Advances in spatially enabled groundwater management

By

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&

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Sinclair Knight Merz, Australia
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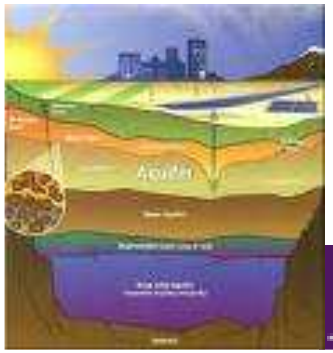

22-25 January, India Geospatial Forum 2013
Hyderabad, India

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SDI definition ...

"The SDI provides a basis for spatial data **discovery, evaluation, and application for users and providers within** all levels of government, the commercial sector, the non-profit sector, academia and by citizens in general."

--The SDI Cookbook
http://www.gsdi.org

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Components of SDI

- Policies & Institutional Arrangements (governance, data privacy & security, data sharing, cost recovery)

- People (training, professional development, cooperation, outreach)

- Data (digital base map, thematic, statistical, place names)

- Technology (hardware, software, networks, databases, technical implementation plans)

- Douglas Nebert, 2009, US, Federal Geographic Data Committee Secretariat

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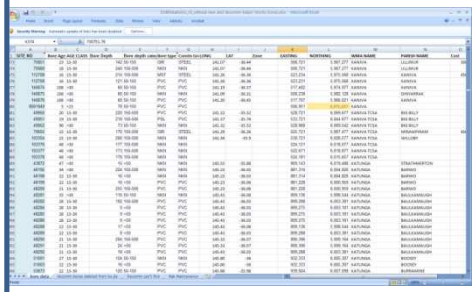
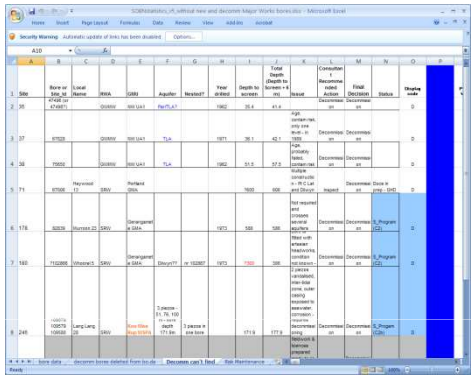
Typical bore well data management …

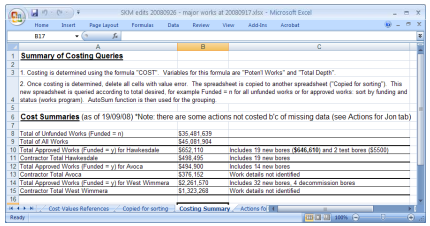
Bore data



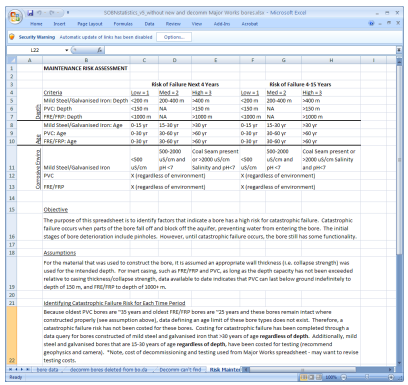
Decommissioned Can’ t Find



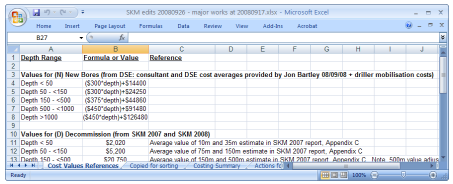
Costing Summary



Risk Maintenance



Cost value references



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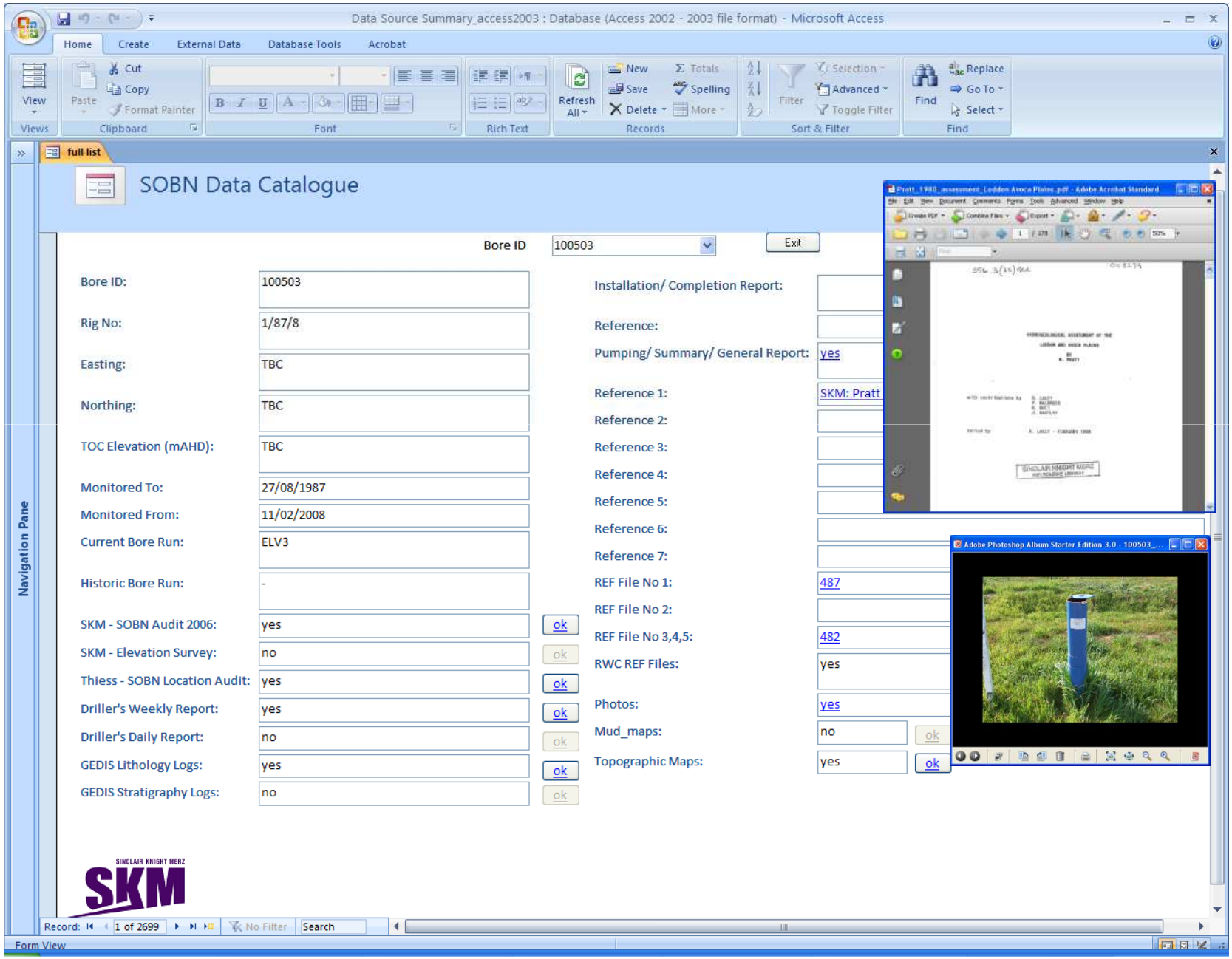
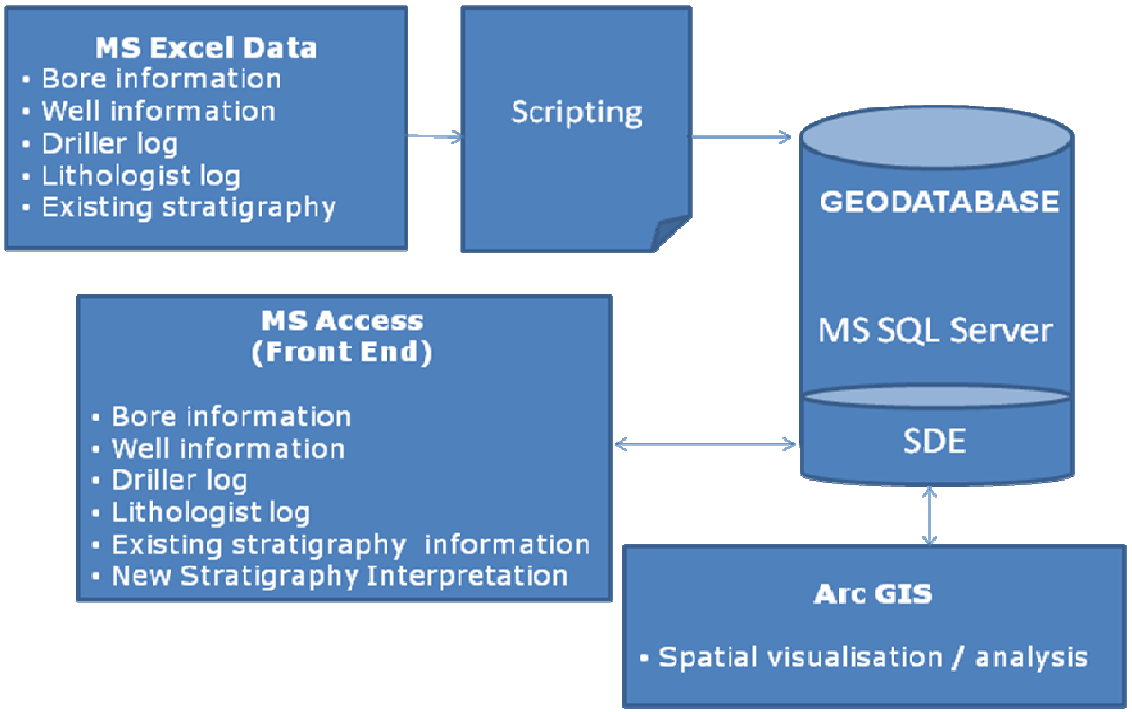
State Observation Bore Network Data Catalogue



