

Appendix J


Groundwater level assessment – Bore hydrographs



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Rev [0]

[April 2012]



Introduction

This appendix includes groundwater level data from data loggers installed in eight Gubberamunda Sandstone and Springbok Formation bores on QGC tenements in 2011.

QGC will continue to install data loggers in selected monitoring bores that will be constructed during the course of the Stage 2 WMMP.

The first major assessment of groundwater level trends based on continuous level monitoring will be reported in April 2013.

FILE NOTE

SUBJECT: QGC STAGE 1 GROUNDWATER
MONITORING BORE DATA LOGGER SUMMARY

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PROJECT: GROUNDWATER

Provided here is a summary of QGC's existing groundwater monitoring data logger network, downloaded 23 February, 2012. Further details of the bores and their groundwater level trends are provided in Table 1 below. Hydrographs are presented in Attachment A.

Berwyndale South GW1 (BWS GW1)

BWS GW1 is screened in the Gubberamunda Sandstone. While the potentiometric level fluctuates on a 24-hour scale between 0.01 and 0.07 m, during the full five-month period of record, potentiometric level fluctuates 0.2 m (between 21.02 m and 21.22 m), regularly oscillating +/- 0.1 m around an average of 21.12 m. Following the eight-hour constant rate pump test, potentiometric level completely recovers within 15 days.

Berwyndale South GW2 (BWS GW2)

BWS GW2 is screened across the Springbok Sandstone. The potentiometric level fluctuates on a daily basis up to 0.05 m and over the period of record by up to 0.12 m. Following the eight-hour constant rate pump test, potentiometric level does not recover and has remained 0.3 m below pre-test levels possibly indicating low leakage rates or an aquifer of finite extent here. BWS GW1 and BWS GW2 are located adjacent to each other and their potentiometric levels indicate that the vertical hydraulic gradient between the two aquifers in this location is 15 m upward from Springbok to Gubberamunda.

Lauren GW1 (LRN GW1)

LRN GW1 is screened across the Gubberamunda Sandstone. Initial potentiometric level readings indicated that the screen was blocked, as depth to water measurements displayed an anomalous decreasing trend. The well was cleared out during additional air lift development four months after initial well drilling, after which it produced water level measurements reflective of true aquifer water levels from November 2011. Daily potentiometric levels fluctuate up to 0.07 m; there is an overall decline over the period of record of 0.2 m according to logger data, but not according to manual readings. The reasons for the difference in the values for the logger data compared to manual readings is at this stage unknown, however could be due to factors such as logger hanger cable stretch. Potentiometric levels following the eight-hour constant rate pump test on 14-15 November appear to have recovered fully within a week.

Lauren GW2 (LRN GW2)

LRN GW2 is screened across the Springbok Sandstone. While potentiometric level fluctuates on a 24-hour scale up to 0.07 m, during the full five-month period of record, potentiometric levels fluctuate regularly by 0.1 m on a weekly basis. Following the eight-hour constant rate pump test, potentiometric level completely recovers within 10 days. LRN GW1 and LRN GW2 are located adjacent to each other and their potentiometric levels indicate that the vertical hydraulic gradient between the two aquifers in this location is 40 m upward from Springbok to Gubberamunda.

Kenya East GW1 (KEE GW1)

KEE GW1 is screened in the Gubberamunda Sandstone. Manual groundwater level measurements show a dip in potentiometric level in August 2011, which was likely the result of extraction from a nearby Gubberamunda bore by QGC and local council for the purpose of road works. Daily potentiometric level fluctuations are typically up to 0.05 m; an exception occurs at end of record on 20 February when water level increased 0.11 m within 24 hours, which at this stage is unable to be explained. Following the constant rate pump test, potentiometric levels decreased 0.6 m and haven't fully recovered, remaining at 0.4 m below pre-test water levels.

Kenya East GW2 (KEE GW2)

KEE GW2 is screened in the Springbok Sandstone. While potentiometric level fluctuates on a daily scale up to 0.06 m, during the full five-month period of record, potentiometric levels fluctuate regularly by 0.1 m on a weekly basis. Following the eight-hour constant rate pump test, the potentiometric level completely recovers within six weeks. KEE GW1 and KEE GW2 are located adjacent to each other and their potentiometric levels indicate that the vertical hydraulic gradient between the two aquifers in this location is 27 m upward from Springbok to Gubberamunda.

