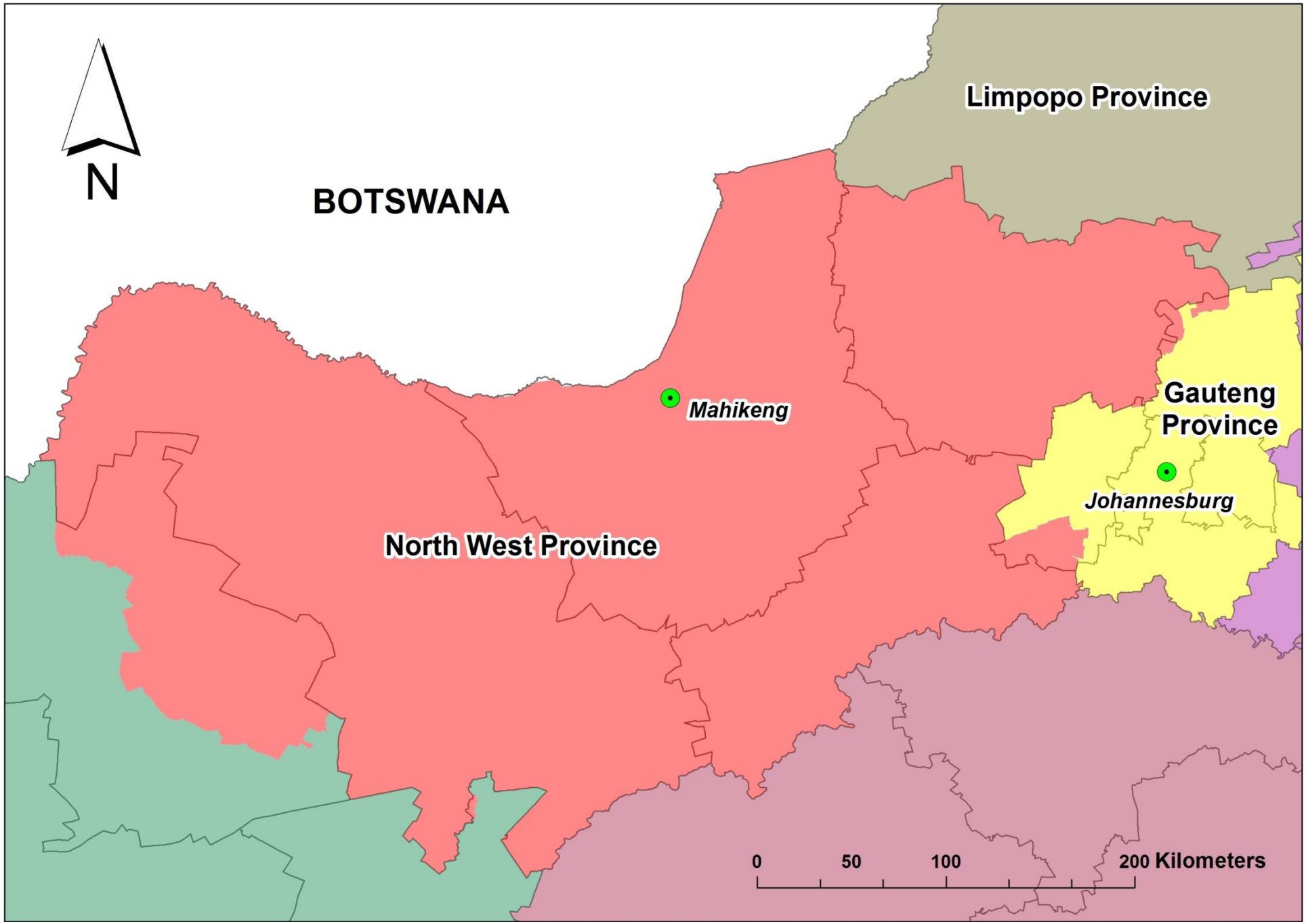
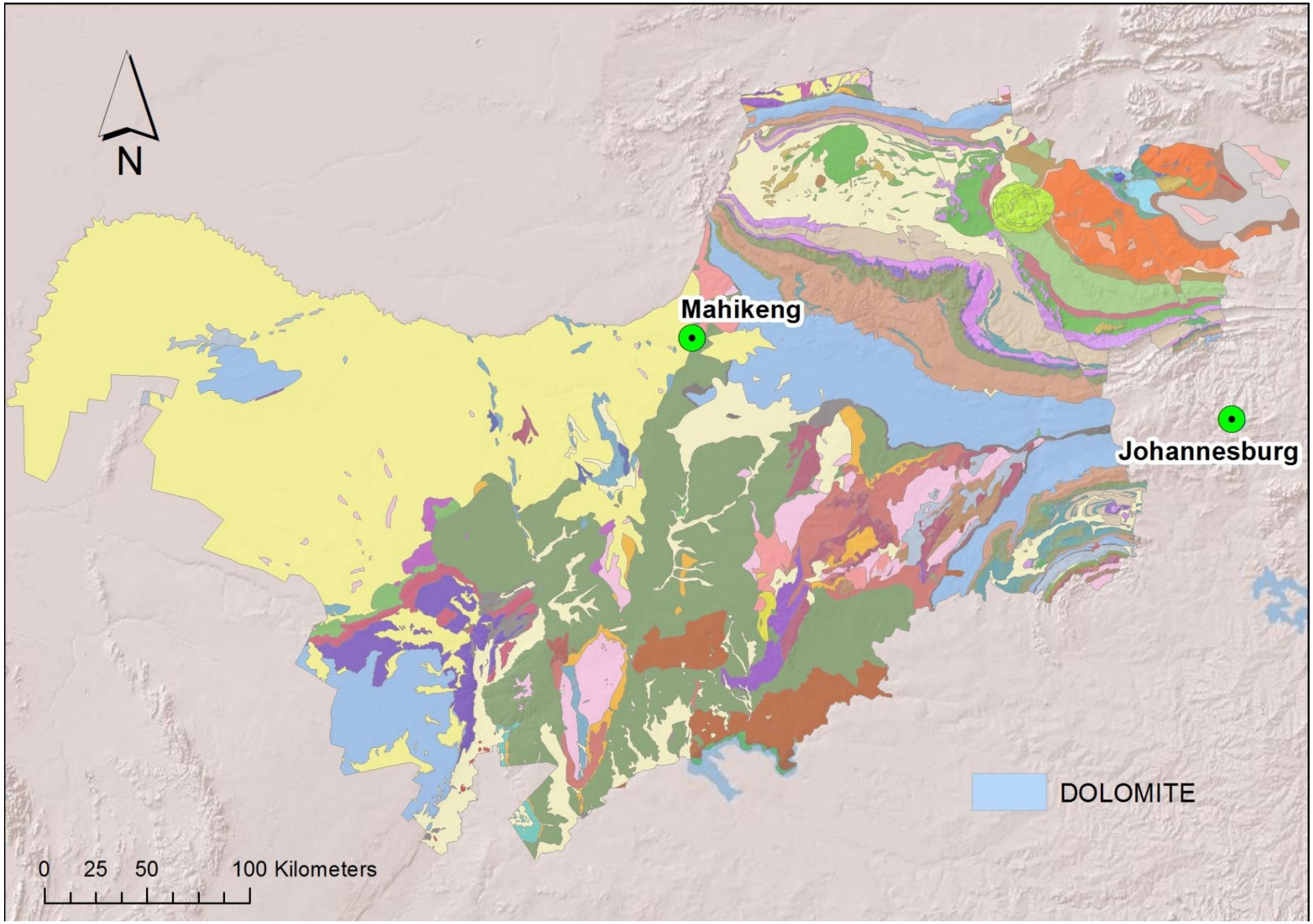
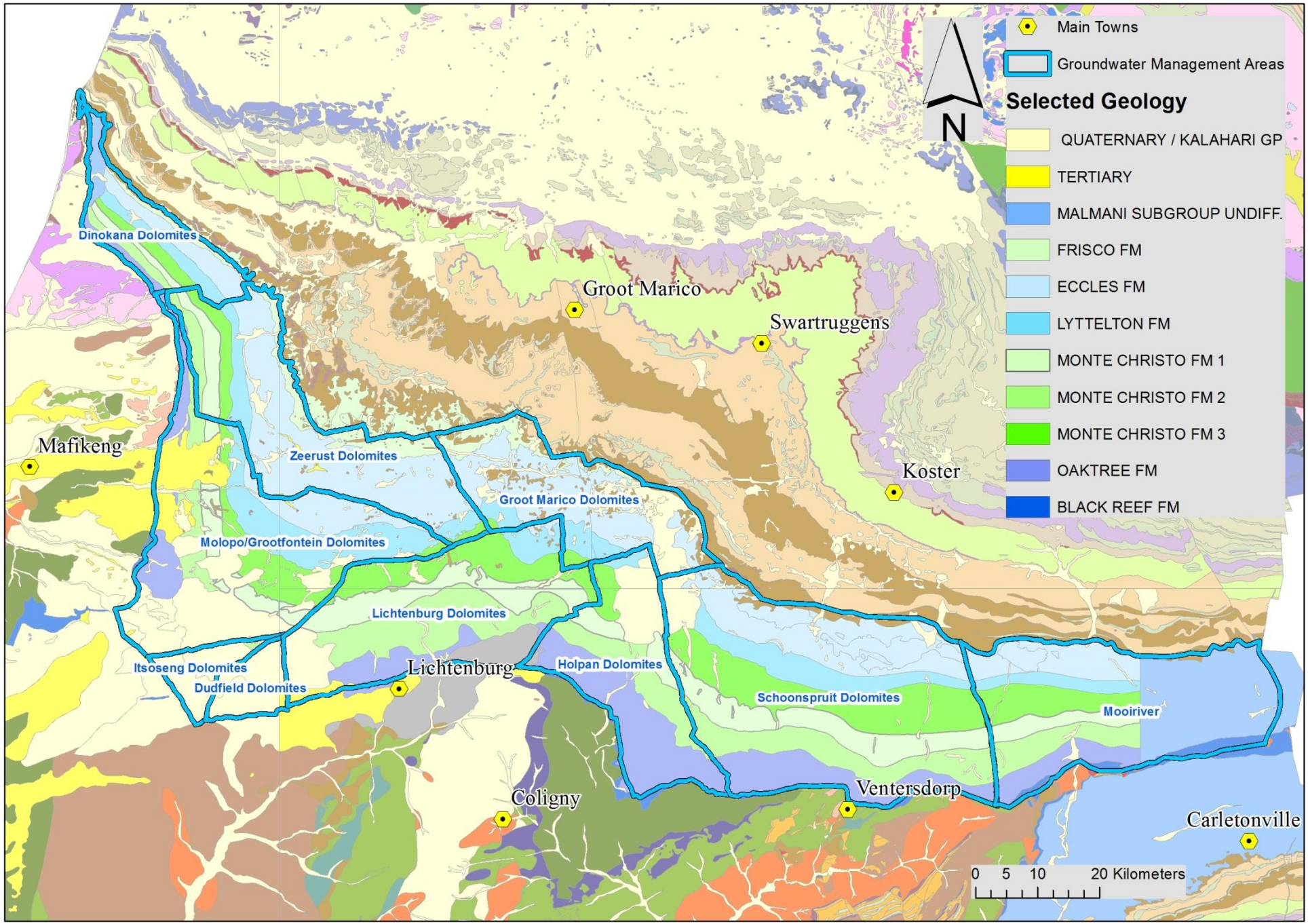
Management of the groundwater resources of the Grootfontein Compartment, Mahikeng

