ASHTON LONGWALL 103 – MID PANEL REPORT

1 INTRODUCTION

This report has been prepared by Ashton Coal Operations Pty Ltd (ACOL) with the assistance of an independent groundwater consultant, RPS Aquaterra.

The report has been prepared to satisfy the requirements of the "*Ashton Coal Project Upper Liddell Seam Extraction Plan, Longwalls 1 to 8", specifically* section 13.1.1.1 of the Ashton Water Management Plan:

> '**13.1.1.1** ***Mid-Panel Data Review***
>
> *ACOL will also prepare a succinct summary review of observed data for LWs 1, 2, and 3 in the ULD Seam, within two weeks of passing XL5 (nominally located above 10ct). A copy of this review will be provided to DRE and NOW for reference.*
>
> *This review will focus on the subsidence survey monitoring and groundwater monitoring data collected to that point. The review will comment on the adequacy of the mine plan, provide a brief comparison of the observed data to the predicted subsidence and ground water effects, and whether it is considered that there have been any impacts to Glennies Creek or the Hunter River.'*

The main body of the report focuses on the subsidence survey monitoring data collected for the Upper Liddell (ULD) seam LW103 to 19ct, and provides a brief comparison of the observed data to the predicted subsidence effects. The report also addresses the groundwater impacts observed during the extraction of approximately the first half of LW103.

2 BACKGROUND

Longwall 103 began extraction on the 21st of August 2014. Longwall 103 is 2,460m long, 205m wide. Mining to date has occurred with no unexpected impacts to the environment or infrastructure above it.

The effects of subsidence were monitored in accordance with the document "*Ashton Coal Project Upper Liddell Seam Extraction Plan, Longwalls 1 to 8"*; this included both regular survey monitoring and visual inspection of both environmental, land and infrastructure features.

3 MINE SUBSIDENCE

The Upper Liddell Seam section is being mined along the length of Longwalls 103 at Ashton Underground Mine. Mining height is nominally in the 2.3m to 2.6m range. The seam dips to the southwest at a grade of up to 1 in 10. Overburden ranges in thickness from 180m near the start of the longwall panel to 110m at the take-off end. The final extraction void is nominally 216m wide. This includes the 5.5m width of development drivage either side of the longwall block. Maingate chain pillars are nominally at a centre to centre width and length of 30m and 150m respectively. Tailgate chain pillars are nominally at a centre to centre width and length of 30m and 150m respectively.

Ashton's longwall mining operation commenced in February 2007. Since then 12 panels have been completed. The progress of longwall extraction in the ULD seam is shown in **Figure 1**.

Ashton Coal has monitored the subsidence movement on the surface during the extraction of Longwall's 1-8 using longitudinal subsidence lines. These are located over the start and finish lines of each panel, a main cross line extending over all seven southern panels and a dedicated cross line extending over Longwall 7B and 8. All panels have monitoring data for each start and end lines and various cross lines relevant to the panel, surface features or strata features.

The ULD seam Longwall 103 utilises panel centre lines (CL1 and CL2), the Pikes Gully LW3 panel centre lines and the cross block survey monitoring lines that were used for the Pikes Gully Seam (PG) longwalls. The subsidence monitoring lines relevant to LW103 to date are LW103-CL1, LW3-CL1 and XL5 as shown in **Figure 2.**

The following table (**Table 1)** outlines the maximum subsidence parameters predicted and recorded during regular survey of subsidence lines as the longwall passed each location.

Subsidence monitoring over Longwall 103 to date consists of regular survey of centreline 1 (LW103 CL1) and cross line 5 (XL5). The frequency and results of the monitoring has been maintained per monitoring document "*Ashton Mine Subsidence Monitoring Programme Longwall 101 to 104".* This information is being supplied to the Principal Subsidence Engineer. A graph of the vertical subsidence of cross line 5 is shown in **Figure 3**.

To manage subsidence impacts 132kV timber poles above LW103 and LW104 were reassessed and replaced with concrete poles in 2014. These powerlines have been fitted with rollers prior to longwall extraction.

Visual and survey monitoring of existing 132kV power transmission structures over Longwall 103 was undertaken regularly. During longwall undermining, Ausgrid 132kV Southern Major Interconnector TARP has been followed as per Ausgrid Asset Management Plan. There has been no adverse impacts or damage observed on the 132kV powerlines and powerlines remain serviceable.

The 132kV poles have been referenced as SET25 (CN-90472), SET26 (CN-90088) and SET27 (CN-90089). The 132kV transmission line was surveyed prior to, during and post undermining. Survey data from the 132kV power lines was recorded and supplied to the Principal Subsidence Engineer as per the "*Ashton Mine Subsidence Monitoring Programme Longwall 103".*

The latest subsidence monitoring survey of power pole SET25 which is sitting on the Tailgate side of Longwall 103 block indicates that a further of 86mm subsidence has been measured since last longwall (Longwall 102) undermining. A total of 150mm subsidence has been measured for both Longwall 102 and Longwall 103 extraction to date. Power pole SET 26 sitting in the middle of Longwall 103 block has subsided approximate 1.5m. Power pole SET27 sitting on the Maingate side of Longwall 103 block has subsided 0.5m. The effects of subsidence on the 132kV structures can be seen in **Figure 4, Figure 5** and **Figure 6**.

Table 1: Cumulative subsidence of Longwall Panel 103 to 16/12/14 - Predicted vs. Actual

	Maximum Predicted SMP	**Maximum Measured as at 17/12/2014**		
Longwall 103		**LW103 CL1**	**LW3 CL1**	**XL5**
Subsidence (mm)	4000	2197	2460	2060
Tilt (mm/m)	162	44.6	41.3	56.7
Tensile Strain (mm/m)	65	12.3	10.1	24.9

3.1 SUBSIDENCE IMPACTS

Surface subsidence cracks have developed along each gate edge of the Longwall panel. These generally run parallel to the gate road within the longwall block. Cracks are evident on the Maingate side and in the mid-block of the panel. Some cracks have occurred parallel to the retreating face. Where this has occurred the features have usually started from a parallel pillar edge crack and continued around to align with the face.

The maximum subsidence movements detected over Longwall 103 are less than those predicted in the SMP. This occurred for all centreline (CL) survey monitoring lines and cross lines. Horizontal movement has occurred in the coal seam up dip direction (East North -East) above each of the Longwall panels. This movement has predominantly occurred within the longwall panels with limited displacement detected outside the panel edge.

Rehabilitation of the surface cracks has been occurring as extraction continues. Effected surface roads have only required a grader to smooth compression humps and minor cracks.

4 GROUNDWATER MONITORING

Ashton has an extensive monitoring network of piezometers, ground water inflow monitoring and laboratory analysis of water quality for monitoring groundwater pressure and levels and quality. Groundwater monitoring around LW103 has been intensified for the period of extraction to identify any potential sudden changes that may occur.

Groundwater monitoring shows that the impact of LW103 is less than that predicted in the EIS and the ULD extraction plan. The monitoring data from key standpipe piezometers and vibrating wire piezometer installation are provided as hydrographs and plots of electrical conductivity (EC) in Appendix 1. Key monitoring data are provided for: Glennies Creek Alluvium and Hunter River Alluvium, as well as for selected standpipe piezometers and vibrating piezometers in the vicinity of LW103. The results of the monitoring are summarised below.

Water Levels

- Glennies Creek Alluvium: Hydrographs for Glennies Creek Alluvium piezometers are presented on Figures A1 to A3 (Appendix 1). Monitoring shows no response in the alluvium to the extraction of LW103. In general there has been an increase in groundwater levels through the period of LW103 extraction to date.
- Hunter River Alluvium: Hydrographs for Hunter River alluvial piezometers are presented on Figure A4 (Appendix 1). There is no response to the mining of LW103 apparent in the piezometers. The monitoring shows a general decline in water levels following a large recharge event in early 2012. The decline is the result of sustained below average rainfall over the past years. Through the period of LW103 extraction the decline is sustained at WMLP337 and WMLP338, but stabilises at WMLP336. At WMLP279 and WMLP280 a slight increase in water level decline is noted, but is not attributed to LW103 extraction.
- WMLC333 is a vibrating wire piezometer installed above the LW104A Maingate. The hydrograph for WMLC333 sensors is shown of Figure A5 (Appendix 1). The sensor in the Arties Seam shows a large depressurisation response at the start of LW103 extraction and the sensor then becomes unsaturated. Smaller responses are observed in the intermediate Lemmington 15 and 19 seams in response to mining at LW103 followed by a partial recovery. Follow the commencement of extraction at LW103, communication with sensors located below Arties Seam has been lost.
- WMLC339 is a VWP installed above LW103 approximately 400m north of the current longwall face. The hydrograph of WMLC339 sensors is presented on Figure A6 (Appendix 1). The hydrograph show sensors in PG Seam and above to become completely depressurised with the passing of LW102. The sensor in Arties seam also

showed a depresurisation response to LW102, which continues into the period of LW103 extraction.