Poppy GW1 (PPY GW1)

PPY GW1 is screened in the Springbok Sandstone. Potentiometric levels fluctuate minimally in this bore, up to 0.04 m across the record period. Potentiometric levels are very slow to recover following the pump test, remaining 0.3 m below pre-test levels. These may be indications of low permeability formation zone, very low rates of leakage to aid recovery, and/or a finite aquifer extent.

Poppy GW2 (PPY GW2)

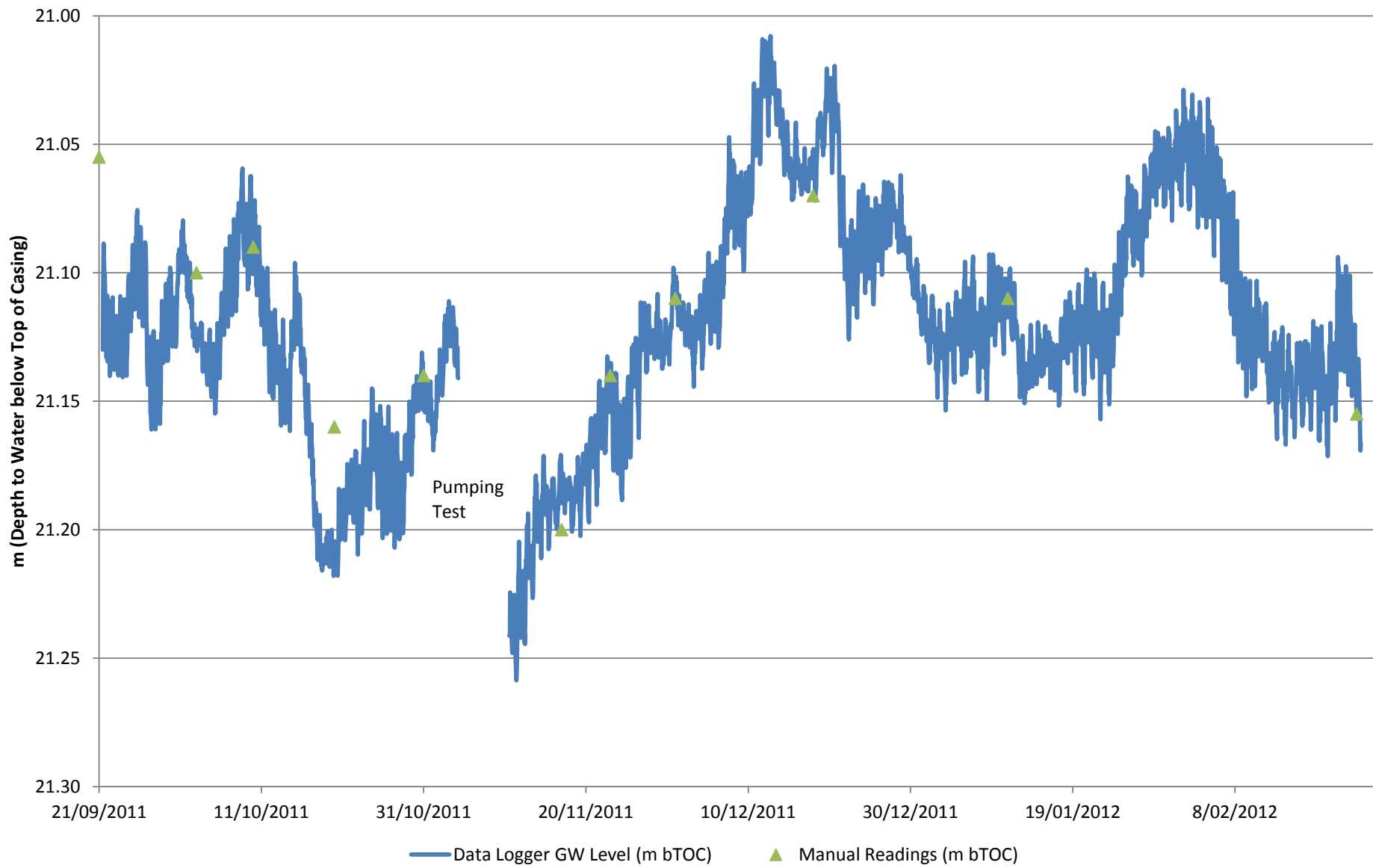
PPY GW2 is screened 50 m deeper than PPY GW1 in the Springbok Sandstone. While potentiometric level fluctuates on a daily scale up to 0.07 m, during the full five-month period of record, potentiometric levels fluctuate regularly by 0.1 m on a weekly basis. Potentiometric levels following the eight-hour constant rate pump test on 13-14 October appear to have recovered fully within two weeks. PPY GW1 and PPY GW2 are located adjacent to each other and their potentiometric levels indicate that the vertical hydraulic gradient within the Springbok at this location is downward, measured here as an average of 8.5 m. This downwards vertical gradient in potentiometric levels is in contrast to the other monitoring sites and the reason for this is at this stage unknown.