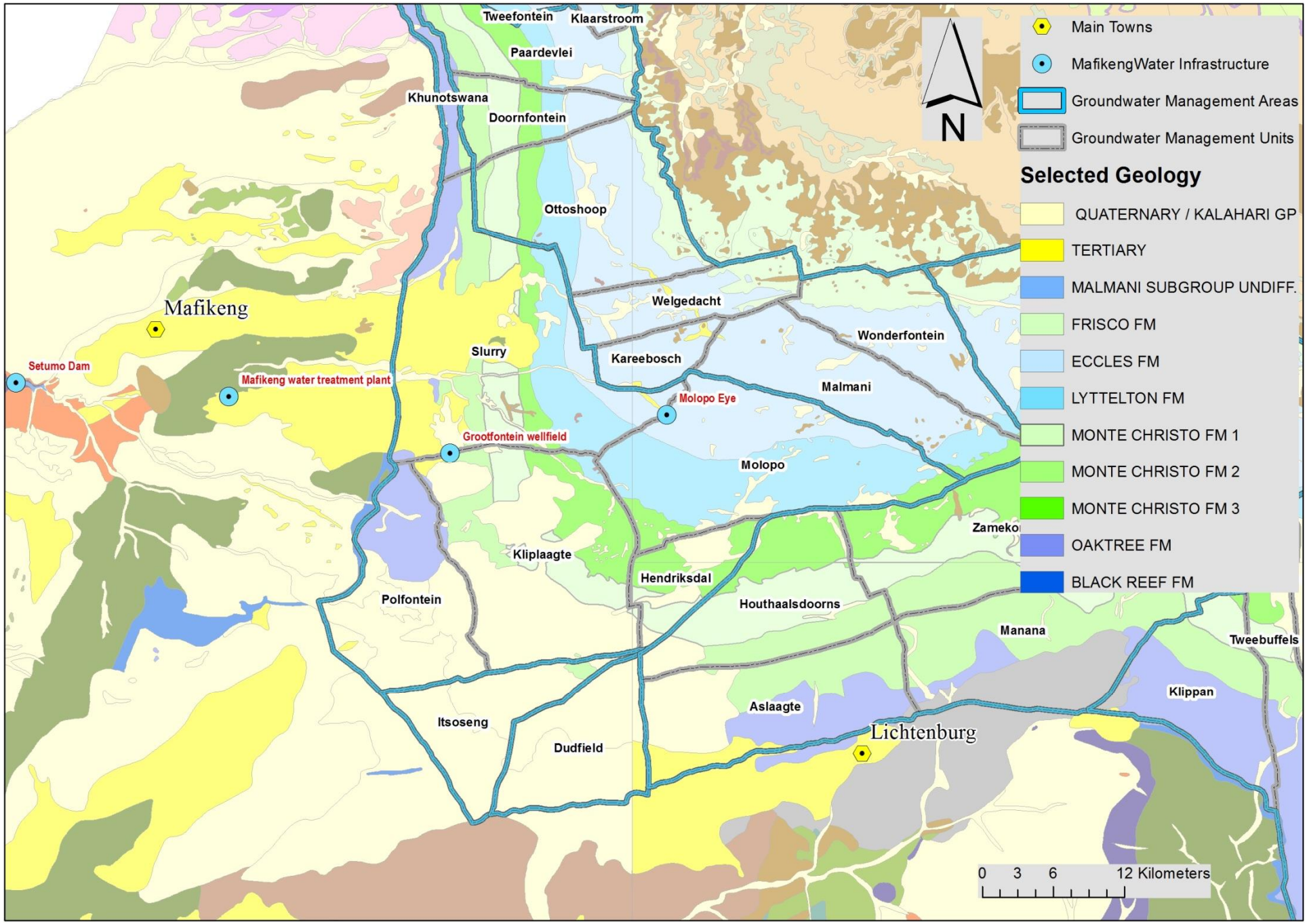
Jude Cobbing, PhD Student

