Mt. Piper Brine Conditioned Fly Ash Co-placement Project

Annual Environmental Monitoring Report 2018/19

EnergyAustralia NSW Pty Ltd

September 2019

Ref. 0470260

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Document Control:

0470260 Mt Piper Ash Repository Annual Environmental Monitoring Report 2018/19

Version	Revision	Author	ERM Approval to Issue	
			Name	Date
Draft	01	Matthew Colthorpe	Tamie Weaver	15 August 2019
Draft	02	Matthew Colthorpe	Tamie Weaver	26 August 2019
Draft	03	Matthew Colthorpe	Tamie Weaver	19 September 2019
Final	01	Matthew Colthorpe	Michael Gaggin	26 September 2019

Mt. Piper Brine Conditioned Fly Ash Co-placement Project

Annual Environmental Monitoring Report 2018/19

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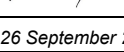
Signed:	
Date:	*26 September 2019*
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EnergyAustralia NSW Pty Ltd

September 2019

Reference: 0470260

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EXECUTIVE SUMMARY

Environmental Resources Management Pty Ltd (ERM) was engaged by EnergyAustralia NSW (EnergyAustralia) to prepare an Annual Environmental Monitoring Report (AEMR) for the Mount Piper Brine Conditioned Fly Ash Co-Placement Project at the Mount Piper Power Station facility located at 350 Boulder Road, Portland, New South Wales (the Site) over the period of 1 July 2018 to 30 June 2019. Refer to *Figure 1* showing the location of the site.

The Mt Piper Ash Repository is relevantly authorised under development consent no. 80/10060 granted under the Environmental Planning and Assessment Act 1979 (NSW) as currently modified (Mt Piper Consent). The conditions of the Mt Piper Consent relevantly operate to require:

- Implementation of Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan (Water Management and Monitoring Plan) (Connell Wagner, 2008); and

- The carrying out of groundwater and surface water monitoring programs as specified in the Water Management and Monitoring Plan.

Results from the monitoring program are reported to key stakeholders that include WaterNSW, NSW Environment Protection Authority , the NSW Department of Planning Industry and Environment and Lithgow City Council.

Based on the review of the surface water and groundwater quality data at the Mount Piper Ash Repository for the 2018/19 reporting period, the following conclusions are made:

- The water quality trigger values set out in the Water Management and Monitoring Plan have been adopted as environmental goals for the monitored analytes (Environmental Goals);

- Some exceedances of the Environmental Goals were recorded during the reporting period with respect to surface water and groundwater;

- In surface water, sporadic exceedances of the Environmental Goals were identified at LMP01 and WX22, however, exceedances reported at LMP01 are not considered to be related directly to the Mt Piper Ash Repository given LMP01 is located up gradient to the Mt Piper Ash Repository;

- Concentrations of some compounds in groundwater from several bores, including bore D9 located towards Neubecks Creek, were reported in exceedance of the Groundwater Environmental Goals (as set out in the Water Management and Monitoring Plan). It is considered likely that the Mt Piper Ash Repository has contributed to these exceedances in groundwater; and

- It is noted that the reported groundwater levels in the monitored bores have generally remained below the most recent maximum predicted groundwater level (912.0 mAHD; CDM Smith, 2013) and below the base of water-conditioned ash placement (917 m AHD).

1. INTRODUCTION

Environmental Resources Management Pty Ltd (ERM) was engaged by EnergyAustralia NSW Pty Limited (EnergyAustralia) to prepare an Annual Environmental Monitoring Report (AEMR) for the Mount Piper Brine Conditioned Fly Ash Co-Placement Project at the Mount Piper Power Station facility located at 350 Boulder Road, Portland, New South Wales (the Site). Refer to *Figure 1* showing the location of the site.

Results from the monitoring program are reported to key stakeholders that include WaterNSW (formerly the NSW Sydney Catchment Authority (SCA)), NSW Environment Protection Authority (EPA), Lithgow City Council (LCC) and NSW Department of Planning Infrastructure and Environment (DPIE).

This Mt Piper Brine in Ash Co-Placement AEMR has been prepared in accordance with Schedule 2, Conditions 44 and 45 of the Mt Piper Consent.

The AEMR has also been prepared in general accordance with the NSW Government's *Post-approval requirements for State Significant Mining Developments Annual Review Guideline* dated October 2015. It is noted that a number of items presented in the abovementioned guideline are not applicable to this AEMR as, in line with the requirements of the Mt Piper Consent, this report relates to surface water and groundwater monitoring only whilst the guideline relates to mining developments. Notwithstanding this, the guideline format has been generally used to inform the content of this AEMR where applicable.

This report should be read in conjunction with the Statement of Limitations presented in *Annex A*.

1.1 PROJECT BACKGROUND

EnergyAustralia (EnergyAustralia) owns and operates the Mt Piper Power Station including the Mt Piper Brine in Ash Co-Placement Project Area. The Mt Piper Brine in Ash Co-Placement Project Area is located approximately 18 kilometres north-west of the city of Lithgow and is situated adjacent to the Lamberts North Ash Repository and approximately 200 m to the east of the Mt Piper Power Station. Refer to *Figure 2* for a plan showing the site setting.

The Mt Piper Consent was originally granted under Part 4 of the Environmental Planning and Assessment Act 1979 (NSW) (**EP&A Act**) on 1 April 1982 and authorised the Mt Piper Power Station subject to conditions.

Development consent no. 230/89 was granted by Lithgow City Council under the EP&A Act on 21 March 1980 and authorised the 'transportation and emplacement of ash and restoration of affected areas' within the Mt Piper Ash Repository subject to conditions. This development consent was supported by a 1989 Environmental Impact Statement (EIS) (Connell Wagner 2007).

In 1999, a Statement of Environmental Effects (SEE) was prepared in support of an application to modify the Mt Piper Consent so as to authorise the placement of both water conditioned ash and brine conditioned ash in the Mt Piper Ash Repository, as detailed in the report titled *Mount Piper Power Station, Brine Conditioned Flyash Co-placement: Statement of Environmental Effects* (Pacific Power International, 1999). A modification was subsequently made under the EP&A Act to the Mt Piper Consent on 3 April 2000 which authorised the co-disposal of brine and flyash within the Mt Piper Ash Repository subject to conditions.

A further application was lodged in 2007 to modify the Mt Piper Consent to authorise an expansion of the Mt Piper Ash Repository and was supported by a report titled *Statement of Environmental Effects, Mount Piper Power Station, Extension of Brine Conditioned Ash Placement Area* (Connell Wagner, 2007). A modification was subsequently made under the EP&A Act to the Mt Piper Consent on 23 March 2008 which authorised an extension of the brine and ash co-placement area within the Mt Piper Ash Repository subject to conditions.

The conditions of the Mt Piper Consent, as modified, relevantly operate to require:

- Implementation of the Groundwater Management Plan and a Surface Water Management Plan (Water Management and Monitoring Plan) (Connell Wagner, 2008); and
- The carrying out of groundwater and surface water monitoring programs as specified in the Water Management and Monitoring Plan.

1.2 SCOPE OF WORKS

The following works have been implemented as part of this project, and were based on the Scope of Works provided by EnergyAustralia and augmented further based on ERM's understanding of the project requirements:

- Review of surface water (2 sites measured weekly) and groundwater (10 sites measured monthly) quality and trace metal data at Mt Piper Power Station Brine Co-placement area for the reporting period;
- Review of the monthly changes including long-term trends in surface and groundwater concentrations;

- Assessment of the EnergyAustralia groundwater data to evaluate potential interactions with the Neubecks Creek water quality;

- Preparation of this factual report on results of the surface and groundwater water quality monitoring required under the Mt Piper Consent, including:

    - Interpretation and discussion of results;

    - A list of occasions in the twelve month reporting period when the Environmental Goals have not been achieved; and

    - Update on the contingency measures currently being implemented in accordance with the Water Management and Monitoring Plan.

1.3 DOCUMENTATION REVIEWED

A review of information provided below has been undertaken as part of this Annual Environmental Monitoring Report and these documents have been relied upon:

- Pacific Power International, August 1999, *Mount Piper Power Station, Brine Conditions Flyash Co-placement: Statement of Environmental Effects*. Prepared by Environmental Services, Pacific Power International for Delta Electricity;

- Pacific Power International, Environmental Services, August, 2000, *Mt Piper Power Station Brine Conditioned Flyash Co-placement - Water Management & Monitoring Plan*;

- Connell Wagner, 21 June 2007, *Statement of Environmental Effects, Mount Piper Power Station, Extension of Brine Conditioned Ash Placement Area*. Prepared by Environmental Services, Pacific Power International for Delta Electricity;

- Connell Wagner, 26 September 2008, *Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan*, Delta Electricity Western, Revision 3 (*Annex B*);

- CDM Smith, 2013, Lamberts North Ash Placement Project Operation Environmental Management Plan (OEMP), Delta Electricity – Western May 2013, Version 2, 9 May 2013;

- NSW Department of Primary Industries, Office of Water, *Statement of Conditions, Water Access Licence (WAL) No. 27428*, Reference Number 10AL116411. Statement of Conditions (as at 28 February 2014) (*Annex B*);

- Environment Protection Licence (EPL) No. 13007 (last amended 20 December 2017) (*Annex B*);

- NSW Department of Primary Industries, Office of Water, *Statement of Approval, Approval Number 10CA11220* (as at 28 February 2018) (*Annex B*);

- ERM, September 2018. *Mt Piper Brine Conditioned Fly Ash Co-placement Project Annual Environmental Monitoring Report 2017/18*. Final Revision 03 26 September 2018;
- Lend Lease Infrastructure, Monthly Client Reports for July 2018 – June 2019, supplied via EnergyAustralia NSW, 5 August 2019;
- Mt Piper Consent as currently modified (*Annex B*);
- Ecolab/Nalco Quality Assurance/Quality Control Program (*Annex J*); and
- Bureau of Meteorology, 2019. Local climate data from Lithgow (Cooerwull) Weather Station No: 063226 (*Annex C*).

In addition to the above it is acknowledged that the information presented in *Sections 1* to *5* and *Section 8* of this report was prepared with input by EnergyAustralia.

1.4 CONTACTS

The contact details for the key personnel responsible for the environmental management of the Mt Piper Brine in Ash Co-Placement Area are listed in *Table* 1 below.

Table 1 Contact Details

Contact Person	Organisation	Position	Telephone
Mr Ben Eastwood	EnergyAustralia NSW	NSW Environment Leader	(02) 6354 8111

2 MT PIPER CONSENT

The operation of the Mt Piper Brine in Ash Co-Placement Project must comply with the key statutory requirements outlined in *Table* 2 below.

Table 2 Summary of Approvals – Mt Piper Brine in Ash Co-Placement Project

Approval/Lease/Licence	Details/Comments
Mt Piper Consent	Granted by Minister for Planning under the EP&A Act as currently modified
Environment Protection Licence (EPL) No. 13007	EPL held by EnergyAustralia for the Mt Piper Power Station

2.1 CONDITIONS OF APPROVAL

The surface water and groundwater monitoring programs are required under conditions 44 and 45 of the Mt Piper Consent. Refer to *Annex B* for a copy of the consolidated Mt Piper Consent.

The Water Management and Monitoring Plan (Connell Wagner, 2008) sets out the surface water and groundwater monitoring requirements. Refer to *Annex B* for a copy of the Water Management and Monitoring Plan. It is noted that a separate and broader investigation of surface and groundwater conditions in the vicinity of the Mt Piper Power Station ash repositories, including the Mt Piper Brine in Ash Co-Placement area is currently being completed in line with the contingency measures identified in the Water Management and Monitoring Plan. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and further contingency measures proposed.

2.2 ENVIRONMENT PROTECTION LICENCE

Environment Protection Licence 13007 (EPL) relates to the activities undertaken across the Mt Piper Power Station, with the Scheduled Activity under the licence denoted as "Electricity Generation". The EPL does not include any specific conditions relating to the Brine in Ash Co-Placement area but it does require monitoring of discharge to waters from discharge point 1, being the final holding pond monitoring station to Neubecks Creek.
Refer to *Annex B* for a copy of the EPL for the site.

2.3 CHANGES TO APPROVALS DURING 2018/19

EnergyAustralia has advised ERM that there were no changes to the Approvals with respect to the surface water or groundwater monitoring programs during the 2018/19 reporting period.

However, it is noted that during the reporting period the NSW Department of Planning, Industry and Environment approved the application to modify the Mount Piper Consent under Section 4.55 (1A) of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) to authorise the construction of a new double-lined 60 ML pond immediately adjacent to the existing Blowdown Pond B. The conditions imposed as part of this modification require the Water Management and Monitoring Plan be updated prior to commissioning the new storage pond.

Further, development consent 7592 was granted under the EP&A Act on 12 January 2018 for the Springvale Water Treatment Project. The Springvale Water Treatment Project is currently under construction. Once the Springvale Water Treatment Project is fully operational (currently expected to occur in Q4 2019), brine from the Water Treatment Project will be deposited on the Mt Piper Ash Repository in accordance with a Brine and Residual Waste Disposal Plan approved under the conditions of development consent 7592.

3 OPERATIONS SUMMARY

All ash placement operations for Mt Piper Power Station, including within the Brine in Ash Co-Placement area authorised by the Mt Piper Consent, are undertaken by the contracted specialist in ash placement. Refer to *Figure 3* for a site layout plan of the ash repository area. Lend Lease Infrastructure (LLI) is the current service provider for EnergyAustralia NSW in all aspects of ash and dust management at the Mt Piper Brine in Ash Co-Placement area. The Mt Piper Brine in Ash Co-Placement Area is currently managed under an 'operate and maintain' contract with EnergyAustralia NSW.

A summary of operations at the Mt Piper Brine in Ash Co-Placement area for the 2018/19 reporting period is presented in *Table 3*.

Table 3 Mt Piper Brine in Ash Co-Placement Project – Operations Summary

Activity	Previous Reporting Period 2017/18	This Reporting Period 2018/19
Ash delivered to site (T)	642,816	564,871
Brine co-placed (ML)	28.41	18.74
Total ash footprint (ha)[2]	63.1	71.2
Area of repository capped (ha)	36.1	36.1

3.1.1 *Ash Placement and Geometry*

The Mt Piper Ash Repository is located within the former Western Main open-cut mine void in the eastern area of the Mt Piper Power Station facility. Connell Wagner (2007) noted in the 1989 Environmental Impact Statement that, prior to the placement of ash in the mine void, the bottom of the mine void was covered with mine spoil to a minimum level of RL 908m AHD in order to facilitate groundwater flow from the adjacent areas of the unmined Lithgow coal seam aquifer and mine goaf areas surrounding the Western Main open cut mine void.

Ash produced from the power station operations has been conditioned using either freshwater or brine since 2000. The conditioning of the ash occurs at the Mt Piper Power Station facility, and the conditioned ash is then transferred via trucks to the ash repository for disposal (Connell Wagner 2008). The ash repository has approval for the placement of ash up to a RL of 980 m AHD, with the upper surface of the ash to be finished with 1 m of normal fly ash, following the contours of the fly ash placement plan approved by the Lithgow City Council in 1990 (Connell Wagner 2007). The conditions of the Mt Piper Consent require activities to be carried out in accordance with the Statements of Environmental Effects produced in 1999 and 2007 for the site. Further, condition 38A of the Mt Piper Consent provides that the placement of brine conditioned ash may only occur between the levels of RL 946 metres (the end-point of the water conditioned ash layer) and RL 980 metres.. Refer to *Figures 3.1* and *3.2* below from Connell Wagner (2007) which show the approved ash repository geometry.

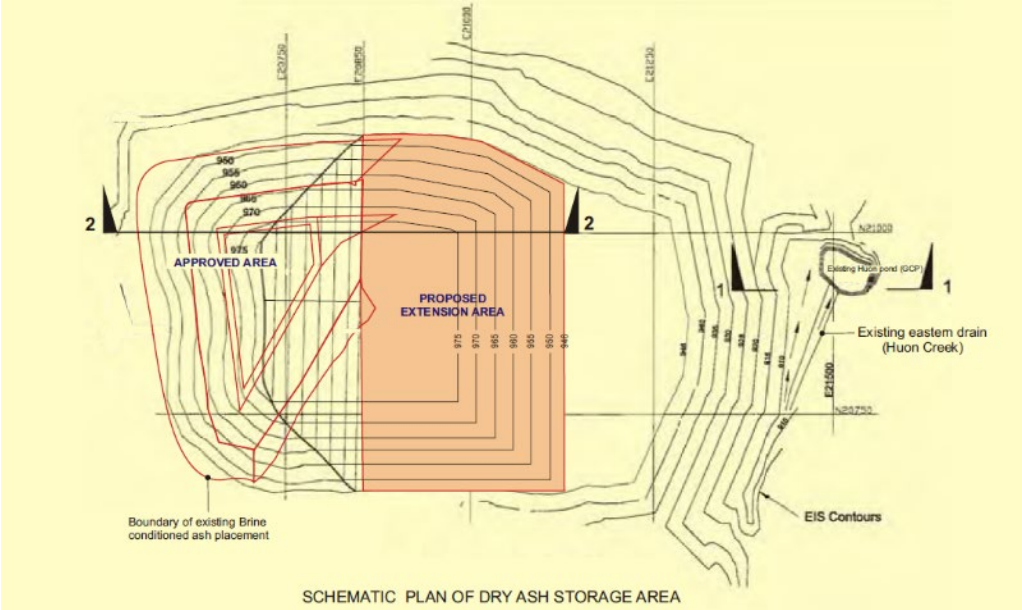

Figure 3.1 *Mt Piper Ash Repository – Plan layout (from Connell Wagner 2007).*

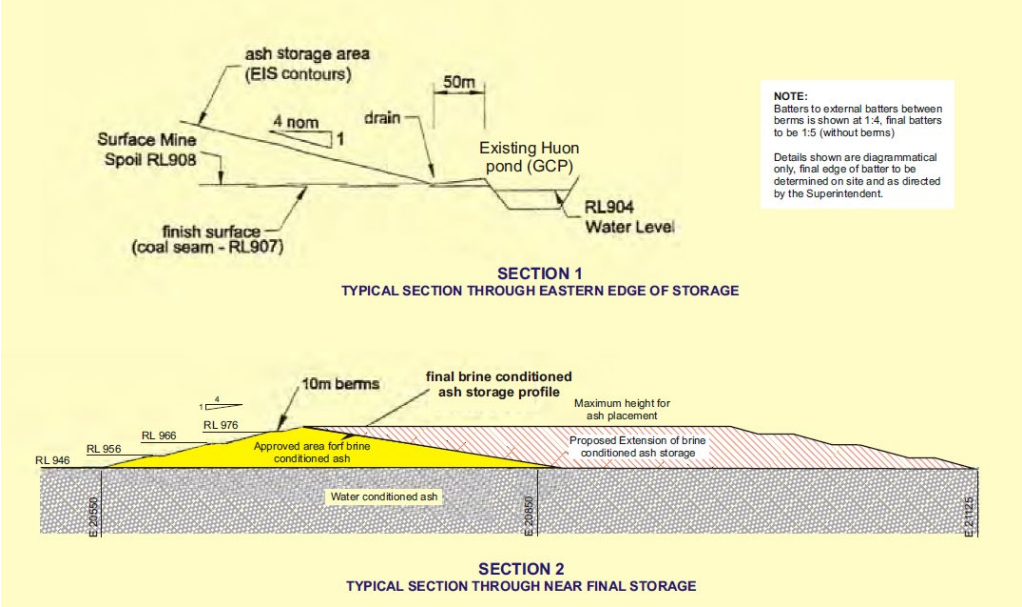

Figure 3.2 *Mt Piper Ash Repository cross section through ash repository (from Connell Wagner 2007)*

Brine and water conditioned ash continued to be deposited across Stages 1 and 2, *Figure 3.3* below shows the boundary between Stage 1 and stage 2, of the ash repository during the 2018/19 reporting period. Refer to *Figure 8* for a plan showing the areas where brine and fresh water conditioned ash were placed. Based on information supplied by EnergyAustralia NSW, a total of 564,871 Tonnes of ash was placed in the ash repository, with a total of 18.74 ML of brine used for ash conditioning. Refer to *Table 3* for the volumes of ash and *Table 4* for the volumes of brine utilised for the reporting period.

The peak ash repository elevations reported on 21 June 2018 were approximately 970 m AHD in Stage I and 695 m AHD in Stage II (CEH Survey, 2018). The elevation of the top of the ash repository area as at July 2019 was approximately 970 m AHD (as per lidar survey of the repository provided by EnergyAustralia via email correspondence on 22 September 2019). The plan provided by EnergyAustralia is provided below.

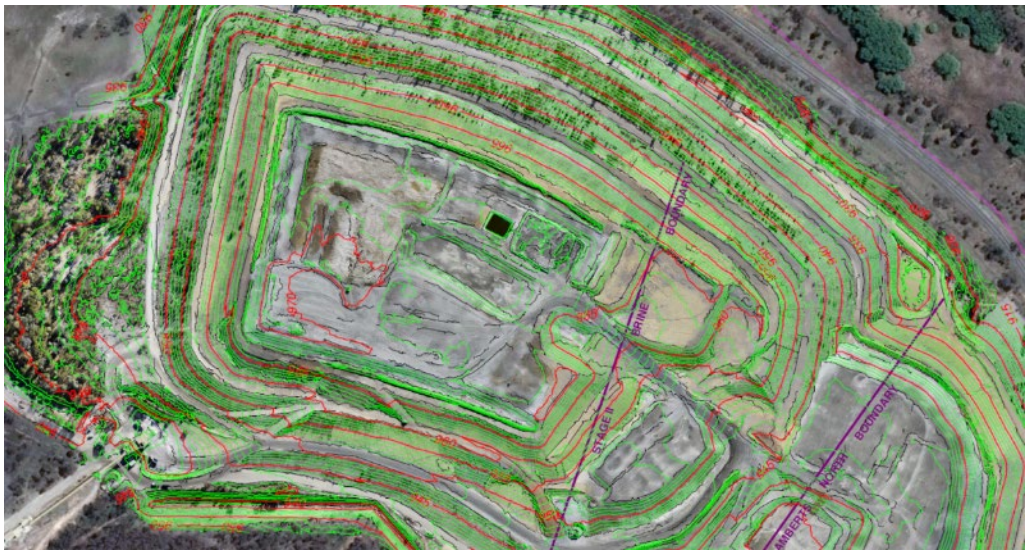

Figure 3.3 *Mt Piper Ash Repository Lidar Survey (Source: EnergyAustralia, via email correspondence, received 22 September 2019)*

Brine Volumes

Brine conditioning of fly ash occurred between October 2018 and June 2019, with a total volume of 18.74 ML of brine used for conditioning across the reporting period. *Table 4* below summarises the volume of brine used for fly ash conditioning during each month of the reporting period.

Table 4 ***Volume of Brine used for Conditioning per Month 2018/2019***

Month	Volume of Brine (ML)
July 2018	0.00
August 2018	0.00
September 2018	0.00
October 2018	0.03
November 2018	0.50
December 2018	5.50
January 2019	3.39
February 2019	0.00
March 2019	2.08
April 2019	0.10
May 2019	1.87
June 2019	5.27
Total	**18.74**

Brine composition data has been used to inform the surface water and groundwater results discussions below.

3.1.2 *Brine Composition*

Brine is the salty residue which is concentrated from the unwanted salts present in the cooling waters used at the Mt Piper Power Station. Monitoring of the brine over time has shown that the concentration of salts in the brine increased between 1999 and 2003-2006 but decreased between 2003-2006 and 2017 as shown in *Table 1* in *Annex E*. The decreased salinity of the brine is attributable mainly to a number of the brine constituents as described below:

- Chloride concentration in the brine decreased from an average of 23,889 mg/L in 2003-2006 to 10,390 mg/L in 2017 (44% decrease);
- Fluoride concentrations in the brine decreased significantly from an average of average of 125.7 mg/L in 2003-2006 to 64.7 mg/L in 2017 (51% decrease);
- Boron concentrations in the brine have decreased from an average of 115,000 ug/L in 2003-2006 to 35,800 ug/L in 2017 (31% decrease); and
- Manganese concentrations in the brine have decreased from an average of 34,000 ug/L in 2003-2006 to 7,210 ug/L in 2017 (21% decrease).

4 ENVIRONMENTAL SETTING

4.1 ENVIRONMENTAL SETTING

Details of the environmental site setting are presented in the following sections to provide some context to the surface water and groundwater assessments presented below.

4.1.1 *Climate*

The climate data was sourced from the Bureau of Meteorology (BoM) (2019) Lithgow (Cooerwull) Weather Station No: 063226, located approximately 16 km south-east from the Mt Piper Power Station. This is the closest operational weather station to the site with publically available data for the 2018/19 reporting period. A summary of the climate data is presented in *Table 5* below and a copy of the data is presented in *Annex C*.

Table 5 Local Climate Data for 2018/19 (BoM 2019)

Month	Rainfall Total (mm)	Min. Temperature (°C)	Max. Temperature (°C)
July 2018	8.0	-9.3	17.6
August 2018	35.8	-6.6	17.3
September 2018	55.3	-3.8	23.8
October 2018	90.5	0.6	27.1
November 2018	133.4	2.2	29.1
December 2018	126.6	5.2	33.8
January 2019	109.2	12.4	36.1
February 2019	20.6	6.4	32.3
March 2019	108.4	4.7	30.5
April 2019	21.3	-0.3	26.2
May 2019	37.9	-2.0	19.6
June 2019	40.0	-6.3	17.9
TOTAL/MIN/MAX	787	-9.3	36.1

Data from Bureau of Meteorology Weather Station 63226.

The total rainfall for the 2018/19 reporting period was 787 mm, with a monthly average of 65.6 mm. This is higher than the total reported rainfall for the 2017/2018 reporting period of 492 mm (ERM, 2018) and is consistent with the average annual rainfall between 2012 and 2017 which was reported by Aurecon (2017) to be 756.5 mm/year.

The average monthly rainfall for the current reporting period of 65.6 mm/month is higher than the previous reporting period average rainfall of 41 mm/month. However, the current monthly average of 65.6 mm/month is relatively consistent with the long-term average of 72 mm/month reported by Aurecon (2017).

4.1.2 *Geology*

The Mount Piper Ash repository is located in the western area of the Sydney geological basin, in the Illawarra Coal Measure. The coal measures are in the order of 40 m thick, underlain by the Shoalhaven Group comprising sandstone and siltstone (SKM 2010). The underlying geology from surface to depth is summarised below (from SKM 2010):

- Lidsdale Seam (1-1.5 m) – Interbedded high ash coal and shale;
- Blackmans Flat Conglomerate (up to 20 m) - coarse sandstone and conglomerate;
- Lithgow Seam (2-3 m);
- Marrangaroo Conglomerate (about 20 m) - massive sandstone and conglomerate, with some boulders; and
- Shoalhaven Group (>20 m) - marine sandstone, siltstone and mudstone, sulphide-bearing and acid-generating in places.

4.1.3 *Hydrogeology*

The coal measures are considered to act as semi-confined aquifers given their higher yields compared to surrounding lithologies and hydraulic conductivities (SKM 2010).

Groundwater elevation contours suggest a generally easterly groundwater flow direction through the Mt Piper Ash Repository, tending north-easterly on the eastern side of the repository towards Neubecks Creek, with groundwater elevations in the vicinity of background groundwater monitoring bores D4 and D5 to the west of the repository in the order of 918.24 m AHD, declining to 914.5 m AHD to the south of the repository and 904 m AHD in the vicinity of Neubecks Creek. Refer to *Figures 5a* to *5d* which show groundwater elevation contours for each season.

As outlined above, Connell Wagner (2007) noted that, prior to the placement of ash in the former mine void (now occupied by the ash repository), the bottom of the mine void was covered with mine spoil to a minimum level of RL 908m AHD in order to facilitate groundwater flow from the adjacent areas of the unmined Lithgow coal seam aquifer and mine goaf areas surrounding the Western Main open cut mine void. Historically groundwater seepage from beneath the ash repository was collected in the Groundwater Collection Basin that was previously located to the east of the Mt Piper Ash Repository (SKM 2010). In 2012, this basin was filled in with mine spoil and compacted as part of the construction of the adjacent Lamberts North Ash Repository.

4.1.4 *Hydrology*

The Mount Piper Power Station and Mt Piper Ash Repository are within the catchment of Neubecks and Wangcol Creek, tributaries of the Coxs River. Neubecks Creek is located to the north-east of the Mt Piper Ash Repository and at its closest is approximately 200 m from the Mt Piper Ash Repository. Neubecks Creek joins Wangcol Creek to the east of the Mt Piper Ash Repository, which joins Coxs River approximately 3.16 km east of the Site.

Coxs River makes up part of the Warragamba water catchment, the largest of Sydney's five drinking water catchments (WaterNSW 2018). Historically, Coxs River flow has been affected by three major factors: the construction of the Lyell Dam; regional climatic variations; and land clearing in the upper and central parts of the river (Young *et al*. 2000). As a result of clearing the land for pastures, Coxs River supports cattle and sheep grazing as its largest single land use.

5 THE WATER MONITORING AND MANAGEMENT PLAN

5.1 GENERAL

The Water Monitoring and Management Plan approved under the Mt Piper Consent outlines the following key elements:

- A water cycle management plan describing the management of surface run off at the ash;
- Water cycle management with respect to the extension area; and
- Water monitoring program, including surface water and groundwater monitoring, including the environmental goals to be adopted.

The various measures outlined in the Water Management and Monitoring Plan seek to minimise the impacts that the brine conditioned ash disposal area could have on groundwater and therefore surface waters in the vicinity of the ash repository (Connell Wagner, 2008). Further to this, the plan also aims to provide measures to identify early changes to water quality in order to provide sufficient time for investigations to be made.

5.2 SURFACE WATER ENVIRONMENTAL GOALS

In order to assess for potential effects on surface water quality in receiving surface waters adjacent to the ash repository site, water quality trigger values set out in the Water Monitoring and Management Plan (Connell Wagner 2008) and modified by Aurecon (2017) have been adopted as environmental goals for the analytes (Surface Water Environmental Goals). The Surface Water Environmental Goals apply to the surface water monitoring sites the Final Holding Pond Weir (LMP01) and Neubecks Creek (WX22), as shown on *Figure 4*.

The Surface Water Environmental Goals take into consideration local baseline surface water conditions in Neubecks Creek prior to the commencement of ash placement in the Stage I area (western side) of the Mt Piper Ash Repository (referred to as pre-placement). Baseline conditions were specifically established based on the 90th percentiles of the water quality dataset from monitoring site WX22 in Neubecks Creek.

The Environmental Goals adopted for this assessment[1] are as per the Water Monitoring and Management Plan and modified by Aurecon (2017) and are presented in *Table 1* in *Annex F*.

[1] The drinking water guidelines referenced in ANZECC (2000), NHMRC (1996) have since been superseded by the Australian Drinking Water Guidelines 6, 2011 (revised

5.3 GROUNDWATER ENVIRONMENTAL GOALS

In order to assess for potential effects on groundwater which may potentially discharge to nearby surface waters adjacent to the Mt Piper Ash Repository site, environmental goals for groundwater (Groundwater Environmental Goals) have been set out in the Water Monitoring and Management Plan.

The Groundwater Environmental Goals are generally based on the ANZECC (now ANZG, 2018, however, although ANZG is published, the website recommends continuing to refer to ANZECC until further notice) water quality guidelines, which are applicable to receiving waters and not to groundwater; however, they form an appropriate basis for undertaking a conservative screening level assessment. The Groundwater Environmental Goals have therefore been applied to the groundwater monitoring sites located up gradient of the Mt Piper Ash Repository, within the Mt Piper Ash Repository, adjacent to the Mt Piper Ash Repository and adjacent to Neubecks Creek, with the objective of identifying where impacts above the Groundwater Environmental Goals exist and to enable mitigation measures to be implemented if required.

Similar to the surface water approach, the Groundwater Environmental Goals also consider local baseline groundwater conditions in the former Groundwater Collection Basin (GCB), also known as the Huon Gully mine void, prior to the backfilling of this basin in 2012 as part of the construction of the Lamberts North ash repository. Baseline conditions (in pre-2000) were specifically established based on the 90th percentiles of the water quality dataset from monitoring undertaken at this location, as presented in the Water Management and Monitoring Plan.

Aurecon (2017) also presented a set of additional baseline values for copper, iron and manganese which were developed based on the dataset from October 2012 to August 2013 at MPGM4/D9, to capture potential changes that had occurred in the underlying aquifer since the operation of the Mt Piper Brine in Ash project.

The Groundwater Environmental Goals are presented in *Table 1* in *Annex G*.

5.4 CONTINGENCY MEASURES

The Water Monitoring and Management Plan includes contingency measures requiring an investigation into the cause to be carried out if:

- concentrations in surface water samples exceed the Neubecks Creek pre-placement 90th percentile concentrations; or
- concentrations in groundwater samples exceed the Groundwater Collection Basin pre-placement 90th percentile concentrations.

October 2017, NHMRC 2011) and Australian and New Zealand Governments (ANZG) (2018), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* and consideration should be given to revising the Environmental Goals if relevant.

These triggers are assessed by comparison of the 50th percentiles for the various water quality indicators at each of the surface and groundwater monitoring sites for the monitoring period with the pre-placement 90th percentile concentrations.

As outlined above, an investigation of surface and groundwater conditions in the vicinity of the Mt Piper Power Station ash repositories, including the Mt Piper Ash Repository, is currently being completed in line with the contingency measures identified in the Water Management and Monitoring Plan. This investigation includes further monitoring and modelling, in addition to that required under the Water Management and Monitoring Plan, and is being separately reported on. Once this separate and broader investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

5.5 GROUNDWATER MODEL PREDICTIONS

The Water Management and Monitoring Plan outlined the following predictions with respect to the initial groundwater model:

- Initial modelling undertaken as part of the ash disposal Environmental Impact Statement (EIS) from 1989 indicated that the sub-surface drain, constructed of mine spoil at the base of the ash repository, would achieve the aim of preventing deposited ash from coming in contact with the groundwater. The placement of brine conditioned ash was expected to be approximately 37 m above the water table;

- The water table was predicted to rise by approximately 2 m as a result of ash placement within the repository, decreasing the distance between the brine conditioned ash and the local water table to be approximately 35 m;

- Small amounts of leachate were predicted to form as the result of rainfall infiltration into the brine conditioned ash deposit;

- Contaminant transport modelling undertaken by Merrick (2007) predicted that the leachate produced from the extended brine conditioned ash area was not expected to have a significant effect on water quality in the Eastern Drain, the Groundwater Collection Basin or Neubecks Creek; and

- Significant increases in the salts and trace metals were not expected in the long-term, and changes in the concentrations due to brine conditioned ash placement were considered unlikely.

6 SURFACE WATER ASSESSMENT

6.1 OBJECTIVE

The objective of the surface water monitoring program is to monitor the impacts of ash placement activities occurring under the Mt Piper Consent on Neubecks Creek having regard to the Surface Water Environmental Goals. The condition of the surface water down-stream of the ash repository is also compared to surface water quality conditions up-stream of the ash repository to assess for any potential changes in water quality.

6.2 SURFACE WATER MONITORING LOCATIONS AND FREQUENCY

A summary of the surface water monitoring site locations under the Water Management and Monitoring Plan is presented in *Table* 6 below and shown on *Figure 4*.