Table 1. Summary of Groundwater Level Data from QGC Monitoring Bores with Data Loggers

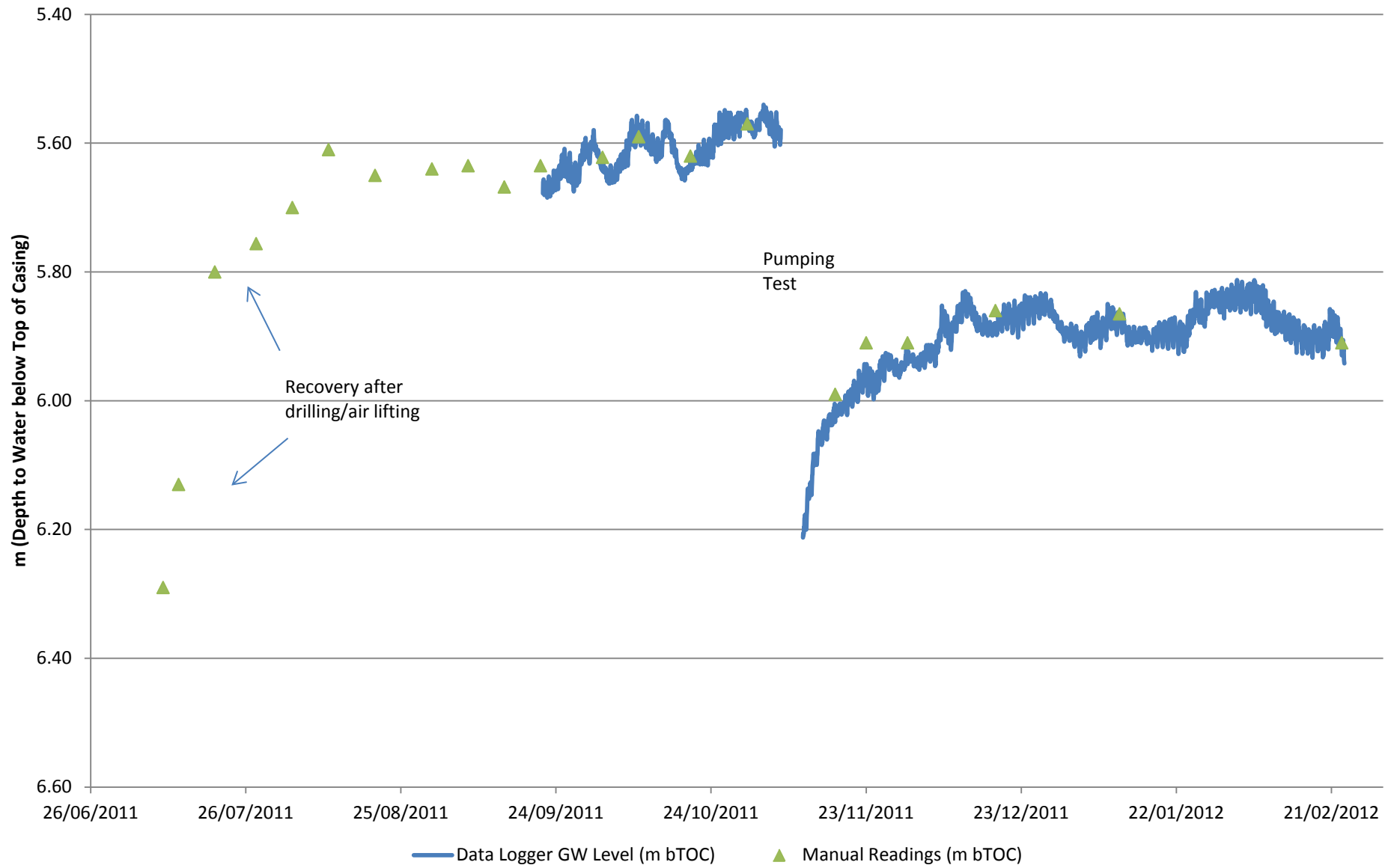
Bore ID	Contributing Aquifer	Screen Interval (m depth bgl)	Record Start Date	Long Term Trend (Daily Average)	Short Term Trends (Range of Daily Fluctuations between Max and Min WL)	Average Vertical Head Gradient between Gubberamunda and Springbok
Berwyndale Sth GW1	Gubberamunda Sandstone	100 – 105	Data Logger: 21/09/2011; Manual: 10/07/2011	+0.02 m/154 d	Daily Δ s between max and min range = 0.01 m– 0.07 m	Upward Δ 15.4 m
Berwyndale Sth GW2	Springbok Sandstone (mid)	225 – 230	Data Logger: 21/09/2011; Manual: 10/07/2011	-0.4 m/154 d; not fully recovered after pumping test	Daily Δ s between max and min range = 0.01 m – 0.05 m	
Lauren GW1	Gubberamunda Sandstone	170 – 175	Data Logger: 23/11/2011; Manual: 23/11/2011	-0.19 m/91 d; not fully recovered after pumping test	Daily Δ s between max and min range = 0.02 m – 0.07 m	Upward Δ 40.5 m
Lauren GW2	Springbok Sandstone (lower)	305 – 310	Data Logger: 21/09/2011; Manual: 28/07/2011	+0.11 m/154 d	Daily Δ s between max and min range = 0.02 m – 0.07 m	
Kenya East GW1	Gubberamunda Sandstone	98 – 103	Data Logger: 21/09/2011; Manual: 27/05/2011	-0.48 m/154 d; not fully recovered after pumping test	Daily Δ s between max and min range = 0.01 m – 0.11 m	Upward Δ 26.8 m
Kenya East GW2	Springbok Sandstone (mid)	250 – 255	Data Logger: 21/09/2011; Manual: 25/06/2011	+0.08 m/154 d	Daily Δ s between max and min range = 0.02 m – 0.06 m	
Poppy GW1	Springbok Sandstone (mid)	122 – 127	Data Logger: 21/09/2011; Manual: 29/06/2011	-0.28 m/154 d	Daily Δ s between max and min range = 0.01 m – 0.04 m	Downward Δ 8.5 m (within Springbok only)
Poppy GW2	Springbok Sandstone (lower)	172 - 177	Data Logger: 24/11/2011; Manual: 10/06/2011	+0.04 m/91 d	Daily Δ s between max and min range = 0.02 m – 0.07 m	

