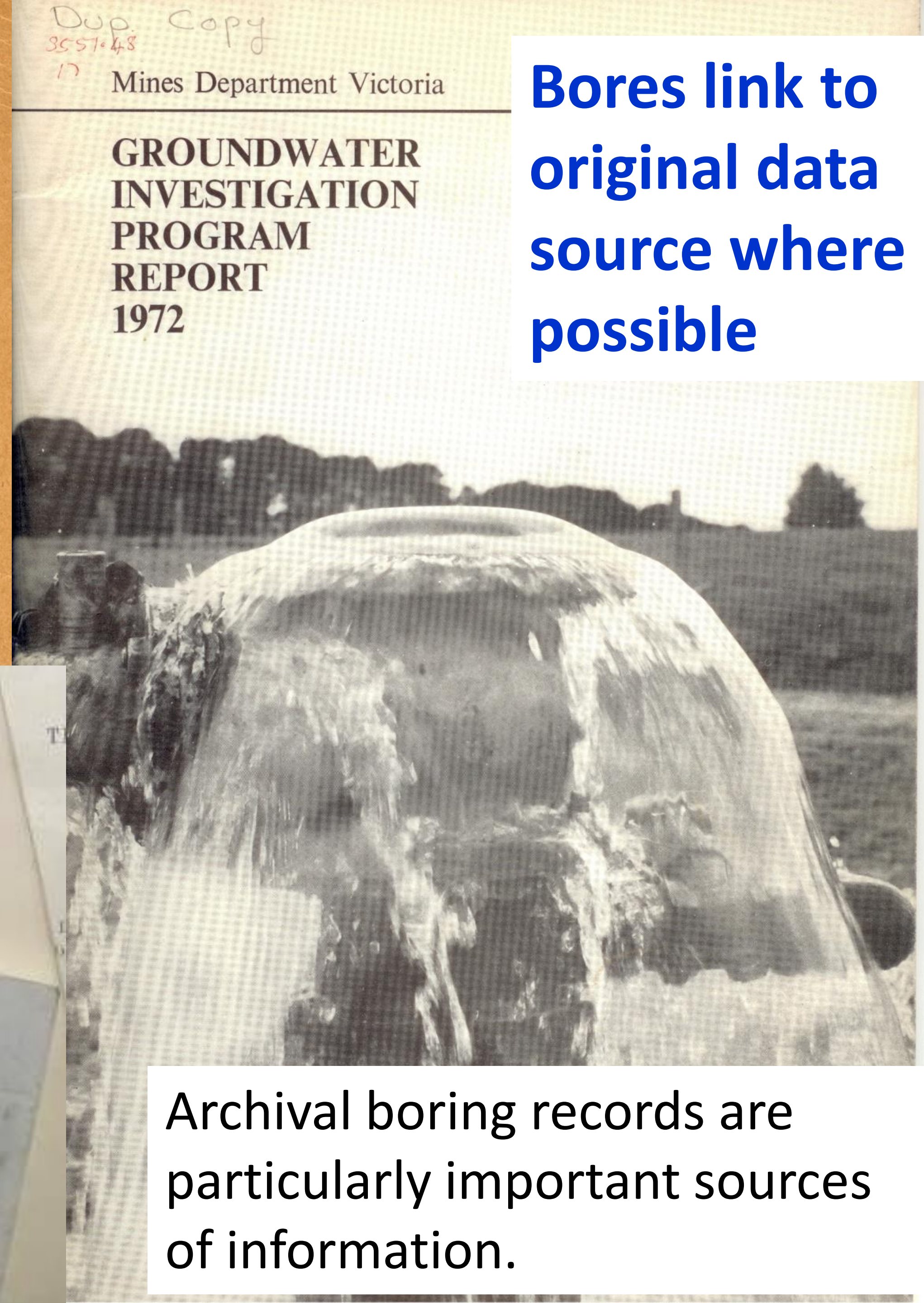


Aquifer	Attribute	Value
Upper Tertiary/Quaternary Basalt (101)	Top Elevation	144.91 mAHD
Upper Tertiary/Quaternary Basalt (101)	Thickness	79.0 m
Upper Tertiary/Quaternary Basalt (101)	Bottom Elevation	65.55 mAHD
Upper-Mid Tertiary Aquitard (108)	Depth to	80.3 m
Upper-Mid Tertiary Aquitard (108)	Top Elevation	65.55 mAHD
Upper-Mid Tertiary Aquitard (108)	Thickness	342.6 m
Upper-Mid Tertiary Aquitard (108)	Bottom Elevation	-277.04 mAHD
Lower-Mid Tertiary Aquitard (110)	Depth to	422.9 m
Lower-Mid Tertiary Aquitard (110)	Top Elevation	-277.04 mAHD
Lower-Mid Tertiary Aquitard (110)	Thickness	7.3 m
Lower-Mid Tertiary Aquitard (110)	Bottom Elevation	-284.30 mAHD
Lower Tertiary Aquifer (111)	Depth to	430.1 m
Lower Tertiary Aquifer (111)	Top Elevation	-284.30 mAHD
Lower Tertiary Aquifer (111)	Thickness	38.2 m

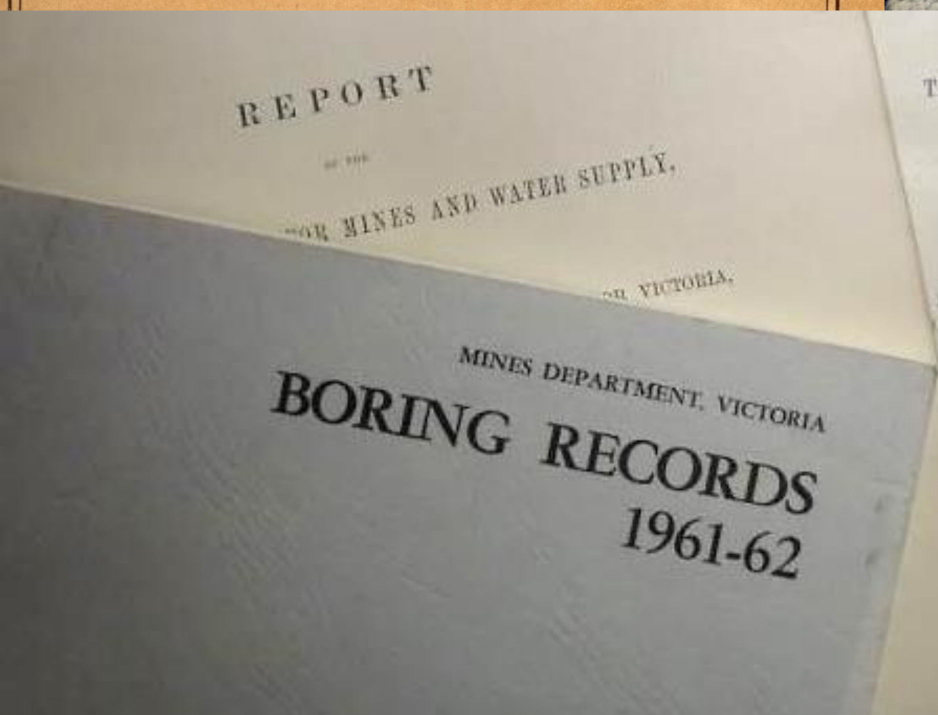
Predictions of aquifer top, bottom and thickness

