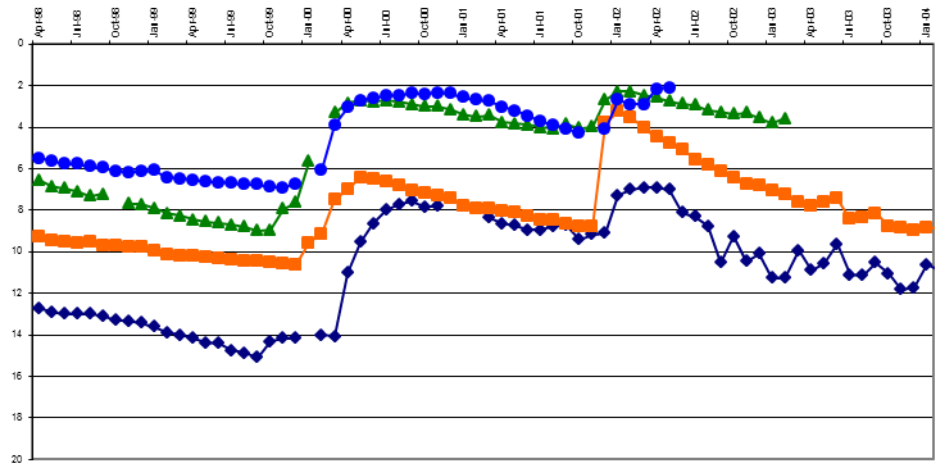
LIMPOPO REGION

QUARTERLY STATUS REPORT ON GROUNDWATER LEVEL TRENDS



H VERSTER

DIRECTORATE
WATER REGULATION AND USE

JUNE 2014

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SUMMARY

Good rainfall was recorded over much of the Province the past rainy season with exceptional high precipitation in some areas. The impact on groundwater levels at most of the stations is positive with 69% indicating higher levels than that of the corresponding time last year.

Compared to available historical data the current groundwater situation is considered to be very healthy in general.

Unfortunately some local deviations from the normal do occur which is mostly due to over abstraction for irrigation or community water supply. Sound resource management is necessary to ensure that the current favourable condition of the resource is maintained as much as possible to enable the sustainable use over the long-term.

1. BACKGROUND

Water level data is collected and analysed quarterly to compile a quarterly status report on groundwater level trend at 188 monitoring stations. The distribution of the monitoring network is illustrated by MAP 1.

A number of specific monitoring stations on different projects are monitored and the results are reported at the conclusion of each project.

Loss of the use of stations due to the installation of pumping equipment by municipalities or other service providers is escalating and poses huge problems for monitoring.

All stations are not always accessible, mostly due to extreme wet conditions in the rainy season, which result in data not available for both dates. High late season rainfall the past rainy season resulted in a number of stations being inaccessible.

Electronic groundwater level data for this report was collected during May 2014.

2. RAINFALL

2.1. RAINFALL DISTRIBUTION; OCTOBER 2013 TO APRIL 2014 (MAP 2)

Rainfall data provided by the South African Weather services were used for compilation of map 2. The highest rainfall the rainy season was, as is usual; mostly long the escarpment with two stations, Wood bush and Tshivase Tea Plantation, recording more than a 1000 mm for the season. Heavy rainfall exceeding 400mm were recorded at some stations in the upper A4, A5 and A6 drainage during March 2014 which resulted in serious flooding in the Lephalale area.

3. GROUNDWATER LEVELS

3.1 DIFFERENCE IN GROUNDWATER LEVELS; FEBRUARY TO APRIL 2014

February to April 2014

Total	188	Stations

With data	176	Stations	93.6%

Water level			**Average(m)**	**%**
Down	47	Stations	-0.1	26.70%
Up	126	Stations	1.3	71.59%
Na change	3	Stations		1.70%
No Data	12	Stations		100.00%

The data above represent the second half of the past rainy season and show that 71.5 % of the stations with available data indicate recharge between February to April. The average rise in water level is 1.3m. At the smaller percentag(26.7 %) of stations which still indicate lower water levels than in February, the average decline was only 0.1m.
The distribution of stations with higher or lower groundwater levels is shown on MAP 3.

3.2 DIFFERENCE IN GROUNDWATER LEVELS; APRIL 2013 TO APRIL 2014

April 2013 to April 2014

Total	188	Stations

With data	174	Stations	92.6%

Water level			**Average(m)**	**%**
Down	51	Stations	-1.33	29.31%
Up	120	Stations	1.42	68.97%
Na change	3	Stations		1.72%
No Data	14	Stations		100.00%

Despite good rainfall over most of the Province since October 2013, there is still a number of stations (29.3%) indicating lower water levels than the same time last year. A number of factors contribute to this. A natural long-term trend of decline can be noted for some years now and seasonal recharge in some instances does not fully compensate for that. An increasing number of monitoring stations, although not indicating direct pumping effects, are in fact reprenting groundwater levels affected by the combine effect of abstraction in the area.

A notable concentration of stations with lower water levels occur in the lower reaches of the A4,A5 and A6 drainage areas despite the recents floods in parts of these areas resulting from high rainfall in the upper reaches during March. Delayed recharge draining from the recharge areas may still occur in time.

The distribution of stations with higher or lower groundwater levels is shown on MAP 4.

4. GROUNDWATER LEVEL TRENDS

Variable rainfall distribution, recharge, abstraction patterns, land use, topography etc. give rise to different groundwater level trends. Comparison with rainfall indicate that stations located in the upstream area of the drainage area usually show more pronounced seasonal fluctuations than those in the lower discharge area.

4.1. RESPONSE OF GROUNDWATER LEVEL TO RAINFALL; A4NABOOM-VAALWATER (GRAPH 2)

A seasonal fluctuation in groundwater level in response to rainfall is clearly indicated. The difference in response to a single high rainfall month/incident and good rainfall for a longer period is also notable. The effect of the three high rainfall months, December, February and March 2014 on the groundwater level is dramatic. The current water level is abnormally high and would probably drain out fast initially.

4.2. GROUNDWATER LEVEL TIME SERIES; A4STOCKPOORT (GRAPH 3)

In contrast to the previous graph the groundwater level at A4Stockpoort located downstream in the discharge area show virtually no recharge with the noted slow long-term declining trend generally displayed clearly

4.3 GROUND WATER LEVEL TRENDS AT SOME STATIONS IN THE A5 DRAINAGE (GRAPH 4)

The underlying trend is very similar for the five stations but the seasonal trends vary, especially for the past three months. Clear indication of recharge can be noted at A5Kitty, A5Visgat and A5Western Lephalale but is absent at A5Tom Burke and A5Setateng.

4.4. LONG-TERM GROUNDWATER LEVEL TRENDS AT TWO STATIONS IN THE A6 DRAINAGE (GRAPH 5)

From the trends displayed by A6Mokopane Dorp, the very slow decline in water level for some years now that was mentioned before can be seen since 2000. The decline at A6Mokopane Nyl is very slight. Seasonal fluctuations can be seen as well but the important fact indicated here is that the current water levels are in a good state compared to the historical.

4.5 LONG-TERM GROUNDWATER LEVEL TRENDS AT TWO STATIONS IN THE A7 DRAINAGE (GRAPH 6)

The declining trend since 2000 is noticeable at A7 Boomzien but at A7Roodewal a slight rising trend started from 2005. Compared to the situation up to 1999 the current situation is healthy.

4.6. GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE A8 DRAINAGE (GRAPH 7)

Normal seasonal fluctuations with only the level at A8Maangani indicating the slight decline over time. The trend at both the other stations indicates a slight rising trend.

4.7. GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE A9 DRAINAGE (GRAPH 8)

Groundwater levels in the A9 drainage had a more marked declining trend than elsewhere over the past few years but have recovered well at some stations the past two years.

4.8. LONG-TERM GROUNDWATER LEVEL TREND AT B3TUINPLAAS (GRAPH 9)

Drought led to drastically lower groundwater level by 1995 after which it recovered almost completely. Heavy abstraction since 2002 resulted in an even worse situation by 2007, forcing the scale of abstraction to decrease and even stop due to the declined water level. The water level recovered almost to the 2001 level over four years where after the impact of renewed abstraction is clear again.

4.9. GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE B5 DRAINAGE (GRAPH 10)

Monitoring stations in the Sekhukhune area of the drainage were established in 2010 and no long-term data for the area is available. The trends displayed since 2010 indicate a slow decline as well.

4.10. GROUNDWATER LEVEL TREND AT B7MICA AND RAINFALL AT HOEDSPRUIT (GRAPH 11)

The trend displayed at B7Mica differ completely from the general situation overall and keep rising after each season. The level decreased from 46 m to 28 m over four years. The reason is not clear but the original level at the start of monitoring may have been a heavily impacted one resulting in a change or cease of abstraction nearby. The exceptional high rainfall in January 2012 which caused serious flooding in the area at the time also had a great impact and the water level after that may have been abnormally high again. The high rainfall again in March 2014 than had a dramatic impact on the already saturated aquifer. Only long-term monitoring will reveal the real situation.

4.11. GROUNDWATER LEVEL TRENDS AT TWO STATIONS IN THE B8 DRAINAGE (GRAPH 12)

Two different trends is displayed which correspond with what was found for other drainages as well, a stable condition with seasonal fluctuations and a slow declining one with virtually no fluctuations.

4.12 GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE B9 DRAINAGE (GRAPH 13)

Clear seasonal fluctuations are displayed bur the underlying declining trend at B9Greenfarm and B9Mukhomi is also clear. Recharge at B9Maphophe 2 was considerable this season. Long-term data for this drainage is not available but the correlation for the past few years with other drainages with long-term data suggest that the current situation is also healthy here.

