



**WOLLONGONG COAL LTD  
NEBO COLLIERY  
END OF PANEL N4  
SURFACE WATER AND GROUNDWATER  
REPORT  
Wollongong, NSW**


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**DRAWINGS**

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Drawing 2      Groundwater Monitoring Locations

## **1. INTRODUCTION**

This document outlines observation of the groundwater and surface water systems in the Nebo Area within the Wollongong Coal Limited (WCL) operated Wongawilli Colliery lease area.

Extraction of the Wongawilli Seam in Longwall N2 was previously conducted between 12/6/2013 and 26/2/2014, with the operation being suspended due to collapse of the roof mid way through the panel. The mined void was 132m wide, 789m long with a 3.3 – 3.4m high face, and had 125 – 280m depth of cover.

Panel N4 was mined by secondary pillar extraction with a continuous miner between 7 August 2016 and 6 March.

### **1.1 Site Description**

The study area is located 13km west of Wollongong in the upper reaches of the Cordeaux River valley within the Sydney Water Catchment Metropolitan Special Area.

The area is within undeveloped bushland comprising native vegetation and other regeneration areas.

Panel N4 is located below a topographic ridge between Little Wattle Tree Creek and Wattle Creek with the ground slope to the south, towards Wattle Creek. An unnamed first order tributary to Wattle Creek is also located above the start line of the panel.

Panel N4 is located outside the Dams Safety Committee Notification Area for the Cordeaux Storage Reservoir.

## **2. SCOPE OF WORK**

GeoTerra were commissioned by WCL to report on any observed groundwater system changes resulting from extraction of Panel N4 in accordance with the Nebo Longwalls N1-N6 Extraction Plan (Niche, 2011), subsidence predictions (MSEC 2010) made in the Extraction Plan (EP) and the Subsidence Management Plan (SMP) (Niche 2012) which was based on the Part 3A Application for the Nebo Area Project (09\_0161).

This report presents the results of our review and analysis in accordance with Condition 18 of SMP Approval 09/5341 and Extraction Plan requirements of Condition 7 in schedule 3 of Project Approval 09\_0161.

### **3. PANEL EXTRACTION AND SUBSIDENCE**

#### **3.1 Mining Layout and Overburden Geology**

Extraction of N4 Panel created a goaf area that is around 125m wide and 395m long, which is a smaller area than was originally approved for Longwall N4.

The panel was mined from east to west with a mining height of 2.8m and had 79% seam extraction within the panel.

The depth to the Wongawilli Seam mining horizon ranges from about 120m at the start of the panel in the east to approximately 180m at the western end.

The Nebo Study Area is predominantly covered by shallow hillslope-based colluvium developed directly over the Cordeaux Crinanite, with very thin to absent alluvial sedimentary deposits in the valley floors.

The colluvial soil ranges up to 6.5m thick and comprises ferruginous clays overlying the thin weathered mantle of the crinanite, or where the crinanite is absent in the west, thin sandy soils developed on Hawkesbury Sandstone or the Bulgo Sandstone in the east.

The crinanite has intruded into the basement between the Hawkesbury Sandstone and the Bulli Seam and dominates the subcropping and outcropping geology at Nebo. Where the crinanite is absent in the western mostly higher elevation portion, over the south western corner of LWN1, thin sandy colluvial soil overlies the Hawkesbury Sandstone, Narrabeen Group and Illawarra Coal Measures stratigraphy.

The crinanite outcrops at surface and ranges from 60 - 70m thick over the panel, with the base of the sill located approximately 50 - 60m above the extracted panel.

Previous exploratory work (SCT 2010) showed that a 65m thick section of the crinanite is sufficiently massive to be able to bridge across a 120m wide void at an overburden depth to the mining horizon of 116m.

No known major faults outcrop at surface as the Cordeaux Crinanite has overprinted any structures that may have been present in the sedimentary overburden.

#### **3.2 Subsidence**

Subsidence behaviour above previous and current panels is significantly influenced by the presence of the intruded crinanite sill.

Up to 92mm of subsidence was observed over the previous Longwall N2 panel, along with a tilt of <0.5mm/m and tensile strain of 0.2m/m (SCT Operations, 2014).

Direct monitoring of the actual subsidence over the panel was not possible as monitoring line NM1 was offset from the panel.

The subsidence movements are of very low magnitude. However, these need to be considered in the context of the expected survey tolerances and Trigger Action Response Plans (TARPS) outlined in the Nebo Longwalls 1-6 Subsidence Monitoring Plan.

Accuracy expectations for regional points are  $\pm 25\text{mm}$  for position and  $\pm 35\text{mm}$  for height.

The maximum subsidence values along subsidence Line NM1 were;

- subsidence 43mm
- tilt <0.9mm/m
- strain 0.6mm/m (compression) and 0.4mm/m (tension)

Overall, subsidence observed in the vicinity of N4 is considered to be less than or consistent with the predictions made in the EP/SMP and Part 3A Application (SCT Operations, 2017).

Monitoring of NM3 (300) line above Longwall N2 (SCT 2014) confirmed the bridging capacity of the crinanite, which has limited the maximum subsidence and associated parameters to levels that are imperceptible for all practical purposes (SCT Operations, 2017).

#### 4. SURFACE WATER

Wattle Creek and Little Wattle Tree Creek are “connected gaining streams” where the soil and, potentially to a lesser degree, the shallow crinanite groundwater, seeps into the creeks and maintains a baseflow during and after extended wet periods.

Variable seepage from the soil and crinanite enters the creeks and has been observed to maintain a continuous flow in the 3<sup>rd</sup> order channel of Wattle Creek, with the volume depending on the interaction between rainfall runoff, recharge and groundwater seepage applying at any one time.

The 2<sup>nd</sup> order channel of Little Wattle Tree Creek does not have a permanent stream flow.

Three channel types are present in the area:

- Channels incised into the crinanite with accumulated crinanite cobbles and boulders, with little to no channel sediment. These “v” shaped channels are usually bound by crinanite outcrop;
- Isolated rock platforms of variable width which are usually smooth except for minor depressions on the vertical, polygonally jointed crinanite. These platforms normally transgress into the pool / riffle sequence described above, and;
- Channels incised into crinanite boulder / cobble substrate in the lower catchment of Jacksons Creek, which is the 2<sup>nd</sup> order tributary of Wattle Creek draining to the north from Jacksons Hill and Wanyambilli Hill.

Three pool types are also present:

- Shallow, linear, small pools located in depressions formed by erosion of the columnar jointed crinanite where the downstream end is usually associated with a low rockbar outcrop,
- Larger pools constrained by a rockbar on the downstream end, or;
- Small pools upstream of a crinanite cobble / boulder accumulation.

##### 4.1 Wattle Creek

Wattle Creek flows in a north easterly, then easterly direction and overlies the middle, narrowed section of LWN5, as well as the creeks catchment within the 20mm subsidence zone as shown in **Drawing 1**.



The creek is a perennial Schedule 2, 3<sup>rd</sup> order stream (DIPNR, 2005) downgradient of LWN5 and to the north of LWN2 and LWN3, with ephemeral 1<sup>st</sup> and 2<sup>nd</sup> order tributaries upstream of the WC1 and WC2 junction.

No proposed workings underlie any 3<sup>rd</sup> order channel of Wattle Creek.

The 2<sup>nd</sup> order north flowing tributary (Jacksons Creek) drains into Wattle Creek at Site WC1.

Wattle Creek drains into the Upper Cordeaux No.2 reservoir to the east, and approximately 320m outside of, the 20mm subsidence zone, whilst its headwaters are predominantly contained within the 20mm subsidence envelope.

The creek is not regulated by any dams or weirs and there are no major waterfalls.

Wattle Creek stream monitoring site details are shown in **Table 1**.

**Table 1 Wattle Creek Stream Monitoring Sites**

SITE	E (MGA)	N (MGA)	DESCRIPTION
<b>WC1</b>	294560	6189435	2 <sup>nd</sup> order tributary draining off Jacksons / Wanyambilli Hill
<b>WC2</b>	294530	6189470	2 <sup>nd</sup> order tributary draining over LWN5
<b>WC3</b>	294875	6189570	3 <sup>rd</sup> order channel downstream of WC1 / WC2 junction
<b>WC4</b>	292915	6189490	1 <sup>st</sup> order channel upstream of the extraction area

Wattle Creek is predominantly characterised by interspersed pools which are located over exposed crinanite or are upstream of crinanite boulder / cobble accumulations.

Generally small pools develop upstream of elevated rock bars or boulder / cobble accumulations, often with less than 0.5m drop between the pools. The pools are generally small due to the steep gradient of the creek bed.

The stream banks in the section upstream of Site WC3 are generally steep, although laid back, and can be over 20m high within a well defined channel with well developed rainforest vegetation along the banks and no apparent erosion or bank instability.

Downstream of WC3, the stream gradient reduces, although the well defined channel and rainforest vegetation is still present, albeit with lower banks.

#### 4.1.1 Stream Chemistry

Water quality monitoring in Wattle Creek commenced in June 2009 as shown in **Appendix A**.

The creek at and downstream of WC2 has had a perennial flow, whilst the north flowing 2<sup>nd</sup> order tributary (Jacksons Creek) draining off Jacksons Hill and Wanyambilli Hill is often dry.

Wattle Creek's pH ranges from 5.7 to 7.5, which is occasionally below the pH 6.5 ANZECC 2000 South Eastern Australia Upland Stream criteria. The creek's salinity ranges from 117 - 185µS/cm, and generally rises after prolonged dry periods with less recharge to the stream.

Iron levels are generally low and there are no significant orange coloured iron oxyhydroxide precipitation areas. Sulfate levels are generally low (3 – 11mg/L) with no indicated dissolution of sulfuric acid after iron sulfide weathering in the crinanite.

Wattle Creek is within the acceptable range for potable water, however it can exceed the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines for the following parameters, depending on the flow conditions at the time of sampling;

- filtered copper and / or zinc very occasionally at all sites, and
- total nitrogen as well as total phosphorous at all sites, occasionally, with no regular pattern.

## 4.2 Little Wattle Tree Creek

Little Wattle Tree Creek flows in an easterly direction over the northern end of LWN5 and the adjacent catchment as shown in **Drawing 3**.

The main channel over LWN5 is a 1<sup>st</sup> order creek (DIPNR, 2005), which becomes a 2<sup>nd</sup> order stream upstream of the LWTC1 monitoring site.

Little Wattle Tree Creek drains into the Upper Cordeaux No.2 reservoir approximately 1250m to the east of LWN5, whilst its headwaters are located within the 20mm subsidence zone.

The channel of Little Wattle Tree Creek has not been undermined by any of the previous or proposed panels

The creek is not regulated by any dams or weirs and there are no waterfalls. Stream monitoring site details are shown in **Table 2**.

**Table 2 Little Wattle Tree Creek Stream Monitoring Sites**

SITE	E (MGA)	N (MGA)	DESCRIPTION
LWTC1	294920	6190020	At Fire Road 6 crossing

Little Wattle Tree Creek is characterised by a series of small boulder and cobble based pools as well as small pools developed on exposed columnar jointed crinanite, often with less than a 0.5m drop between the pools.

The stream is well defined with steeply sloping banks up to 10m high with a well developed rainforest and no apparent erosion or bank instability.

### 4.2.1 Stream Chemistry

Water quality monitoring in Little Wattle Tree Creek commenced in June 2009 as shown in **Appendix A**.

The LWTC1 site is generally dry, or ponded but not flowing. The creek's pH ranges from 5.5 to 6.6, which is generally marginally more acidic than Wattle Creek, and is predominantly below the pH 6.5 – 7.5 ANZECC 2000 South Eastern Australia Upland Stream criteria.

The creek's salinity ranges from 95 - 134 $\mu$ S/cm, which is generally less saline than Wattle Creek, and rises after prolonged dry periods.

Iron levels in the creek are generally low with some minor orange coloured iron oxyhydroxide precipitation seepage locations.

Sulfate levels are generally low (2 – 7mg/L) indicating no distinctive dissolution of sulfuric acid after iron sulfide weathering in the crinanite.

The creek is within the acceptable range for potable water, however it can exceed the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines for the following parameters, depending on the flow conditions at the time of sampling;

- filtered zinc very occasionally at all sites,
- total nitrogen, in all samples to date, and;
- total phosphorous, infrequently.

## **5. PREDICTED AND OBSERVED SURFACE WATER IMPACTS**

### **5.1 Creek Subsidence**

#### **5.1.1 Potential Impacts**

Maximum subsidence of;

- 50 - 100mm in Wattle Creek;
- <20mm in Little Wattle Tree Creek

#### **5.1.2 Creek Subsidence Observations**

No direct subsidence measurements have been conducted in Wattle Creek or Little Wattle Tree Creek, however extrapolation from monitoring Line NM1 indicates there has been no perceptible impacts on either creek due to extraction of Panel N4.

*No stream flow related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.*

### **5.2 Stream Flow**

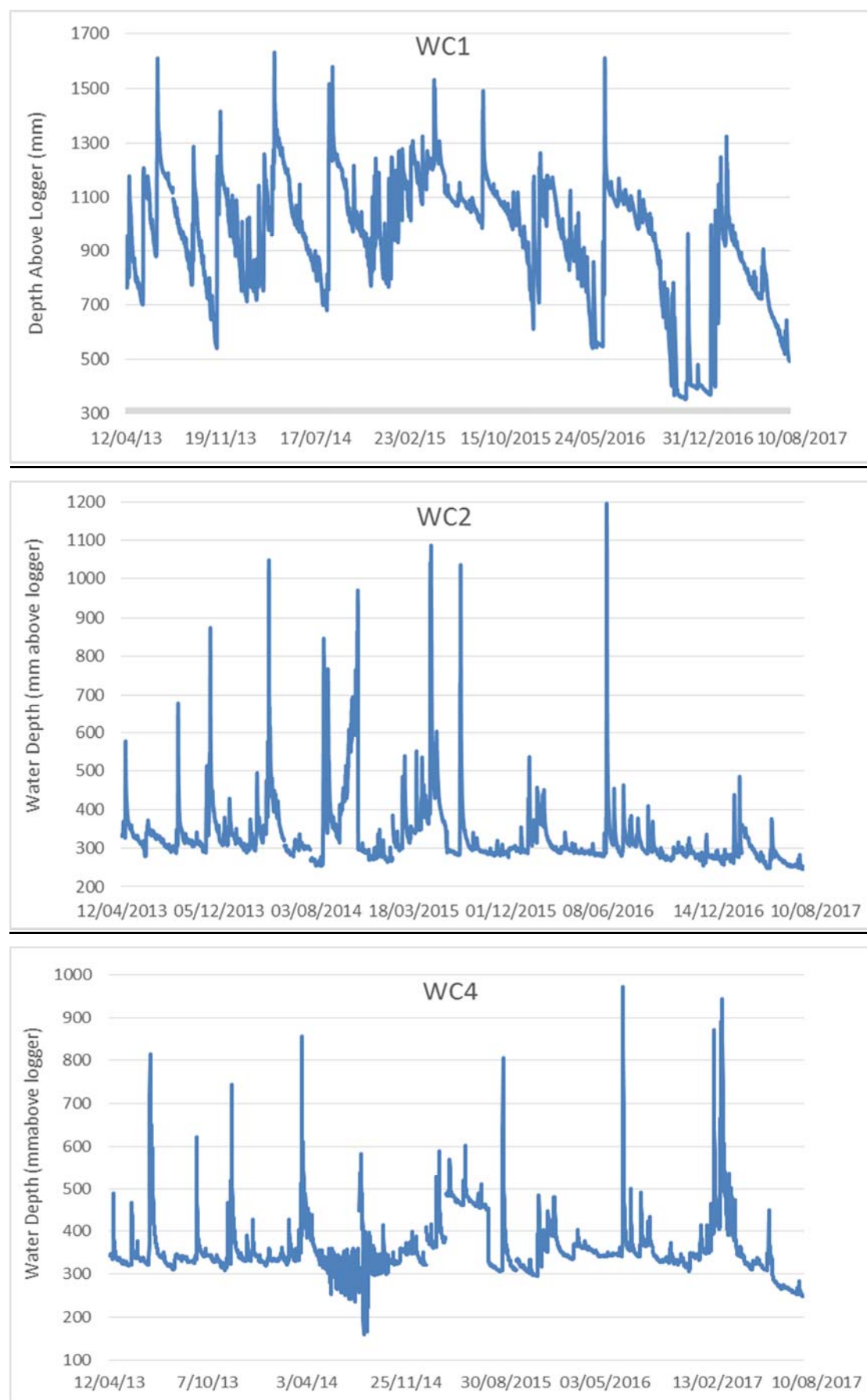
#### **5.2.1 Potential Impacts**

- No anticipated adverse effect on stream flow in Wattle Creek or Little Wattle Tree Creek.

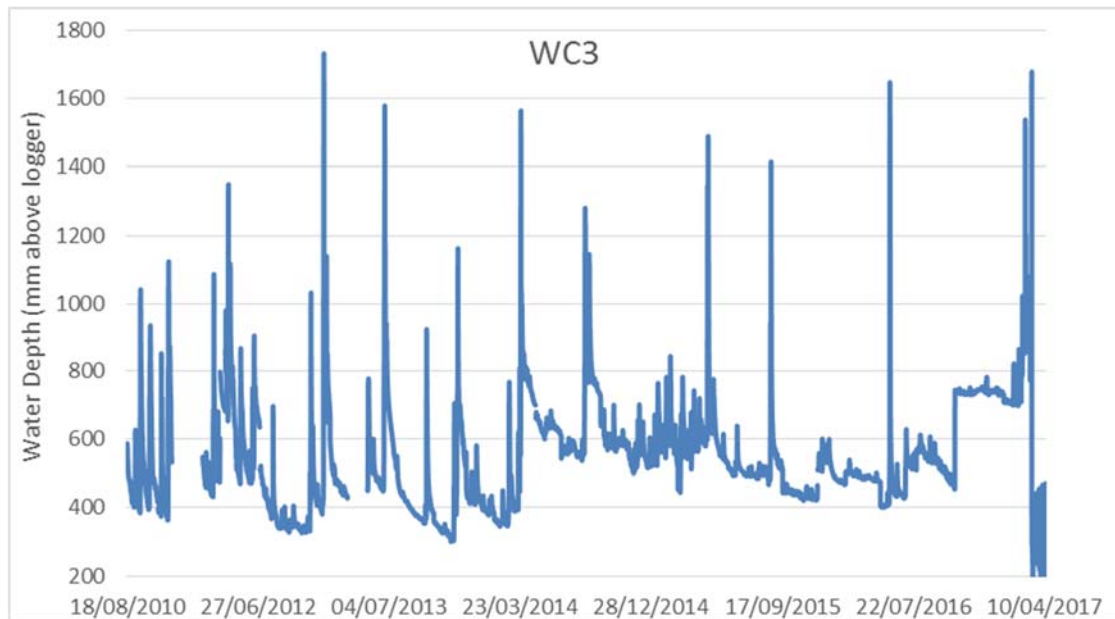
#### **5.2.2 Stream Flow Observations**

AS shown in Figures 1 and 2, there has been no observed adverse effect on stream flow in Wattle Creek or Little Wattle Tree Creek due to extraction of Panel N4.