Hydrogeological mapping



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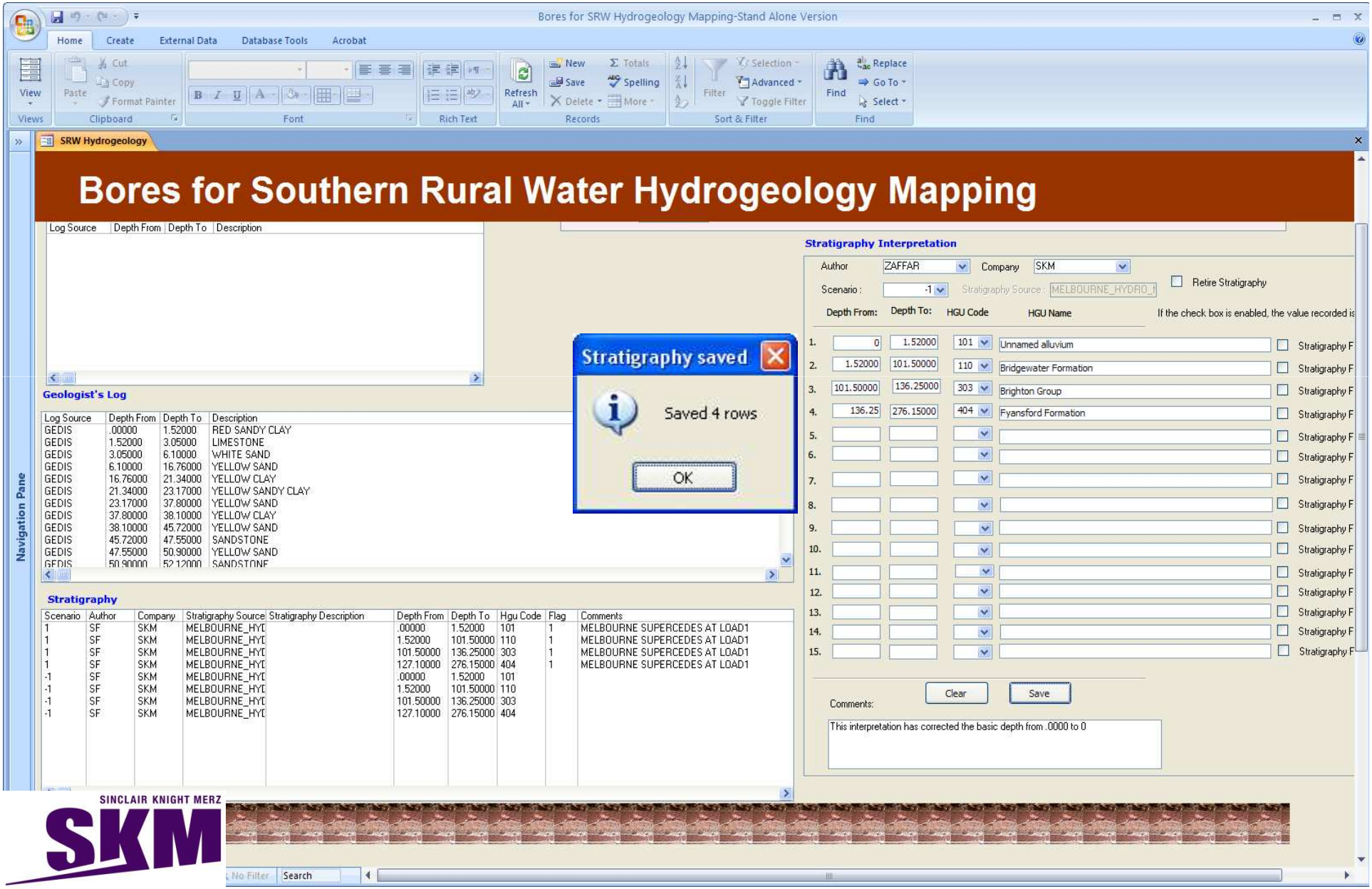
Hydrogeological mapping
STRATIGRAPHY INTERPRETATION TOOL



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au-d12364/pca_demo/

log out

Bore Interpretation System for Hydrogeology Mapping

View Bore/Well Data | Stratigraphic Interpretation

Enter a Bore ID: 101014 View

Bore Details

Bore Id	101014	Map Sheet	n/a			RLNS	n/a
Bore Source	GMS	Easting	2376480	Latitude	-36.99	RLNS DEM	207.04
Bore Depth	25.9	Northing	2500200	Longitude	143.612	RLNS Source	n/a
Completed Date	15/06/1971	Datum	GDA94				
		Projection	VICGRID94				

Bore Flag 1

Well Details #1

Well Source	GMS	TDS	n/a	WL	n/a
SCRN From	0	TDS Date	01/01/1900	RWL	n/a
SCRN To	n/a	TDS Source	n/a	WL Date	01/01/1900
Aquifer Code		TDS Flag	n/a	WL Source	n/a
				WL Flag	n/a
EC	n/a	Date Created	23/06/2010		
EC Date	01/01/1900				
EC Source	n/a				
EC Flag	n/a				

Web Interface

au-d12364/pca_demo/

Enter a Bore ID: 101014 View

Map Sheet n/a Surface HGU 1005 Surface HGU Name Undifferentiated Quaternary Basalt