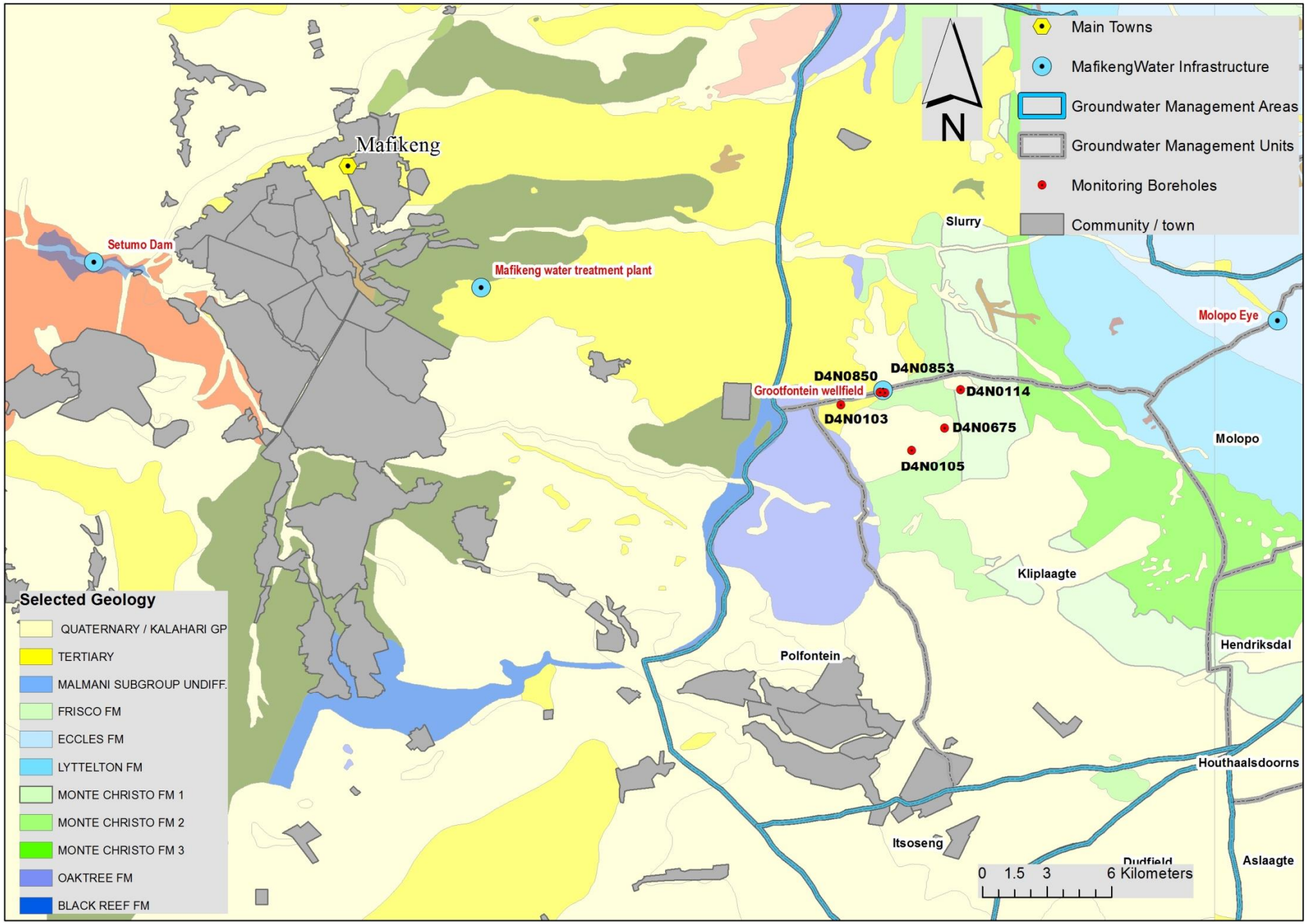
Nelson Mandela Metropolitan University, Port Elizabeth