Attachment A Monitoring Hydrographs

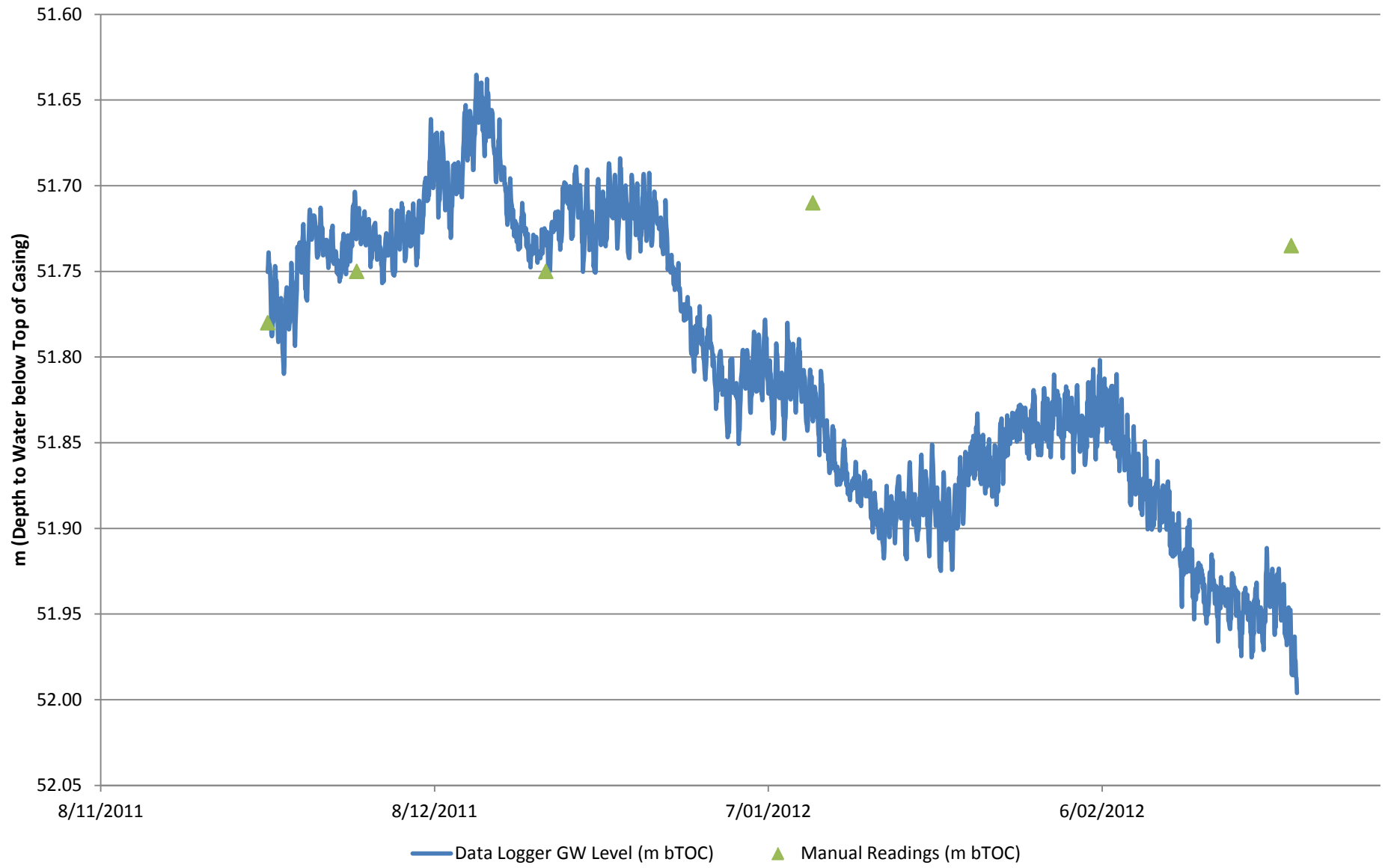
Berwyndale South GW1 (Gubberamunda)



