GROUNDWATER GOVERNANCE OF FOUR PRODUCTIVE AQUIFERS IN SOUTH AFRICA

K.C. Pietersen[1], H.E. Beekman[1] S.A Adams[2] and J.E. Cobbing[1]

[1]SLR Consulting:

[2]Water Research Commission

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Project Details

- World Bank Project “Too Big to Fail: the paradox of groundwater governance”
- Studied groundwater governance in various countries (e.g. Kenya, India)
- In partnership with the WRC and DWA

water affairs
Department:
Water Affairs
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Methodology

- World Bank (GW MATE) framework for governance provisions for groundwater
- Benchmarking criteria in four groups:
  - Technical
  - Legal and Institutional
  - Cross-sector policy coordination
  - Operational
- Pragmatic, fits with current South African governance documents (NWRS, NGS, etc)





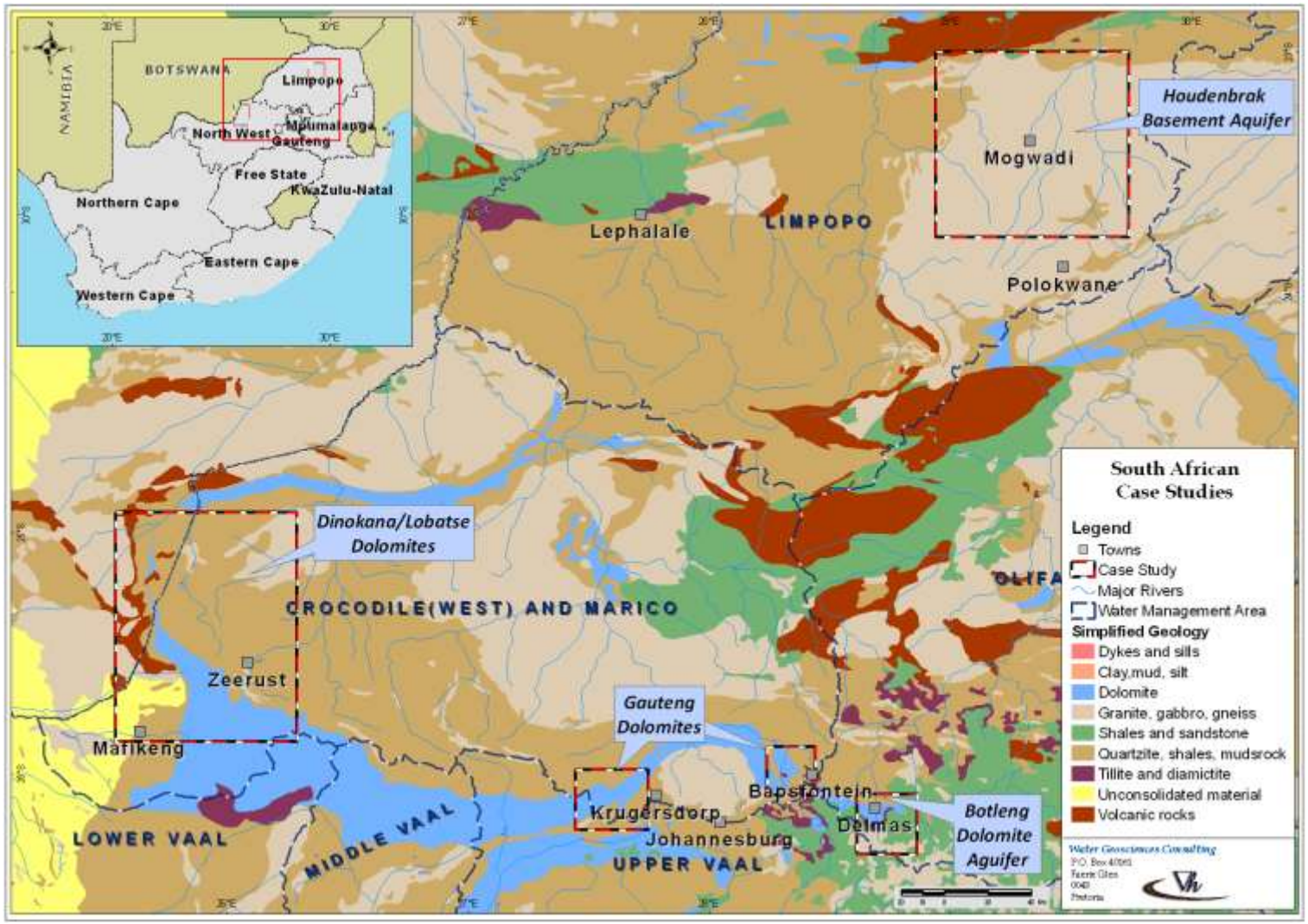
Case study aquifers

- Botleng Dolomite Aquifer (Delmas area)
  - (Focus of this talk)
- Gauteng Dolomites (Steenkoppies and Bapsfontein compartments)
- Houdenbrak Basement Aquifer (Mogwadi (Dendron)-Vivo area)
- Dinokana-Lobatse Transboundary Dolomite Aquifer





Case study aquifers



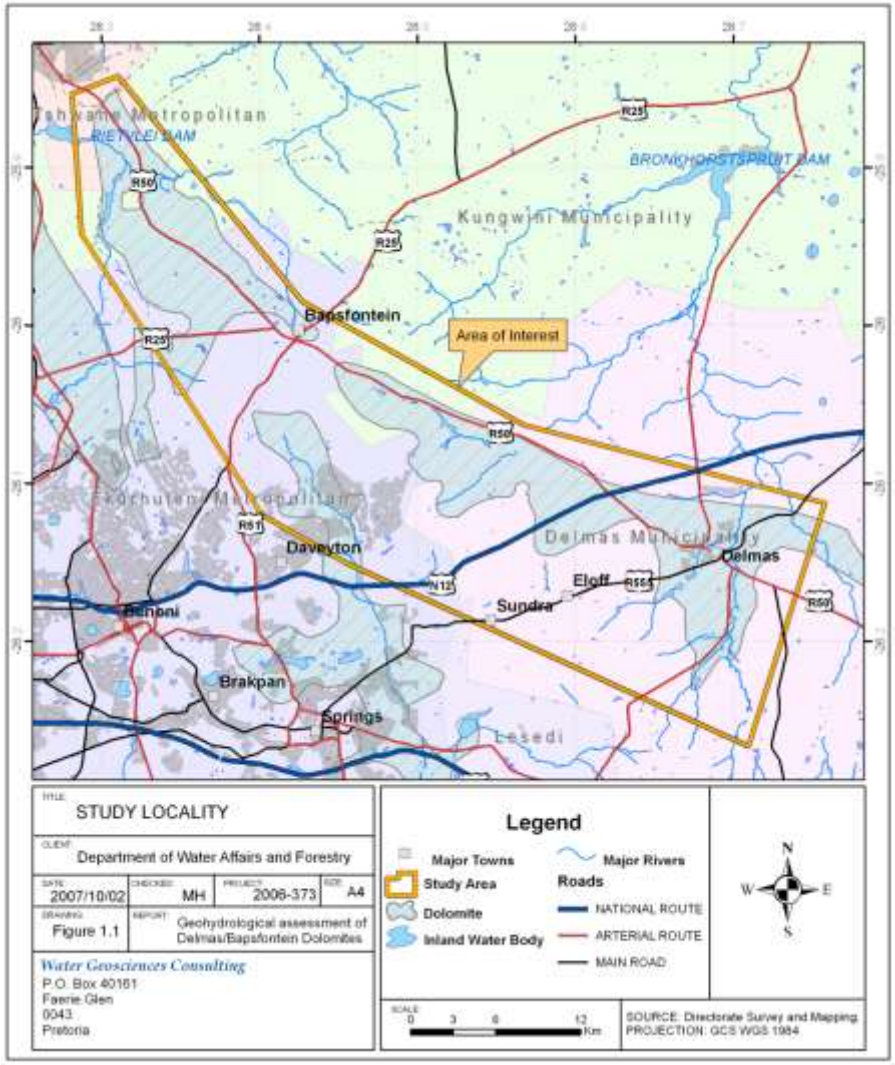
Botleng Dolomite Aquifer

- Karst aquifer: Unconfined conditions (vulnerable)
- Groundwater levels: 1-78m b.g.l.
- Storativity 1-5%
- Transmissivity several hundred m^2/day
- Recharge: 8-12% MAP (670 mm)
- Borehole yields: up to 50 L/s (about 4 Ml/day)
- Groundwater use: Large scale agricultural irrigation and domestic use by Delmas from well fields
- Potable water demand Delmas: 16 Ml/day; 10 Ml from well-fields and 6 Ml from current Rand Water pipeline
- Future water demand: 21 Ml/day by 2015