N
BOTSWANA
Limpopo Province
Mahikeng
Gauteng
Province
Johannesburg
North West Province
0
50
100
200 Kilometers


N
Mahikeng
Johannesburg
DOLOMITE
0 25 50 100 Kilometers


Main Towns
Groundwater Management Areas
Selected Geology
QUATERNARY / KALAHARI GP
TERTIARY
MALMANI SUBGROUP UNDIFF.
FRISCO FM
ECCLES FM
LYTTELTON FM
MONTE CHRISTO FM 1
MONTE CHRISTO FM 2
MONTE CHRISTO FM 3
OAKTREE FM
BLACK REEF FM
N
Dinokana Dolomites
Groot Marico
Swartruggens
Mafikeng
Zeerust Dolomites
Koster
Groot Marico Dolomites
Molopo/Grootfontein Dolomites
Lichtenburg Dolomites
Itsoseng Dolomites
Dudfield Dolomites
Lichtenburg
Holpan Dolomites
Schoonspruit Dolomites
Mooiriver
Coligny
Ventersdorp
Carletonville
0 5 10 20 Kilometers


Tweefontein
Klaarstroom
Paardevlei
Khunotswana
Doornfontein
Ottoshoop
Mafikeng
Welgedacht
Wonderfontein
Slurry
Kareebosch
Setumo Dam
Mafikeng water treatment plant
Malmani
Molopo Eye
Grootfontein wellfield
Molopo
Zameko
Kliplaagte
Hendriksdal
Polfontein
Houthaalsdoorns
Manana
Tweebuffels
Klippan
Aslaagte
Itsoseng
Dudfield
Lichtenburg
N
Main Towns
MafikengWater Infrastructure
Groundwater Management Areas
Groundwater Management Units
Selected Geology
QUATERNARY / KALAHARI GP
TERTIARY
MALMANI SUBGROUP UNDIFF.
FRISCO FM
ECCLES FM
LYTTELTON FM
MONTE CHRISTO FM 1
MONTE CHRISTO FM 2
MONTE CHRISTO FM 3
OAKTREE FM
BLACK REEF FM
0 3 6 12 Kilometers