Table 6 Surface Water Monitoring Site Network and Frequency

Site ID	Location Description	Monitoring Frequency
LMP01 (also referred to as WX22)	Final Holding Pond Weir - Licence discharge/monitoring point is located north-west of the Mt Piper Ash Repository. This monitoring site is located in an upstream position relative to the Lamberts North Ash Placement Area.	Weekly[1]
	Located in Neubecks Creek at a stream gauge to the east/down-stream of the Mt Piper and Lamberts North Ash Repositories and monitoring site LDP01. This monitoring site is also situated down-stream of groundwater monitoring bore D8.	Weekly[1]/Monthly[2]

1. Selected field parameters monitored on a weekly basis (see *Section 6.4* below)
2. Monitoring undertaken by analytical laboratory Nalco Water – Ecolab

6.3 SURFACE WATER MONITORING METHODOLOGY

Surface water quality monitoring was undertaken by Nalco Water – Ecolab (Nalco) on behalf of EnergyAustralia. Information on Nalco's general monitoring methodology, supplied by EnergyAustralia, indicates that sampling is performed by trained personnel in accordance with (Nalco) internal procedures and relevant parts of Australian Standard AS5667 *Water-quality Sampling*, for which the laboratory holds NATA accreditation.

Nalco documentation states that pre-labelled sample containers are used and the containers are prepared to ensure that samples are preserved in accordance with Australian Standard 5667.1:1998 and Standard Methods for the Examination of Water and Wastewater, 22nd Edition (APHA).

Nalco documentation states that coolers and freezer packs are used to maintain the integrity of the samples during transport from the sampling sites to the laboratory. Conductivity, pH and temperature are measured in the field using a calibrated instrument, with all other parameters measured by a NATA Accredited Laboratory (Nalco, undated).

A summary of the surface water sample analytical schedule is presented *Section 6.4*.

6.4 SURFACE WATER QUALITY DATASET

Samples were obtained by Nalco for either field or laboratory analysis in accordance with the following monitoring and analysis schedule:

- pH - weekly laboratory analysis (LMP01 only) and monthly field analysis;
- Electrical conductivity (EC) - monthly field analysis (WX22), weekly lab analysis (LMP01 only);
- Dissolved oxygen (DO) - monthly field analysis;
- Total dissolved solids (TDS) - monthly laboratory analysis;
- Temperature (^{o}C) - monthly field analysis at WX22 only;
- Redox – field analysis on one occasion at LMP01 in May 2018;
- Total suspended solids (TSS) - weekly laboratory analysis (LMP01 only);
- Major anions including chloride, fluoride and alkalinity – monthly laboratory analysis;
- Sulfate (as SO_4) – weekly laboratory analysis (LMP01 only) and monthly laboratory analysis (WX22 only);
- Major cations including calcium, potassium, magnesium, sodium – monthly laboratory analysis;
- Nutrients including nitrate, nitrite and nitrogen and on occasion ammonia – monthly laboratory analysis; and
- Metals (including Al, Sb, As, Ba, Be, B, Cd, Cr (total), Cr (IV), Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Vn and Zn) – monthly laboratory analysis.

The trace metals in surface water samples were unfiltered, except for iron and manganese. Concentrations of aluminium, copper and zinc concentrations in filtered water collected at the surface water monitoring points (LMP01 and WX22) were also analysed.

Data Quality Assurance and Quality Control (QA/QC) checks for compliance are performed by EnergyAustralia prior to the publishing of the surface water data on a monthly basis online.

Nalco have indicated that various checks as part of internal and external QA/QC programs are implemented. Please refer to *Annex J* for a copy of the laboratory QA/QC program outline.

Evidence of the collection of field QC samples (i.e. rinsate, trip blanks or trip spikes) during the field based programs was not provided. Further, results of laboratory QC measures including laboratory duplicate, triplicate, internal RPDs, method blanks or spike data were not presented in the laboratory reports reviewed.

No other specific QA/QC information was presented in the laboratory reports reviewed.

6.5 SURFACE WATER RESULTS

A summary of the surface water analytical results obtained for the 2018/19 reporting period against the Surface Water Environmental Goals is presented in *Table 7* below. Tabulated results along with summary statistics for each monitoring point (minimum, maximum, 50th percentile and 90th percentile) are presented in *Annex F* and shown on *Figure 6a*.

Table 7 Surface Water Monitoring Results – 2018/19

Analyte/Location	Surface Water Concentration Range			
	Neubecks Creek (WX22)	Final Holding Pond Weir (LMP01)	Neubecks Creek at WX22 Pre-placement 90th Percentile[a]	Environmental Goal
pH (field)	6.74 - 7.56	6.88 – 7.63	6.7-7.8	**6.5 – 8.0[k]**
pH (laboratory)	NA	7.4 – **8.1**	6.7-7.8	**6.5 – 8.0[k]**
Conductivity (µS/cm)	272 – 621	229 – 630	894	**2200[c]**
TDS and Major Ions (mg/L)				
TDS	218 - 641	158 – 464	580	**1500[d]**
Sulfate (as SO_4)	38 – 159	13 – 170	332	1000[e]
Chloride	7 – 41	4 – 19	22	350[f]
Fluoride	<0.1 – 0.84	0.09 – 0.21	0.338	1.5[f]
Trace Metals (µg/L)				
Arsenic	<1	<1 – 2	<1	**24[b]**
Barium	10 - 26	15 - 64	29	**700[g]**
Beryllium	NA	<1	<1	**100[i]**
Boron	<50 - 150	<50 – 160	90	**370[b]**
Cadmium	<0.1	<0.1	<1	**0.85[h]**
Chromium (total)	<1	<1 - **3**	<1	**2[h]**
Copper	<1 - **4**	**3 - 15**	<1	**3.5[h]**
Iron (filtered)	75 – 216	31 - 220	281	**300[f]**
Mercury	<0.04	<0.04	-	**0.06[b]**
Manganese (filtered)	73 – 1,440	8– 561	720	**1900[b]**
Molybdenum	<1 - 1	1 – 4	<1	**10[i]**
Nickel	9 - **27**	3 - 8	5	**17[b]**
Lead	<1	<1 - 2	<1	**5b**
Selenium	<0.2	0.2 – 0.5	<1	**5[b]**
Silver	**<1**	**<1**	-	**0.05[b]**
Zinc	<5 - 13	11 - 34	116	**116[j]**

Notes:

NA Not Available

All metals concentrations presented are from unfiltered samples, as per Aurecon (2017)

Shaded cell indicates exceedance of the adopted criterion (Environmental Goal)

Bold indicates result is 1 - <10 times the Environmental Goal

a. Values adopted from Aurecon (2017)

b. ANZECC 2000 for Freshwater Slightly-Moderately disturbed aquatic ecosystems (Boron 90th, Pb 90th, Ni 80th, Se 90th, Ag 90th)

c. ANZECC 2000 – Conductivity range for lowland rivers in slightly disturbed ecosystems in south-east Australia is 125-2200 uS/cm

d. 1,500 mg/L based on a conversion factor of 0.68 and an EC of 2200 uS/cm lowland river conductivity for slightly disturbed ecosystems

e. ANZECC (2000) Livestock

f. ANZECC (2000) Irrigation for moderately tolerant crops

g. ANZECC (2000) Drinking water guidelines

h. Concentrations of cadmium, chromium and copper modified by Aurecon (2017) due to changes in water hardness Cd from 0.001 to 0.00085 mg/L; Cr from 0.001 to 0.002 mg/L and Cu from 0.0025 to 0.0035 mg/L

i. ANZECC (2000) Irrigation LTV

j. Local guideline based on 90th percentile pre-brine placement

k. ANZECC (2000) pH values presented are for groundwater systems and based on aesthetic considerations such as corrosion and fouling of pumping, irrigation and stock watering systems) for primary industries.

6.5.1 *Up-Stream - Licence Monitoring Point*

The surface water field and analytical results obtained from surface water sample point LMP01 (also known as LDP6) for the 2018/19 reporting period are discussed below. The monitoring point is the V-notch adjacent to the Final Holding Pond Weir. The Final Holding Pond Weir holds stormwater collected from the Mt. Piper Power Station Facility. This monitoring location is located upstream of the Mt Piper Ash Repository and is not considered to be impacted by the ash repository. During the 2018/19 reporting period, discharge from the Final Holding Pond Weir were estimated to be approximately 244 mega litres (ML). Detailed records of flow readings during the reporting period, along with conductivity and pH readings, are provided in *Annex L*.

Field Parameters

Field parameters monitored at LMP01 for the 2018/19 monitoring period are summarised below:

- Surface water pH values (field) at LMP01 ranged between 6.88 to 7.63 standard pH units, with laboratory measured values reported between 7.4 and 8.1 standard pH units. The higher value for the laboratory pH measurements was marginally above the ANZECC (2000) trigger value range upper limit of 8.0 standard pH units. It is noted that the exceedances of trigger values for pH data obtained from laboratory analysis are potentially inaccurate due to this parameter's sensitivity to changes in temperature (among other factors) which can occur in the time between sample collection and laboratory analysis. Field-based pH measurements are often considered to have a greater reliability and accuracy;
- Field electrical conductivity (EC) values ranged between 229 µS/cm and 630 µS/cm and were generally consistent with laboratory determined values ranging between 180 µS/cm and 610 µS/cm. The reported EC values were generally consistent[2] with Total Dissolved Solids (TDS) concentrations (measured monthly), which ranged from 158 mg/L to 464 mg/L. Field/laboratory EC and TDS values were all below the Surface Water Environmental Goals of 2,200 µS/cm and 1,500 mg/L, respectively;
- Dissolved oxygen (DO) levels measured in the field ranged between 4.9 mg/L and 13 mg/L and generally decreased over the monitoring period. There are no Surface Water Environmental Goals for DO;
- Total suspended solids (TSS) were measured weekly and were generally variable with higher concentrations noted between January and March 2019. TSS ranged from 1 mg/L to 160 mg/L. There are no Surface Water Environmental Goals for TSS; and
- Turbidity generally ranged from 7.8 to 130 NTU. There are no Surface Water Environmental Goals for turbidity.

[2] Based on approximate EC to TDS conversion factor of 0.65

Anions

Concentrations of anions including sulphate, chloride and fluoride were generally stable at LMP01 throughout the 2018/19 reporting period. All reported analyte concentrations were below the Surface Water Environmental Goals.

Concentrations of nitrate, nitrite, Total Kjeldahl Nitrogen (TKN), ammonia, and total nitrogen were tested for and detected (except for nitrite) in the surface water samples collected from the LMP01; however, no Surface Water Environmental Goals are applicable for these analytes.

Metals

Throughout the reporting period, various metals were identified at concentrations above the Surface Water Environmental Goals at LMP01. A summary of the results reported above the Surface Water Environmental Goals during the 2018/19 reporting period is presented below:

- Concentrations of chromium were reported at <1 - 3 µg/L throughout the period of reporting. The exceedance of the Environmental Goal value of 2 µg/L occurred during the March 2019 sampling event;
- Copper concentrations ranged between 3 µg/L and 15 µg/L, consistently exceeding the pre-placement level of 1 µg/L during the reporting period, with a peak concentration of 15 µg/L noted in June 2019. Copper concentrations did not exceed the Surface Water Environmental Goal of 3.5 µg/L during November 2018, March 2019 and May 2019. These results are not influenced by the ash repository and are considered to be representative of background surface water quality;
- Concentrations of iron (filtered) ranged between 31 µg/L and 220 µg/L and were below the Surface Water Environmental Goal of 300 µg/L. These results are not influenced by the ash repository and are considered to be representative of background surface water quality;
- Silver concentrations were reported below the limit of reporting (of <1 µg/L) for the entire monitoring period; however, the limit of reporting exceeded the Surface Water Environmental Goal of 0.05 µg/L. No pre-placement trigger levels are available for silver; and
- Concentrations of aluminium, phosphorus and strontium were intermittently tested for and detected at concentrations above the limits of reporting in the surface water samples collected from LMP01, however, no Surface Water Environmental Goals apply to these parameters.

LMP01 results were below the adopted Surface Water Environmental Goals, with the exception of copper (up to 15 µg/L), chromium (single event reported at 3 µg/L) and silver (<1 µg/L). The detections are considered to be related to the background water quality in the area given this site location is up-stream of the Mt Piper Ash Repository and is not considered to be impacted by the ash repository.

6.5.2 *Down-Stream – Neubecks Creek*

The surface water field and analytical results obtained from sample point WX22, located in Neubecks Creek, for the 2018/19 reporting period are discussed below and presented in *Annex F*. This monitoring location is located down-stream of the Mt Piper Ash Repository.

Field Parameters

Field parameters monitored at WX22 are summarised below:

- pH (field) ranged from 6.74 to 7.56, with all pH results within the Surface Water Environmental Goal pH range of 6.5 – 8.0 standard pH units;
- Field electrical conductivity (EC) values ranged between 272 µS/cm and 621 µS/cm and were generally consistent with laboratory determined TDS values ranging between 218 mg/L and 641 mg/L[3]. EC (field) and TDS (lab) values did not exceed the Surface Water Environmental Goals of 2,200 µS/cm and 1,500 mg/L, respectively;
- DO (field) concentrations ranged from 7.9 mg/L to 16 mg/L throughout the monitoring period. No Surface Water Environmental Goals apply to DO; and
- Turbidity ranged from 1.1 NTU to 50.9 NTU across the monitoring period and was generally variable. No Surface Water Environmental Goals apply to turbidity.

Major and Minor Ions

Concentrations of the major and minor ions analysed (including chloride, sulphate and fluoride) were below the Surface Water Environmental Goals in surface water sampled from WX22.

Nitrate, nitrite, Total Kjeldahl Nitrogen (TKN) and total nitrogen were detected at concentrations above the limits of reporting in the surface water samples collected from WX22, however, no Surface Water Environmental Goals apply to these parameters.

Metals

Throughout the reporting period elevated concentrations of various metals in surface water from WX22 were identified at concentrations above the adopted Surface Water Environmental Goals (the ANZECC (2000) or baseline concentration). A summary of the results reported above the Surface Water Environmental Goals during the 2017/18 reporting period is presented below:

[3] Based on approximate EC to TDS conversion factor of 0.65.

- Copper concentrations ranged between <1 µg/L and 4 µg/L, with only the one sample from April 2019 exceeding the Surface Water Environmental Goal of 3.5 µg/L;

- Concentrations of iron (filtered) ranged between 75 µg/L and 216 µg/L and were below the Surface Water Environmental Goal of 300 µg/L;

- Nickel concentrations ranged from 9 µg/L to 27 µg/L, with the highest concentrations reported in September 2018, March, 2019 and April 2019 of 20 µg/L, 27 µg/L and 22 µg/L respectively, which exceeded the Surface Water Environmental Goal of 17 µg/L; and

- Silver concentrations were all reported below the laboratory limit of reporting of <1 µg/L, with the limit of reporting exceeding the Surface Water Environmental Goal of 0.05 µg/L. No pre-placement data are available for silver.

Concentrations of aluminium, phosphorus, strontium and vanadium were tested for and, except for vanadium, were present at concentrations above the limits of reporting in the surface water samples collected from the WX22, however, no Surface Water Environmental Goals apply to these analytes.

6.6 DISCUSSION

Neubecks Creek results at WX22 were generally below the Surface Water Environmental Goals, with the exception of copper (up to 4 µg/L) and nickel (up to 27 µg/L) which intermittently exceeded the Surface Water Environmental Goals during the 2018/19 reporting period.

The elevated concentrations of iron during the 2018/19 reporting period are considered to be related to the background water quality in the area, based on the background surface water results from LMP01. The elevated concentrations of manganese and nickel are also in part considered to be associated with background conditions, with detectable concentrations identified at LMP01 and WX22. It is noted that the exceedances for nickel were intermittent during the 2018/19 monitoring period, with concentrations of nickel declining to below the Surface Water Environmental Goals in May 2019 and therefore not suggestive of long term increases in nickel concentrations in surface water at WX22.

Higher concentrations of calcium, magnesium and bicarbonate were reported in the same samples as peak concentrations of barium, boron, manganese and nickel during March and April 2019 in WX22, a relationship evident to date only during the 2018/19 reporting period. The affect is not considered to be seasonal, as relatively low rainfall was measured before and during this period.

6.6.1 *Contingency Plan Assessment*

A summary of the surface water analytical results (50th percentile) for the 2018/19 reporting period compared with the Pre-placement 90th Percentile in Neubecks Creek at sampling locations LMP01 (upstream) and WX22 (downstream) is presented in *Table 8* below and shown on *Figure 6b*. A requirement of the Water Management and Monitoring Plan, this assessment serves to provide an early indication of changes in surface water quality as part of contingency planning.

Table 8 Surface Water Concentrations (50th Percentile) - 2018/19 Reporting Period

Analyte/Location	Surface Water Concentrations (50% percentile)		Neubecks Creek at WX22 Pre-placement 90th Percentile [a]
	WX22	LMP01	
pH	7.175	7.33	**6.7-7.8**
Conductivity (µS/cm)	514	373	**894**
TDS (mg/L)	328	234	**580**
Sulphate (as SO_4) (mg/L)	124	64	**332**
Chloride (mg/L)	**28.6**	10	**22**
Fluoride (mg/L)	0.14	0.15	**0.338**
Arsenic (µg/L)	<1	**2**	**<1**
Barium (µg/L)	15	**31**	**29**
Beryllium (µg/L)	NA	<1	**<1**
Boron (µg/L)	90	90	**90**
Cadmium (µg/L)	<0.1	<0.1	**<1**
Chromium (total) (µg/L)	<1	<1	**<1**
Copper (µg/L)	**1.5**	**6**	**<1**
Iron (filtered) (µg/L)	122	87	**281**
Mercury (µg/L)	<0.04	<0.04	**-**
Manganese (filtered) (µg/L)	220	48	**720**
Molybdenum (µg/L)	**1**	**2**	**<1**
Nickel (µg/L)	**15**	5	**5**
Lead (µg/L)	<1	**2**	**<1**
Silver (µg/L)	<1	<1	**-**
Selenium (µg/L)	<0.2	0.3	**<1**
Zinc (µg/L)	10	22	**116**

Notes

[a] Neubecks Creek at WX22 Pre-placement 90th Percentile values for analytes (Water Management and Monitoring Plan)

All metals concentrations presented are from unfiltered samples unless otherwise noted

Shaded cell indicates value is equal to or exceeds the adopted criterion (Neubecks Creek at WX22 Pre-placement 90th Percentile)

Bold indicates result is 1 - <10 times the adopted criterion

The elevated concentrations (50th percentile for the 2018/19 period) of arsenic, boron, copper and molybdenum identified at WX22 were reported at levels comparable to the up-stream site suggesting these exceedances are potentially due to up-stream/background conditions.

Concentrations of nickel were found to be higher in downstream site WX22 (15 µg/L) relative to the up-stream locations LMP01 (5 µg/L).

Chloride concentrations (50th percentile) were also found to be higher in down-stream monitoring location WX22 (28.6 mg/L) compared the background chloride 50th percentile results at LMP01 (10 mg/L).

The comparison of 50th percentile chloride and nickel results indicate a potential change in the surface water quality down-stream of the ash repository. This is the "early warning trigger" under the Water Management and Monitoring Plan; however, it may not be associated with the Mt Piper Ash Repository. As outlined above, the exceedance of this early warning trigger is currently being further investigated as part of a separate and broader investigation into the ash repositories at Mt Piper. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

50th percentile EC, TDS, sulphate, iron and manganese concentrations were also higher in downstream monitoring location WX22 compared to the background 50th percentile results at LMP01 although concentrations did not exceed the pre-placement 90th percentile value.

6.6.2 *Trend Analysis*

A review of concentration trends in surface water with respect to key indicators including TDS, sulphate, chloride and nickel is presented below. These indicators were selected based on their exceedances of Surface Water Environmental Goals and/or the potential increase in concentration observed at WX22. Graphs generated and reviewed as part of the trend analysis are presented in *Annex H*.

Chloride

Chloride concentrations were consistently below the Surface Water Environmental Goal of 350 mg/L throughout the 2010-2018 period. Chloride concentrations from samples at WX22 during the 2018/19 monitoring period appeared to be generally comparable with previous years. Chloride concentrations at LMP01 have remained relatively stable and low since 2010.

TDS

TDS values in surface water at LMP01 have remained relatively stable since 2010, consistently below the Surface Water Environmental Goal of 1,500 mg/L. Down-stream of the ash repository, the TDS levels at WX22 were generally stable between 2010 and 2012, with sporadic increases in TDS levels above the pre-placement levels observed after this time. Peak concentrations above the Surface Water Environmental Goal were identified in February 2014 and February 2018. These correlated with the maximum chloride concentrations.

Sulphate

Sulphate concentrations at LMP01 have remained relatively stable since 2010, consistently below the Surface Water Environmental Goal of 1,000 mg/L. The sulphate concentrations at WX22 were generally stable between 2010 and 2012, with large fluctuations in sulphate concentrations evident after this time. Post 2012, the sulphate concentrations at WX22 were equal and or above the Surface Water Environmental Goal on two occasions, February 2014 and February 2018, which correlated with peak concentrations of TDS and chloride.

Nickel

Nickel concentrations at LMP01 have been generally stable since 2012, with only one exceedance at LMP01 above the adopted Surface Water Environmental Goal of 17 µg/L in April 2014. Concentrations of 115 µg/L and 136 µg/L were reported in surface water samples from WX22 in January and February 2018, at a similar magnitude to the peak of 150 µg/L reported in February 2014. These peaks were potentially associated with low stream flows. Nickel concentrations in surface water from WX22 exceeded the pre-placement trigger level in all 12 months of the monitoring period; however concentrations exceeded the Surface Water Environmental Goal only in September 2018, March 2019 and April 2019.

As outlined above, the identified exceedances of the Surface Water Environmental Goals are currently being further investigated as part of a separate and broader investigation into the ash repositories at Mt Piper. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

7 GROUNDWATER

7.1 OBJECTIVE

The objective of the groundwater monitoring program is to monitor the impacts of ash placement activities at the Mount Piper Ash Repository occurring under the Mt Piper Consent on local groundwater quality and hydrogeology having regard to Groundwater Environmental Goals.

7.2 GROUNDWATER MONITORING LOCATIONS AND FREQUENCY

A summary of the groundwater monitoring site locations is presented in *Table 7* below and shown on *Figure 4*.

Table 9 Groundwater Monitoring Network and Frequency

Bore ID	Location Description	Screened Material [1]	Monitoring Frequency	Required under Water Management and Monitoring Plan
MPGM4/D1	North-eastern boundary of ash repository	Mudstone, sandstone and coal	Monthly[2]	Yes
MPGM4/D8	Down-gradient of ash repository, adjacent to Neubecks Creek	Alluvial deposits	Monthly[2]	Yes
MPGM4/D9	Down-gradient of ash repository, adjacent to Neubecks Creek	Alluvial deposits	Monthly[2]	Yes
MPGM4/D10	Inside of Mt Piper ash repository footprint	Fill / mine spoil	Monthly[2]	Yes
MPGM4/D11	Inside of Mt Piper ash repository footprint	Fill beneath the ash	Monthly[2]	Yes
MPGM4/D15	Centennial coal area south of Lamberts North ash repository	Sandstone and/or shale	Monthly[2]	Yes
MPGM4/D16	Centennial coal area south of Lamberts North ash repository	Sandstone and/or shale	Monthly[2]	Yes
MPGM4/D17	Centennial coal area south of Lamberts North ash repository	Sandstone and/or shale	Monthly[2]	Yes
MPGM4/D18	Centennial coal area south of Lamberts North ash repository	Sandstone and/or shale	Monthly[2]	Yes
MPGM4/D19	Down-gradient of ash repository to east	Fill / mine spoil	Monthly[2]	Yes
MPGM4/D20	Down-gradient of ash repository to north-east	Screened in mine spoil	Monthly[2]	No
MPGM4/D23	Inside of Mt Piper ash repository	Sandstone	Monthly[2]	No

[1] ERM 2018a

[2] Monitoring undertaken by analytical laboratory Nalco

7.3 GROUNDWATER MONITORING METHODOLOGY

Groundwater quality monitoring was undertaken by Nalco Water – Ecolab (Nalco) on behalf of EnergyAustralia. Information on Nalco's general monitoring methodology, supplied by EnergyAustralia, indicates that sampling is performed by trained personnel in accordance with Nalco internal procedures and relevant parts of Australian Standard AS5667 *Water-quality Sampling*, for which the laboratory holds NATA accreditation.

EnergyAustralia have advised that sample collection methodologies were consistent with those presented in previous monitoring reports. Groundwater bores were bailed and sampled after allowing time for the water level in the bore to re-establish (Aurecon, 2017). Prior to bailing, the depth to the water level was measured from the top of the bore pipe (Aurecon 2017).

Nalco documentation states that pre-labelled sample containers are used and the containers are prepared to ensure that samples were preserved in accordance with Australian Standard 5667.1:1998 and Standard Methods for the Examination of Water and Wastewater, 22nd Edition (APHA).

Coolers and freezer packs are used by Nalco to maintain the integrity of the samples during transport from the sampling sites to the laboratory. Conductivity, pH and temperature are measured in the field using a calibrated instrument, with all other parameters measured by a NATA Accredited Laboratory (Nalco, undated).

A summary of the groundwater sample analytical schedule is presented in *Section 7.4* below.

7.4 GROUNDWATER QUALITY DATASET

EnergyAustralia engaged Nalco Water – Ecolab (Nalco) to collect groundwater samples from the twelve groundwater monitoring bores throughout the reporting period. Samples were obtained for field and laboratory analysis in accordance with the following monitoring and analysis schedule:

- pH - monthly field measurement;
- Electrical Conductivity (EC) - monthly field measurement;
- Total Dissolved Solids (TDS) - monthly laboratory analysis;
- Major and minor anions including chloride, fluoride and alkalinity – monthly laboratory analysis;
- Sulphate (as SO_4) – monthly laboratory analysis;
- Major cations including calcium, potassium, magnesium, sodium – monthly laboratory analysis; and
- Metals (including Al, As, Ba, B, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, V and Zn) – monthly laboratory analysis.

The trace metals in groundwater samples were measured on unfiltered samples, except for iron, manganese and vanadium.

Data Quality Assurance and Quality Control (QA/QC) checks are performed by EnergyAustralia prior to the publishing of the groundwater data on a monthly basis online.

Nalco have indicated that various checks as part of internal and external QA/QC programs are implemented. Please refer to *Annex J* for a copy of the laboratory QA/QC program outline.

Evidence of the collection of field QC samples (i.e. rinsate, trip blanks or trip spikes) during the field based programs was not provided. Results of laboratory QC measures including laboratory duplicate, triplicate, internal RPDs, method blanks or spike data were not presented in the laboratory reports reviewed. No other specific QA/QC information was presented in the laboratory reports reviewed.

7.5 GROUNDWATER RESULTS

7.5.1 *Groundwater Levels and Inferred Flow Direction*

Water levels in the groundwater monitoring wells were generally stable across the monitoring period; one exception was identified for D11 where water levels peaked at 914.08m AHD during February 2019. It is noted that the reported groundwater levels in the monitored bores have remained below the base of the water-conditioned ash placement (917m AHD).

Groundwater elevation contours indicate flow away from the Mt Piper Ash Repository, with flow from the eastern side of the repository indicated to the south-east and east, and north-east. Groundwater elevations in the vicinity of D4 and D5 to the north and north-west of the repository ranged from 918.04 to 914.81m AHD (respectively), declining to 911.93m AHD to the south of the repository and 904.09m AHD to the east, in the vicinity of Neubecks Creek (based on April 2019 data). The inferred groundwater flow directions have remained relatively consistent throughout the monitoring period based on hydrographs prepared for each season. Groundwater elevation contour plans are presented in *Figures 5a* to *5d*.

Standing water levels and groundwater elevations calculated for each bore are presented in *Annex K*.

Hydrographs for each of the key areas are presented in *Annex K.* These show that water levels within each borehole generally fluctuated over less than 1.5 m during the monitoring period with the exception of D10 and D11 in which water levels increased from approximately 910m AHD in August 2018 to approximately 912m AHD in June 2019. The potential causes of this increase in groundwater level are being evaluated as part of an independent groundwater and surface water assessment at the site.

7.5.2 *Groundwater Analytical Results Summary*

A summary of the groundwater analytical results obtained for the 2018/19 reporting period is presented in *Table 10* below. The results are also presented on *Figure 7a.*

Table 10 Summary of Groundwater Concentrations - 2018/19 Reporting Period

Analyte/Location	Groundwater Concentration Range					
	Upgradient/ Background[1]	On Site /Inside Mt Piper Ash Repository[2]	Adjacent to Ash Repository[3]	Down-gradient/Adjacent to Neubecks Creek[4]	Groundwater Collection Basin Pre-Ash Placement 90th Percentile[a]	Groundwater Environmental Goal[a]
pH	**3.33 – 6.02**	**5.36 –** *6.7*	**5.86 – 6.13**	**5.28 – 6.06**	-	6.5 – 8.0[a]
Conductivity (µS/cm)	820 – 1,290	**3,495 – 10,830**	*630* – ***45,010***	113 – **8,050**	1,576	2,600[a]
TDS (mg/L)	704 – 1,020	**2,930 – 9,400**	414 **– 6,580**	147 – **6,840**	1,306	1,500[a]
Sulphate (as SO_4) (mg/L)	362 – 629	989 – **6,370**	221 **– 3,880**	31.8 – **3,910**	824	1,000[a]
Chloride (mg/L)	10.9 – 27.2	*201* – **1,110**	19 - **954**	1.32 – **987**	31.5	350[a]
Arsenic (µg/L)	<1 – **52**	<1 - *10*	<1 - 19	<1 – *6*	1	24[b]
Silver (µg/L)	**<1**	**<1**	**<1**	**<1**	<1	0.05[b]
Barium (µg/L)	11 - 20	13 - 116	13 - 52	25 – 53	37	700[f]
Beryllium (µg/L)	NA	NA	NA	NA	1	100[a]
Boron (µg/L)	<50 - 120	*320* – ***4,750***	80 **– 3,510**	<50 **– 1,570**	244	370[b]
Cadmium (µg/L)	<0.1 – 0.7	<0.1 – **7**	<0.1 – 0.4	<0.1 – 0.4	2	2[d,e]
Chromium (total) (µg/L)	2 - 3	<1 – **7**	<1	<0.1 – *2*	1	5[d]
Copper (µg/L)	<1 - 3	<1 - 4	**<1 - 15**	<1 – ***50***	1	5[a]
Fluoride (mg/L)	0.04 – 0.187	<0.01 – **3.18**	<0.1 – **3.99**	0.024– **3.02**	0.435	1.5[d]
Iron (µg/L) (filtered)	***30,600***– ***121,000***	**3,670 –** ***106,000***	**2680 –** ***58,100***	61 – ***55,800***	664	664[e]
Mercury (µg/L)	<0.04	<0.04	<0.04	<0.04 – *0.2*	<0.1	0.06[c]
Manganese (µg/L)	653 – ***9110***	1,970 – **20,800**	371 **– 28,600**	24 – **25,000**	5,704	5,704[e]
Molybdenum (µg/L)	<1	<1 - 3	<1 - *6*	<1 – 5	1	10[a]
Nickel (µg/L)	16 – 323	157 **– 1,060**	2 – **1,670**	15– **1,480**	550.9	550.9[e]
Lead (µg/L)	<1 - **26**	<1 - **8**	<1 - ***50***	<1 – 4	1	5[f]
Selenium (µg/L)	<0.2 – 0.4	<0.2 – 4	<0.2 – 2	<0.2 – 0.4	2	5[c]
Zinc (µg/L)	11 – 345	53 **– 1,060**	<5 **– 1,960**	26 - 256	908	908[e]

Notes:

1. Monitoring wells upgradient of Mt Piper Ash Repository: MPGM4/D4 and MPGM4/D5
2. Monitoring well inside Mt Piper Ash Repository: MPGM4/D10, MPGM4/D11 and MPGM4/D23 targeting the southern coal mine groundwater inflows to the area between the southern brine placement and bore D10.
3. Monitoring wells at boundary of the Mt Piper Ash Repository MPGM4/D1, MPGM4/D3 and MPGM4/D19.
4. Monitoring wells adjacent to Neubecks Creek MPGM4/D8 (north of Neubecks Creek) and MPGM4/D9 (south of Neubecks Creek).

Italic values are equal to or exceed 90th Percentile Value. Shaded cells and bold values indicate values are equal to or exceed the Groundwater Environmental Goals.

a Criteria from Water Management and Monitoring Plan.

Bold indicates result is 1 - <10 times the Environmental Goal

Bold and italicised indicates result is >10 times the Environmental Goal

7.5.3 *Upgradient Groundwater Quality*

Data obtained from bores D4 and D5 located to the north-west of the Mt Piper Ash Repository, in an up-hydraulic gradient position are outlined below and compared to the Groundwater Environmental Goals. It is noted that bores D4 and D5 are located up gradient of the Mt Piper Ash Repository and are considered to represent background conditions around the Mt Piper Ash Repository rather than any impacts from the Mt Piper Ash Repository.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 3.33 to 6.02, with the pH (field) values in groundwater from D4 indicating acidic conditions, ranging between in 3.33 to 3.41 throughout the reporting period. The pH levels remained generally stable in groundwater from these bores, however, were generally consistently lower than the Groundwater Environmental Goal range of 6.5 – 8.0 standard pH units.
- EC (field) values ranged between 820 µS/cm and 1,290 µS/cm, remaining generally stable throughout the monitoring period. EC values in groundwater from D4 and D5 did not exceed the Groundwater Environmental Goal of 2,600 µS/cm.
- TDS contents in groundwater from each of the bores were relatively consistent, ranging between 704 mg/L and 1,020 mg/L. Values in groundwater from neither of the bores exceeded the Groundwater Environmental Goal of 1,306 mg/L during the reporting period.

Major and Minor Ions

Throughout the reporting period chloride, sulphate and fluoride in groundwater from these bores were reported at concentrations below the Groundwater Environmental Goals.

Concentrations of calcium, magnesium, sodium and potassium were measured at concentrations above the laboratory limits of reporting; however, no Groundwater Environmental Goals apply to these analytes.

Metals

Throughout the reporting period various metals were identified at concentrations above the Groundwater Environmental Goals.

A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below:

- Arsenic concentrations reported in groundwater from D4 were between 43 µg/L and 52 µg/L and were above the Groundwater Environmental Goal (24 µg/L ANZECC (2000)/Local Guideline), in contrast to D5 which reported concentrations between <1 µg/L and 2 µg/L;

- Iron concentrations (up to 121,000 µg/L) in groundwater from D4 and D5 consistently exceeded the Groundwater Environmental Goal of 664 µg/L throughout the period of monitoring. Concentrations of iron were generally higher in groundwater from D4 than from D5. The maximum concentration of 121,000 µg/L was reported in groundwater from D4;
- Lead concentrations up to 26 µg/L were reported in groundwater from D4 only, and exceeded the Groundwater Environmental Goal of 5 µg/L throughout the reporting period. Lead concentrations were below laboratory detection limits in groundwater from D5, with only one minor detections of 1 µg/L reported in D5 during the reporting period;
- Silver concentrations were consistently below the laboratory reporting limit of 1 µg/L. This detection level was above the Groundwater Environmental Goal of 0.5 µg/L; and
- Reported manganese concentrations in groundwater from bore D5, with a maximum concentration of 9,110 µg/L, were above the Environmental Goal of 5,740 µg/L throughout the period of reporting. Manganese concentrations in D4 were below the Environmental Goal values for the reporting period.

Vanadium and aluminium were also analysed for in the groundwater samples collected from D4 and D5, however, no Groundwater Environmental Goals apply to these analytes. Concentrations of aluminium were much higher in groundwater from D4 (up to 17,100 µg/L) compared to concentrations in groundwater from D5 (up to 80 µg/L). Concentrations of vanadium were generally below the limit of reporting of 10 µg/L, with some detections of 10 µg/L occurring during the reporting period in D4.