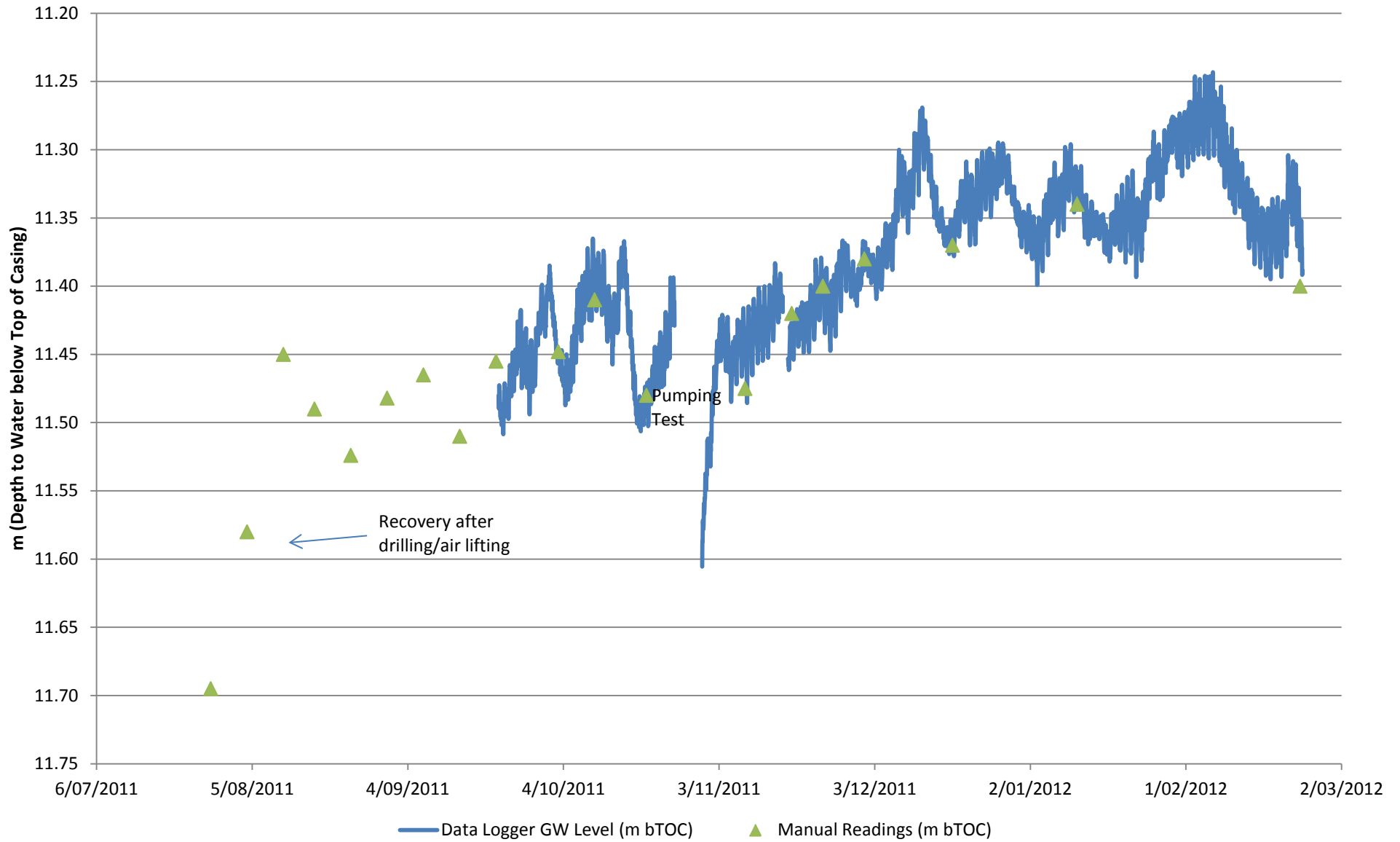
Berwyndale South GW2 (Springbok)