4. IMPORTANCE OF GROUNDWATER MANAGEMENT

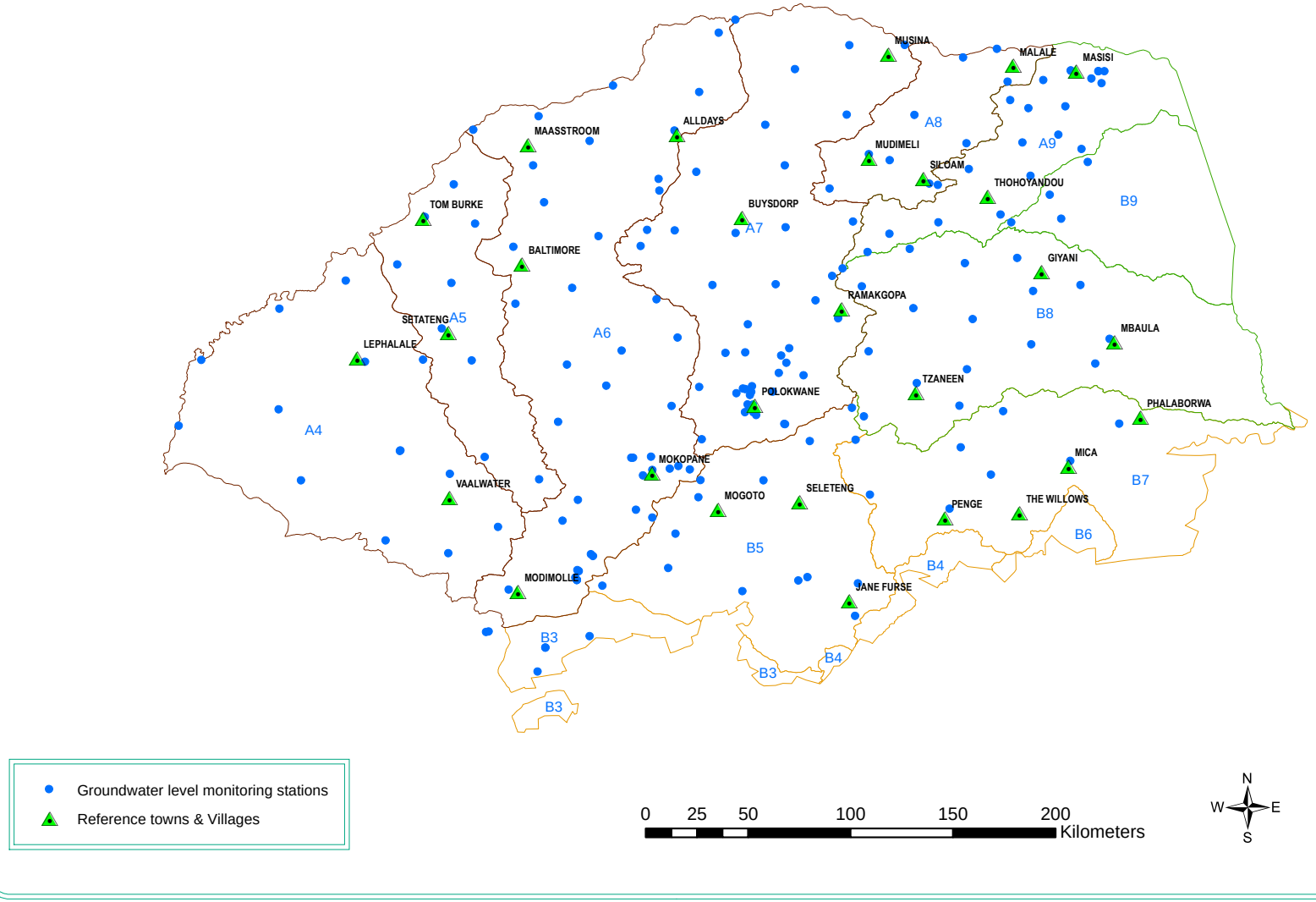
Graph 14.ilustrate the effect of continued high abstraction over time in an area on groundwater levels. If such a situation is not monitored to enable sound resource management decisions the source will eventually fail.

5. AKNOWLEDGEMENT

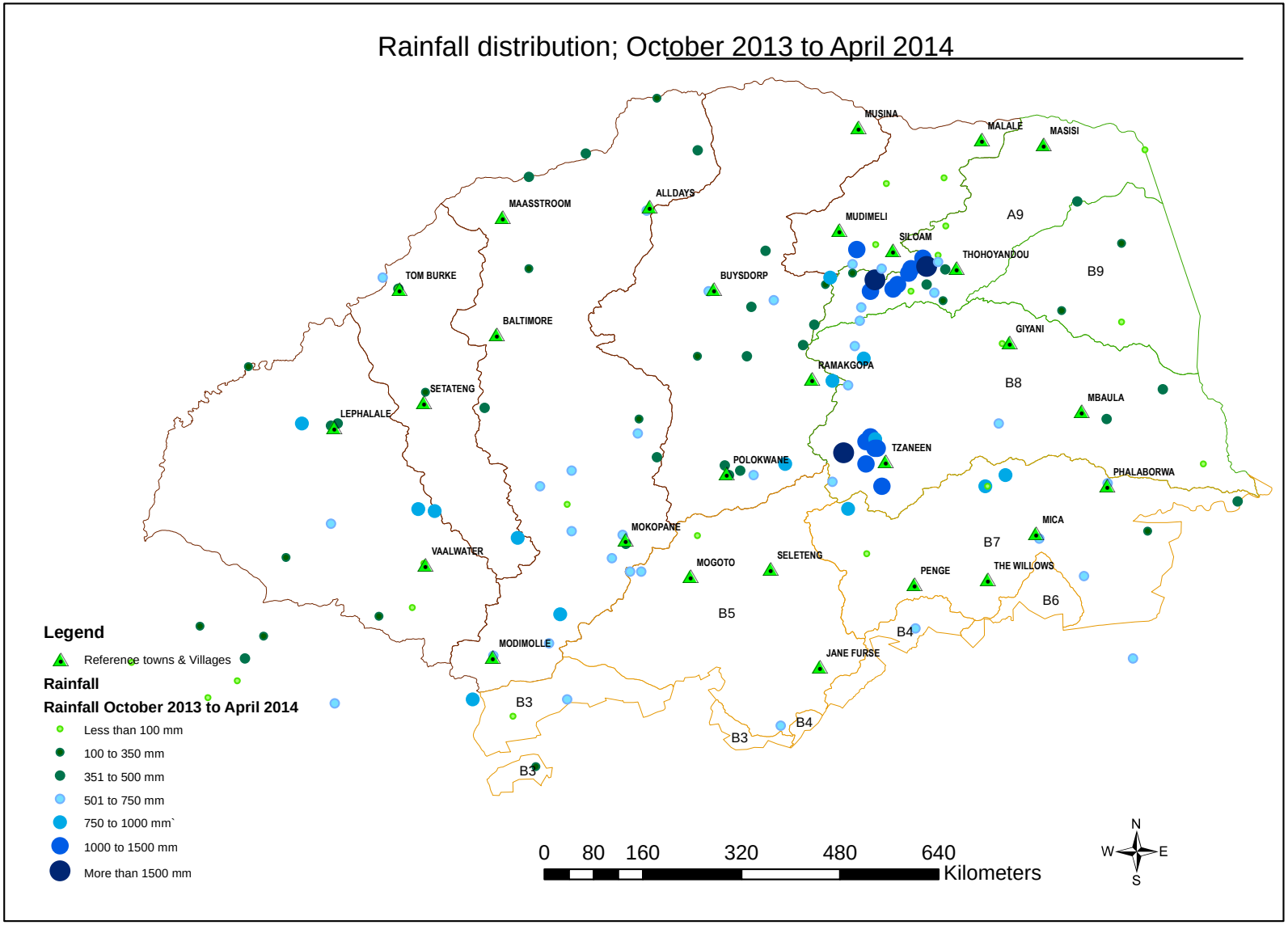
info@weathersa.co.zahttp://www.weathersa.co.za/

(Rainfall data for Limpopo Province)

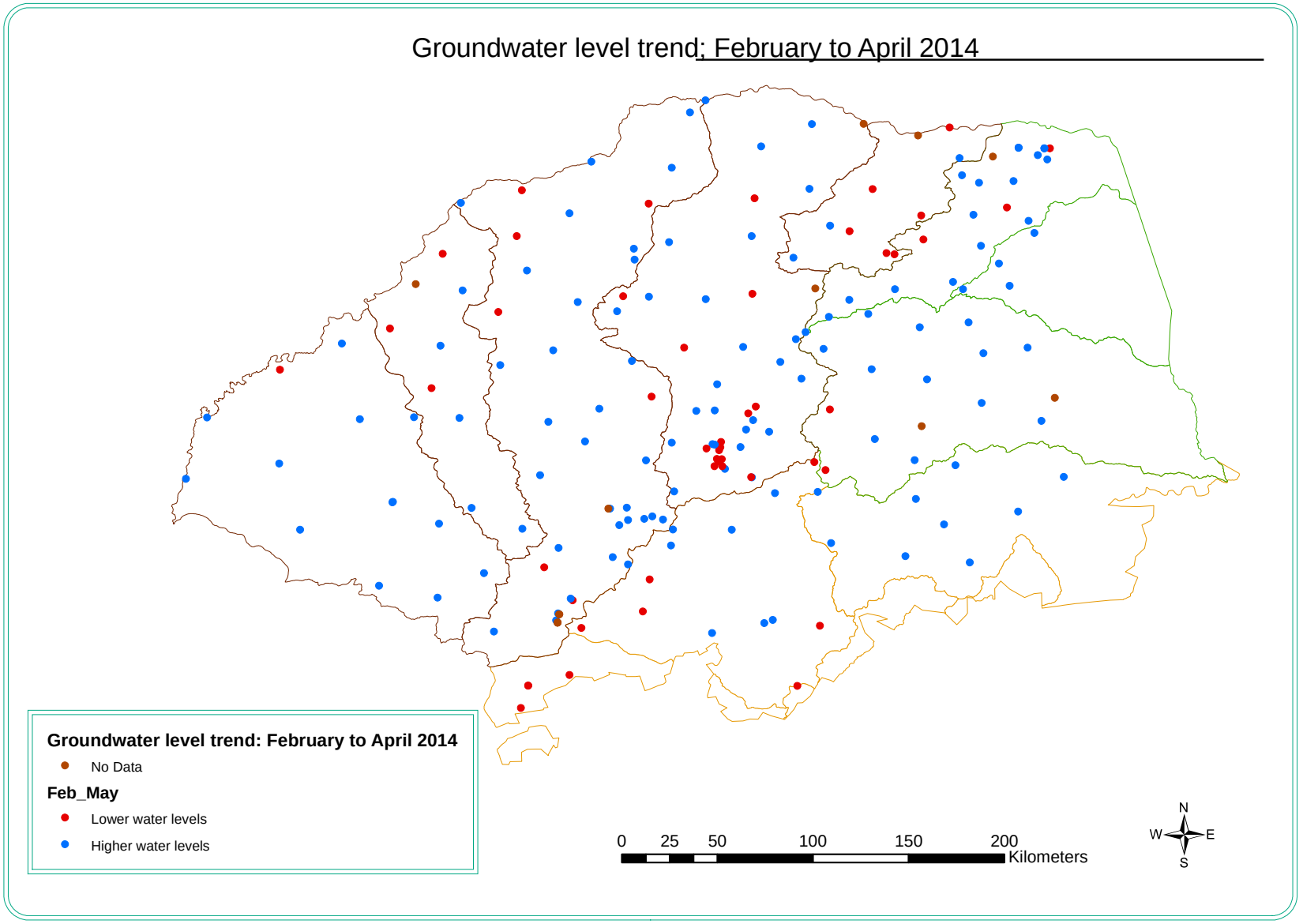
Distribution of Limpopo groundwater level monitoring stations