- WMLC335 is a VWP located south of the LW101 Tailgate. The hydrograph on Figure A7 (Appendix 1) shows a general trend of gradual depressurisation in all sensors that has increased following extraction of LW101 and again following extraction of LW102. Only a minor increase in depressurisation is noted in the ULD coinciding with LW103 extraction. Of interest to note is that greater degree of depressurisation has occurred in the Arties Seam than either the PG or ULD seams, possibly indicating an elevated permeability of the Arties Seam relative to the PG and ULD seams.

Water Quality

Plots of salinity (as electrical conductivity) from key Glennies Creek and Hunter River Piezometers are provided on Figures A8 and A9 (Appendix 1).

- Glennies Creek Alluvium: Salinity for selected Glennies Creek piezometers is presented on Figure A8 (Appendix 1). Over the period of LW103 extraction salinity is shown to fluctuate but with and overall trend of decreasing salinity. Values are observed to range from 382 to 1,010 µS/cm showing the water to be fresh and within baseline data limits (300 to 16,300 µS/cm).
- Hunter River Alluvium: Salinity for selected Hunter River alluvial piezometers is presented on Figure A9 (Appendix 1). Salinity is shown to fluctuate but remain generally stable over the LW103 extraction period, with no significant increasing or decreasing trend apparent. A drop in salinity does appear to coincide with the commencement of LW103, however, as the change occurs in all three piezometers it is not inferred to be associated with the longwall extraction. Salinity over the review period ranged from 1,742 to 3,330 µS/cm, and exceeds baseline data limits of 1,375 to 2,540 µS/cm, as detailed in the 2012 WMP (Section 8.3.2, Table 8.2). The trend of increasing EC prior to LW103 is attributed to natural fluctuation and correlates with the declining water levels observed over the same period. No impacts associated with LW103 extraction are indicated.

Above active mining areas, complete desaturation of the majority of Permian formations is anticipated, observations at WMLC333 and WMLC339 show this to be occurring as expected.

No impacts to Glennies Creek or Hunter River alluvial aquifers resulting from operations at ACP are indicated.

5 ADEQUACY OF THE MINE PLAN

The subsidence data and the groundwater monitoring data both show that the effects of multi seam extraction of LW103 is within the predictions of the EIS and the SMP. The offset layout of the multi seam panels is resulting in impacts that are less than those effects that were predicted. The results also show consistency across different monitoring sites indicating that the multi seam response is predictable.

Visual observation on the surface indicates that deformation from the subsidence is as expected with surface cracks occurring in similar locations as the single seam extraction with respect to the extraction panel edges. Underground observations show minimal effects from the overlying extraction in the Pikes Gully seam. These results are less than anticipated, indicating that the approach to mine design, operation and management of the multi seam extraction has been conservative.