Driller's Log

Log Source	Depth From	Depth To	Description
GEDIS	0	2.44	RED BROWN CLAYS
GEDIS	2.44	4.57	DARK GREY CLAYS
GEDIS	4.57	12.19	MED TO SOFT GREY BASALT
GEDIS	12.19	13.41	BROWN HONEYCOMB BASALT
GEDIS	13.41	24.69	GREY BASALT
GEDIS	24.69	25.6	BROWN HONEYCOMB BASALT
GEDIS	25.6	25.91	LIGHT PUGGY GREY CLAY

Geologist's Log

Log Source	Depth From	Depth To	Description

Stratigraphy

Scenario	Author	Company	Stratigraphy Source	Stratigraphy Description	Depth From	Depth To	Hga Code
-1	DPI_BENDIGO	DPI	DPI	Surface alluvium	0	5	1000
-1	DPI_BENDIGO	DPI	DPI	Tertiary Basalt (upper)	5	26	1005
1	DPI_BENDIGO	DPI	DPI	Surface alluvium	0	5	1000
1	DPI_BENDIGO	DPI	DPI	Tertiary Basalt (upper)	5	26	1005

Stratigraphy Interpretation

Scenario 1 Select Scenario

Author | Company | Stratigraphy Source DPI | ☑ Stratigraphy Flag | ☐ Retire Stratigraphy

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Hydrogeological mapping – Visualisation of Aquifers

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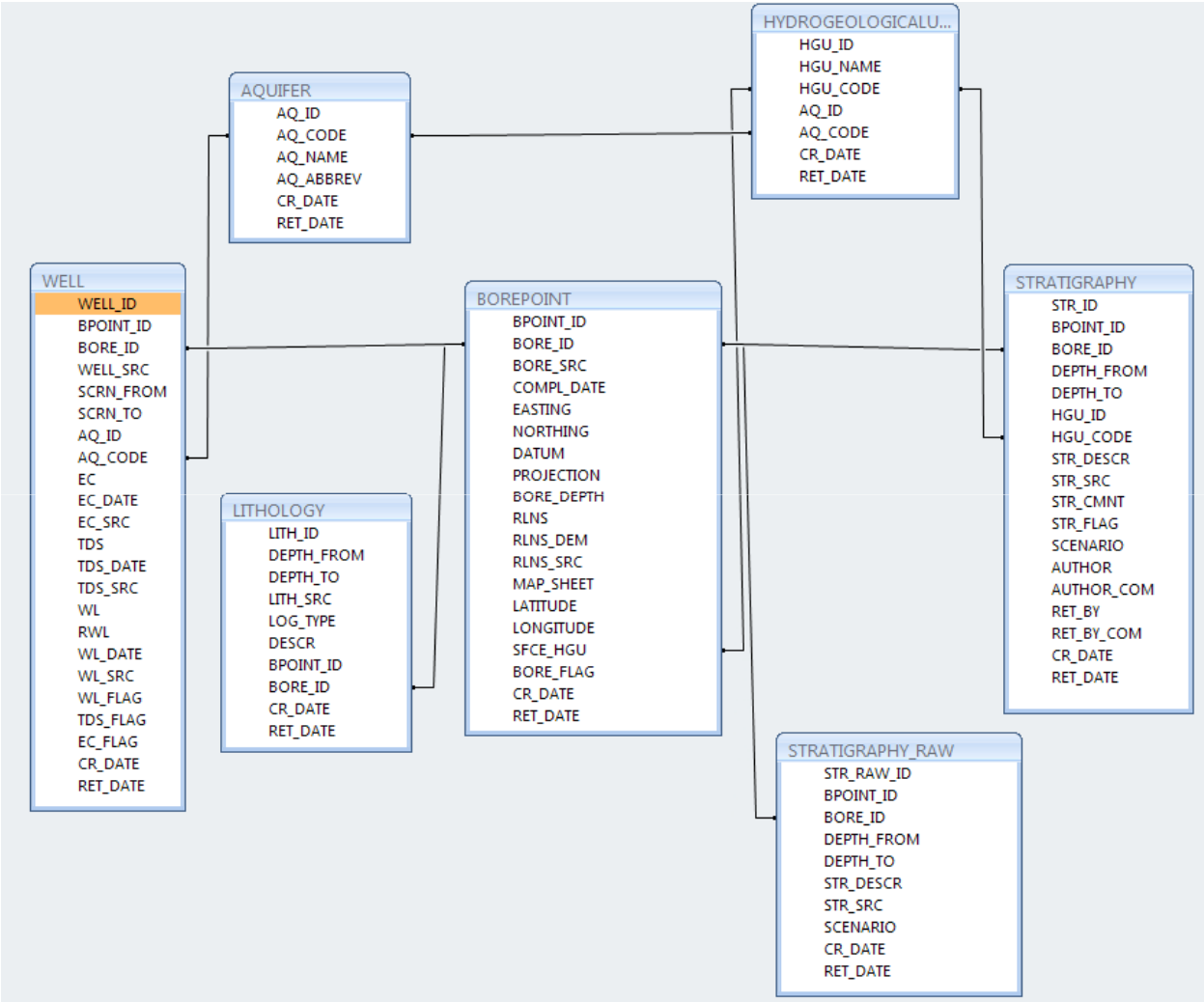
INTEGRATED SPATIAL DATA MODEL FOR MANAGING BORE STRATIGRAPHIC AND HYDROLOGICAL INFORMATION



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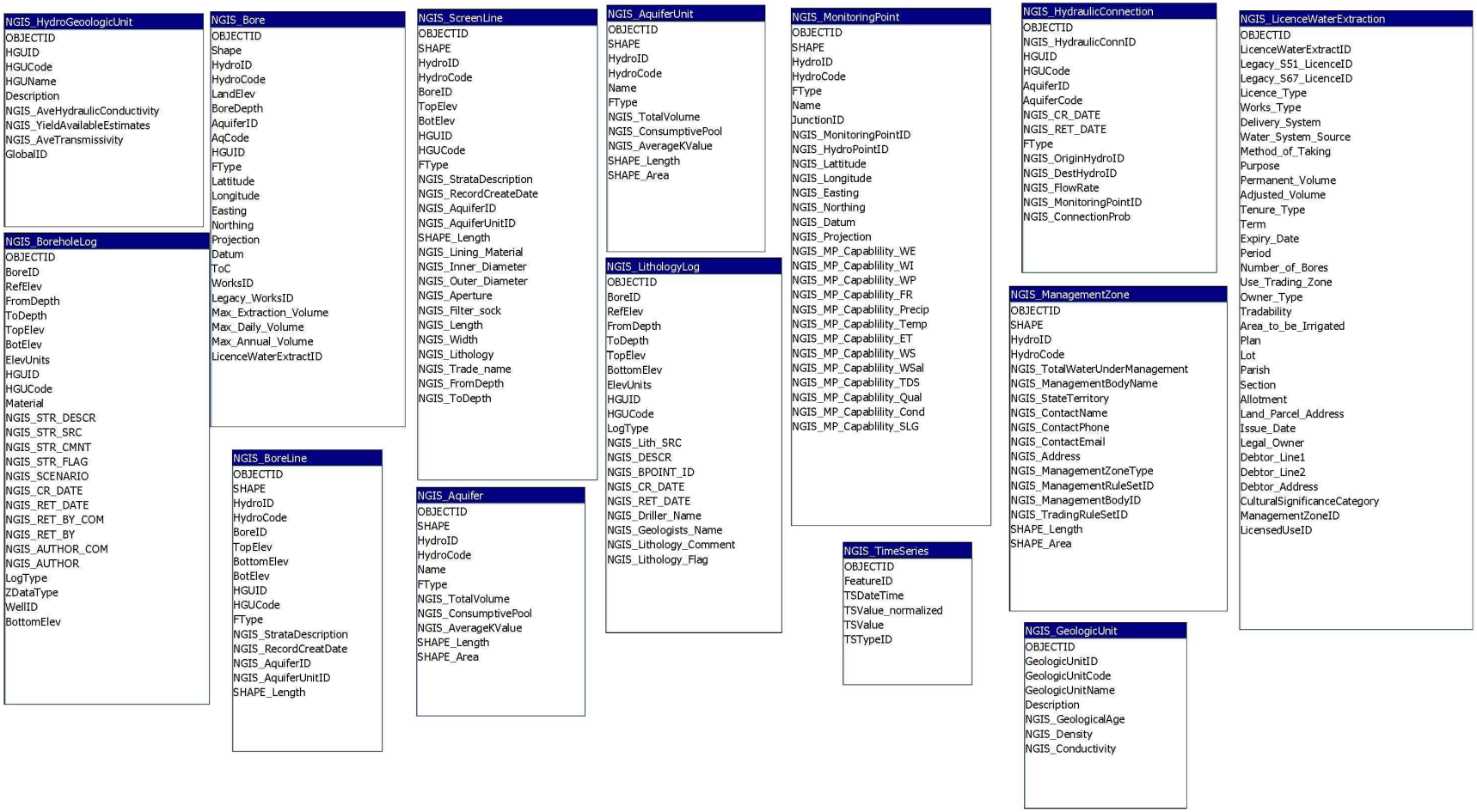
Mohamed-Ghouse, Z. Sadiq., Goodin, D. and H. Chaplin (2009).Integrated spatial data model for managing bore stratigraphic and hydrological information. In: Ostendorf B., Baldock, P., Bruce, D., Burdett, M. and P. Corcoran (eds.), Proceedings of the Surveying & Spatial Sciences Institute Biennial International Conference, Adelaide 2009, Surveying & Spatial Sciences Institute, pp. 857-862. ISBN: 978-0-9581366-8-6.