*No stream flow related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.*



**Figure 1** Stream Water Levels



**Figure 2 Stream Water Levels**

### 5.3 Stream Water Quality

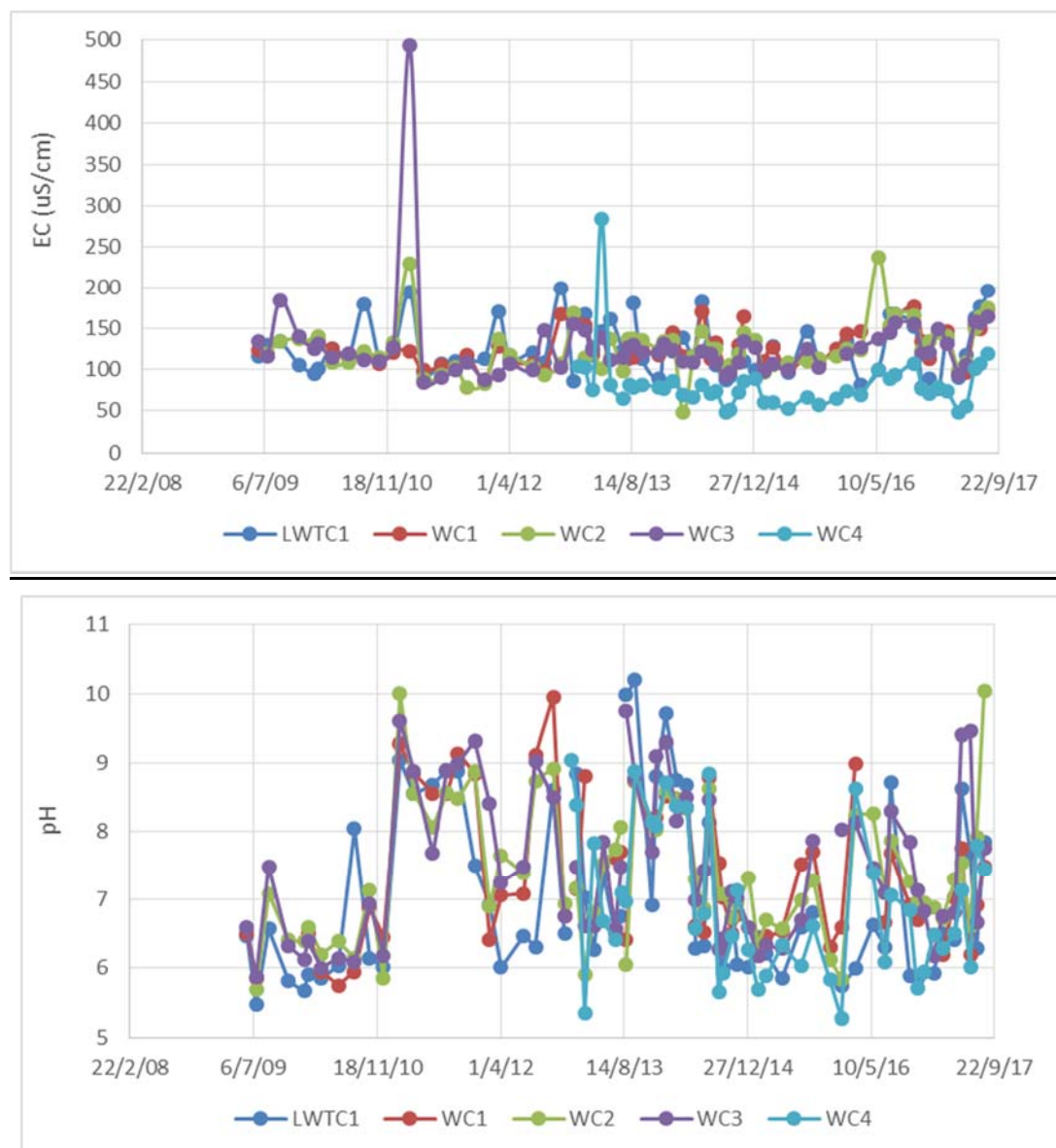
#### 5.3.1 Potential Impacts

- increased iron hydroxide precipitation, and;
- lowering (acidification) of pH.

#### 5.3.2 Wattle and Little Wattle Tree Creek Observations

As shown in **Figure 3** and **Appendix A**, no observable water quality changes occurred in Wattle Creek or Little Wattle Tree Creek due to extraction of Longwall N2 or Panel N4.

No stream water quality related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.



**Figure 3 Stream Water Field Chemistry**

## 5.4 Stream Bed and Bank Stability

### 5.4.1 Potential Impacts

- no anticipated adverse effect on stream bed or bank instability or cracking of the stream bed is anticipated in Wattle Creek or Little Wattle Tree Creek resulting from extraction of Longwall N2 and Panel N4.

### 5.4.2 Observed Impacts

No adverse effect has been observed on stream bed or bank instability or cracking of the stream bed in Wattle Creek or Little Wattle Tree Creek.

No stream bed or bank stability related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.

## 6. NEBO GROUNDWATER

The hydrogeology of the Nebo area is distinctly different to all other underground coal mines in the Southern Coalfield due to the presence of the up to 97.5m thick (as drilled) crinanite with its very low permeability, low storativity and its “aquitard” nature both pre and post subsidence (GeoTerra, 2010).

The crinanite is located at the top of the overburden stratigraphic profile and outcrops over approximately 95% of the Nebo area workings as a flat lying to bowl shaped igneous intrusion.

The presence of the crinanite is very significant, in that it acts as an aquitard over the Narrabeen Group and Permian Coal Measures. It separates the shallow soil groundwater system and connected streams at surface from the underlying Narrabeen Group and Permian Coal Measures.

The crinanite differentiates Nebo from all other coal mining areas in the Southern Coalfield and provides a unique hydrogeological and hydrological setting in which to assess and predict coal extraction subsidence effects on surface water and groundwater systems overlying the proposed workings.

Aquifers present that can interact with the local streams are;

- shallow, perched ephemeral aquifers in the up to 6.5m deep soil profile, and, if present
- low flow, short duration seeps from the crinanite or interface drainage originating between the crinanite and the limited exposures of the Narrabeen Group or Hawkesbury Sandstone along the western ridge.

In some cases the sill complex has replaced the majority of the standard sequence of sandstone / shale seen in all other Southern Coalfields mining areas.

Geotechnical studies (SCT Operations, 2017) indicate that even after extraction where the Illawarra Coal Measures and Narrabeen Group (or Hawkesbury Sandstone if present) overburden is subsided and fractured, the Cordeaux Crinanite is anticipated to maintain its aquitard status where it is greater than 30m thick. This conservative value is an interpreted thickness under which the aquitard properties of the crinanite is likely to remain intact.

Due to the steep topography and the above mentioned factors, as well as depressurisation in subsided and fractured areas over and within the previous workings at Eloura / Nebo, there is anticipated to be essentially no notable remnant groundwater bearing strata in the Illawarra Coal Measures or Narrabeen Group sedimentary units underneath the crinanite.

No NOW registered private bores are located within the Nebo area as it is within a restricted access water catchment area administered by Water NSW.

### 6.1 Open Standpipe Piezometers

Open standpipe piezometers installed within the Nebo area include seven (6.5 to 109.5m deep) open standpipe piezometers installed by Gujarat NRE FCGL Pty Ltd (now Wollongong Coal Limited) in January 2010 as summarised in **Table 3** and shown in **Drawing 2**.

Each piezometer was installed with a pressure transducer reading water pressure (levels) at least twice per day.



**Table 3 Nebo Open Standpipe Piezometers**

Piezometer	Licence	E	N	RL mAHD	TD mbg	Intake (mbgl)
Nebo 1 (S)	10BL603365	295153	6188762	366.4	6.0	5.0 – 6.0
Nebo 1 (D)	10BL603365	295152	6188761	366.5	97.6	85.6 – 97.6
Nebo 2 (S)	10BL603365	294662	6189246	347.7	6.5	5.5 – 6.5
Nebo 2 (D)	10BL603365	294662	6189237	348.5	31.0	19.0 – 31.0
Nebo 3	10BL603365	295033	6189838	356.7	33.6	21.6 – 33.6
Nebo 4	10BL603365	294661	6189893	374.1	110.0	107.5 – 109.5

**NOTE:** n/a - not available      mbgl - metres below ground level      SWL - standing water level  
mbtoc - metres below top of casing      Nebo 5 was not drilled      all bores drilled in Dec 2009

## 6.2 Vibrating Wire Piezometers

Four vibrating wire piezometer arrays were installed between December 2009 and January 2010 as outlined in **Table 4** and shown in **Drawing 2**.

**Table 4 Nebo Vibrating Wire Piezometers**

Piezometer	Installed	E	N	RL mAHD	TD mbg	VWP Intakes (mbgl)
Nebo 6	Dec 2009	295237	6189510	354.2	119	60, 80, 100 (CC), 119 (KS)
Nebo 7	Dec 2009	295477	6189585	336.4	92	30, 45, 63 (CC), 90 (WW)
Nebo 8	Dec 2009	294679	6189485	343.4	91	15, 35, 52 (CC), 72 (SS)
Nebo 8A	Jan 2010	294549	6189499	359.6	69	25, 45, (CC)

**NOTE:** CC – Cordeaux Crinanite      SS - Scarborough Sandstone      WW – Wongawilli Coal Seam  
KS – Kembla Sandstone

## 7. PREDICTED AND OBSERVED GROUNDWATER IMPACTS

### 7.1 Aquifer / Aquitard Interconnection

#### 7.1.1 Potential Impacts

- no adverse interconnection of aquifers and aquitards is anticipated within 20m of the surface;
- potential increase in the rate of groundwater recharge into the basement following rainfall due to increased porosity and permeability of the fractured strata.

#### 7.1.2 Aquifer / Aquitard Interconnection Observations

No adverse aquitard / aquifer interconnection or increased recharge has been observed in the vicinity of, or resulting from, extraction of Longwall N2 and Panel N4.

No aquifer / aquitard interconnection related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.



## 7.2 Groundwater Levels

### 7.2.1 Potential Impacts

The following groundwater level impacts could potentially occur;

- groundwater levels may reduce by up to 10m, and may stay at that reduced level until maximum subsidence develops at a specific location;
- groundwater levels should recover over a few months as the newly developed secondary porosity is recharged by rainfall;
- no permanent post mining reduction in groundwater levels unless a new outflow path develops, and;
- temporary lowering of the deep piezometric surface over the subsidence area due to horizontal dilation of strata and resultant increase in secondary porosity.

### 7.2.2 Groundwater Level Observations

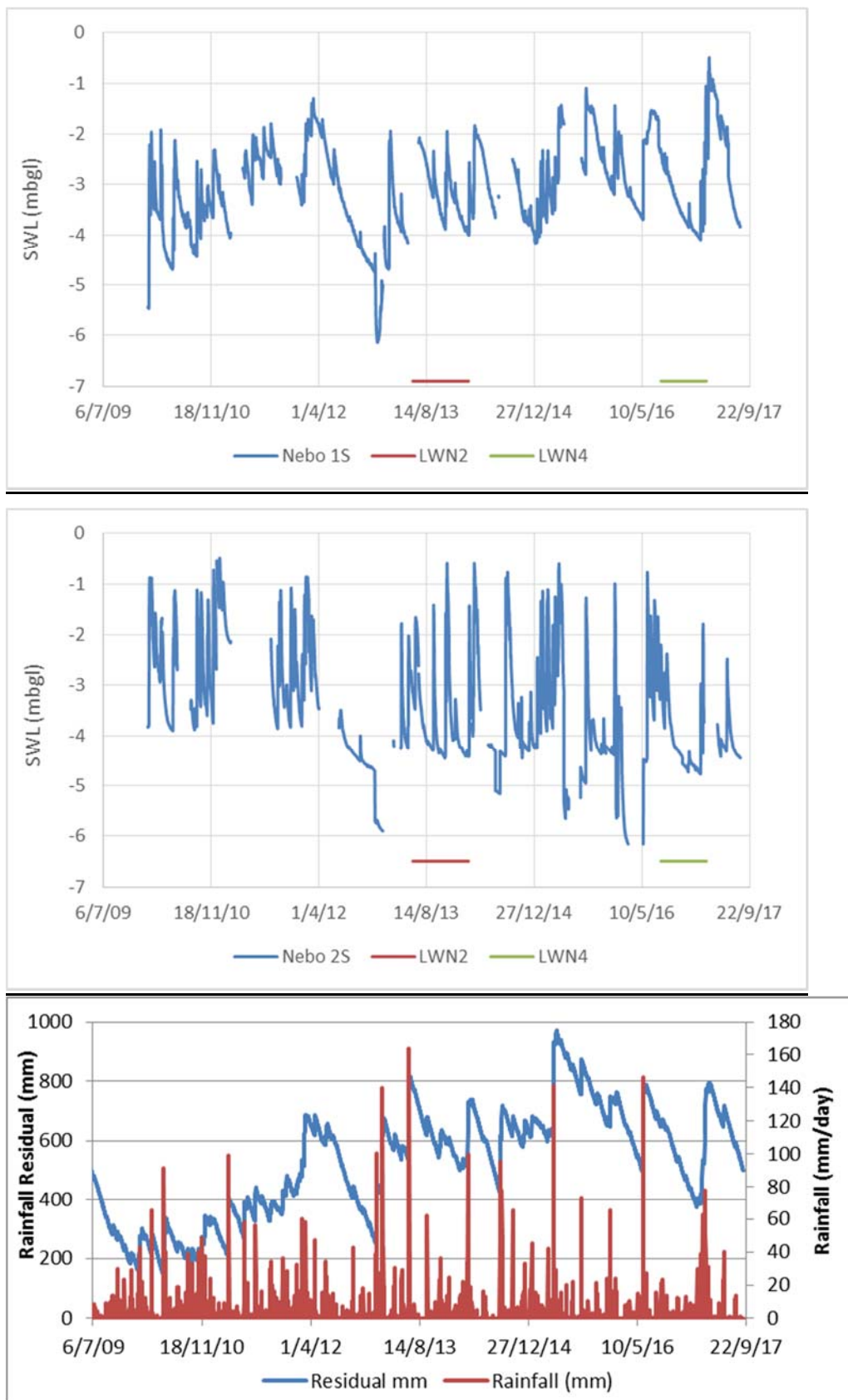
Neither of the shallow soil, alluvium or colluvium piezometers (Nebo1S or Nebo2S) overlie Panel N4, and both have varied in response to rainfall in the catchment as shown in **Figure 4**, with no influence from N4 during its period of extraction.

Neither of the crinanite piezometers Nebo2D or Nebo3 overlie N4, and both have varied in response to rainfall in the catchment as shown in **Figure 5**, with no apparent diversion from the natural water level trends from N4 during its period of extraction.

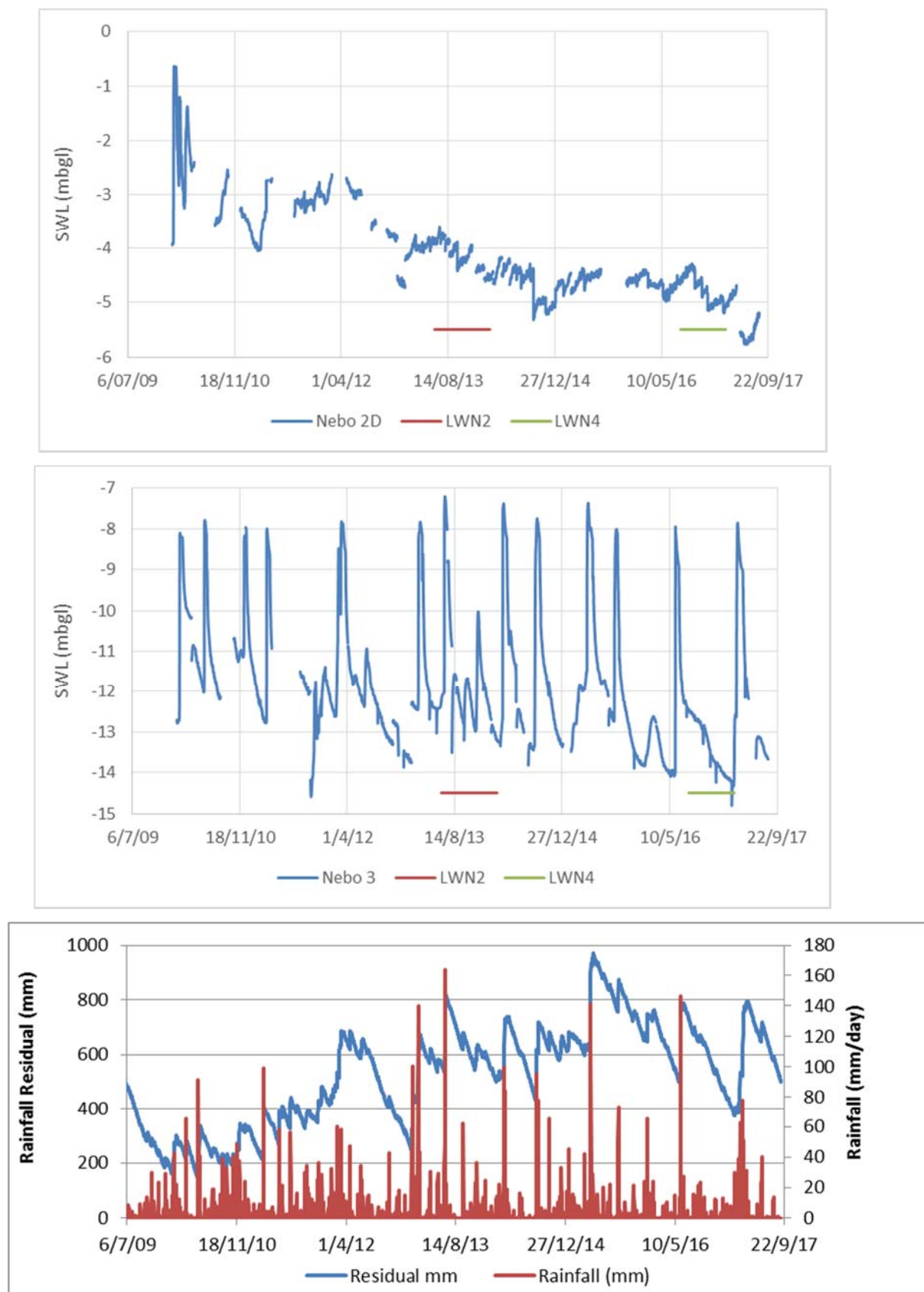
Piezometer Nebo1D was installed in the Narrabeen Group, although is also not in close proximity to, and did not show a response to extraction of N4 as shown in **Figure 6**.

Piezometer Nebo4, which was installed in the Bulli Seam, to the north of N4, showed a rising water level during extraction of LWN2, albeit with short term drops and recoveries following water extraction sampling events, along with a 2.1m decline in water level during extraction of Panel N4, and a subsequent total drying out as shown in **Figure 7**.