Figures

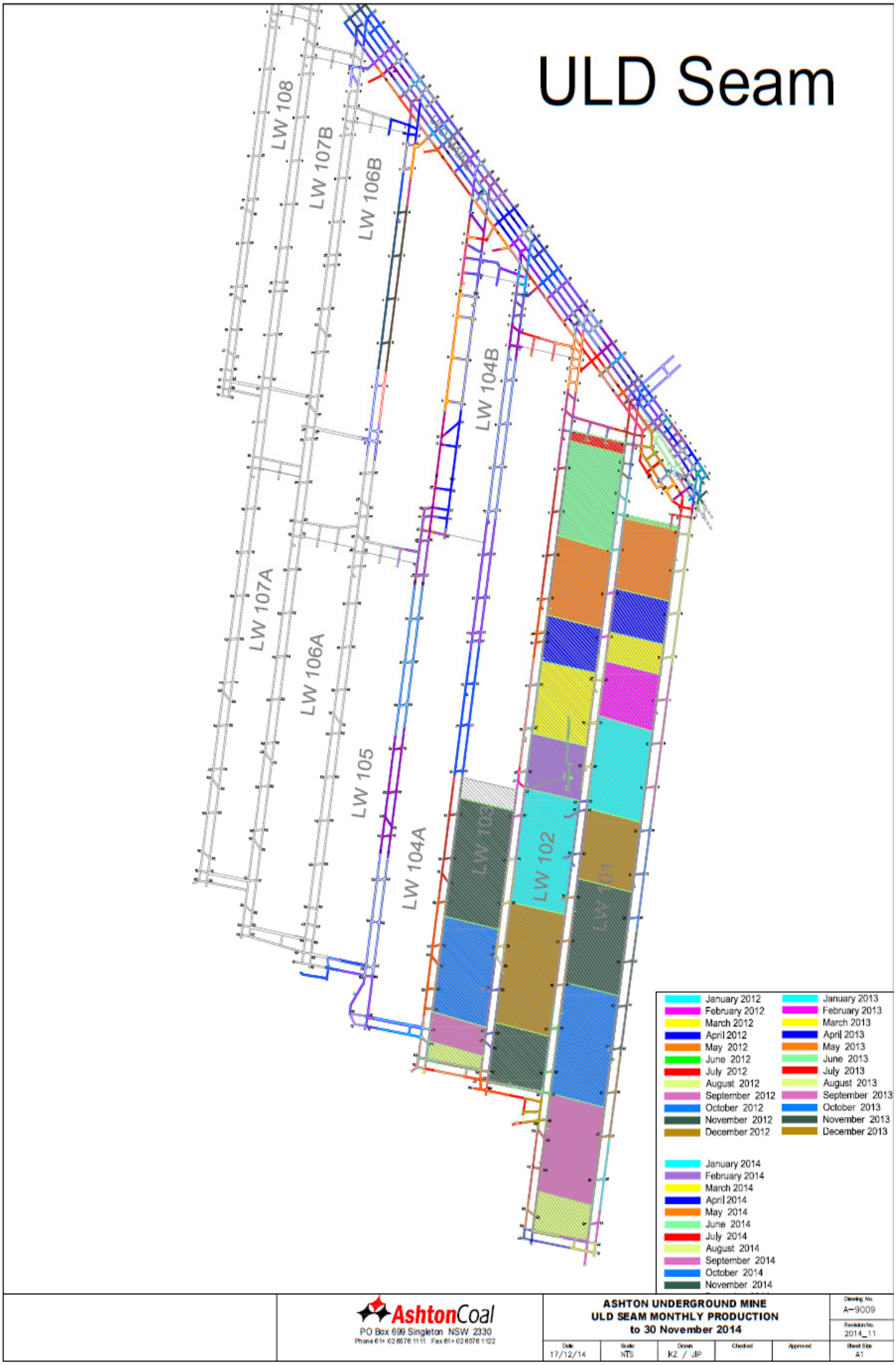


Figure 1: Progression of Longwall Extraction in the Upper Liddell Seam

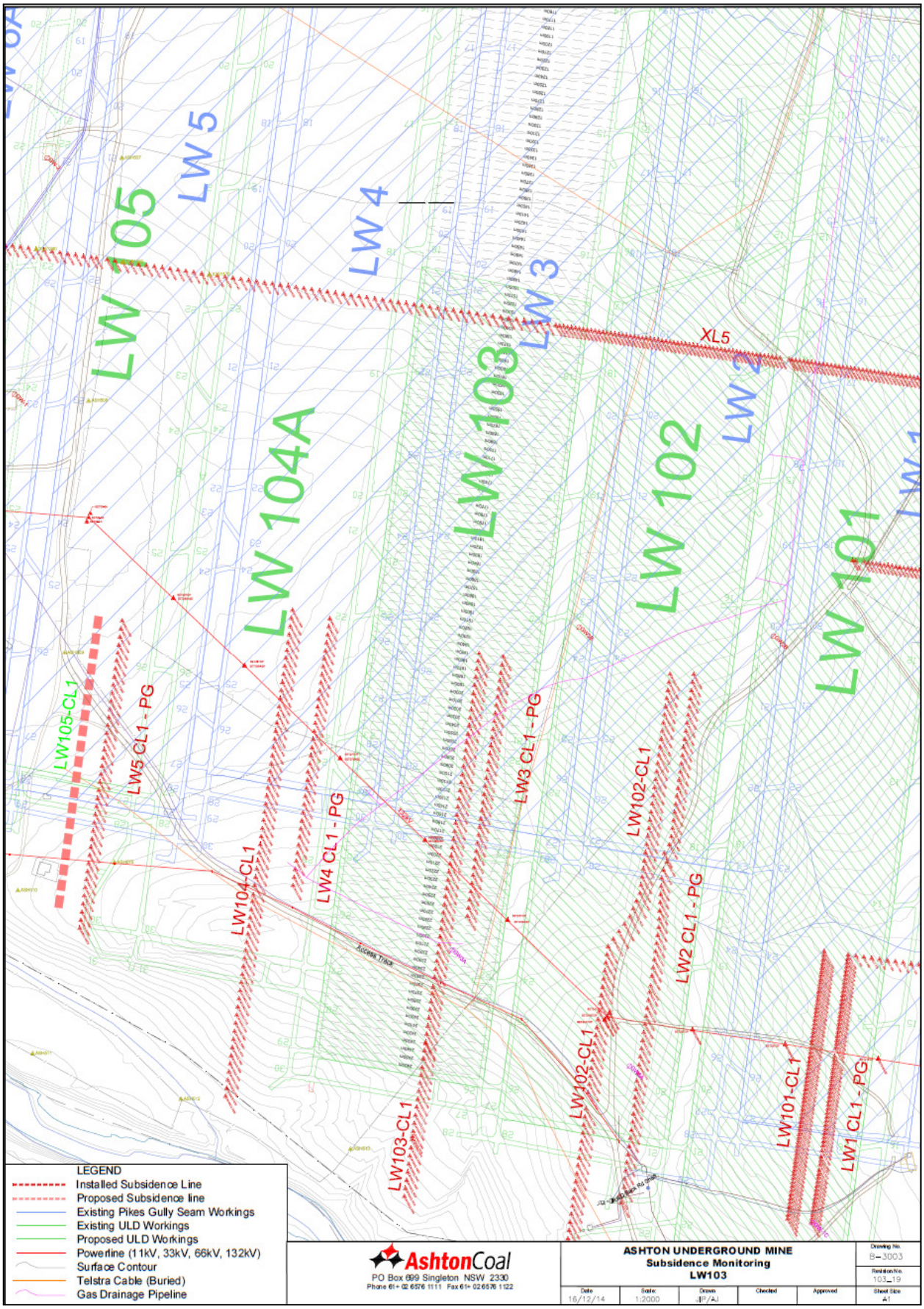


Figure 2 Plan Location of Subsidence Monitoring Lines. Also Shown is the 132kV Transmission Lines.

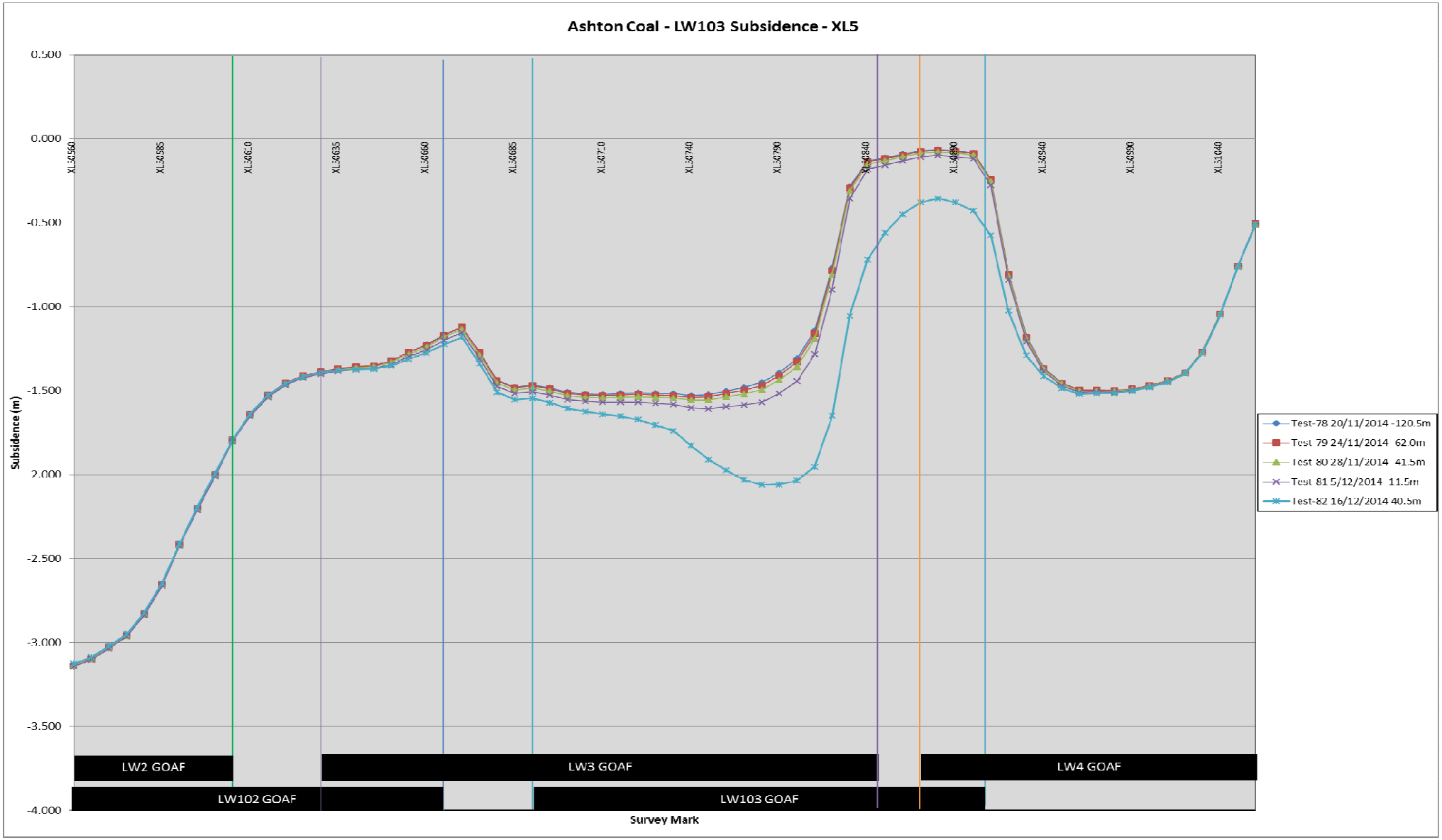


Figure 3 Vertical Subsidence of XL5 – Pre and Post LW103

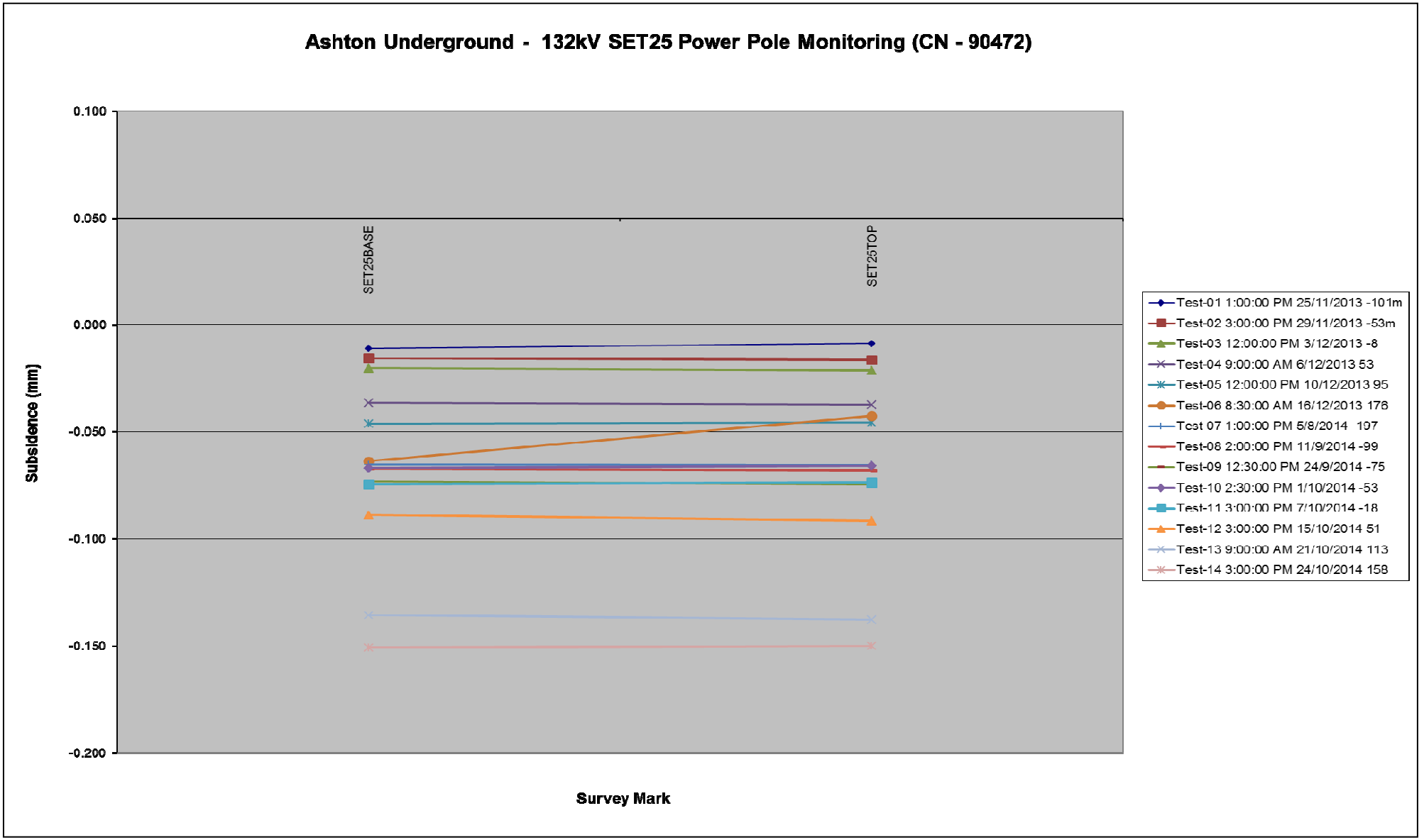


Figure 4 Subsidence Monitoring Data 132kV Power Poles – SET 25 (CN-90472)