e.g. surface elevation + basalt thickness





Bores link to original data source where possible



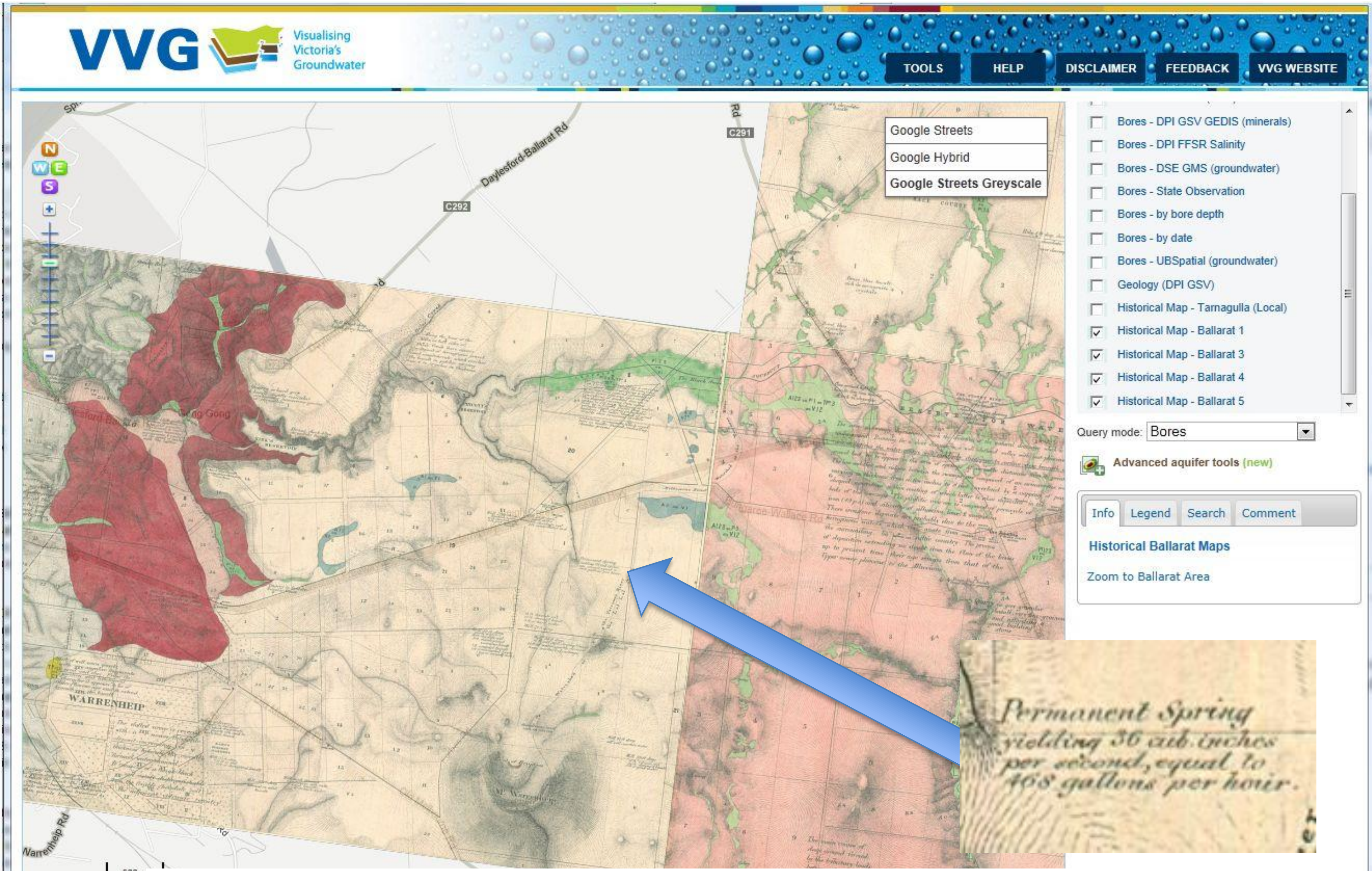
Archival boring records are particularly important sources of information.

But what about the qualitative data?

Data often overlooked by scientists (hydrogeologists), but it can be critically important.

