Classification & RQO determination of water resources in the Inkomati Water Management Area

Project Steering Committee Meeting
20 August 2013

Water Resources Status Quo

water affairs
Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

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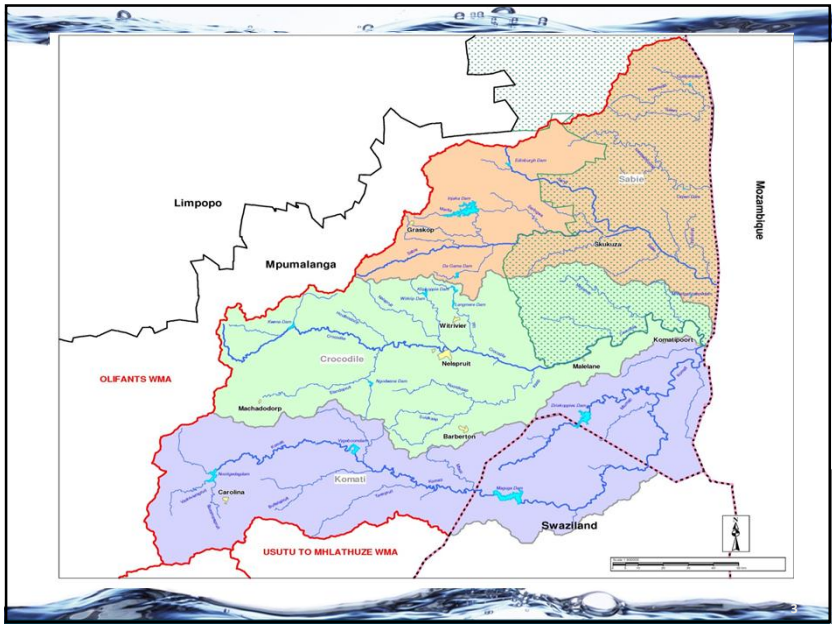
The Study Area

- The water resources is presented firstly in terms of the three main catchments of which the WMA is comprised, namely:
  - The Komati River
  - The Crocodile River, and
  - The Sabie River



Komati

- The Komat catchment has an interesting location in that it rises upstream of Swaziland, flows through Swaziland, and back into South Africa.
- The Komati catchment has relatively high rainfall (500 to over 1 600 mm/annum)
- The Mean Annual runoff from the catchment is estimated to be 1 357 million m^3/annum

Summary of water use

- Water use in the Komati catchment is estimated to be as follows:

Sector	Allocations (DWA) (million m^3/annum)	Actual use (million m^3/annum)
Domestic	21	21
Strategic	106	106
Industrial	11	11
Irrigation	642	~ 500
Total	847	638

- There are significant transfers out of the Komati catchment:
  - ~100 million m3/a to the Olifants catchment
  - ~170 million m3/a to the Mbuluzi catchment
  - ~ 9 million m3/a to the Crocodile catchment

Dams

- Significant dams in the catchment are:
  - Nooitgedacht
  - Vygeboom
  - Maguga (located in Swaziland)
  - Driekoppies
  - Lomati
  - Shiyalongubo

Land use activities

- In addition to direct abstractions, there is an estimated 1 203 Km^2 of forestry in the Komati catchment.
- This reduces the runoff from the catchment by an estimated 117 million m^3 /annum.

Overview of the Crocodile catchment

- The Crocodile catchment also has relatively high rainfall (450 to over 1 400 mm/annum)
- The Mean Annual runoff from the catchment is estimated to be 1 136 million m^3/annum

Crocodile catchment

- Water use in the Crocodile is also dominated by irrigation but domestic and industrial use are also significant.

Sector	Allocation (million m^3/annum)	Actual use (million m^3/annum)
Domestic	45	52
Industrial	22	22
Irrigation	480	~ 400
Total	**539**	**465**

Dams

- Significant dams in the Crocodile catchment are:
  - Kwena
  - Ngodwana
  - Witklip
  - Klipkopjes
  - Longmere
  - Primkop

Landuse activities

- In addition to direct abstractions, there is an estimated 1 941 Km^2 of forestry in the Crocodile catchment.
- This reduces the runoff from the catchment by an estimated 157 million m^3 /annum.