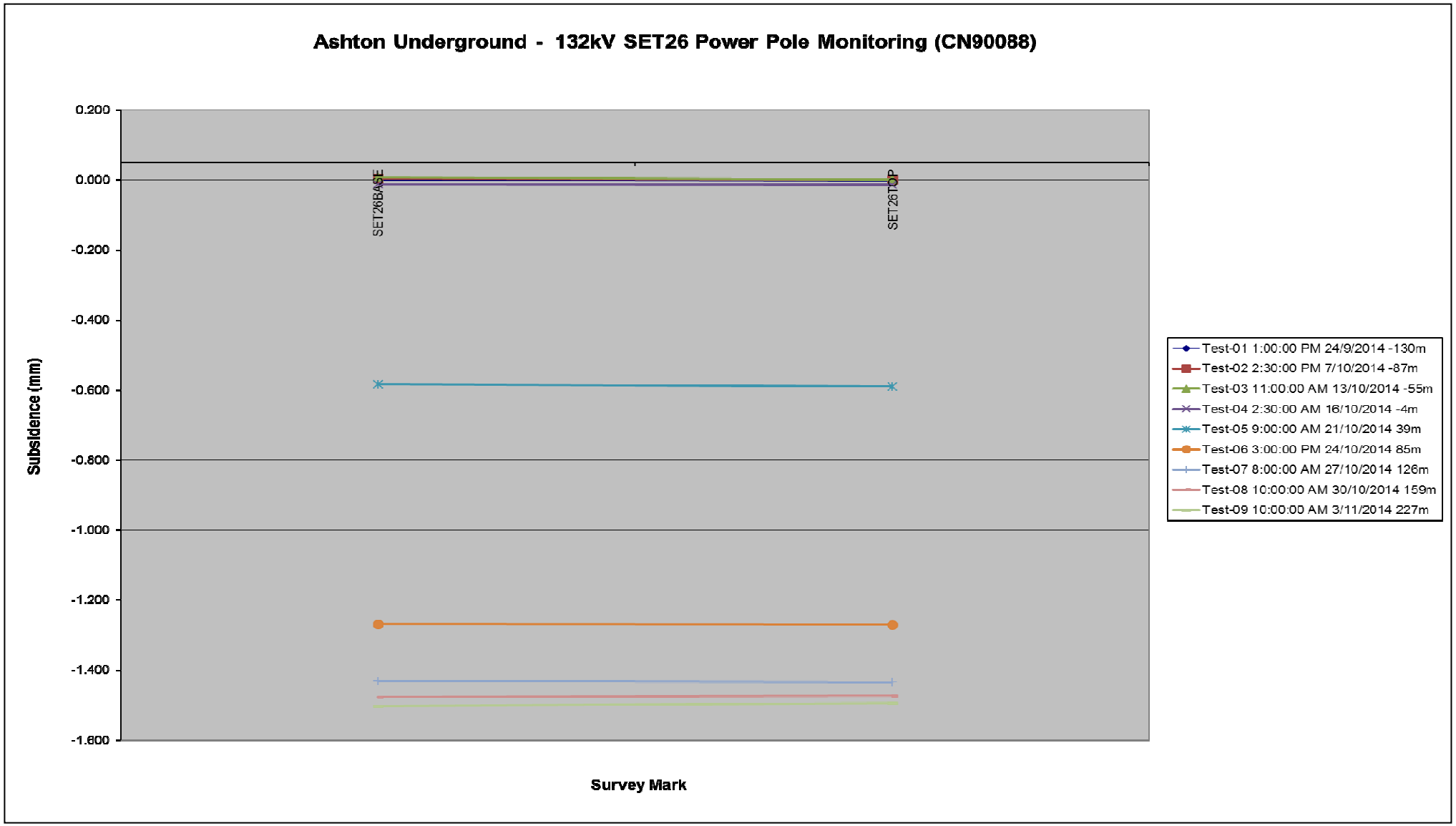


Figure 5 Subsidence Monitoring Data 132kV Power Poles – SET 26 (CN-90088)

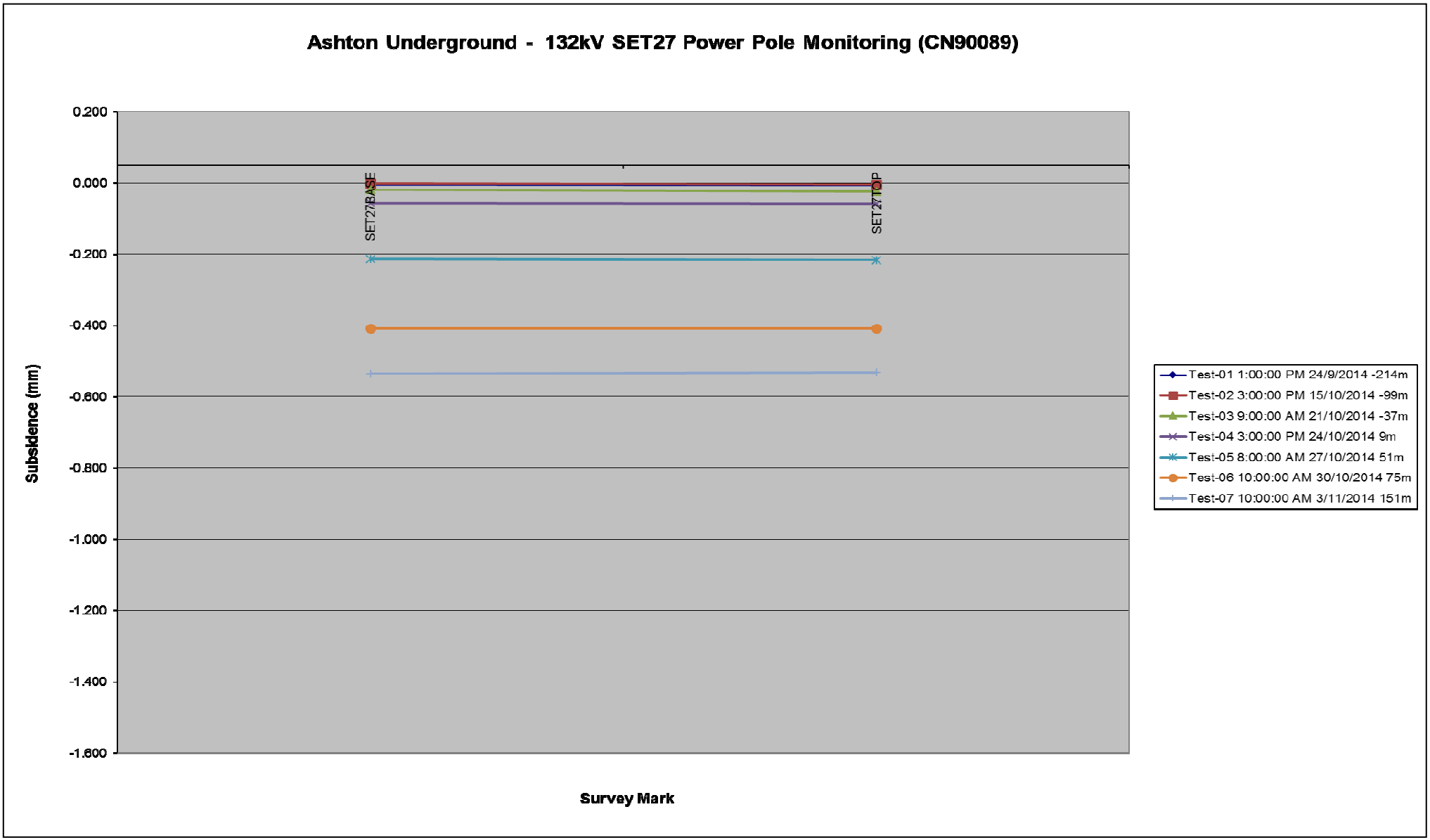
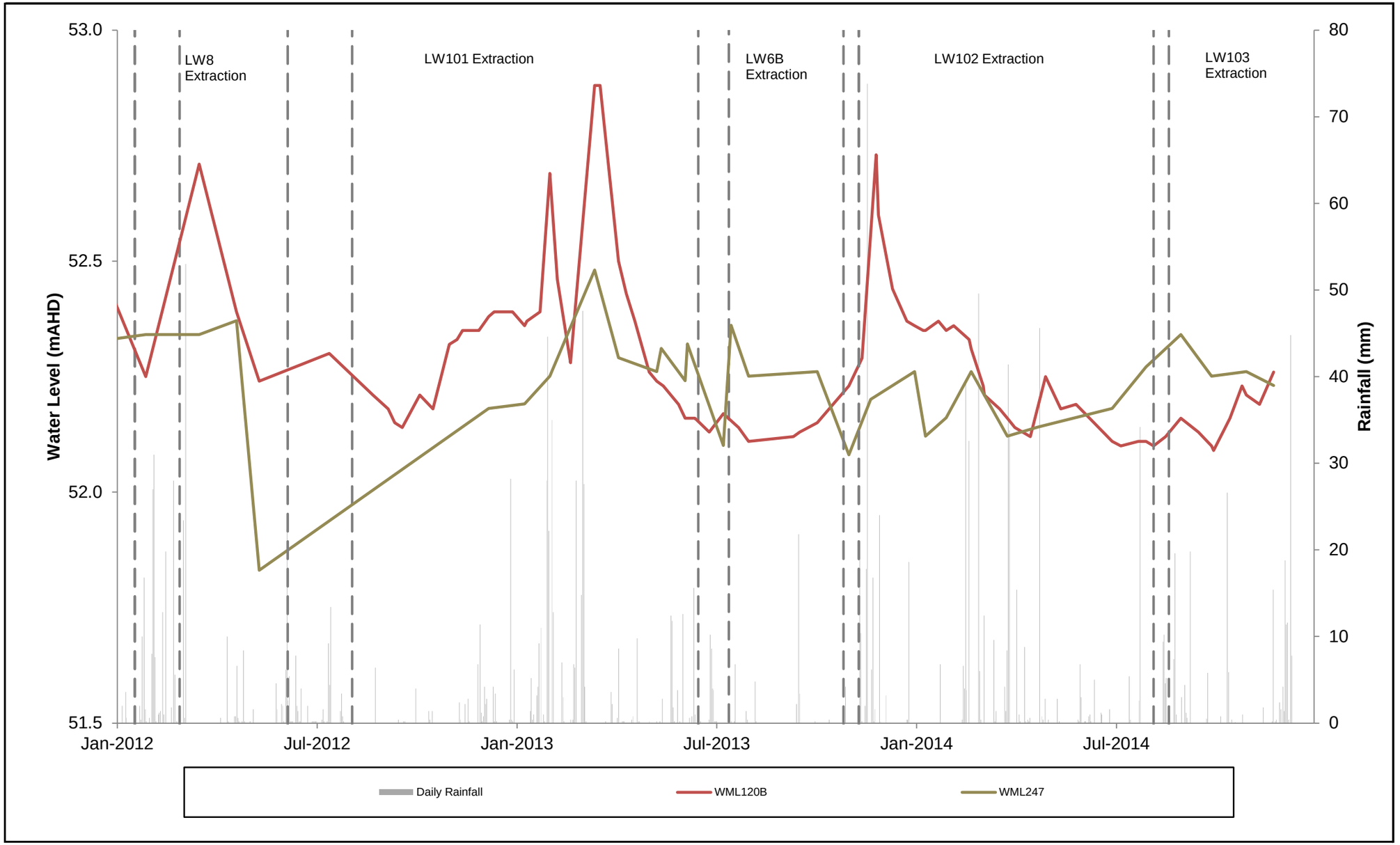