Redoximorphic features in saprolite, Dundas Tableland, Vic

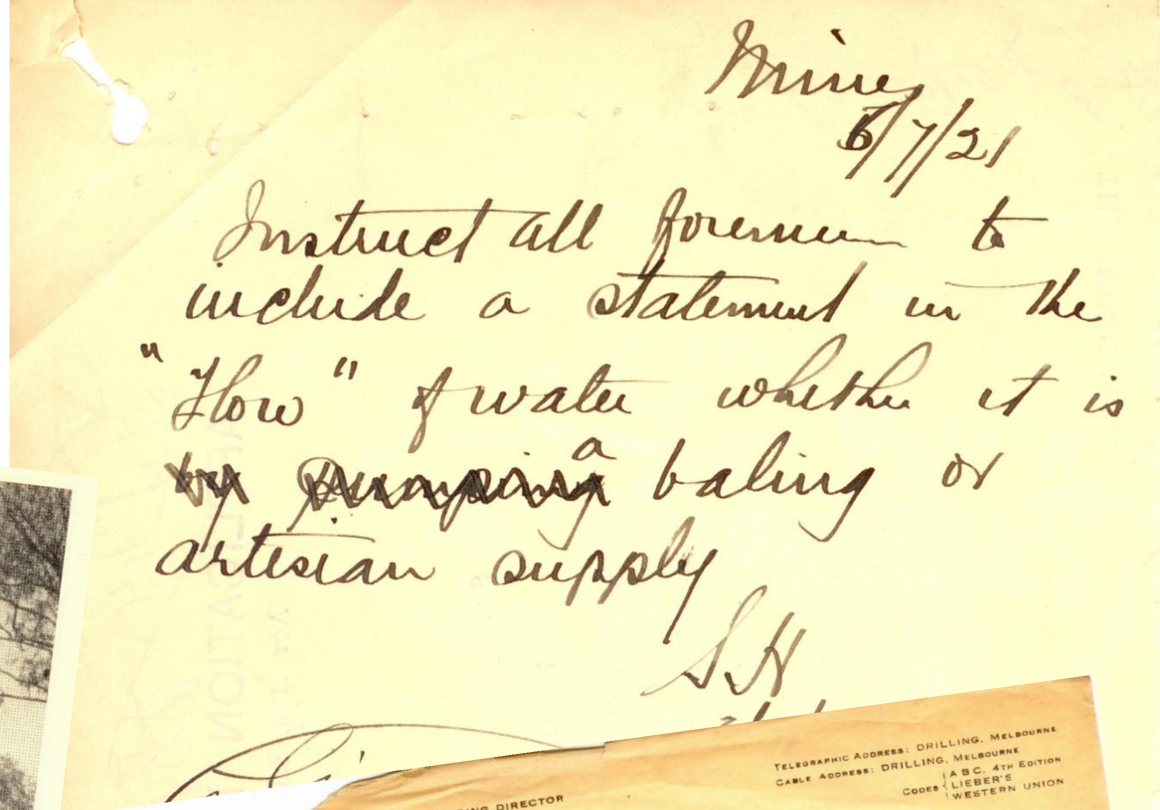
Examples include observations about landscape features, soil colours, vegetation types, seeps, springs, wetland ecosystems, and anecdotal information from long-term occupiers of the land.