Main Towns
MafikengWater Infrastructure
Groundwater Management Areas
Groundwater Management Units
Monitoring Boreholes
Community / town
N
Mafikeng
Setumo Dam
Mafikeng water treatment plant
Slurry
Molopo Eye
D4N0850
D4N0853
Grootfontein wellfield
D4N0114
D4N0103
D4N0675
D4N0105
Molopo
Kliplaagte
Hendriksdal
Polfontein
Houthaalsdoorns
Itsoseng
Dudfield
Aslaagte
0 1.5 3 6 Kilometers
Selected Geology
QUATERNARY / KALAHARI GP
TERTIARY
MALMANI SUBGROUP UNDIFF.
FRISCO FM
ECCLES FM
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MONTE CHRISTO FM 1
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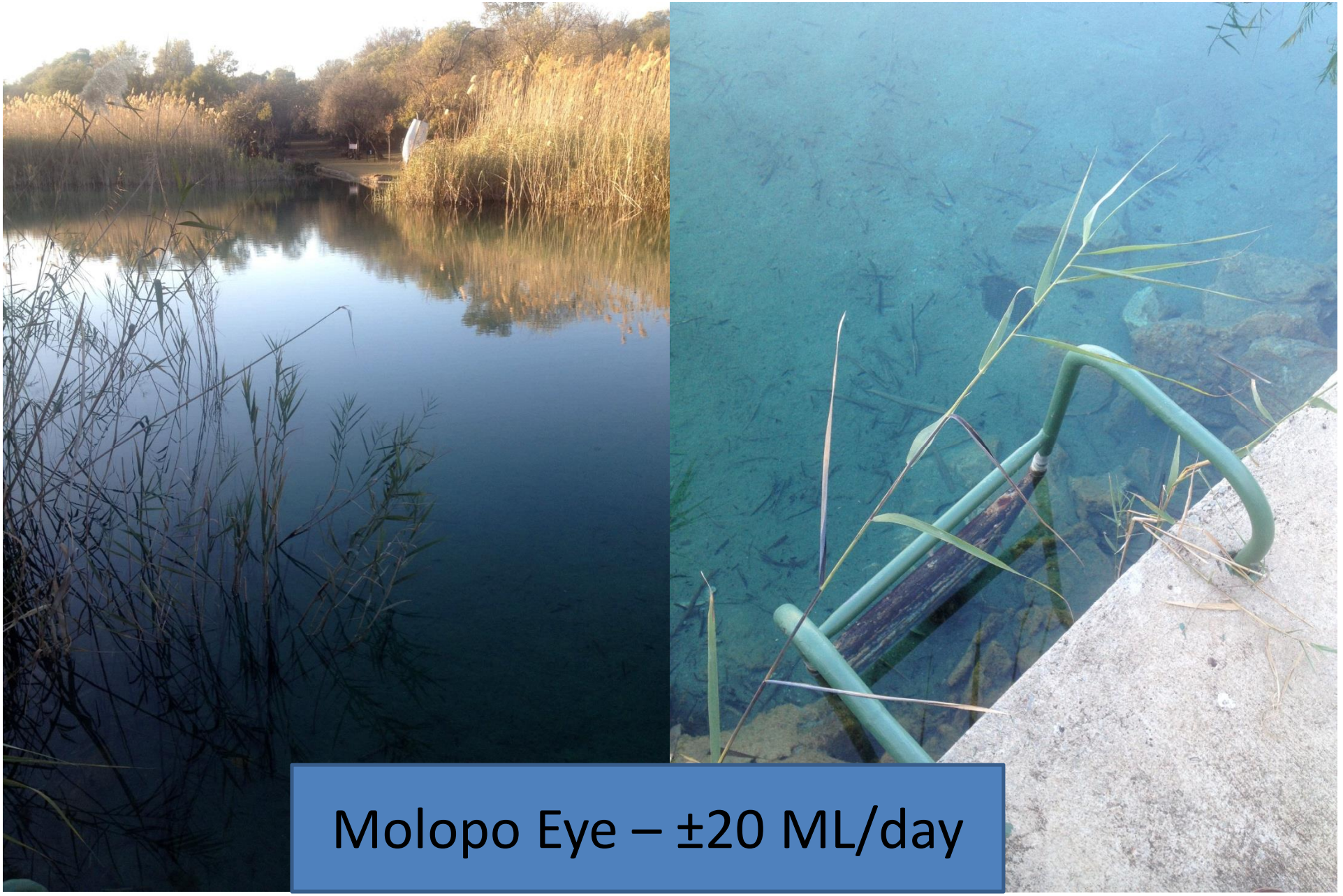
OAKTREE FM
BLACK REEF FM