Figure 6 Subsidence Monitoring Data 132kV Power Poles – SET 27 (CN-90089)

Appendix 1 – Piezometer monitoring hydrographs



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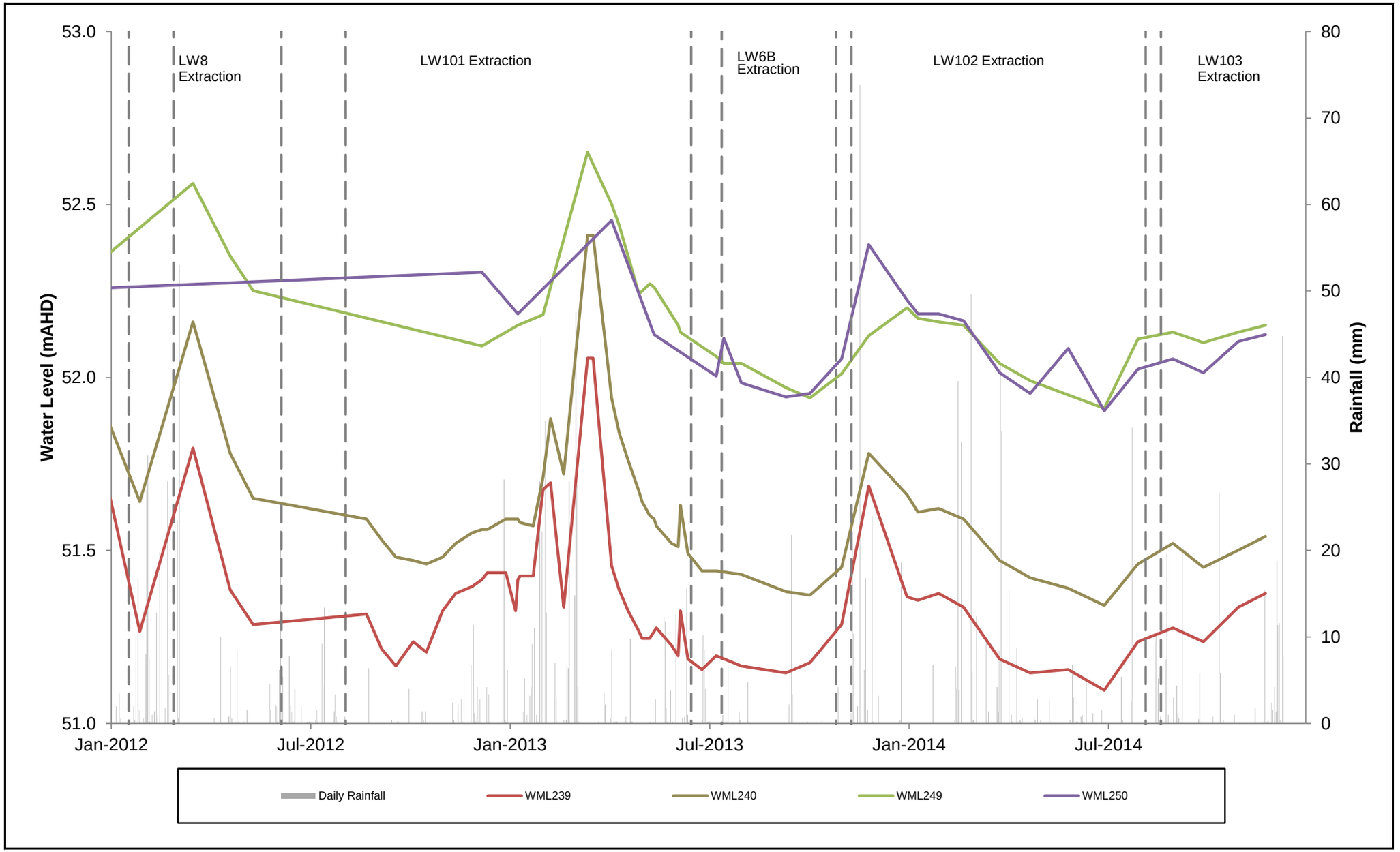
HYDROGRAPH - GLENNIES CREEK ALLUVIUM (NORTH) FIGURE A1