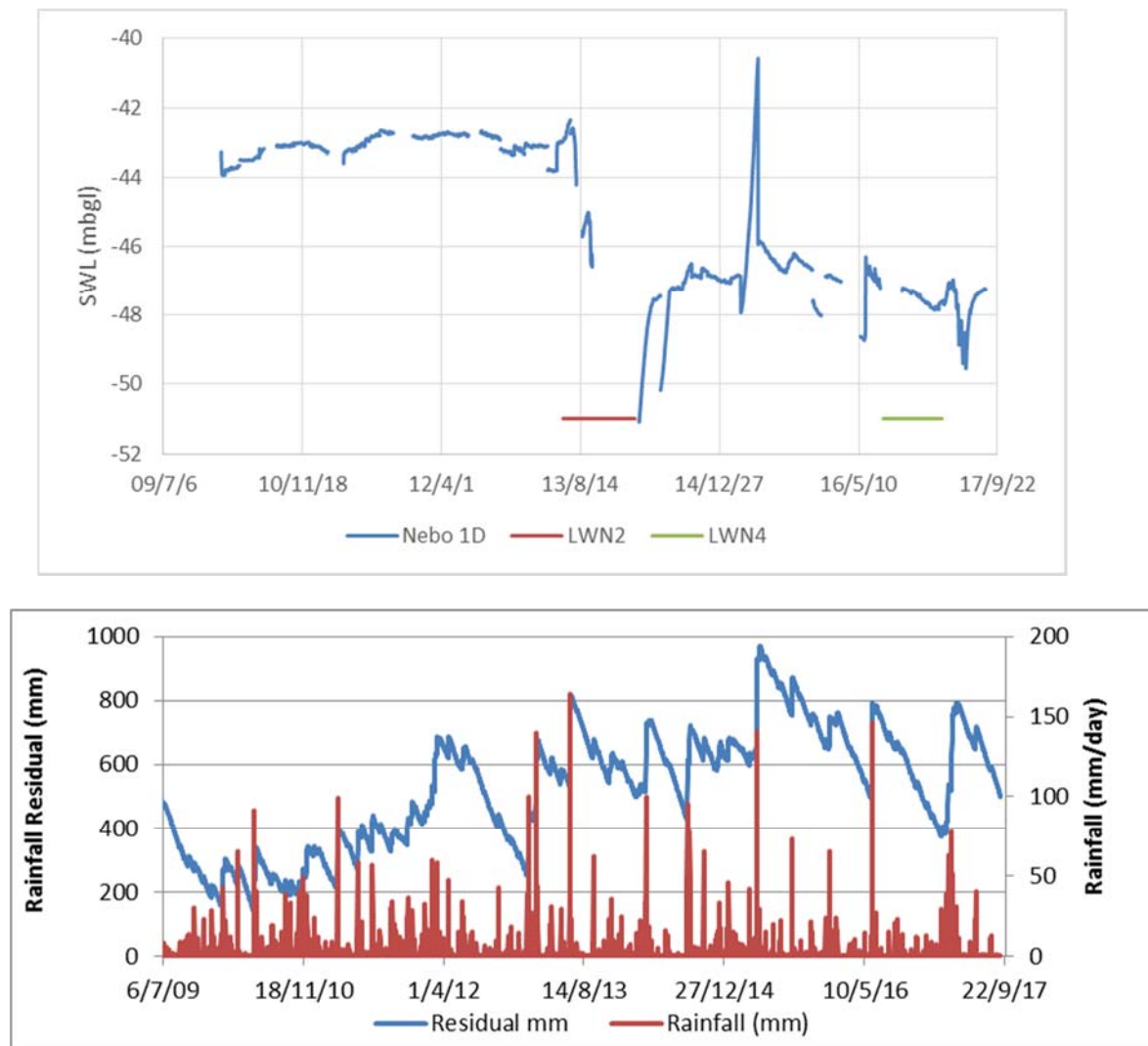
*No groundwater level related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.*



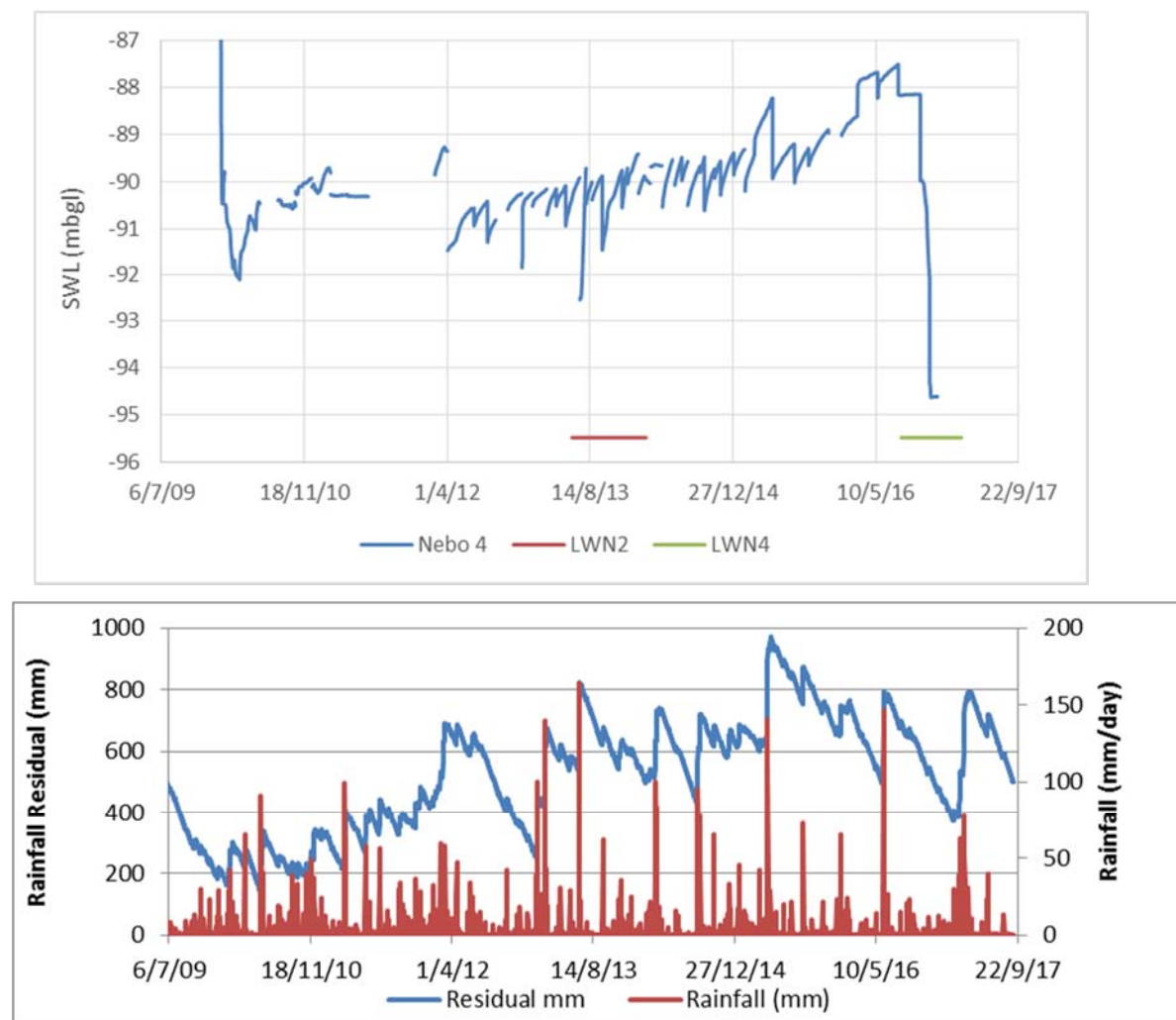
**Figure 4 Alluvium / Colluvium Groundwater Levels**



**Figure 5** Crinanite Groundwater Levels



**Figure 6** Narrabeen Group Groundwater Level

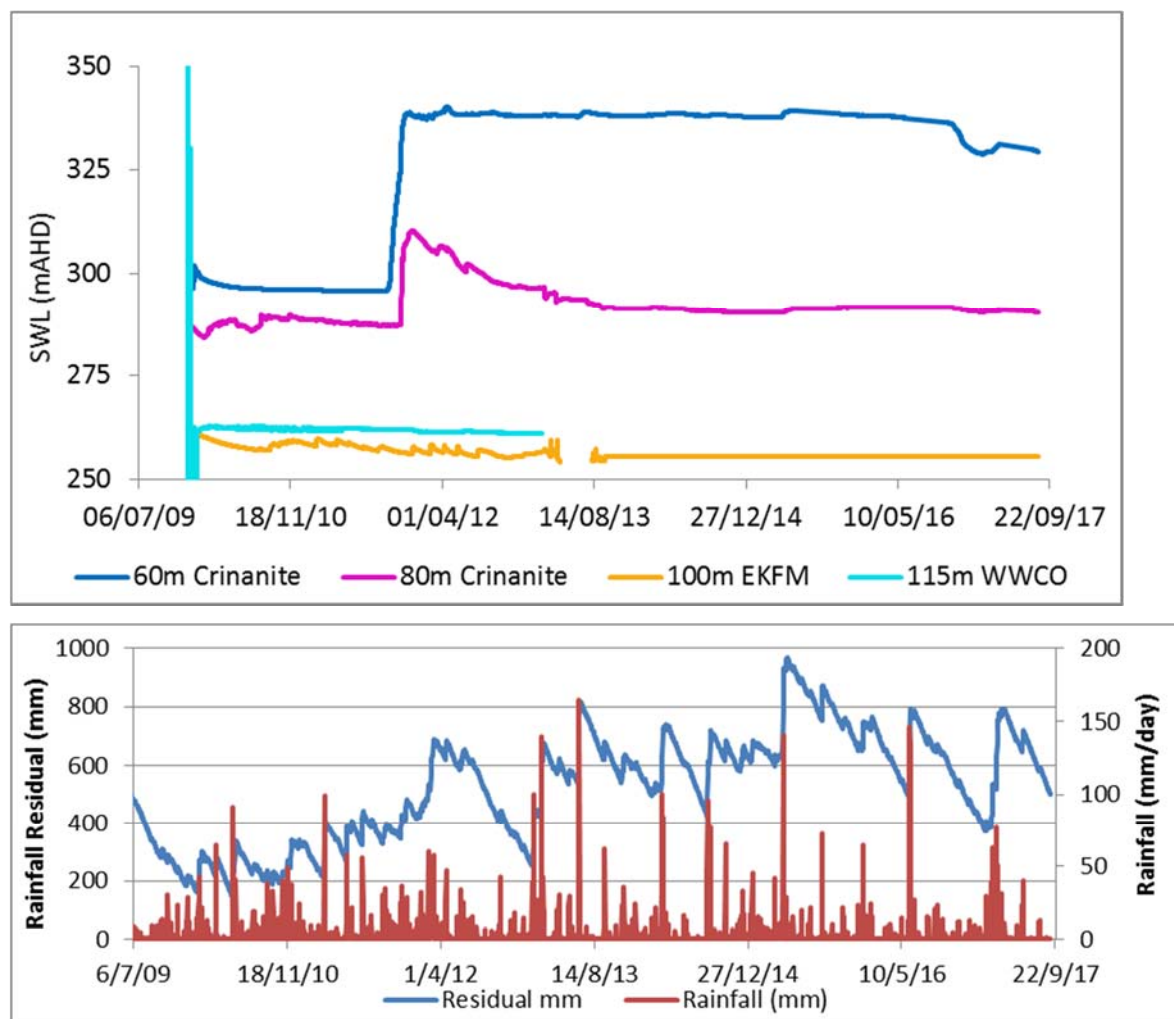


**Figure 7 Bulli Seam Groundwater Level**

The vibrating wire arrays installed in Nebo6, Nebo 7, Nebo 8 or Nebo8A demonstrated no response to Longwall N2 or Panel N4 extraction which indicates no mining subsidence effect in the crinanite.

In addition, no correlation with the water level of Cordeaux dam and the VWP intakes is apparent.

Water levels in the four VWP arrays are shown in **Figures 8 to 11**.



**Figure 8**      **Nebo 6 VWP**

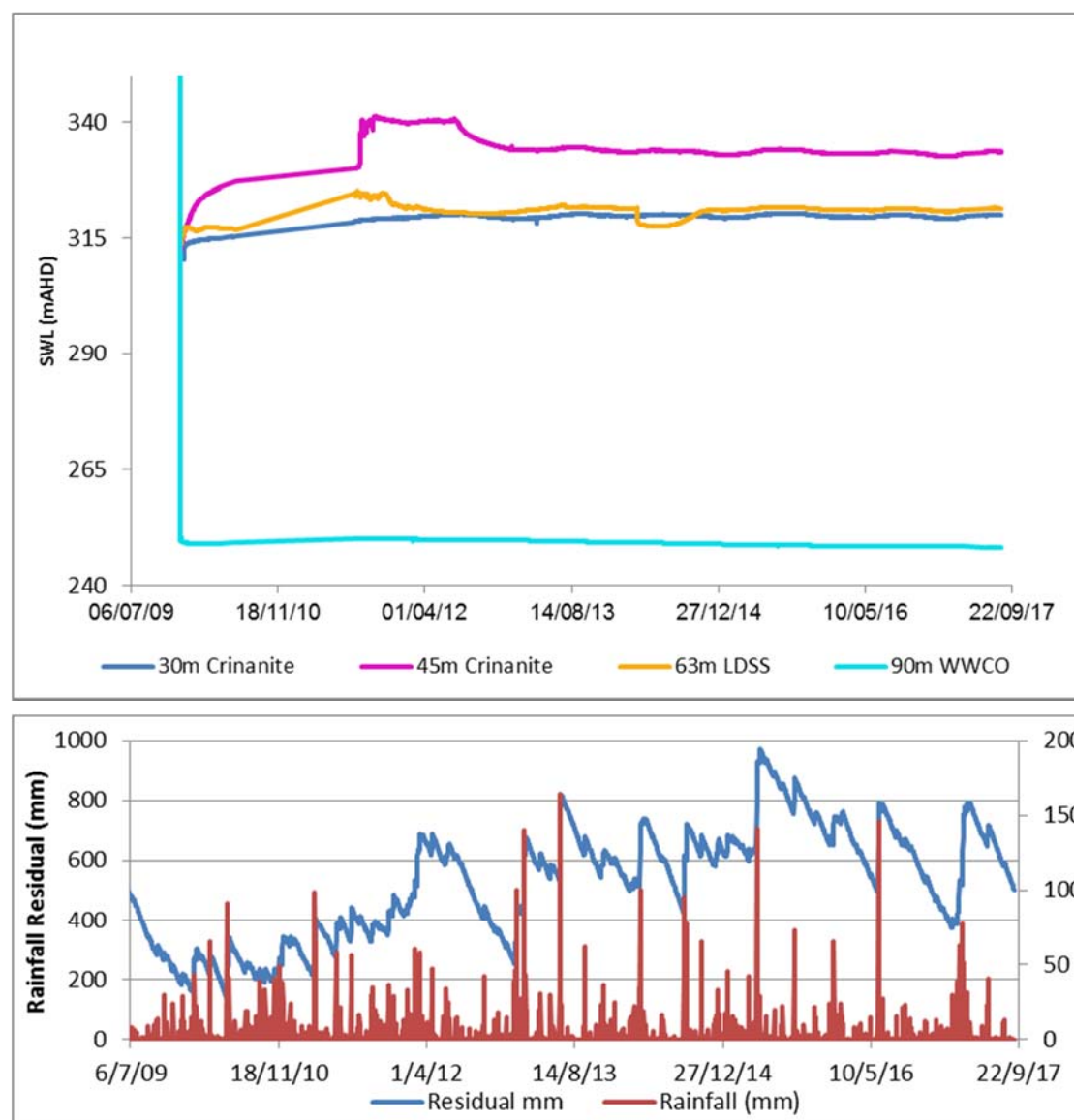
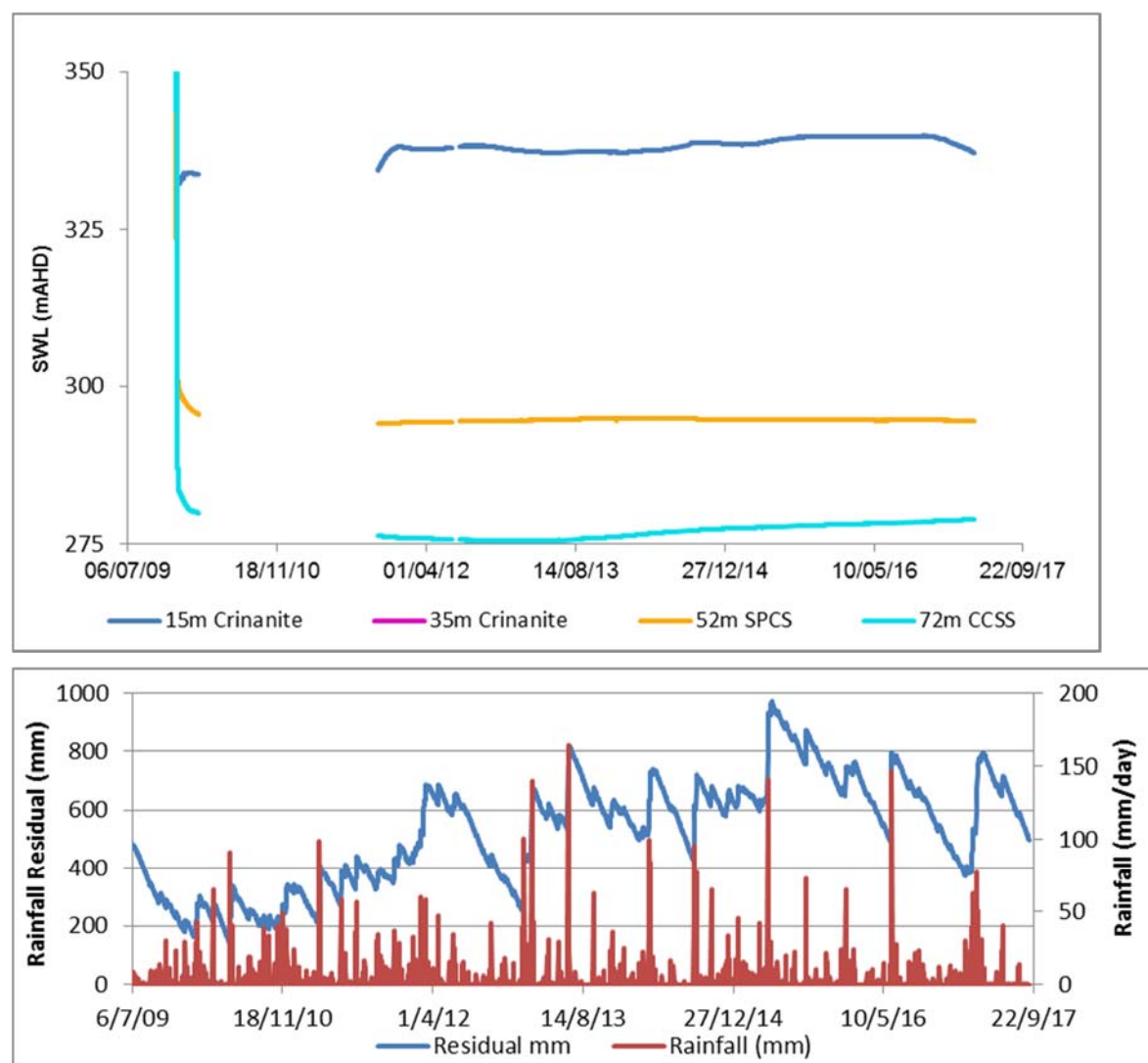


Figure 9 Nebo 7 VWP





**Figure 10**      **Nebo 8 VWP**



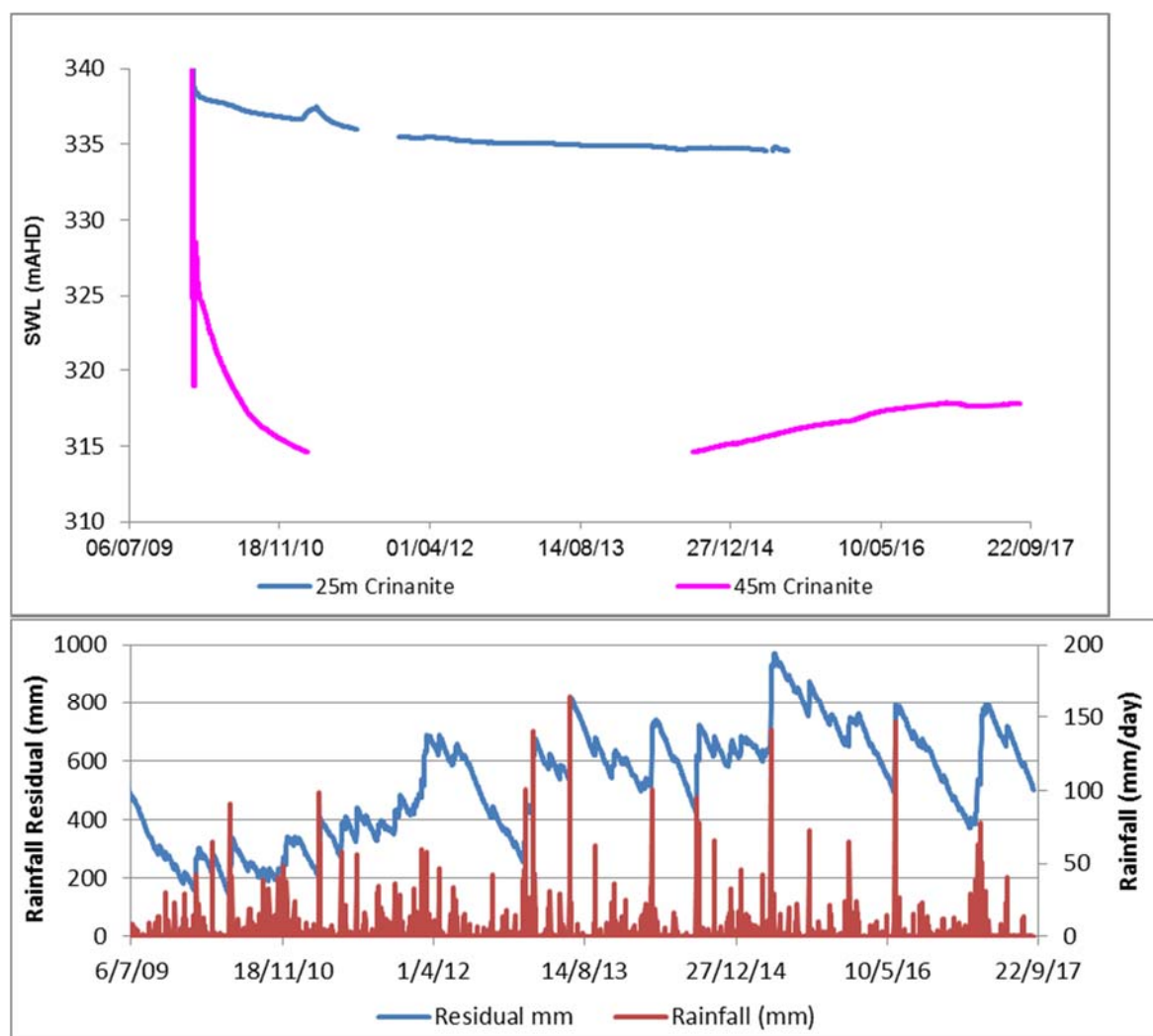


Figure 11 Nebo 8A VWP

#### 4.5 Groundwater Quality

Groundwater in the Nebo study area has generally fresh to brackish salinity (39-2965 $\mu$ S/cm) with acid to acidic to circum-neutral pH (3.3 – 7.5) as summarised in **Table 5** and shown in **Figures 12 to 15**.