Access to rare spatial data
(e.g. Ballarat Water Board maps from 1870)

Even ephemera can be valuable

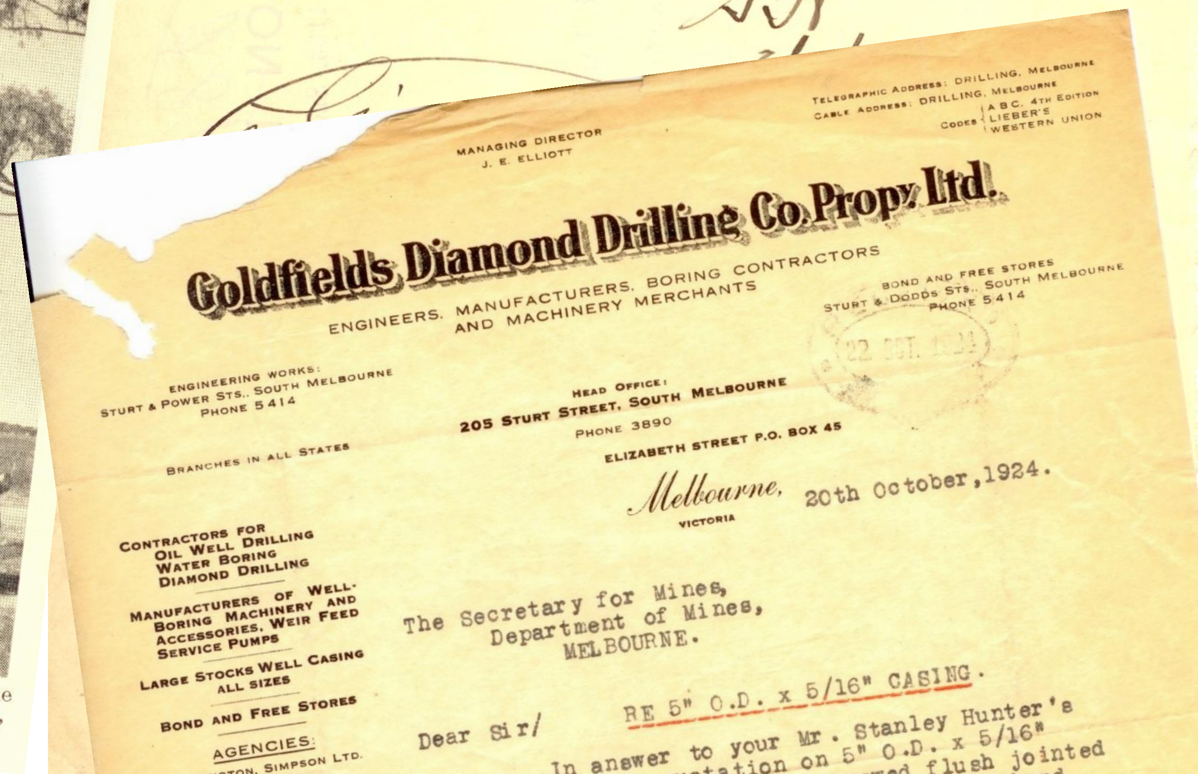
Fig. 17.—The Percussion Drilling Plant putting down the "Dimboola No. 1" Bore (WI–31–2), Crown Allotment 38, Parish of Watchegatcheca, West Wimmera District.