These exceedances of the Groundwater Environmental Goals are considered unlikely to be a result of impacts of the Mt Piper Ash Repository as these bores are located up gradient of the Mt Piper Ash Repository and are considered to represent background conditions around the Mt Piper Ash Repository

7.5.4 *Groundwater Quality On-Site/Inside Mt Piper Ash Repository*

Data obtained from groundwater bores considered to be situated within the Mt Piper Ash Repository general area are summarised below and compared to the Groundwater Environmental Goals. Bores in this area include D10 located immediately south-east of the Mt Piper Ash Repository, D11 to the east and D23 targeting the southern coal mine groundwater inflows to the area between the southern brine placement and bore D10.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 5.36 to 6.7, indicating slightly acidic conditions throughout the reporting period. The pH levels remained generally stable, however were consistently lower than the Groundwater Environmental Goal range of 6.5 – 8.0 standard pH units, with the exception of results from February and March 2019 in D11 which was reported at 6.7 during both months;

- EC (field) levels ranged between 3,495 µS/cm and 10,830 µS/cm throughout the reporting period. EC levels in groundwater from D10 peaked in July and August 2018 and then generally remained stable for the remainder of the reporting period. EC levels in groundwater from D11 remained generally consistent throughout the period, with the exception of February and March 2019 when levels dropped to 4050 µS/cm. The EC results in groundwater from these bores exceeded the Groundwater Environmental Goal of 2,600 µS/cm consistently throughout the reporting period; and

- Laboratory determined TDS concentrations ranged between 2,930 mg/L and 9,400 mg/L, with these levels exceeding the Groundwater Environmental Goal of 2,000 mg/L in groundwater from these bores for all monitoring events.

Major and Minor Ions

Throughout the reporting period major and minor ions were identified at concentrations above the Groundwater Environmental Goals.

A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below:

- Sulphate concentrations (up to 6,370 mg/L) in groundwater from each of these monitoring bores exceeded the Groundwater Environmental Goal for sulphate of 1000 mg/L. There was one occurrence in March 2019 in D11 where the reported sulphate concentration was below the Groundwater Environmental Goal;

- Chloride concentrations up to 1,110 mg/L were reported in groundwater from D10 and D11. The reported concentrations from D10 and D11 exceeded the Groundwater Environmental Goal of 350 mg/L; however, chloride concentrations in groundwater from D23 (≤ 324 mg/L) were below the Groundwater Environmental Goal; and

- Fluoride concentrations up to 3.18 mg/L and 2.08 mg/L were reported in groundwater from D23 during the July and August 2018 monitoring events respectively, and exceeded the Groundwater Environmental Goal of 1.5 mg/L. It is noted that these results were higher than prior monitoring events and may be anomalous.

Calcium, magnesium, sodium and potassium were detected in groundwater from these bores at concentrations above the laboratory limits of reporting; however, no Groundwater Environmental Goals apply to these analytes. Magnesium, sodium, and potassium concentrations were higher in groundwater from D10 and D11 when compared to concentrations in groundwater from D23, with the exception of calcium, which was higher in D11 only. The concentrations of these analytes were relatively stable over the monitoring period.

Metals

Throughout the reporting period concentrations of various metals exceeded the Groundwater Environmental Goals. A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below.

- Concentrations of boron in groundwater from bores D10, D11 and D23 (up to 4,750 µg/L) exceeded the Environmental Goal of 370 µg/L for the entire reporting period, with the exception of September 2018 at bore D23 only;

- Concentrations of iron (up to 106,000 µg/L) and nickel (up to 1,060 µg/L) in groundwater from these bores exceeded the Environmental Goals (of 664 µg/L and 550.9 µg/L, respectively) through the entire reporting period, with the exception of nickel during March 2019 for D11 and July and September 2018 for D23. No noticeable trends are apparent in iron or nickel during the reporting period, although nickel concentrations tended to decrease over the reporting period in groundwater from D10;

- Concentrations of cadmium were reported at up to 7 µg/L in groundwater from bore D10, exceeding the Groundwater Environmental Goal of 2 µg/L. The cadmium concentrations in groundwater from D11 and D23 were below the Groundwater Environmental Goal.

- Manganese exceeded the Groundwater Environmental Goal of 5,704 µg/L during the monitoring period in groundwater from bore D11 (up to 20,800 µg/L) and select months for D10 (up to 8,610 µg/L);

- Lead concentrations of up to 6 µg/L in groundwater from bores D10 and D23 exceeded the Groundwater Environmental Goal of 5 µg/L in July and August 2018 for D10 and July 2018 for D23. A single lead concentration of 8 µg/L in groundwater was detected in groundwater from bore D11 during March 2019, although this is likely anomalous as every other sampling event for D11 returned readings lower than the laboratory reporting limit (<1 µg/L);

- Concentrations of nickel in groundwater from bore D10 (up to 1,050 µg/L) and from bore D11 (up to 1,060 µg/L) exceeded the Groundwater Environmental Goal of 550.9 µg/L throughout the period of reporting. On one occasion (August 2018), the concentration of nickel in groundwater from D23 (559 µg/L) exceeded the Groundwater Environmental Goal;

- Zinc concentrations exceeded the Groundwater Environmental Goal of 908 µg/L in groundwater from bore D10 throughout the reporting period, and on one occasion in groundwater from bore D23 (August 2018); and

- All silver concentrations were below the laboratory limit of reporting of 1 µg/L, with this detection level being above the Groundwater Environmental Goal of 0.5 µg/L.

Aluminium and vanadium were also analysed throughout the reporting period; however, no Groundwater Environmental Goals apply to these analytes. Aluminium concentrations peaked at a concentration of 1,820 µg/L in groundwater from bore D23. Vanadium concentrations were below the laboratory detection limits of 10 µg/L.

7.5.5 *Groundwater Quality Immediately Adjacent to Ash Repository*

Data obtained from groundwater bores D1 (east), D3 (north) and D19 (east) located immediately adjacent to the Ash Repository, are summarised below and compared to the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) values ranged from 5.82 to 6.13, indicating slightly acidic conditions in groundwater from D1, D3 and D19 throughout the reporting period. The pH levels remained generally stable, however were consistently lower than the Groundwater Environmental Goal range of 6.5 – 8.0 standard pH units;

- EC (field) values ranged between 630 µS/cm and 45,010 µS/cm, and remained generally stable throughout the monitoring period. However, the EC results typically exceeded the Groundwater Environmental Goal of 2,600 µS/cm throughout the reporting period in groundwater D1 and D19. A slight increase in EC values was noted in groundwater from D1 over the monitoring period. The highest EC value (45,010 µS/cm) was reported in groundwater from D19 in April 2019. This is likely an anomalous reading as all other reported values were in the 4500-7000 µS/cm range; and

- Laboratory determined TDS concentrations ranged between 414 mg/L and 6,580 mg/L, with all reported TDS concentrations exceeding the Environmental Goal of 2,000 mg/L in groundwater from D1 and D19. No exceedances were reported in groundwater from D3 during the reporting period.

Major and Minor Ions

Throughout the reporting period concentrations of several major and minor ions in groundwater from several of these bores exceeded the Groundwater Environmental Goals.

A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below:

- Concentrations of sulphate (up to 3,880 mg/L) were consistently above the Groundwater Environmental Goal of 1,000 mg/L in groundwater from D1 and D19. No exceedances were reported in groundwater from D3;

- Chloride concentrations were reported at up to 954 mg/L in groundwater from D1 and 578 mg/L in groundwater from D19, exceeding the Groundwater Environmental Goal of 350 mg/L. These exceedances were intermittent in groundwater from D1 and relatively consistent in groundwater from D19. D3 reported no exceedances; and

- Fluoride concentrations were all reported below the Groundwater Environmental Goal in groundwater from D1, D3 and D19, with the exception of the July results for D1 and D19 for which reported concentrations exceeded the Groundwater Environmental Goal.

Calcium, magnesium, sodium and potassium were reported at concentrations above the laboratory limits of reporting; however, no Groundwater Environmental Goals apply to these analytes. Sodium and potassium concentrations were higher in groundwater from D19 when compared to the other bores. Calcium and magnesium concentrations were generally higher in groundwater in D1 than in groundwater from the other bores.

Metals

Throughout the reporting period various metals were identified at concentrations above the Groundwater Environmental Goals. A summary of the results reported above the Groundwater Environmental Goals during the 2017/18 reporting period is presented below:

- Concentrations of boron (up to 3,510 µg/L), iron (up to 58,100 µg/L), manganese (up to 28,600 µg/L) and nickel (up to 1,670 µg/L) in groundwater from each of these bores exceeded the Groundwater Environmental Goals (of 370 µg/L, 664 µg/L, 5,704 µg/L and 550.9 µg/L, respectively) through the entire reporting period, with the exception of D3. Concentrations of these metals in groundwater from D3 did not exceed the Groundwater Environmental Goals throughout the reporting period. A general increasing trend was noted in boron, manganese and nickel concentrations in groundwater from D1 throughout the reporting period. A general decreasing trend was noted in boron, iron, manganese and nickel concentrations in groundwater from D19 throughout the reporting period;

- Cadmium concentrations did not exceed the Groundwater Environmental Goal of 2 µg/L throughout the reporting period. A number of detections above the lower laboratory reporting limit of <0.1 µg/L occurred at D19;

- Concentrations of copper (up to 15 µg/L) and lead (up to 50 µg/L) in groundwater from D19 exceeded the Groundwater Environmental Goals (5 µg/L for each analyte) intermittently through the reporting period. A generally decreasing trend was noted in copper and lead concentrations in groundwater from D19 throughout the reporting period. Copper and lead concentrations were consistently reported below the Groundwater Environmental Goals in groundwater from D1 and D3;

- One zinc concentration (1,960 µg/L) was reported above the Groundwater Environmental Goal of 908 µg/L in groundwater from D19 during the August 2018 monitoring event only; and
- All silver concentrations were below the laboratory limit of reporting of 1 µg/L, with this detection level above the Groundwater Environmental Goal of 0.5 µg/L.

Aluminium and vanadium were also analysed throughout the reporting period, however, no Groundwater Environmental Goals apply to these analytes. Aluminium concentrations peaked at 1,760 µg/L in groundwater from D19 in August 2018 and have since declined. The vanadium concentrations in groundwater from these bores were below the laboratory limit of reporting.

7.5.6 *Groundwater Quality Adjacent to Neubecks Creek*

Data obtained from groundwater bores D8 and D9 located adjacent to Neubecks Creek are summarised below and compared to the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 5.28 to 6.06, indicating slightly acidic conditions throughout the reporting period. The pH levels remained generally stable, however were consistently lower than the Groundwater Environmental Goal range of 6.5 – 8.0 standard pH units;
- EC (field) values ranged between 113 µS/cm and 8,050 µS/cm, remaining generally stable throughout the monitoring period. The EC values in groundwater from D9 exceeded the Groundwater Environmental Goal of 2,600 µS/cm consistently throughout the reporting period. EC concentrations at D8 did not exceed the Groundwater Environmental Goal; and
- Laboratory determined TDS concentrations ranged between 147 mg/L and 6,840 mg/L. TDS concentrations in groundwater from D9 exceeded the Groundwater Environmental Goal while TDS concentrations in groundwater from D8 were below the Groundwater Environmental Goal.

Major and Minor Ions

Throughout the reporting period elevated concentrations of major and minor ions were identified at concentrations above the Groundwater Environmental Goals in groundwater from bore D9. Concentrations were typically below the Groundwater Environmental Goals in groundwater from bore D8.

A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below:

- Exceedance of the Groundwater Environmental Goal was noted for sulphate only in groundwater from D9 (up to 3,910 mg/L), while sulphate concentrations in groundwater from D8 were below the Groundwater Environmental Goal. A generally increasing sulphate concentration trend was noted in groundwater from D9 over the monitoring period; and

- Elevated concentrations of chloride (up to 987 mg/L) and occasional elevated concentrations of fluoride (3.02 mg/L in July 2018 only) were reported above the Groundwater Environmental Goals of 350 mg/L and 1.5 mg/L respectively in groundwater from monitoring bore D9 only Monitoring bore D8 did not report any exceedances for chloride and fluoride.

Concentrations of calcium, magnesium, sodium and potassium were detected at concentrations above the laboratory limits of reporting; however, no Groundwater Environmental Goals apply to these analytes. Calcium, magnesium, sodium, potassium and alkalinity concentrations were higher in groundwater from D9 (south side of Neubecks Creek) when compared to those in groundwater from D8 and were noted to be generally increasing over the monitoring period.

Metals

Throughout the reporting period various metals were identified at concentrations above the adopted Groundwater Environmental Goals (ANZECC (2000) or baseline conditions). A summary of the results reported above the Groundwater Environmental Goals during the 2018/19 reporting period is presented below:

- Concentrations of boron (up to 1570 µg/L) and manganese (up to 25,500 µg/L) in groundwater from bore D9 exceeded the Groundwater Environmental Goals (of 370 µg/L and 5,740 µg/L, respectively) throughout the reporting period. Boron and manganese concentrations were not reported to exceed the Groundwater Environmental Goals in groundwater from D8;

- Copper concentrations at up to 50 µg/L were reported in groundwater from bore D8. This monitoring result for November 2018 in groundwater from this bore (50 µg/L) was followed by a decrease in concentrations back to below the Groundwater Environmental Goal by May 2019. Copper concentrations in groundwater from D9 exceeded the Groundwater Environmental Goal of 5 µg/L in October 2018 (20 µg/L) and November 2018 (10 µg/L);

- Iron (filtered) concentrations exceeded the Groundwater Environmental Goal of 664 µg/L in groundwater from D9 consistently throughout the reporting period. Iron concentrations in groundwater from bore D8 were below the Groundwater Environmental Goal;

- Manganese concentrations up to 25,000 µg/L were reported in groundwater from D9. These exceeded the Groundwater Environmental Goal of 5,704 µg/L throughout the entire monitoring period. Manganese concentrations in groundwater from bore D8 were below the Groundwater Environmental Goal;
- Nickel concentrations above the Groundwater Environmental Goal of 550.9 mg/L were reported in groundwater from D9 with the exception of the November 2018 monitoring event. Nickel concentrations in groundwater from D8 were below the Groundwater Environmental Goal; and
- Silver concentrations were below the laboratory limit of reporting of 1 µg/L, with this reporting limit being above the Groundwater Environmental Goal of 0.5 µg/L.

Aluminium and vanadium were also analysed throughout the reporting period; however, no Groundwater Environmental Goals apply to these analytes. Aluminium concentrations peaked at a concentration of 1,920 µg/L in groundwater from bore D8 in November 2018 declining after this time. Vanadium concentrations were below the laboratory limit of reporting.

7.6 DISCUSSION

A discussion of the groundwater results in each of these areas is outlined below.

As outlined above, the identified exceedances of the Groundwater Environmental Goals are currently being further investigated as part of a separate and broader investigation into the ash repositories at Mt Piper. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

Background Groundwater Quality

Metals including iron, lead, nickel and manganese were identified in groundwater from bores D4 and D5 at concentrations above the Groundwater Environmental Goals. pH values in groundwater from these bores were also more acidic than the Groundwater Environmental Goal for pH. These exceedances are considered unlikely to be a result of impacts from the Mt Piper Ash Repository as these bores are located in an up gradient position of the Mt Piper Ash Repository; instead, they are likely associated with regionally elevated background concentrations in the area, noting that areas up gradient of the ash repository have been highly disturbed by historical regional mining activities. Connell Wagner (2007) notes that the low pH conditions are likely due to the presence of pyrites (iron sulphides) in the area.

Inside of the Ash Repository

Elevated EC and TDS values as well as concentrations of anions including chloride, sulphate and fluoride, and metals including boron, cadmium, copper, lead, nickel, manganese, iron and zinc were identified at concentrations at or above the Groundwater Environmental Goals in groundwater from bores inside of the ash repository. Low pH levels (more acidic than the Environmental Goal) were also evident in groundwater from this area, however the pH values were slightly higher than background values. This may be potentially related to the ash placement. Concentrations of iron and lead and are considered to be related to background groundwater monitoring well results (from D4 and D5) which reported concentrations that were a similar order of magnitude.

The reported TDS, EC, sulphate, chloride, fluoride, boron, cadmium, manganese, nickel and zinc concentrations in groundwater from bores in this area are considered elevated relative to background data from groundwater bores D4 and D5. Connell Wagner (2007), reported elevated levels of sulphate, boron, nickel, zinc, manganese and iron previously in this area based on pre-placement ash data from bore B904 (operational between 1997 and 2000), which have been influenced by goaf underground mine workings to the south of this area. However, concentrations of sulphate, chloride, boron, nickel and zinc and potentially cadmium and lead indicate a different composition relative to the background bores and the 90th percentile pre-placement data from groundwater from historical bore B904 (from Aurecon 2017). In consideration of the brine composition (refer to *Annex E*), which also contains elevated levels of these constituents, groundwater in this area is potentially influenced by leaching of brine higher in the Mt Piper Ash Repository into the underlying water table. This is being further investigated as part of the separate and broader investigation currently underway.

Adjacent to the Ash Repository

Elevated concentrations of copper (up to 15 µg/L), iron (up to 58,100 µg/L) and manganese (up to 28,600 µg/L) in groundwater from bores adjacent to the Mount Piper Ash Repository intermittently exceeded the Groundwater Environmental Goals. These concentrations are considered to be related to the background water quality in the area, based on the background groundwater monitoring well results (from D4 and D5) which reported concentrations that were a similar order of magnitude. Iron is noted to be significantly lower in groundwater from D1, D3 and D19 compared to background concentrations in groundwater from D4 and D5.

Concentrations of boron and nickel at D1 and D19 and, at times, lead at D19 exceeded the Groundwater Environmental Goals. The elevated boron and nickel concentrations are considered to represent changes to water quality relative to background and pre-ash placement concentrations. As noted earlier, boron and nickel are present at elevated concentrations in the brine that is used in the brine conditioned ash placed in the repository and are therefore potentially associated with leaching of brine conditioned ash on site. This is being further investigated as part of the separate and broader investigation currently underway. The elevated lead concentrations in groundwater from D19 were below the maximum concentration measured in groundwater from the background bore D4 and, as such, are considered to be related to background groundwater conditions in the area.

Adjacent to Neubecks Creek

Concentrations of EC and TDS, chloride, sulphate, boron, copper, nickel and manganese were reported above the Groundwater Environmental Goals; pH values were more acidic than the Groundwater Environmental Goal. Low pH levels and elevated iron and potentially manganese concentrations are considered to be associated with background concentrations, consistent with data from up gradient monitoring wells D4 and D5. The elevated EC and TDS, chloride, sulphate, copper, nickel and boron were only identified at concentrations above the Groundwater Environmental Goals in groundwater from D9 (south side of Neubecks Creek); these concentrations are potentially associated with leaching of brine conditioned ash placed at Mt Piper Ash Repository. This is being further investigated as part of the separate and broader investigation currently underway. There was no clear evidence of consistent changes in water quality at D8.

7.6.1 *Early Warning Assessment*

A summary of the groundwater analytical results (50th percentile) for the 2018/19 reporting period compared with the adopted Groundwater Trigger Value Environmental Goal (Groundwater Collection Basin Pre-Ash Placement 90th Percentile) is presented in *Table 11* below. The results are also presented on *Figures 7b* and *7c*. ERM notes that the early warning assessment in the Water Management and Monitoring Plan was based in large part on concentrations in the Groundwater Collection Basin, however, the Groundwater Collection Basin was filled in as part of the development of the Lamberts North Ash Repository. Consequently, ERM has adopted the approach as presented in the 2016 - 2017 (Aurecon, 2017b) and 2017 – 2018 (ERM, 2018b) AEMRs to complete an early warning assessment.

This assessment serves to provide an early indication of changes in groundwater quality. As outlined above, the exceedance of the early warning triggers noted below are currently being further investigated as part of a separate and broader investigation into the ash repositories at Mt Piper. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

Table 11 Early Warning Assessment of Groundwater Concentrations (50th Percentile) - 2018/19 Reporting Period

Analyte/Location	Groundwater Concentration (mg/L) - 50th percentile (2018 – 2019)										Groundwater Collection Basin Pre-Ash Placement 90th Percentile (mg/L) [a]
	Up-gradient		Inside Ash Repository			Adjacent to Repository			Down-gradient		
	D4	D5	D10	D11	D23	D1	D3	D19	D8	D9	
pH	3.39	5.93	5.58	6.2	5.68	5.96	6.04	5.93	5.51	5.99	-
Conductivity (µS/cm)	890	1,250	**6,075**	**10,239**	**3,940**	**4,365**	945	**6,050**	620	**5,415**	1,576
TDS (mg/L)	738	947	**5,000**	**9,010**	**3,060**	**3,520**	600	**4,480**	431.5	**4,580**	1,306
Sulphate (as SO_4) (mg/L)	418	557	**3,350**	**4,840**	**1,970**	**1,940**	313	**3,130**	236	**2760**	824
Chloride (mg/L)	12.9	23	***488***	***982***	**277**	***376***	**33.7**	***400***	28.65	***543***	31.5
Fluoride (mg/L)	0.1135	0.126	0.364	**0.628**	**1.115**	**2.1665**	0.3925	**0.917**	0.0285	**0.553**	0.435
Arsenic (µg/L)	**48**	1	-	**6.5**	**2.5**	**5**	-	**4**	-	1	1
Barium (µg/L)	12	18	16	21	18	26	28	19	35	**40**	37
Beryllium (µg/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Boron (µg/L)	50	100	**1,750**	***3,030***	**420**	**1,630**	140	***2,560***	100	**1430**	244
Cadmium (µg/L)	0.6	0.2	**2.6**	0.1	0.4	0.1	-	0.2	-	0.25	2
Chromium (total) (µg/L)	**2**	**3**	**2**	**2**	**4.5**	**2.5**	-	**7**	1	1	1
Copper (µg/L)	1	**3**	**2.5**	**2**	**3**	**1.5**	**3**	**5.5**	**4**	**2**	1
Iron (µg/L)	***92,200***	***47,900***	***16,500***	***80,200***	***16,345***	***28,300***	***8,620***	***18,200***	410	***34900***	664
Mercury (µg/L)	NA	NA	NA	NA	NA	NA	NA	NA	0.125	0.055	<0.1
Manganese (µg/L)	746	**7,505**	5,140	**17,100**	2,905	**14,000**	730	**10,300**	646.5	**15,400**	5,704
Molybdenum (µg/L)	-	-	**2**	**2**	**-**	-	1	**2.5**	**2**	**3**	1
Nickel (µg/L)	18	46	**627**	**988**	476	**720**	4	**666**	56	**908**	550.9
Lead (µg/L)	**23**	1	**2**	**8**	**4**	**2**	1	**8**	**2.5**	**2**	1
Selenium (µg/L)	0.2	0.2	1	0.2	0.5	0.35	-	0.75	0.2	0.3	2
Silver (µg/L)	-	-	-	-	-	-	-	-	-	-	<1
Zinc (µg/L)	186	18	**1,000**	103	789	76	9	346	78	129	908

a Groundwater Collection Basin Pre-Ash Placement 90th Percentile from Aurecon (2017)

Shaded cells value equals or exceeds the trigger level

Bold indicates result equals exceeds the Pre-Ash Placement 90th Percentile level by 1 to 10 times.

Bold and Italicised indicates result exceeds the Pre-Ash Placement 90th Percentile level by > 10 times.

Up-gradient of the ash repository, the 50th percentile concentrations of arsenic, chromium, copper, iron manganese and lead from the 2018/19 reporting period were identified at levels above the pre-placement trigger levels. These values are considered to represent background concentrations of these metals in groundwater in the region.

Inside the Mt Piper Ash Repository a change in the groundwater chemistry is apparent, with increases evident in the 50th percentile concentrations for EC, TDS, sulphate, chloride, fluoride, cadmium (minor change evident), boron, molybdenum (minor change evident) and nickel relative to concentrations in groundwater form the background bores. These increased concentrations indicate a change in groundwater quality from groundwater bores monitoring the Mt Piper Ash Repository. Increased concentrations of cadmium, selenium and zinc were also evident in this area, but in groundwater from D10 only. This may be associated with influences on groundwater quality from outside of the Mt Piper Ash Repository footprint, where goaf mine workings have been noted as influences on groundwater quality (Connell Wagner 2007).

Similarly, adjacent to the Mt Piper Ash Repository, elevated 50th percentile concentrations for EC, TDS, sulphate, chloride, fluoride, boron, nickel, molybdenum (D3 and D19) and manganese were identified in groundwater from D1 and D19 to the east and south-east of the Mt Piper Ash Repository respectively. It is noted that groundwater from bore D3 appeared to show little to no influence from the ash repository, which is consistent with this bore's location in a cross-hydraulic gradient location relative to the ash repository.

Groundwater from down-gradient bore D9 had elevated boron, molybdenum (relative minor change evident), sulphate, iron, manganese, chloride, TDS and EC, with 50th percentile results for the 2018/19 reporting period exceeding the 90th percentile pre-placement levels. Elevated concentrations of iron, copper and manganese are considered to be associated with background groundwater quality identified at D4 and D5. The elevated concentrations of boron, sulphate, chloride, TDS and EC indicate a change in water quality in the vicinity of Neubecks Creek and down gradient of the Mt Piper Ash Repository. Groundwater form bore D8 did not exceed 50th percentile concentrations with except for chromium, copper and lead.

7.6.2 *Trend Analysis*

A review of concentration trends with respect to key indicators including EC, TDS, sulphate, chloride, boron, iron, manganese is presented below. These indicators were selected based on their exceedances above ANZECC (2000) Trigger Values and the observed increase in concentrations down-gradient of the ash repository. Graphs were generated for selected bores from the inside of the Mt Piper Ash Repository (D10 and D11), adjacent to the Mt Piper Ash Repository (D1) and adjacent to Neubecks Creek (D9) and reviewed as part of the trend analysis as presented in *Annex I*.

These trends are also being further investigated as part of the separate and broader investigation into the ash repositories at Mt Piper.

Electrical Conductivity

EC values in groundwater from bore D11 have increased since at least September 2015. EC values in groundwater from bore D9 were below those recorded in groundwater form D1, D10 and D11 and were just above the local guideline trigger up until 2017. However, EC values have been above the pre-placement trigger levels since at least 2015. An increasing trend in EC concentrations in D9 was noted from 2017; this trend continued through to 2019. EC values in groundwater from D10 have been variable over time but there has been a sharp decrease since 2018, with a declining trend since 2017.

TDS

A generally increasing trend in TDS concentrations was noted for D1, D10 and D11 since 2010, especially between 2010 and 2012. TDS concentrations have generally been more variable since 2013. TDS concentrations in D11 have been steady at current levels for the past three monitoring periods, while concentrations in groundwater form D9 have indicated an upward trend since 2017. TDS concentrations in D10 have fallen sharply since the last annual monitoring period.

Sulphate

A large increase in sulphate concentrations was noted between 2013 and 2014 in D11 and concentrations have continued to rise since then. Increasing sulphate concentration trends are also present in groundwater data from bores D1 and D9. Sulphate concentrations in D10 have been generally increasing since 2010 but, recently (in the last two monitoring periods, 2017/2018 and 2018/2019) concentrations have declined.

Chloride

Generally increasing trends in chloride concentrations were noted in groundwater from D1, D10 and D11, most notably from 2013. In D10, the increase in chloride concentrations slowed from 2015 and concentrations have declined since the 2017/18 monitoring period. Chloride concentrations were generally stable in groundwater from D9 from 2013 to 2017, however, a spike in concentration was noted in the 2017/18 monitoring period and chloride concentrations continued to increase over the 2018/19 monitoring period.

Boron

Boron concentrations have generally been variable over time especially in D10, with a significant decrease in boron concentrations occurring over the past two monitoring periods. A significant increase in boron concentrations was noted in groundwater from D11 in 2013; concentrations have remained generally steady since. Boron concentrations have been generally lower in groundwater from D9, however, they have increased since 2016 and have been above Groundwater Environmental Goals since.

Iron

Increases in iron concentrations were noted from 2013 in groundwater D1 and D11 but are highly variable over time. Iron concentrations in D10 generally increased from 2013 and peaked in 2014 and then stabilised, but have since peaked again in the most recent monitoring period. Iron concentrations in D9 were relatively stable up until 2014 when they started to increased and then concentrations peaked in 2015. Following this, concentrations decreased for the next two years and have subsequently started to increase again for the last two monitoring periods. Iron concentrations in D1, D9 and D10 are noted to be generally increasing, with D11 remaining fairly stable to decreasing slightly. It is noted that groundwater quality in D10 may potentially be influenced from other areas (e.g. outside of the ash repository footprint), where goaf mine workings have been noted as influences on groundwater quality (Connell Wagner 2007).

Manganese

Manganese concentrations have been generally increasing over time in D1, D9, D10 and D11. The rate of increase declined from approximately 2014 in D9 and D10 and 2015 in D1 and D11. A possible decline in manganese concentrations was noted in D10 and D11 since 2018. However, a significant increase in manganese concentrations to their highest value was noted in D9 and D1 during the most recent monitoring period. As noted earlier, D10 is potentially also being influenced by groundwater from the south of the site.

8 CONCLUSIONS

Based on the review of the surface water and groundwater quality data at the Mt Piper Ash Repository for the 2018/19 reporting period, the following conclusions are drawn:

- Exceedances of the adopted Environmental Goals (contained in the Water Management and Monitoring Plan were recorded during the reporting period with respect to surface water and groundwater;

- In surface water samples collected at locations described in the Water Management and Monitoring Plan, sporadic exceedances of the Surface Water Environmental Goals were identified at LMP01 and WX22. Although there is the potential that activities at Mt Piper Ash Repository may have contributed to these exceedances in surface water, these concentrations are considered unlikely to be predominately related to the Mt Piper Ash Repository;

- Concentrations of some compounds in groundwater from multiple bores, including bore D9 located towards Neubecks Creek, were reported in exceedance of the Groundwater Environmental Goals (as set out in the Water Management and Monitoring Plan). It is considered likely that the Mt Piper Ash Repository has contributed to these exceedances in groundwater; and

- It is noted that the reported groundwater levels have generally remained below the most recent maximum predicted groundwater level (912.0 mAHD) from CDM Smith (2013) and below the base of the ash placement (917 m AHD).

While some of the exceedances of the Environmental Goals noted in this report are considered likely to be associated with the Mt Piper Ash Repository, a separate and broader investigation of surface water and groundwater conditions in the vicinity of both the Mt Piper Ash Repository and the separately approved Lamberts North Ash Repository is currently being completed in line with the contingency measures contained in the Water Management and Monitoring Plan and OEMP to confirm the extent to which the ash repositories are the source of the reported exceedances and identify further contingency measures. Once this investigation is completed, the Water Management and Monitoring Plan will be updated to reflect the key findings and the further contingency measures proposed.