National Groundwater Information System (NGIS) – Phase 1

Relationships for NGIS_Prototype_Demo_DB
Tuesday, 27 April 2010



Concept: SKM and Continuum consulting
Client : Australian National Water Commission

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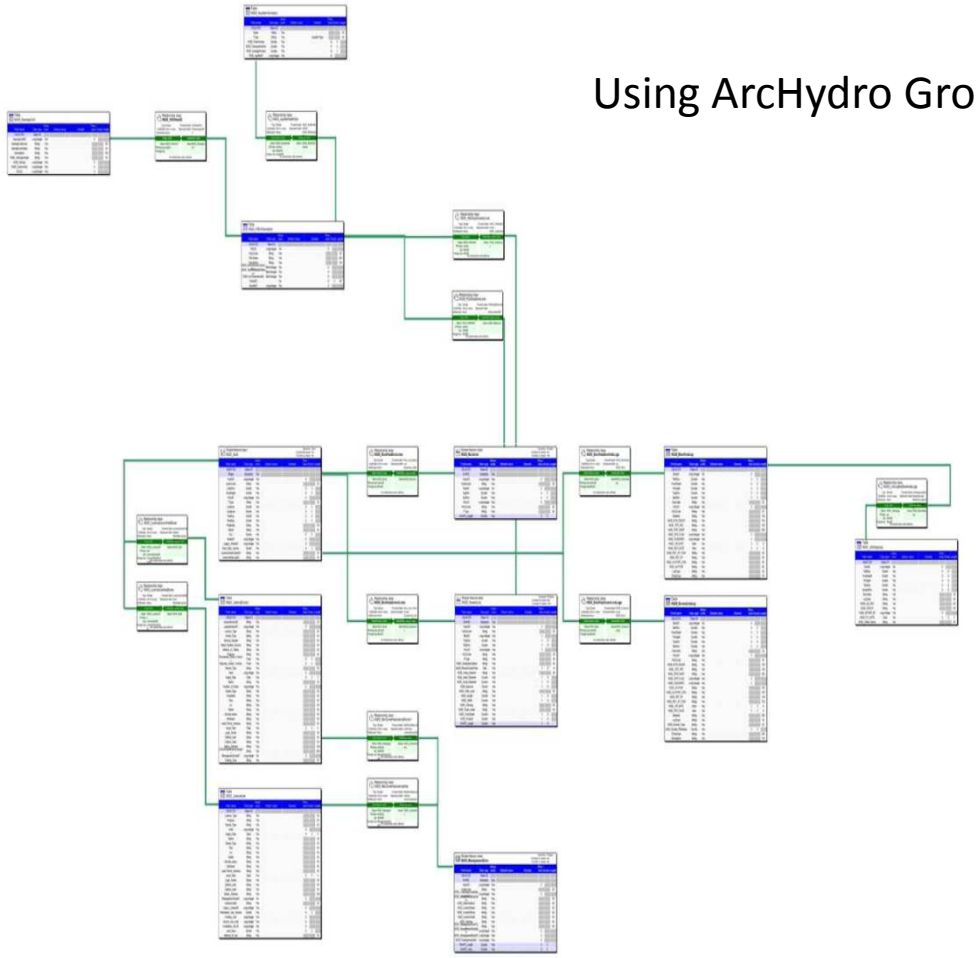
National Groundwater Information System (NGIS) – Phase 2

NGIS Prototype Geodatabase
Stage 1 schema diagram

Australian Bureau of Meteorology

Using ArcHydro Groundwater Data Model



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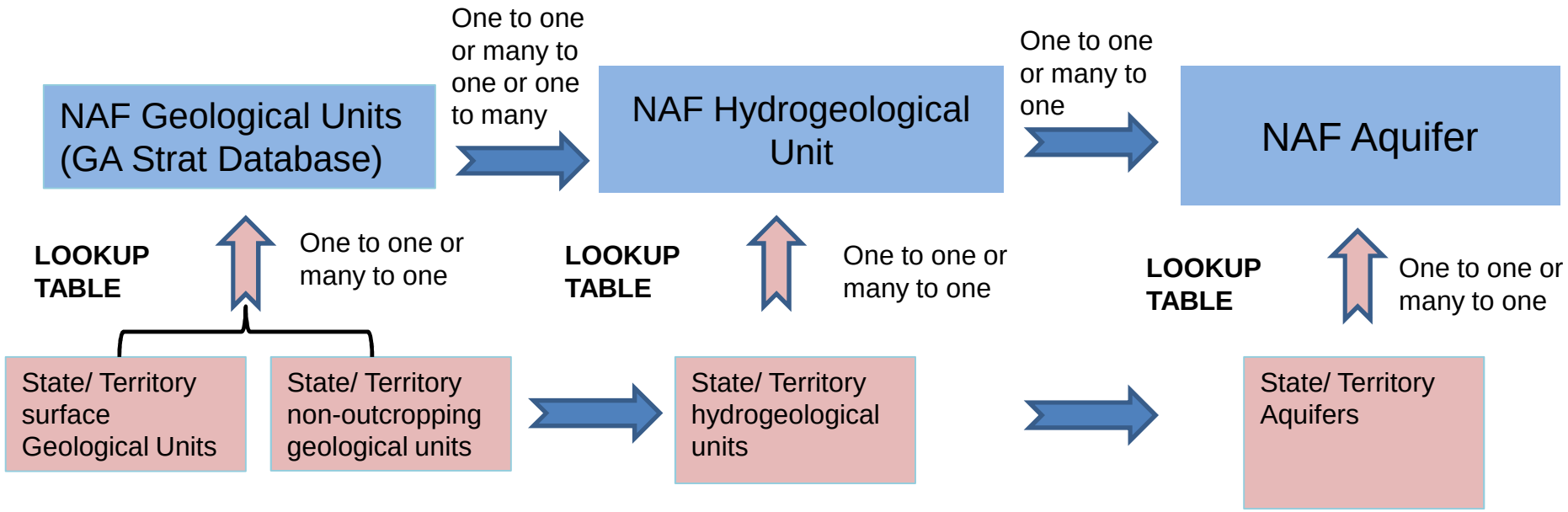
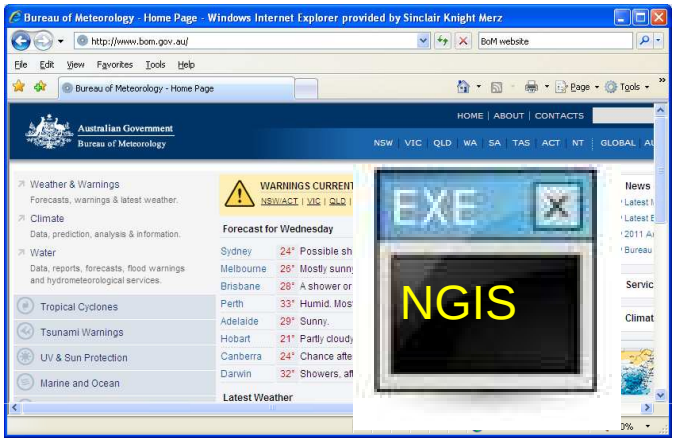
National Aquifer Framework (NGIS – Phase 2)