Study area location



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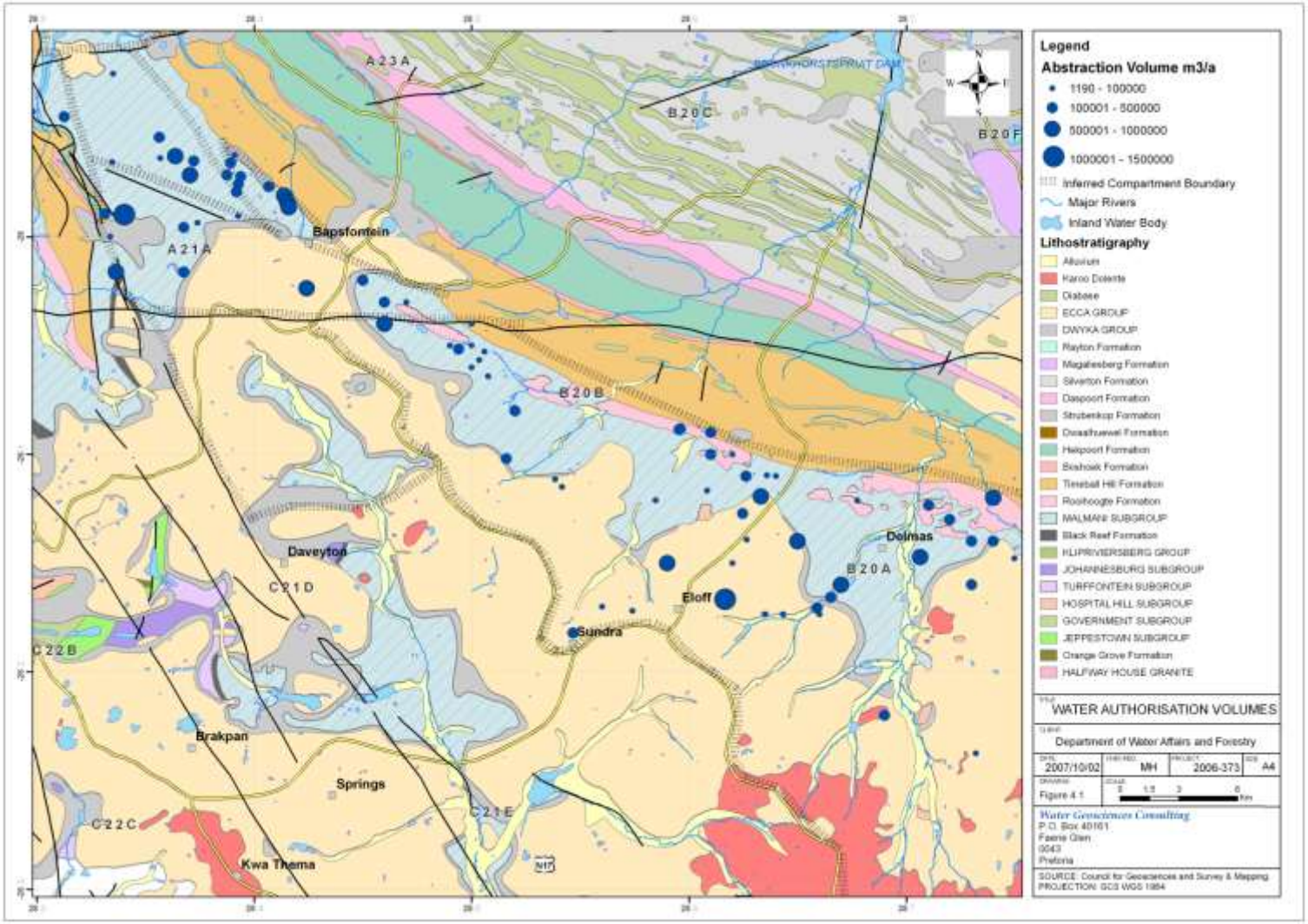
Location of major abstractions