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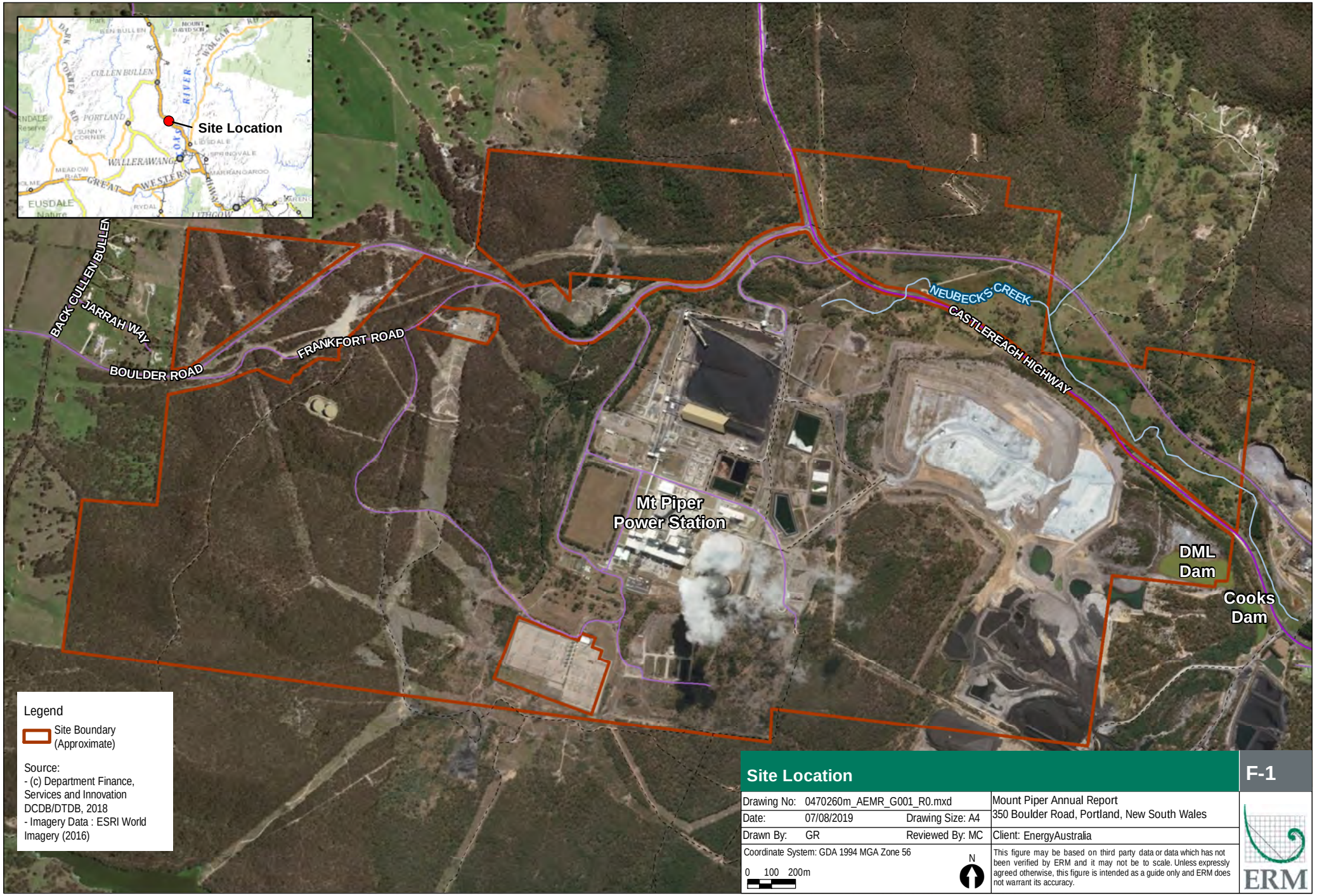
Figures



Site Location

F-1

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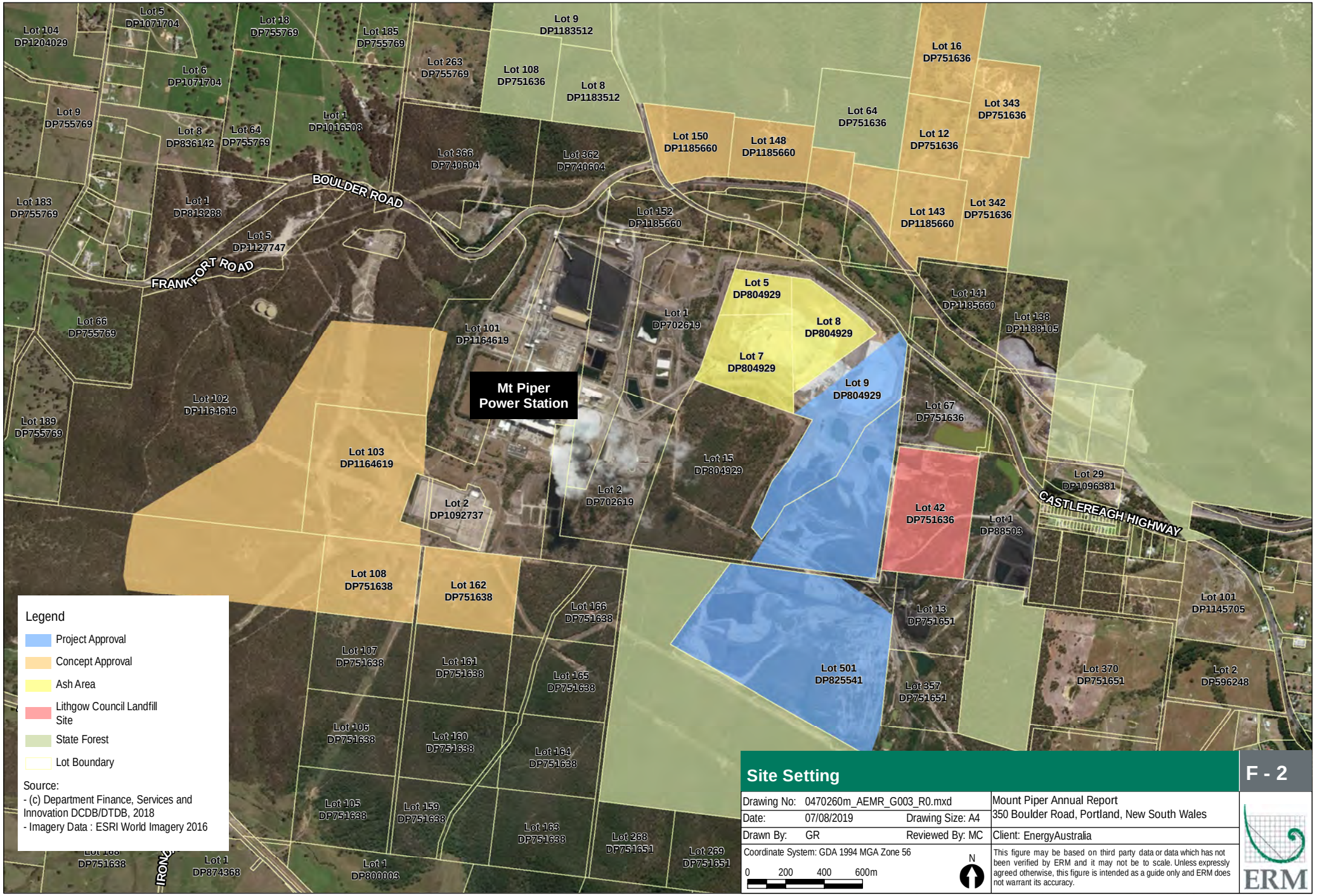
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Lot 8 DP836142
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Lot 1 DP1016508
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Lot 366 DP740604
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BOULDER ROAD
Lot 183 DP755769
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Lot 152 DP1185660
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FRANKFORT ROAD
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Mt Piper Power Station
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Lot 2 DP1092737
Lot 42 DP751636
Lot 1 DP88503
CASTLEREAGH HIGHWAY
Lot 108 DP751638
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Lot 163 DP751638
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Lot 1 DP800003
IRONS
Legend
Project Approval
Concept Approval
Ash Area
Lithgow Council Landfill Site
State Forest
Lot Boundary
Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
Site Setting
F - 2
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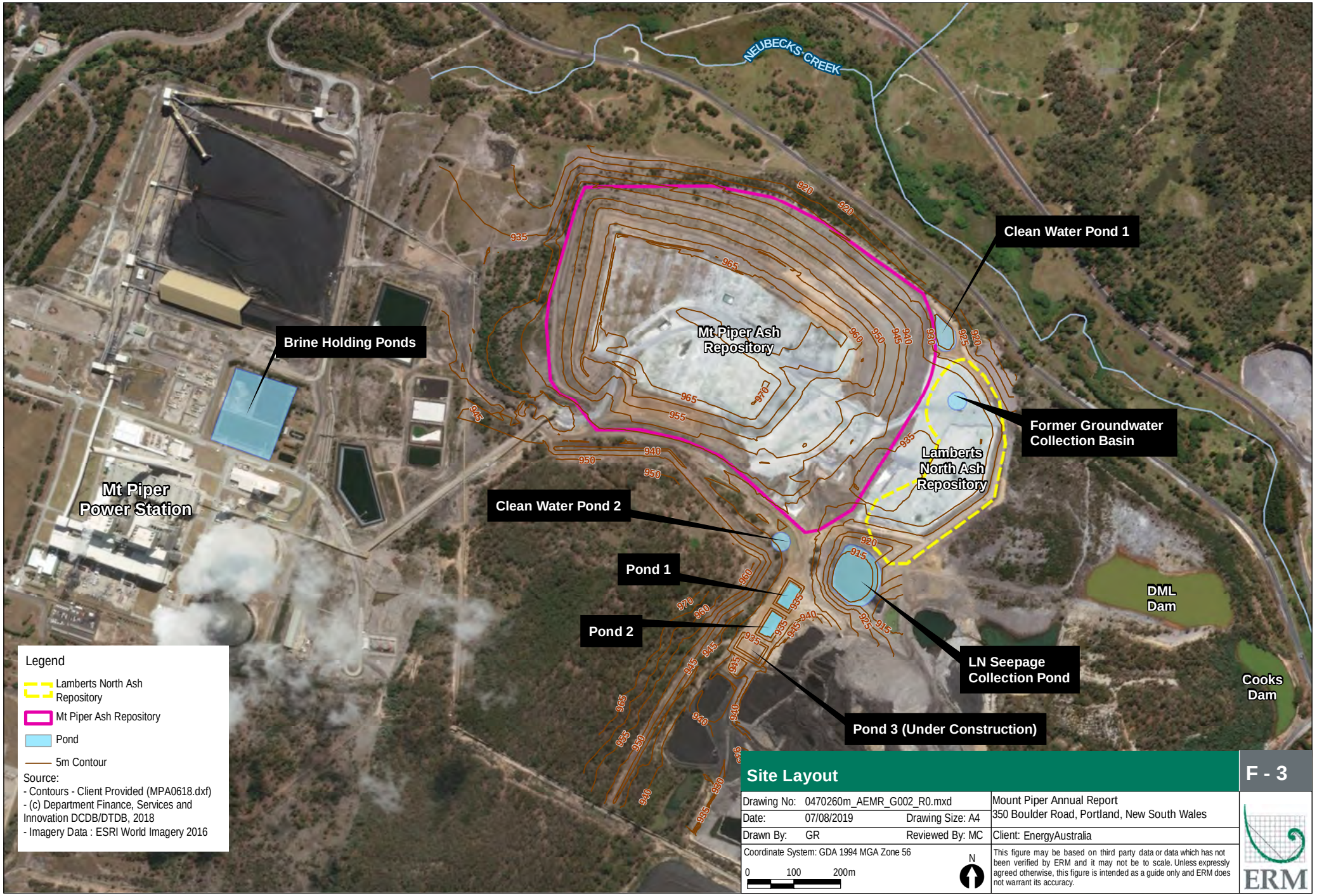
NEUBECKS CREEK
Clean Water Pond 1
Brine Holding Ponds
Mt Piper Ash Repository
Former Groundwater Collection Basin
Lamberts North Ash Repository
Mt Piper Power Station
Clean Water Pond 2
Pond 1
Pond 2
DML Dam
LN Seepage Collection Pond
Cooks Dam
Pond 3 (Under Construction)
Legend
Lamberts North Ash Repository
Mt Piper Ash Repository
Pond
5m Contour
Source:
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- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
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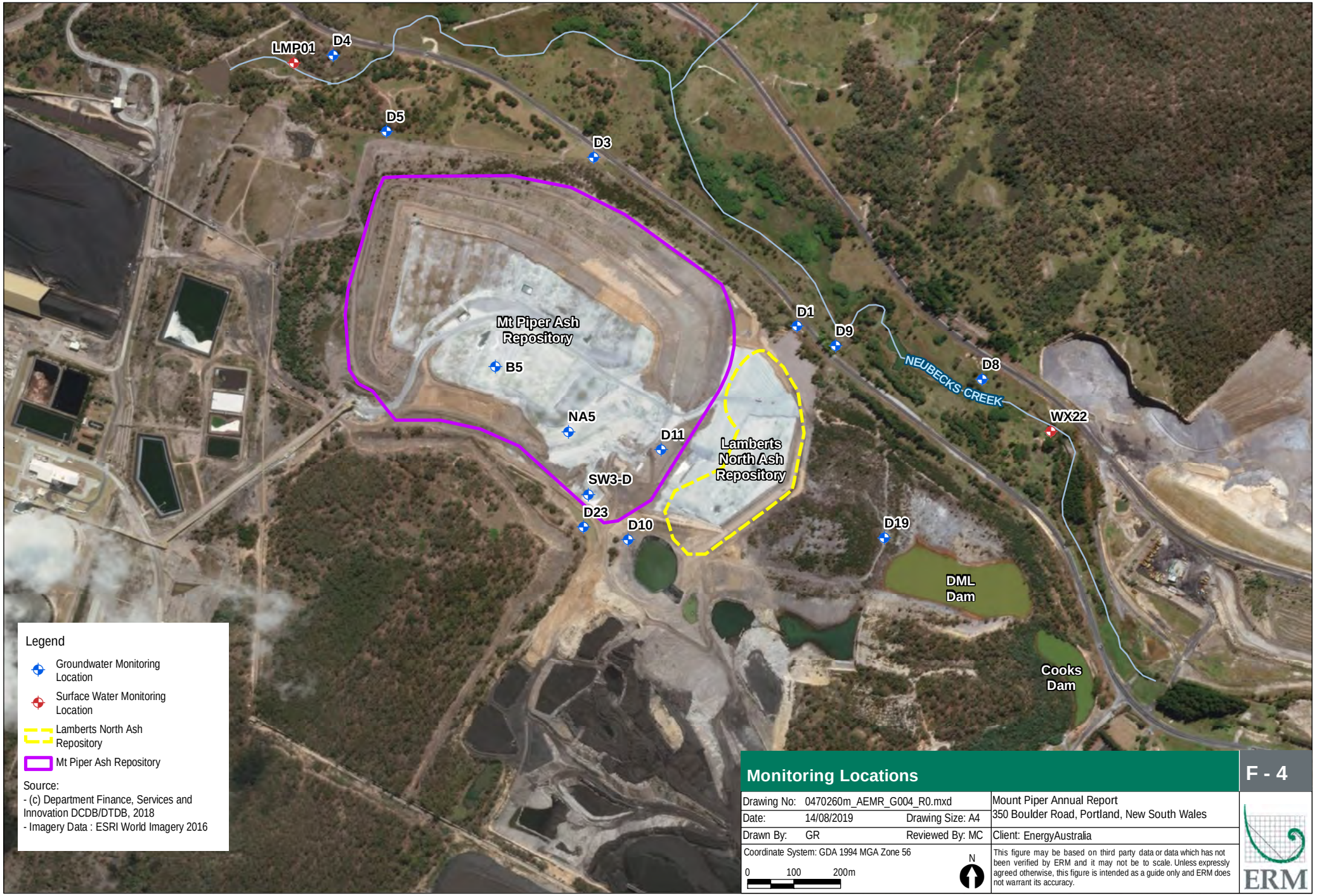
LMP01
D4
D5
D3
Mt Piper Ash Repository
B5
NA5
D11
Lamberts North Ash Repository
SW3-D
D23
D10
D1
D9
D8
NEUBECKS CREEK
WX22
D19
DML Dam
Cooks Dam
Legend
Groundwater Monitoring Location
Surface Water Monitoring Location
Lamberts North Ash Repository
Mt Piper Ash Repository
Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
Monitoring Locations
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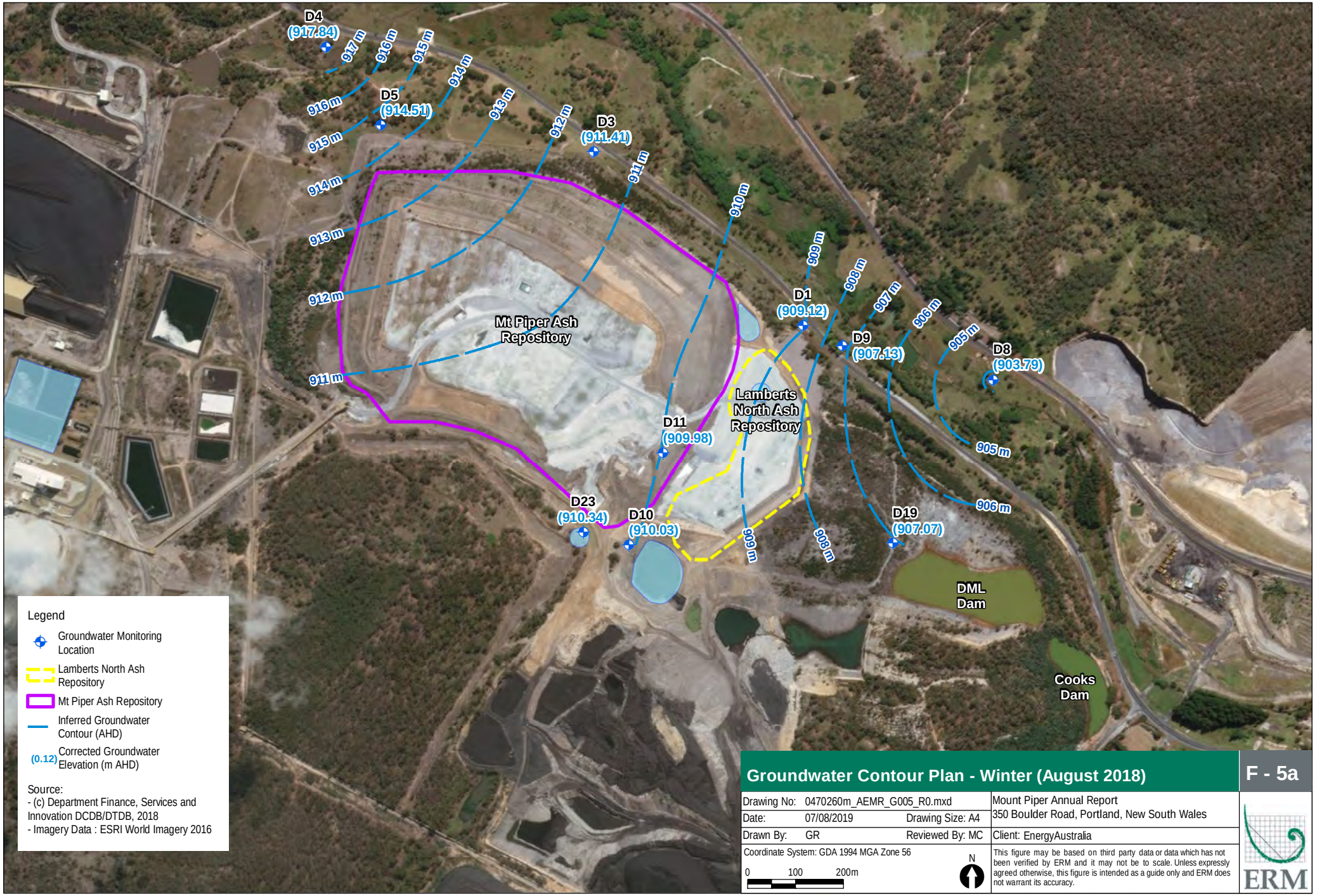
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D5
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D3
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D1
(909.12)
D9
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D8
(903.79)
D11
(909.98)
D23
(910.34)
D10
(910.03)
D19
(907.07)
917 m
916 m
915 m
914 m
913 m
912 m
911 m
910 m
909 m
908 m
907 m
906 m
905 m
Mt Piper Ash Repository
Lamberts North Ash Repository
DML Dam
Cooks Dam
Legend
Groundwater Monitoring Location
Lamberts North Ash Repository
Mt Piper Ash Repository
Inferred Groundwater Contour (AHD)
(0.12) Corrected Groundwater Elevation (m AHD)
Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
Groundwater Contour Plan - Winter (August 2018)
F - 5a
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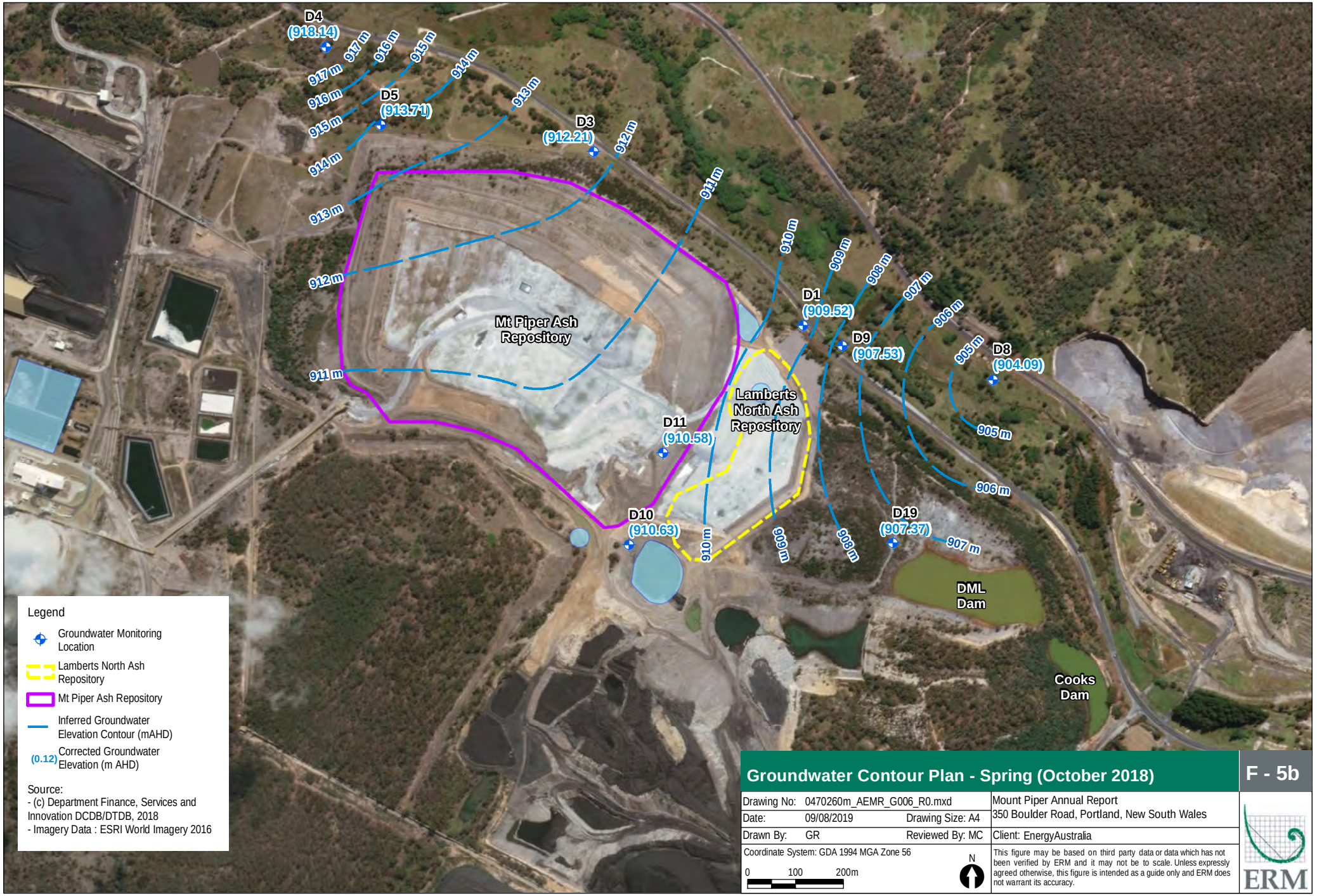
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D10
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(907.37)
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916 m
915 m
914 m
913 m
912 m
911 m
910 m
909 m
908 m
907 m
906 m
905 m
Mt Piper Ash
Repository
Lamberts
North Ash
Repository
DML
Dam
Cooks
Dam
Legend
Groundwater Monitoring Location
Lamberts North Ash Repository
Mt Piper Ash Repository
Inferred Groundwater Elevation Contour (mAHD)
(0.12) Corrected Groundwater Elevation (m AHD)
Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
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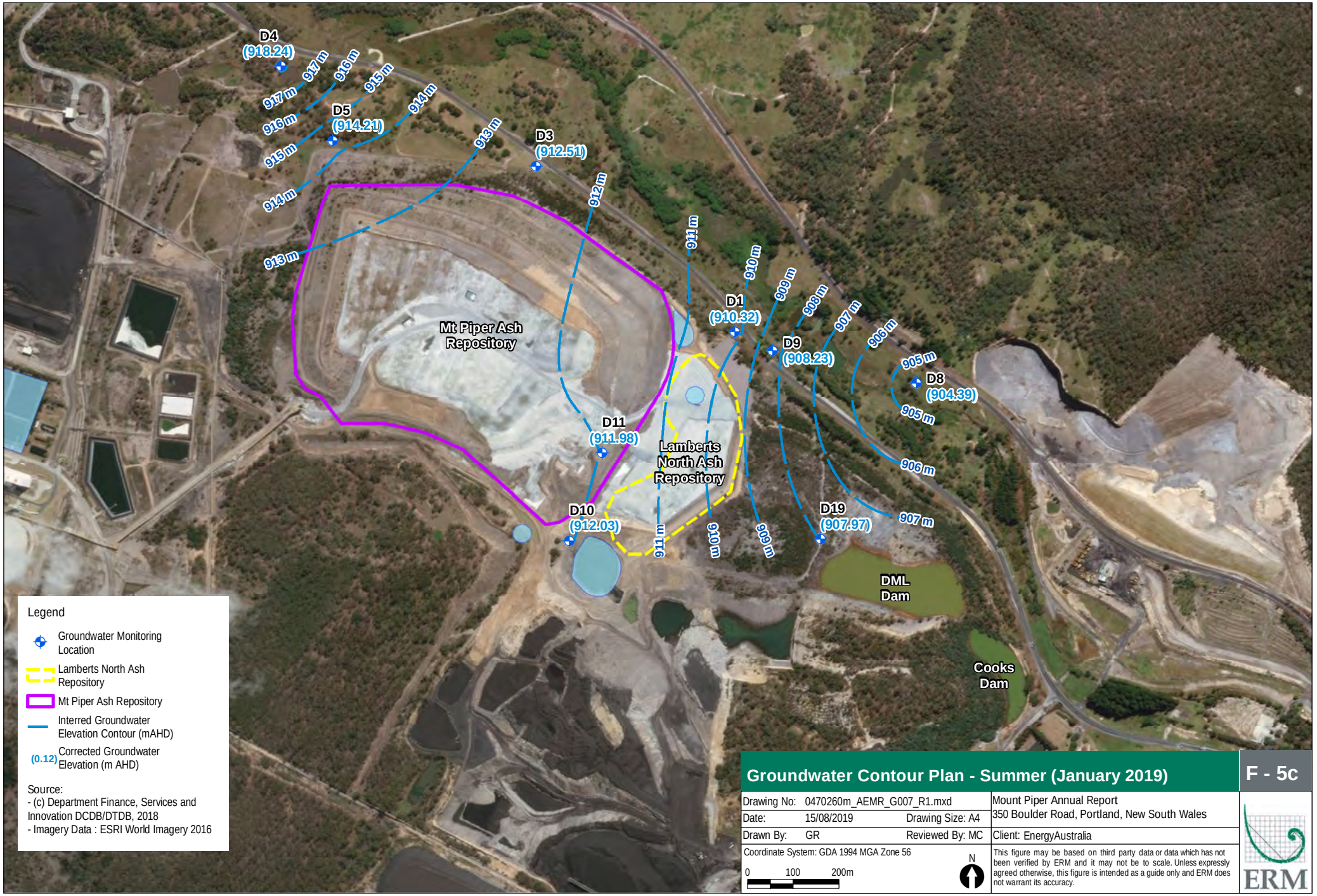
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D9
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D11
(911.98)
D10
(912.03)
D19
(907.97)
917 m
916 m
915 m
914 m
913 m
912 m
911 m
910 m
909 m
908 m
907 m
906 m
905 m
Mt Piper Ash Repository
Lamberts North Ash Repository
DML Dam
Cooks Dam
Legend
Groundwater Monitoring Location
Lamberts North Ash Repository
Mt Piper Ash Repository
Interred Groundwater Elevation Contour (mAHD)
(0.12) Corrected Groundwater Elevation (m AHD)
Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
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Groundwater Contour Plan - Summer (January 2019)
F - 5c
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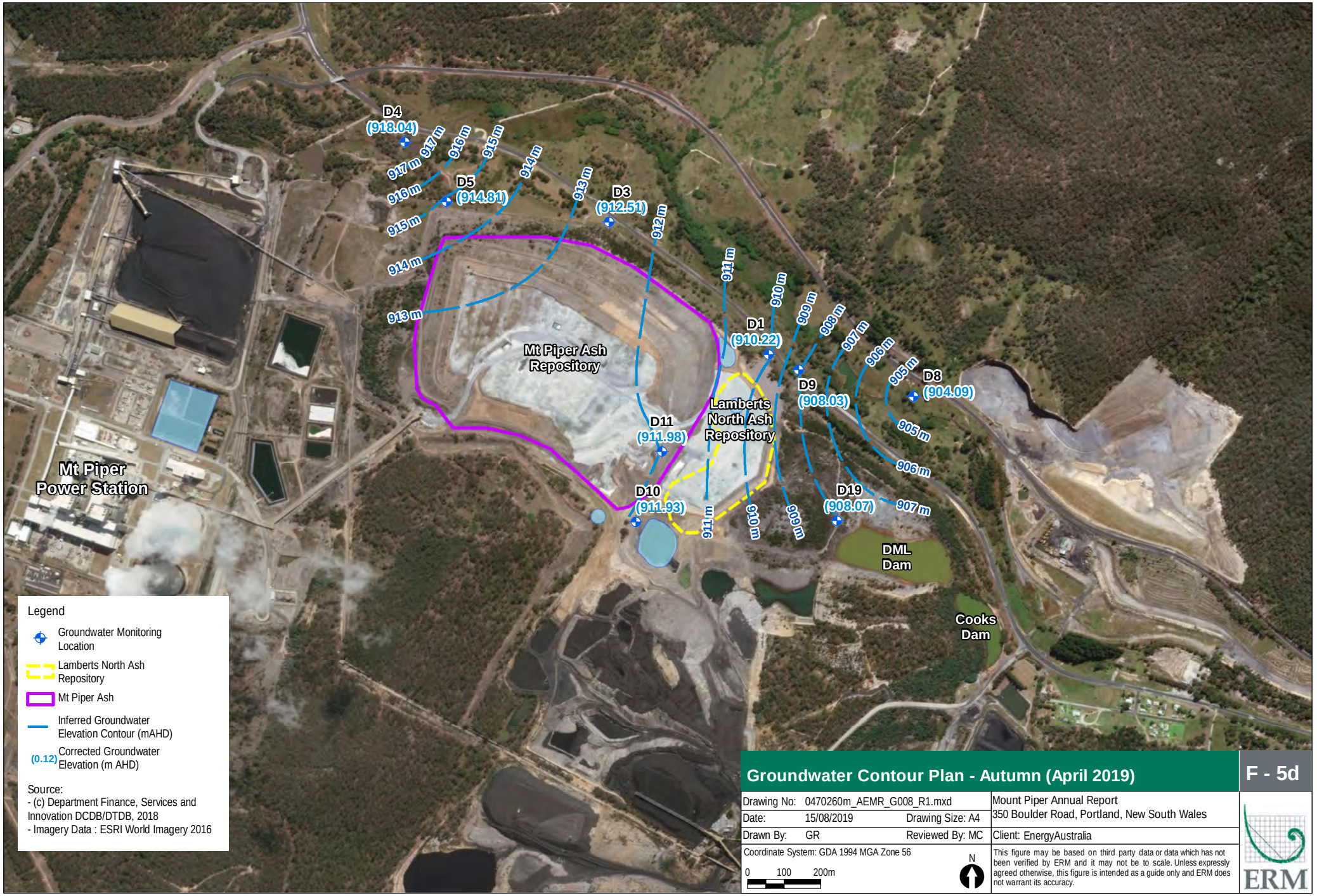

Groundwater Contour Plan - Autumn (April 2019)

F - 5d

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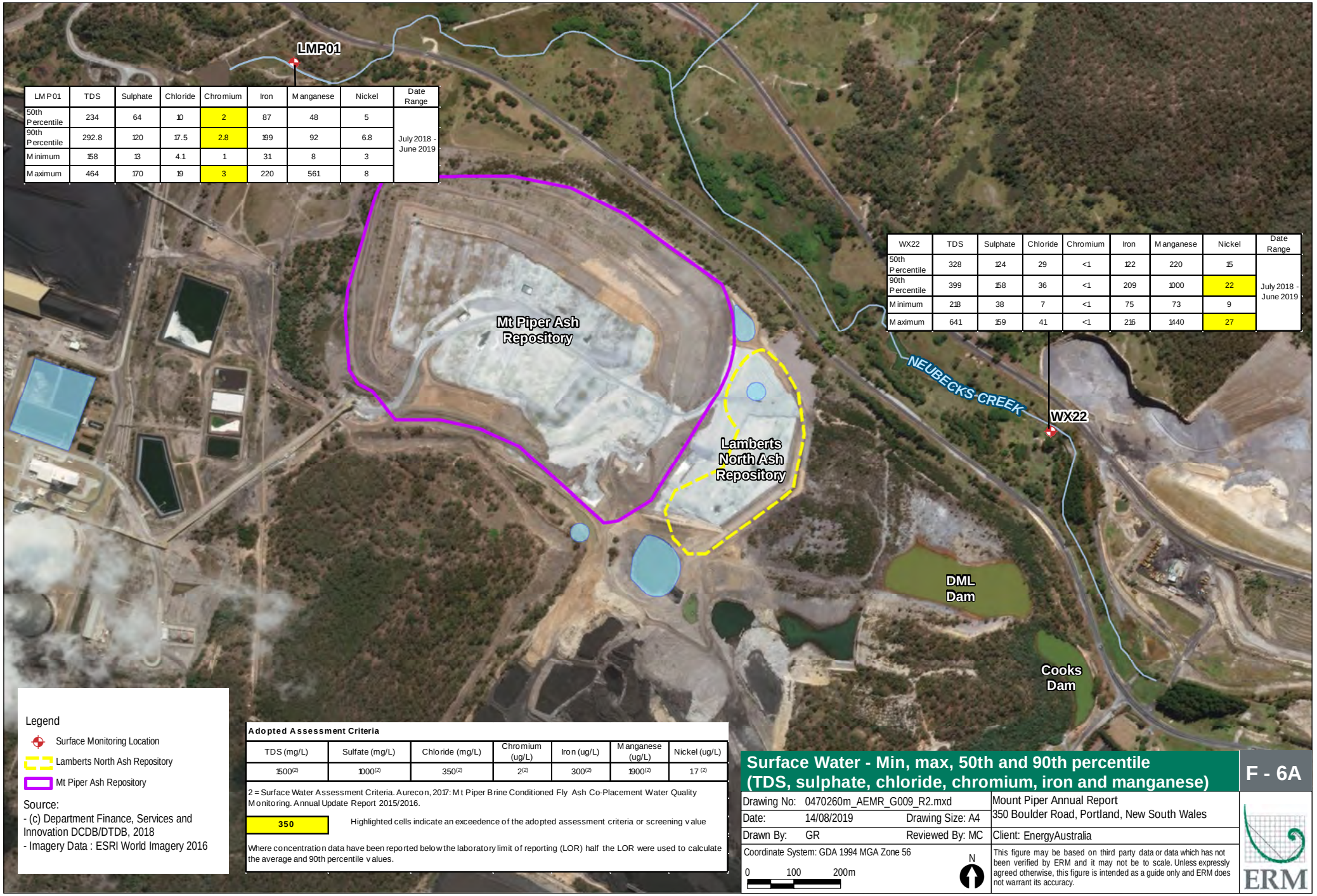
Coordinate System: GDA 1994 MGA Zone 56

Mount Piper Annual Report
350 Boulder Road, Portland, New South Wales

Client: EnergyAustralia

ERM



LMP01	TDS	Sulphate	Chloride	Chromium	Iron	Manganese	Nickel	Date Range
50th Percentile	234	64	10	2	87	48	5	July 2018 - June 2019
90th Percentile	292.8	120	17.5	2.8	199	92	6.8	
Minimum	158	13	4.1	1	31	8	3	
Maximum	464	170	19	3	220	561	8	

WX22	TDS	Sulphate	Chloride	Chromium	Iron	Manganese	Nickel	Date Range
50th Percentile	328	124	29	<1	122	220	15	July 2018 - June 2019
90th Percentile	399	158	36	<1	209	1000	22	
Minimum	218	38	7	<1	75	73	9	
Maximum	641	159	41	<1	216	1440	27	

Legend

- Surface Monitoring Location
- Lamberts North Ash Repository
- Mt Piper Ash Repository

Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016

Adopted Assessment Criteria

TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Chromium (ug/L)	Iron (ug/L)	Manganese (ug/L)	Nickel (ug/L)
1500(2)	1000(2)	350(2)	2(2)	300(2)	1900(2)	17 (2)

2 = Surface Water Assessment Criteria. Aurecon, 2017: Mt Piper Brine Conditioned Fly Ash Co-Placement Water Quality Monitoring. Annual Update Report 2015/2016.

350 — Highlighted cells indicate an exceedence of the adopted assessment criteria or screening value

Where concentration data have been reported below the laboratory limit of reporting (LOR) half the LOR were used to calculate the average and 90th percentile values.