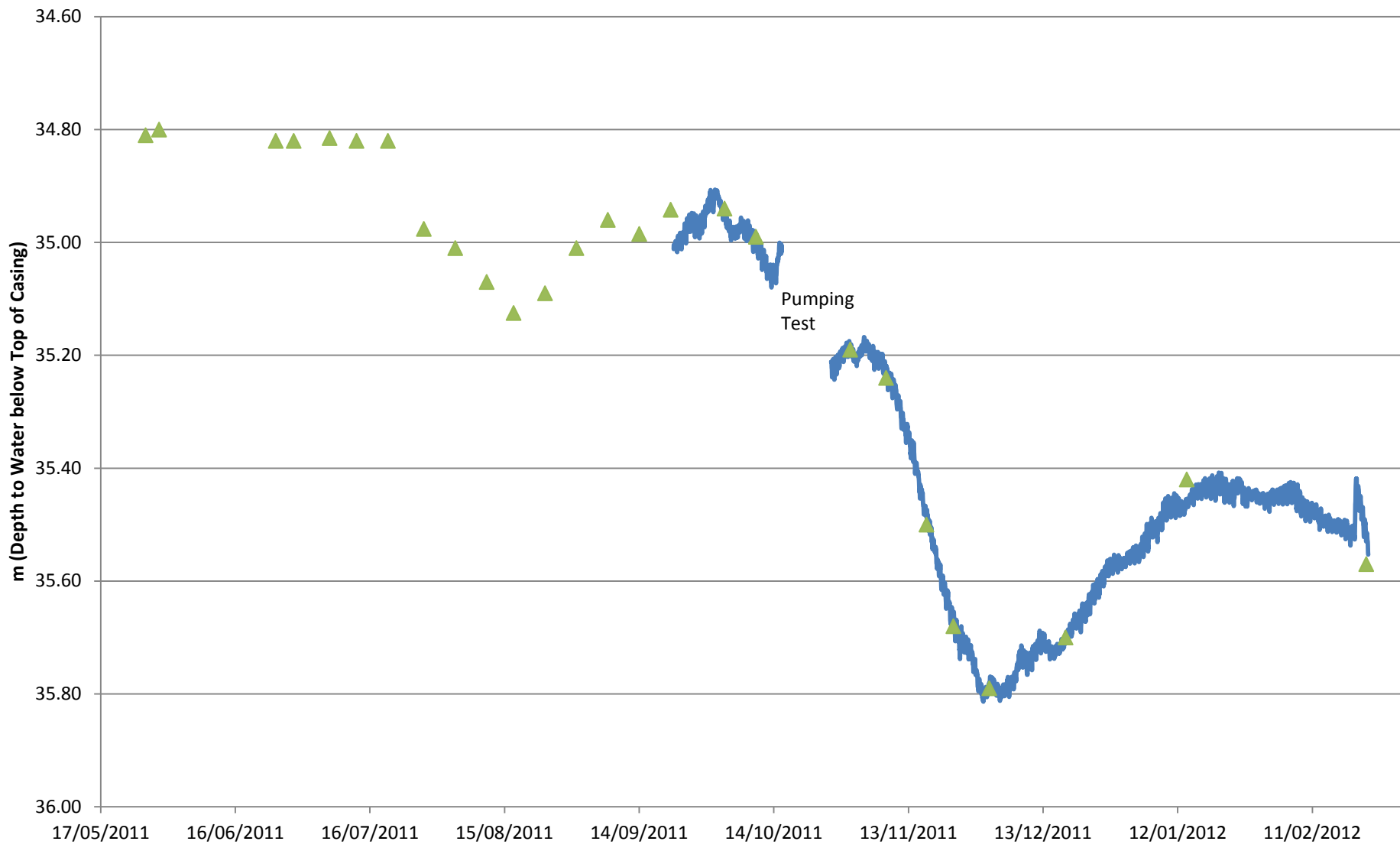
Lauren GW1 (Gubberamunda)