C:\JOBS\Ashton\[LW103_Hydrographs.xls]Figure A1



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HYDROGRAPH - GLENNIES CREEK ALLUVIUM (CENTRAL) FIGURE A2

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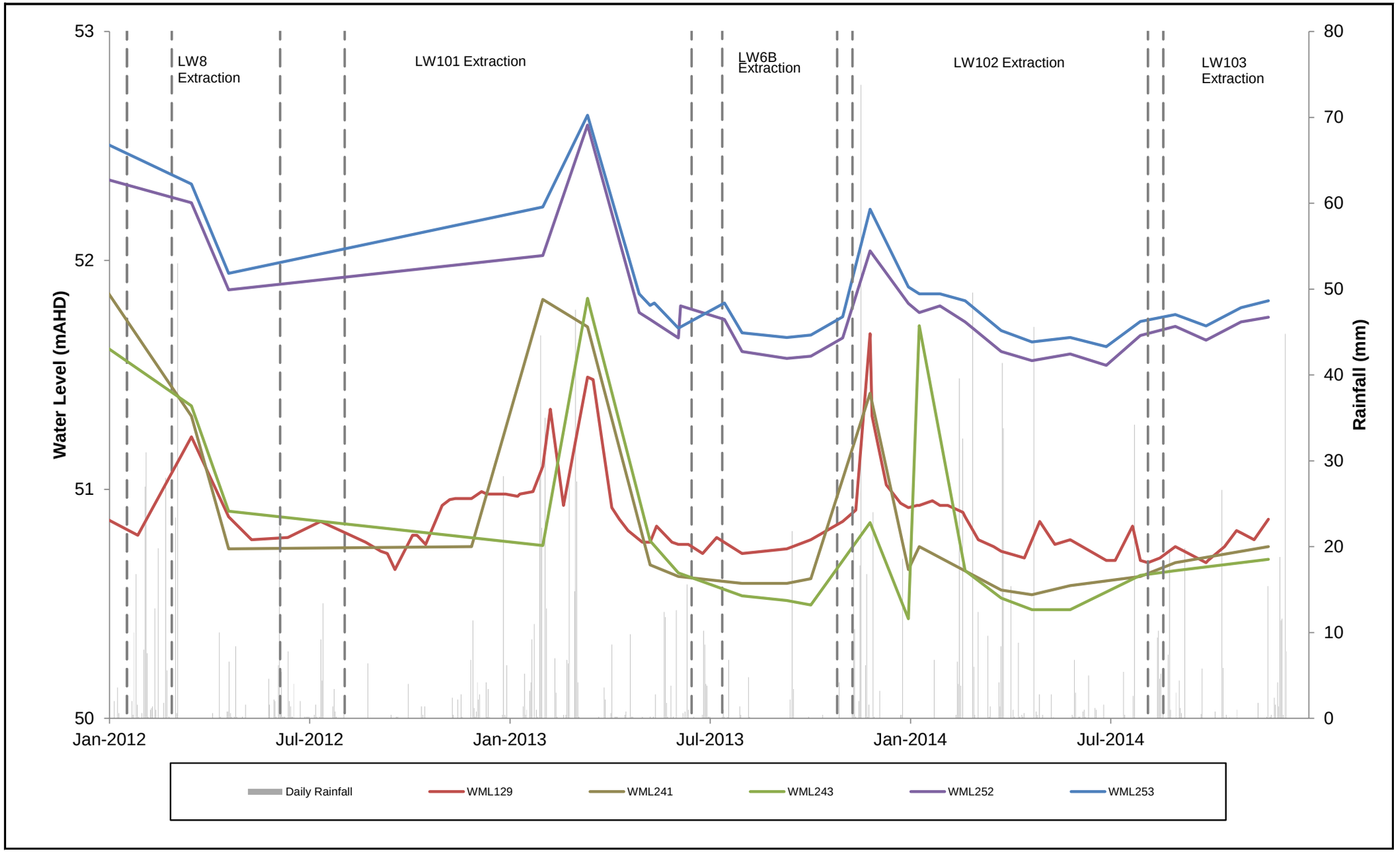

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HYDROGRAPH - GLENNIES CREEK ALLUVIUM (SOUTH) FIGURE A3

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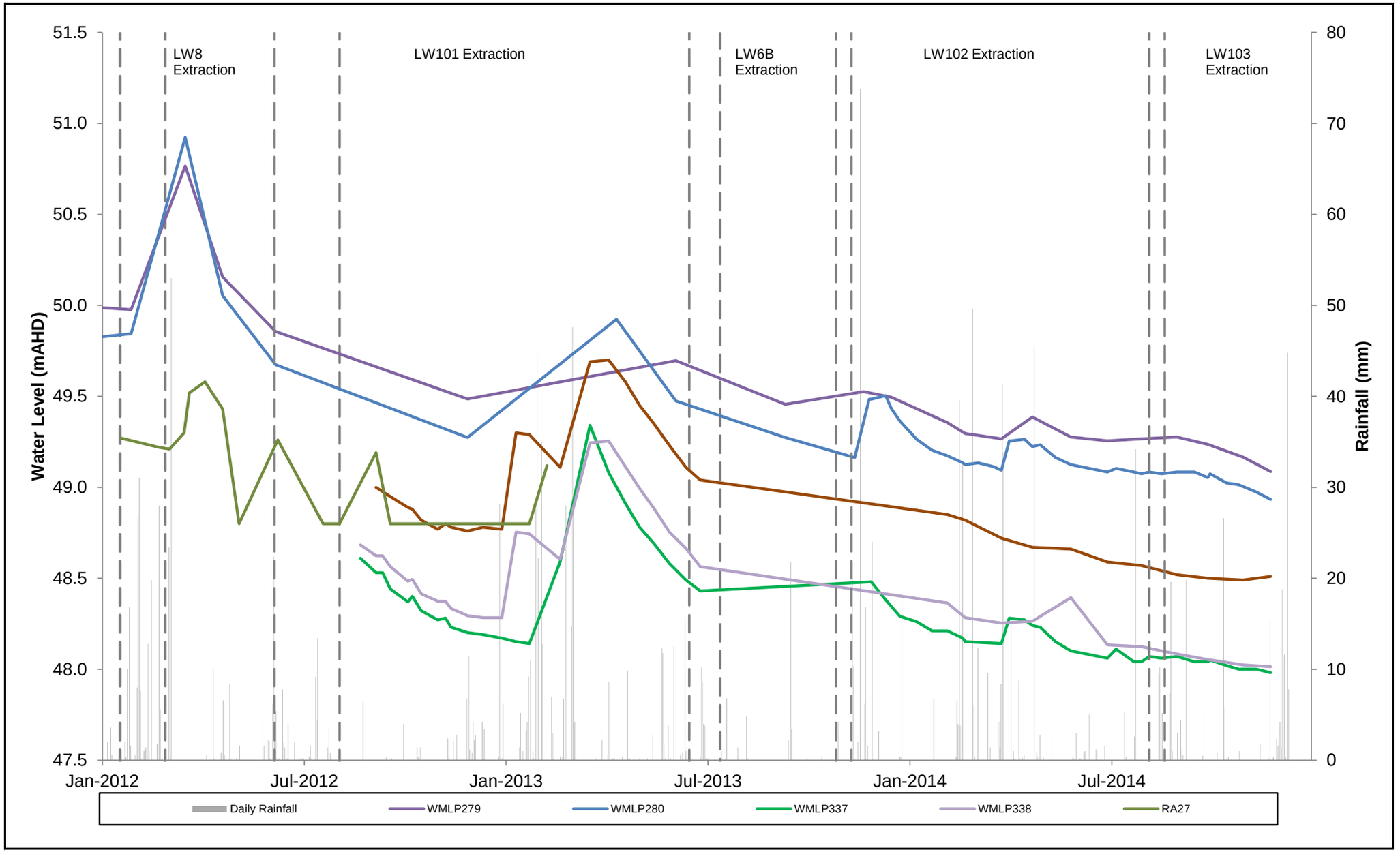