Mines
6/7/21

Instruct all foremen to include a statement in the "Flow" of water whether it is ~~by pumping~~ a baling or artesian supply

S.H.



TELEGRAPHIC ADDRESS: DRILLING, MELBOURNE
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MANAGING DIRECTOR
J. E. ELLIOTT

Goldfields Diamond Drilling Co. Propy. Ltd.

ENGINEERS, MANUFACTURERS, BORING CONTRACTORS AND MACHINERY MERCHANTS

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STURT & DODDS STS., SOUTH MELBOURNE
PHONE 5414

22 OCT. 1924

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STURT & POWER STS., SOUTH MELBOURNE
PHONE 5414

HEAD OFFICE:
205 STURT STREET, SOUTH MELBOURNE
PHONE 3890
ELIZABETH STREET P.O. BOX 45

BRANCHES IN ALL STATES

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MANUFACTURERS OF WELL-BORING MACHINERY AND ACCESSORIES, WEIR FEED SERVICE PUMPS

LARGE STOCKS WELL CASING ALL SIZES

BOND AND FREE STORES

AGENCIES:
...TON, SIMPSON LTD.

Melbourne, VICTORIA 20th October, 1924.

The Secretary for Mines,
Department of Mines,
MELBOURNE.

Dear Sir/ RE 5" O.D. x 5/16" CASING.

In answer to your Mr. Stanley Hunter's ...tation on 5" O.D. x 5/16" ...ed flush jointed

So what constitutes groundwater data?

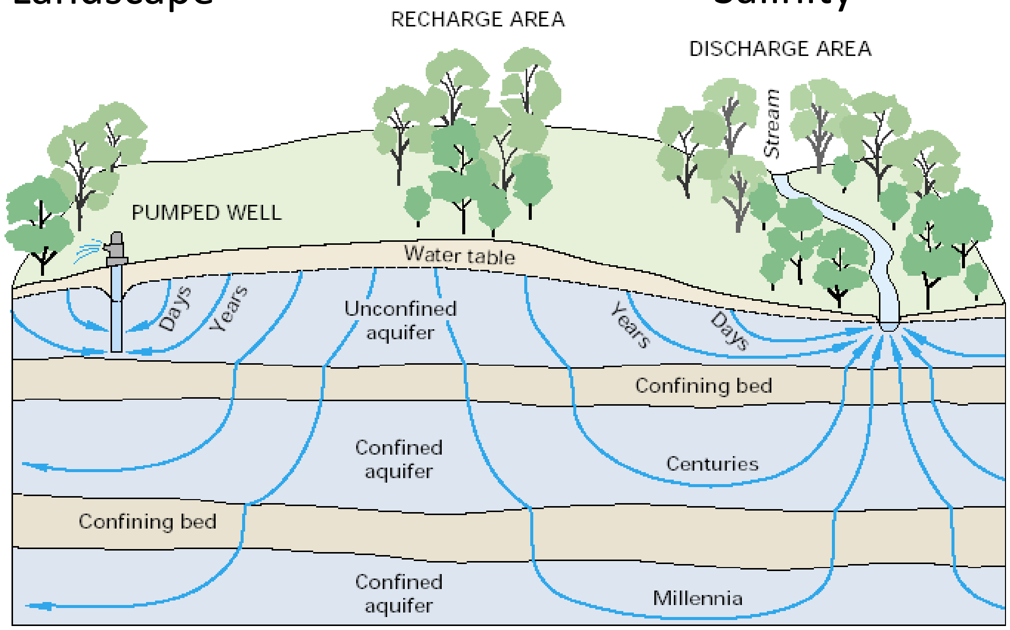
Climate
Rainfall
Runoff
Infiltration
Recharge

Geomorphology
Terrain
Landscape

Environmental History
Land use
Soils
Salinity

Bore construction
Extraction
Water levels
Storage

Discharge
Springs
GDEs
Baseflow
River flows
Lake levels



Geology
Lithology
Stratigraphy
Hydrostratigraphy
Aquifers
Aquifer parameters

Hydrobiology
Phreatophytes
Stygofauna
Microbiology

Flow systems

Age (dating)