Australian Bureau of Meteorology



Link between State/Territory frameworks and NAF

National Aquifer Framework (NGIS – Phase 2)



Jurisdictions

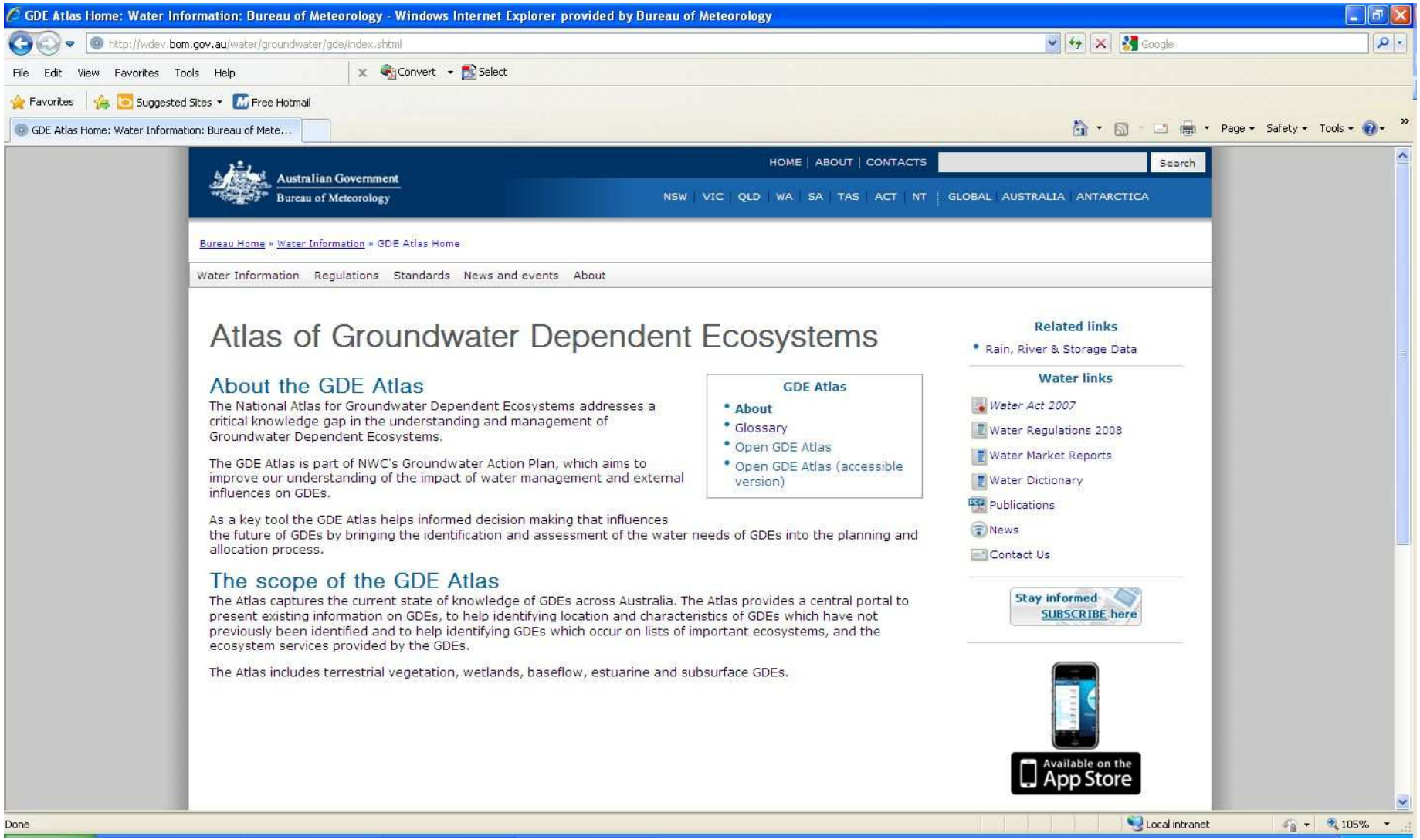
Conversion Tool

Jurisdiction NGIS < V2.1 Database (State Framework)

NGIS V2.1 NAF compliant Database

BoM

Client: Australian Bureau of Meteorology



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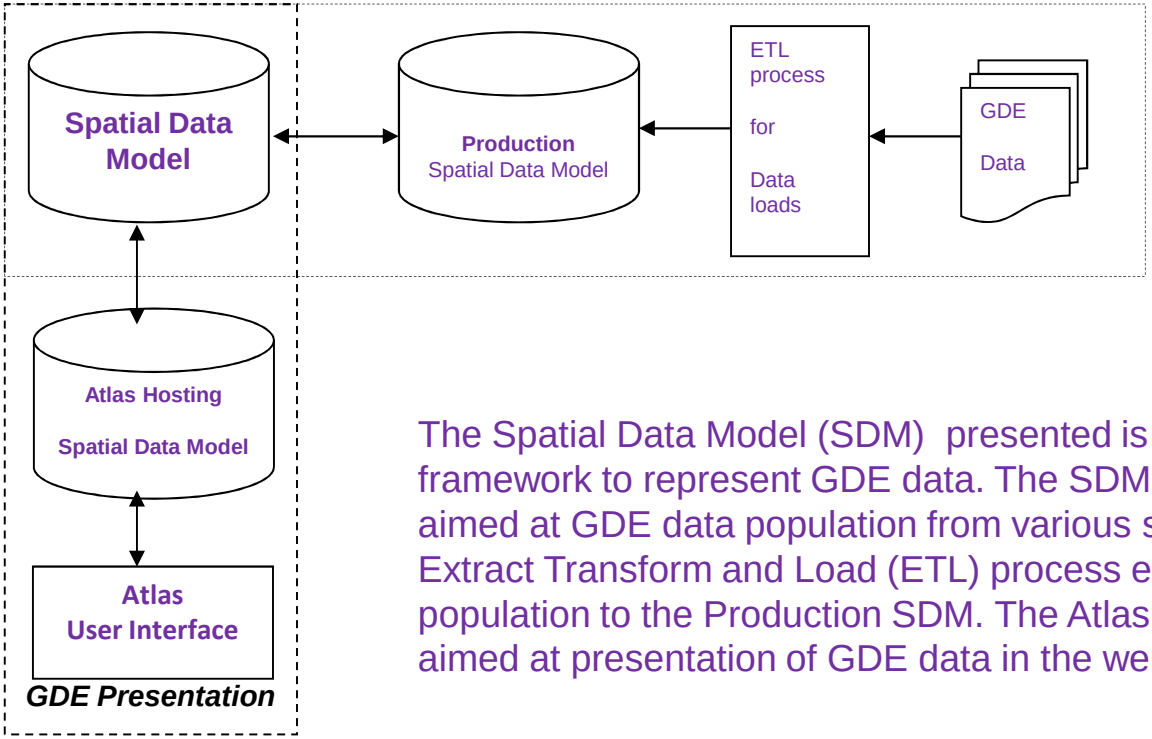
National Atlas of Groundwater Dependent Ecosystems (GDE)

Spatial Data Model



The Spatial Data Model (SDM) presented is a basic framework to represent GDE data. The SDM Production is aimed at GDE data population from various sources. An Extract Transform and Load (ETL) process enables GDE data population to the Production SDM. The Atlas Hosting SDM is aimed at presentation of GDE data in the web based Atlas.