Molopo Eye – ±20 ML/day

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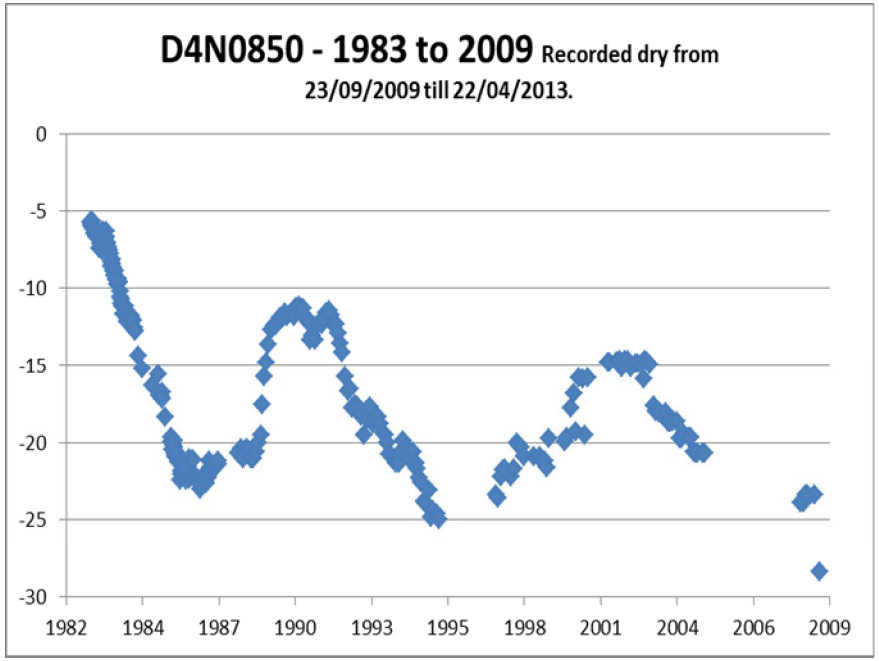
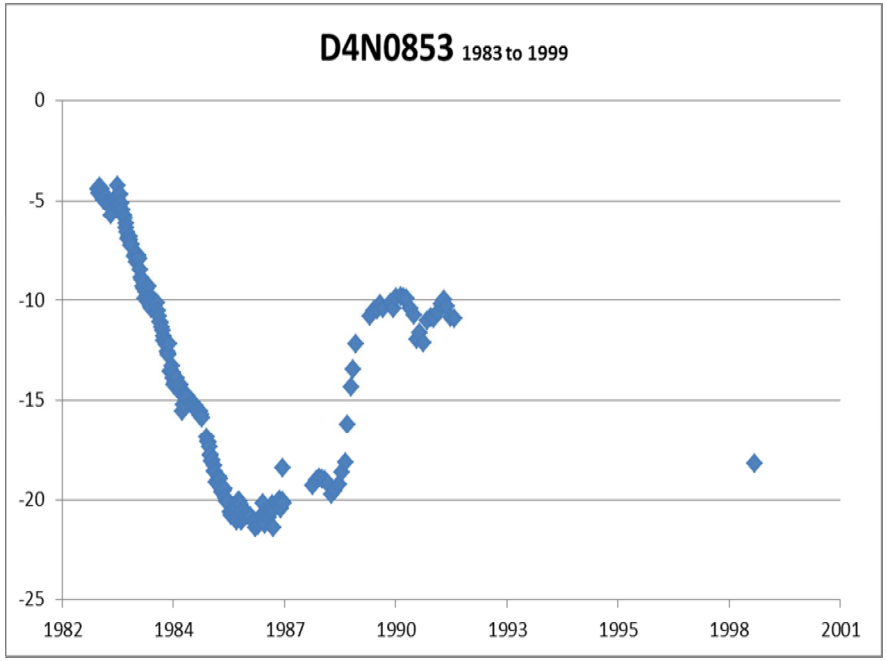
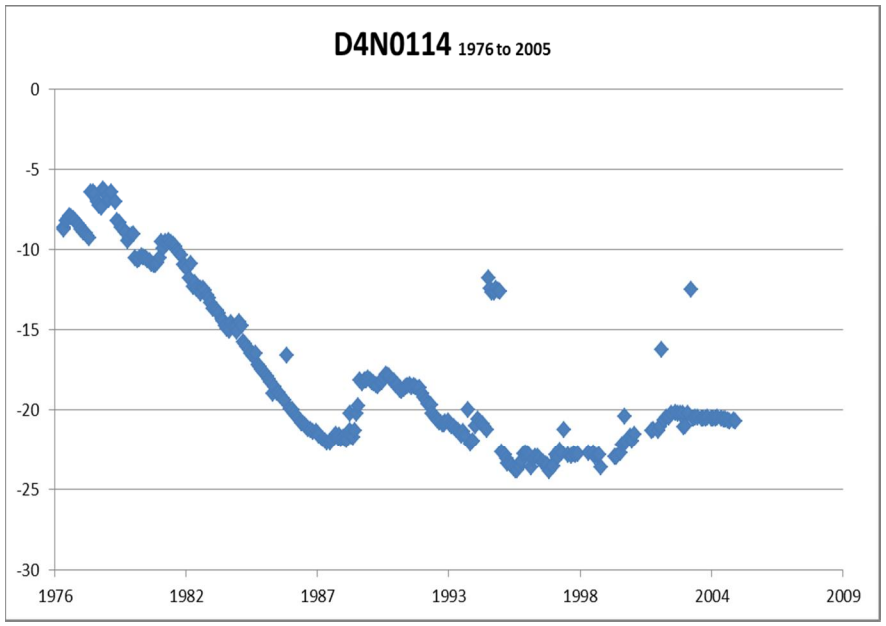
© 2014 Google
2011
Imagery Date: 10/9/2013 lat -25.887631° lon 26.025547°