Chemistry

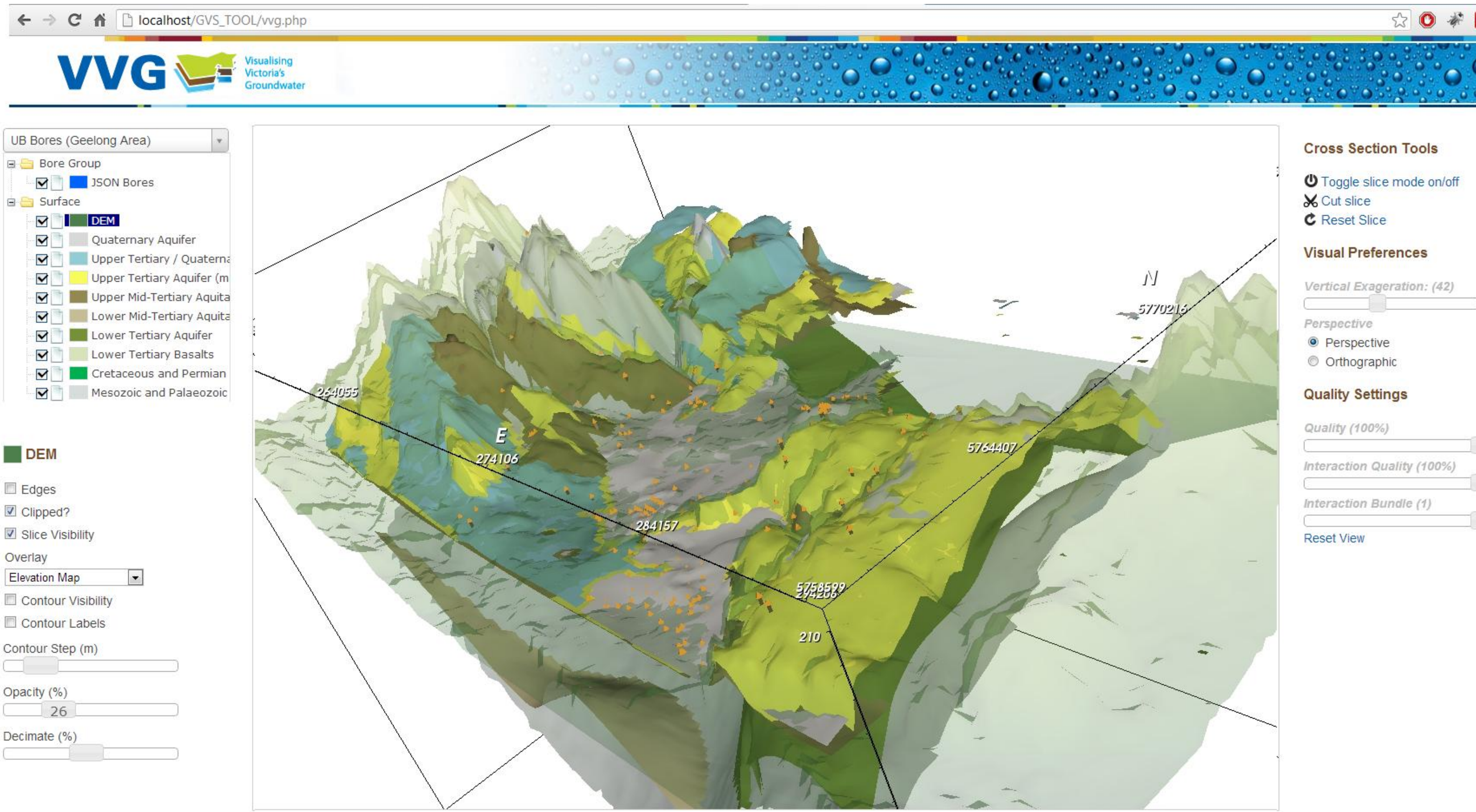
Contamination

Geophysics

Management
Beneficial uses
Licences

Risk

3D visualisation of Victoria's groundwater systems on demand uses pre-modelled surfaces…
Will modelling on-the-fly ever be possible?



Combining technologies with QUT – dynamic 3D visualisations in a browser

The 21st Century Groundwater Research Challenge

How to take advantage of the 21st Century New Digital Age

- **Interoperability**
- **Big data**
- **Legacy data**
- **Crowdsourced data**

To answer the frequently asked hydrogeological questions?

To dynamically generate conceptual and predictive models?

To make new discoveries and avoid Zombie Science?