However, cement used to seal the piezometers during installation has had a definitive increase in alkalinity (up to pH 14) and salinity (up to 14500 $\mu$ S/cm) in Nebo 1D, 2D and 4, which means they do not represent the actual formation water chemistry.

Piezometers 1S, 2S and 3 appear to be unaffected by cement and better represent the formation water chemistry, although a cement influence is present.

**Table 5      Nebo Field Groundwater Quality**

Formation	Piezometers	EC (µS/cm)	pH
Shallow	1S, 2S	32 – 1,071	3.3 – 9.3
Crinanite	2D, 3	230 – 2,950	6.7 – 9.8
Narrabeen	1D	123 – 2,965	7.5 – 10.5
Bulli Seam	4	798 – 14,440	10.9 – 13.9

**Note:** Nebo 1D, 2D and 4 are strongly affected by cement, 1S, 2S and 3 better represent actual formation water chemistry

Laboratory analyses indicate that the monitored groundwater is outside ANZECC 2000 criteria (default trigger values for physical & chemical stressors in SE Aust Upland Rivers / 95% protection of freshwater species / livestock / irrigation) as shown in **Appendix B** for:

- Total nitrogen;
- Total phosphorous
- Copper
- Lead
- Zinc;
- Nickel, and
- Aluminium

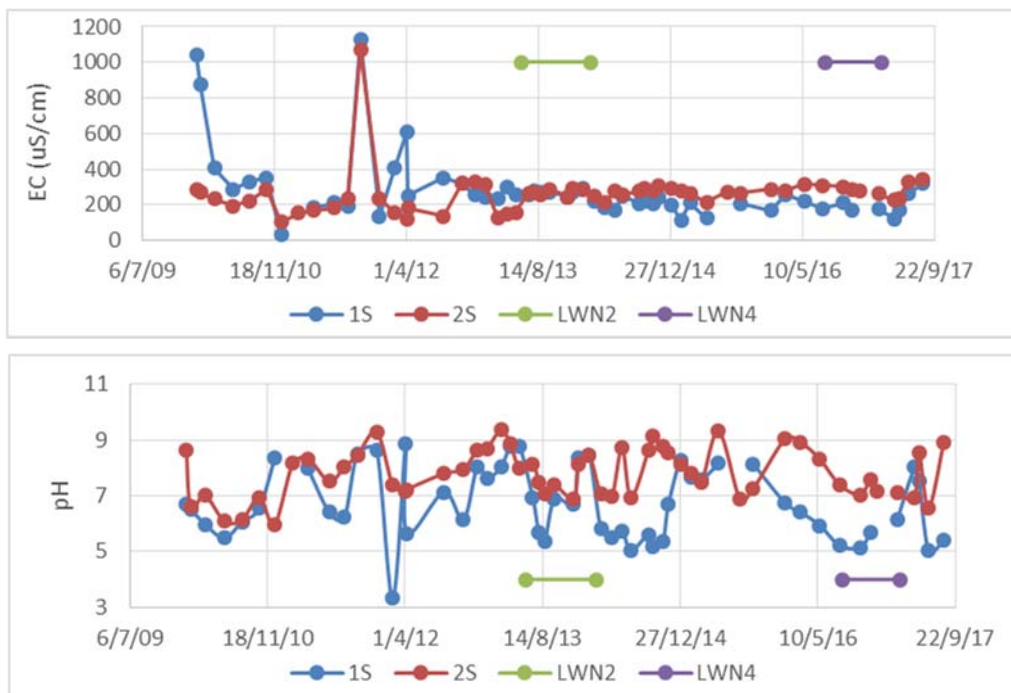
Note that the water chemistry of Nebo 1D, 2D and 4 are strongly affected by cement used to seal the piezometer intake and do not therefore represent the actual formation water quality.

The exceedance varies depending on the applicable guideline applied for the end use of the water.

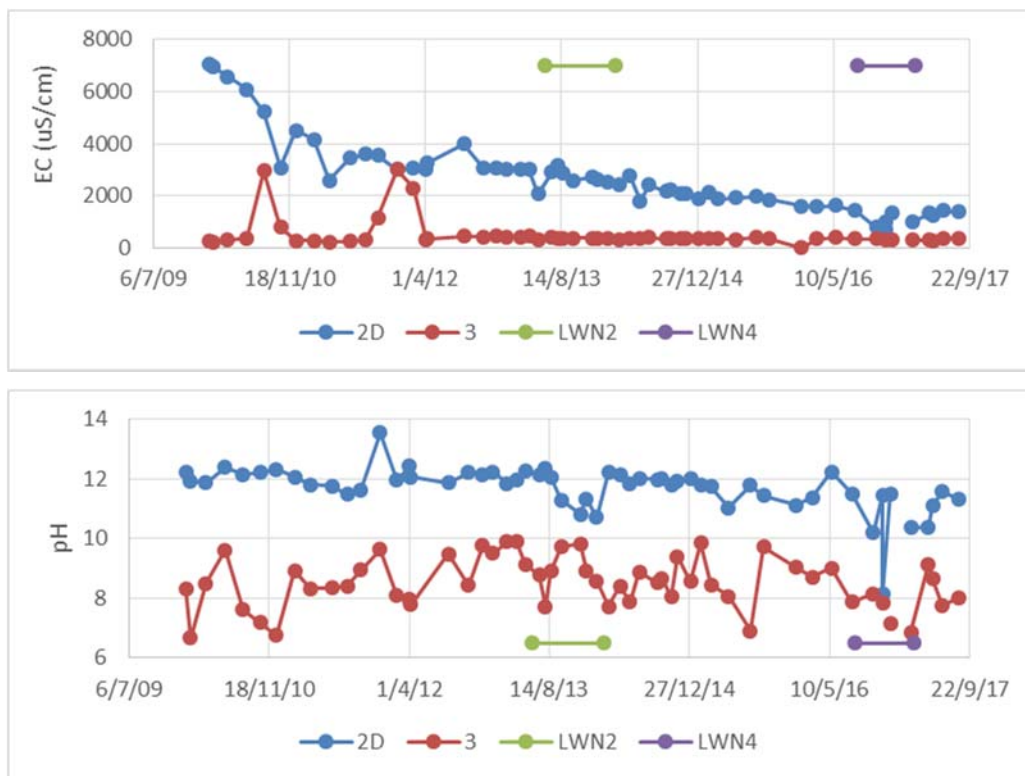
Groundwater in the Nebo area is suitable for selected livestock and limited irrigation use, but not for potable water.

No adverse change to groundwater quality in the Nebo piezometers has been observed, along with no distinctive increase in salinity, nutrients or metals as summarised in **Appendix B**.

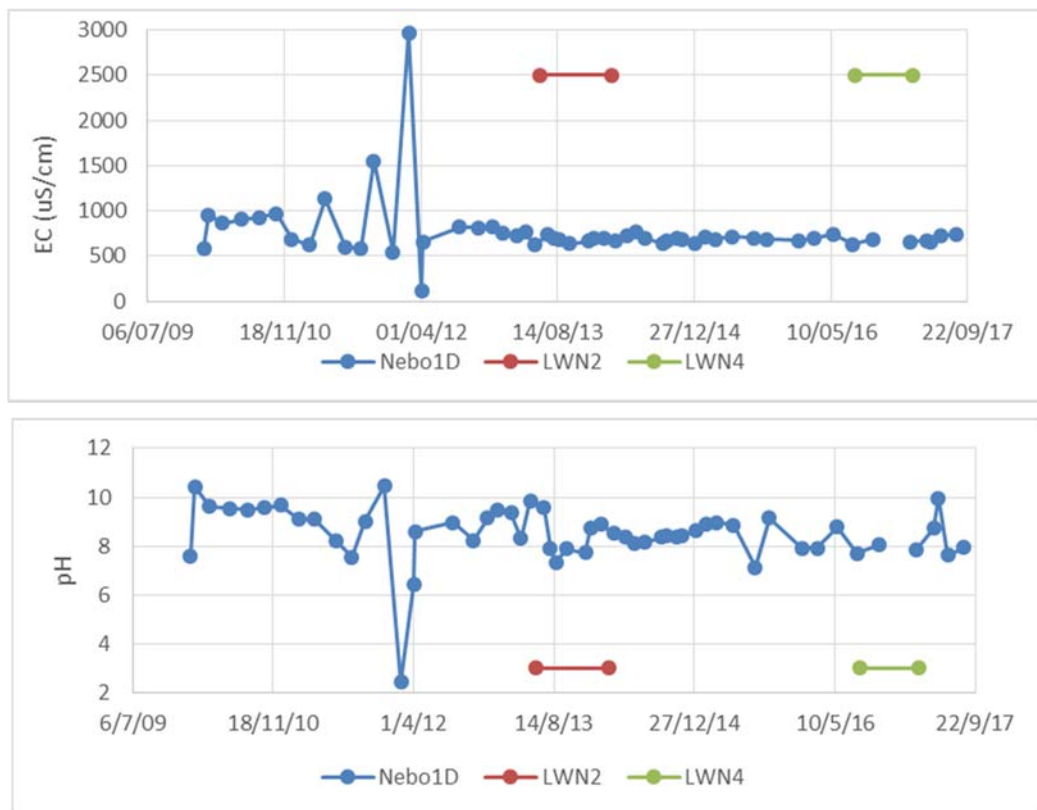
No groundwater quality related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.



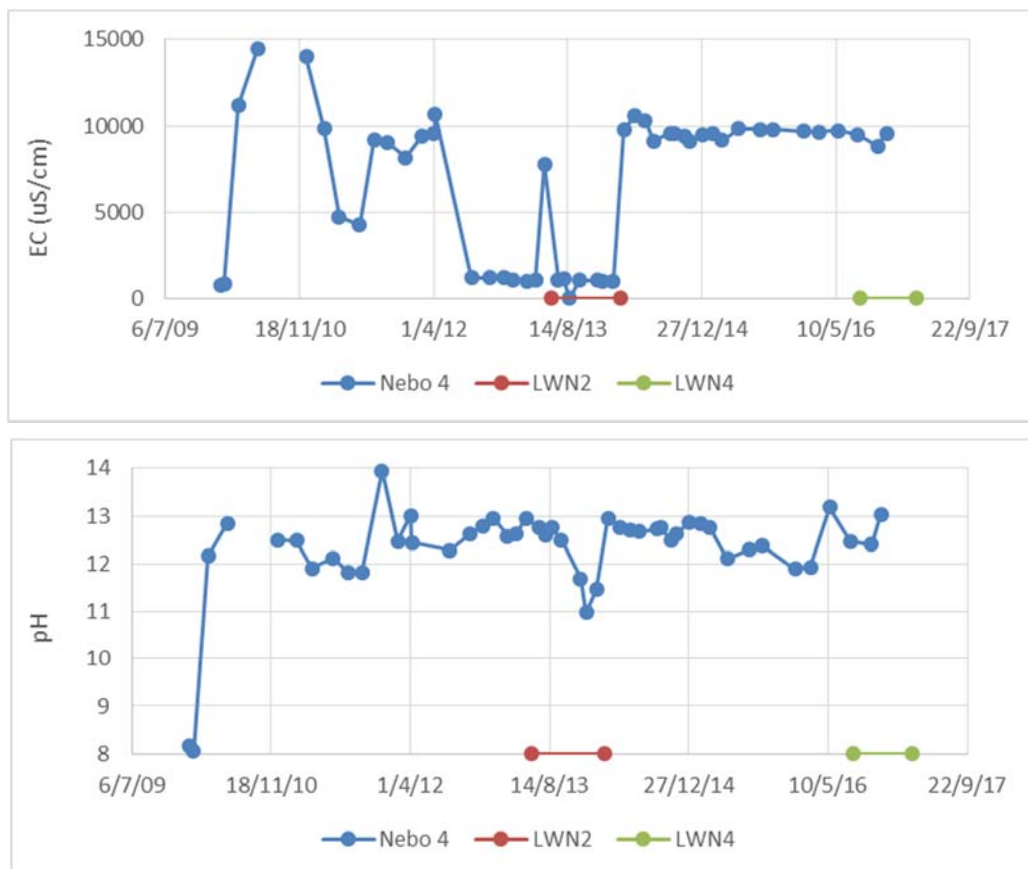
**Figure 12 Soil and Shallow Field Groundwater Quality**



**Figure 13 Crinanite Field Groundwater Quality**



**Figure 14 Narrabeen Formation Field Groundwater Quality**



**Figure 15 Bulli Seam Field Groundwater Quality**

## 4.6 Inflow to Mine Workings

### 4.6.1 Predicted Impacts

- No observable increase in groundwater inflow to mine workings.

### 4.6.2 Mine Inflow Observations

There was no groundwater make from the Panel N4 during and after extraction of N4, (Pers comm. - Paul Coxhead - Mining Engineering Manager).

No mine water discharge related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2 or Panel N4.

## 5 SUMMARY OF RESULTS

Although the subsidence movements along the axis or across the whole panel were not directly measured, the subsidence that was observed in the vicinity of N4 Panel is less than or consistent with the predictions made in the EP/SMP and Part 3A Application.

Recent subsidence monitoring above the nearby Longwall N2 (SCT2014) has confirmed the bridging capacity of the Cordeaux Crinanite (dolerite) sill within the overburden sequence for the approved panel geometries in the Nebo area.

This bridging has limited the magnitude of the maximum subsidence and associated parameters to levels that are imperceptible for all practical purposes. Similar overburden behaviour is likely to have occurred above N4 Panel, although this has not been confirmed with direct measurement.

The maximum subsidence parameters observed in the vicinity of the N4 Panel along NM1 monitoring line but outside the goaf edge are:

- subsidence 43mm
- tilt <0.9mm/m
- strain 0.6mm/m (compression) and 0.4mm/m (tension)

Based on the low levels of ground movement observed as a result of Longwall N2 and Panel N4 extraction, there have been no adverse or unexpected impacts on the groundwater or surface water systems at Nebo.

The only notable impact has been that Piezometer Nebo 4, which is screened adjacent to Panel N4 within the Bulli Seam, became fully dewatered during extraction of N4. This impact is within the predicted impacts and was expected to happen due to the coal extraction and transmitted effect from creating an atmospheric pressure void within the seam due to mining Panel N4.

The subsidence impacts and consequences from the extraction of Longwall N2 and Panel N4 are within the predicted impacts and comply with the subsidence impact performance measures in Project Approval 09\_0161 for surface water and groundwater systems at Nebo.

## 6 REFERENCES

- ANZECC 2000 Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Vol 1 & 2
- Department of Environment and Conservation, 2004 Contaminated Sites: Draft Guidelines for the Assessment and Management of Groundwater Contamination
- Department of Land and Water Conservation, 1997 The NSW State Groundwater Policy Framework Document
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- DIPNR, 2002 Draft Guidelines For Management of Stream Systems in Coal Mining – Hunter Valley
- DIPNR, 2003 Groundwater Monitoring Guidelines for Mines Within the Hunter Region
- GeoTerra, 2010 Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Panels 1 to 6 Groundwater Assessment
- GeoTerra, 2010A Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Panels 1 to 6 Surface Water Assessment
- MSEC, 2010 Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts of Natural Features and Surface Infrastructure Resulting From the Proposed Extraction of Longwalls N1 to N6 in the Nebo Area in Support of a Part 3A Application
- Niche, 2011 Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Longwalls N1-N6 Extraction Plan, Rev. D2
- SCT Operations, 2014                      Wongawilli Colliery N2 End of Panel Subsidence Report
- SCT Operations, 2017                      Wongawilli Colliery N4 End of Panel Subsidence Report

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The findings contained in this report are the result of discrete / specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site / sites in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site / sites at all points. Should

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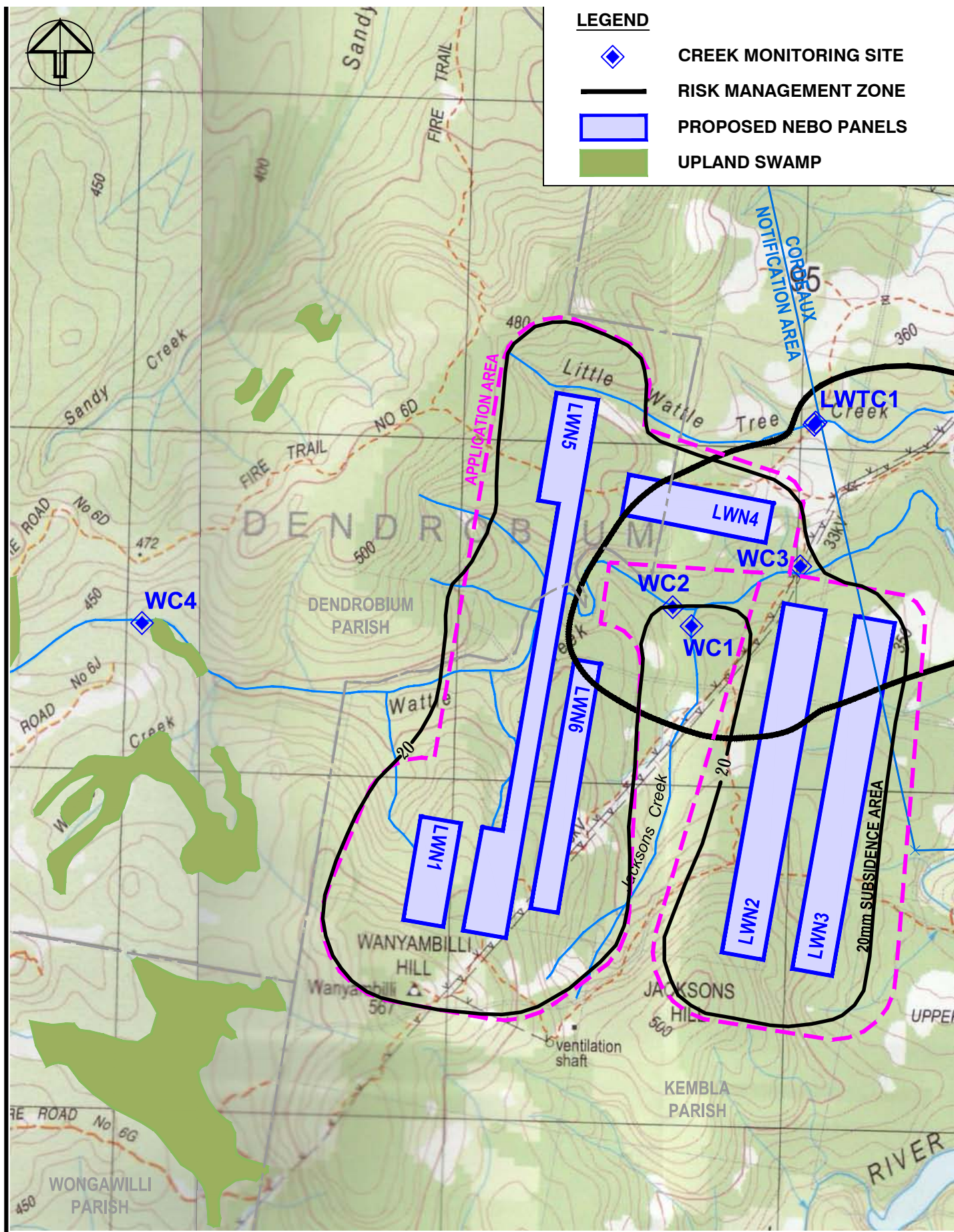
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PROJECT:	NEB5	<b>WOLLONGONG COAL LTD</b> <b>NEBO</b> <b>SURFACE WATER</b> <b>MONITORING LOCATIONS</b>	<b>GeoTerra</b>
DRAWN:	A. DAWKINS		
DATE:	28 May 2010		<b>DRAWING 1</b>
SCALE:	1:15 000		