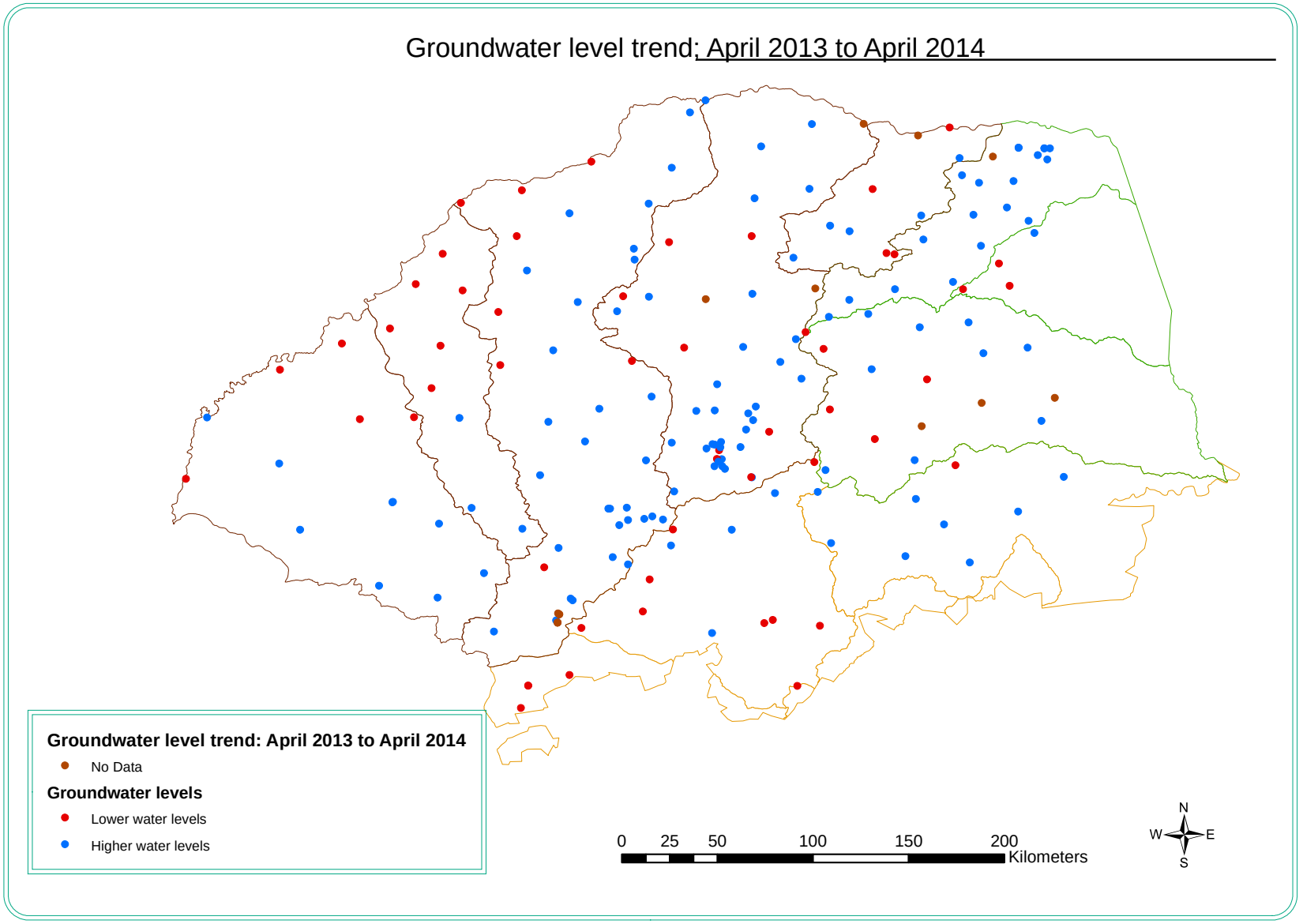
MAP 1


Rainfall distribution; October 2013 to April 2014
MUSINA
MALALE
MASISI
ALLDAYS
MAASSTROOM
MUDIMELI
A9
SILOAM
THOHOYANDOU
B9
TOM BURKE
BUYSDORP
BALTIMORE
GIYANI
RAMAKGOPA
B8
SETATENG
MBAULA
LEPHALALE
TZANEEN
POLOKWANE
PHALABORWA
MICA
MOKOPANE
B7
VAALWATER
SELETENG
MOGOTO
PENGE
THE WILLOWS
B6
B5
B4
MODIMOLLE
JANE FURSE
B3
B4
B3
B3
Legend
Reference towns & Villages
Rainfall
Rainfall October 2013 to April 2014
Less than 100 mm
100 to 350 mm
351 to 500 mm
501 to 750 mm
750 to 1000 mm`
1000 to 1500 mm
More than 1500 mm
0 80 160 320 480 640
Kilometers
N
W
E
S

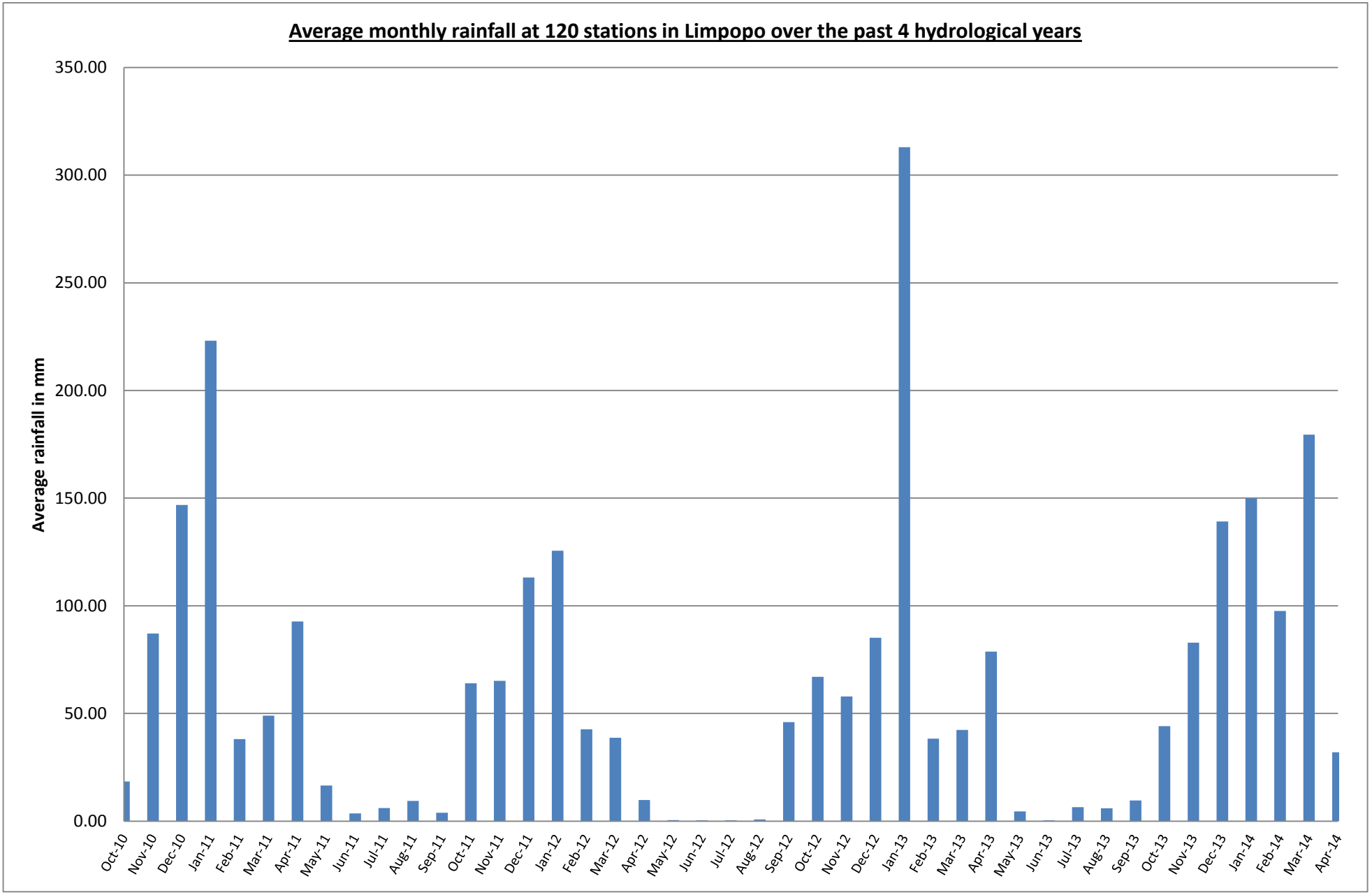
MAP 2


Groundwater level trend; February to April 2014
Groundwater level trend: February to April 2014
No Data
Feb_May
Lower water levels
Higher water levels
0 25 50 100 150 200
Kilometers
N
W
E
S