Overview of the Sabie catchment

- The Sabie catchment also has relatively high rainfall (500 to over 1 600 mm/annum)
- The Mean Annual runoff from the catchment is estimated to be 676 million m^3/annum

Sabie catchment

- Water use in the Sabie is also dominated by irrigation but domestic use has grown dramatically over the last 10 years

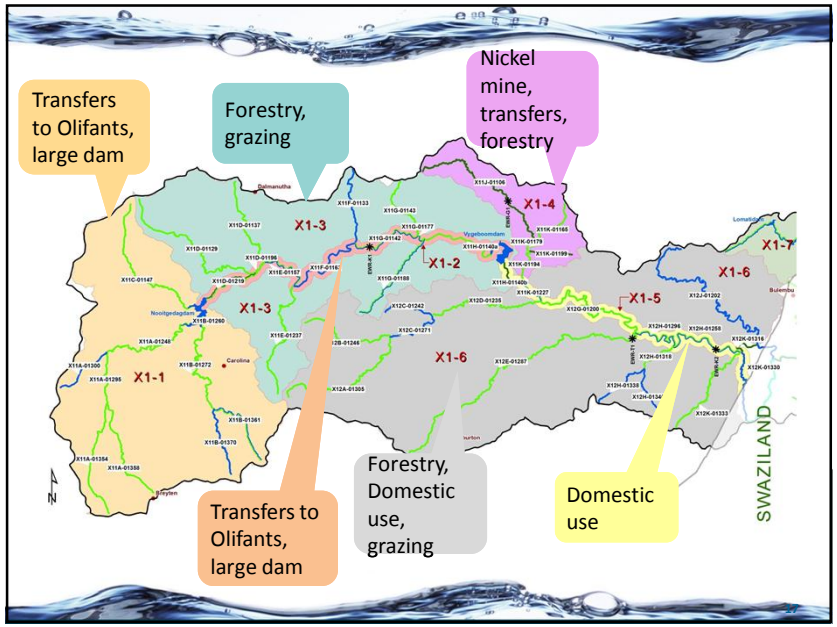
Sector	Allocation (million m^3/annum)	Actual use (million m^3/annum)
Domestic	44	40
Industrial	1	1
Irrigation	80	~ 70
Total	**125**	**111**