# APPENDIX A

ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC1	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
9/6/2009	2	78	17	4.2	0.5	5.3	36	0.1	4	33	0.50	0.01	0.17	0.13	0.020	0.01	0.001	0.001	0.002	0.01	<0.1	0.01	0.003	0.01	0.11
17/7/2009	1	69	14	4.1	0.7	5.3	26	0.1	4	26	0.20	0.03	0.08	0.10	0.010	0.01	0.001	0.001	0.01	0.01	0.030	0.01	0.003	0.01	0.03
6/4/2010	3	65	12	5.3	0.4	4.9	20	0.1	4	31	0.40	0.01	1.50	0.13	0.070	0.06	0.001	0.001	0.012	0.01	0.030	0.01	0.001	0.012	0.014
15/6/2010	2	65	12	5.2	0.2	3.6	21	0.1	4	25	0.20	0.01	0.12	0.09	0.01	0.01	0.001	0.001	0.002	0.01	0.030	0.01	0.010	0.006	0.027
18/8/2010	1	87	11	3.0	1.0	4.0	20	0.5	3	35	0.10	0.01	0.05	0.05	0.001	0.001	0.001	0.001	0.005	0.001	0.060	0.001	0.001	0.006	0.031
19/10/2010	1	72	13	3.0	1.0	4.0	20	0.1	3	27	0.10	0.01	0.09	0.05	0.002	0.002	0.001	0.001	0.005	0.001	0.100	0.001	0.001	0.007	0.032
14/12/2010	1	65	12	4.0	1.0	4.0	26	0.1	3	24	0.10	0.01	0.15	0.25	0.002	0.007	0.031	0.06	0.15	0.028	0.100	0.001	0.001	0.087	0.033
18/2/2011	1	69	15	4.0	1.0	5.0	20	0.2	3	25	0.10	0.01	0.18	0.06	0.006	0.004	0.001	0.001	0.005	0.001	0.060	0.001	0.001	0.009	0.033
15/4/2011	2	101	13	4.0	<1	4.0	18	<0.1	3	25	0.30	0.15	0.21	0.14	0.01	0.007	<0.001	<0.001	<0.005	<0.001	0.090	<0.001	<0.001	0.012	0.034
7/1/2011	<1	81	12	4.0	<1	5.0	20	<0.1	14	18	0.20	<0.01	0.21	0.13	0.004	0.001	<0.001	<0.001	<0.005	<0.001	0.190	<0.001	<0.001	0.008	0.029
26/8/2011	2	71	11	4.0	<1	4.0	21	<0.1	3	25	0.50	<0.01	0.12	0.09	0.002	0.001	<0.001	<0.001	<0.005	<0.001	0.120	<0.001	<0.001	0.008	0.029
20/12/2011	<1	89	14	4.0	<1	5.0	21	<0.1	3	28	0.40	0.02	0.14	0.07	0.002	0.002	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.008	0.032
16/2/12	8	91	11	3.0	<1	4.0	19	0.1	3	20	0.40	0.03	0.38	0.19	0.008	0.006	<0.001	<0.001	<0.005	<0.001	0.200	<0.001	<0.001	0.009	0.03
4/3/2012	<1	69	13	4.0	<1	5.0	21	<0.1	3	22	0.40	<0.01	0.23	0.09	0.006	0.004	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	0.008	0.032
7/4/2012	<1	75	12	4.0	<1	4.0	22	<0.1	3	23	0.40	0.01	0.16	0.10	0.004	0.002	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.011	0.033
20/8/2012	<1	86	12	3.0	<1	4.0	23	<0.1	4	22	0.20	<0.01	0.47	0.15	0.006	0.005	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.02	0.043
30/10/2012	<1	72	14	4.0	<1	6.0	24	<0.1	4	27	0.80	0.02	0.40	0.24	0.011	0.006	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.038	0.062
17/12/2012	<1	119	13	4.0	2.0	5.0	23	<0.1	4	30	0.40	0.04	0.55	0.38	0.014	0.007	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	0.001	0.042	0.073
4/2/2013	2	89	14	4.0	<1	4.0	25	<0.1	4	17	1.10	<0.01	0.10	<0.005	0.003	0.001	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	0.011	0.036
8/3/2013	2	92	11	3.0	<1	4.0	21	<0.1	4	14	0.50	<0.02	0.09	<0.05	0.002	<0.001	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	<0.001	0.027
31/7/2013	1	88	11	2.0	<1	2.0	21	<0.1	4	13	0.20	0.07	0.10	<0.05	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	0.140	<0.001	<0.001	0.006	0.025
1/10/2013	5	73	13	4.0	<1	4.0	19	<0.1	3	29	0.40	<0.01	0.11	0.08	0.001	0.001	<0.001	<0.001	<0.005	<0.001	0.140	<0.001	<0.001	0.007	0.03
5/12/2013	<1	97	12	3.0	<1	4.0	20	<0.1	4	21	0.10	0.01	0.08	0.07	0.002	0.001	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.007	0.028
13/3/2014	<1	69	13	4.0	<1	4.0	25	<0.1	3	25	0.20	<0.01	<0.05	<0.05	0.002	0.002	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	0.007	0.033
30/5/2014	<1	65	15	3.0	<1	4.0	17	<0.01	4	26	0.50	<0.01	0.43	0.14	0.038	0.019	<0.001	<0.001	0.007	<0.001	0.080	<0.001	<0.001	0.007	0.028
23/7/2014	1	92	15	4.0	1.0	4.0	19	0.1	4	26	0.90	0.04	1.47	0.15	0.073	0.024	0.001	0.001	0.016	0.001	0.120	0.001	0.001	0.008	0.034
18/9/2014	2	87	13	2.0	<1	3.0	19	<0.1	3	22	0.20	<0.01	0.08	<0.05	0.003	0.002	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.006	0.025
14/11/2014	2	77	13	4.0	<1	5.0	23	<0.1	<1	26	1.70	<0.01	0.08	0.05	0.004	0.003	<0.001	<0.001	0.009	<0.001		<0.001	<0.001	0.008	0.034
6/2/2015	3	92	12	4.0	<1	4.0	16	<0.1	2	21	1.20	0.01	0.47	0.22	0.008	0.003	0.001	<0.001	0.015	<0.001		<0.001	<0.001	0.008	0.031
15/5/2015	1	70	12	4.0	<1	4.0	18	<0.1	3	17	0.20	<0.01	0.10	0.08	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.120	<0.001	<0.001	0.006	0.025
31/7/2015	2	86	12	4.0	<1	4.0	15	<0.1	3	25	0.50	0.01	0.14	<0.05	0.006	0.002	0.002	<0.001	0.006	0.001	0.060	<0.001	<0.001	0.007	0.029
18/9/2015	<1	71	12	4.0	<1	4.0	20	<0.1	3	25	0.20	0.01	0.18	0.06	0.003	0.003	<0.001	<0.001	<0.005	<0.001	0.060	<0.001	<0.001	0.006	0.027
12/1/2016	2	88	12	4.0	<1	4.0	19	<0.1	4	24	0.60	<0.01	0.13	<0.05	0.001	0.001	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	<0.001	0.008	0.032
6/7/2016	1	65	10	4.0	<1	3.0	17	<0.1	4	24	0.20	<0.01	0.10	0.10	0.001	0.001	<0.001	<0.001	0.006	0.001	0.140	<0.001	<0.001	0.005	0.024
29/7/2016	2	68	11	3.0	<1	4.0	19	<0.1	3	21	0.60	<0.01	0.15	<0.05	0.008	0.001	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.005	0.024
13/4/2017	1	74	12	3.0	<1	4.0	18	<0.1	2	16	0.20	<0.01	0.11	0.05	0.005	0.002	<0.001	<0.001	<0.005	<0.001	0.060	<0.001	<0.001	0.005	0.023
12/5/2017	1	82	13	3.0	<1	4.0	20	<0.1	3	18	0.40	<0.01	0.09	<0.05	0.002	0.001	<0.001	<0.001	<0.005	<0.001	0.040	0.002	<0.001	0.006	0.025
16/6/2017	1	74	12	3.0	<1	4.0	19	<0.1	2	21	0.70	0.03	0.17	<0.05	0.004	<0.001	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.006	0.027

ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC1	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
11/7/2017	1	82	10	3.0	<1	4.0	18	<0.1	2	20	0.20	<0.01	0.77	0.05	0.009	0.001	<0.001	<0.001	0.01	<0.001	0.090	<0.001	<0.001	0.006	0.026

ST Dev	1	12	1	0.7	0.5	0.7	4	0.1	2	5	0.34	0.03	0.33	0.08	0.303	0.312	0.009	0.019	0.036	0.008	0.043	0.005	0.003	0.015	0.016
Max	8	119	17	5.3	2.0	6.0	36	0.5	14	35	1.70	0.15	1.50	0.38	1.900	1.900	0.031	0.060	0.150	0.028	0.200	0.010	0.010	0.087	0.110
Min	1	65	10	2.0	0.2	2.0	15	0.1	2	13	0.10	0.01	0.05	0.05	0.001	0.001	0.001	0.001	0.002	0.001	0.020	0.001	0.001	0.005	0.014
Median	2	77	12	4.0	1.0	4.0	20	0.1	3	24	0.40	0.01	0.15	0.10	0.004	0.002	0.001	0.001	0.008	0.006	0.070	0.002	0.001	0.008	0.030

ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC2	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
17/7/2009	2	68	16	4.1	0.7	5.1	27	0.0	5	25	0.10	0.01	0.20	0.12	0.01	0.01	0.001	0.001	0.006	0.01	0.040	0.01	0.004	0.02	0.05
7/9/2009	2	62	12	3.5	0.5	5.0	21	0.0	5	25	0.10	0.01	0.19	0.14	0.020	0.01	0.002	0.001	0.003	0.01	0.020	0.01	0.004	0.28	0.06
27/11/2009	3	65	14	3.6	0.6	5.2	23	0.0	4	32	0.10	0.01	0.30	0.28	0.01	0.01	0.001	0.001	0.005	0.01	0.030	0.01	0.001	0.03	0.056
29/1/2010	4	73	14	4.9	0.8	5.2	24	0.0	3	36	0.10	0.03	1.30	0.45	0.040	0.02	0.001	0.001	0.005	0.01	0.030	0.01	0.001	0.03	0.06
6/4/2010	4	68	14	3.8	0.3	5.0	23	0.0	4	26	0.40	0.01	9.20	0.17	0.100	0.05	0.001	0.001	0.011	0.01	0.030	0.01	0.002	0.01	0.012
15/6/2010	2	67	14	5.7	0.3	4.7	25	0.0	4	28	0.10	0.01	0.16	0.11	0.01	0.01	0.001	0.001	0.001	0.01	0.020	0.01	0.007	0.027	0.026
18/8/2010	1	78	12	3.0	1.0	4.0	21	0.5	4	27	0.10	0.08	0.18	0.10	0.005	0.005	0.001	0.001	0.005	0.001	0.030	0.001	0.001	0.033	0.052
19/10/2010	1	72	14	3.0	1.0	4.0	22	0.0	4	25	0.20	0.11	0.24	0.16	0.008	0.007	0.001	0.001	0.007	0.001	0.050	0.001	0.001	0.034	0.054
14/12/2010	2	76	14	4.0	1.0	5.0	28	0.0	3	28	0.10	0.01	0.33	0.26	0.007	0.011	0.01	0.016	0.04	0.008	0.080	0.001	0.001	0.058	0.053
18/2/2011	3	58	14	3.0	1.0	5.0	21	0.4	3	31	0.10	0.06	1.16	0.34	0.046	0.008	0.001	0.001	0.005	0.001	0.050	0.001	0.001	0.034	0.052
15/4/2011	2	87	14	4.0	<1	5.0	21	<0.1	3	23	0.20	0.06	0.26	0.20	0.007	0.006	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	0.001	0.031	0.052
7/1/2011	<1	96	13	4.0	<1	5.0	21	<0.1	4	16	<0.1	<0.01	0.29	0.19	0.009	0.007	<0.001	<0.001	<0.005	<0.001	0.100	<0.001	0.001	0.03	0.044
26/8/2011	2	71	12	3.0	<1	5.0	20	<0.1	4	21	<0.1	<0.01	0.21	0.16	0.006	0.006	<0.001	<0.001	<0.005	<0.001	0.090	<0.001	<0.001	0.025	0.042
20/12/2011	2	77	13	3.0	<1	4.0	20	<0.1	2	15	0.10	0.02	0.40	0.37	0.011	0.012	<0.001	<0.001	<0.005	<0.001	0.130	<0.001	<0.001	0.025	0.033
16/2/12	3	90	12	3.0	<1	4.0	19	<0.1	2	20	0.10	0.03	0.51	0.27	0.021	0.016	<0.001	<0.001	0.006	0.002	0.160	<0.001	<0.001	0.027	0.04
4/3/2012	2	74	14	4.0	<1	5.0	22	<0.1	3	24	0.20	<0.01	0.67	0.32	0.017	0.014	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.036	0.061
7/4/2012	<1	71	13	3.0	<1	4.0	22	<0.1	3	24	0.30	<0.01	0.34	0.18	0.007	0.005	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.032	0.047
20/8/2012	<1	62	13	3.0	1.0	4.0	22	<0.1	4	28	<0.1	<0.01	0.24	0.19	0.005	0.005	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.037	0.059
30/10/2012	<1	88	16	5.0	<1	6.0	23	<0.1	5	26	0.50	0.02	0.59	0.25	0.02	0.005	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.043	0.068
17/12/2012	<1	111	13	4.0	1.0	5.0	23	<0.1	4	31	0.20	0.20	0.48	0.36	0.012	0.008	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.042	0.073
4/2/2013	3	86	16	3.0	<1	4.0	25	<0.1	6	18	0.30	<0.01	0.38	0.23	0.018	0.011	<0.001	<0.001	0.006	<0.001	0.060	<0.001	<0.001	0.031	0.046
8/3/2013	2	84	12	3.0	<1	4.0	22	<0.1	4	15	0.10	<0.01	0.25	0.17	0.014	0.01	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	<0.001	0.047
12/4/2013	2	64	14	4.0	<1	5.0	21	<0.1	5	27	0.40	<0.01	0.20	0.16	0.009	0.008	<0.001	<0.001	0.01	<0.001	0.030	<0.001	0.001	0.03	0.063
31/7/2013	2	101	12	2.0	<1	3.0	23	<0.1	4	18	0.30	0.02	0.30	0.11	0.011	0.005	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	0.001	0.036	0.058
1/10/2013	5	70	14	4.0	<1	4.0	21	<0.1	4	31	0.20	0.04	0.17	0.11	0.006	0.005	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	0.002	0.038	0.063
5/12/2013	3	72	13	3.0	<1	4.0	21	<0.1	5	24	0.10	<0.01	0.23	0.18	0.008	0.007	<0.001	<0.001	0.006	<0.001	0.080	<0.001	0.002	0.041	0.06
30/1/2014	2	81	22	4.0	<1	5.0	24	<0.1	4	24	0.10	0.24	0.26	0.16	0.009	0.008	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.038	0.064
13/3/2014	2	83	15	4.0	<1	5.0	27	<0.1	3	26	<0.1	<0.01	0.31	0.25	0.009	0.008	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	<0.001	0.037	0.057
30/5/2014	2	72	16	4.0	<1	5.0	23	<0.1	4	29	0.40	<0.01	0.14	0.11	0.005	0.005	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.037	0.064
23/7/2014	1	82	17	4.0	1.0	5.0	23	0.1	2	27	1.00	0.01	0.09	0.06	0.007	0.003	0.001	<0.001	<0.007	<0.001	0.010	<0.001	0.001	0.038	0.072
18/9/2014	2	85	14	3.0	<1	4.0	22	<0.1	4	25	<0.1	<0.01	0.16	0.11	0.006	0.005	<0.001	<0.001	<0.005	<0.001		<0.001	0.001	0.034	0.052
14/11/2014	2	95	14	5.0	<1	6.0	24	<0.1	<1	28	0.70	<0.01	0.32	0.14	0.028	0.005	<0.001	<0.001	<0.005	<0.001		<0.001	0.001	0.045	0.076
6/2/2015	3	75	12	3.0	<1	4.0	17	<0.1	3	15	0.20	<0.01	0.56	0.28	0.018	0.011	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.027	0.033
15/5/2015	2	68	13	4.0	<1	5.0	19	<0.1	4	22	<0.1	<0.01	1.12	0.14	0.056	0.006	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.032	0.051
31/7/2015	1	59	12	3.0	<1	4.0	16	<0.1	4	24	0.10	0.01	0.13	0.07	0.006	0.006	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.036	0.05
18/9/2015	1	82	13	4.0	<1	5.0	23	<0.1	4	24	0.20	0.02	0.21	0.12	0.006	0.004	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	0.001	0.037	0.054
27/11/2015	2	80	13	4.0	<1	5.0	24	<0.1	4	30	0.20	0.02	0.27	0.18	0.013	0.006	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.046	0.072
12/01/2016	2	86	13	3.0	<1	5.0	20	<0.1	4	20	<0.1	<0.01	0.24	0.14	0.009	0.007	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.033	0.049

ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC2	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
08/03/2016	2	112	14	4.0	<1	6.0	20	<0.1	4	28	0.20	<0.01	0.30	0.21	0.008	0.006	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	0.001	0.038	0.064
17/5/2016	1	70	12	4.0	2.0	5.0	21	<0.1	4	27	<0.1	<0.01	0.17	0.11	0.004	0.003	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.034	0.06
6/7/2016	1	59	11	3.0	<1	4.0	19	<0.1	5	23	<0.1	<0.01	0.18	0.13	0.005	0.004	<0.001	<0.001	<0.005	<0.001	0.090	<0.001	0.001	0.028	0.046
29/7/2016	2	76	12	3.0	<1	4.0	20	<0.1	4	23	13.20	<0.01	0.19	0.08	0.005	0.004	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.027	0.043
13/10/2016	1	81	14	4.0	<1	6.0	23	<0.1	5	26	<0.1	<0.01	0.13	0.14	0.004	0.004	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.036	0.06
14/11/2016	2	100	12	4.0	<1	5.0	21	<0.1	4	24	0.10	<0.01	0.26	0.20	0.006	0.004	<0.001	<0.001	0.005	<0.001	0.040	<0.001	0.001	0.039	0.063
12/12/2016	2	102	13	4.0	<1	6.0	21	<0.1	5	29	<0.1	<0.01	0.24	0.17	0.007	0.005	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	0.001	0.038	0.064
13/4/2017	2	86	13	2.0	<1	4.0	19	<0.1	3	18	<0.1	<0.01	0.23	0.13	0.014	0.012	<0.001	<0.001	0.007	<0.001	0.070	<0.001	<0.001	0.025	0.039
12/5/2017	1	85	14	4.0	<1	4.0	22	<0.1	2	24	0.30	<0.01	1.43	0.92	0.69	0.663	0.002	<0.001	0.01	0.002	<0.01	0.001	<0.001	0.006	0.043
16/6/2017	2	76	12	3.0	<1	4.0	20	<0.1	3	17	<0.1	0.01	0.24	0.14	0.008	0.007	<0.001	<0.001	<0.005	0.001	0.060	0.003	<0.001	0.029	0.045
11/7/2017	1	64	11	3.0	<1	4.0	19	<0.1	2	22	<0.1	<0.01	0.10	0.06	0.004	0.004	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.028	0.049