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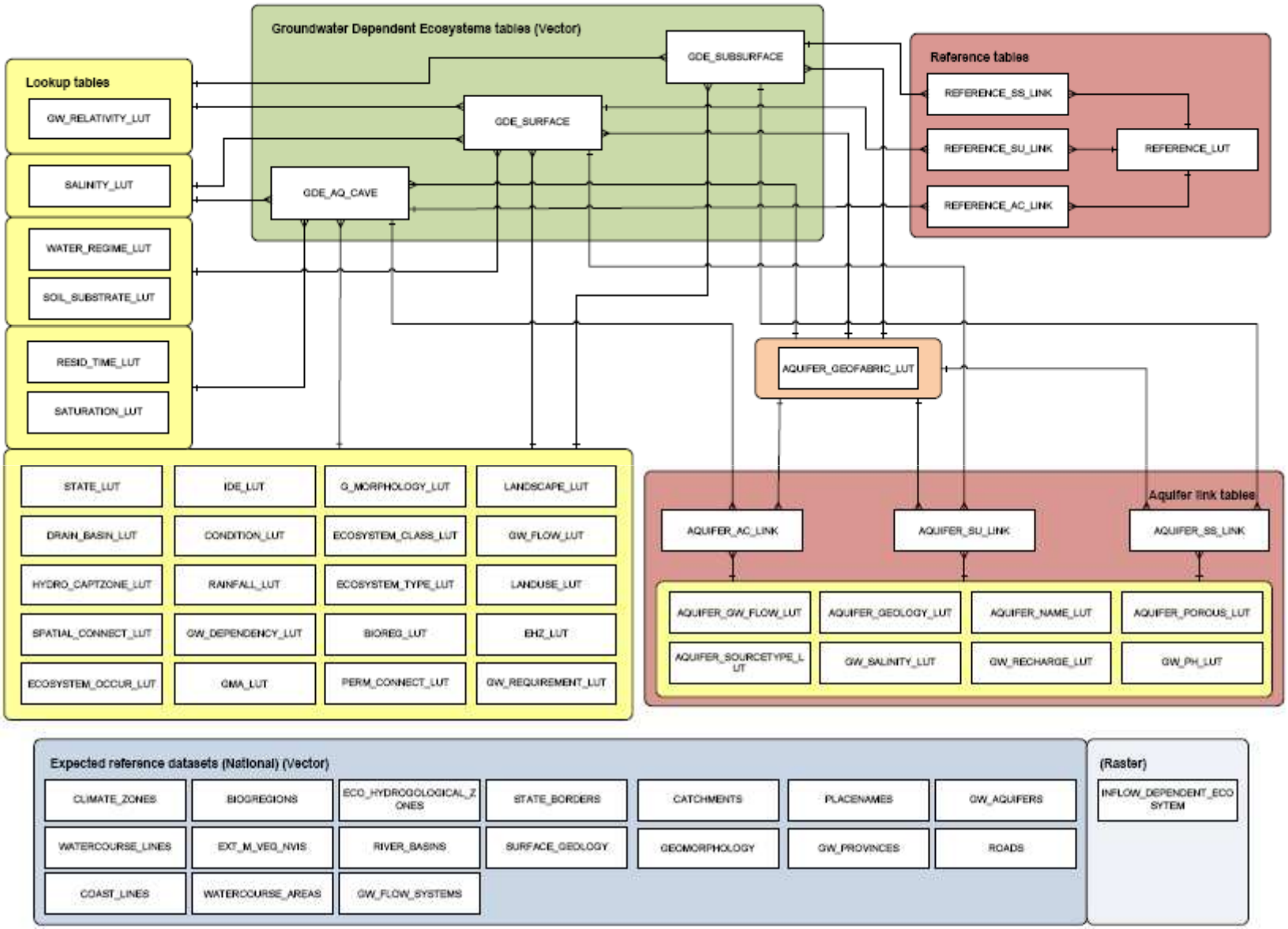
Concept: SKM

Client : Australian National Water Commission

National Atlas of Groundwater Dependent Ecosystems (GDE)



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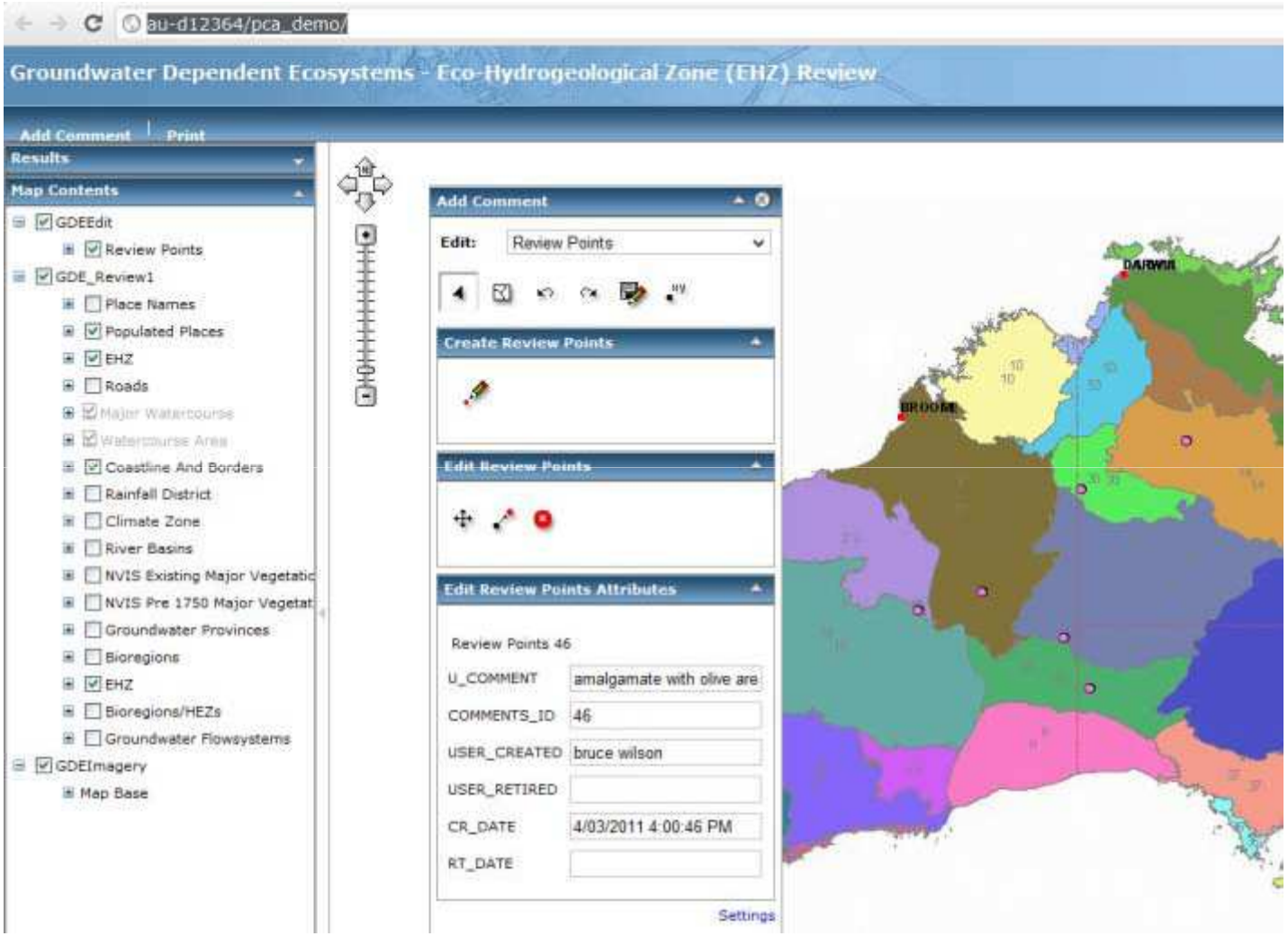
Concept: SKM