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HYDROGRAPH - HUNTER RIVER ALLUVIUM FIGURE A4

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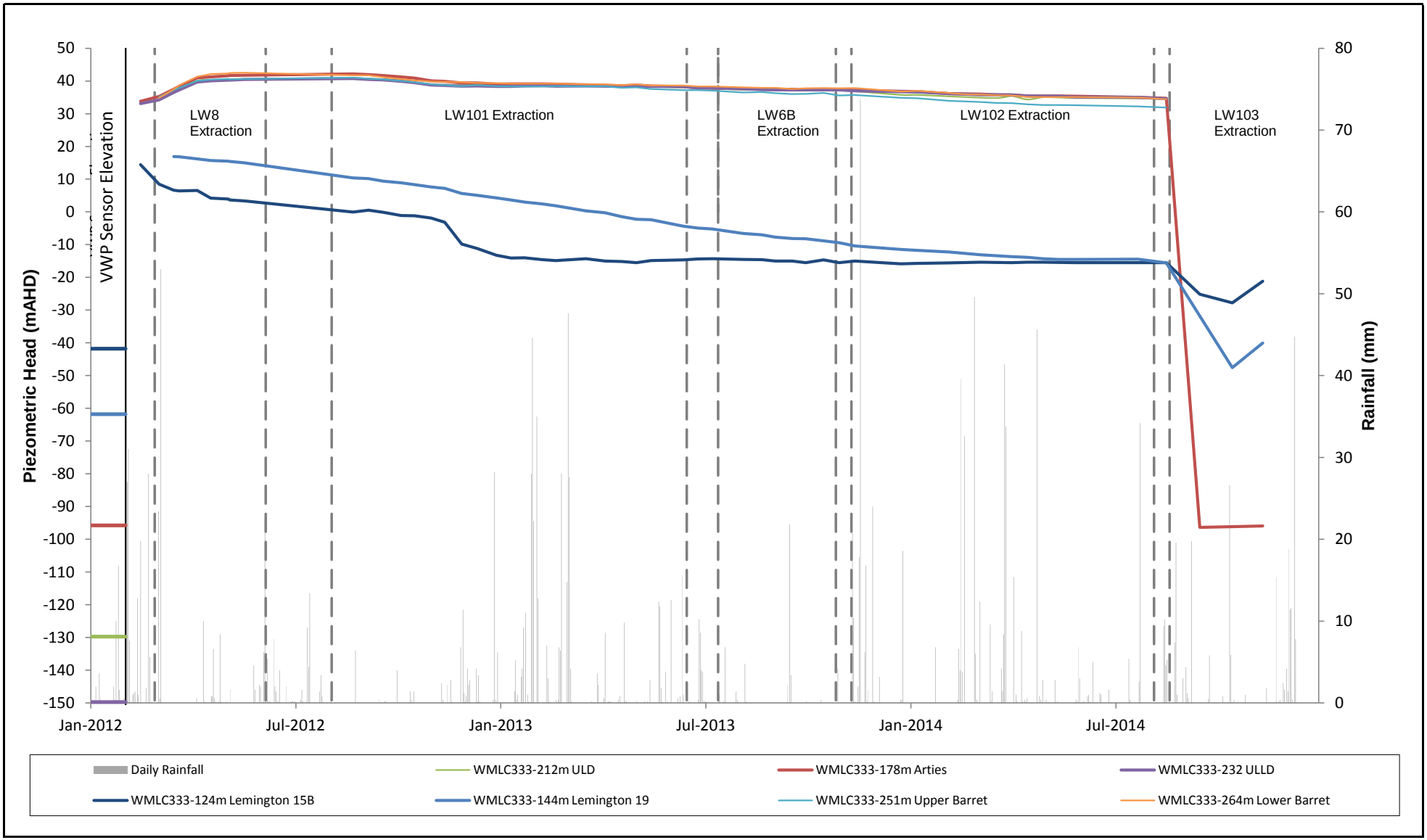

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HYDROGRAPH WMLC333 PIEZOMETERS FIGURE A5

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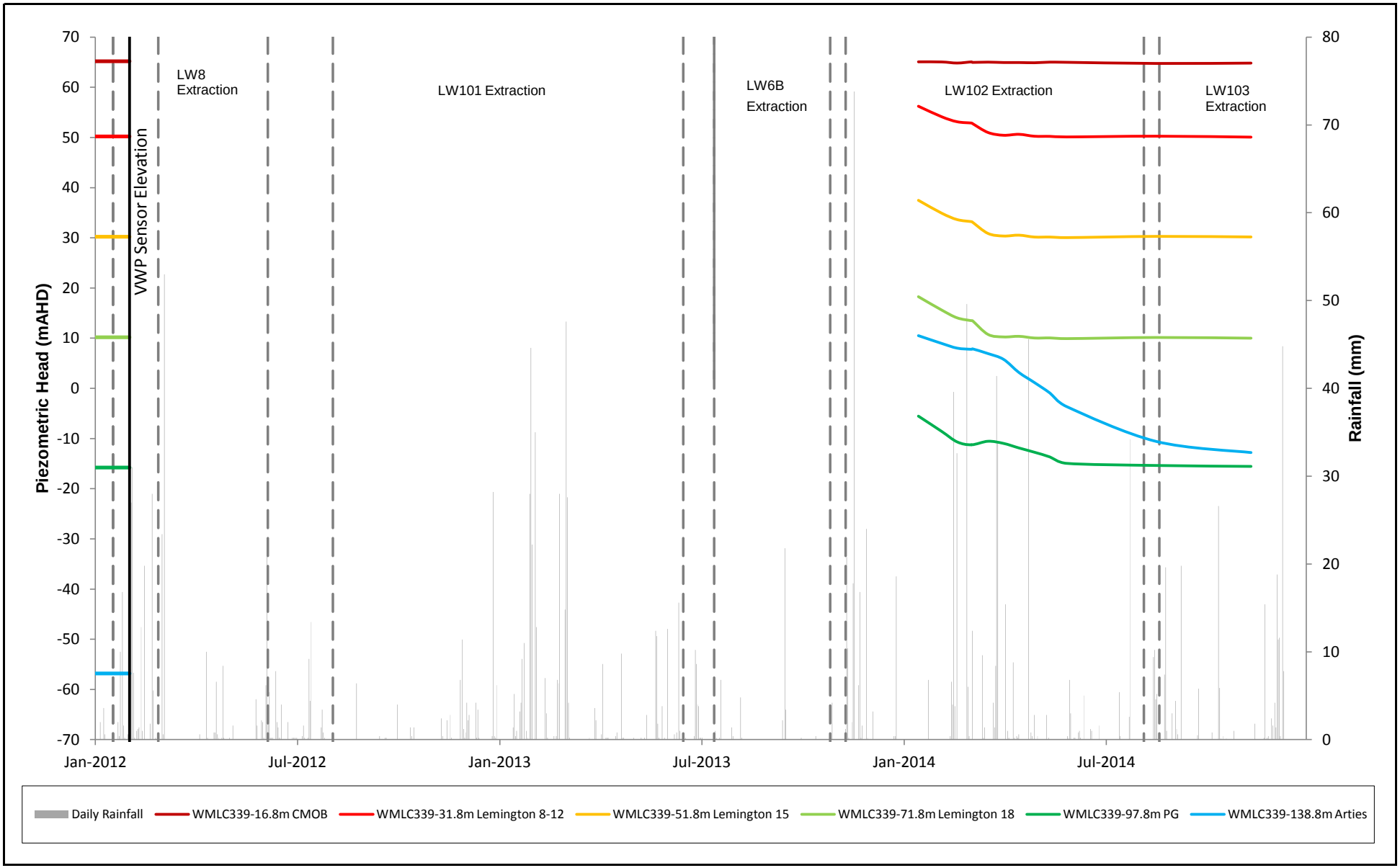

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HYDROGRAPH WMLC339 PIEZOMETERS FIGURE A6

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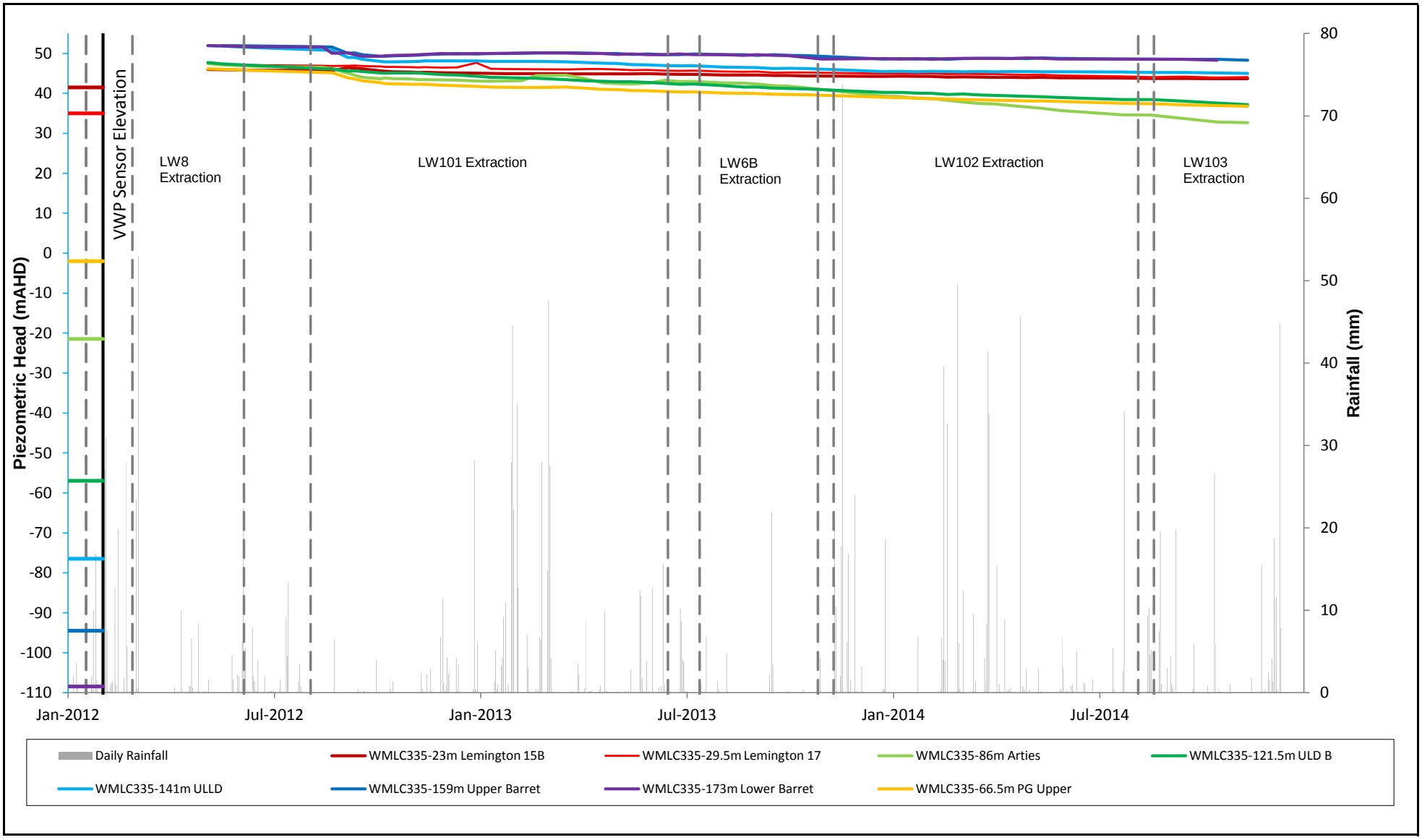