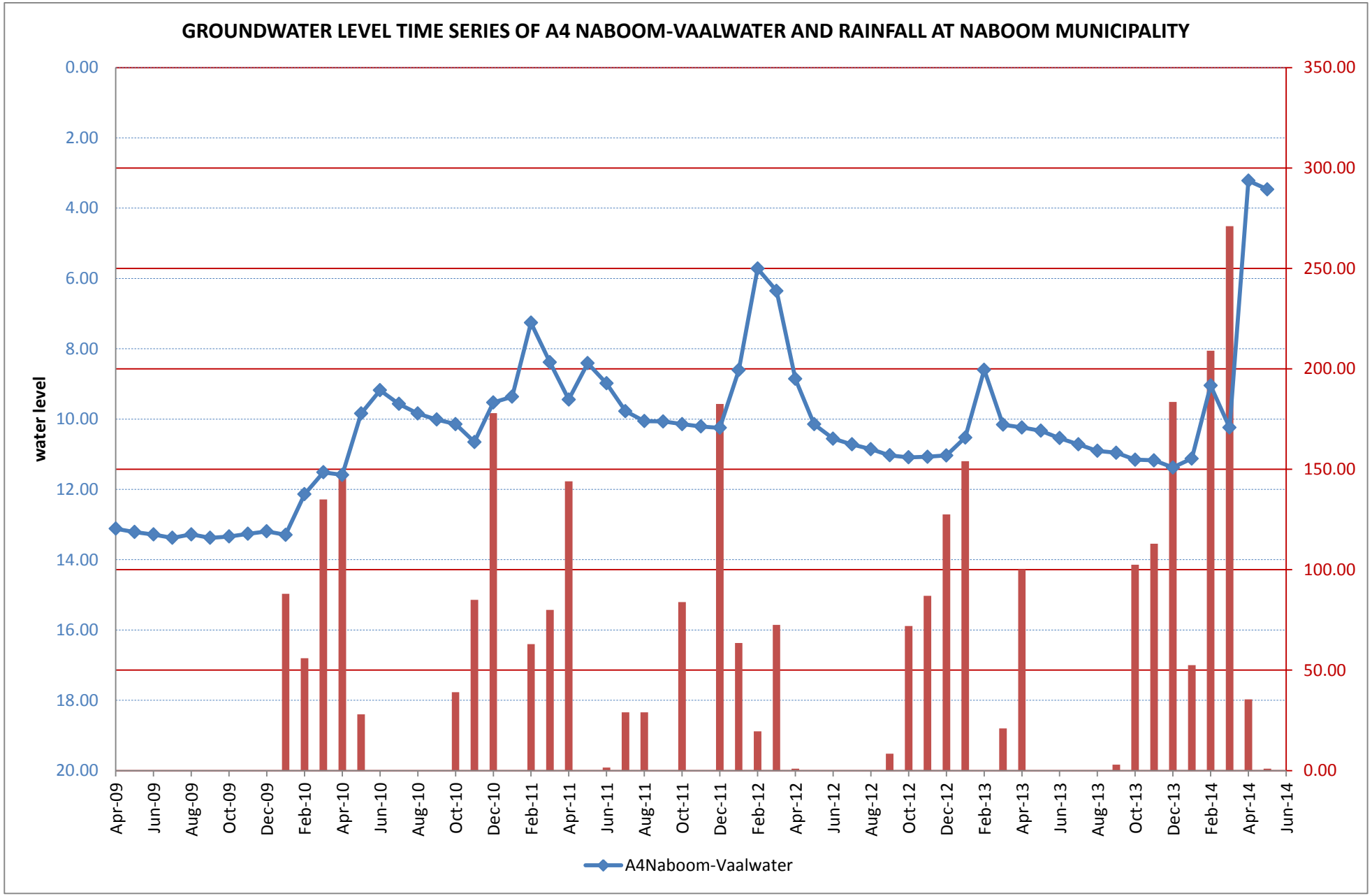
MAP 3


Groundwater level trend; April 2013 to April 2014
Groundwater level trend: April 2013 to April 2014
No Data
Groundwater levels
Lower water levels
Higher water levels
0 25 50 100 150 200
Kilometers
N
W
E
S

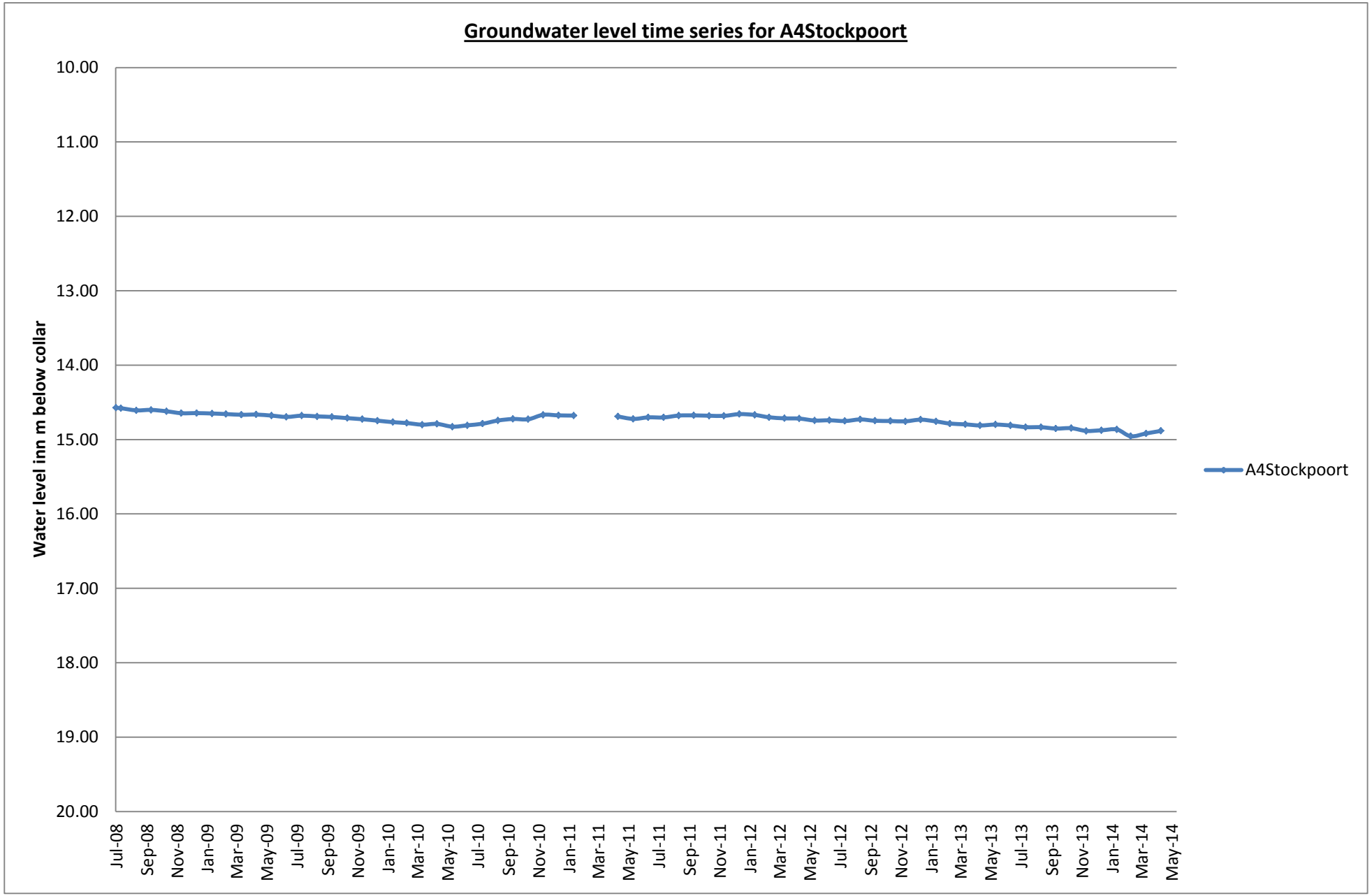
MAP 4


Average monthly rainfall at 120 stations in Limpopo over the past 4 hydrological years
Average rainfall in mm
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
May-12
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14

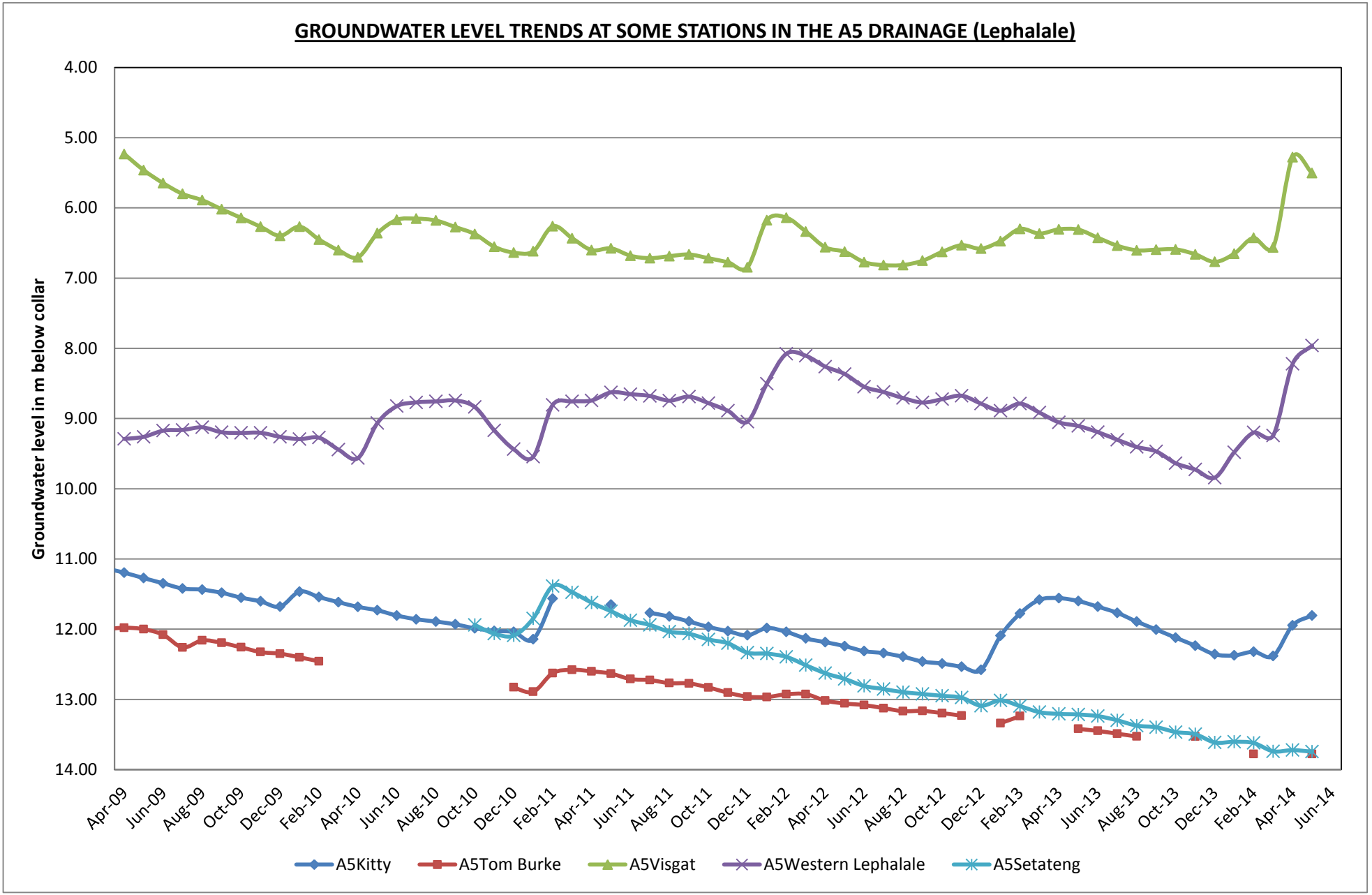
GRAPH 1


GROUNDWATER LEVEL TIME SERIES OF A4 NABOOM-VAALWATER AND RAINFALL AT NABOOM MUNICIPALITY
water level
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
A4Naboom-Vaalwater