Lauren GW2 (Springbok)

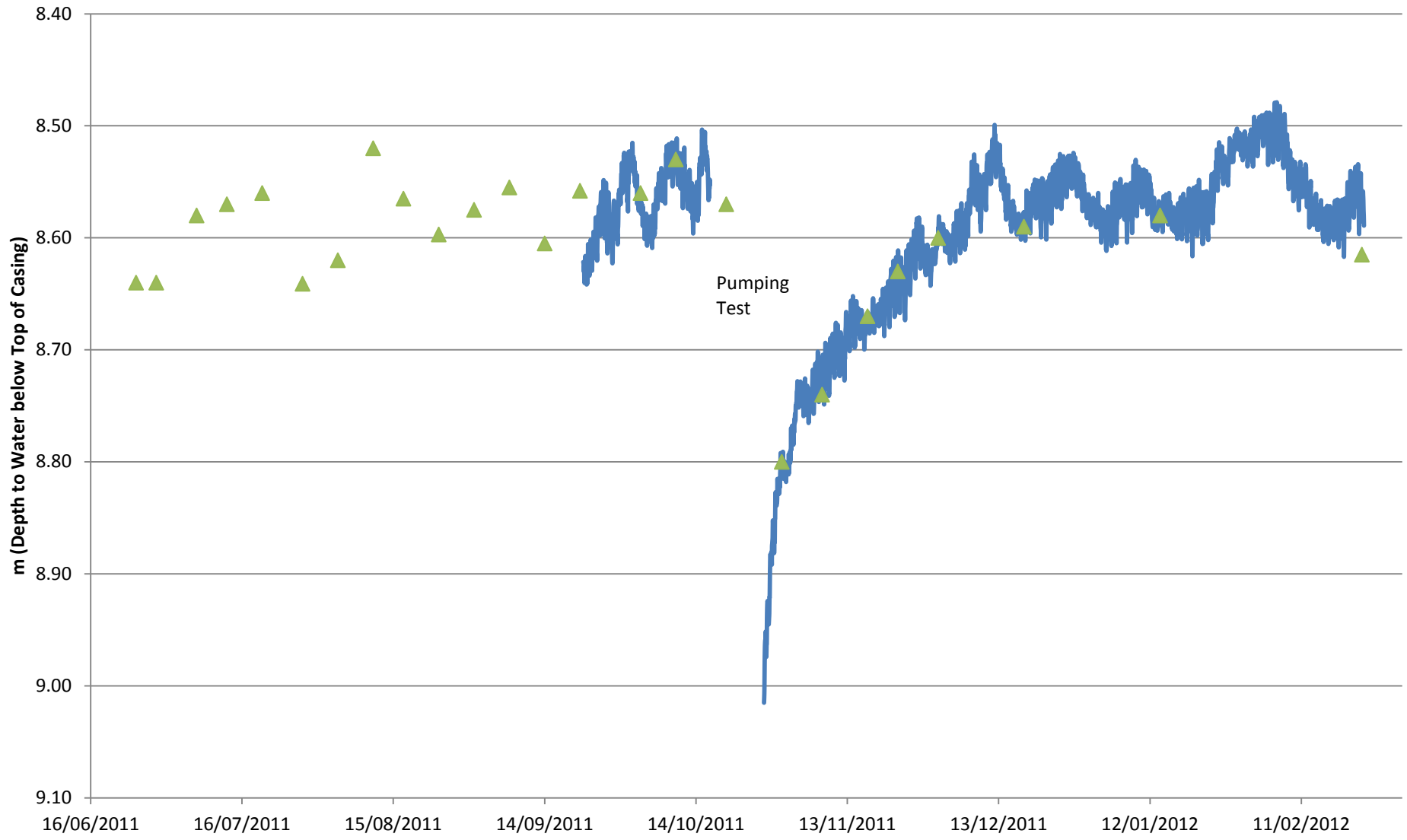


Kenya East GW1 (Gubberamunda)