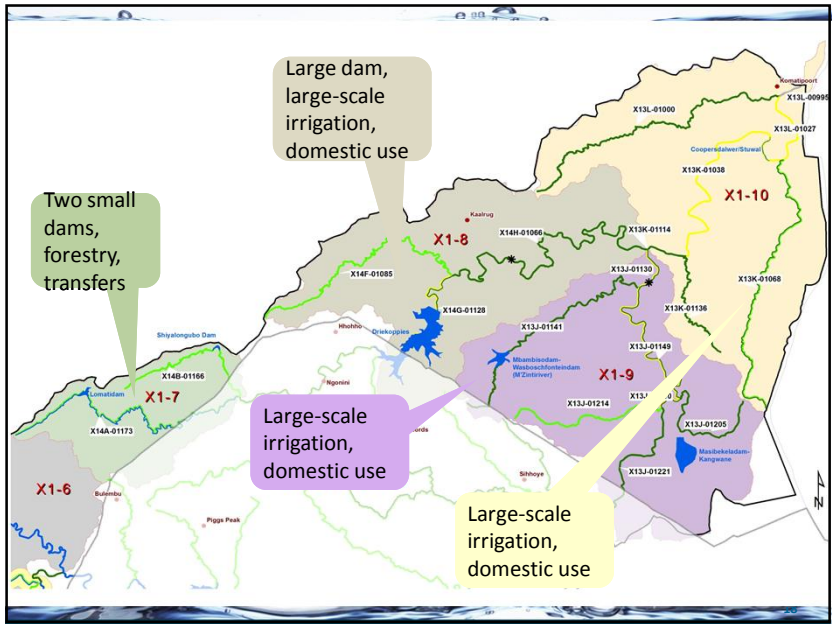
Dams

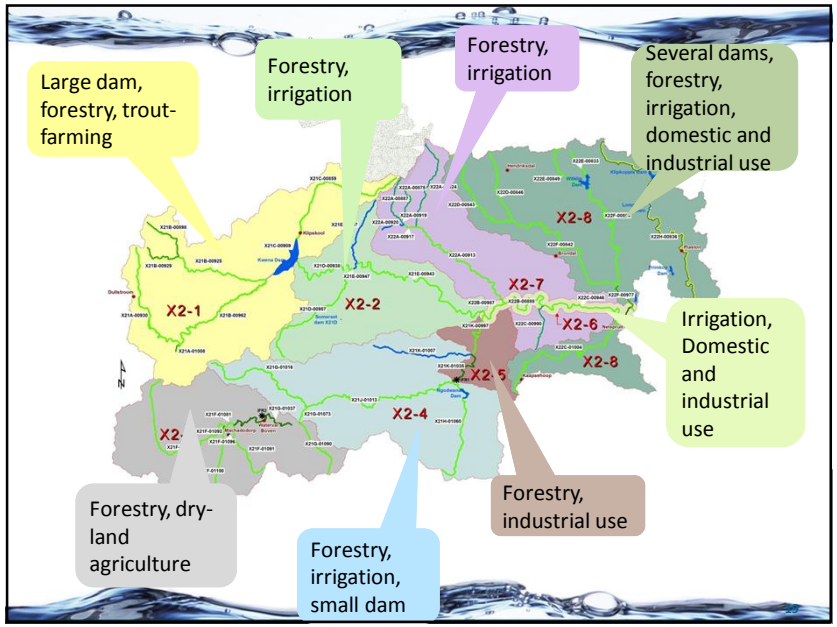
- Significant dams in the Sabie catchment are:
  - Inyaka
  - Da Gama

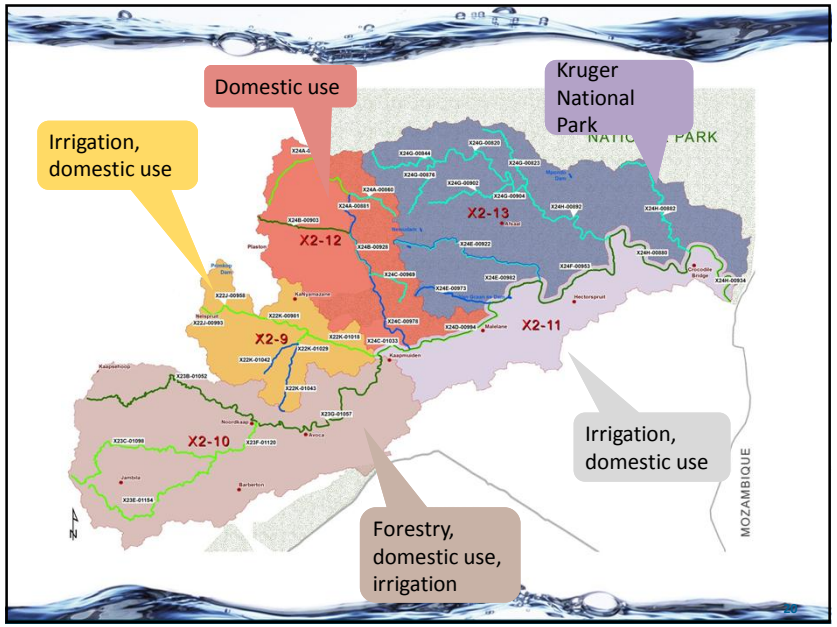
Landuse activities

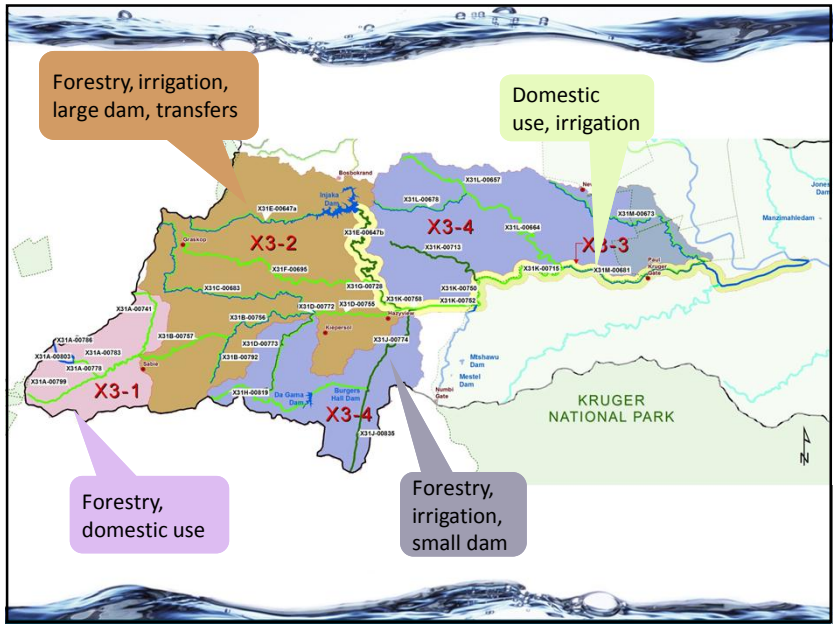
- In addition to direct abstractions, there is an estimated 853 Km^2 of forestry in the Sabie catchment.
- This reduces the runoff from the catchment by an estimated 95 million m^3 /annum.