Surface Water - Min, max, 50th and 90th percentile (TDS, sulphate, chloride, chromium, iron and manganese)

F - 6A

Drawing No:	0470260m_AEMR_G009_R2.mxd		Mount Piper Annual Report 350 Boulder Road, Portland, New South Wales
Date:	14/08/2019	Drawing Size: A4	Client: EnergyAustralia
Drawn By:	GR	Reviewed By: MC	

Coordinate System: GDA 1994 MGA Zone 56

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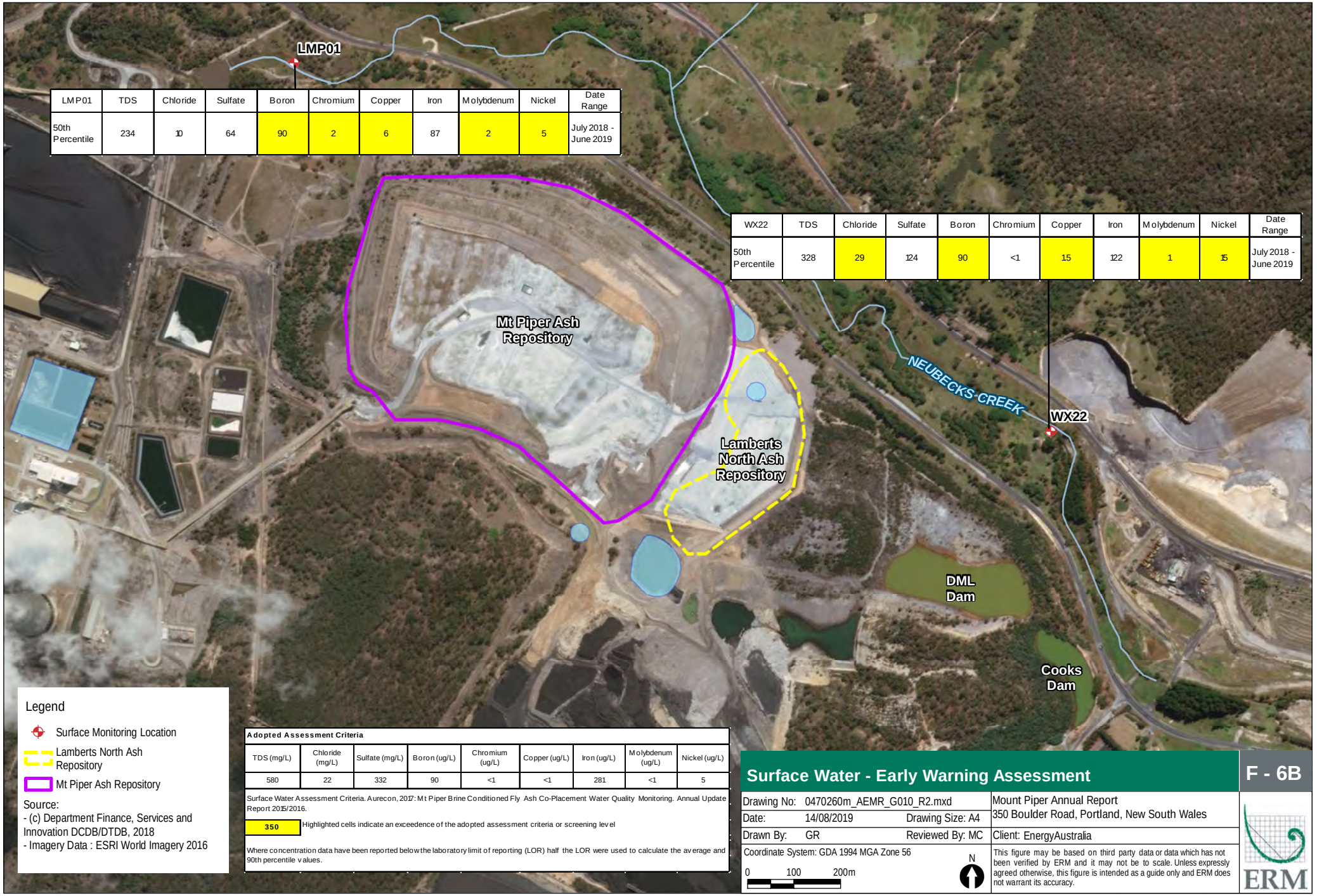
N

ERM



LMP01	TDS	Chloride	Sulfate	Boron	Chromium	Copper	Iron	Molybdenum	Nickel	Date Range
50th Percentile	234	10	64	90	2	6	87	2	5	July 2018 - June 2019

WX22	TDS	Chloride	Sulfate	Boron	Chromium	Copper	Iron	Molybdenum	Nickel	Date Range
50th Percentile	328	29	124	90	<1	15	122	1	15	July 2018 - June 2019

Legend

- Surface Monitoring Location
- Lamberts North Ash Repository
- Mt Piper Ash Repository

Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016

Adopted Assessment Criteria

TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (ug/L)	Chromium (ug/L)	Copper (ug/L)	Iron (ug/L)	Molybdenum (ug/L)	Nickel (ug/L)
580	22	332	90	<1	<1	281	<1	5

Surface Water Assessment Criteria. Aurecon, 2017: Mt Piper Brine Conditioned Fly Ash Co-Placement Water Quality Monitoring. Annual Update Report 2015/2016.

350 Highlighted cells indicate an exceedence of the adopted assessment criteria or screening level

Where concentration data have been reported below the laboratory limit of reporting (LOR) half the LOR were used to calculate the average and 90th percentile values.

Surface Water - Early Warning Assessment

F - 6B

Drawing No: 0470260m_AEMR_G010_R2.mxd
Date: 14/08/2019 Drawing Size: A4
Drawn By: GR Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
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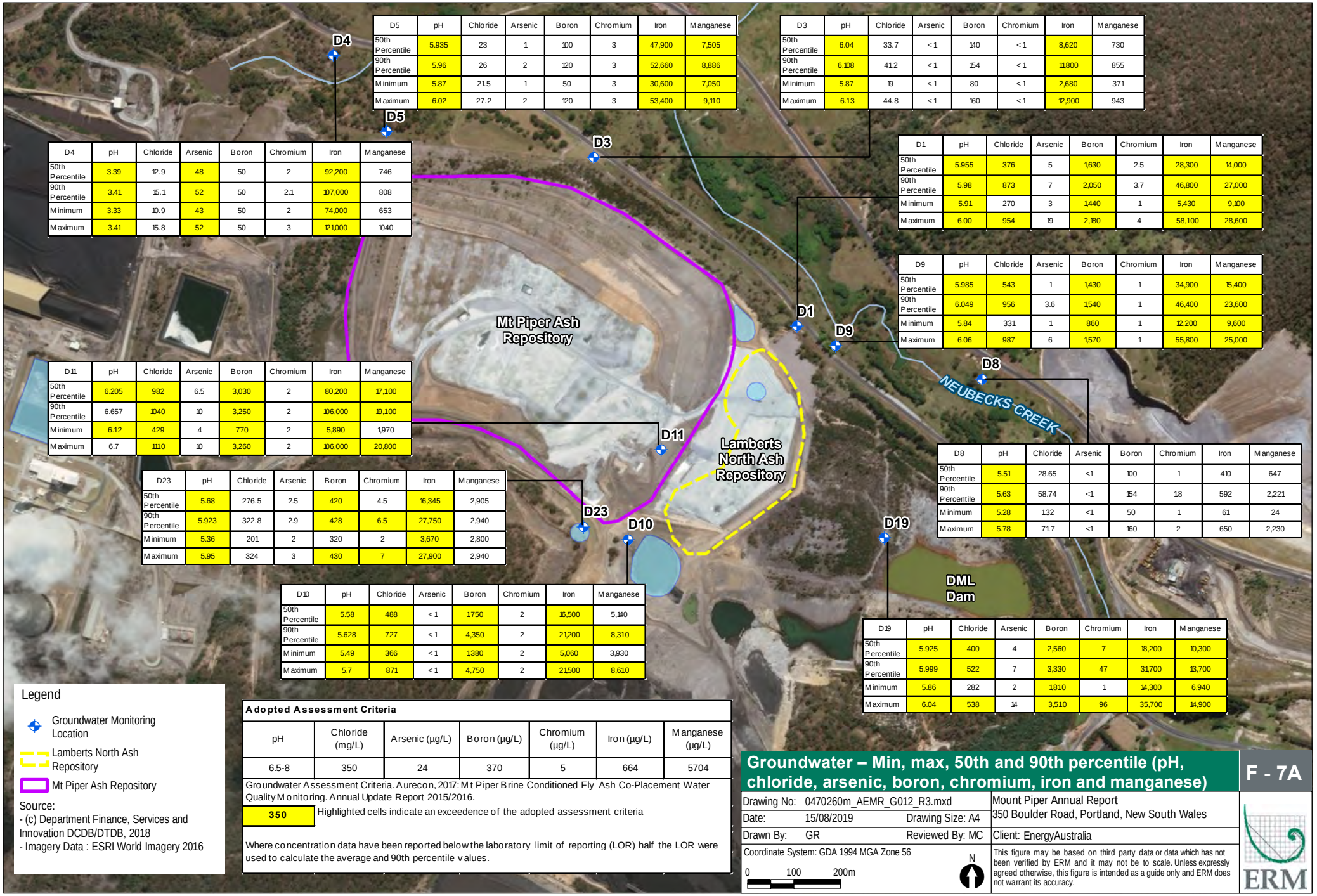
Mount Piper Annual Report
350 Boulder Road, Portland, New South Wales
Client: EnergyAustralia

ERM



D5	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.935	23	1	100	3	47,900	7,505
90th Percentile	5.96	26	2	120	3	52,660	8,886
Minimum	5.87	21.5	1	50	3	30,600	7,050
Maximum	6.02	27.2	2	120	3	53,400	9,110

D3	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	6.04	33.7	< 1	140	< 1	8,620	730
90th Percentile	6.108	41.2	< 1	154	< 1	11,800	855
Minimum	5.87	19	< 1	80	< 1	2,680	371
Maximum	6.13	44.8	< 1	160	< 1	12,900	943

D4	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	3.39	12.9	48	50	2	92,200	746
90th Percentile	3.41	15.1	52	50	2.1	107,000	808
Minimum	3.33	10.9	43	50	2	74,000	653
Maximum	3.41	15.8	52	50	3	121,000	1040

D1	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.955	376	5	1,630	2.5	28,300	14,000
90th Percentile	5.98	873	7	2,050	3.7	46,800	27,000
Minimum	5.91	270	3	1,440	1	5,430	9,100
Maximum	6.00	954	19	2,180	4	58,100	28,600

D9	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.985	543	1	1,430	1	34,900	15,400
90th Percentile	6.049	956	3.6	1,540	1	46,400	23,600
Minimum	5.84	331	1	860	1	12,200	9,600
Maximum	6.06	987	6	1,570	1	55,800	25,000

D11	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	6.205	982	6.5	3,030	2	80,200	17,100
90th Percentile	6.657	1040	10	3,250	2	106,000	19,100
Minimum	6.12	429	4	770	2	5,890	1,970
Maximum	6.7	1110	10	3,260	2	106,000	20,800

D8	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.51	28.65	<1	100	1	410	647
90th Percentile	5.63	58.74	<1	154	18	592	2,221
Minimum	5.28	1.32	<1	50	1	61	24
Maximum	5.78	71.7	<1	160	2	650	2,230

D23	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.68	276.5	2.5	420	4.5	16,345	2,905
90th Percentile	5.923	322.8	2.9	428	6.5	27,750	2,940
Minimum	5.36	201	2	320	2	3,670	2,800
Maximum	5.95	324	3	430	7	27,900	2,940

D10	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.58	488	< 1	1750	2	16,500	5,140
90th Percentile	5.628	727	< 1	4,350	2	21,200	8,310
Minimum	5.49	366	< 1	1,380	2	5,060	3,930
Maximum	5.7	871	< 1	4,750	2	21,500	8,610

D19	pH	Chloride	Arsenic	Boron	Chromium	Iron	Manganese
50th Percentile	5.925	400	4	2,560	7	18,200	10,300
90th Percentile	5.999	522	7	3,330	47	31,700	13,700
Minimum	5.86	282	2	1,810	1	14,300	6,940
Maximum	6.04	538	14	3,510	96	35,700	14,900

Legend

- Groundwater Monitoring Location
- Lamberts North Ash Repository
- Mt Piper Ash Repository

Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016

Adopted Assessment Criteria

pH	Chloride (mg/L)	Arsenic (µg/L)	Boron (µg/L)	Chromium (µg/L)	Iron (µg/L)	Manganese (µg/L)
6.5-8	350	24	370	5	664	5704

Groundwater Assessment Criteria. Aurecon, 2017: Mt Piper Brine Conditioned Fly Ash Co-Placement Water Quality Monitoring. Annual Update Report 2015/2016.

350 Highlighted cells indicate an exceedence of the adopted assessment criteria

Where concentration data have been reported below the laboratory limit of reporting (LOR) half the LOR were used to calculate the average and 90th percentile values.

Groundwater – Min, max, 50th and 90th percentile (pH, chloride, arsenic, boron, chromium, iron and manganese)

F - 7A

Drawing No: 0470260m_AEMR_G012_R3.mxd
Date: 15/08/2019 Drawing Size: A4
Drawn By: GR Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
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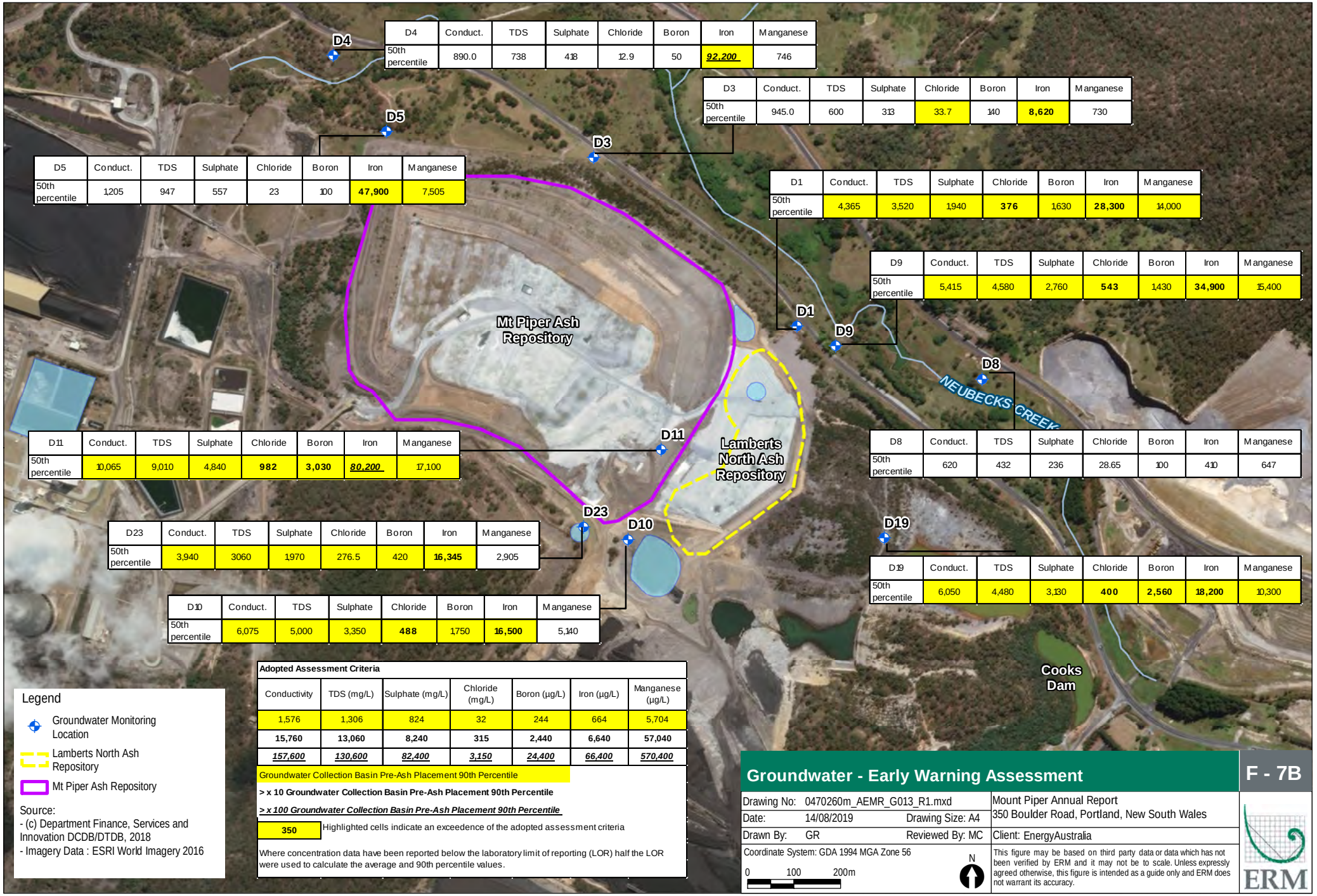
Mount Piper Annual Report
350 Boulder Road, Portland, New South Wales
Client: EnergyAustralia

ERM



D4	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	890.0	738	418	12.9	50	***92,200***	746

D3	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	945.0	600	313	33.7	140	**8,620**	730

D5	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	1205	947	557	23	100	**47,900**	7,505

D1	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	4,365	3,520	1940	**376**	1630	**28,300**	14,000

D9	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	5,415	4,580	2,760	**543**	1430	**34,900**	15,400

D11	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	10,065	9,010	4,840	**982**	**3,030**	***80,200***	17,100

D8	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	620	432	236	28.65	100	410	647

D23	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	3,940	3060	1,970	276.5	420	**16,345**	2,905

D19	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	6,050	4,480	3,130	**400**	**2,560**	**18,200**	10,300

D10	Conduct.	TDS	Sulphate	Chloride	Boron	Iron	Manganese
50th percentile	6,075	5,000	3,350	**488**	1750	**16,500**	5,140

Adopted Assessment Criteria

Conductivity	TDS (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Boron (µg/L)	Iron (µg/L)	Manganese (µg/L)
1,576	1,306	824	32	244	664	5,704
15,760	**13,060**	**8,240**	**315**	**2,440**	**6,640**	**57,040**
157,600	***130,600***	***82,400***	***3,150***	***24,400***	***66,400***	***570,400***

Groundwater Collection Basin Pre-Ash Placement 90th Percentile

> x 10 Groundwater Collection Basin Pre-Ash Placement 90th Percentile

> x 100 Groundwater Collection Basin Pre-Ash Placement 90th Percentile

350 Highlighted cells indicate an exceedence of the adopted assessment criteria

Where concentration data have been reported below the laboratory limit of reporting (LOR) half the LOR were used to calculate the average and 90th percentile values.

Legend

- Groundwater Monitoring Location
- Lamberts North Ash Repository
- Mt Piper Ash Repository

Source:
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016

Groundwater - Early Warning Assessment

F - 7B

Drawing No: 0470260m_AEMR_G013_R1.mxd
Date: 14/08/2019 Drawing Size: A4
Drawn By: GR Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56

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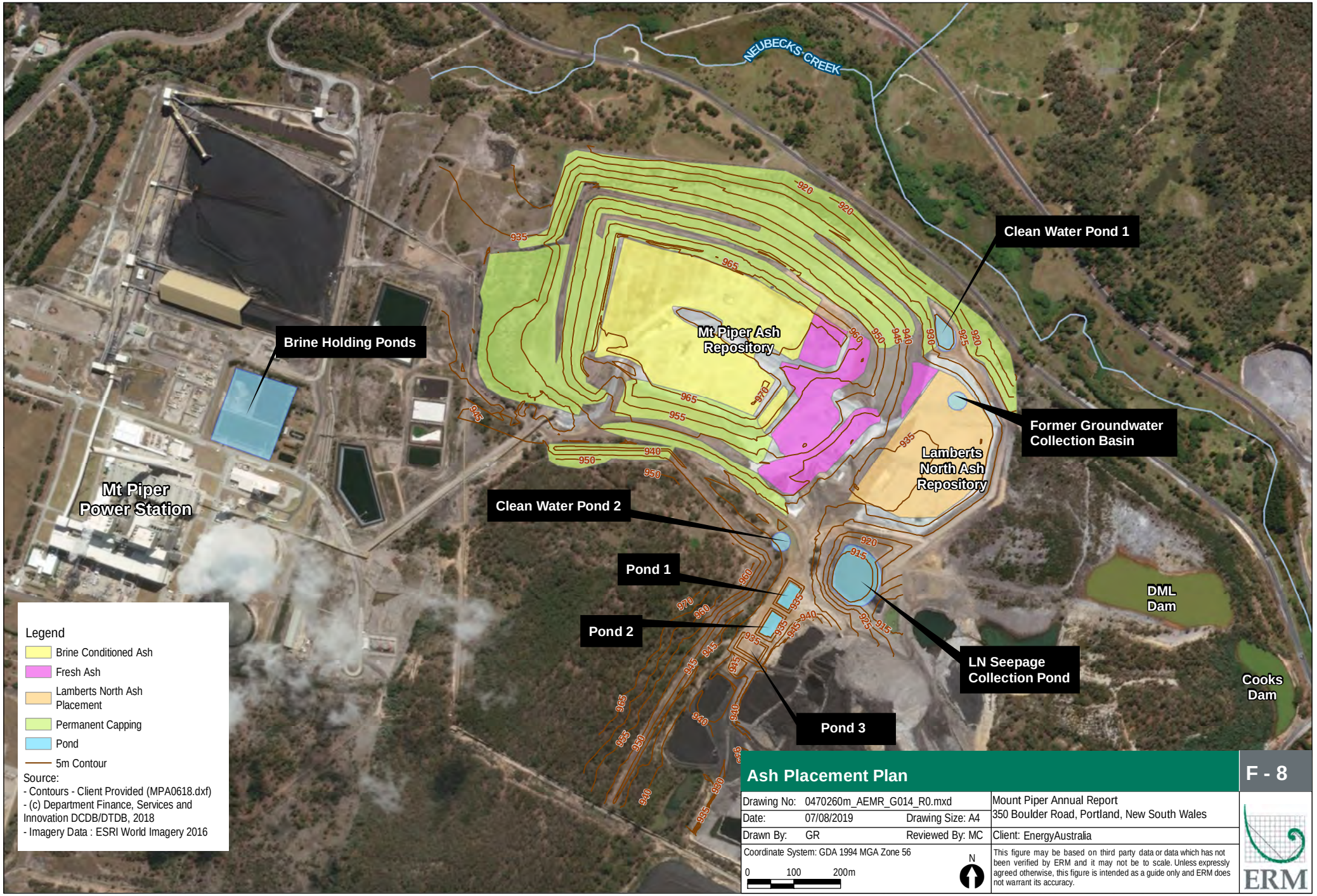
Mount Piper Annual Report
350 Boulder Road, Portland, New South Wales
Client: EnergyAustralia

ERM


NEUBECKS CREEK
Clean Water Pond 1
Brine Holding Ponds
Mt Piper Ash Repository
Former Groundwater Collection Basin
Lamberts North Ash Repository
Mt Piper Power Station
Clean Water Pond 2
Pond 1
Pond 2
Pond 3
LN Seepage Collection Pond
DML Dam
Cooks Dam
Legend
Brine Conditioned Ash
Fresh Ash
Lamberts North Ash Placement
Permanent Capping
Pond
5m Contour
Source:
- Contours - Client Provided (MPA0618.dxf)
- (c) Department Finance, Services and Innovation DCDB/DTDB, 2018
- Imagery Data : ESRI World Imagery 2016
Ash Placement Plan
F - 8
Drawing No: 0470260m_AEMR_G014_R0.mxd
Date: 07/08/2019
Drawing Size: A4
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Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
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Mount Piper Annual Report
350 Boulder Road, Portland, New South Wales
Client: EnergyAustralia
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Annex A

Statement of Limitations

STATEMENT OF LIMITATIONS

This report is based solely on the scope of work described in our proposal dated 25 June 2018 and reconfirmed via email on 11 July 2019 (**Scope of Work**) and performed by Environmental Resources Management Australia Pty Ltd (**ERM**) for EnergyAustralia NSW Pty Ltd (the **Client**). The Scope of Work was governed by a contract between ERM and the Client (**Contract**).

No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.

The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.

This report was prepared between 9 July 2019 and 17 August 2019 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.

Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.

This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:

- did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
- assumes no responsibility or liability for errors in data obtained from,
- the Client, any third parties or external sources (including regulatory agencies).

Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.

Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:

- the suitability of the site(s) for any purpose or the permissibility of any use;
- the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
- the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.

This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.

Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:

- has been prepared and is intended only for the exclusive use of the Client;
- must not to be relied upon or used by any other party;
- has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
- does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
- does not purport to provide, nor should be construed as, legal advice.

Annex B

Mt Piper Consents

DEPARTMENT OF ENVIRONMENT AND PLANNING

OF NEW SOUTH WALES

PROPOSED MT. PIPER POWER STATION

CONSENT TO A DEVELOPMENT APPLICATION REFERRED FOR DETERMINATION PURSUANT TO SECTION 101 OF THE ENVIRONMENTAL PLANNNG AND ASSESSMENT ACT, 1979.

APPLICANT'S NAME AND ADDRESS:

The Electricity Commission of New South Wales

(hereinafter called the "Applicant")

T. & G. Tower,

Park and Elizabeth Streets,

SYDNEY. N.S.W. 2000

(80-10060 Part 2)

Signed at Sydney this first day of April, 1982

Eric Bedford

Minister for Planning and Environment

Red type represents the 18 March 1991 modification (Mod 1)

Gold type represents the 21June 1996 modification (Mod 2)

Light blue type represents the 18 January 1999 modification (Mod 3 and Mod 4)

Purple type represents the 3 April 2000 modification (Mod 5)

Dark green type represents the 3 June 2006 modification (Mod 6)

Dark blue type represents the 23 March 2008 modification (Mod 7)

Pink type represents the 24 July 2019 modification (Mod 8)

DEFINITIONS

Applicant	EnergyAustralia Pty Ltd, or any person carrying out any development to which this consent applies
BCD	Biodiversity Conservation Division within the Department
Construction	All physical works to enable operation, including but not limited to, the carrying out of earthworks on site and the construction of solar panels and ancillary infrastructure (but excludes upgrades to the public roads required under this consent, geotechnical drilling and surveying).
Council	Lithgow City Council
Department	NSW Department of Planning, Industry and Environment
DPIE Water	Water Division within the Department
DRG	Division of Resources and Geoscience within the Department
EPA	NSW Environment Protection Authority
Minister	NSW Minister for Planning and Public Spaces (or delegate)
POEO Act	*Protection of the Environment Operations Act 1997*
Reasonable	Means applying judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The restoration of land disturbed by the development to a good condition to ensure it is safe, stable and non-polluting
RMS	NSW Roads and Maritime Services
Secretary	Planning Secretary under the EP&A Act, or nominee
Site	Mount Piper Power Station
the Act	*Environmental Planning and Assessment Act 1979*

WHEREAS:

(a) The Minister for Planning and Environment (hereinafter called "the Minister") gave a Direction in writing (hereinafter called "the Direction") in accordance with Section 101(I) of the *Environmental Planning and Assessment Act, 1979* (hereinafter called "the Act") dated 19 February, 1981, to the Council of the City of Greater Lithgow (hereinafter called the "Council") to refer to the Secretary of the Department for determination by the Minister any development application specified in the Direction;

(b) A development application (hereinafter called the “application") for the development of a power station to be known as Mt. Piper Power Station (hereinafter called the “proposed development") on land delineated by red edging on the plan annexed hereto and marked with the letter “A” (hereinafter called the “land”) and being an application to which the Direction applies was received by the Council from the applicant and referred to the Department in accordance with Section 101(2) of the Act; and

(c) The persons referred to in Section 101(3) of the Act have not required to be afforded the opportunity of a hearing as provided in Section 101(4) of the Act, before the Minister determines the application.

Now I, the Minister for Planning and Environment, in accordance with Section 101(6) of the Act, do hereby determine the application for the proposed development by granting consent to that application for the proposed development as described in the Environmental Impact Statement (hereinafter called the “Statement”) entitled “Mt. Piper Power Station Environmental Impact Statement”, dated August, 1980, and “Mt. Piper Power Station Environmental Impact

Statement Supplementary Information", dated August 1980, as modified by the works set out in figures 1 and 2 attached to this Notice of Amendment subject to the following conditions:

1. That the Applicant, prior to the commencement of construction of the proposed development or any subsequent modification, obtain from the Environment Protection Authority (EPA) all necessary statutory pollution control approvals and licences under the *Protection of the Environment Operations Act 1997, Waste Avoidance and Resource Recovery Act 2001* and/or any other Act as advised by the EPA.

2. That the applicant shall meet the reasonable requirements of all public authorities having statutory responsibilities in in respect of the construction and operation of the power station;

3. That the applicant shall prepare and submit to the Council, development applications supported by environmental impact statements (prepared in accordance with the Environmental Planning and Assessment Act and Regulations) in respect of any new coal mines required to provide fuel for the proposed development, and any other designated development associated with the project, prior to the letting of appropriate contracts for these developments;

4. That the applicant shall prepare and submit for the approval of the Commission plans of the proposed desalination plant, including the nature of the salt residues anticipated therefrom, together with evidence of the environmental acceptability of the proposals for the disposal of same;

5. That the applicant shall submit to the DRG a report setting out the reasons for the suitability of the Neubecks Creek site for the construction of the proposed ash disposal dam with particular reference to the stability of the structure, the alienation of mineable coal and the possibility of mining such coal prior to construction of the dam;

6. That the applicant shall inform the Department should it be decided not to construct the Neubecks Creek ash disposal dam and seeks its prior approval to the development of an alternative site which will include consideration of the question of possible sterilization of coal reserves;

7. That the applicant shall submit to the Commission results of site investigations and studies of existing ground water quality and ground water flows in the catchment of the proposed Neubecks Creek ash disposal dam, together with an assessment of the potential for any increase in acid drainage to the Cox's River from changes to ground water flow that may result from the construction and operation of the dam;

8. That the applicant shall prepare and implement a monitoring programme to the satisfaction of the Commission relative to the quantity and quality of the Neubecks Creek ash disposal dam discharge water and of waters in Neubecks Creek downstream of the power station and make any arrangements required by the Commission to alleviate any significant adverse effects should they arise;

9. That the applicant shall submit to the Commission the results of studies into the pyritic content of its initial coal resources, and of the acid generating potential of run-off from its proposed coal stockpiles for the proposed development;

10. That the applicant shall, prior to commencement of construction of the proposed development, prepare and submit to the Commission comprehensive plans of work necessary, and proposed policies for the controlling of those works for the management of water flowing from the site to watercourses during the period of construction of the proposed development;

11. That the applicant shall prepare and submit to the Commission proposals environmentally acceptable to the Commission for the disposal of any carbonaceous material encountered during the preparation of the power station site;

12. That the applicant shall submit to the Department and to the Commission a report on the current status of the construction and operation of the existing developments known as the Wallerawang Reservoir and the Lilyvale Reservoir, and on action taken and proposed, having regard to the Commission's conditions of approval to the applicant's water supply scheme for its existing development known as Wallerawang Unit 8 and other power station needs;

13. That the applicant shall implement a monitoring programme to the satisfaction of the Commission, of the meteorology in respect of the land the subject of the proposed development;

14. That the applicant shall implement a monitoring programme, to the satisfaction of the Commission, relative to the ground-level concentrations of sulphur dioxide, nitrogen oxide and suspended dust resulting from the operations of the proposed development and the applicant's existing development known as Wallerawang Power Station. Such monitoring programme shall be commenced at least one year before the commissioning of the proposed development;

15. That the applicant shall prepare and implement to the satisfaction of the Commission, a monitoring programme relative to the sulphur dioxide content of the flue gas and opacity of the stack emissions;

16. That the applicant shall, to the satisfaction of the Commission, carry out an appropriate study programme into the meteorology of the area the subject of the proposed development to assist in the final determination of the stack height;

17. That the applicant shall carry out, to the satisfaction of the Commission, wind tunnel tests modelling buildings; cooling towers and terrain to assist in final determination of the stack height;

18. That the applicant shall prepare and implement, to the satisfaction of the Commission, relative to air particulate concentrations consequent to the coal stockpile and make suitable arrangements to alleviate any significant adverse effects should they arise;

19. That the applicant shall, prior to any site works being carried out, submit to DRG, its proposals for the restoration and rehabilitation of any coal mining operations on the lands the subject of the proposed development which mines are the responsibility of the applicant;

20. That the applicant shall undertake to preserve vegetation on the escarpment to the south of the lands the subject of the proposed development and on the rocky outcrops and canyons in the north of the proposed Neubecks Creek ash disposal area;

21. That the applicant shall, prior to any site works being carried out, submit to the National Parks and Wildlife Service, the archaeological, flora and fauna reports referred to in the Statement. Further, the applicant shall consider, in conjunction with the Blue Circle Southern Cement Company, implementing any reasonable advice that that Service may provide;

22. That the applicant shall obtain the approval of RMS to proposals for;
    (a) intersections of the power station access road and Boulder Road;
    (b) crossings for water supply;
    (c) furnace and fly ash disposal pipelines; and
    (d) cool conveyor crossing with Trunk Road No.55;

23. That the applicant shall negotiate with the Council and any other public authority having an interest in the proposed development with a view to meeting any reasonable requirements relative to the proposed development, and shall refer any disputed matters to the Department before determining them. In particular, the applicant shall meet the requirements of the Council as set out in Appendix 2 of the Department's Environmental Impact Assessment Report dated March, 1981, except for those matters involving the provision of on appropriate monetary contribution from the applicant which shall be the subject of negotiations between the Council and the applicant and which shall take into account the value of relevant preinvestment by the applicant;

24. That the applicant shall co-operate with the Inter-Departmental Committee formed to oversight the social impact studies relevant to Local Environmental Studies and to Local Environmental Plans for Greater Lithgow and which will include a review of the social impacts of development proposals in the Lithgow area;

25. That the applicant shall report to the Department, as soon as it is able, to confirm the accommodation, infrastructure and transport requirements of personnel engaged in the construction and operation of the power station in order that appropriate action can be taken to plan and provide for all necessary facilities required;

26. That the applicant shall provide evidence to the Department that the location of the buildings of the proposed development and associated facilities will not without good reason alienate part of the coal reserves of Clutha Development Pty. Ltd. and that it has satisfied all reasonable claims of the Company in that regard;

27. That the granting of this consent to the proposed development shall not relieve the applicant from any future condition or contribution which may be required by the Council in respect of any of the following:
    (a) the development of coal mines by the applicant for the purposes of or in association with the generation of electricity at the proposed development;
    (b) an expansion of the proposed development; or
    (c) any other development by the applicant;

28. That the applicant shall:
    a) forthwith, take all necessary steps to effect the expeditious transfer to the Council of:

    (i) all those pieces or parcels of land situate at Wallerawang in the City of Greater Lithgow, Parish of Lidsdale and County of Cook, being part of Lot 2, in Deposited Plan 618280, as delineated by red edging on the plan annexed hereto and marked with the letter "B", being part of the estate known as the "Barton Estate", and having on area of 67. 38 hectares or thereabouts, and being known as the "Wallerawang East Site"; and

    (ii) all those pieces or parcels of land situate at Wallerawang in the City of greater Lithgow, Parish of Lidsdale and County of Cook, being part of Lot 2, in Deposited Plan 618280, as delineated by red and yellow edging on the plan referred to in (i) above and having an area of 124.4 hectares or thereabouts, and being known as the Wallerawang South site; and

    (b) upon the transfer to it by the Council of all those pieces or parcels of land situate at Wallerawang in the City of Greater Lithgow, Parish of Lidsdale, and County of Cook, being the land shown in Deposited Plan 443235 (but excluding thereout right of easements for electricity transmission line resumed by Government Gazette of 6th March, 1959 , Folio 665), as delineated by orange edging on the plan referred to in (i) above and having an area of 4.279 hectares, or thereabouts, and described as the "Heel Street Site", make that site available to the Council

    Provided that the transactions referred to in (a)(i), (ii), and (b) above shall be in accordance with the terms and conditions agreed to between the applicant and the Council as set forth in letters dated 20th October, 1981, and 5th November, 1981, respectively, copies of which are annexed hereto and marked with the letters "C" and "D" respectively;

29. That the applicant shall, to the Council's satisfaction, provide access roads, parking areas, landscaping, and boat ramps at the Wallerawang Dam generally in accordance with the Council's Development Plan, a copy of which is annexed hereto and marked with the letter "E".

    Provided that the applicant shall use its best endeavours to complete such works and facilities in order that they may be available for use not later than 1st December, 1982, or such further time as the Council may agree.

30. That the applicant shall, upon the preparation and adoption by the Council of a Development Plan for the Lilyvale Dam Foreshores, negotiate with the Council the carrying out of works in accordance with the Development Plan, as required by the Council;

31. That the applicant shall carry out to the satisfaction of the Council all necessary works to effect the upgrading of the Boulder Rood from its intersection with the Mudgee Road to the point of deviation of preferred route for the crossing of the Wallerawang-Gwabegar Railway line;

32. That the applicant shall contribute the sum of $350,000.00 towards the upgrading of the Wallerawang-Gwabegar Railway line crossing and the extension of such upgrading from that crossing to the intersection of Wallerawang Road and Cullen Street, Portland. Such money to be advanced to match the Council's design and construction programme in respect of all works west of the north-eastern extremity of Portland;

33. Temporary Brine Waste Disposal – The applicant shall construct the temporary brine waste disposal facilities in conformity with the environmental protection measures and

general specifications set out in Section 2 of the "Supporting Environmental Information Document" accompanying the application.

34. Deleted

35. The storage capacity of the brine storage ponds shall not be exceeded at any time. Brine reduction initiatives and monitoring of the brine production rate and remaining storage capacity must be undertaken as appropriate to ensure this condition is met.

36. The applicant shall forward a summary progress report and field test results of the long term brine management investigation to the Catchment Services Unit of Sydney Water Corporation annually prior to finalisation of the long term brine management solution.