Client : Australian National Water Commission

National Atlas of Groundwater Dependent Ecosystems (GDE)



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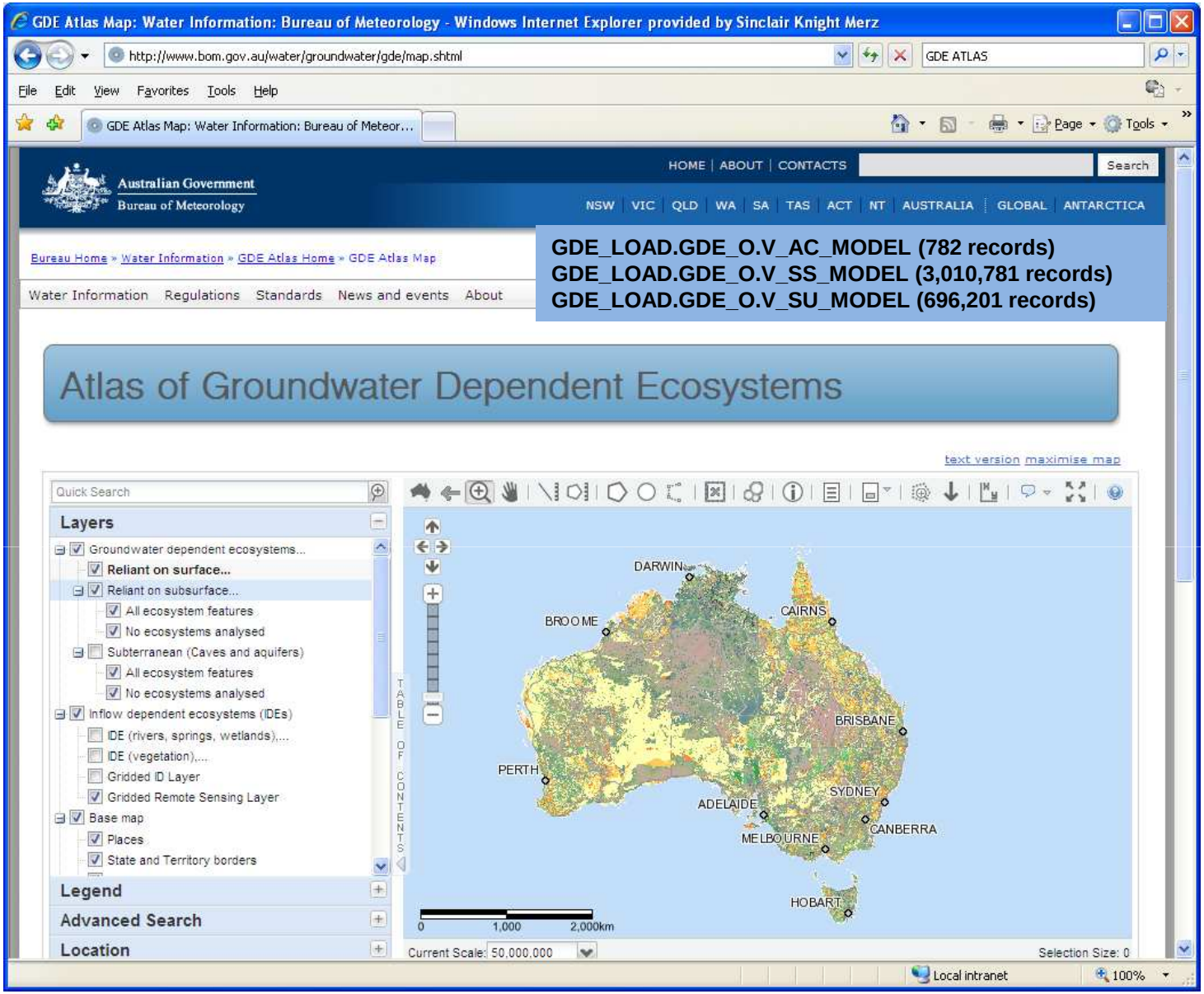
Concept: SKM

Client : Australian National Water Commission



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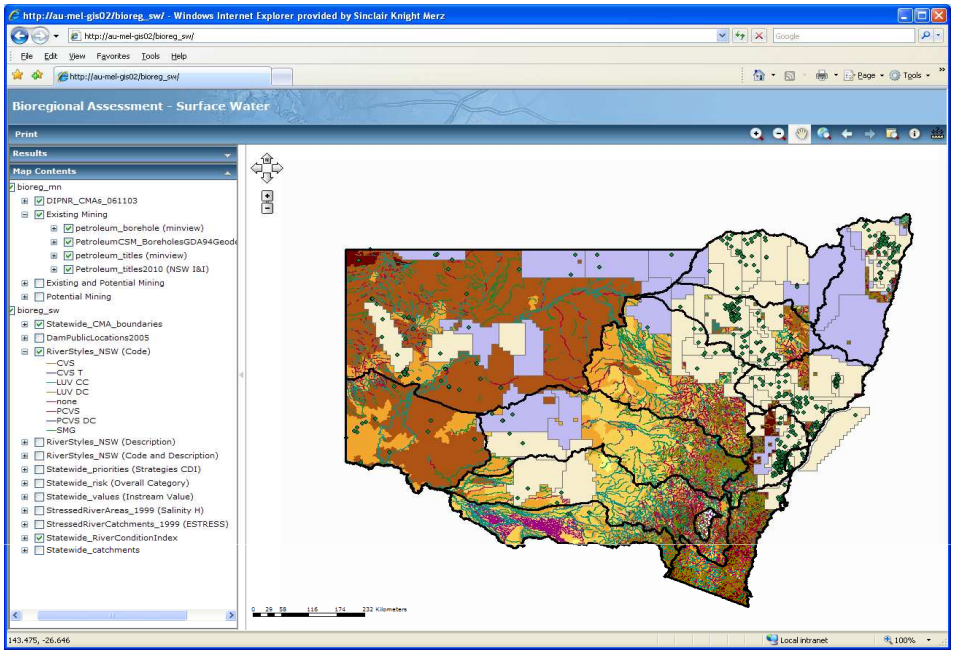
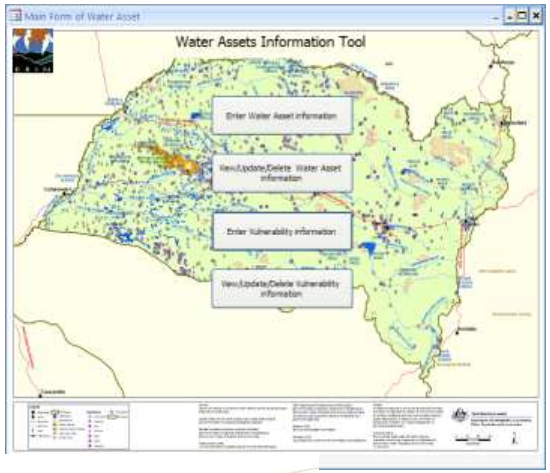
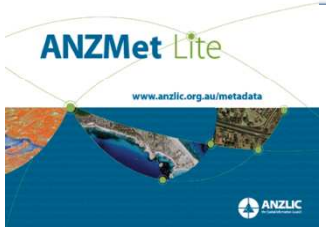
Concept: SKM

Client : Australian National Water Commission

Coal Seam Gas and Coal Mining Phase 1- Bioregional Assessment







The project objective was to assess potential impact of mining activities on water assets across five CMAs in New South Wales.