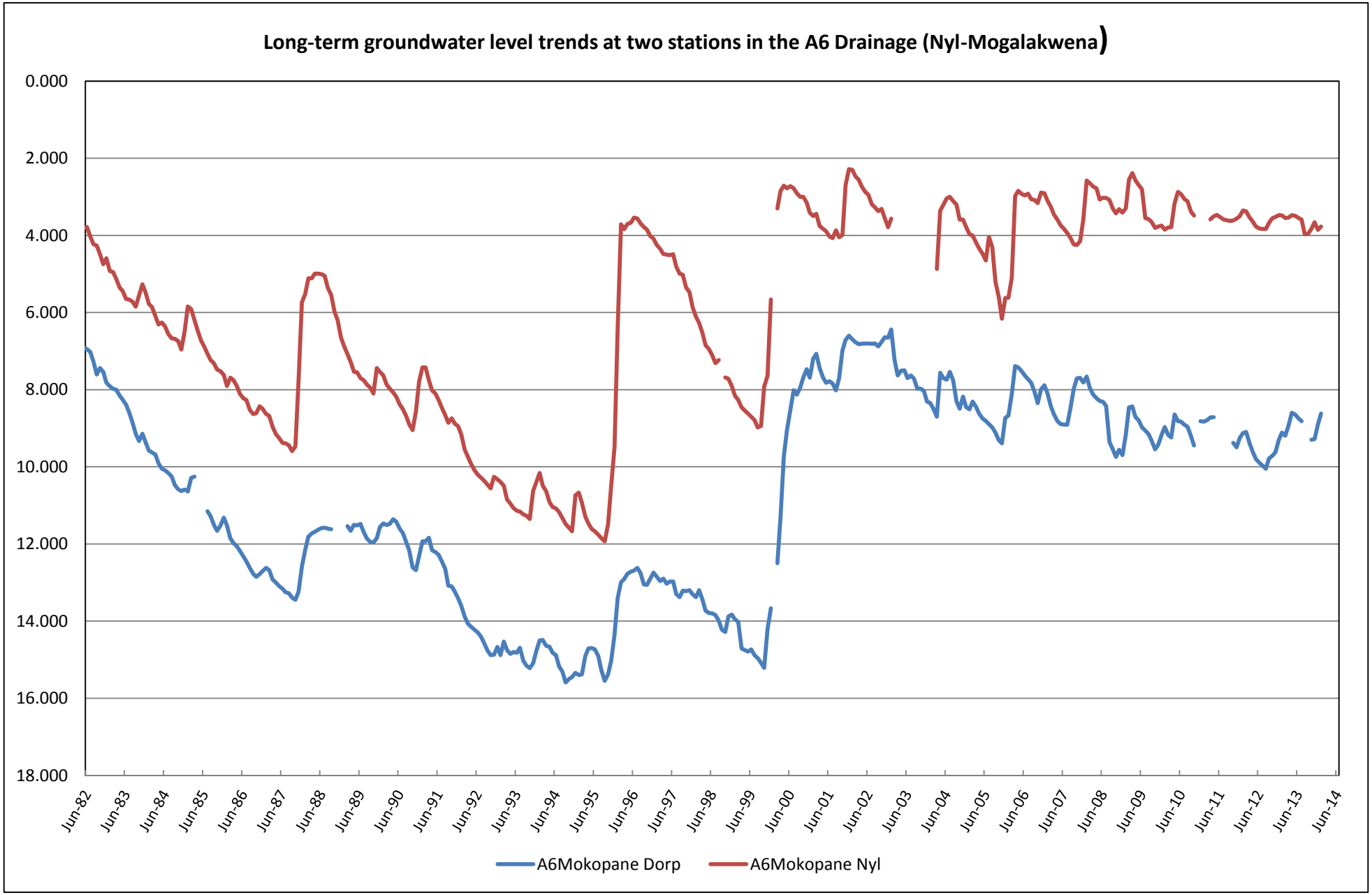
GRAPH 2


Groundwater level time series for A4Stockpoort
Water level inn m below collar
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
20.00
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Jan-10
Mar-10
May-10
Jul-10
Sep-10
Nov-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11
Nov-11
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
A4Stockpoort

GRAPH 3

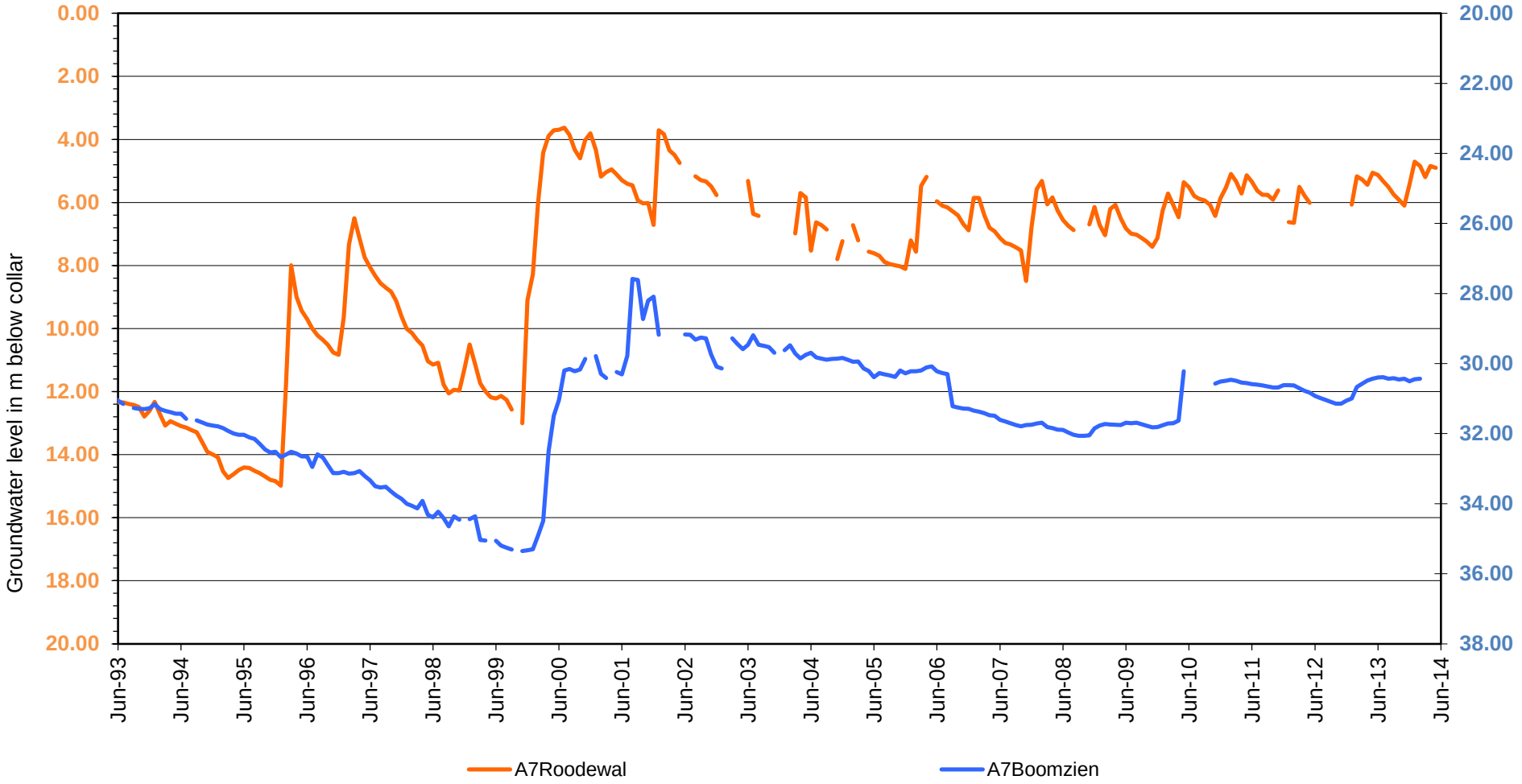

GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE A5 DRAINAGE (Lephalale)
Groundwater level in m below collar
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
13.00
14.00
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
A5Kitty
A5Tom Burke
A5Visgat
A5Western Lephalale
A5Setateng