37. Deleted

38. The Applicant shall carry out modifications to the development generally in accordance with the Statement of Environmental Effects (SEE) dated August 1999, prepared by Environmental Services, Pacific Power International for Delta Electricity, and as modified by the following conditions. Any alteration, variation or extension of the development shall require the further consent of the Secretary.

EXTENSION OF THE EXISTING BRINE AND ASH CO-PLACEMENT AREA

38 A Notwithstanding the provisions of Condition No. 38, the brine and ash co-placement area may be extended and shall be undertaken generally in accordance with the *Statement of Environmental Effects: Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area*, prepared by Connell Wagner Pty Ltd and dated June 2007. This includes:

(i) The extended area must lie within the existing ash placement area;

(ii) Co-placement activities in the proposed extended area must use existing facilities and methods;

(iii) The placement of brine conditioned ash may only occur between the levels of RL 946 metres (the end-point of the water conditioned ash layer) and RL 980 metres.

38 B The groundwater and surface water monitoring programs required by Condition No. 40 and 41 apply to the extension of the brine and ash co-placement area, permitted by Condition 38 A.

38 C The Applicant must update the Water Management Plan (WMP) required by Condition No. 43, and obtain the approval of the Secretary for the update, prior to undertaking any works permitted by Condition No. 38 A. In determining whether to grant approval, the Secretary must consult with the BCD, WaterNSW, DPIE Water, and Council.

38 D The spray irrigation system of the ash disposal area must be automated to operate when conditions indicate the potential for dust movement to occur, with a manual override function, in order to reduce the likelihood of non-compliant dust emissions from the ash placement area. The implementation of the automated system must occur no later than 30 June 2008 or as otherwise agreed by the Secretary.

39. The Applicant shall, prior to the first placement of brine-conditioned flyash, apply to the EPA for a modification to the EPA licence for the Site. The licence modification shall address conditions for the continued on-site storage of brine, the placement of brine-conditioned flyash, and any reasonable requirements of the EPA.

WATER MONITORING PROGRAMS

40. The Applicant shall, at least one month prior to the first placement of brine-conditioned flyash, consult with the EPA, DPIE Water and WaterNSW to establish the requirements for Water Monitoring Programs for groundwater and surface water. The Water Monitoring Programs shall:

    (i) be based on the monitoring programs presented in the Statement of Environmental Effects for this modification;

    (ii) include water quality testing at a minimum frequency of every three months;

    (iii) be at the expense of the Applicant.

41. The Applicant shall expand the groundwater and surface water monitoring programs, including, if so required, the establishment of additional groundwater monitoring bores and surface water sampling points, in accordance with any reasonable requirements of the EPA, DPIE Water or WaterNSW.

42. The Applicant shall, prior to the construction or operation of any monitoring bore on or in the vicinity of the development, consult with DPIE Water regarding the licensing of any bore on or in the vicinity of the development, under the provisions of the *Water Act 1912* or *Water Management Act 2000*.

WATER MANAGEMENT PLAN

43. At least one month prior to the placement of brine-conditioned flyash, or within such further period as the Secretary may agree, the Applicant shall prepare and submit for the approval of the EPA, WaterNSW, DPIE Water, Council, and the Secretary, a Water Management Plan (WMP) which shall include, but not be limited to:

    (a) Details of the monitoring programs for surface water and groundwater required under conditions 40 and 41.

    (b) Details of measures to be employed to control surface water run-off from the site.

    (c) Contingency plans for the mitigation of environmental impacts should run-off or leachate from the site be found to be negatively impacting on natural surface water or groundwater.

    (d) Brine management objectives and strategies, with specific reference to measures aimed at reducing the volume of brine produced at the Mount Piper Power Station.

43A. The Applicant must update the Water Management Plan required by Condition 43 to the satisfaction of the Secretary, prior to commissioning the storage pond associated with Modification 8.

The Applicant must implement the approved Water Management Plan.

ENVIRONMENTAL MONITORING REPORT

44. The Applicant shall provide to the Secretary, EPA, DPIE Water, WaterNSW and Council, an Environmental Monitoring Report (EMR) on a yearly basis, with the first EMR to be submitted no later than six months after the first placement of brine-conditioned flyash on-site. The Applicant shall agree to Council making the Environmental Monitoring Reports available on request for public inspection.

45. The Environmental Monitoring Report shall include, but not be limited to:

    (a) a summary and discussion of all available results and analyses from Water Monitoring Programs;
    (b) a discussion of the aims of the Water Management Plan and to what degree these aims have been attained in the context of results and analyses of the Water Monitoring Programs;
    (c) actions taken, or intended to be taken, if any, to mitigate any adverse environmental impacts; and to meet the reasonable requirements of the Secretary, EPA, DPIE Water, WaterNSW or Council.

GROUNDWATER MODELLING

46. The Secretary, EPA, DPIE Water, WaterNSW or Council may, based on the results and analyses presented in the Environmental Monitoring Report, or any other information that may be reasonably interpreted as indicating significant impacts on the groundwater quality in the vicinity of the Site as a result of the placement of brine-conditioned flyash, request the preparation of a Groundwater Modelling Report.

47. The Groundwater Modelling Report shall be an update of the groundwater modelling presented in the Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area - Statement of Environmental Effects (dated June 2007). The report must also employ the results and analyses of the Water Monitoring Programs to calibrate the groundwater contaminant transport model. The Groundwater Modelling Report shall be prepared by a qualified person approved by the Secretary or relevant Authority.

48. The Applicant shall comply with any reasonable requirement of the Secretary, DPIE Water, EPA, WaterNSW or Council with regard to the content or scope of the Groundwater Modelling Report, or actions to be taken in response to the results of the report.

49. This approval does not relieve the applicant of the obligation to obtain any other approval required under the *Local Government Act, 1919*, as amended, or the Ordinances (including approval of building plans) or any other Act.

50. The Applicant is permitted to upgrade and expand the development in two stages:
    (a) stage 1 being the operation of the development at a capacity factor of up to 90%, to generate up to a nominal capacity of 1400 megawatts; and
    (b) stage 2 being the implementation of equipment upgrade works or replacements to provide a nominal capacity of 1500 megawatts when operating at a capacity factor of up to 90%.

51. Expansion and upgrade of the development, as defined under condition 50 of this consent shall be undertaken generally in accordance with *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005.

AIR QUALITY IMPACTS

52. The Applicant shall design, construct, commission, operate and maintain the expanded and upgraded development to ensure that the concentration of each pollutant listed in Table 1 does not exceed the maximum allowable discharge concentration for that pollutant when measured at discharge monitoring point 2 and 3 (as defined under the Environment Protection Licence (No. 13007) for the site). For the purpose of monitoring and determining compliance with this condition, "dioxins and furans" shall be polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), presented as 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) equivalent and calculated in accordance with the procedures included in Part 4, clause 29 of the *Protection of the Environment Operations (Clean Air) Regulation 2002*.

Table 1 – Maximum Allowable Discharge Concentration Limits (Air)

Pollutant	Maximum Allowable Discharge Concentration Limit	Reference Conditions
Nitrogen dioxide (NO_x) or nitric oxide (NO) or both	1500 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Sulfuric acid mist (H_2SO_4) or sulfur trioxide (SO_3), or both, as (SO_3)	100 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Solid particles	50 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Total fluoride	50 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Chlorine	200 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Hydrogen chloride	100 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Total of Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn and V	1 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Cadmium	0.2 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Mercury	0.2 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Dioxins and furans	0.1 ngm^{-3}	I-TEQ, dry, 273K, 101.3 kPa, 11% O_2
Total volatile organic compounds	40 mgm^{-3} (as VOC) or 125 mgm^{-3} (as CO)	dry, 273K, 101.3 kPa, 7% O_2

53. The Applicant shall determine the pollutant concentrations and emission parameters specified in Table 2 below, at discharge monitoring points 2 and 3 (as defined under the Environment Protection Licence (No. 13007) for the site), and employing the sampling and analysis method specified. Monitoring shall be undertaken at the frequency specified in the Table.

Table 2 –Pollutant and Parameter Monitoring (Air)

Pollutant/ Parameter	Units of Measure	Frequency	Method
Nitrogen oxides	gm^{-3}	continuously	CEM-2
Sulfur dioxide	mgm^{-3}		CEM-2
Solid particles	mgm^{-3}		TM-15

Sulfuric acid mist and sulfur trioxide (as SO_3)	mgm^{-3}	quarterly during the first 12 months following commissioning of Stage 1 and Stage 2, then annually or as otherwise specified by Environment Protection Licence conditions thereafter	TM-3
Chlorine	mgm^{-3}		TM-7 & TM-8
Total fluoride	mgm^{-3}		TM-9
Hydrogen chloride	mgm^{-3}		TM-7 & TM-8
Total of Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn and V	mgm^{-3}		TM-12, TM-13 & TM-14
Cadmium	mgm^{-3}		
Mercury	mgm^{-3}		TM-12, TM-13 & TM-14
Copper	mgm^{-3}		TM-12, TM-13 & TM-14
Dioxins and furans	ngm^{-3}		TM-18
Carbon dioxide	%		TM-24
Oxygen	%		CEM-3
Dry gas density	kgm^{-3}		TM-23
Moisture content	%		TM-22
Molecular weight of stack gases	$gmol^{-1}$		TM-23
Temperature	^oC		TM-2
Velocity	ms^{-1}		TM-2
Volumetric flowrate	m^3s^{-1}		TM-2

54. Notwithstanding conditions 52 and 53, nothing in this consent relieves the Applicant from the requirement to comply with the Environment Protection Licence for the site issued under the *Protection of the Environment Operations Act 1997*. In the event that the Environment Protection Licence for the site is modified from time to time to be inconsistent with or more stringent than the requirements of this consent, the requirements of the Licence shall prevail over this consent to the extent of any such inconsistency.

AIR QUALITY PERFORMANCE VERIFICATION

55. Within 90 days of commissioning Stage 2 of the expanded and upgraded development, or as may be directed by the Secretary, and during a period in which the upgraded and expanded development is operating under design loads and normal operating conditions, the Applicant shall undertake a program to confirm the air emission performance of the development and update air quality modelling. The program shall include, but not necessarily be limited to:
    (a) point source emission sampling and analysis subject to the requirements listed under condition 54;
    (b) an update of the air quality impact assessment presented in *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005, using actual air emission data collected under a). The assessment shall be undertaken strictly in accordance with the methods outlined in *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) and to meet the requirements of the EPA with respect to updating the air quality impact assessment;
    (c) a comparison of the results of the air quality impact assessment required under b) above, and the predicted air quality impacts detailed in *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005; and
    (d) a comparison of the results of the air quality impact assessment required under b) above, and the impact assessment criteria detailed in *Approved Methods and*

Guidance for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2005).

A report providing the results of the program shall be submitted to the Secretary and the EPA with 28 days of completion of the testing required under a).

CONSTRUCTION ENVIRONMENTAL MANAGEMENT

56. Prior to the commencement of construction of each Stage of the expanded and upgraded development, the Applicant shall prepare and implement a Construction Environmental Management Protocol to outline environmental management practices and procedures to be followed during the construction of the development. The Protocol(s) shall be prepared in accordance with *Guideline for the Preparation of Environmental Management Plans* (DIPNR 2004) and shall focus on the management of erosion and sedimentation, dust, heavy vehicle movements and noise during the construction works.

57. Prior to the commencement of construction associated with Modification 8, the Applicant must prepare and implement a Construction Environmental Management Plan (CEMP) to the satisfaction of the Secretary. The CEMP must be prepared in accordance with the *Guideline for the Preparation of Environmental Management Plans* (DIPNR 2004) to outline environmental management practices and procedures to be followed during construction, including:
    (a) erosion and sediment controls;
    (b) an unexpected finds protocol for contamination;
    (c) noise management measures;
    (d) air quality management measures; and
    (e) traffic and access management measures.

    The Applicant must implement the approved CEMP.

Department of Primary Industries
Office of Water

Statement of Approval

as at 28 February 2014

issued under *Water Management Act 2000*.

Approval Number	10CA117220
Approval Holder (See note 1)	EnergyAustralia NSW Pty Ltd ABN: 67 139 819 642
Contact Details	
Name	EnergyAustralia NSW Pty Ltd
Customer ID	1139922
Contact Address	EnergyAustralia NSW Pty Ltd Locked Bag 1 Portland NSW 2847
Approval Details	
Status (See note 2)	Current
Water Source	Upper Nepean and Upstream Warragamba Water Source (hereafter described as 'this water source')
Water Management Area	Wywandy
Kind of Approval	Water Supply Work and Water Use
Date of Commencement of Conditions	1 July 2011
Expiry Date	30 June 2031
Authorised Water Supply Works	This approval is for the authorised water supply works described in Schedule 1
Authorised Water Use	Power Generation as described in Schedule 1
Conditions	This approval is subject to the conditions set out in Schedule 1
Dictionary	Schedule 2

Notes

1. Pursuant to section 106 of the *Water Management Act 2000*, an approval is taken to be held by, and for the benefit of, each successive landholder for the time being of the land specified in the approval as the land benefited by the approval. Pursuant to section 106 (3) of the *Water Management Act 2000*, a major utility is taken to be a landholder of land in respect of which a water management work approval held by it is in force.
2. The status of an approval may change. An approval may be "current", in addition an approval is no longer in force if it has "expired", been "surrendered", "suspended" or "cancelled".
3. During periods of severe water shortages, the Minister may suspend part or all of the provisions of a management plan under section 49A of the *Water Management Act 2000*. Whilst an order under s49A is in force, depending on the terms of the order, the mandatory conditions applying to this approval may be affected. The Approval Holder must comply with any notification issued by the Minister under section 60 of the *Water Management Act 2000.*
4. See Dictionary in Schedule 2 to interpret words and expressions used in this approval.
5. A requirement to notify the Minister in writing or to provide information or data to the Minister, under this approval, is satisfied by making the notification or providing the information or data in writing to the administrative contact detailed on this Statement.

NOTICE OF CHANGE OF HOLDER OR CONTACT

1. The NSW Office of Water is to be advised of any change of Approval Holder. This will occur whenever there is a change of ownership of works shown in this approval. The advice should be accompanied by evidence of transfer of ownership of the works.
2. If the Approval Holder wishes to nominate a new contact person a written statement signed by the holder should be submitted to the NSW Office of Water.
3. The contact person should advise the NSW Office of Water of any change of mailing address as soon as possible.

Administrative contact details All correspondence and notifications in relation to compliance with the conditions of this approval must be addressed to:	Manager Water Regulation Hunter/ Sydney/ South Coast NSW Office of Water PO Box 3720 PARRAMATTA NSW 2124

Schedule 1 – Conditions

INTRODUCTION

Under section 100 (1) (a) of the *Water Management Act 2000* this approval is subject to such conditions as are from time to time required to be imposed on the approval by the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 (hereinafter referred to as the Water Sharing Plan). Under section 102 (1) of the *Water Management Act 2000* this approval is also subject to such other conditions as the Minister may impose on the approval after it has been granted, including conditions relating to the protection of the environment.

The Operating Protocol referenced in this approval is a set of agreed documents between the Approval Holder and the Minister. The Operating Protocol takes into account the complex nature of operations and procedures that the Approval Holder needs to undertake to implement the requirements of this approval. The Operating Protocol is subordinate to the approval and does not constitute a regulatory instrument.

AUTHORISED WATER SUPPLY WORKS

1. The Approval Holder is authorised to construct and use the water supply works listed below and further described in Attachment 1 of this Schedule ('the authorised water supply works') to capture, store, extract, use and release water in accordance with the Water Sharing Plan or any direction from the Minister.

    - Lilyvale Dam (Lake Lyell)
    - Wallerawang Dam (Lake Wallace)
    - Thompsons Creek Dam (Thompsons Creek Reservoir)
    - Sawyers Swamp Creek Ash Dam

    Note 1: Under section 90 (2) of the *Water Management Act 2000* the term 'construct' is defined to include install, maintain, repair, alter or extend the work.

2. The use and operation of the authorised water supply works are subject to the conditions of this approval.

3. Notwithstanding condition one (1) of this approval, the Approval Holder is not authorised to do anything to the authorised water supply works which would change the capacity of the works as described in Attachment 1 of this Schedule to affect the flow, volume, quality and behaviour of the water, without the written approval of the Minister.

    Note 1: To amend an approval the process in section 107 of the *Water Management Act 2000* must be followed.

4. The Approval Holder must not use the authorised water supply works to take water under an access licence unless in compliance with the access rules for the taking of water as specified in the relevant access licence conditions.

5. Subject to the conditions of this approval, the Approval Holder is authorised to use water for the purpose of Power Generation.

6. The Approval Holder must not take any water using any work authorised by this approval if the water allocation account of the access licence under which the water is to be taken, is or will go into debit.

ENVIRONMENTAL MANAGEMENT

Environmental Flow Releases from Lilyvale Dam (Lake Lyell) when Storages are greater than or equal to 50,000 megalitres

7. Notwithstanding conditions nine (9) and fourteen (14) of this approval, the Approval Holder must ensure, when the daily inflows into Lake Lyell are less than or equal to 13.6 ML/day, that the daily release of water which is equal to the daily inflows is made from Lilyvale Dam.

   Note 1: The release requirements may be temporarily altered under circumstances described in the Operating Protocol.

8. Notwithstanding conditions nine (9) and fourteen (14) of this approval, the Approval Holder must ensure, when the daily inflows into Lake Lyell are greater than 13.6 ML/day, that a daily release of water which is equal to 13.6 ML/day plus twenty five percent of the daily inflow volume above 13.6 ML/day is made from Lilyvale Dam.

   Note 1: Note 1 from condition seven (7) of this approval applies.

Environmental Flow Releases from Lilyvale Dam (Lake Lyell) when Storages are less than 50,000 megalitres

9. The Approval Holder is not required to make releases under conditions seven (7), eight (8) and thirteen (13) of this approval when the total active storage in Lake Lyell, Lake Wallace and Thompson Creek Reservoir is less than 50,000 megalitres.

10. The Approval Holder must ensure, when the total active storage in Lake Lyell, Lake Wallace and Thompsons Creek Reservoir has been less than 50,000 megalitres continuously for less than six months, that a daily release of water is made which is equal to the lesser of daily inflows to Lake Lyell and 9 ML/day.

    Note 1: Note 1 from condition seven (7) of this approval applies.

11. The Approval Holder must ensure, when the total active storage in Lake Lyell, Lake Wallace and Thompsons Creek Reservoir has been less than 50,000 megalitres continuously for six months or more, that a daily release of water is made which is equal to the lesser of daily inflows to Lake Lyell and 5 ML/day.

    Note 1: Note 1 from condition seven (7) of this approval applies.

12. The Approval Holder must notify the Minister before the total active storage in Lake Lyell, Lake Wallace and Thompsons Creek Reservoir either falls below or rises above 50,000 megalitres. The Approval Holder must provide a statement of its use of water allocated from the Fish River Water Supply Scheme, including the following:

    a) minimum annual quantity allocated that water year;
    b) amount of water used from the allocation to that time; and
    c) any demand management restrictions that apply at the time under the scheme.

Annual Channel Maintenance Flow Releases from Lilyvale Dam (Lake Lyell)

13. Notwithstanding condition nine (9) of this approval, if in any water year a flow of 800 ML/day or more has not occurred for a period of at least one hour at the Coxs River at Lithgow, Gauging Station Number 212011, the Approval Holder must release an annual channel maintenance flow which is equal to the lesser of:

    a) a release rate of 800 ML/day; or
    b) the maximum released rate obtainable from the outlet valves when fully open;

    for a period of two hours continuously from Lake Lyell in accordance with procedures and a timeframe determined in writing by the Minister.

    Note 1: The release must be stepped up and down to mimic the trigger event hydrograph as per the procedures described in the operating protocol.

14. The Approval Holder is not required to make releases under conditions seven (7) and eight (8) of this approval when an annual channel maintenance flow release is being made in accordance with condition thirteen (13) of this approval.

Methods to Determine Inflows and Releases from Lilyvale Dam (Lake Lyell)

15. For the purposes of conditions seven (7) to fourteen (14) of this approval, the Approval Holder must calculate the volume of water released by a method approved in writing by the Minister taking into account flows measured at the Coxs River at Lithgow, Gauging Station Number 212011, or such alternative flow reference points as determined in writing by the Minister.

16. For the purposes of conditions seven (7) to fourteen (14) of this approval, the Approval Holder must calculate daily inflows into Lake Lyell by a method approved in writing by the Minister taking into account:

    a) flows measured at the Coxs River at upstream of Lake Lyell, Gauging Station Number 212058) and Farmers Creek at Mount Walker, Gauging Station Number 212042), or such alternative flow reference points as determined in writing by the Minister; or
    b) changes in water storage levels, net evaporation, other losses and outflows.

Environmental Flow Releases from Lake Wallace

17. The Approval Holder must ensure a daily release of water is made from Lake Wallace which is equal to or greater than 0.7 ML/day. This release requirement may also be met by water released below the Lake Wallace dam wall from the Wallerawang Power Station cooling towers.

Environmental Flow Releases from Thompsons Creek Reservoir

18. The Approval Holder must ensure a daily release of water is made from Thompsons Creek Reservoir in accordance with the following:

    a) between 1 September and 30 April inclusive, a daily release of water must be made which is equal to or greater than 0.8 ML/day;
    b) between 1 May and 31 August inclusive, a daily release of water must be made which is equal to or greater than 0.3 ML/day; and

c) the volume of water released must be calculated by a method approved in writing by the Minister taking into account flows measured at the v notch weirs at Thompson Creek Reservoir, or such alternative flow reference points as determined in writing by the Minister.

Environmental Flow Releases from Spilling Storages

19. The Approval Holder is not required to make daily releases of water under conditions seven (7) to eighteen (18) of this approval when the storage is spilling at a rate that equals or exceeds the release requirement.

Banked Environmental Flow Rules for Lilyvale Dam

20. The Approval Holder must create and manage a banked environmental flow account for Lilyvale Dam.

21. The Approval Holder must ensure that the difference between the recorded release and the required release is set aside in Lilyvale Dam and credited to the banked environmental flow account in accordance with the requirements of the Minister, where releases have been altered or were not required for the following reasons:

    a) the release requirements cannot be met due to an emergency situation and the Approval Holder notifies the Minister in writing within seven (7) days of becoming aware of the emergency;
    b) the Minister is satisfied that the release requirements cannot be met due to water supply work capacity constraints or necessary maintenance, refurbishment or modification work that has the potential to temporarily affect the flow rate or behaviour of water for a period of more than twenty four (24) hours and has granted permission in writing; or
    c) the Minister requires an alternate release to be made due to an emergency situation or a maintenance activity and has notified this in writing.

    Note 1: The circumstances referred to in condition twenty one (21) of this approval are further outlined in the Operating Protocol.

22. The Approval Holder must ensure that water required to be credited to the banked environmental flow account under condition twenty one (21) of this approval is released from Lilyvale Dam in accordance with any written direction from the Minister.

23. The Approval Holder must ensure that the volume of water credited to the banked environmental flow account is:

    a) debited by the amount of a release made in accordance with condition twenty two (22) of this approval;
    b) reset to zero if any water is spilling from Lilyvale Dam; and
    c) reduced at a rate of one percent of the volume of water remaining in the banked environmental flow account per day.

    Note 1: The one percent reduction rate accounts for evaporation and other losses, and mitigates potential risks to the reliability of the potable water supply as a result of the long-term storage of banked environmental water.

24. The Approval Holder must ensure that any reductions made in accordance with condition twenty three (23) of this approval are limited so that the banked environmental flow account does not have a negative balance.

Fire Fighting Releases

25. If the Approval Holder is required to make a release of water from any of the water supply works authorised by this approval for fire fighting purposes, the Approval Holder must notify the Minister in writing within seven (7) days of the release specifying the date, time and approximate volume of water released.

    Note 1: A rural fire brigade may take and use water from any water source, and any water supply work under the management of a water supply authority in accordance with section 26 of the *Rural Fires Act 1997*.

MONITORING

Water Quantity Monitoring

26. The Approval Holder must have metering equipment installed that meets the following requirements:

    a) the metering equipment must measure and record the flow of all water taken through the authorised water supply works with less than 5% error;
    b) the metering equipment must comply with the NSW Interim Water Meter Standards (issued by the NSW Office of Water) as may be updated or replaced from time to time;
    c) the metering equipment must be operated and maintained in a proper and efficient manner at all times;
    d) the metering equipment must be sited and installed at a place in the pipe, channel or conduit between the water source and the first discharge outlet. There must be no flow of water into or out of the pipe, channel or conduit between the water source and the metering equipment; and
    e) any other requirements as to type, standard or other criteria for the metering equipment specified by the Minister by notice in writing.

    Note 1: The Minister may direct the Approval Holder to install, repair, replace or to properly maintain metering equipment under section 326 of the *Water Management Act 2000*.

    Note 2: Details of the Approval Holder's water quantity monitoring equipment and agreed procedures are described in the Operating Protocol.

27. The Approval Holder must keep a Logbook and record the following in the Logbook:

    a) each date on which water was taken under the access licence;
    b) the access licence number of the access licence under which water was taken on that date;
    c) the volume of water taken on that date;
    d) the volume of water released as environmental flow on that date;
    e) the volume of water released as spill on that date;
    f) the data and calculations to determine the daily environmental flow release requirements;
    g) the total system storage and volume/level of each storage;
    h) where metering equipment has been installed for use in connection with the authorised water supply works, the meter reading before water is taken; or the start time and end time of extraction and the flow rate during extraction;

i) confirmation that the environmental flow protection conditions do not apply at the time of extraction; and
j) any other information required to be recorded in the Logbook under the rules of the Water Sharing Plan.

Note 1: A "Logbook" means a record, kept in hard copy or electronic form, which accurately records all information required to be kept for this approval. The requirement of this condition will be met when the Approval Holder continues to measure, record and report its extractions, inflows and outflows (releases) as agreed using Citect and described under the Operating Protocol.

Note 2: Spill volume calculations are based on the difference between the inflows and measured releases and extractions, and supported and verified by operational release strategies. Accurate outlet rating curves are available for a range of combinations of valves and storage heights allowing a full range of flows to be delivered.

28. The Approval Holder must produce the Logbook to the Minister for inspection, when requested.

29. The Approval Holder must retain the information required to be recorded in the Logbook for five (5) years from the date to which that information relates.

30. The Approval Holder must monitor and record daily inflows to, storage volumes of, releases and extractions from, its authorised water supply works and flows at the locations listed in Attachment 3 of this Schedule in accordance with the Operating Protocol approved by the Minister.

Access to Data

31. The Approval Holder must make data available to the Minister regarding flows at flow reference points at a frequency and time determined by the Minister.

32. The Approval Holder must make data publicly available at the earliest time that is practically possible and no later than 9:00 am regarding details of any releases from its storages for environmental and other purposes, and details of any run of river transfers, planned for the next twenty four (24) hours.

Water Quality Monitoring

33. The Approval Holder must monitor the effectiveness of environmental flow releases on river health parameters including water quality, ecological and geomorphological parameters to the satisfaction of the Minister.

Measurement and Data Quality Standards

34. The Approval Holder must undertake all monitoring, data management and reporting consistent with appropriate quality assurance and quality control procedures, to the satisfaction of the Minister. The Approval Holder may include data of acceptable quality from other sources to meet the monitoring requirements of this approval.

REPORTING

Water Quantity Report

35. The Approval Holder must, by or on the 15th day of each month submit a water quantity report for the previous month to the Minister. The report must be provided in electronic format and must contain, but need not be limited to, the following:

    a) total daily inflows to storages;
    b) total daily environmental and other releases from storages;
    c) total daily extractions;
    d) storage levels;
    e) banked environmental flow account transactions;
    f) a summary of notified events including emergencies, variations from release requirements, failure to measure releases or extractions in accordance with the requirements, and
    g) stream flow and river height data recorded at the gauging stations listed in Attachment 3 of this Schedule.

    Note 1: This requirement will be satisfied by the Approval Holder providing the NSW Office of Water with the monthly environmental flow spreadsheet as outlined in the Operating Protocol.

Event Notification

36. The Approval Holder must notify the Minister in writing at the earliest practical possible opportunity following any event, but not exceeding seven (7) working days that has caused or is likely to cause, deviation to any of the conditions of this approval. The notification must include, but need not be limited to, the following information:

    a) whether the event has resulted in deviation to any of the approval conditions (at the date of the notification) and details of any altered release;
    b) the date, time and location of the event, or works involved;
    c) the cause and nature of the event, including details of any environmental harm or damage that may have occurred;
    d) any action taken where it was necessary to avoid harm; and
    e) any action that was, or will be taken to prevent a recurrence of the event.

    Note 1: An event may include accident, equipment failure or any other such cause outside of the Approval Holder's effective control and planned events such as maintenance and refurbishment, which are described in the Operating Protocol.

37. The Approval Holder must comply with any requirements and take any actions specified by the Minister for the management of the event, and continue to report to the Minister to the satisfaction of those, or updated, requirements and actions, for as long as the event continues.

Annual Compliance Report

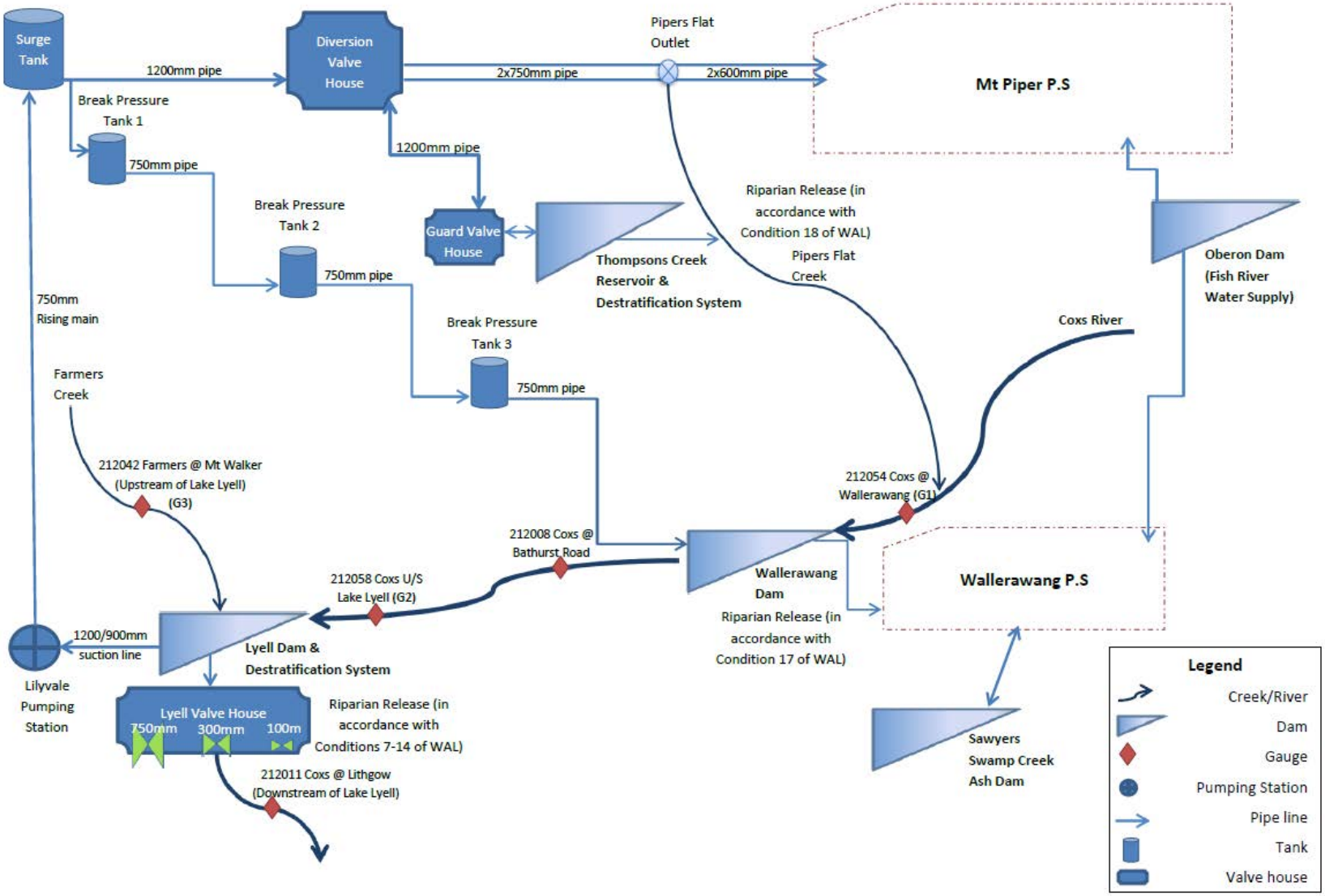
38. The Approval Holder must, by 30 November each year, submit an Annual Compliance Report for the preceding water year in electronic format to the satisfaction of the Minister. The report must contain, but need not be limited to, the following:

    a) an introduction, including an overview of the Approval Holder's water management activities associated with this water source;
    b) updated maps to scale, depicting the location of this water source and the authorised water supply works listed in Attachment 1 and gauging stations listed in Attachment 3 of this Schedule;
    c) detailed analysis of all data for environmental and any other flow releases and water extractions, including banked environmental flows, any releases made for fire fighting purposes, comparisons with data from previous years and an interpretation of the results;
    d) results and interpretation/discussion of results of the ecological monitoring programs required by condition thirty three (33) of this approval;
    e) evidence verifying that all monitoring, recording and assessment was conducted using appropriate quality assurance and control standards;
    f) evidence verifying that the devices used for measuring and recording extractions and releases were subject to appropriate quality assurance and complied with appropriate or mandatory standards;
    g) a summary of all notifiable events, including any non-compliance with the conditions of this approval;
    h) performance reporting against any of the remaining conditions of this approval; and
    i) an electronic appendix that includes all raw data used in the preparation of this report.

Provision of Data and Information

39. The Minister may, from time to time, request data arising from the operation of the authorised water supply works to undertake its resource management functions. Within one (1) month of the Minister making such a request, the Approval Holder must provide the required data.

SCHEDULE 1 – ATTACHMENT 1: SCHEMATIC OF AUTHORISED WATER SUPPLY WORKS



SCHEDULE 1 – ATTACHMENT 2: DESCRIPTION OF AUTHORISED WATER SUPPLY WORKS

The following tables provide detailed information on the authorised water supply works used by the Approval Holder within this water source.