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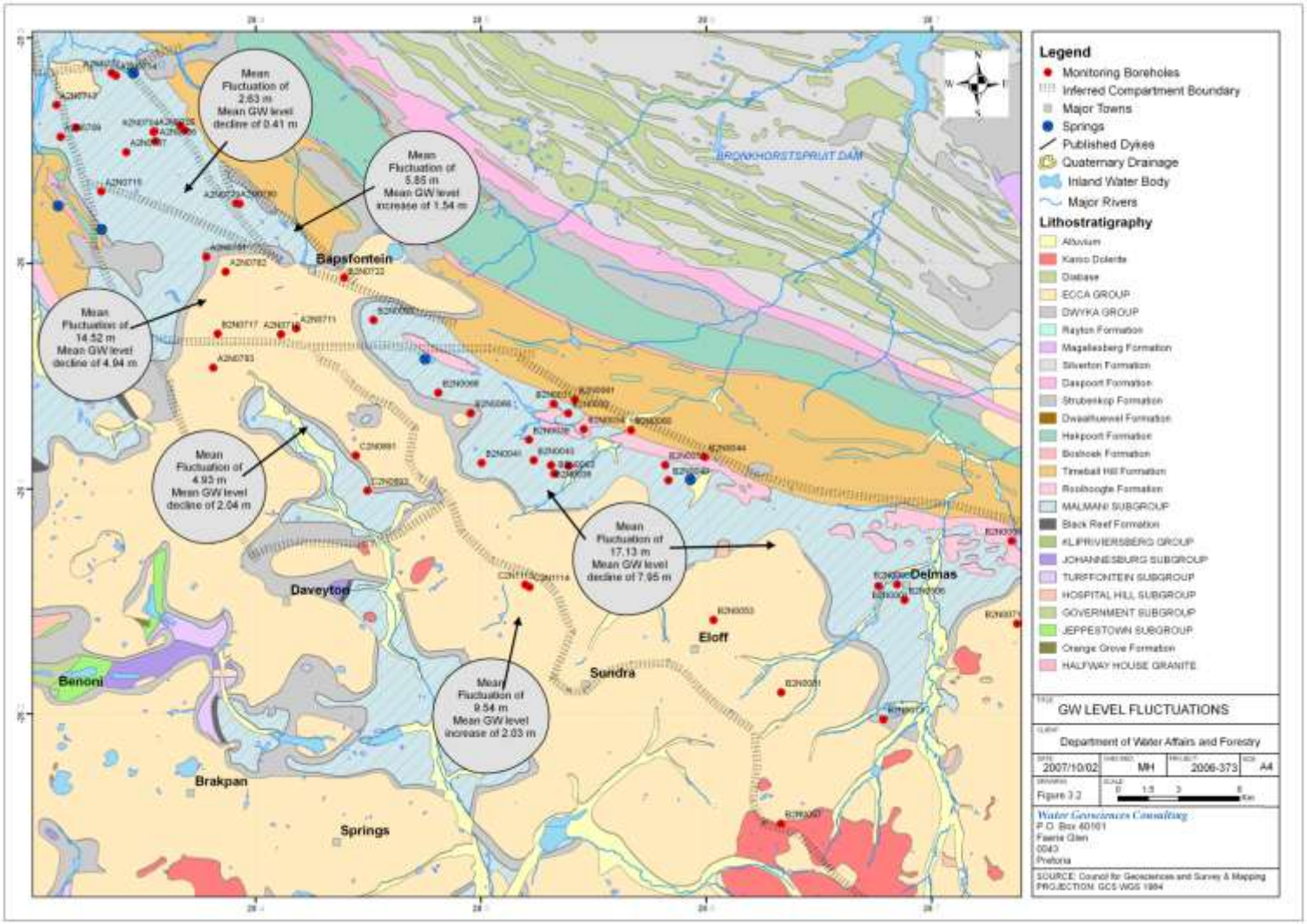
Fluctuations and gw level decline: late 1980s onwards, Bapsfontein – Delmas compartment



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Risks to the aquifer

- Overexploitation
  - Resource depletion
  - Subsidence
  - Sinkholes
- Pollution
  - Sewage effluent, pit latrines
  - 2005 typhoid outbreak: 600 cases, 4 fatalities
  - 1993: 1000 typhoid cases
- Inadequate management provisions





Responsibilities for management

- WSP = Delmas Local Municipality
- CMA = not yet formed (Olifants WMA)
- DWA Regional Office
- WSA and Water Quality Monitoring = Nkangala DM (National Health Act)
- DWA National Office