Grootfontein wellfield – ±8 ML/day


D4N0850 - 1983 to 2009 Recorded dry from
23/09/2009 till 22/04/2013.
0
-5
-10
-15
-20
-25
-30
1982
1984
1987
1990
1993
1995
1998
2001
2004
2006
2009


D4N0853 1983 to 1999
0
-5
-10
-15
-20
-25
1982
1984
1987
1990
1993
1995
1998
2001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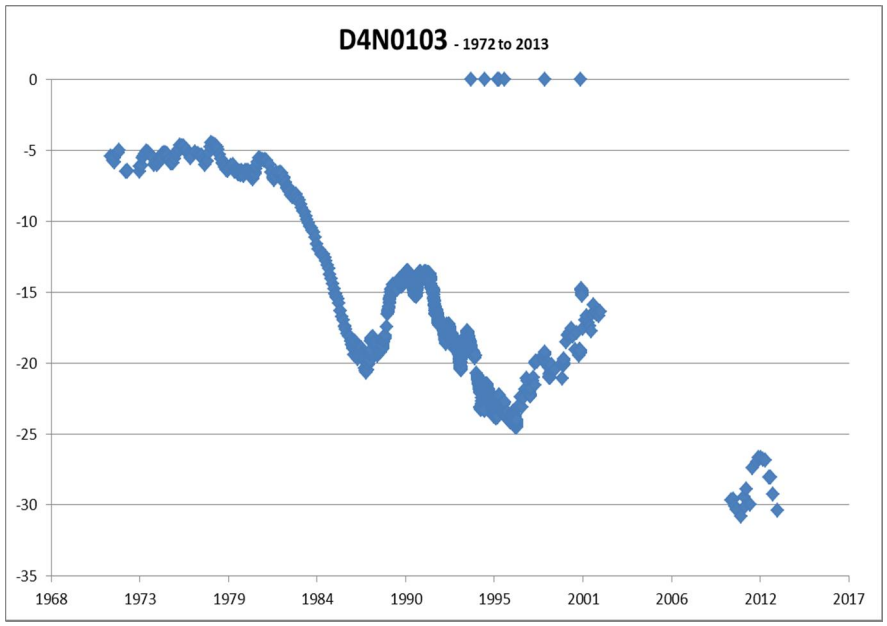
1976
1982
1987
1993
1998
2004
2009


D4N0103 - 1972 to 2013
0
-5
-10
-15
-20
-25
-30
-35
1968
1973
1979
1984
1990
1995
2001
2006
2012
2017

Mahikeng: Future water requirements

Growth Scenario	2020 Requirement		2020 Shortfall		2030 Requirement		2030 Shortfall	
	(Mm^3/a)	(ML/d)	(Mm^3/a)	ML/d)	(Mm^3/a)	(ML/d)	(Mm^3/a)	(ML/d)
LOW GROWTH	16.961	46.47	2.361	6.47	17.851	48.91	3.251	8.91
HIGH GROWTH	17.612	48.25	3.012	8.25	19.093	52.31	4.493	12.31

2030

- Pipeline from (distant) Vaal River?
- Existing sources sufficient?
- High externalised and opportunity costs associated with poor water supply reliability
- Difficult choices may need to be made
- Cooperation between organisations is missing, but vital.

Organisations and cooperation: water governance in South Africa

Some Research Questions:

Do the current hydrogeological conditions confirm previous (and comprehensive) hydrogeological work? (piezometry, chemistry etc)

What appear to be the main obstacles towards setting up a Water User Association? Alternatively, what are the drivers needed for a WUA?

Methodology:

Comprehensive literature review (hydrogeology and organisations / institutions)

Field sampling and water levels

Semi-structured stakeholder interviews

Comparison with the Steenkoppies Water User Association

Observations so far:

- Current conditions appear to support previous conceptual and numerical models for volumes and water quality
- Resource is over-utilised, with a variety of negative impacts (externalities and spillovers)
- Organisational framework is stalling in Mahikeng, although there are ongoing initiatives
- High transaction costs between and within organisations, and lack of clarity over *de facto* power and responsibility. Long time frames. These are all trans-jurisdictional issues.
- Situation has many parallels with other groundwater resource (and natural resource generally) management challenges in South Africa - lessons from this study likely to be more widely applicable