GRAPH 4

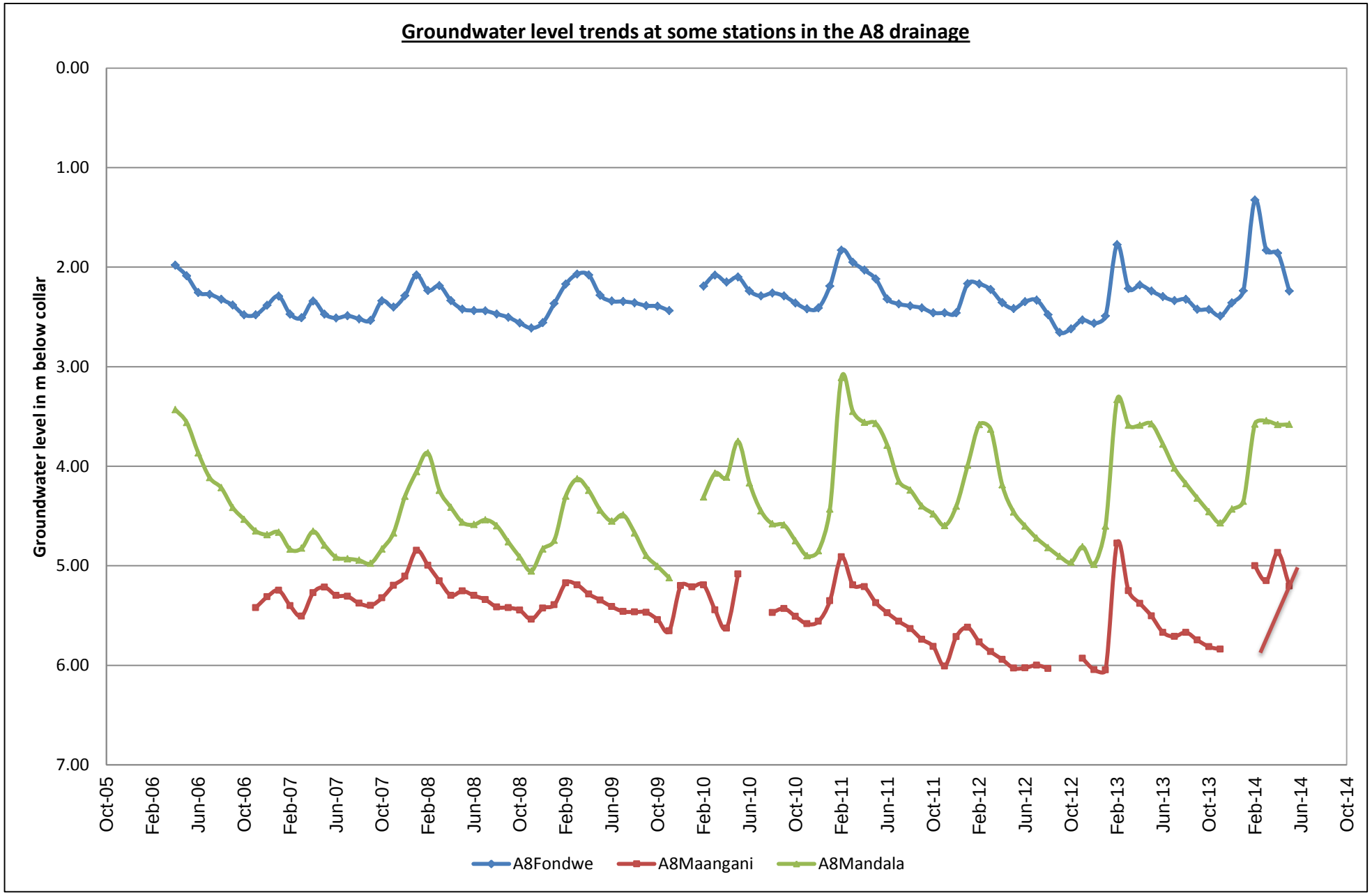

Long-term groundwater level trends at two stations in the A6 Drainage (Nyl-Mogalakwena)
0.000
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
18.000
Jun-82
Jun-83
Jun-84
Jun-85
Jun-86
Jun-87
Jun-88
Jun-89
Jun-90
Jun-91
Jun-92
Jun-93
Jun-94
Jun-95
Jun-96
Jun-97
Jun-98
Jun-99
Jun-00
Jun-01
Jun-02
Jun-03
Jun-04
Jun-05
Jun-06
Jun-07
Jun-08
Jun-09
Jun-10
Jun-11
Jun-12
Jun-13
Jun-14
A6Mokopane Dorp
A6Mokopane Nyl

GRAPH 5

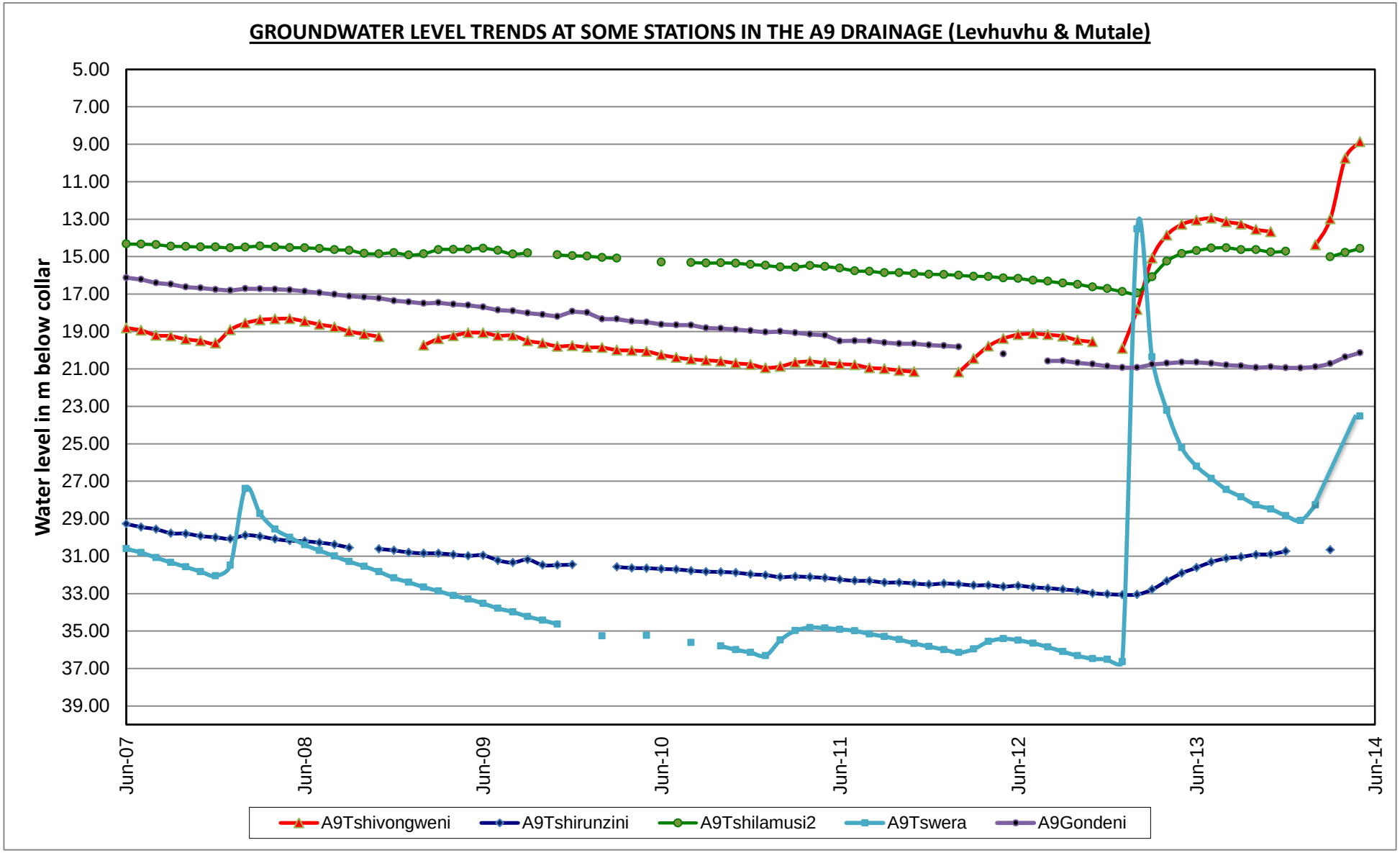
Long-term groundwater level trends at two stations in the A7 drainage



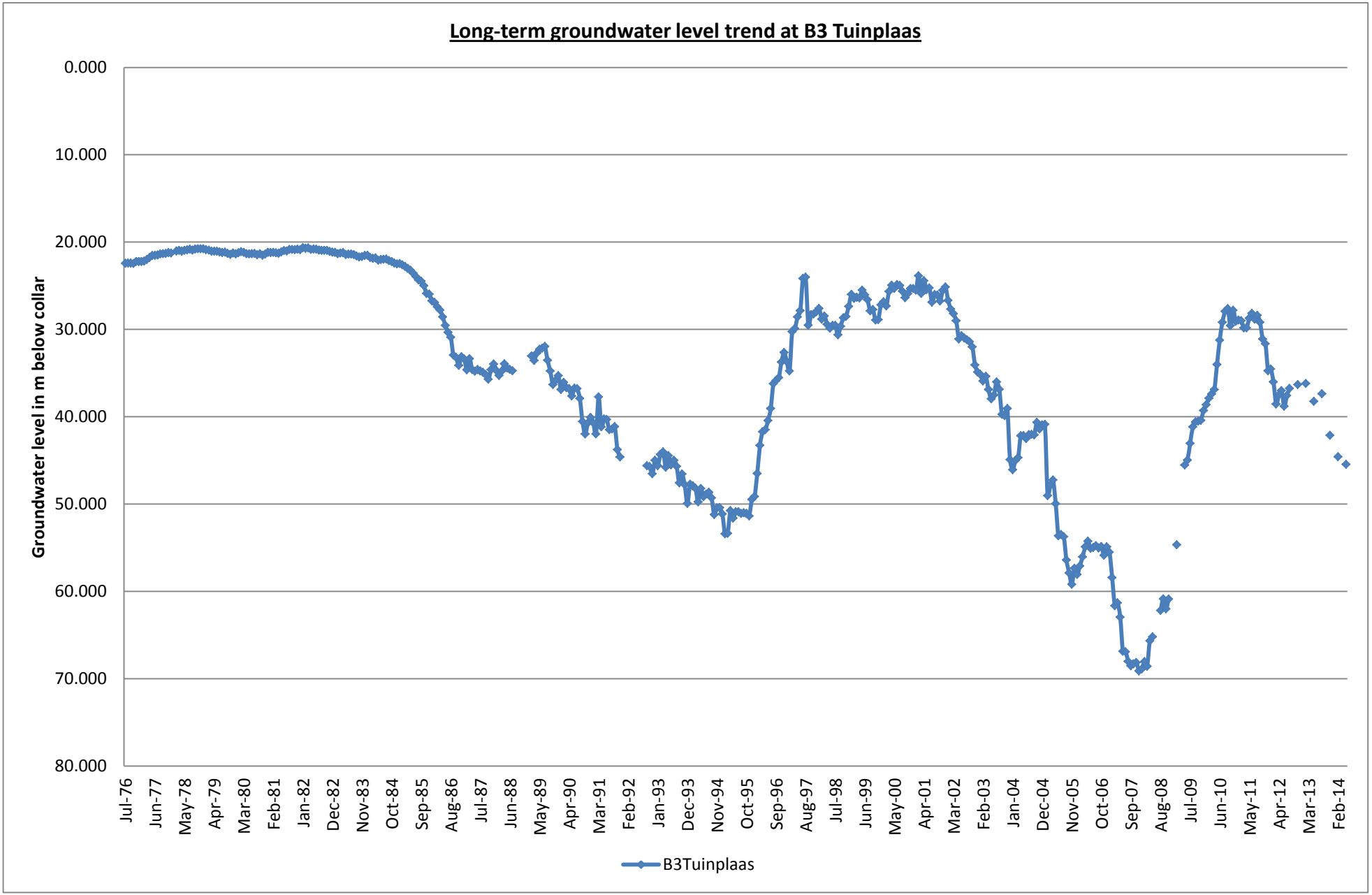
GRAPH 6


Groundwater level trends at some stations in the A8 drainage
Groundwater level in m below collar
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
Oct-05
Feb-06
Jun-06
Oct-06
Feb-07
Jun-07
Oct-07
Feb-08
Jun-08
Oct-08
Feb-09
Jun-09
Oct-09
Feb-10
Jun-10
Oct-10
Feb-11
Jun-11
Oct-11
Feb-12
Jun-12
Oct-12
Feb-13
Jun-13
Oct-13
Feb-14
Jun-14
Oct-14
A8Fondwe
A8Maangani
A8Mandala