ST Dev	1	13	2	0.7	0.4	0.7	2	0.2	1	5	2.20	0.06	1.33	0.09	0.276	0.276	0.003	0.005	0.009	0.004	0.032	0.005	0.001	0.037	0.013
Max	5	112	22	5.7	2.0	6.0	28	0.5	6	36	13.20	0.24	9.20	0.45	1.900	1.900	0.010	0.016	0.040	0.011	0.160	0.010	0.007	0.280	0.076
Min	1	58	11	2.0	0.3	3.0	16	0.0	2	15	0.10	0.01	0.09	0.06	0.004	0.003	0.001	0.001	0.001	0.001	0.010	0.001	0.001	0.010	0.012
Median	2	76	13	4.0	1.0	5.0	22	0.0	4	25	0.20	0.02	0.26	0.17	0.009	0.007	0.001	0.001	0.006	0.010	0.040	0.010	0.001	0.034	0.054



ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC3	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
9/6/2009	3	140	37	4.7	0.9	7.6	57	0.1	11	35	0.70	0.05	0.26	0.17	0.010	0.01	0.001	0.001	0.004	0.01	0.100	0.01	0.006	0.01	0.13
17/7/2009	2	68	15	3.4	0.8	4.8	26	0.1	5	22	0.10	0.01	0.51	0.11	0.01	0.01	0.001	0.001	0.008	0.01	0.020	0.01	0.001	0.02	0.05
7/9/2009	2	55	11	3.3	0.6	4.7	19	0.1	4	25	0.10	0.03	0.27	0.15	0.020	0.01	0.002	0.001	0.003	0.01	0.040	0.01	0.002	0.16	0.06
27/11/2009	3	61	13	3.1	0.9	5.1	22	0.1	3	31	0.10	0.01	0.36	0.33	0.01	0.01	0.001	0.001	0.006	0.01	0.030	0.01	0.001	0.03	0.05
29/1/2010	3	90	16	12.0	1.0	3.6	24	0.1	3	57	0.10	0.01	1.30	0.60	0.040	0.03	0.001	0.001	0.001	0.01	0.030	0.01	0.002	0.03	0.07
6/4/2010	3	65	13	3.8	0.4	5.1	22	0.1	4	26	0.20	0.01	1.70	0.16	0.080	0.03	0.001	0.001	0.007	0.01	0.030	0.01	0.001	0.01	0.013
15/6/2010	1	65	14	3.8	0.2	4.3	23	0.1	4	27	0.20	0.01	0.75	0.10	0.03	0.01	0.001	0.001	0.001	0.01	0.020	0.01	0.012	0.020	0.022
18/8/2010	1	82	12	2.0	1.0	4.0	19	0.4	4	22	0.10	0.01	0.12	0.09	0.004	0.005	0.001	0.001	0.005	0.001	0.030	0.001	0.001	0.021	0.044
19/10/2010	1	78	13	3.0	1.0	4.0	21	0.1	3	23	0.10	0.08	0.24	0.17	0.011	0.009	0.001	0.001	0.005	0.001	0.050	0.001	0.001	0.025	0.045
14/12/2010	2	66	14	4.0	1.0	5.0	25	0.1	3	27	0.10	0.01	0.50	0.28	0.015	0.013	0.018	0.017	0.056	0.015	0.110	0.001	0.001	0.057	0.045
18/2/2011	3	66	14	4.0	1.0	5.0	20	0.3	3	24	0.10	0.04	0.58	0.31	0.014	0.01	0.001	0.001	0.005	0.001	0.070	0.001	0.001	0.024	0.047
15/4/2011	2	87	13	3.0	<1	4.0	18	<0.1	3	21	0.30	0.14	0.22	0.14	0.011	0.01	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.017	0.034
7/1/2011	<1	73	12	4.0	<1	4.0	20	<0.1	3	25	<0.1	<0.01	0.24	0.15	0.008	0.006	<0.001	<0.001	<0.005	<0.001	0.090	<0.001	<0.001	0.022	0.037
26/8/2011	1	72	11	3.0	<1	4.0	21	<0.1	3	17	<0.1	<0.01	0.34	0.18	0.01	0.006	<0.001	<0.001	0.01	<0.001	0.080	<0.001	<0.001	0.032	0.046
20/12/2011	2	85	12	3.0	<1	4.0	20	<0.1	2	16	0.40	0.01	0.36	0.24	0.011	0.008	<0.001	<0.001	0.007	<0.001	0.130	<0.001	<0.001	0.02	0.032
16/2/12	4	94	11	3.0	<1	4.0	19	<0.1	2	20	0.20	0.02	0.46	0.26	0.015	0.011	<0.001	<0.001	<0.005	<0.001	0.170	<0.001	<0.001	0.021	0.038
4/3/2012	1	75	13	4.0	<1	5.0	22	<0.1	3	24	0.30	<0.01	0.64	0.31	0.022	0.016	<0.001	<0.001	0.037	<0.001	0.080	<0.001	<0.001	0.024	0.049
7/4/2012	<1	65	12	3.0	<1	4.0	18	<0.1	3	22	0.20	<0.01	0.26	0.14	0.006	0.005	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.023	0.041
20/8/2012	<1	77	11	3.0	<1	4.0	20	<0.1	4	26	<0.1	<0.01	0.19	0.13	0.006	0.006	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.027	0.047
30/10/2012	<1	78	13	4.0	<1	5.0	21	<0.1	4	24	0.50	<0.01	0.61	0.34	0.024	0.017	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.024	0.047
17/12/2012	1	98	12	4.0	<1	5.0	22	<0.1	3	27	0.20	0.20	0.65	0.45	0.025	0.023	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.027	0.055
4/2/2013	3	93	15	3.0	<1	4.0	25	<0.1	6	18	0.40	<0.01	0.28	0.26	0.008	0.01	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.026	0.047
8/3/2013	2	118	12	3.0	<1	4.0	24	<0.1	4	24	0.80	<0.01	0.29	0.16	0.017	0.014	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	<0.001	0.04
12/4/2013	<1	57	14	4.0	<1	4.0	20	<0.1	4	23	0.10	<0.01	0.18	0.11	0.011	0.011	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.018	0.046
31/7/2013	1	105	11	2.0	<1	3.0	20	<0.1	4	16	0.20	0.06	0.18	0.12	0.008	0.008	<0.001	<0.001	<0.005	<0.001	0.060	<0.001	<0.001	<0.001	0.043
1/10/2013	5	67	13	3.0	<1	4.0	18	<0.1	4	26	0.20	0.03	0.17	0.11	0.01	0.006	<0.001	<0.001	<0.005	<0.001	0.060	<0.001	<0.001	0.024	0.048
5/12/2013	3	76	13	3.0	<1	4.0	15	<0.1	4	22	0.20	<0.01	0.49	0.26	0.031	0.026	<0.001	<0.001	<0.005	<0.001	0.090	<0.001	<0.001	0.027	0.048
30/1/2014	2	81	14	4.0	<1	5.0	22	<0.1	3	23	2.30	<0.01	0.22	0.13	0.014	0.011	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.024	0.054
13/3/2014	2	79	13	4.0	<1	4.0	26	<0.1	3	23	<0.1	<0.01	0.27	0.20	0.01	0.009	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	0.025	0.048
29/5/2014	1	52	13	2.0	<1	4.0	20	<0.1	3	21	0.30	0.07	0.46	0.08	0.026	0.008	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.02	0.043
23/7/2014	1	84	16	3.0	<1	4.0	20	<0.1	9	23	1.00	0.01	0.17	0.05	0.012	0.006	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.02	0.05
18/9/2014	2	87	14	2.0	<1	3.0	21	<0.1	4	17	0.30	<0.01	0.18	0.08	0.008	0.006	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.021	0.041
14/11/2014	2	76	12	4.0	<1	5.0	22	<0.1	<1	24	0.60	<0.01	0.16	0.11	0.014	0.011	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.025	0.051
6/2/2015	3	83	11	3.0	<1	4.0	17	<0.1	3	16	0.60	<0.01	0.51	0.26	0.1	0.008	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.02	0.032
15/5/2015	2	68	12	4.0	<1	4.0	17	<0.1	3	18	0.50	<0.01	0.46	0.10	0.013	0.007	<0.001	<0.001	<0.005	<0.001	0.080	<0.001	<0.001	0.02	0.039
31/7/2015	<1	88	12	3.0	<1	4.0	15	<0.1	4	22	0.40	0.12	0.29	0.06	0.012	0.005	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.024	0.042
18/9/2015	<1	65	13	4.0	<1	4.0	21	<0.1	3	22	0.20	0.04	0.15	0.11	0.005	0.006	0.001	<0.001	0.007	<0.001	0.060	<0.001	<0.001	0.023	0.042
27/11/2015	2	65	12	4.0	<1	4.0	22	<0.1	3	26	0.20	<0.01	0.17	0.13	0.011	0.01	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	<0.001	0.029	0.052

ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC3	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
12/01/2016	2	86	12	3.0	<1	4.0	20	<0.1	4	20	0.20	<0.01	0.29	0.16	0.01	0.008	<0.001	<0.001	<0.005	<0.001	0.060	<0.001	<0.001	0.024	0.041
08/03/2016	2	89	13	4.0	<1	5.0	19	<0.1	3	26	<0.1	<0.01	0.26	0.17	0.01	0.009	<0.001	<0.001	<0.005	<0.001	0.040	<0.001	<0.001	0.024	0.05
17/5/2016	2	69	11	3.0	<1	4.0	20	<0.1	3	23	<0.1	<0.01	0.16	0.10	0.008	0.007	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.02	0.044
6/7/2016	1	59	10	3.0	<1	4.0	18	<0.1	4	23	<0.1	<0.01	0.13	0.10	0.005	0.004	<0.001	<0.001	<0.005	<0.001	0.070	<0.001	<0.001	0.017	0.034
29/7/2016	1	72	11	3.0	<1	4.0	20	<0.1	4	18	0.50	<0.01	0.17	0.10	0.008	0.005	0.001	<0.001	0.013	<0.001	0.140	<0.001	<0.001	0.02	0.037
13/10/2016	1	74	13	4.0	<1	5.0	21	<0.1	4	25	<0.1	<0.01	0.18	0.14	0.019	0.007	<0.001	<0.001	<0.005	<0.001		<0.001	<0.001	0.022	0.044
14/11/2016	2	96	12	4.0	<1	5.0	19	<0.1	3	24	0.20	0.01	0.27	0.18	0.01	0.011	0.002	<0.001	0.026	0.001	0.040	<0.001	<0.001	0.023	0.046
12/12/2016	2	94	13	3.0	<1	5.0	20	<0.1	4	26	0.20	<0.01	0.30	0.15	0.018	0.012	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.021	0.044
13/4/2016	2	78	12	3.0	<1	4.0	18	<0.1	2	17	<0.1	<0.01	0.18	0.10	0.011	<0.001	<0.001	<0.005	<0.001	0.050	<0.001	<0.001	0.017	0.032	
12/5/2017	1	84	16	3.0	<1	5.0	20	<0.1	3	18	<0.1	<0.01	0.21	0.12	0.013	0.018	<0.001	<0.001	<0.005	<0.001	0.020	<0.001	<0.001	0.018	0.04
16/6/2017	1	77	12	3.0	<1	4.0	19	<0.1	3	21	<0.1	<0.01	0.20	0.12	0.008	0.008	<0.001	<0.001	<0.005	<0.001	0.070	0.001	<0.001	0.02	0.036
11/7/2017	<1	71	10	3.0	<1	4.0	17	<0.1	2	21	<0.1	<0.01	0.14	0.05	0.005	0.005	<0.001	<0.001	<0.005	<0.001	0.030	<0.001	<0.001	0.02	0.038

ST Dev	1	16	4	1.4	0.3	0.7	6	0.1	2	6	0.38	0.05	0.29	0.10	0.264	0.267	0.004	0.005	0.014	0.005	0.035	0.005	0.003	0.021	0.015
Max	5	140	37	12.0	1.0	7.6	57	0.4	11	57	2.30	0.20	1.70	0.60	1.900	1.900	0.018	0.017	0.056	0.015	0.170	0.010	0.012	0.160	0.130
Min	1	52	10	2.0	0.2	3.0	15	0.1	2	16	0.10	0.01	0.12	0.05	0.004	0.004	0.001	0.001	0.001	0.001	0.020	0.001	0.001	0.010	0.013
Median	2	77	13	3.0	0.9	4.0	20	0.1	3	23	0.20	0.02	0.27	0.14	0.011	0.010	0.001	0.001	0.007	0.010	0.045	0.010	0.001	0.023	0.044



ANZECC											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)			
WC4	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
10/1/2013	2	69	10	<1	<1	2.0	20	<0.1	5	3	<0.1	<0.01	0.42	0.14	0.112	0.106	<0.001	<0.001	0.011	0.002	0.020	<0.001	0.001	0.018	0.011
5/2/2013	1	61	12	<1	<1	2.0	21	<0.1	6	2	<0.1	0.10	0.19	0.15	0.116	0.11	<0.001	<0.001	0.014	0.002	0.040	<0.001	<0.001	0.013	0.009
8/3/2013	2	50	9	<1	<1	1.0	15	<0.1	4	<1	0.30	<0.01	0.41	0.13	0.099	0.088	0.001	<0.001	0.012	0.002	0.120	<0.001	<0.001	<0.001	0.006
12/4/2013	<1	37	10	<1	<1	2.0	17	<0.1	5	2	<0.1	<0.01	0.37	0.12	0.099	0.088	<0.001	<0.001	0.012	0.002	0.020	<0.001	<0.001	0.014	0.008
7/8/2013	2	38	10	<1	<1	1.0	23	<0.1	4	<1	0.20	0.02	0.29	0.16	0.081	0.08	<0.001	<0.001	0.015	0.001	0.040	<0.001	<0.001	0.012	0.007
2/10/2013	1	37	10	<1	<1	2.0	10	<0.1	4	1	0.20	0.06	0.30	0.11	0.069	0.065	<0.001	<0.001	0.014	0.002	0.040	<0.001	<0.001	0.015	0.009
5/12/2013	2	51	10	<1	<1	1.0	12	<0.1	4	<1	0.10	0.02	0.30	0.09	0.07	0.067	<0.001	<0.001	0.012	0.001	0.060	<0.001	<0.001	0.01	0.006
30/1/2014	1	51	11	<1	<1	2.0	20	<0.1	4	1	<0.1	<0.1	0.19	0.06	0.062	0.056	<0.001	<0.001	0.014	0.002	0.010	<0.001	<0.001	0.014	0.008
13/3/2014	<1	34	10	<1	<1	2.0	24	<0.1	3	1	<0.1	<0.01	0.20	0.09	0.067	0.062	0.001	<0.001	0.011	0.001	0.020	<0.001	<0.001	0.014	0.008
30/5/2014	6	40	11	<1	<1	1.0	16	<0.1	4	3	0.10	<0.01	0.32	0.10	0.075	0.068	<0.001	<0.001	0.011	0.002	0.020	<0.001	<0.001	0.016	0.008
23/7/2014	<1	56	12	<1	<1	2.0	18	<0.1	6	2	0.40	0.01	0.22	0.10	0.061	0.055	<0.001	<0.001	0.012	0.001	0.010	<0.001	<0.001	0.018	0.01
18/9/2014	2	43	9	<1	<1	<1	16	<0.1	4	<1	<0.1	<0.01	0.22	0.10	0.063	0.06	<0.001	<0.001	0.011	0.001		<0.001	<0.001	0.009	0.006
14/11/2014	2	52	10	<1	<1	2.0	16	<0.1	5	2	0.70	<0.01	0.08	<0.05	0.031	0.03	<0.001	<0.001	0.012	0.002		<0.001	<0.001	0.015	0.009
6/2/2015	3	51	9	<1	<1	1.0	15	0.1	2	<1	0.40	<0.01	0.26	0.11	0.07	0.065	<0.001	<0.001	0.016	0.002		<0.001	<0.001	0.008	<0.01
15/5/2015	2	45	9	<1	<1	1.0	14	<0.1	3	<1	0.80	<0.01	0.43	0.17	0.091	0.082	<0.001	<0.001	0.015	0.002	0.100	<0.001	<0.001	0.008	0.005
31/7/2015	1	32	9	<1	<1	2.0	13	<0.1	4	2	0.30	0.09	0.64	0.10	0.099	0.078	<0.001	<0.001	0.01	0.002	0.040	<0.001	<0.001	0.012	0.007
18/9/2015	<1	39	9	<1	<1	2.0	17	<0.1	3	2	<0.1	0.01	0.27	0.14	0.07	0.071	<0.001	<0.001	0.009	0.002	0.040	<0.001	<0.001	0.011	0.006
27/11/2015	1	40	9	<1	<1	2.0	18	<0.1	4	2	0.80	0.02	0.18	<0.05	0.054	0.032	<0.001	<0.001	0.009	0.002	0.020	<0.001	<0.001	0.015	0.009
12/01/2016	2	62	10	<1	<1	2.0	18	<0.1	4	1	0.10	<0.01	0.18	0.10	0.09	0.072	<0.001	<0.001	0.008	0.002	0.030	<0.001	<0.001	0.013	0.008
08/03/2016	<1	68	10	<1	<1	2.0	17	<0.1	4	2	<0.1	<0.01	0.24	0.08	0.087	0.079	<0.001	<0.001	0.009	0.002	0.020	<0.001	<0.001	0.017	0.01
17/5/2016	<1	50	10	1.0	<1	2.0	18	<0.1	4	2	<0.1	<0.01	0.21	0.06	0.05	0.048	<0.001	<0.001	0.014	0.001	0.010	<0.001	<0.001	0.019	0.014
6/7/2016	1	36	7	<1	<1	1.0	15	<0.1	5	1	<0.1	<0.01	0.32	0.12	0.074	0.067	<0.001	<0.001	0.007	0.002	0.060	<0.001	<0.001	0.01	0.006
29/7/2016	1	48	8	<1	<1	1.0	16	<0.1	3	<1	0.20	<0.01	0.28	0.12	0.073	0.072	<0.001	<0.001	0.010	0.002	0.050	<0.001	<0.001	0.01	0.006
13/10/2016	<1	48	10	<1	<1	2.0	19	<0.1	4	2	<0.1	<0.01	0.16	0.09	0.045	0.048	<0.001	<0.001	0.009	0.002		<0.001	<0.001	0.017	0.01
14/11/2016	1	63	10	<1	<1	2.0	18	<0.1	4	2	0.20	0.01	0.13	0.06	0.034	0.031	<0.001	<0.001	0.009	0.002	0.020	<0.001	<0.001	0.016	0.01
12/12/2016	1	60	10	<1	<1	2.0	18	<0.1	6	3	<0.1	<0.01	0.10	0.05	0.034	0.031	<0.001	<0.001	0.006	0.001	0.010	<0.001	<0.001	0.016	0.01
13/4/2017	2	45	8	<1	<1	1.0	14	<0.1	2	<1	<0.1	<0.01	0.20	0.11	0.072	0.067	<0.001	<0.001	0.008	0.001	0.120	<0.001	<0.001	0.006	0.004
12/5/2017	1	54	11	<1	<1	2.0	17	<0.1	3	1	0.50	<0.01	0.24	0.12	0.085	0.085	<0.001	<0.001	0.013	0.002	0.050	<0.001	<0.001	0.12	0.006
16/6/2017	1	45	9	<1	<1	1.0	16	<0.1	3	4	<0.1	<0.01	0.25	0.10	0.075	0.071	<0.001	<0.001	0.01	0.002	0.060	<0.001	<0.001	0.011	0.006
11/7/2017	<1	41	9	<1	<1	2.0	15	<0.1	3	<1	<0.1	<0.01	0.27	0.11	0.070	0.062	<0.001	<0.001	0.01	0.002	0.020	<0.001	<0.001	0.013	0.007

ST Dev	1	10	1	#DIV/0!	#####	0.5	3	#DIV/0!	1	1	0.24	0.04	0.11	0.03	0.021	0.020	0.000	#DIV/0!	0.003	0.000	0.031	#DIV/0!	#DIV/0!	0.020	0.002
Max	6	69	12	1.0	0.0	2.0	24	0.1	6	4	0.80	0.10	0.64	0.17	0.116	0.110	0.001	0.000	0.016	0.002	0.120	0.000	0.001	0.120	0.014
Min	1	32	7	1.0	0.0	1.0	10	0.1	2	1	0.10	0.01	0.08	0.05	0.031	0.030	0.001	0.000	0.006	0.001	0.010	0.000	0.001	0.006	0.004
Median	2	48	10	1.0	#NUM!	2.0	17	0.1	4	2	0.30	0.02	0.25	0.11	0.071	0.067	0.001	#NUM!	0.011	0.002	0.035	#NUM!	0.001	0.014	0.008