	Lilyvale Dam (Lake Lyell)	**Wallerawang Dam (Lake Wallace)**	**Thompsons Creek Dam (Thompsons Creek Reservoir)**
Description	Concrete faced earth and rock-fill dam with concrete spillway	105 m long central semi-gravity concrete spillway section with earth fill spur embankments	Zoned earth and rock fill with riprap upstream face
Use	Water storage for electricity generation	Water storage for electricity generation	Water storage for electricity generation
Location*	-33.526961^{o}S,150.081847^{o}W	-33.424386^{o}S,150.079122^{o}W	-33.42829^{o}S,149.998484^{o}W
Wall Height (m)	49.5	14.3	63.5
Crest Length (m)	200	600	1,911
Spillway	Dual 40 meter wide concrete ogee crests with flip buckets, design flow approx. 5,900 m^3/s (509,760 ML/d)	Concrete crest	Concrete nib to unlined natural watercourse
FSL (m AHD)	785.5	871.5	1,033
Total capacity (ML)	34,192	4,004	27,500
Operational Capacity (ML)	32,109	2,206	27,500
Outlet Works	1,200 mm conduit from outlet tower	500 mm ductile bypass riparian	Non-selective submerged intake tower with trash racks
Diversion Works	750 mm rising main from 4 pumps with design flow 95 ML/d	4 pumps (total capacity 55.3 ML/d) and pipeline to storage tank	1,220 mm mild steel cement lined pipe with welded joints, gravity feed to Mount Piper Power Station
Flow/Level Measurement Device	Vega ultrasonic height recorder	Vega ultrasonic height recorder	Calibrated staff gauge

	Sawyers Swamp Creek Ash Dam
Description	**Ash dam:** Large zoned earth fill dam **Coffer dam:** Earth dam with concrete spillway for diverting upstream flows **Diversion dams:** Two small earth dams used for diverting flows from northern gullies into the coffer dam
Use	For storage of ash and station wash-down water
Location	-33.387629°S,150.101137°W
Wall Height (m)	**Ash dam:** 40 **Coffer dam:** 6 **Diversion dams:** Nominal
Crest Length (m)	**Ash dam:** 900 **Coffer dam:** 150 **Diversion dams:** Nominal
Spillway	**Ash dam:** Broad crested concrete 30 m **Coffer dam:** Concrete (10 m) with fuse plug **Diversion dams**: No spillway
FSL (m AHD)	**Ash dam:** 941.6 **Coffer dam:** 946 **Diversion dams:** No storage
Total capacity (ML)	**Ash dam:** 8,500 **Coffer dam:** No significant storage **Diversion dams:** No storage
Operational Capacity (ML)	**Ash dam:** 1,197 ML **Coffer dam:** Nil **Diversion dams:** Nil
Outlet Works	**Ash dam:** 600 mm offtake syphon **Coffer dam:** No outlet works **Diversion dams:** No outlet works
Diversion Works	**Ash dam:** 600 mm HDPE pipe and open canal **Coffer dam:** 900 mm earth encased concrete pipe and 5 m wide earth bypass channel for diverting water to downstream of the ash dam **Diversion dams:** 150 mm HDPE and 300 mm ‘rib loc’ HDPE diversion pipes diverting fresh water from northern gullies into coffer dam
Flow/Level Measurement Device	**Ash dam:** Calibrated staff gauge **Coffer dam:** No measurement **Diversion dams:** No measurement

SCHEDULE 1 – ATTACHMENT 3: GAUGING STATIONS

Gauging Station Number	Gauging Station Location	Stream
212011	Coxs River at Lithgow (Downstream of Lake Lyell)	Coxs River
212042	Farmers Creek at Mt Walker (Upstream of Lake Lyell)	Farmers Creek
212054	Coxs River at Wallerawang (Upstream of Lake Wallace)	Coxs River
212058	Coxs River Upstream of Lake Lyell	Coxs River

Note 1: The following gauging stations are not required by the water supply work and use approval but are used by the Approval Holder for background information:

- Coxs River at Bathurst Road Gauge downstream of Lake Wallace, Gauging Station Number 212008 (Coxs River)
- Coxs River at Island Hill, Gauging Station Number 212045 (Coxs River)
- Neubecks Creek upstream of Wallerawang, Gauging Station Number 212055 (Neubecks Creek)

Schedule 2 – Dictionary

Words and expressions that appear in this approval have the meanings set out in this Dictionary. Words and expressions defined in this Dictionary that appear in the Dictionary of the *Water Management Act 2000* (WMA) *are the same. A reference in this Dictionary to a section is a reference to a section of the WMA.*

Access licence means an access licence referred to in section 56.

Altered water release events are water releases that vary from the water release rates required under this approval.

Approval means a water supply work approval and water use approval.

Blowdown Water means water released from Wallerawang Power Station No. 7 and No. 8 Cooling Towers and under EnergyAustralia's Environment Protection Licence issued by the Office of Environment and Heritage.

Emergency may include an event that is pending, or an event that has already occurred but could not be reasonably foreseen or scheduled, including occurrences such as:

a) major infrastructure failures, or
b) a water contamination incident that may place the Approval Holder in serious breach of either its Operating Licence or the *Protection of the Environment Operations Act 1997* (NSW), or
c) declared disasters or any other event considered by the Ministerial Corporation to constitute an actual or potential emergency.

Environment includes all aspects of the surroundings of human beings, whether affecting them as individuals or in their social groupings.

Full Supply Level **(FSL)** means the normal maximum water level of a water storage when not affected by floods.

Megalitre (ML) means one megalitre, which is equivalent to 1,000,000 litres.

Minister means the Minister responsible for the *Water Management Act 2000.* The Minister may delegate functions under section 389.

Outlet (works) (conduit) means infrastructure built to control the release of water from a water impoundment or distribution system.

Percentile (flow rate) is the flow rate that is exceeded for that percentage of the relevant unit of time (usually year). The value of the percentile varies depending on the period length analysed. For example, the 95th percentile is the flow that is exceeded 95 percent of the time.

River includes:

a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and
b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and
c) anything declared by the regulations to be a river,

whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.

Spill means the uncontrolled discharge of water from an impoundment to the natural watercourse when the storage level rises above the full supply level.

Total active storage means the entire volume of water in the water storage at Full Supply Level minus the volume of dead storage capacity.

Unregulated river means a river that is not declared by the Minister to be a regulated river.

Water allocation means the water to which the holder of an access licence is entitled from time to time under the licence, as recorded in the water allocation account for the licence.

Water management area means an area of land that is constituted as a water management area by an order in force under section 11.

Water source means the whole or any part of:

a) one or more rivers, lakes or estuaries; or
b) one or more places where water occurs naturally on or below the surface of the ground;
and includes the coastal waters of the State.

Water supply work means:

a) a work (such as a water pump or water bore) that is constructed or used for the purpose of taking water from a water source;
b) a work (such as a tank or dam) that is constructed or used for the purpose of;
    i. capturing or storing rainwater run-off; or
    ii. storing water taken from a water source;
c) a work (such as a water pipe or irrigation channel) that is constructed or used for the purpose of conveying water to the point at which it is to be used;
d) any work (such as a bank or levee) that has the effect of diverting away from a water source any overflow from the water source; or
e) any work (such as a weir) that has the effect of impounding water in a water source; including a reticulated system of such works, and includes all associated pipes, sluices, valves and equipment, but does not include:
    i. any work (other than a water supply work under the control or management of the Sydney Water Corporation, the Hunter Water Corporation or a local water utility) that receives water from a water supply work under the control or management of the Sydney Water Corporation, the Hunter Water Corporation or a local water utility; or
    ii. any work declared by the regulations not to be a water supply work.

Water supply work approval means an approval referred to in section 90 (2).

Water year means a year commencing 1 July.

ABBREVIATIONS

ABN	Australian Business Number
AHD	Australian Height Datum (elevation relative to standardised mean sea level)
FSL	Full Supply Level (as designed)
GPS	Global Positioning System
m	Metre
ML	Megalitre
ML/d	Megalitres per day
NSW	New South Wales

Appendix 1 – Operating Protocol

An Operating Protocol has been developed by EnergyAustralia in consultation with the NSW Office of Water. The Operating Protocol is in the process of being updated and will be included in the Water Supply Work and Water Use Approval soon.

Appendix 2 – Monitoring Manual

A Monitoring Manual has been developed by EnergyAustralia in consultation with the NSW Office of Water. The Monitoring Manual is in the process of being updated and will be included in the Water Supply Work and Water Use Approval soon.

Department of Primary Industries
Office of Water

Statement of Conditions

as at 28 February 2014

issued under *Water Management Act 2000*

Water Access Licence Number	27428
Reference Number	10AL116411

Contact Details

Name	EnergyAustralia NSW Pty Ltd
Customer ID	1139922
Contact Address	EnergyAustralia NSW Pty Ltd Locked Bag 1 Portland NSW 2847

Licence Details

Status	Current
Category	Major Utility [Power generation]
Date of Commencement	1 July 2011
Tenure Type	Specific Purpose
Share Component	25,000 megalitres per year
Extraction Management Unit	Upper Nepean and Upstream Warragamba
Water Source	Upper Nepean and Upstream Warragamba Water Source
Water Sharing Plan	Greater Metropolitan Region Unregulated River Water Sources 2011
Extraction Zone	Wywandy
Conditions	Schedule 1
Notes:	1. The extraction component of this access licence may be amended by the Minister in accordance with the water sharing plan for the water source specified on this licence. 2. A requirement to notify the Minister in writing is satisfied by making a notification in writing to the address shown on this Statement.

Administrative contact details All correspondence and notifications in relation to compliance with the conditions of this licence must be addressed to:	Manager Water Regulation Hunter/ Sydney/ South Coast NSW Office of Water PO Box 3720 PARRAMATTA NSW 2124

Schedule 1 – Conditions

INTRODUCTION

Under section 66 (1) (a) of the *Water Management Act 2000* this access licence is subject to such conditions as are from time to time required to be imposed on the access licence by the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 (hereinafter referred to as the Water Sharing Plan). Under section 66 (1) (b) of the *Water Management Act 2000* this access licence is subject to such other conditions as the Minister may impose on the licence as the Minister thinks fit, including conditions relating to the protection of the environment.

CONDITIONS

1. The Licence Holder must not take water under this access licence other than in compliance with the conditions of the water supply work and water use approval nominated by this licence. The nominated water supply work and water use approval for this licence is 10CA117220.

2. The volume of water taken by the Licence Holder under this access licence must not exceed 23,000 megalitres per year for that water year.

3. Notwithstanding condition two (2) of this approval, if in any water year the Licence Holder's volume of water available from the Fish River Water Supply Scheme is reduced by 30 percent or more relative to the full entitlement, the volume of water taken by the Licence Holder under this access licence must not exceed 25,000 megalitres for that water year.

   Note 1: EnergyAustralia NSW entitlement in the Fish River Water Supply Scheme is 8,184 megalitres per year. A reduction of 30 percent from the full entitlement equates to 5,729 megalitres per year.

4. The Licence Holder must not take any water from the Coxs River under this access licence unless the Licence Holder has first used all available mine water from its storages for the purpose of power generation.

   Note 1: To meet the requirements of this condition, EnergyAustralia NSW must account for water taken from sources other than the Coxs River prior to accounting for water taken from the Coxs River, under this access licence.

   Note 2: Mine water discharged directly into the Coxs River and then extracted for consumption by EnergyAustralia NSW will be debited against its water allocation.

   Note 3: Mine water received directly to EnergyAustralia NSW via pipework will not be accounted for in its water allocation.

5. The Licence Holder must not take water using the works authorised by the nominated water supply work and water use approval in excess of its annual share component.

6. The Licence Holder must ensure water allocations remaining in the access licence account are not carried over from one water year to the next.

7. The Licence Holder must not take any water using the works authorised by the nominated water supply work and water use approval if the water allocation account of this licence is, or will go into debt in any water year.

8. The Licence Holder must keep a Logbook and record the following in the Logbook:

    a) each date on which water was taken under the access licence;
    b) the volume of water taken on that date;
    c) the water supply work and water use approval number of the water supply work used to take the water on that date;
    d) the purpose or purposes for which the water was taken on that date;
    e) confirmation that environmental flow protection conditions do not apply at the time of extraction; and
    f) any other information required to be recorded in the Logbook under the rules of the Water Sharing Plan.

    Note 1: A "Logbook" means a record, kept in hard copy or electronic form, which accurately records all information required to be kept for this licence.

9. The Licence Holder must produce the Logbook to the Minister for inspection, when requested.

10. The Licence Holder must retain the information required to be recorded in the Logbook for 5 years from the date to which that information relates.

11. The Licence Holder must notify the Minister in writing at the earliest practical opportunity following any event, but not exceeding seven (7) working days that has caused, or is likely to cause, deviation to any of the conditions of this licence. The notification must include, but need not be limited to, the following information:

    a) whether the event has resulted in deviation to any of the licence conditions (at the date of the notification) and details of any altered releases;
    b) the date, time and location of the event, or works involved;
    c) the cause and nature of the event, including details of any environmental harm or damage that may have occurred;
    d) any action taken where it was necessary to avoid harm; and
    e) any action that was, or will be taken to prevent a recurrence of the event.

12. Notwithstanding conditions one (1) to eleven (11) of this licence, the Licence Holder must comply with any other conditions required to implement the provisions of the Water Sharing Plan.

Environment Protection Licence

Licence - 13007

Licence Details	
Number:	13007
Anniversary Date:	01-January

Licensee

ENERGYAUSTRALIA NSW PTY LTD

LEVEL 33, 385 BOURKE STREET

MELBOURNE VIC 3000

Premises

MOUNT PIPER POWER STATION

350 BOULDER ROAD

PORTLAND NSW 2847

Scheduled Activity

Electricity Generation

Fee Based Activity	Scale
Generation of electrical power from coal	> 4000 Gwh generated

Region

South - Bathurst

Lvl 2, 203-209 Russell Street
BATHURST NSW 2795

Phone: (02) 6332 7600

Fax: (02) 6332 7630

PO Box 1388 BATHURST

NSW 2795

Environment Protection Licence

Licence - 13007

Environment Protection Licence

Licence - 13007

Environment Protection Licence

Licence - 13007

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 13007

The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

ENERGYAUSTRALIA NSW PTY LTD
LEVEL 33, 385 BOURKE STREET
MELBOURNE VIC 3000

subject to the conditions which follow.

Environment Protection Licence

Licence - 13007

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Electricity Generation	Generation of electrical power from coal	> 4000 Gwh generated

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
MOUNT PIPER POWER STATION
350 BOULDER ROAD
PORTLAND
NSW 2847
LOT 1 DP 325532, LOT 1 DP 400022, LOT 191 DP 629212, LOT 1 DP 702619, LOT 2 DP 702619, LOT 362 DP 740604, LOT 366 DP 740604, LOT 18 DP 751636, LOT 59 DP 751636, LOT 1 DP 800003, LOT 2 DP 800003, LOT 1 DP 803655, LOT 5 DP 804929, LOT 7 DP 804929, LOT 8 DP 804929, LOT 1 DP 813288, LOT 40 DP 827626, LOT 41 DP 827626, LOT 42 DP 827626, LOT 46 DP 827626, LOT 47 DP 827626, LOT 48 DP 827626, LOT 49 DP 827626, LOT 50 DP 827626, LOT 51 DP 827626, LOT 52 DP 827626, LOT 1 DP 829065, LOT 1 DP 920999, LOT 1 DP 999329, LOT 2 DP 999329, LOT 3 DP 999329, LOT 4 DP 999329, LOT 5 DP 999329, LOT 5 DP 1092737, LOT 6 DP 1092737, LOT 7 DP 1092737, LOT 6 DP 1127747

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

Ancillary Activity
Chemical storage
Coal works
Crushing, grinding or separating
Sewage treatment
Waste storage

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
2	Discharge to air. Air emissions monitoring.	Discharge to air. Air emissions monitoring.	Mt Piper Power Station Boiler 1, identified as "EPA ID 2" on a map provided to the EPA in a letter dated 12 December 2008.
3	Discharge to air. Air emission monitoring.	Discharge to air. Air emission monitoring.	Mt Piper Power Station Boiler 2, identified as "EPA ID 3" on a map provided to the EPA in a letter dated 12 December 2008.
4	Weather monitoring		Mount Piper Power Station Weather Station, identified as "EPA ID 4" on a map provided to the EPA in a letter dated 12 December 2008.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description

Environment Protection Licence

1	Discharge to waters. Discharge quality and total volume monitoring.	Discharge to waters. Discharge quality and total volume monitoring.	Final holding pond monitoring station to Neubecks Creek, identified as "EPA ID 1" on a map provided to the EPA in a letter dated 12 December 2008.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Load limits

L2.1 The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the table below.

Note: An assessable pollutant is a pollutant which affects the licence fee payable for the licence.

L2.2 The actual load of an assessable pollutant must be calculated in accordance with the relevant load calculation protocol.

Assessable Pollutant	Load limit (kg)
Arsenic (Air)	
Benzo(a)pyrene (equivalent) (Air)	
Coarse Particulates (Air)	
Fine Particulates (Air)	
Fluoride (Air)	
Lead (Air)	
Mercury (Air)	
Nitrogen Oxides (Air)	
Salt (Enclosed Water)	
Selenium (Enclosed Water)	
Sulfur Oxides (Air)	
Total suspended solids (Enclosed Water)	

L3 Concentration limits

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L3.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L3.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L3.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L3.4 Air Concentration Limits

POINT 2,3

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
Mercury	milligrams per cubic metre	0.2			
Chlorine	milligrams per cubic metre	200			
Type 1 and Type 2 substances in aggregate	milligrams per cubic metre	1.0			
Dioxins & Furans	nanograms per cubic metre	0.1			
Volatile organic compounds	milligrams per cubic metre	40			
Hydrogen chloride	milligrams per cubic metre	100			
Solid Particles	milligrams per cubic metre	50			
Sulfuric acid mist and sulfur trioxide (as SO3)	milligrams per cubic metre	100			
Cadmium	milligrams per cubic metre	0.2			
Nitrogen Oxides	grams per cubic metre	1.5			
Total Fluoride	milligrams per cubic metre	50			

L3.5 The monitoring results undertaken under reference bases and collected in compliance with condition M2.1 can be used to determine compliance with the 100% concentration limits specified in condition L3.4.

L3.6 Monitoring at points 2 and 3 must be undertaken under the following reference basis for the pollutants specified in condition L3.4:

a) For sulphuric acid mist and/or sulphur trioxide, Chlorine, Hydrogen chloride, Total Flouride, Hazardous subtances, Cadmium, and Mercury: dry, 273 K, 101.3 kPa.

b) For Nitrogen oxides and Solid particles: dry, 273 K, 101.3 kPa, 7% O2.

L3.7 The concentration of an impurity contained in the solid alternative fuel must not exceed the concentration specified for that impurity in the table.

Impurity	Units of measure	100% concentration limit
Type 1 and Type 2 substances in aggregate	milligrams per kilogram	350

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L4.2 Only the following types of waste generated at the premises may be disposed of at the premises:

- Ash
- Mill pyrites
- Demineralisation and polisher plant effluents
- Chemical clean solutions
- Cooling tower sediments
- Ion exchange resins
- Fabric filter bags
- Brine conditioned fly ash
- Biomass co-firing ash
- Settling pond sediments
- Oil and grit trap sediments

L4.3 The wastes listed in condition L4.2 must only be disposed of to the ash disposal area at Mount Piper Power Station.

L4.4 The licensee is permitted to receive the following wastes generated outside the premises for storage, treatment, processing, reprocessing or disposal:

1) Waste water from the Wallerawang Power Station water treatment plant processes, including ash return water.

L5 Potentially offensive odour

L5.1 No condition in this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997 provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and

d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 2,3

Pollutant	Units of measure	Frequency	Sampling Method
Carbon dioxide	percent	Yearly	TM-24
Chlorine	milligrams per cubic metre	Yearly	TM-7 & TM-8
Copper	milligrams per cubic metre	Yearly	TM-12, TM-13 & TM-14
Dioxins & Furans	nanograms per cubic metre	Yearly	TM-18
Dry gas density	kilograms per cubic metre	Yearly	TM-23
Hydrogen chloride	milligrams per cubic metre	Yearly	TM-7 & TM-8
Moisture content	percent	Yearly	TM-22
Molecular weight of stack gases	grams per gram mole	Yearly	TM-23
Nitrogen Oxides	grams per cubic metre	Quarterly	Special Method 2
Oxygen (O2)	percent	Yearly	CEM-3
Solid Particles	milligrams per cubic metre	Yearly	TM-15
Sulfuric acid mist and sulfur trioxide (as SO3)	milligrams per cubic metre	Yearly	TM-3
Sulphur dioxide	milligrams per cubic metre	Quarterly	TM-4
Temperature	degrees Celsius	Yearly	TM-2
Total Fluoride	milligrams per cubic metre	Yearly	TM-9
Type 1 and Type 2 substances in aggregate	milligrams per cubic metre	Yearly	TM-12, TM-13 & TM-14
Velocity	metres per second	Yearly	TM-2
Volatile organic compounds	milligrams per cubic metre	Yearly	TM-19
Volumetric flowrate	cubic metres per second	Yearly	TM-2

M2.3 For the purpose of the table above, Special Method 2 means sampling in accordance with TM-11 and

include recording of the respective boiler MW Load at time of sampling, to enable reporting under condition R1.10.

M2.4 Water and/ or Land Monitoring Requirements

POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Monthly during discharge	Representative sample
pH	pH	Monthly during discharge	Representative sample
Total suspended solids	milligrams per litre	Monthly during discharge	Representative sample

M2.5 Samples taken pursuant to a requirement in this licence to monitor the volume, mass or concentration of pollutants, must be analysed and reported in accordance with the laboratory accreditation requirements set out in section 2.1.3 of the Load Calculation Protocol.

Note: The Load Calculation Protocol is the Protocol referred to in clause 21 of the Protection of the Environment (General) Regulation 2009. A copy of the Protocol was published in the NSW Government Gazette on 25 June 2009 and can be purchased from the Environment Protection Authority or viewed at http://www.epa.nsw.gov.au.

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

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M4 Weather monitoring

M4.1 For licence monitoring point 4 (weather monitoring), the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1. The licensee must use the units of measure, frequency, averaging period and sampling method specified opposite in the other columns.

Parameter	Units of Measure	Frequency	Averaging Period	Sampling Method
Air temperature	oC	Continuous	1 hour	AM-4
Wind Direction	-	Continuous	15 minute	AM-2 & AM-4
Wind speed	m/s	Continuous	15 minute	AM-2 & AM-4
Sigma Theta	o	Continuous	15 minute	AM-2 & AM-4
Rainfall	mm	Continuous	24 hour	AM-4
Siting	-	-	-	AM-1 & AM-4
Measurement	-	-	-	AM-1 & AM-4

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M5.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 3 months after:
a) the date of the issue of this licence or
b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M7 Requirement to monitor volume or mass

M7.1 For each discharge point or utilisation area specified below, the licensee must monitor:
a) the volume of liquids discharged to water or applied to the area;
b) the mass of solids applied to the area;
c) the mass of pollutants emitted to the air;
at the frequency and using the method and units of measure, specified below.

POINT 1

Frequency	Unit of Measure	Sampling Method
Continuous	kilolitres per week	Weir structure and level sensor

M8 Other monitoring and recording conditions

M8.1 The licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1 contained in any solid alternative fuel, and the Calorific Value (MJ/kg) of the fuel. The licensee must use the units of measure, and sample at the frequency specified opposite in the other columns:

Parameter	Units of measure	Frequency
Antimony	milligrams per kilograms	Per batch, as processed
Arsenic	milligrams per kilograms	Per batch, as processed
Beryllium	milligrams per kilograms	Per batch, as processed
Cadmium	milligrams per kilograms	Per batch, as processed
Chlorine	%	Per batch, as processed
Chromium (total)	milligrams per kilograms	Per batch, as processed
Cobalt	milligrams per kilograms	Per batch, as processed
Copper	milligrams per kilograms	Per batch, as processed
Flourine	%	Per batch, as processed
Lead	milligrams per kilograms	Per batch, as processed
Manganese	milligrams per kilograms	Per batch, as processed
Mercury	milligrams per kilograms	Per batch, as processed
Nickel	milligrams per kilograms	Per batch, as processed
Selenium	milligrams per kilograms	Per batch, as processed

Sulfur	%	Per batch, as processed
Tin	milligrams per kilograms	Per batch, as processed
Vanadium	milligrams per kilograms	Per batch, as processed

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
a) a Statement of Compliance; and
b) a Monitoring and Complaints Summary.
At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 Where the licensee is unable to complete a part of the Annual Return by the due date because the licensee was unable to calculate the actual load of a pollutant due to circumstances beyond the licensee's control, the licensee must notify the EPA in writing as soon as practicable, and in any event not later than the due date. The notification must specify:
a) the assessable pollutants for which the actual load could not be calculated; and
b) the relevant circumstances that were beyond the control of the licensee.

R1.7 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.8 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R1.9 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

Further information to be reported in the Annual Return

R1.10 The Annual Return must also include the following information:
1. To validate the SSEF-PEMS for Nitrogen oxides approved by the EPA on 27 February 2008, the licensee must provide a report that plots the quarterly Nitrogen oxide concentration sampling results required by condition M2.1, against the historical Nitrogen oxide CEMS data curve for boiler units 1 and 2 at Mount Piper Power Station, and
2. The licensee must report any exceedance of any discharge limit, standard, or concentration set by a condition of this licence. The report must include the sample results or the exceedance and indicate the name of the testing laboratory, parameter(s) monitored, the limit, standard, or concentration exceeded, the date of the exceedance and the results of any analysis.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Signage

G2.1 The location of EPA point number(s) 1 to 4 must be clearly marked by signs that indicate the point identification number used in this licence and be located as close as practical to the point.

8 Special Conditions

E1 Solid Alternative Fuel

E1.1 For the purpose of this licence, Solid Alternative Fuel means timber products that are either:

- Biomass that is sustainably harvested as defined in "Greenhouse Gas Emissions from Electricity Supplied in NSW: Emissions Workbook, October 2000, Ministry of Energy and Utilities"; or
- Recycled timber products obtained from the manufacturing, construction and demolition sources that comply with the fuel specification L3.4 for hazardous substances; or
- In accordance with Regulation 8 (Special requirements - wood waste) of Division 2.2 (Eligible renewable

energy sources) in Part 2 of the Renewable Energy (Electricity) Regulation 2001 and Renewable Energy (Electricity) Act 2000.

E1.2 Solid Alternative Fuel may only be fed to the boiler during coal firing.

E1.3 Solid Alternative Fuel may only be fed to the boiler at a feed rate of less than or equal to 5% weight of the coal feed rate.

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Darryl Clift

Environment Protection Authority

(By Delegation)

Date of this edition: 01-January-2009

End Notes

1	Licence varied by correction to Load Limits table, issued on 07-Jan-2009, which came into effect on 07-Jan-2009.
2	Licence varied by notice 1110821, issued on 21-Jan-2010, which came into effect on 21-Jan-2010.
3	Licence varied by notice 1118174, issued on 20-Aug-2010, which came into effect on 20-Aug-2010.
4	Licence varied by notice 1516460 issued on 19-Aug-2013
5	Licence transferred through application 1516748 approved on 29-Aug-2013 , which came into effect on 02-Sep-2013

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Mt Piper Power Station Brine Conditioned Flyash Co-placement Extension Water Management and Monitoring Plan

Delta Electricity Western

26 September 2008
Reference 7053 01 EC
Revision 3

Connell Wagner

Document Control

Document ID: O:\7053\MOUNT PIPER WQ 2440\MTPIPER + BRINE\WATER MGT PLAN\MT PIPER BRINE-ASH EXPANSION WMP C DE & GM AND DOP COMM.DOC

Rev No	Date	Revision Details	Typist	Author	Verifier	Approver
0	20/03/08	Draft	BRH	BRH	GM	LK
1	15/04/08	Final Draft	BRH	BRH	GM	LK
2	5/05/08	Final Report with DE comments	BRH	BRH	GM	LK
3	26/09/08	Revised Final Report with DoP comments	BRH	BRH	GM	CV

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Contents

Figures

Attachments

Summary

A Statement of Environmental Effects (SEE) was prepared for extension of the Mount Piper Power Station brine co-placement project area (Connell Wagner, 2007a) due to space limitations in the currently approved area and to allow for increased brine production resulting from the approved upgrade of the power station from 1,320 MW to 1,500 MW (Connell Wagner, 2005). In accordance with the requirements of the Development Consent, the Water Management Plan (WMP) for the existing brine co-placement area has been updated to include the expanded area. The updated WMP includes:

- a water monitoring program for surface and groundwater monitoring at the ash disposal site and receiving waters;
- the requirements for an annual environmental monitoring report;
- strategies for reduction of brine production, and
- requirements for an update of the groundwater modelling, based upon the monitoring data.

The updated WMP contains a water cycle management plan that describes how surface runoff will be managed to prevent contamination of groundwater and surface water from the brine conditioned ash placement area. A contingency plan is also described in the event that monitoring suggests surface or groundwater contamination may be occurring.

1. Introduction

Mount Piper Power Station obtained development approval from the Department of Urban Affairs and Planning (DUAP) on 3rd April, 2000 for the co-placement of brine conditioned flyash in the existing ash placement area. The existing brine/ash placement, as described in the PPI (1999) Statement of Environmental Effects (SEE), allows brine produced in the treatment of the cooling tower blowdown and other waste waters, to be disposed on site with acceptable environmental effects.

A Water Management Plan (WMP) was prepared, as required under Clause 43 of Schedule 2 attached to the original brine conditioned ash co-placement consent (see Attachment 2). This plan, and storage of brine conditioned ash within the ash placement area, has been in operation since November, 2000.

In 2006, the Department of Planning approved an application to upgrade the nominal capacity of the power station from 1,320 MW to 1,500 MW on 3rd June, 2006 (Attachment 3). This was described in a SEE for the project (Connell Wagner PPI, 2005).

Due to space limitations in the currently approved area and to provide for increased brine production due to the upgrade, Delta Electricity proposes to extend the existing brine and ash co-placement area at Mount Piper Power Station. The environmental effects of the proposal were examined in a SEE (Connell Wagner, 2007a) which was submitted in support of an application to modify the ash disposal area. The modification was approved by the Department of Planning on 23rd March 2008 (Attachment 4). The area involved is shown in Figure 1.

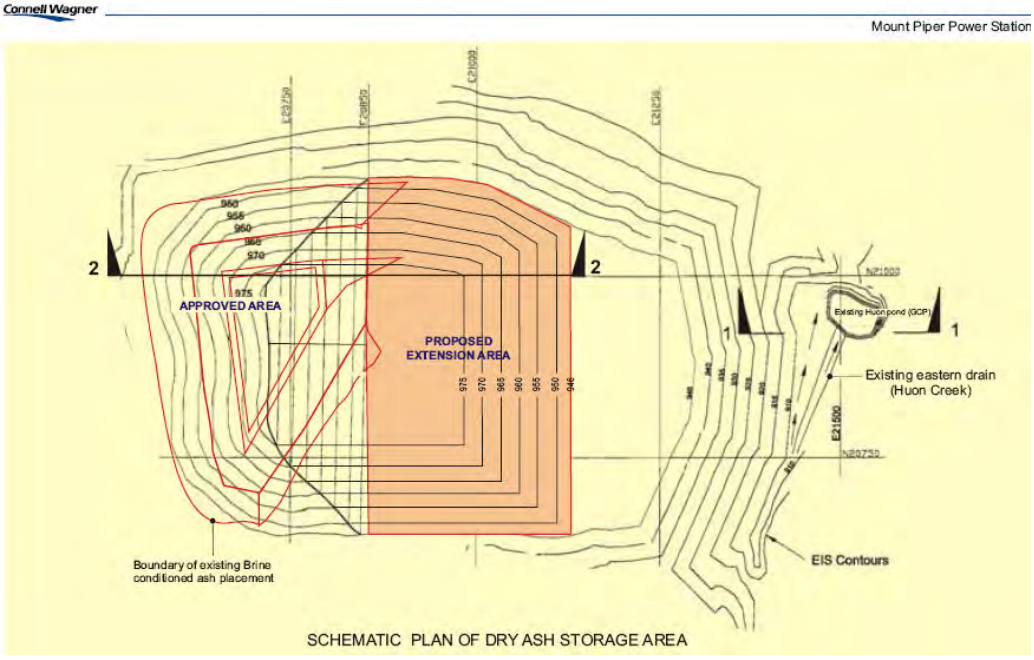

Figure 1. Existing and Approved Extension to the Brine Conditioned Ash Placement Area

The extension shown in Figure 1 will provide adequate volume for placement of brine conditioned ash for the remaining life of the ash placement facility. The existing and proposed extension areas are also overlayed on Figure 5 to show the relation between the monitoring points and the two areas.

The development consent for the extension required that the existing Water Management and Monitoring Plan (WMP) be updated and approved by the Director-General prior to undertaking extension of the brine conditioned ash placement area. The update must include details of:

- the increased catchment area;
- extension of drains, and
- the additional detention pond and/or storage areas.

This WMP addresses the water cycle management on the site, including strategies for reduction of brine production. It also includes a water monitoring program for surface and groundwater monitoring at the ash disposal site and receiving waters. The requirement for an annual environmental monitoring report is also included in the WMP.

Should the water quality monitoring indicate significant effects of the brine placement, groundwater modelling would be undertaken and the report is required to be an update of the modelling presented in the Connell Wagner (2007) SEE. The model is required to be calibrated using the water quality monitoring data.

The WMP for the extended brine placement area was updated by modifying the original Water Management and Monitoring Plan (PPI 2000), as required by the 2007 SEE and the 2008 approval conditions. The aim of the WMP is to minimise the effect of the placement of brine conditioned ash on local natural waters. It outlines the existing water quality, describes surface water and groundwater management strategies and documents the surface water and groundwater monitoring programs. Contingency plans in the event of runoff or leachate having an effect upon natural surface water or groundwater quality are also presented.

It is expected that the WMP will be integrated with the Repository Site Management Plan for the brine conditioned ash area (BBS, 2007). The site is administered by Bilfinger Berger Services Pty Ltd (BBS) for the power station. The Mount Piper Environment Section will be responsible for monitoring and will request Bilfinger Berger Services to implement the contingency plan, if required.

2. Current Water Cycle Management and Water Quality

2.1 Water Cycle Management

The Mount Piper Power Station and ash storage area are located within the catchment of Neubecks Creek, a tributary of the Coxs River, which is a Sub-catchment of the Warragamba Catchment. Water cycle management practices in the Mount Piper Power Station ash placement area direct surface runoff from the external batters away from the deposited ash into drains and clean water collection ponds (Figure 2). External runoff is also directed to the Eastern Drain (called Huon Creek), which flows into settling ponds or the local Huon Mine void called the Groundwater Collection Basin (GCB).

Surface water management of runoff from within the existing brine conditioned ash and proposed extension placement areas are outlined in Figure 2. The normal water conditioned ash runoff is directed to dirty water storage ponds, runoff from the brine area to the brine dirty water ponds and clean water diversion to a detention pond. Details of the existing brine runoff system and proposed brine dam are also shown in Figure 2. Collected water will only be used for dust suppression within the ash and brine placement area.

2.2 Surface Water Quality

Surface water in the nearby Neubecks Creek is characterised by elevated concentrations of sulphate, iron and manganese. This reflects the nature of the local geology, which includes out-cropping coal seams, some of which have been mined in this area (Connell Wagner, 2007b). Attachment 1 provides a summary of the existing surface and groundwater quality in and near the ash disposal area.

Water quality in Neubecks Creek is relatively poor and variable due to catchment inputs and stream flows. The median stream flow is only about 3.7 ML/day.

2.3 Groundwater Quality

Groundwater management is an essential part of the water cycle management for the ash disposal area. Groundwater flows travel from west of the ash disposal area to the Eastern Drain, which enters the Huon mine void. Limited flow occurs between the mine void and Neubecks Creek (Merrick, 2007).

The local groundwater is elevated in salts, mainly sulphate, and iron and manganese as well as some trace elements such as lead and zinc. The trace elements such as zinc and lead are due to local mineralisations originating from an old copper, lead and zinc open-cut mine to the north-west of the ash disposal site. The groundwater has low pH due to the presence of iron pyrites. Oxidation of the iron pyrites, by groundwater passing through the area, results in very high concentrations of iron and sulphate.

Poor water quality is also present in underground mine goaf areas to the south of the site. This has affected the water quality in the Groundwater Collection Basin in recent years (Connell Wagner, 2007b). The goaf areas are the underground mine areas where coal pillars between former mine headings have been partially mined and the roof allowed to collapse. The water quality is characterised by elevated concentrations of boron and sulphate as well as iron, manganese, nickel and zinc.

The groundwater concentrations of trace metals are much lower at background bores located away from the old mine area. Due to the localised nature of the various ore bodies and coal mines in the area, the groundwater water quality is highly variable between sampling bores. The relevant background bores are used to represent background conditions for comparison with the ash placement area down-gradient bores (see Attachment 1).