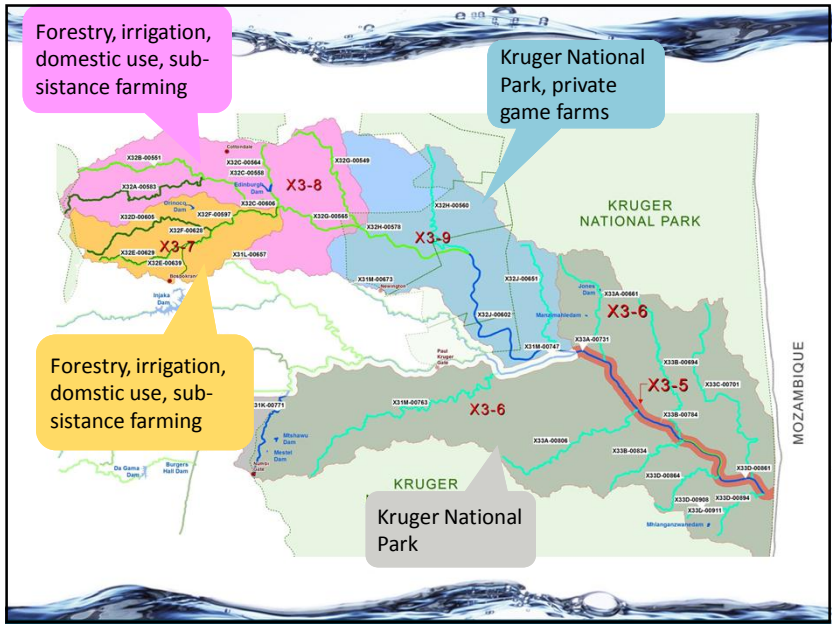

Transfers to Olifants, large dam
Forestry, grazing
Nickel mine, transfers, forestry
Forestry, Domestic use, grazing
Domestic use
Transfers to Olifants, large dam
X1-1
X1-2
X1-3
X1-4
X1-5
X1-6
X1-7
SWAZILAND


Large dam, large-scale irrigation, domestic use
Two small dams, forestry, transfers
Large-scale irrigation, domestic use
Large-scale irrigation, domestic use
X1-6
X1-7
X1-8
X1-9
X1-10


Large dam, forestry, trout-farming
Forestry, irrigation
Forestry, irrigation
Several dams, forestry, irrigation, domestic and industrial use
X2-1
X2-2
X2-4
X2-5
X2-6
X2-7
X2-8
X2-8
Irrigation, Domestic and industrial use
Forestry, industrial use
Forestry, dry-land agriculture
Forestry, irrigation, small dam


Domestic use
Kruger National Park
Irrigation, domestic use
X2-9
X2-10
X2-11
X2-12
X2-13
Irrigation, domestic use
Forestry, domestic use, irrigation
MOZAMBIQUE