## APPENDIX B

ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo1S	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	2	675	135	72	2.1	28	89	0.11	175	370	1.5	3.6	25.00	0.08	1.600	0.63	0.002	0.001	0.005	0.01	0.04	0.01	0.004	0.17	0.34
30/6/2011	1	194	27	10	2	7	4.1	0.1	18	48	3.4	1.17	25.30	0.5	0.712	0.304	0.008	0.001	0.029	0.01	0.03	0.001	0.002	0.052	0.044
24/8/2011		171	26	5	1	5	53	0.1	4	17	0.3	0.13	4.89	0.05	0.260	0.199	0.012	0.001	0.024	0.016	0.04	0.001	0.002	0.089	0.032
16/2/2012	2	200	24	4	1	4	39	0.1	21	1	15.7	0.23	4.33	0.18	0.215	0.156	0.008	0.001	0.013	0.007	0.14	0.001	0.002	0.082	0.031
20/8/2012	1	176	35	4	2	7	68	0.1	4	27	0.8	0.54	10.60	0.18	0.438	0.385	0.011	0.001	0.028	0.014	0.05	0.001	0.003	0.13	0.042
24/1/2013	3	128	26	5	2	4	44	0.1	6	31	2.9	6.26	106.00	13.4	2.240	0.797	0.001	0.001	0.017	0.012	0.03	0.001	0.002	0.046	0.043
15/3/2013	2	136	24	6	1	6	39	0.1	5	35	0.9	0.5	9.55	0.07	0.378	0.205	0.013	0.001	0.055	0.014	0.1	0.001	0.001	0.065	0.044
18/04/2013	2	182	43	5	2	6	62	0.1	11	8	5.2	0.08	6.11	0.05	0.386	0.216	0.015	0.001	0.055	0.017	0.06	0.001	0.003	0.118	0.041
31/07/2013	1	151	30	2	2	5	64	0.1	4	1	6	0.02	0.30	0.05	0.096	0.093	0.009	0.001	0.03	0.009	0.08	0.001	0.002	0.133	0.033
04/12/2013	4	141	34	5	2	6	58	0.1	4	15	0.3	0.14	2.25	0.2	0.142	0.197	0.018	0.001	0.051	0.01	0.011	0.001	0.003	0.138	0.052
30/01/2014	2	171	38	4	2	7	68	0.1	4	14	0.3	0.44	10.20	0.49	0.437	0.233	0.009	0.001	0.042	0.011	0.05	0.001	0.002	0.129	0.044
13/03/2014	1	151	31	4	1	5	57	0.1	4	16	0.2	0.15	3.85	0.16	0.242	0.158	0.006	0.001	0.028	0.009	0.1	0.001	0.001	0.112	0.112
29/05/2014	5	80	19	3	2	3	24	0.1	4	26	1.1	0.07	2.30	0.21	0.093	0.067	0.007	<0.001	0.076	0.006		<0.001	0.002	0.053	0.031
23/07/2014	6	194	43	4	2	5	66	0.1	4	27	2.6	3.92	70.10	12	1.660	0.849	0.007	<0.001	0.075	0.01	0.18	<0.001	0.003	0.086	0.043
18/09/2014	1	150	36	2	1	4	56	0.1	4	9	0.5	0.1	2.10	<0.05	0.106	0.086	0.006	<0.001	0.039	0.008		<0.001	0.002	0.115	0.03
14/11/2014	4	127	28	3	2	4	54	0.1	6	13	2	0.63	10.50	<0.05	0.218	0.084	0.006	<0.001	0.045	0.008		<0.001	0.002	0.089	0.039
06/02/2015	11	104	13	4	<1	4	9	0.1	2	30	1.3	0.18	4.67	0.8	0.070	0.027	0.011	<0.001	0.013	0.007		<0.001	0.001	0.021	0.033
27/11/2015	1	106	26	2	1	4	50	0.1	5	1	0.7	0.64	14.7	1.73	0.284	0.147	0.001	0.001	0.021	0.006	0.08	0.096	0.002	0.096	0.037
08/03/2016	2	162	32	5	1	6	54	<0.1	6	22	2	0.42	12.9	0.45	0.369	0.181	0.003	<0.001	0.03	0.008	0.08	<0.001	0.003	0.119	0.064
17/05/2016	1	119	24	2	<1	3	39	<0.1	5	12	2	0.2	1.83	0.3	0.113	0.072	0.002	<0.001	0.087	0.005	0.08	0.027	0.002	0.084	0.027
13/10/2016	1	118	27	2	<1	4	41	<0.1	6	15	1.2	0.12	2.87	0.05	0.132	0.07	0.003	<0.001	0.014	0.006		<0.001	0.002	0.086	0.028
14/11/2016	5	136	23	2	<1	3	36	<0.1	4	12	1.2	0.35	8.88	0.12	0.17	0.062	0.003	<0.001	0.026	0.005	0.1	<0.001	0.002	0.066	0.03
12/05/2017	5	136	24	4	2	4	31	<0.1	4	23	1.2	<0.01	1.06	0.56	0.078	0.072	0.013	<0.001	0.25	0.011	0.13	<0.001	<0.001	0.057	0.029
16/06/2017	2	136	25	2	1	4	42	<0.1	4	13	0.4	0.03	2.1	0.13	0.098	0.076	0.008	<0.001	0.049	0.008	0.2	<0.001	0.001	0.084	0.03
ST Dev	2	112	23	14	1	5	19	0.0	35	73	3.2	1.56	24.28	3.67	0.569	0.226	0.005	0.000	0.048	0.003	0.05	0.026	0.001	0.035	0.06
Max	11	675	135	72	2	28	89	0.1	175	370	15.7	6.26	106.00	13.40	2.240	0.849	0.018	0.001	0.250	0.017	0.20	0.096	0.004	0.170	0.34
Min	1	80	13	2	1	3	4	0.1	2	1	0.2	0.02	0.30	0.05	0.070	0.027	0.001	0.001	0.005	0.005	0.01	0.001	0.001	0.021	0.03
Median	2	146	27	4	2	5	52	0.1	4	16	1.2	0.23	5.50	0.19	0.230	0.157	0.008	0.001	0.030	0.009	0.08	0.001	0.002	0.088	0.04

ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo 2S	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	2	140	17	23	1.9	8.7	24	0.1	15	110	0.3	0.1	1.40	0.02	0.170	0.05	0.003	0.005	0.042	0.01	0.01	0.01	0.002	0.02	0.12
18/8/2010	5	138	14	11	2	10	16	1.1	6	96	0.5	0.25	0.72	0.11	0.566	0.566	0.003	0.001	0.036	0.004	0.01	0.001	0.001	0.13	0.072
18/2/2011	10	93	11	16	6	5	9	0.5	6	62	1.2	0.01	8.38	0.93	0.21	0.165	0.006	0.001	0.02	0.004	0.05	0.001	0.001	0.011	0.053
30/6/2011	6	158	15	13	3	10	15	0.1	13	69	2.3	0.02	5.75	0.45	0.627	0.518	0.004	0.001	0.026	0.008	0.04	0.001	0.001	0.009	0.057
24/8/2011		176	17	11	1	15	19	0.2	1	96	0.7	0.16	2.26	1.72	0.97	0.924	0.001	0.001	0.006	0.003	0.01	0.001	0.001	0.01	0.062
16/2/2012	7	140	7	28	4	2	9	0.1	45	14	6.3	0.1	0.55	0.33	0.018	0.005	0.006	0.001	0.017	0.002	0.06	0.001	0.001	0.008	0.06
20/8/2012	5	118	12	17	4	8	10	0.2	7	90	1.4	0.05	1.62	0.05	0.272	0.012	0.007	0.001	0.196	0.002	0.02	0.001	0.001	0.009	0.057
24/1/2013	4	166	20	13	1	20	22	0.2	1	130	0.9	0.09	5.84	0.05	1.110	1.1	0.002	0.001	0.01	0.004	0.01	0.001	0.001	0.008	0.001
15/3/2013	6	62	6	11	2	1	10	0.1	4	29	1.1	0.02	0.92	0.24	0.013	0.004	0.005	0.001	0.015	0.004	0.02	0.001	0.001	0.009	0.042
18/04/2013	5	131	8	13	5	2	10	0.1	7	1	14.8	0.01	0.72	0.2	0.036	0.026	0.006	0.001	0.019	0.006	0.03	0.001	0.001	0.01	0.044
31/07/2013	3	138	17	9	2	12	11	0.3	3	93	1.4	0.06	1.92	1.28	0.419	0.339	0.008	0.005	0.026	0.004	0.15	0.001	0.001	0.012	0.054
04/12/2013	4	140	17	14	1	14	21	0.2	1	94	0.2	0.08	4.16	2.14	1.270	0.903	0.004	0.001	0.013	0.01	0.01	0.003	0.001	0.01	0.07
30/01/2014	4	164	20	13	2	19	20	0.2	1	112	1.2	0.05	0.98	0.32	1.160	1.05	0.002	0.001	0.009	0.008	0.01	0.001	0.001	0.01	0.06
13/03/2014	1	181	20	11	1	16	22	0.3	1	110	0.3	0.08	0.42	0.17	1.220	1.19	0.001	0.001	0.005	0.005	0.01	0.001	0.001	0.01	0.059
29/05/2014	4	138	18	10	2	12	13	0.3	1	100	1	0.03	1.03	0.24	0.800	0.759	0.002	<0.001	0.022	0.004		<0.001	<0.001	0.012	0.07
23/07/2014	4	156	23	11	1	15	16	0.3	3	119	0.18	0.06	5.24	0.37	1.170	1.09	0.002	<0.001	0.012	0.003	0.02	<0.001	<0.001	0.014	0.059
18/09/2014	3	164	20	12	1	18	25	0.3	2	133	0.1	0.05	3.19	0.37	1.010	0.95	0.002	<0.001	0.011	0.002		<0.001	0.001	0.01	0.077
14/11/2014	5	169	19	12	<1	20	23	0.3	<1	112	1.2	0.07	2.08	0.38	1.250	1.14	0.001	<0.001	<0.005	0.002		<0.001	<0.001	0.008	0.076
06/02/2015	3	150	18	13	1	18	16	0.3	<1	111	0.8	0.04	0.37	<0.05	0.841	0.806	0.004	<0.001	0.015	0.002		<0.001	0.001	0.009	0.058
31/07/2015	2	145	18	13	1	13	12	0.3	4	90	0.6	0.02	1.08	<0.05	0.075	0.08	0.002	<0.001	0.016	0.127	0.03	<0.001	0.001	0.012	0.054
27/11/2015	2	151	18	11	1	18	21	0.3	6	100	0.6	0.07	3.99	0.35	1.110	1.05	0.002	0.001	0.005	0.006	0.02	0.001	0.001	0.007	0.057
08/03/2016	2	172	19	11	<1	19	18	0.3	<1	126	0.5	0.03	1.22	0.82	0.583	0.563	0.002	<0.001	0.009	0.007	0.02	<0.001	<0.001	0.008	0.057
17/05/2016	3	120	19	11	1	17	18	0.4	<1	128	1.9	0.04	1.52	0.98	0.678	0.664	0.002	<0.001	<0.005	0.003	0.02	<0.001	<0.001	0.007	0.046
13/10/2016	2	153	23	13	<1	23	21	0.3	<1	138	0.5	0.12	4.27	<0.05	0.723	0.691	<0.001	<0.001	<0.005	0.002		<0.001	<0.001	0.006	0.047
14/11/2016	3	169	20	11	<1	19	19	0.3	<1	116	0.9	0.14	7.01	<0.05	0.927	0.752	0.003	<0.001	0.021	0.002	0.04	<0.001	<0.001	0.009	0.053
12/12/2016	2	193	20	10	<1	19	20	0.3	<1	110	5.7	0.05	4.75	0.07	1.03	0.827	0.002	<0.001	0.008	0.002	0.03	<0.001	<0.001	0.008	0.051
12/05/2017	2	143	25	8	<1	14	18	0.3	<1	108	<0.1	<0.01	0.16	0.13	0.006	0.006	<0.001	<0.001	0.049	<0.001	0.03	<0.001	<0.001	0.031	0.059
16/06/2017	4	162	21	11	1	17	18	0.2	<1	116	0.4	0.04	1.25	<0.05	0.672	0.642	0.006	<0.001	0.02	0.003	0.01	<0.001	<0.001	0.009	0.047
ST Dev	3	113	24	14	1.1	6.7	22.8	0.2	37.6	78.3	3.7	1.43	23.14	3.25	0.600	0.440	0.004	0.001	0.057	0.004	0.054	0.024	0.001	0.051	0.063
Max	11	675	135	72	6.0	28.0	89.0	1.1	175.0	370.0	15.7	6.26	106.00	13.40	2.240	1.900	0.018	0.005	0.250	0.017	0.200	0.096	0.004	0.170	0.340
Min	1	62	6	2	0.5	1.0	4.1	0.0	1.0	1.0	0.1	0.01	0.30	0.02	0.013	0.004	0.001	0.000	0.005	0.002	0.010	0.001	0.001	0.008	0.001
Median	3	140	24	5	2	5	39	0.1	4	26	1.2	0.14	4.33	0.21	0.266	0.173	0.006	0.001	0.03	0.008	0.05	0.001	0.002	0.066	0.043

ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo 1D	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	8	340	110	12	6.9	7.8	51	0.14	11	270	1.5	0.37	6.50	0.04	0.190	0.04	0.009	0.084	0.47	0.01	0.04	0.01	0.028	0.05	0.25
18/8/2010	1	226	29	11	1	6	48	0.1	6	38	0.4	0.25	1.09	0.12	0.240	0.261	0.015	0.001	0.021	0.011	0.12	0.001	0.002	0.056	0.079
18/2/2011	8	440	125	8	26	5	42	2	103	168	2.4	0.08	5.02	0.05	0.103	0.023	0.001	0.001	0.005	0.002	0.15	0.003	0.035	0.157	0.271
30/6/2011	8	452	121	6	19	5	41	0.3	118	146	5.8	0.18	6.04	0.1	0.12	0.032	0.003	0.001	0.018	0.002	0.15	0.002	0.035	0.206	0.338
24/8/2011		464	123	6	19	6	47	0.4	100	150	2.1	0.11	1.22	0.05	0.065	0.033	0.002	0.001	0.02	0.002	0.06	0.002	0.035	0.25	0.364
16/2/2012	4	910	133	9	18	6	43	0.3	430	1	47	0.01	0.28	0.06	0.047	0.042	0.003	0.001	0.014	0.003	0.05	0.003	0.033	0.257	0.39
20/8/2012	4	392	134	8	16	6	48	0.3	104	181	2.1	0.07	0.2	0.07	0.049	0.048	0.002	0.001	0.006	0.002	0.04	0.003	0.039	0.261	0.348
24/1/2013	5	370	150	10	14	7	50	0.3	126	183	2.2	0.07	0.65	0.11	0.06	0.05	0.002	0.001	0.011	0.002	0.04	0.002	0.031	0.235	0.391
15/3/2013	2	378	124	9	13	7	44	0.3	93	177	1.7	0.07	0.41	0.07	0.057	0.049	0.002	0.001	0.006	0.002	0.03	0.002	0.029	0.242	0.383
18/04/2013	4	354	140	8	18	6	47	0.4	103	186	5.8	0.02	0.43	0.07	0.055	0.053	0.002	0.001	0.005	0.002	0.04	0.002	0.035	0.254	0.361
31/07/2013	5	425	123	7	14	5	48	0.4	95	158	3.9	0.01	0.32	0.05	0.058	0.05	0.002	0.001	0.009	0.002	0.04	0.002	0.034	0.254	0.404
04/12/2013	8	385	139	6	16	5	52	0.4	94	168	0.4	0.08	0.38	0.08	0.064	0.048	0.011	0.001	0.035	0.005	0.04	0.003	0.041	0.264	0.501
30/01/2014	4	403	132	6	16	5	48	0.4	85	181	1.2	0.05	0.35	0.06	0.056	0.046	0.002	0.001	0.01	0.004	0.03	0.002	0.036	0.223	0.436
13/03/2014	4	327	119	8	14	6	49	0.4	91	169	1.5	0.06	0.39	0.05	0.052	0.044	0.001	0.001	0.006	0.005	0.03	0.002	0.033	0.213	0.438
30/05/2014	6	360	136	6	13	5	47	0.4	79	200	2.1	0.1	0.35	0.1	0.065	0.053	0.002	<0.001	0.016	0.005		0.002	0.035	0.211	0.365
23/07/2014	4	392	138	9	12	6	45	0.4	103	197	1.5	0.08	0.32	0.13	0.055	0.054	<0.001	<0.001	0.007	0.003	0.04	0.003	0.034	0.21	0.402
18/09/2014	5	374	133	8	12	6	48	0.4	81	212	1.8	0.08	1.16	0.11	0.071	0.06	0.001	<0.001	0.006	0.003		0.002	0.037	0.202	0.374
14/11/2014	6	396	126	12	11	8	51	0.4	94	176	2.4	0.08	0.59	0.1	0.071	0.06	0.002	<0.001	0.008	0.003		0.002	0.041	0.204	0.396
06/02/2015	4	400	130	13	11	8	41	0.4	80	192	1.9	0.08	0.32	0.06	0.051	0.049	0.002	<0.001	0.023	0.003		0.002	0.037	0.204	0.416
31/07/2015	5	392	123	12	11	7	32	0.4	84	178	4.2	0.06	0.46	<0.05	0.061	0.05	0.004	<0.001	0.016	0.007	0.04	0.002	0.031	0.201	0.366
27/11/2015	4	363	125	14	11	7	47	0.3	79	187	5.64	0.1	1.03	0.05	0.07	0.051	0.001	0.001	0.016	0.007	0.16	0.002	0.037	0.233	0.468
08/03/2016	3	445	123	13	10	8	43	0.4	80	213	0.9	0.04	0.24	<0.05	0.039	0.025	<0.001	<0.001	0.018	0.007	0.03	0.003	0.037	0.209	0.444
17/05/2016	<1	384	126	13	10	7	42	0.4	72	222	1.5	0.06	0.54	<0.05	0.032	0.018	0.002	0.002	0.081	0.007	0.05	0.002	0.034	0.199	0.414
13/10/2016	3	412	139	15	12	9	47	0.4	70	236	0.6	0.04	0.38	<0.05	0.018	0.011	<0.001	<0.001	0.009	0.008		0.002	0.035	0.214	0.438
14/11/2016	3	420	121	14	10	7	44	0.4	63	200	0.9	0.06	0.53	0.06	0.028	0.015	<0.001	<0.001	0.01	0.008	0.06	0.002	0.034	0.191	0.439
12/05/2017	2	474	125	15	10	8	43	0.3	61	200	0.9	0.04	1.09	0.19	0.042	0.029	0.001	<0.001	0.006	0.006	0.02	0.002	0.033	0.217	0.4
16/06/2017	2	444	124	14	10	8	44	0.2	63	212	0.7	0.04	0.83	0.09	0.037	0.031	0.002	<0.001	0.007	0.008	0.02	0.002	0.034	0.214	0.427
ST Dev	2	125	24	3	5.0	1.0	4.5	0.4	80.3	58.4	9.8	0.08	1.94	0.03	0.049	0.048	0.004	0.022	0.100	0.003	0.044	0.002	0.008	0.058	0.087
Max	8	910	150	14	26.0	8.0	52.0	2.0	430.0	270.0	47.0	0.37	6.50	0.13	0.240	0.261	0.015	0.084	0.470	0.011	0.150	0.010	0.041	0.264	0.501
Min	1	226	29	6	1.0	5.0	32.0	0.1	6.0	1.0	0.4	0.01	0.20	0.04	0.047	0.023	0.001	0.001	0.005	0.002	0.030	0.001	0.002	0.050	0.079
Median	5	392	125	8	16	6	48	0.3	100	168	2.1	0.07	0.43	0.07	0.060	0.048	0.002	0.001	0.011	0.002	0.04	0.002	0.035	0.242	0.364

ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo 2D	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	25	2410	80	770	105	50	47	0.1	860	1	2.2	0.06	2.50	0.01	0.090	0.01	0.003	0.003	0.013	0.01	0.03	0.01	0.12	0.18	10
18/8/2010	29	2080	51	596	47	1	28	0.1	569	1	0.7	0.21	0.5	0.05	0.004	0.001	0.025	0.003	0.027	0.005	0.05	0.001	0.022	0.137	7.3
18/2/2011	59	1780	57	505	42	1	26	0.1	392	868	1.7	0.05	0.75	0.05	0.011	0.001	0.031	0.003	0.018	0.002	0.05	0.001	0.018	0.114	7.54
30/6/2011	74	1630	72	335	39	1	21	0.1	331	734	3.3	0.03	0.97	0.5	0.012	0.001	0.031	0.004	0.018	0.005	0.07	0.001	0.017	0.114	6.63
24/8/2011		1720	65	309	32	1	21	0.1	254	702	2.1	0.08	0.05	0.5	0.003	0.001	0.03	0.002	0.01	0.005	0.02	0.001	0.017	0.118	
16/2/2012	57	1500	78	343	42	1	18	0.1	397	609	13.9	0.1	0.08	0.05	0.001	0.001	0.03	0.002	0.011	0.003	0.04	0.001	0.012	0.099	6.43
20/8/2012	58	1930	80	248	33	1	23	0.1	238	496	2.9	0.02	0.13	0.05	0.008	0.001	0.039	0.004	0.014	0.004	0.12	0.001	0.013	0.106	5.78
24/1/2013	58	1350	80	280	29	1	29	0.1	285	495	6.3	0.03	0.93	0.05	0.013	0.002	0.036	0.002	0.014	0.004	0.08	0.001	0.016	0.111	0.001
15/3/2013	66	1300	82	305	32	1	25	0.1	260	585	3.5	0.05	0.12	0.05	0.003	0.001	0.038	0.002	0.013	0.005	0.19	0.001	0.013	0.113	6.11
18/04/2013	57	1340	81	202	28	1	31	0.1	350	270	7.2	0.01	0.1	0.05	0.003	0.001	0.033	0.002	0.007	0.004	0.1	0.001	0.016	0.113	5.96
31/07/2013	115	1230	82	257	28	1	31	0.1	338	372	3.1	0.09	0.05	0.05	0.002	0.001	0.041	0.002	0.008	0.003	0.05	0.001	0.016	0.103	5.69
04/12/2013	63	1160	108	262	34	1	30	0.1	293	418	2.4	0.02	0.27	0.05	0.006	0.001	0.048	0.002	0.012	0.005	0.06	0.001	0.018	0.108	6.78
30/01/2014	55	1200	102	214	31	1	30	0.1	292	366	2.8	0.02	0.17	0.05	0.003	0.002	0.038	0.001	0.008	0.004	0.05	0.001	0.013	0.089	5.54
13/03/2014	56	1190	90	234	28	1	31	0.1	261	359	3	0.01	0.12	0.05	0.005	0.003	0.036	0.001	0.005	0.004	0.09	0.001	0.013	0.086	5.4
30/05/2014	59	896	104	200	26	<1	28	<0.1	231	346	3.7	0.02	0.6	<0.05	0.015	0.002	0.034	<0.001	0.039	0.004		<0.001	0.012	0.087	5.22
23/07/2014	210	1100	97	192	23	<1	28	<0.01	258	320	1.9	0.01	0.38	<0.05	0.007	0.001	0.028	<0.001	0.011	0.004	0.17	<0.001	0.012	0.079	4.26
18/09/2014	52	1050	107	208	25	<1	33	<0.1	277		2.9	<0.05	0.43	<0.05	0.007	0.001	0.031	<0.001	0.005	0.004		<0.001	0.012	0.069	3.87
14/11/2014	56	1010	104	244	22	<1	23	<0.1	276	275	3.8	<0.02	0.18	<0.05	0.008	<0.001	0.029	<0.001	0.001	0.004		<0.001	0.012	0.071	4.08
06/02/2015	87	813	126	172	26	<1	26	<0.1	228	332	4.1	0.02	0.29	<0.05	0.006	<0.001	0.029	<0.001	0.013	0.005		<0.001	0.012	0.068	3.41
31/07/2015	53	716	100	167	18	<1	19	<0.1	210	258	7	<0.02	0.49	<0.05	0.005	<0.001	0.021	<0.001	0.007	0.006	0.24	<0.001	0.009	0.066	3.32
27/11/2015	125	964	105	172	18	1	28	0.1	217	184	9.5	0.27	5.22	0.05	0.042	0.001	0.014	0.001	0.005	0.004	0.21	0.001	0.01	0.064	3.65
08/03/2016	46	875	101	132	16	<1	27	<0.1	180	<1	2.9	0.02	0.48	<0.05	0.006	<0.001	0.009	<0.001	0.005	0.005	0.57	<0.001	0.008	0.054	3.18
17/05/2016	116	476	96	131	16	<1	22	0.1	158	<1	3.1	0.02	0.38	<0.05	0.007	0.003	0.006	<0.001	<0.005	0.005	0.58	<0.001	0.007	0.049	2.84
13/10/2016	108	454	113	72	20	<1	27	0.1	218	43	3.7	0.04	<0.05	<0.05	0.003	0.004	0.01	0.002	0.017	0.005		<0.001	0.007	0.044	2.21
14/11/2016	36	703	105	60	17	<1	26	<0.1	179	<1	4.5	0.03	1.66	0.06	0.014	0.003	0.012	<0.001	0.052	0.014	0.61	<0.001	0.007	0.032	2.2
12/12/2016	53	573	97	77	16	<1	27	<0.1	207	<1	5.1	<0.01	0.72	<0.05	0.012	0.003	0.007	<0.001	0.008	0.006	0.64	<0.001	0.007	0.035	1.99
12/05/2017	68	724	104	77	15	<1	23	<0.1	139	195	4.4	<0.01	0.27	<0.05	0.006	0.002	0.006	<0.001	0.006	0.007	0.58	<0.001	0.006	0.04	1.64
16/06/2017	62	767	102	110	14	<1	25	<0.1	159	<1	1	<0.01	0.18	<0.05	0.004	0.002	0.004	<0.001	0.005	0.006	0.63	<0.001	0.006	0.046	2.29
ST Dev	37	492	17	159	17	13	5	0.0	143	230	2.7	0.07	1.06	0.15	0.017	0.002	0.013	0.001	0.011	0.002	0.23	0.002	0.021	0.035	2.23
Max	210	2410	126	770	105	50	47	0.1	860	868	13.9	0.27	5.22	0.50	0.090	0.010	0.048	0.004	0.052	0.014	0.64	0.010	0.120	0.180	10.00
Min	25	454	51	60	14	1	18	0.1	139	1	0.7	0.01	0.05	0.01	0.001	0.001	0.003	0.001	0.001	0.002	0.02	0.001	0.006	0.032	0.00
Median	58	1130	97	211	27	1	27	0.1	259	353	3.2	0.03	0.38	0.05	0.006	0.001	0.030	0.002	0.011	0.005	0.10	0.001	0.012	0.087	4.26

ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo 3	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	3	130	27	17	2.6	5.7	16	0.1	12	120	1	0.13	1.50	0.02	0.090	0.04	0.004	0.05	0.091	0.01	0.01	0.01	0.001	0.01	0.08
18/8/2010	7	240	26	20	2	6	9	0.1	12	80	0.12	0.08	0.43	0.05	0.042	0.001	0.001	0.001	0.005	0.001	0.03	0.001	0.001	0.006	0.044
18/2/2011	10	148	33	21	3	6	12	0.6	9	129	0.9	0.01	1.34	0.05	0.054	0.007	0.005	0.001	0.068	0.008	0.06	0.001	0.004	0.013	0.055
30/6/2011	9	252	37	19	4	7	13	0.3	23	118	1.6	0.02	1.87	0.1	0.1	0.069	0.031	0.048	0.097	0.03	0.18	0.001	0.003	0.013	0.054
24/8/2011		242	41	20	5	7	13	0.4	10	146	1.4	0.3	0.97	0.05	0.082	0.061	0.003	0.011	0.034	0.014	0.06	0.001	0.006	0.016	0.063
16/2/2012	18	272	52	17	5	6	13	0.6	33	133	3.6	0.07	0.25	0.05	0.027	0.018	0.003	0.004	0.034	0.19	0.03	0.001	0.006	0.015	0.058
20/8/2012	15	206	62	19	4	5	13	0.6	22	152	7.4	0.08	0.34	0.05	0.024	0.008	0.004	0.004	0.032	0.016	0.03	0.001	0.004	0.011	0.056
24/1/2013	10	156	70	13	4	5	13	0.5	20	165	2	0.06	0.3	0.05	0.011	0.007	0.002	0.001	0.024	0.009	0.04	0.001	0.004	0.011	0.057
15/3/2013	11	300	65	13	3	4	12	0.8	13	165	1.9	0.1	0.48	0.05	0.024	0.015	0.006	0.001	0.017	0.008	0.06	0.001	0.003	0.011	0.062
18/04/2013	8	256	62	9	3	4	8	0.8	18	142	1.6	0.11	0.46	0.05	0.01	0.004	0.002	0.001	0.01	0.008	0.05	0.001	0.004	0.011	0.048
31/07/2013	10	184	66	7	3	3	10	0.8	17	139	2.1	0.01	0.59	0.05	0.042	0.007	0.004	0.001	0.019	0.008	0.09	0.001	0.003	0.01	0.05
04/12/2013	10	230	68	10	4	4	10	0.8	17	155	0.7	0.04	0.18	0.05	0.019	0.011	0.004	0.003	0.018	0.007	0.07	0.001	0.006	0.013	0.071
30/01/2014	6	217	64	5	4	3	8	0.8	17	146	1.5	0.05	0.15	0.05	0.012	0.007	0.003	0.001	0.02	0.008	0.01	0.001	0.002	0.009	0.056
13/03/2014	3	222	66	9	4	4	9	0.8	20	138	1.7	0.11	0.26	0.05	0.041	0.021	0.001	0.001	0.014	0.008	0.01	0.001	0.002	0.01	0.051
30/05/2014	4	231	74	5	3	2	9	0.9	19	142	1.6	0.14	0.46	<0.05	0.057	0.034	0.001	0.001	0.014	0.007		0.002	0.002	0.011	0.043
23/07/2014	5	231	78	7	3	3	10	0.9	21	152	1.7	0.11	0.24	<0.05	0.047	0.044	0.001	<0.001	0.018	0.007	0.02	0.001	0.002	0.013	0.058
18/09/2014	5	216	80	5	3	2	11	0.9	15	170	1.1	0.16	0.58	<0.05	0.041	0.032	0.003	<0.001	0.011	0.006		0.002	0.004	0.013	0.056
14/11/2014	5	232	70	8	3	3	10	0.9	<1	144	1.4	0.17	0.35	<0.05	0.043	0.035	0.003	<0.001	0.015	0.007		0.002	0.003	0.012	0.055
06/02/2015	6	308	70	9	3	3	10	1	16	156	1.8	0.18	0.69	<0.05	0.043	0.031	0.006	<0.001	0.014	0.007		0.002	0.004	0.013	0.05
31/07/2015	4	260	66	8	2	3	8	0.9	37	118	9	0.18	0.88	<0.05	0.032	0.018	0.002	<0.001	0.007	0.004	0.06	0.001	0.003	0.019	0.046
27/11/2015	4	182	59	7	2	2	9	0.8	14	153	1.3	0.2	0.84	0.05	0.032	0.019	0.003	0.001	0.01	0.006	0.07	0.002	0.002	0.012	0.041
08/03/2016	3	264	62	7	2	3	12	0.8	15	159	1.3	0.16	0.74	<0.05	0.026	0.019	0.003	<0.001	0.008	0.005	0.05	<0.001	0.003	0.011	0.042
17/05/2016	4	184	63	8	3	3	10	0.9	15	160	1.5	0.17	0.51	<0.05	0.019	0.008	0.004	<0.001	0.01	0.006	0.06	<0.001	0.003	0.011	0.043
13/10/2016	4	218	70	9	3	3	10	0.8	17	154	1	0.18	0.73	<0.05	0.036	0.02	0.005	<0.001	0.03	0.008		0.001	0.003	0.012	0.044
14/11/2016	4	186	63	7	3	2	9	0.8	13	132	1.4	0.22	1.18	<0.05	0.047	0.017	0.004	<0.001	0.03	0.008	0.11	0.002	0.003	0.012	0.042
12/12/2016	4	241	67	6	2	3	10	0.8	17	134	0.9	0.14	0.79	<0.05	0.03	0.014	0.003	<0.001	0.033	0.007	0.04	0.002	0.002	0.011	0.049
12/05/2017	2	246	57	5	2	2	9	0.7	10	45	79.7	0.14	0.31	<0.05	0.01	0.001	0.004	<0.001	0.038	0.006	0.05	0.002	0.001	0.009	0.055
16/06/2017	2	210	58	6	2	2	8	0.4	13	127	1.1	0.13	0.28	<0.05	0.012	0.002	0.006	<0.001	0.064	0.008	0.04	<0.001	0.001	0.009	0.04
ST Dev	44	540	23	180	21	15	8	0.0	172	246	3.2	0.07	1.29	0.17	0.329	0.352	0.014	0.001	0.012	0.003	0.23	0.003	0.027	0.039	2.485
Max	210	2410	126	770	105	50	47	0.1	860	868	13.9	0.27	5.22	0.50	1.900	1.900	0.048	0.004	0.052	0.014	0.64	0.010	0.120	0.180	10.000
Min	25	454	17	60	14	1	5	0.0	139	1	0.3	0.01	0.05	0.01	0.001	0.001	0.001	0.001	0.001	0.002	0.02	0.001	0.006	0.032	0.001
Median	58	1115	97	210	27	1	27	0.1	259	349	3.1	0.03	0.38	0.05	0.006	0.001	0.029	0.002	0.011	0.005	0.10	0.001	0.012	0.086	4.260



ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)			
Nebo 4	DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As	Filt Li	Filt Ba	Filt Sr
29/1/2010	18	460	130	30	7.1	15	110	0.16	6	310	4.1	0.19	22.00	0.06	0.510	0.13	0.008	0.16	1.2	0.01	0.04	0.01	0.025	0.22	0.51
18/2/2011	17	2760	249	681	300	1	29	0.1	1	2710	8.3	0.01	3.32	0.05	0.06	0.001	0.022	0.012	0.084	0.005	0.31	0.001	0.846	1.59	7.92
30/6/2011	13	3030	241	534	292	1	34	0.1	11	2100	9.8	0.14	6.14	0.5	0.076	0.001	0.017	0.006	0.074	0.005	0.38	0.001	0.815	1.76	6.7
24/8/2011		3020	251	506	287	1	28	0.1	1	2290	12.2	0.41	5.36	0.55	0.088	0.078	0.014	0.043	0.067	0.17	0.43	0.001	0.007	0.022	0.071
16/2/2012	3	2920	264	425	230	1	24	0.1	14	2110	17	0.16	2.03	0.05	0.038	0.001	0.097	0.02	0.115	0.002	0.37	0.001	0.902	2.12	8
20/8/2012	13	2630	282	397	229	1	35	0.1	4	2040	12.5	0.1	1.85	0.5	0.42	0.001	0.076	0.017	0.1	0.003	0.36	0.001	0.746	1.76	6.14
24/4/2013	11	2600	258	641	181	1	41	0.1	3	2380	14	0.17	5.76	0.05	0.083	0.001	0.054	0.02	0.076	0.002	0.39	0.001	0.583	1.54	5.22
15/3/2013	14	2340	241	736	154	1	36	0.1	2	2300	12.1	0.15	3.98	0.024	0.067	0.001	0.046	0.024	0.07	0.002	0.42	0.001	0.442	1.7	5.91
18/04/2013	11	2270	225	528	162	1	45	0.1	1	1880	14.1	0.02	0.2	0.05	0.005	0.001	0.049	0.018	0.058	0.002	0.46	0.001	0.558	1.56	5.44
31/07/2013	12	6560	239	677	219	1	47	0.1	1	2190	16.6	0.14	0.14	0.05	0.004	0.001	0.057	0.014	0.065	0.002	0.4	0.001	0.629	1.5	5.31
04/12/2013	13	2390	224	465	203	1	51	0.1	1	1840	8.8	0.01	0.13	0.05	0.003	0.001	0.082	0.016	0.073	0.003	0.35	0.001	0.767	1.65	6.78
30/01/2014	9	2370	205	742	156	1	51	0.1	1	2200	9.3	0.01	0.34	0.05	0.009	0.001	0.071	0.016	0.059	0.002	0.37	0.001	0.461	1.47	5.29
13/03/2014	15	2420	242	704	181	1	49	0.1	1	2160	12.1	0.03	0.29	0.05	0.006	0.001	0.103	0.012	0.062	0.003	0.42	0.001	0.507	1.32	5.18
30/05/2014	16	2380	254	780	282	<1	45	<0.1	<1	2480	10.3	0.2	2.59	<0.05	0.04	<0.001	0.077	0.012	0.042	0.003		<0.001	0.552	1.32	5.58
23/07/2014	14	2330	233	730	142	<1	47	<0.1	8	2130	16.6	0.04	0.86	<0.05	0.017	0.002	0.074	0.008	0.068	0.003	0.42	<0.001	0.388	1.16	4.15
18/09/2014	14	2180	245	736	146	<1	52	<0.1	2	1890	12.1	0.04	0.81	<0.05	0.009	0.001	0.067	0.008	0.064	0.002		<0.001	0.361	1.08	3.56
14/11/2014	13	2260	218	758	120	<1	45	<0.1	<1	1980	12	0.01	0.27	<0.05	0.006	0.001	0.067	0.014	0.077	0.002		<0.001	0.362	1.15	4.11
06/02/2015	13	2050	265	732	125	<1	49	<0.1	<10	2180	12.9	0.02	0.22	<0.05	0.004	<0.001	0.061	0.011	0.064	0.003		<0.001	0.336	1.18	3.68
31/07/2015	14	2120	204	666	103	<1	37	<0.1	<10	2150	11	<0.01	0.4	<0.05	0.007	<0.001	0.051	0.01	0.056	0.003	0.48	<0.001	0.3	1.23	3.9
27/11/2015	11	2380	214	693	102	1	54	0.1	12	2200	12.8	0.37	14.9	0.05	0.167	0.001	0.057	0.011	0.058	0.002	0.48	0.001	0.344	1.29	4.25
08/03/2016	11	2320	216	684	99	<1	48	<0.1	<1	<1	9.8	<0.01	0.44	<0.05	0.006	<0.001	0.054	0.011	0.062	0.002	0.46	<0.001	0.339	1.15	3.73
17/05/2016	10	2440	217	668	97	<1	39	<0.1	3	<1	9.9	<0.01	0.44	<0.05	0.004	<0.001	0.058	0.01	0.053	0.002	0.43	<0.001	0.308	1.11	3.62
13/10/2016	10	2030	225	750	105	<1	65	<0.1	4	<1	11.7	<0.01	0.51	<0.05	0.004	<0.001	0.053	0.01	0.052	0.002		<0.001	0.310	1.18	3.61
14/11/2016	11	2370	204	682	93	<1	52	<0.1	<1	<1	14	0.03	1.4	<0.05	0.013	<0.001	0.059	0.008	0.066	0.002	0.55	<0.001	0.3	1.13	3.45
ST Dev	3	1077	32	180	75.5	4	18	0.0	4	464	3.1	0.10	5.87	0.21	0.139	0.040	0.026	0.033	0.253	0.037	0.10	0.002	0.247	0.49	2.02
Max	18	6560	282	780	300.0	15	110	0.2	14	2710	17.0	0.41	22.00	0.55	0.510	0.130	0.103	0.160	1.200	0.170	0.46	0.010	0.902	2.12	8.00
Min	3	460	130	30	7.1	1	24	0.1	1	310	4.1	0.01	0.13	0.02	0.003	0.001	0.008	0.006	0.042	0.002	0.04	0.001	0.007	0.02	0.07
Median	13	2615	241	531	211	1	39	0.1	2	2150	12.2	0.14	2.68	0.05	0.064	0.001	0.052	0.018	0.074	0.003	0.38	0.001	0.606	1.58	5.68