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HYDROGRAPH WMLC335 PIEZOMETERS FIGURE A7

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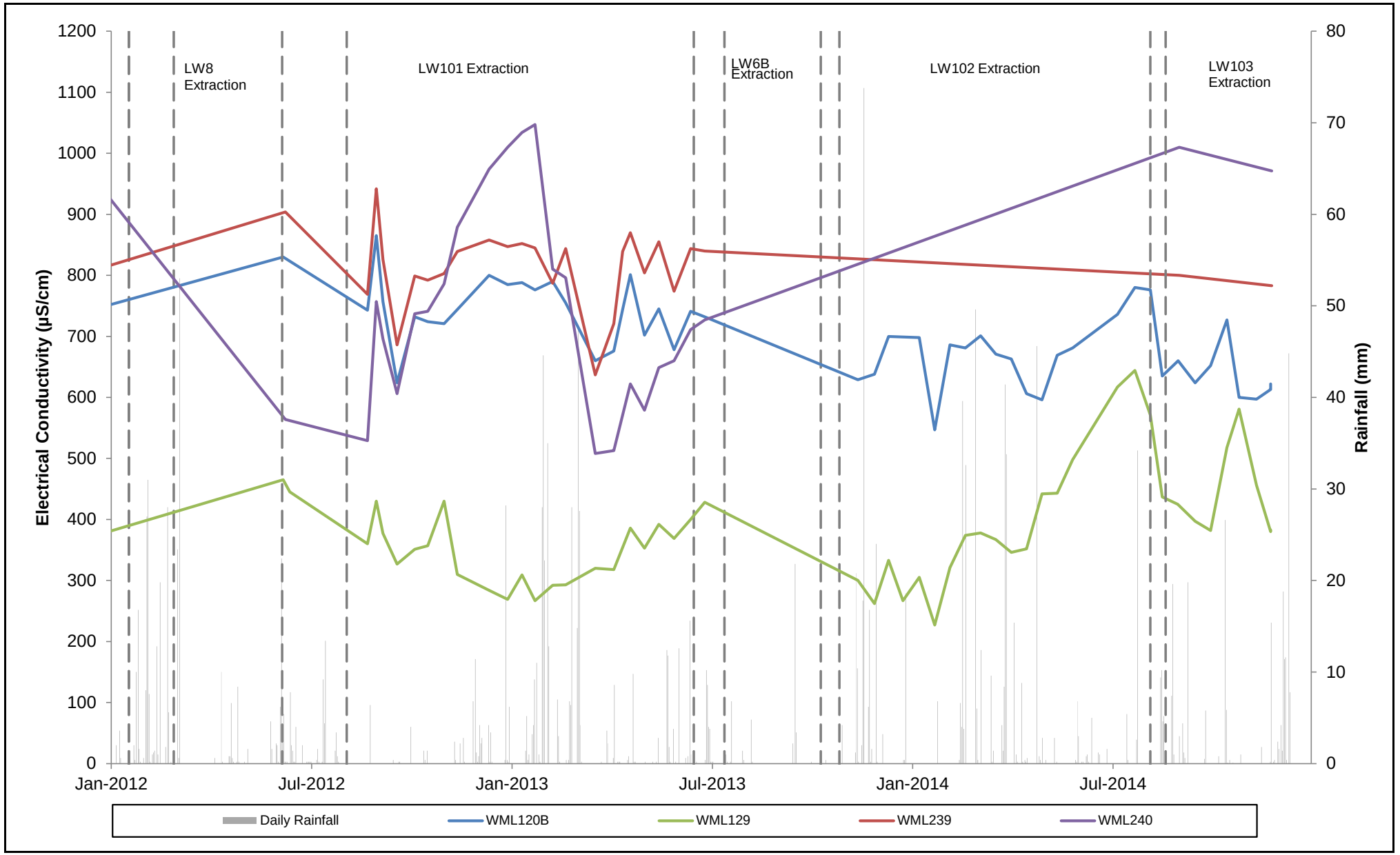

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GROUNDWATER SALINITY - GLENNIES CREEK ALLUVIUM FIGURE A8

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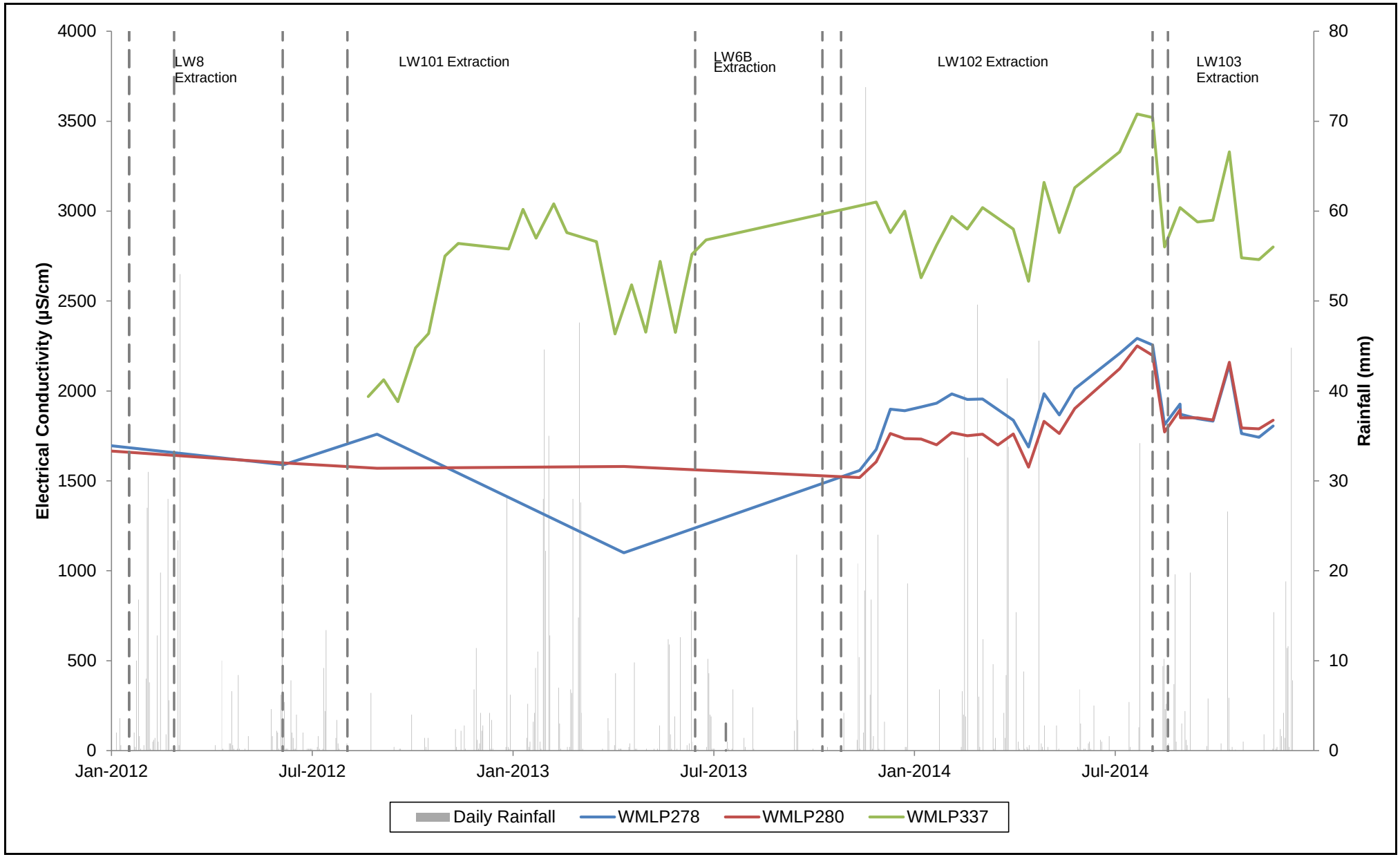

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GROUNDWATER SALINITY - HUNTER RIVER ALLUVIUM FIGURE A9

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