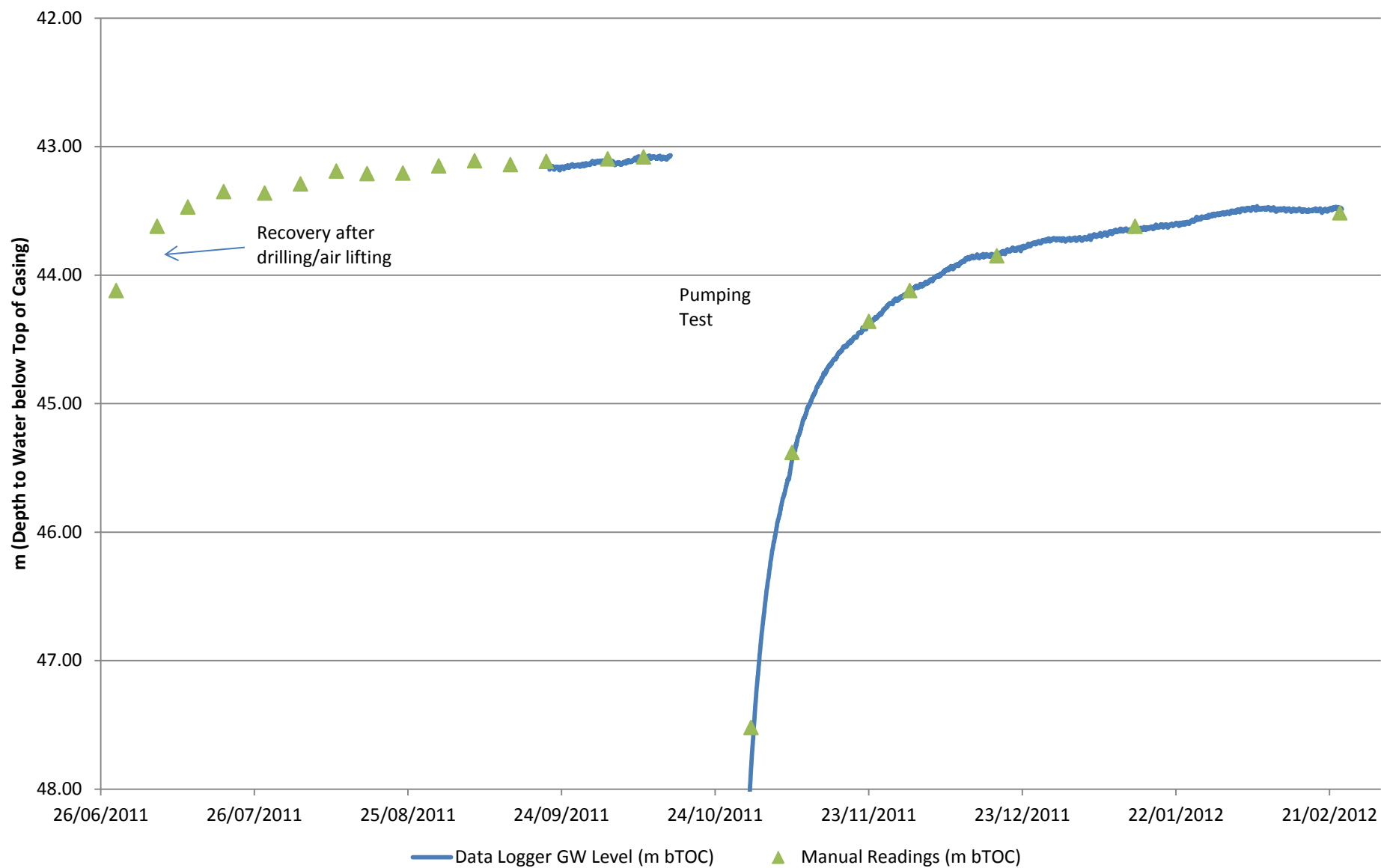
— Data Logger GW Level (m bTOC) ▲ Manual Readings (m bTOC)

Kenya East GW2 (Springbok)



— Data Logger GW Level (m bTOC) ▲ Manual Readings (m bTOC)

Poppy GW1 (Springbok)



Poppy GW2 (Springbok)