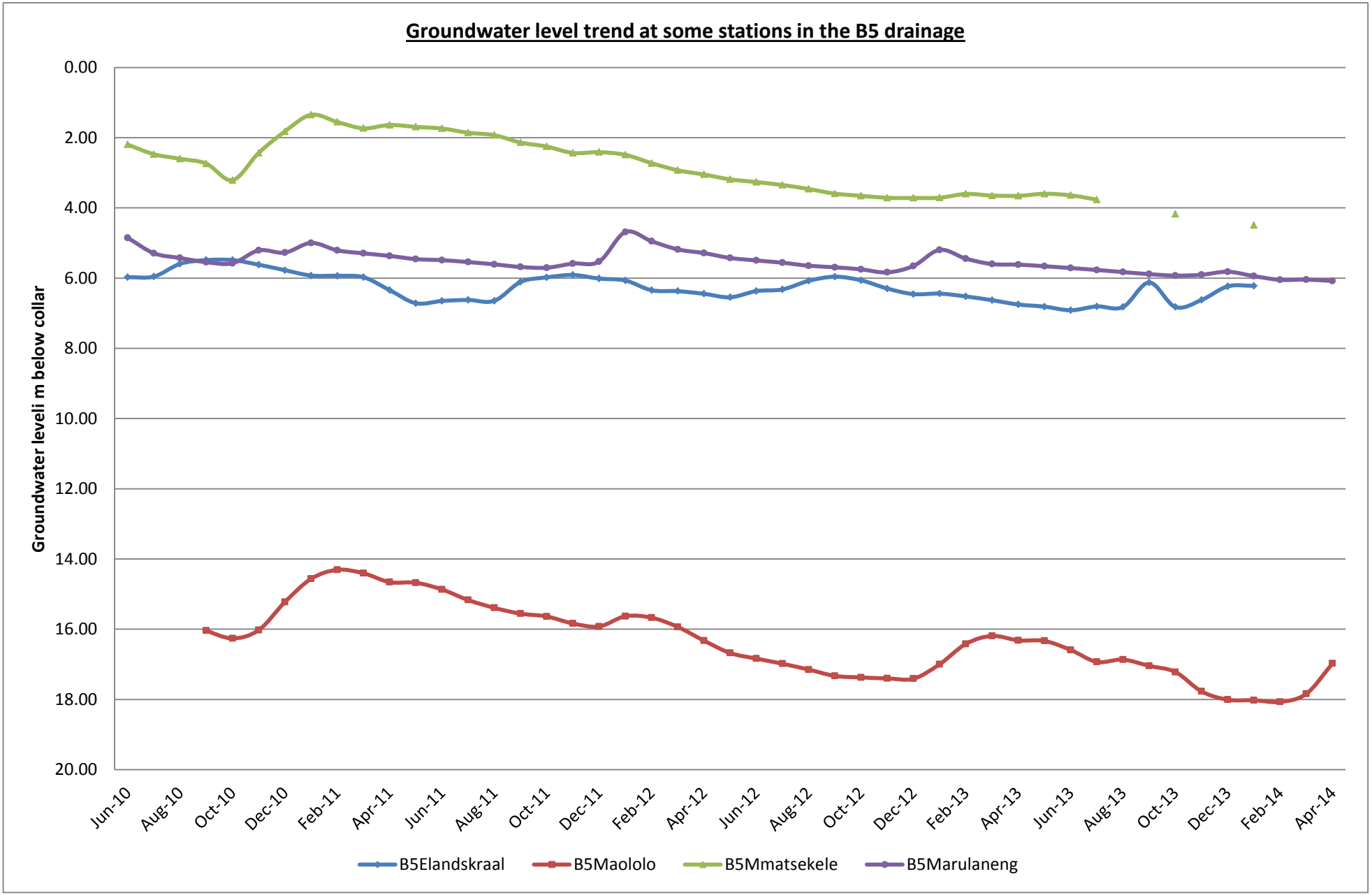
GRAPH 7


GROUNDWATER LEVEL TRENDS AT SOME STATIONS IN THE A9 DRAINAGE (Levhuvhu & Mutale)
Water level in m below collar
5.00
7.00
9.00
11.00
13.00
15.00
17.00
19.00
21.00
23.00
25.00
27.00
29.00
31.00
33.00
35.00
37.00
39.00
Jun-07
Jun-08
Jun-09
Jun-10
Jun-11
Jun-12
Jun-13
Jun-14
A9Tshivongweni
A9Tshirunzini
A9Tshilamusi2
A9Tswera
A9Gondeni

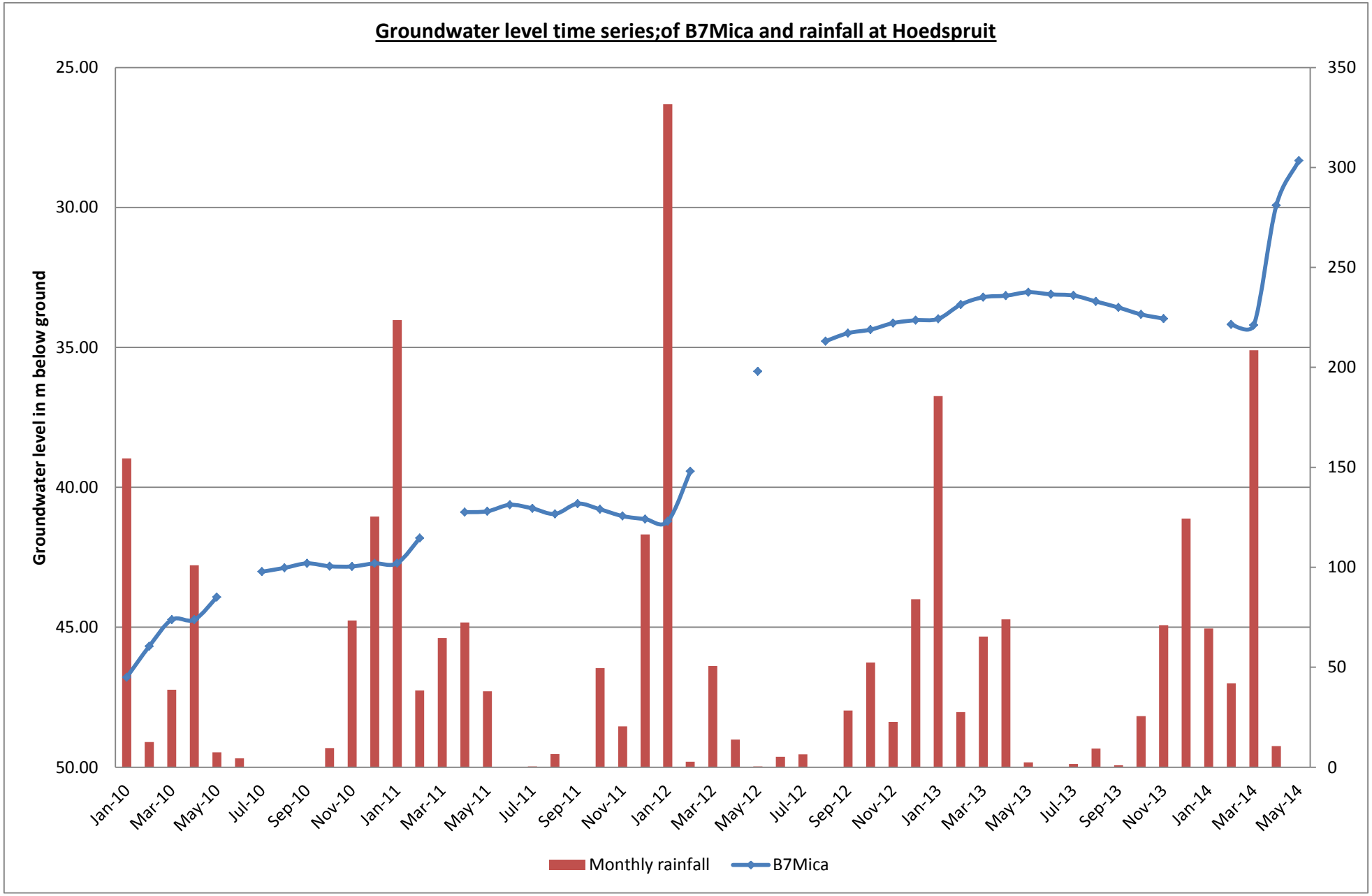
GRAPH 8


Long-term groundwater level trend at B3 Tuinplaas
Groundwater level in m below collar
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
Jul-76
Jun-77
May-78
Apr-79
Mar-80
Feb-81
Jan-82
Dec-82
Nov-83
Oct-84
Sep-85
Aug-86
Jul-87
Jun-88
May-89
Apr-90
Mar-91
Feb-92
Jan-93
Dec-93
Nov-94
Oct-95
Sep-96
Aug-97
Jul-98
Jun-99
May-00
Apr-01
Mar-02
Feb-03
Jan-04
Dec-04
Nov-05
Oct-06
Sep-07
Aug-08
Jul-09
Jun-10
May-11
Apr-12
Mar-13
Feb-14
B3Tuinplaas