Evaluation of governance provisions

Capacity	Criterion	Context	Provision	Inst. capacity
Technical	Basic hydrogeological maps	For identification of groundwater resources	3	1
	Groundwater body/aquifer Delineation	With classification of typology	3	1
	Groundwater piezometric monitoring network	To establish resource status	2	1
	Groundwater pollution hazard assessment	For identifying quality degradation risks	1	1
	Availability of aquifer numerical 'management models'	At least preliminary for strategic critical aquifers	0	0
	Groundwater quality monitoring network	To detect groundwater pollution	1	1
Legal & Institutional	Water well drilling permits & groundwater use rights	For large users, with interests of small users noted	2	1
	Instruments to reduce groundwater abstraction	Water well closure/constraint in critical areas	1	1
	Instruments to prevent water well construction	In overexploited or polluted areas	2	1
	Sanction for illegal water well operation	Penalizing excessive pumping above permit	1	1
	Groundwater abstraction & use charging	'Resource charge' on larger users	2	1
	Land use control on potentially polluting activities	Prohibition or restriction since groundwater hazard	1	0
	Levies on generation/discharge of potential pollutants	Providing incentives for pollution prevention	0	0
	Government agency as 'groundwater resource guardian'	Empowered to act on cross-sectoral basis	1	1
	Community aquifer management organisations	Mobilising and formalising community participation	0	0
Cross-Sector Policy Coordination	Coordination with agricultural development	Ensuring 'real water saving' and pollution control	1	1
	Groundwater based urban/industrial planning	To conserve and protect groundwater resources	0	0
	Compensation for groundwater protection	Related to constraints on land-use activities	0	0
Operational	Public participation in groundwater management	Effective in control of exploitation and pollution	1	1
	Existence of groundwater management action plan	With measures and instruments agreed	3	0





Governance provisions: National level

- Technical, legal and institutional and operational governance provisions are reasonable but weak for cross-sector policy coordination
- Institutional capacity is weak across all thematic areas except for the technical provisions.





Governance provisions: Local level

- Similarity in results for aquifers across all thematic areas
- Basic technical provisions in place (e.g. hydrogeological maps)
- Effectiveness other governance provisions weak or non-existent
  - Groundwater monitoring weak; assessment groundwater resources poor
  - Fair provisions for water well drilling and groundwater use rights
  - Weak control groundwater abstraction and pollution (poor compliance monitoring and enforcement)
  - Weak provisions for establishment aquifer management organizations
  - Weak cross-sector policy coordination
  - Only for Botleng groundwater management action plan but not implemented
- Institutional capacity across all thematic areas weak or non-existent except for the Steenkoppies dolomite aquifer





Management measures

Macro policy adjustments	Regulatory provisions	Community participation
• Integration of NGS into NWRS, CMS, and other strategies • Include groundwater abstraction in the water pricing strategy • Harmonize water related legislation • Integrate groundwater resource planning between different spheres of government	• Registration of new wells and boreholes • Review of general authorizations • Registration of drillers • Registration and verification of water use • Simplification of groundwater licensing (e.g. single license for DWA and DEA) • Timeous issuing of water use license • Compliance monitoring and enforcement • Protection zoning around boreholes and pollution pathways • Establish regulations for borehole construction • In stressed catchments implement compulsory licensing	• Accelerate establishment of CMAs and WUAs • Establishment of Aquifer Management Committees • Stakeholder engagement in decision-making





Some recent hydrogeological / groundwater planning tools / outputs in RSA:

- South Africa's Groundwater Regions (Vegter) maps and booklets
- The Groundwater Harvest Potential Map project
- The National Hydrogeological Map series (groundwater resource assessment phase 1, or GRA1)
- The Department of Water Affairs' GRA2 project
- The NORAD toolkit for water services
- The GRIP project
- The National Groundwater Strategy and GRA3
- The Department of Water Affairs' All-Towns Reconciliation Study
- The SADC hydrogeological map, and the UNESCO map legend
- The National Groundwater Strategy, the Artificial Recharge Strategy, and the development of the Artificial Recharge zone potential atlas
- The WRC project K5/2048 Development of a Groundwater Resource Assessment Methodology
- WRC project K5/1763 The delineation of high-yielding wellfield areas in Karoo Aquifers as future water supply options to local authorities
- Groundwater potential studies done for Tshwane Metro, the Nelson Mandela Bay area, eThekwini, etc
- The update of the Water Resources of South Africa (WR2005) project