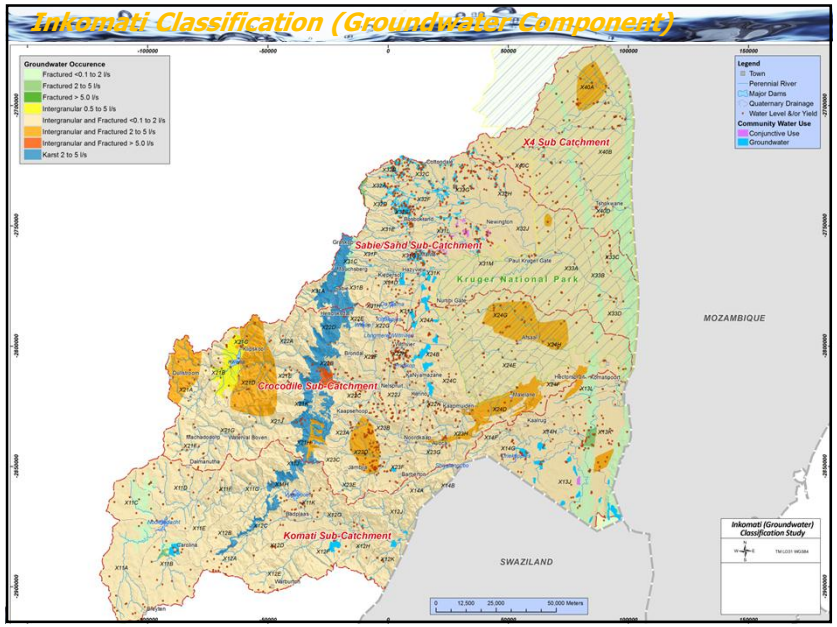

Forestry, irrigation, large dam, transfers
Domestic use, irrigation
X3-2
X3-4
X3-3
X3-1
X3-4
KRUGER NATIONAL PARK
Forestry, domestic use
Forestry, irrigation, small dam


Forestry, irrigation, domestic use, sub-sistance farming
Kruger National Park, private game farms
X3-8
X3-7
X3-9
KRUGER NATIONAL PARK
X3-6
X3-5
X3-6
MOZAMBIQUE
Forestry, irrigation, domstic use, sub-sistance farming
KRUGER
Kruger National Park

Groundwater

Data Collation

- 1:250 000 geological maps (Council for Geoscience)
- 1:500 000 Nelspruit and 1:500 000 Phalaborwa
- Groundwater Resources Information (GRA II) Project (DWAF, 2006) – Quaternary Scale
- Recharge; Baseflow; Groundwater/harvest potential
- Groundwater Use → (GRAII & WARMS 2013)
- Inkomati Water Availability Assessment (as part of this project)
- Vegter (1995) groundwater map set (borehole yield prospect)
- Regional groundwater quality and water level data from the National Groundwater Archive (DWA)
- Groundwater Regions (Vegter 2000)



Inkomati Classification (Groundwater Component)

Preliminary Results (Refer to Map) – Status Quo

- Regional groundwater level data from the National Groundwater Archive (DWA)
  - 2458 boreholes with water levels and or yield (Coordinate accuracy ? Ÿ < 1300 within 100m
- Groundwater levels and yields (Inkomati WMA)
- Groundwater Quality

Stat.	Water Level (mbs)	Yield (l/s)
No of Boreholes	*1069*	*651*
Min.	0.2	0.01
Mean	16.7	1.65
Max.	115.0	27.20

Stat.	pH Value at 25°C	EC (mS/m) at 25°C	Total Dissolved Solids	Alkalinity as $CaCO_3$	Ca	Mg	Na	K	Cl	SO_4	Nitrate as N	Free & Saline Ammonia as N	Ortho Phosphate as P	F	Fe	Mn	Al
				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
No of Samples	892	892	876	891	891	891	885	886	890	885	882	878	878	889	176	178	178
Min.	6.3	3	21	7.0	0.5	0.5	1.0	0.2	1.5	1.5	0.02	0.015	0.003	0.050	0.002	0.001	0.003
Mean	**8.0**	**107**	**781**	**294.6**	**41.6**	**39.0**	**134.7**	**2.9**	**162.1**	**16.3**	**5.7**	**0.06**	**0.03**	**0.72**	**0.11**	**0.03**	**0.08**
Max.	9.8	1450	9312	871.3	423.7	433.0	2583.5	42.4	5224.6	254.9	67.4	4.55	0.46	9.95	8.83	1.08	0.50
Drinking Water Quality Limits - DWAF, 1996; DWAF, DOH and WRC, 1998*																	
Class 1	*5-6 or 9-9.5*	*70-150*	*450-1000*		*80-150*	*30-70*	*100-200*	*25-50*	*100-200*	*200-400*	*6-10*			*0.7-1*	*0.1-0.2*	*0.05-0.1*	*0-0.15*
Class 2	*4-5 or 9.5-10*	*150-370*	*1000-2400*		*150-300*	*70-100*	*200-600*	*50-100*	*200-600*	*400-600*	*10-20*			*1-1.5*	*0.2-2*	*0.1-1*	*0.15-0.5*
Class 3	*3.5-4 or 10-10.5*	*370-520*	*2400-3400*		*>300*	*100-200*	*600-1200*	*100-500*	*600-1200*	*600-1000*	*20-40*			*1.5-3.5*	*2-10*	*1-5*	*>0.5*