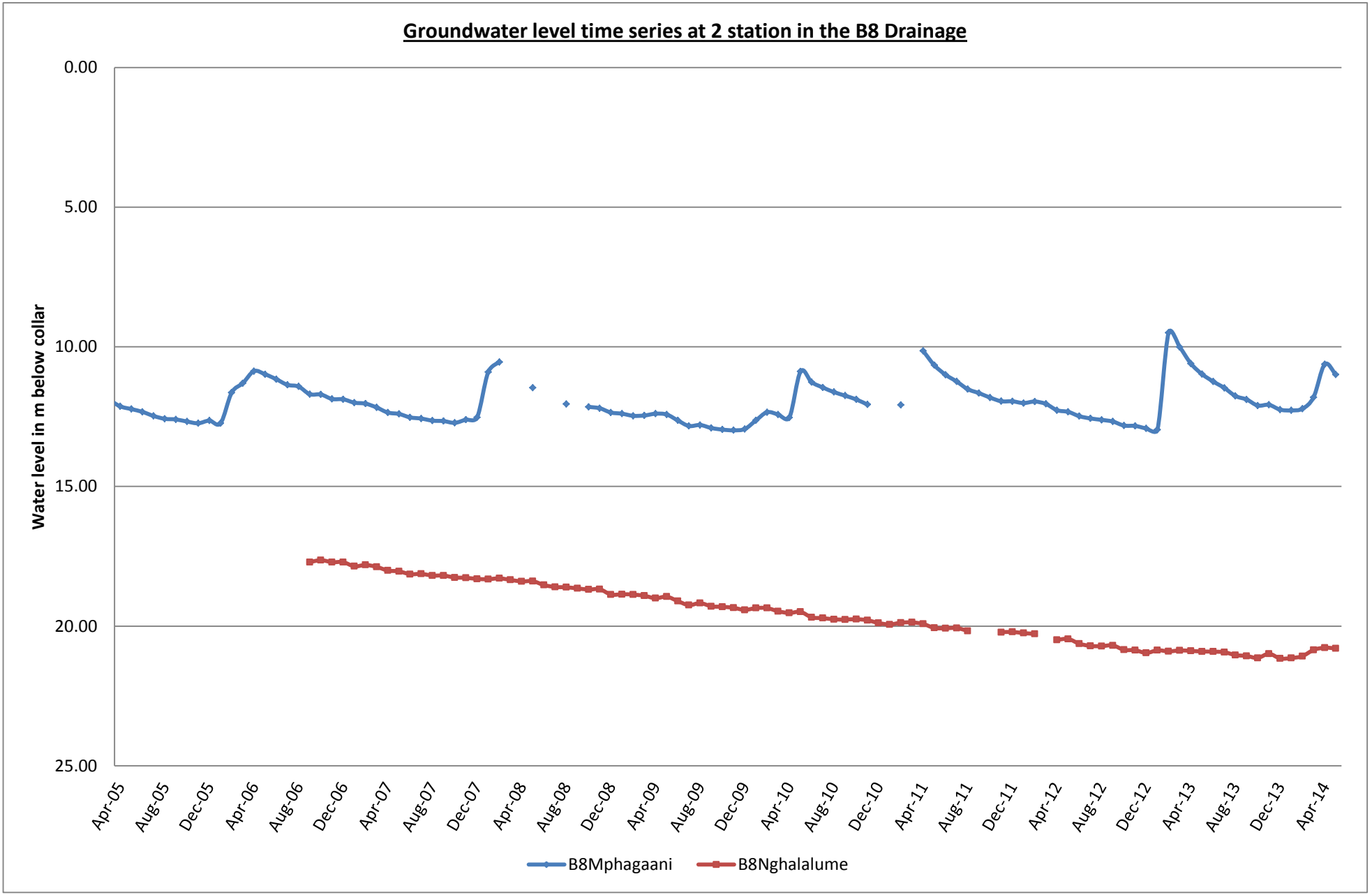
GRAPH 9


Groundwater level trend at some stations in the B5 drainage
Groundwater leveli m below collar
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Jun-10
Aug-10
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
B5Elandskraal
B5Maololo
B5Mmatsekele
B5Marulaneng

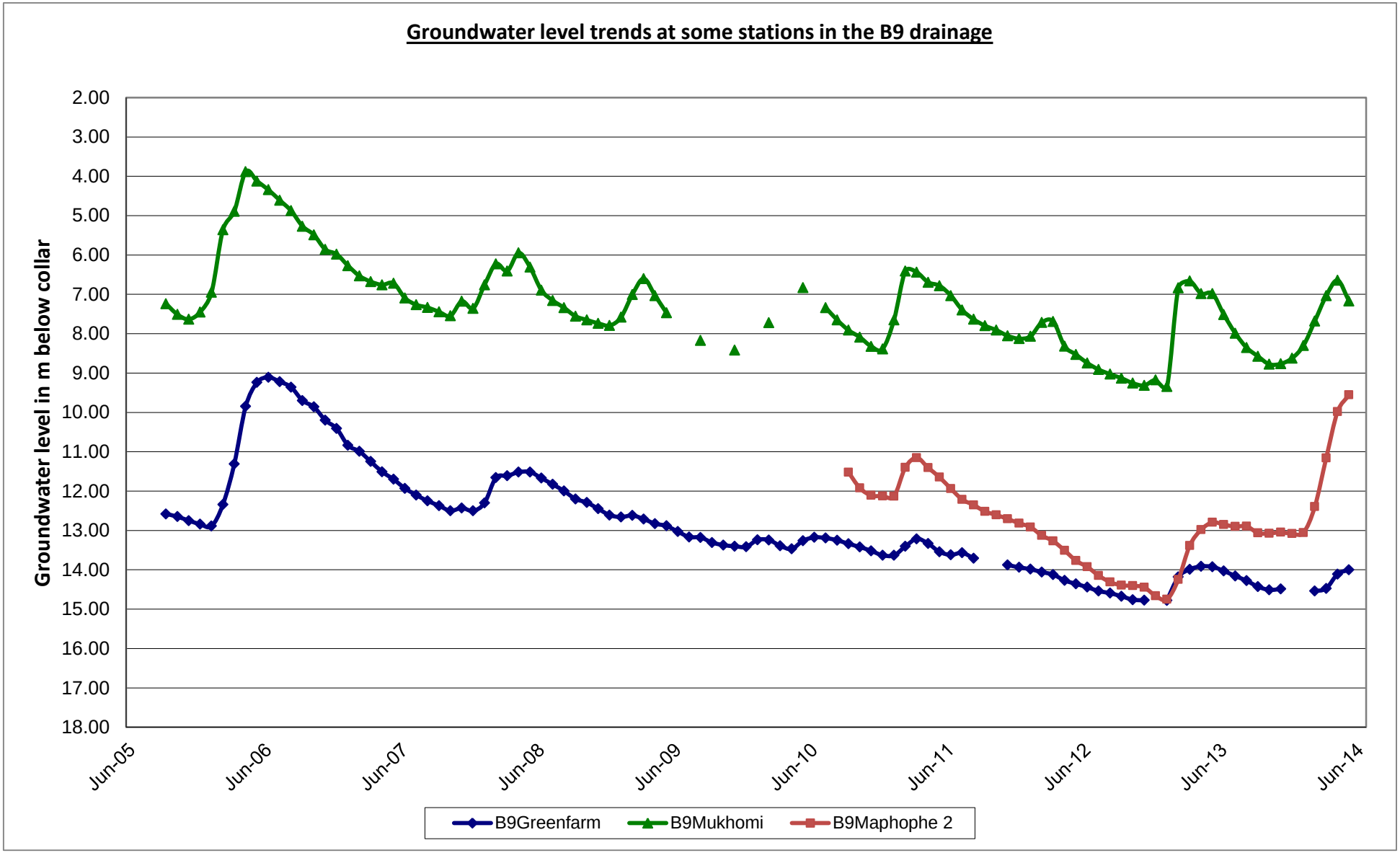
GRAPH 10


Groundwater level time series;of B7Mica and rainfall at Hoedspruit
Groundwater level in m below ground
25.00
30.00
35.00
40.00
45.00
50.00
350
300
250
200
150
100
50
0
Jan-10
Mar-10
May-10
Jul-10
Sep-10
Nov-10
Jan-11
Mar-11
May-11
Jul-11
Sep-11
Nov-11
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Monthly rainfall
B7Mica

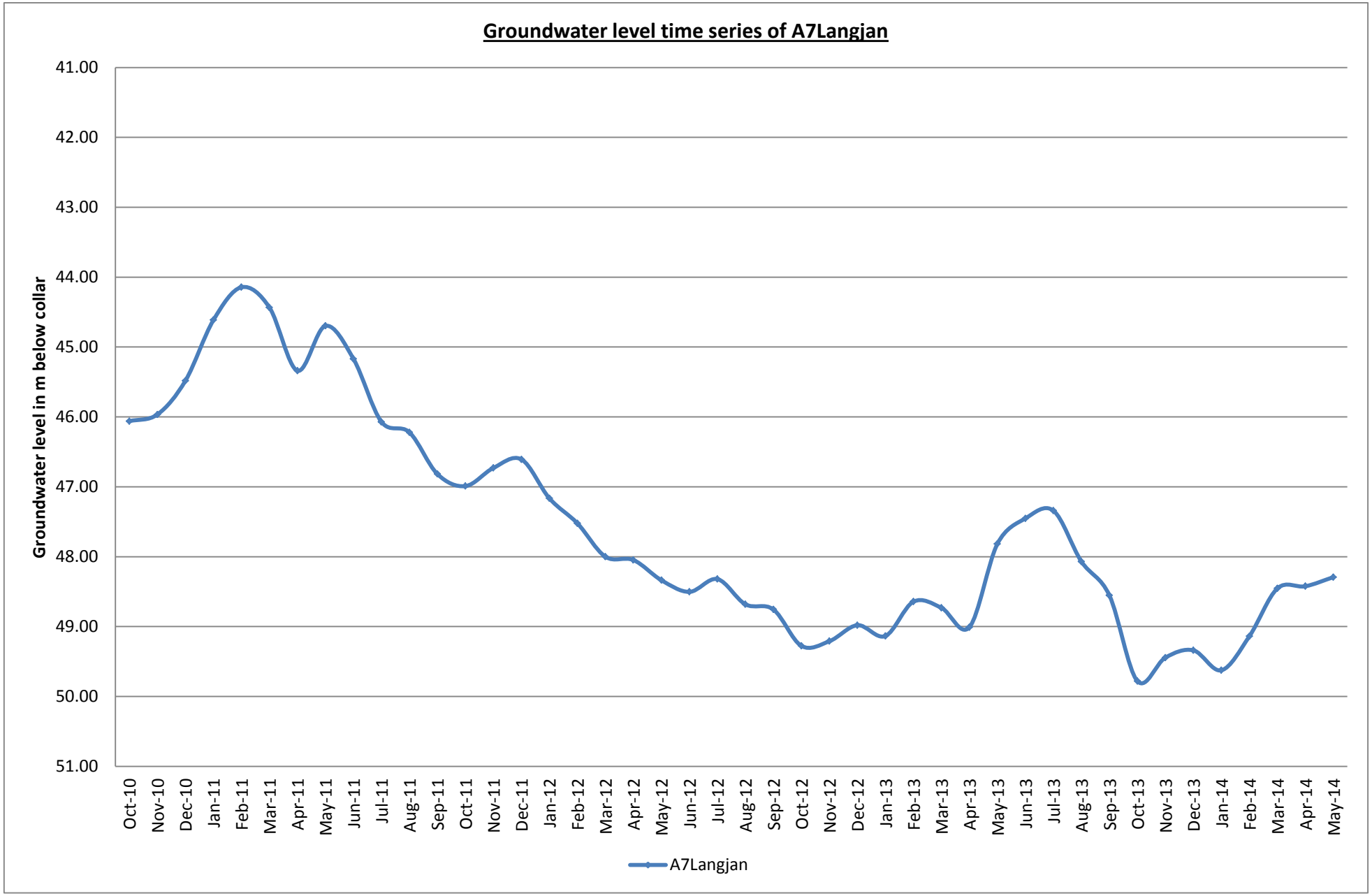
GRAPH 11


Groundwater level time series at 2 station in the B8 Drainage
Water level in m below collar
0.00
5.00
10.00
15.00
20.00
25.00
Apr-05
Aug-05
Dec-05
Apr-06
Aug-06
Dec-06
Apr-07
Aug-07
Dec-07
Apr-08
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
B8Mphagaani
B8Nghalalume

GRAPH 12


Groundwater level trends at some stations in the B9 drainage
Groundwater level in m below collar
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
Jun-05
Jun-06
Jun-07
Jun-08
Jun-09
Jun-10
Jun-11
Jun-12
Jun-13
Jun-14
B9Greenfarm
B9Mukhomi
B9Maphophe 2

GRAPH 13


Groundwater level time series of A7Langjan
Groundwater level in m below collar
41.00
42.00
43.00
44.00
45.00
46.00
47.00
48.00
49.00
50.00
51.00
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
May-12
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
A7Langjan

GRAPH 14