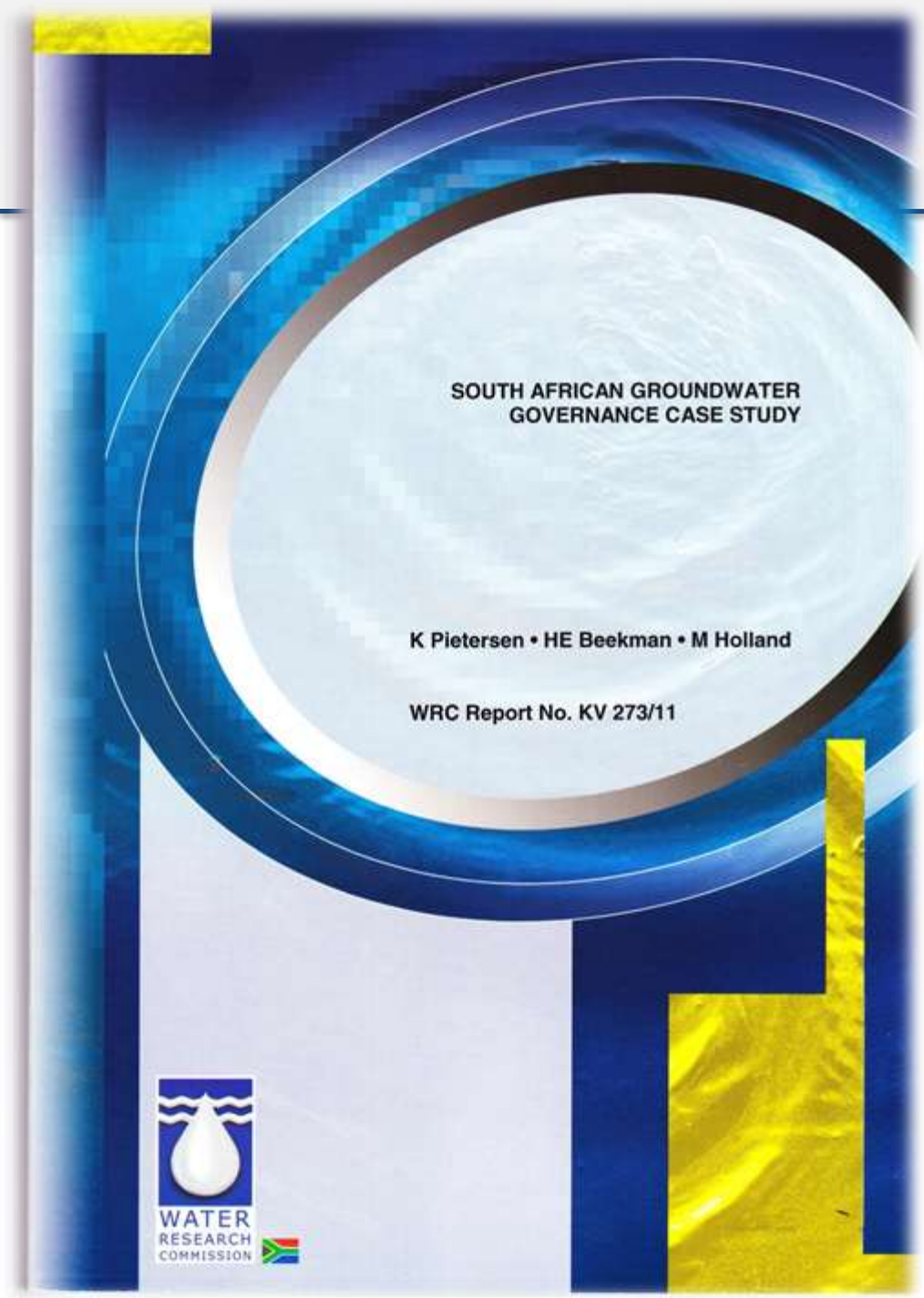


Conclusions

- “Technical” products available;
- National level skills and capacity;
- Seems to be limited capacity at local level;
- Institutional landscape still in flux;
- Pragmatic “adaptive” approach needed?
- “Further outbreaks [of typhoid] may occur if urgent and appropriate steps are not taken to ensure that inhabitants of Delmas have safe water” *Keddy et al, Epidemiol. Infect. 2010*







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- The report is available from the WRC.
- WRC Report No. KV 273/11

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