Inkomati Classification (Groundwater Component)

Preliminary Results – Status Quo

- Most of the groundwater use is for rural domestic supplies, as well as for game and livestock watering
- 139 ("Rural") Communities dependant entirely on Groundwater, while 9 use both surface- and groundwater, 142 surface water Ÿ DWA All Town Studies
- Groundwater Use (Inkomati WMA) – Previous Studies
  - Inkomati ISP (2004) Ÿ Mainly based on NWRS and WARMS (8 and 27.5 Mm^3/a respectively)
  - GRA II (2004) Ÿ 13.3 Mm^3/a (67 % Rural supply)
  - Inkomati Water Availability Assessment (2009) Ÿ Mainly based on NGA and WARMS (59 and 8.5 Mm^3/a respectively)
  - 2013 Assessment

Ÿ NGA (Yield = blow/discharge yields) 12 to 35 Mm^3/a

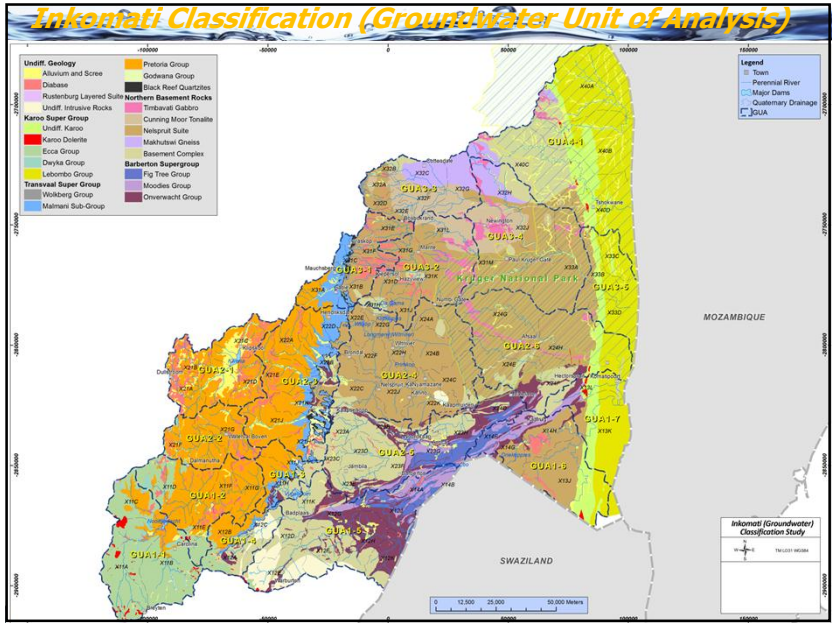
Ÿ WARMS (2013) Registered 29.6 Mm^3/a

Agriculture – 49%, Mining & Industry, 13%, Water Supply

- Likely Total Groundwater Use 35 to 45 Mm^3/a

Stat.	Yield (l/s)	Mm^3
All Data		
No of BHs	*1265*	
Sum Yields (All)	1819.63	**57.4**
30% of Yield	600.48	**18.9**
Accuracy of BHs (< 1 km)		
No of BHs	*651*	
Sum Yields (Acc.)	1075.16	**33.91**
30% of Yield (Likely)	354.80	**11.19**

Inkomati Classification (Groundwater Unit of Analysis)



Inkomati Classification (Groundwater Component)

Summary and Conclusion

- The groundwater resource/yield potential in the Inkomati WMA is limited largely to (< 0.1 to 2 l/s).
- In the few areas where the abstractions are potentially high, there is strong connectivity with surface water baseflows (i.e. along major Rivers, and head waters along the escarpment), and or local groundwater qualities are poor (i.e. high nitrate concentrations)
- Groundwater is used throughout the WMA for rural water supply where the water requirements are small and widely dispersed.
- Groundwater abstractions in the Inkomati WMA are not significant (in relation to groundwater recharge) but are likely to be under reported.
- Concerns about the impact on groundwater water quality from;
  - small coal mines (upper Komati catchment),
  - abandoned mines (adits, shafts, mine residue dumps and other features) scattered across the area,
  - current mining activities, including the reprocessing of old waste dumps, present a possible threat to local groundwater resources,
  - irrigation, urban and waste water treatment return flows.