- Identification of water asset and its environmental, economy, socio-cultural and hydrological properties.
- Challenges come in form of disparate data and its varying data quality
- Web mapping service was set to assist in the screening process, mainly to collaborate and communicate spatial information to the specialist
- Data Model developed
- Process Automation
- In summary, SKM have developed a robust system which has provenance of data and ability to perform audit trial for Coal Seam Gas and Coal Mining related assessments.

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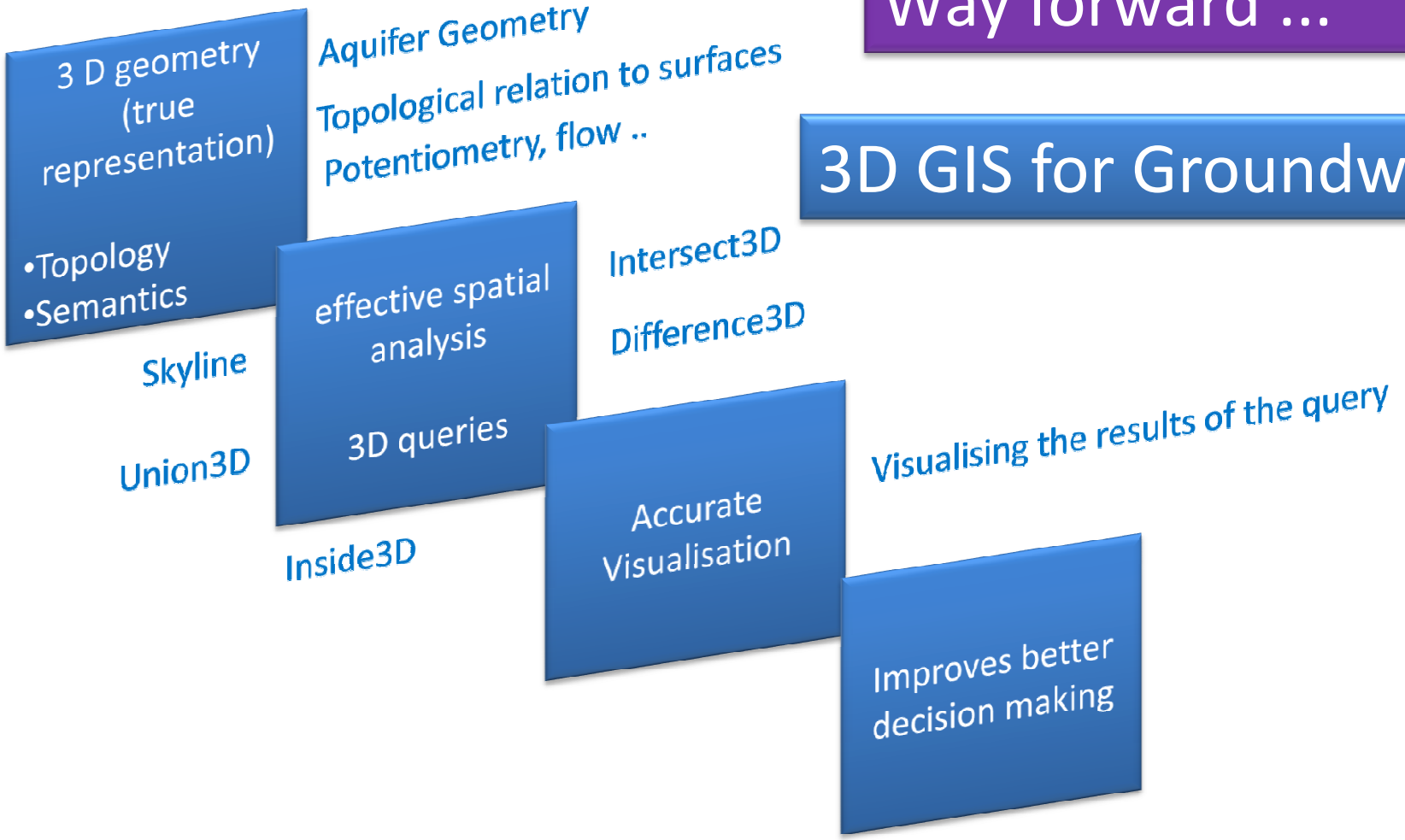
Way forward ...

3D GIS for Groundwater



3D GIS for Groundwater comprises of 3D geometry, 3D topology, semantics and appearance

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Way forward ...

- Representing 3D geometry from a spatial database perspective for groundwater data has been a challenge.

- Although, 3D geometry has been well represented for above surface features for eg. 3D city models , but there are limitations in representing subsurface features such as groundwater data in 3D geometry.

- There are data models such as ArcHydro groundwater with 2.5 D representation, still the true 3D geometry which includes 3D topology for groundwater related features from a spatial database perspective has to be explored.

- By representing true 3D geometry the users will be able to analyse (query) the spatial data from a 3D perspective and generate better visualisation from true 3D.

- Absence of remote sensors to depict the reality below ground and limited data models across the 3rd dimension for sub surface features are the problems across this area.

- Another interesting problem in groundwater related 3D features is the spatial semantics

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Revisiting Components of SDI

- Policies & Institutional Arrangements (governance, data privacy & security, data sharing, cost recovery)

- People (training, professional development, cooperation, outreach)

- Data (digital base map, thematic, statistical, place names)

- Technology (hardware, software, networks, databases, technical implementation plans)

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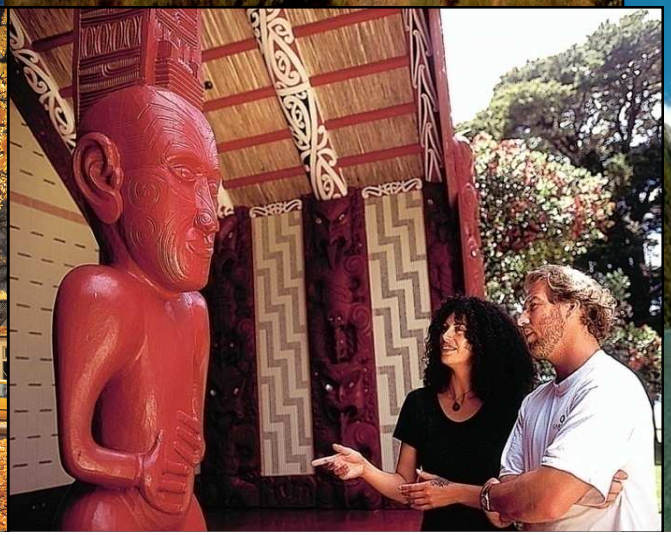
IEEE IGARSS 2013

Melbourne, 21 – 26 July 2013

Dr Peter Woodgate & Prof Simon Jones
Co-Chairs, Local Organising Committee IGARSS2013

Australia and New Zealand – opportunity of a lifetime!!



Thank You

Questions?

Email : zsadiq@globalskm.com

Building sustainable water resources using the strength of Spatial Information!

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