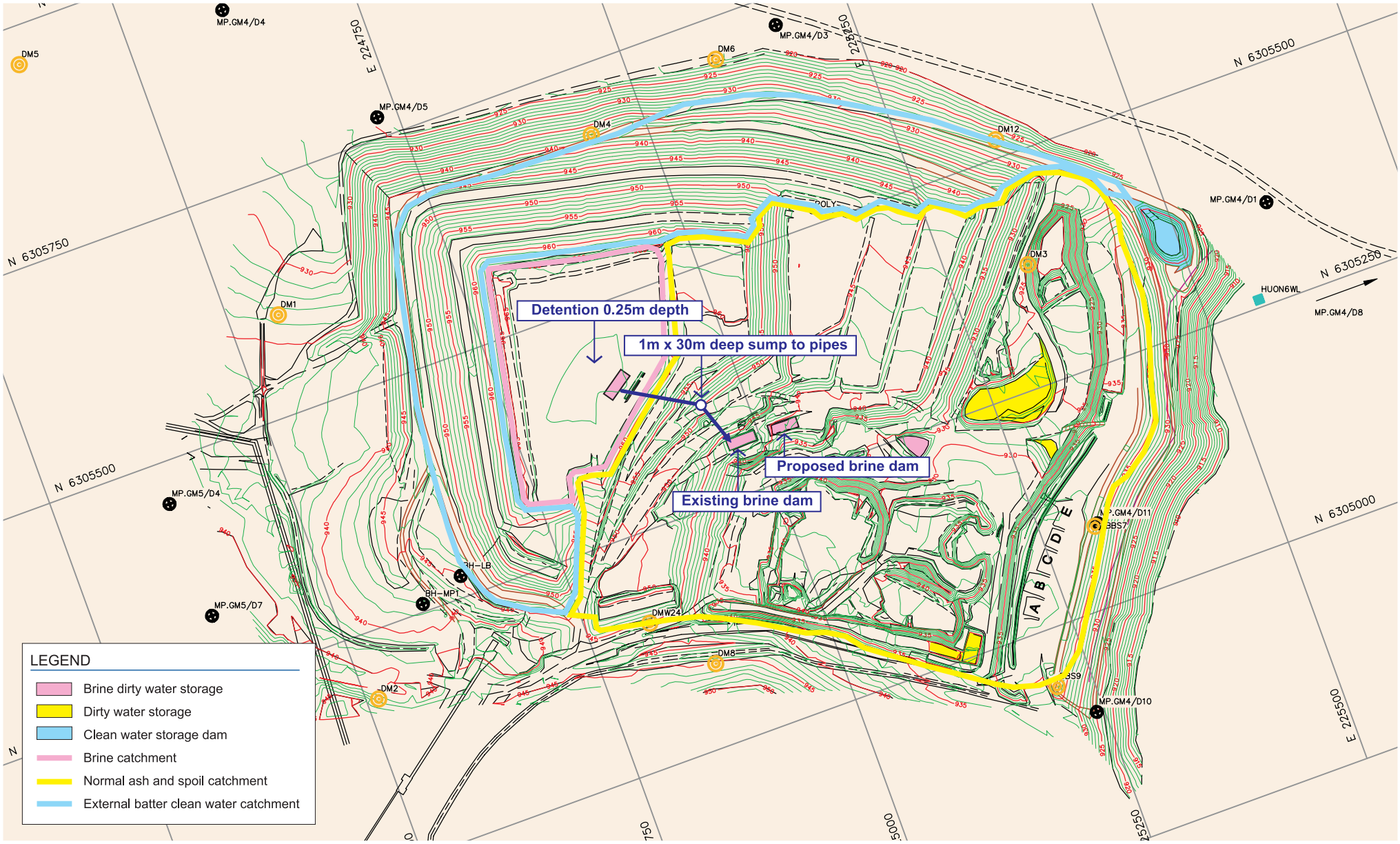

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Figure 2

Mt Piper Power Station Ash Placement Area Contours in April, 2008 with brine area, dirty water and Clean Water runoff ponds and Proposed Extension Area Brine Dam

3. Planned Extended Area Water Cycle Management

Management of surface runoff for the existing brine conditioned ash placement is described in the following section. A similar arrangement will be used for the extended area.

3.1 Existing Surface Runoff

The brine-conditioned flyash placement area is managed to control surface runoff to minimise contamination of the local groundwater and surface water. As can be seen in Figure 3, the brine conditioned flyash is placed in layers and the external batters are capped with one metre of normal flyash to prevent leaching of the brine by runoff into surface waters outside the placement area.

At the completion of a placement stage, the normal flyash capping is covered with spoil and revegetated, in accordance with the Bilfinger Berger Services Repository Site Management Plan (BBS, 2007). In this way, the brine conditioned ash deposit is segregated from the surrounding environment by an envelope of water conditioned ash and spoil capping, as originally approved for the ash placement proposal. The location of the ash disposal area is such that the risk of surface runoff entering natural water courses is minimal.

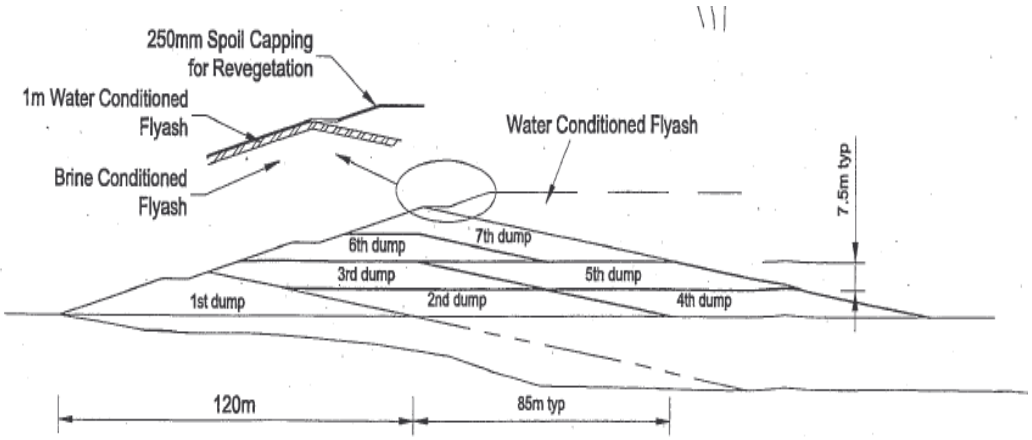

Figure 3. Schematic of Water Conditioned Ash External Batter Placement for Containment of Brine Conditioned Ash Placement (from PPI, 1999)

The annual "Long term average rainfall" measured at Lithgow is 870mm (Forster 1999). The brine/ash pilot field test showed that the majority of the rainfall is evaporated from the ash surface, resulting in an average of only 5% of the annual rainfall appearing as surface runoff.

Surface runoff from within the existing brine conditioned ash placement area is as shown in Figure 4. A surface slope of 2% directs the rainfall runoff to a wide detention pond in the centre of the deposit, which has a maximum depth of 0.25m. Water collected in this pond is directed to a 30m long, 1m deep sump which then directs water to the lined 300m^3 Brine Dam. Inspections of the system are undertaken daily to ensure its integrity during the placement period. A variety of other components are checked during these inspections as detailed in the BBS Ash Placement Area Daily Inspection Sheet (Attachment 5).

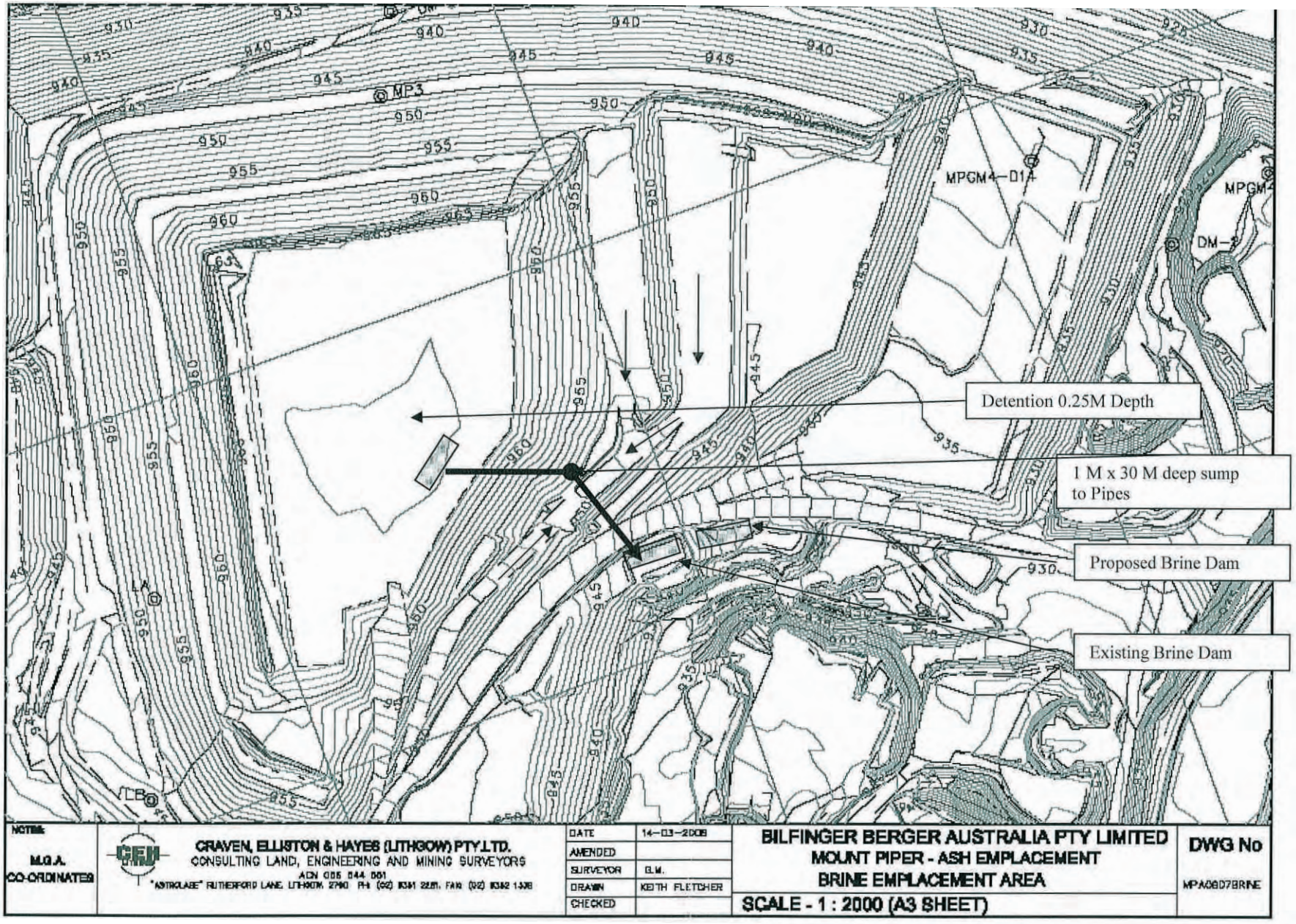

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Figure 4

Existing Brine Conditioned Ash Placement Area Rainfall Runoff System

The lined Brine Dam was sized at 300m^3 to collect 1 in 10 year storm events from individual ash placement stage areas. This was estimated based upon the 90th percentile of 100 years of monthly rainfall data and taking 5% of surface runoff from the area of the placement. Storm intensity runoff calculation showed that the original pond size was conservative so the larger size was used.

Water collected in the dam is reused for dust suppression by spraying onto the ash/brine area. In this way the size of the pond can be kept to a minimum. The dam will be kept empty as far as possible to reduce the possibility of an overflow. In the unlikely event that the dam was to overflow, the water would drain to the dirty water storage dams where it could be pumped back to the brine placement area. The contingency plans in Section 5 would then be adopted with regards to increased monitoring frequency for the detection of seepage, and the treatment of any confirmed contaminated water in the Groundwater Collection Basin.

3.2 Extended Area Surface Runoff

The design of the extended brine conditioned ash placement area drainage system, to manage external and internal runoff, will be similar to that used for the existing area. The existing detention pond will be extended into the expanded area as required, maintaining a similar configuration to that shown in Figure 4. The 30m long, 1m deep sump for collection of runoff will be moved as required. Water from the sump will be directed to the existing lined Brine Dam as well as an additional Brine Dam in the extended area. As the configuration for extended area will be similar to that for the existing placement, the size of the second Brine Dam will also be 300m^3, as depicted in Figure 4.

The design of the drainage system will be suited to the extended placement area and the planned design is expected to be similar to that shown in Figure 4.

3.3 Surface Runoff at Completion of Brine Placement

Once placement of brine conditioned ash ceases, the area will be covered with normal ash and the Brine Dam will be decommissioned. All areas will be rehabilitated and free draining. Runoff from the rehabilitated areas will be diverted to the main site drainage system for clean runoff (Figure 2).

3.4 Groundwater

Protection of natural groundwater is an essential part of the water cycle management. Measures outlined in this management plan seek to minimise the impact that the ash disposal area could have on local groundwater and in turn surface water.

The location of the ash disposal area was chosen to minimise the formation of leachates and its infiltration into the local groundwater. Groundwater modelling carried out for the original 1989 ash disposal EIS (ECNSW, 1989) indicated that a sub-surface drain, constructed of mine spoil, to prevent the deposited ash from coming in contact with the groundwater in the mine void would achieve this aim. The brine conditioned flyash proposal has the brine conditioned ash deposit placed on top of the ash deposit, some 37m above the water table.

Brine-conditioned flyash will not come into contact with the local groundwater table. The water table is predicted to rise by about 2m as a result of ash placement. The local groundwater should therefore be some 35 m below the brine conditioned ash disposal area (Merrick and Tammetta, 1999 and Merrick, 2007).

As the compacted flyash has a low porosity, only very small amounts of leachate are predicted to be formed as a result of rainfall infiltration into the brine conditioned ash deposit. The brine in ash field trial (Forster, 1999) found that the rainfall infiltration was only about 5 mm per year, equivalent to less than 1% of the annual average rainfall. Recent contaminant transport modelling (MERRICK, 2007) has indicated that the leachate produced from the extended brine conditioned ash area is not expected to

have a significant effect on water quality in the Eastern Drain, the Groundwater Collection Basin or Neubecks Creek.

4. Water Monitoring Program

Water quality monitoring provides important feedback for water cycle management in the ash disposal area. The monitoring program has been designed to supply sufficient information to give an accurate picture of the state of the water cycle management so that decisions can be made as to whether changes in local water quality are due to the placement of brine conditioned ash or other activities within the area. The aim is to identify water quality changes at an early stage so the causes can be investigated. In the event that changes are expected to be due to the brine co-placement, decisions can be made regarding corrective actions.

The original April, 2000 Development Approval conditions No. 40 and 41 (Attachment 2) and the recent approval to modify the development (Attachment 4) requires the Department of Planning to consult with the DECC, Department of Water and Energy (DWE), Sydney Catchment Authority (SCA) and Lithgow Council regarding proposed changes to the existing groundwater and surface water monitoring program, before approval of an updated Water Quality Management Plan (WQMP) can be granted.

4.1 Water Quality Guidelines

The local guidelines used are the pre-placement 90th percentile or the ANZECC (2000) guidelines for protection of freshwater (see Connell Wagner, 2007b and Attachment 1). It should be noted that modelling indicates that significant increases of salts and trace metals are not expected in the long-term, so changes in concentrations due to the brine conditioned ash placement are unlikely.

4.2 Groundwater

The groundwater monitoring bores, shown in Figure 5, have been used to monitor effects of the existing brine conditioned placement area. Due to the placement of water conditioned ash, the pre-brine conditioned ash bores MP3, B901 and B904 have been capped before being covered by ash. The background bore MP1 has been dry since brine conditioned ash placement began but is uncapped because it is monitored each quarter for water content. The more recent bores MPGM4/D12, D13 and D14 have also been capped before being covered by ash and recently bores D10 and D11 have been capped and covered with mine spoil. Therefore, changes in water quality in the seepage detection bores and the Groundwater Collection Basin will continue to be used to monitor the effects of brine conditioned ash placement in the ash placement area. In addition, vibrating wire piezometers (which only monitor water level) have been placed around the location of the covered bore D14 (see Figure 5) to provide early warning of increasing groundwater elevation and therefore possible brine leachates from the extended brine placement area. Where a significant increase in groundwater elevation is detected by a vibrating wire piezometer, a bore will be drilled through the ash. Free water in the bore will be analysed for water quality and ash core samples collected and analysed for moisture and salts in leachate tests. However, due to the water conditioned ash placement, there is no possibility of installing more groundwater monitoring bores inside the ash placement area.

It is proposed that, as well as installing additional vibrating wire piezometers in the expanded brine placement area (see Section 4.2.2), the water quality in the Groundwater Collection Basin and the existing monitoring bores outside the ash placement area, shown in Figure 5, will be used to monitor the extended brine conditioned placement area. The vibrating wire piezometers, Groundwater Collection Basin and remaining bores are sufficient for monitoring purposes.

If, for some reason, expansion of the existing groundwater and surface water monitoring programs becomes necessary, it will be undertaken with consultation and in accordance with reasonable requirements of DOP, in consultation with DECC, DWE, SCA and Lithgow Council. To avoid any confusion, it should be noted that Attachment 2 refers to the DLWC and that DWE replaces any reference to the former DLWC.

Extensive groundwater monitoring has been ongoing on at least a quarterly basis around the ash disposal site since 1985 to characterise the water quality and hydraulic characteristics of the area. The locations of the bores were selected according to the ANZECC (1995) principles of up-gradient and down-gradient bores. The bores were placed inside and adjacent to the ash disposal area for early warning of leachates originating from the ash/brine deposit. In addition , bores have been established further away to allow detection of groundwater movements toward the Groundwater Collection Basin and Neubecks Creek and to monitor background conditions. The location of the bores are shown in Figure 5.

The existing groundwater monitoring program will be continued under the WMP with sampling undertaken every three months at all of the groundwater monitoring boreholes . The parameters monitored in the bores are: water depth before bailing (to Australian Height Datum, AHD), conductivity (calibrated YSI meter), pH, sulphate, chloride and trace elements listed in Attachment 1 that are relevant to the ANZECC (2000) guidelines. As discussed in attachment 1, groundwater bore MPGM4/D5 (Figure 5) is used as the background bore due to its consistent results.

Bores are bailed 24 hours before sampling and if the bore has high recharge it is bailed a minimum of three times the bore volume.

All water quality analyses are undertaken in accordance with DECC approved methods (EPA 2004). Detection limits are set so that accurate measurements can be obtained at a level relevant to specific guidelines. In some cases, this may be as low as 1/10th the guideline concentration.

The results from the sampling, including core samples as required, will be presented in the annual Environmental Monitoring Report (EMR), as set out in the following section describing Data Management and Assessment.

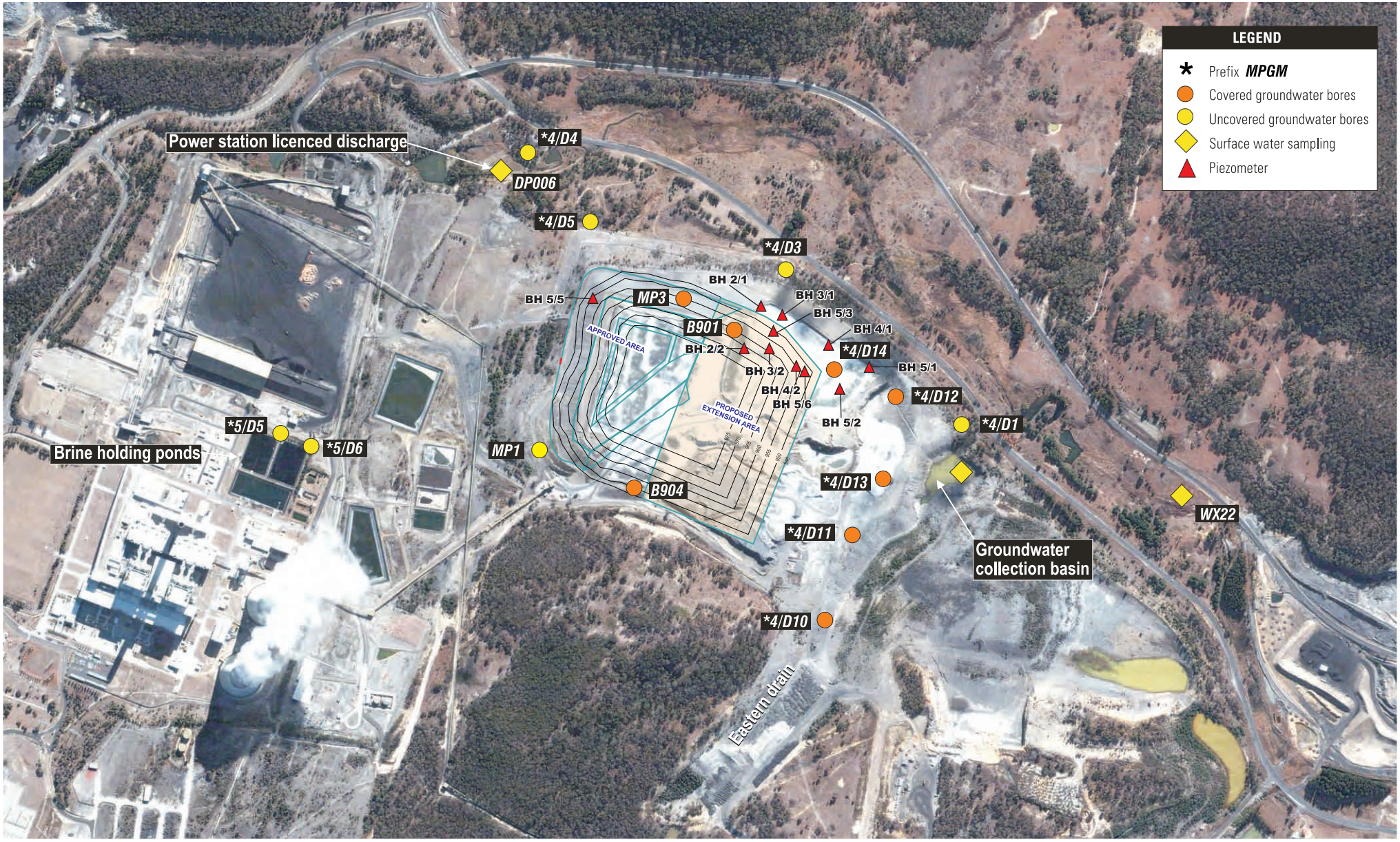

Figure 5

Mount Piper Power Station Ash and Brine Co-placement Area Groundwater and Surface Water Quality Monitoring Sites

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4.2.1 Data Management and Assessment

As the data is received from the laboratory it is compared with the existing data base for outliers and exceedence of guideline concentrations. A trace element outlier is defined using the ANZECC (2000) procedure, which is if a data point is equal to, or greater than, three times the standard deviation of the database away from the database mean. If this occurs, the laboratory is requested to repeat the test. If the outlier is above the guideline concentration, an investigation is undertaken to determine if the result is real or due to sample contamination. Such data is not deleted from the database until an investigation of the likely causes of the outlier can recommend that it be deleted.

The water quality data is graphed over time to show trends at the background and receiving water groundwater and surface water monitoring sites. Chloride is used as a tracer for brine leachates because the local area is highly mineralised and it is difficult to distinguish the origin of other trace elements,. The chloride concentration provides an early warning of leaching from the brine conditioned ash deposit. Chloride is also unlikely to undergo chemical alteration in the groundwater.

If concentrations increase above background and approach the relevant local guidelines and it can be reasonably expected to due the brine placement area, when the local mineralisations and background conditions are taken into account, the contingency plan, described in the following sections will be implemented.

4.2.2 Seepage Monitoring

In addition to groundwater bores, vibrating wire piezometers (VWP) have been installed within the ash disposal area to detect rainfall infiltration and seepage, if any, from the brine conditioned flyash deposit. The first VWP will be installed in the extended area after placement of the first layer is completed. The VWP will be sunk to a suitable depth to indicate whether there is seepage from the brine conditioned flyash placement. If the VWP's indicate that seepage is occurring, the sampling frequency of the outside bores will be increased, as required, to provide feedback for management of the brine conditioned flyash placement area. The VWPs will be monitored regularly and leachates analysed for the presence of salts, such as conductivity measurements.

4.2.3 Groundwater Model Verification

The DA conditions (Attachment 4) require that the next Groundwater Modelling Report is to be an update the groundwater modelling presented in the Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area - Statement of Environmental Effects (dated June 2007). The report is also required to use the results and analyses from the water quality monitoring to calibrate the groundwater contaminant transport model.

The contaminant transport modelling undertaken for extension of the existing brine conditioned ash placement area SEE was calibrated using the current water level and water quality database. In order to calibrate the model for the extended area, it will be re-run once sufficient data has been collected after brine conditioned flyash placement has started in the extended area.

The time required to collect sufficient data to do this is uncertain. Modelling suggests it is in the order of 40 years, which is after the life of ash placement. However, calibration could be undertaken once the leachate plume (as indicated by chloride concentrations) reaches the sub-surface drain, below the placed ash, on the bottom of the mine void, or when some significant change in water quality has occurred that may indicate leachates originating from the brine conditioned ash area have reached the groundwater.

4.3 Surface Water

Surface water quality monitoring involves the water quality at the Mt Piper Power Station licensed discharge point (LDP006), in Neubecks Creek at the stream gauging station, site WX22 and the GCB.

The sampling sites are shown in Figure 5. Stream flows are recorded at WX22 by DWE and provided to Mt Piper Power Station when requested. The WX22 site in Neubecks Creek is located downstream of the ash and brine co-placement areas for monitoring of water quality changes relative to the upstream site at LDP006.

Surface water quality monitoring is currently undertaken on a three monthly basis, except at WX22 which has been monthly since October, 2007, and consistent with the requirements of the original April, 2000 Development Consent. This sampling frequency will be maintained at the surface water quality monitoring sites. Characteristics measured and methods used, such as conductivity (calibrated YSI meter), will be consistent with those used for the groundwater bores (see Section 4.2 and Attachment 1). Data management and assessment will continue to be the same as for groundwater data management.

5. Contingency Plans

In the unlikely event that the brine runoff collection dam was to overflow, the water would drain to the dirty water storage dams where it could be pumped back to the brine placement area. The following contingency plans would then be adopted.

In the event that monitoring indicates the contaminant concentrations in the Groundwater Collection Basin void or Neubecks Creek have increased, and are approaching the relevant locally derived ANZECC guideline concentrations, the monitoring results will be examined to determine if:

- the increase can reasonably be expected to be due the brine placement area, when the local mineralisations and background conditions are taken into account, and
- there has been a significant and consistent exceedence of the relevant locally derived ANZECC guideline concentration for any of the water quality characteristics.

Should the review of the data suggest the increase is potentially caused by the brine/ash deposit, the following actions/risk assessments will be undertaken:

- The Groundwater Collection Basin , Neubecks Creek and all the groundwater bores will be re-sampled, as soon as the increase is evident, to determine if the increase is real and to determine the cause. The frequency of sampling will be increased to monthly until the matter is resolved;
- The runoff Brine Dam liner will be re-checked for leaks. Any leaks that are detected will be repaired;
- The integrity of the surface runoff collection systems in the brine conditioned ash placement area, which are regularly checked, will be inspected to ensure runoff has not bypassed the detention pond, sump and dam and repaired, if necessary, as part of site maintenance activities;
- The rate of seepage of leachates from the co-placement area will be regularly monitoring by the vibrating wire piezometers installed in each stage of the brine conditioned ash placement area. The piezometers would be expected to detect seepage well before it reached the mine spoil below;
- If the water quality in the Groundwater Collection Basin is shown to have the potential to affect the water quality in Neubecks Creek, it will be pumped out and sprayed on the ash placement area. Leachates in the vibrating wire piezometers will be checked to determine if this is the cause of changes to the water quality in the Groundwater Collection Basin;
- A groundwater investigation, including modelling, will be undertaken to determine if the cause of the water quality change in the Groundwater Collection Basin is due to brine leachate from the ash/brine deposit;
- The placement of brine conditioned flyash will be temporarily suspended pending the outcome of the above investigations. The brine storage ponds have the capacity to store 40ML of brine. Therefore there is ample time to undertake an investigation (predicted annual brine production is 8 to 16 ML).
- Should the source of contaminant concentrations be identified as the brine/ash deposits, an investigation will be carried out to determine how to overcome the problem;
- The relevant stakeholders (SCA, DWE, Lithgow City Council and DECC) will be notified and involved in discussions on actions needed to rectify the situation. The Department of Planning will be provided with evidence of this consultation process and details of any increase in contaminants and the remediation measures undertaken;
- Once an acceptable solution is devised and approved, co-placement would then recommence, following approval by the relevant Authorities.

Approval for the discharge of brine via the Wollongong sewage treatment plant was previously granted by DUAP, as a contingency to the on site brine/ash placement. Ocean disposal involves trucking the brine to the sewage plant where it is mixed with sewage to give a dilution of about 300 to 1, giving a total dilution of 20,000 times once the sewage and brine are diluted in the 'mixing zone' of the ocean outfall.

In the unlikely event that the above situation was to occur when there was inadequate capacity in brine storage ponds, additional temporary storage could be arranged on site or surplus brine could be transported to Wollongong for ocean disposal.

Should leaks be detected from the brine storage ponds, through regular monitoring of the adjacent bores (shown in Figure 5) or as a result of special investigations, the storage of the brine could be transferred to another pond at the Power Station while the defective liner is repaired. Construction of a temporary storage area could also be considered if the adjacent ponds were not suitable for storage.

6. Brine Management Strategies

As far as is practicable, Mount Piper Power station is operated so that the production, handling and storage of the brine is minimised and its management is carried out in a responsible manner.

Several strategies for minimising brine production at Mt Piper Power Station have been investigated. The most effective method is to use a greater proportion of the Fish River water supply allocation and to reduce the use of the more saline Coxs River supply. This has limited brine production, even when the power station was operated at near full capacity. The current prolonged drought has limited access to the Fish River water supply and increased the salinity of the Coxs River supply, so the volume of brine production has increased in recent years. The extended area of brine conditioned ash placement has taken this effect into account for future co-placement requirements.

Other brine reduction strategies being used include recycling of plant wastewater and using cooling tower water to condition ash. The option to discharge brine via at the Wollongong sewage treatment is available as a contingency plan in the event that on site disposal of brine conditioned flyash is interrupted or suspended.

The handling of brine at the site is carried out to prevent any release into the surrounding environment. Brine conditioning of the flyash occurs within the paved power station area, away from the ash disposal area, to prevent any brine or brine contaminated material entering natural waterways. The fly ash conditioning plant area is protected by drainage systems that collects and pumps drainage water to settling basins from where the water is recycled for appropriate uses. The brine conditioned flyash is transported to the designated disposal area by conveyor.

The pump to transport the brine to the ash conditioning plant is located adjacent to the brine holding ponds, and any drainage from the pump area is directed back to the brine ponds. The pipeline is fully welded HDPE and ABS pipe, located above ground to ensure that the possibility of an undetected leak is minimised.

The site layout ensures that any spill of brine is intercepted at the earliest point. The drainage system is backed up by the Mt Piper Final Holding Pond, so that in the unlikely event of leaked brine, it can be collected and pumped back to the water treatment plant.

The brine storage ponds are double lined to minimise the risk of leaks and local groundwater contamination. Groundwater bores have been installed adjacent to the ponds and are monitored quarterly to provide early warning of leaks in the outer liner. The groundwater is monitored for pH, chloride, sulphate, conductivity and total dissolved solids. In addition, trace metals are sampled quarterly to confirm the local guidelines are not exceeded.

During storage of the brine in the holding ponds, some solids settle as the settled material cannot be slurried with the brine for mixing with the fly ash. The material is periodically excavated as required and transported to the ash storage area in sealed trucks, where it is deposited in the brine conditioned ash placement area. The brine sludge is spread in thin layers and covered by a layer of brine conditioned fly ash in the manner described in the “Mount Piper Power Station Brine Conditioned Flyash Co-placement - Statement of Environmental Effects” (PPI 1999). These solids will continue to be spread in a thin layer in the designated brine conditioned flyash disposal area as necessary.

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PPI, 2000. Mt Piper Power Station Brine Conditioned Flyash Co-placement Water Management and Monitoring Plan. Prepared for Delta Electricity by Pacific Power International, Environmental Services

Attachment 1

Table 1. Existing Surface and Groundwater Quality in and Near the Ash Disposal Area

Element	Ash Disposal Area		Background **	Neubecks Creek ***	ANZECC (2000) Guidelines #	
(mg/L)	B901 and MPGM4/D12	GCB	MPGM4/D5	WX22	Groundwater	Freshwater
Al	14.05	-	-	-		0.055
Ag	0.001	0.00067	0.001	<0.001	0.00005	0.00005
ALK	68	132	42	54		
As	0.008	0.001	0.001	0.001	0.024	0.024
B	1.84	0.790	0.151	0.049	0.37	0.370
Ba	0.022	0.025	0.022	0.026	0.7	0.7+++
Be	0.002	0.001	0.001	0.001	0.100	0.100
Cd	0.016	0.001	0.001	0.001	0.002	0.001
Cl	28	38	27	19	350	350+
COND (uS/cm)	1370	1499	1117	316	2600^	2200
Cr	0.001	0.001	0.003	0.001	0.005	0.001
Cu	0.011	0.001	0.002	0.001	0.005	0.0025
F	2.37	0.095	0.175	0.246	1.5	1.5+++
Fe-filtered	13.12	0.163	56.3	0.089	**0.664**	0.3+++
Hg	0.000113	0.000120	<0.00012	0.00017	0.00006	0.00006
Mn-filtered	7.47	4.29	8.41	0.575	**5.704**	1.900
Mo	0.002	0.003	0.003	0.003	0.01	0.01+
NFR	99	-	-			10.0
Ni	1.483	0.356	0.083	0.013	**0.5509**	0.017
Pb	0.003	0.001	0.004	0.001	0.005	0.005
pH	6.2	7.3	6.0	7.1	6.5-8.0	6.5-8.0
Se	0.002	0.001	0.001	0.001	0.005	0.005
SO4	753	762	586	90	1000	1000++
TDS	1232	1216	910	220	2000	1500^
Zn	1.050	0.077	0.085	0.061	**0.908**	**0.116**

* average of bores B901and MPGM4/D12 in ash placement area

** bore MPGM4/D5 upgradient of ash disposal area and between ash disposal area and Neubecks Creek

^ 2000 mg/L TDS/0.77 for groundwater; 0.68 x 2200 uS/cm low land river conductivity protection of aquatic life

ANZECC (2000) guidelines for protection of freshwaters, livestock, irrigation water or drinking water. Local guideline based upon 90th percentile (**shown in bold**) – see text.
Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Current Ca, Mg in GCB 147, 113 mg/L: in Neubecks Creek 19.7, 11.8 mg/L, respectively
Note: Chromium is for CrVI only and not adjusted for hardness

\+ Irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L

++ Livestock

+++ Drinking water

Attachment 2

Modification of the Mt Piper Power Station Development Consent to allow
Brine Conditioned Ash Placement in the Ash Placement Area, 3rd April, 2000

NOTICE OF AMENDMENT OF A DEVELOPMENT CONSENT GRANTED UNDER SECTION 101 OF THE UNAMENDED ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979 PURSUANT TO SECTION 96(2) OF THE AMENDED ACT.

I, the Minister for Urban Affairs and Planning, pursuant to Section 96(2) of the amended Environmental Planning and Assessment Act 1979, modify the development consent referred to in Schedule 1 in the manner set out in Schedule 2 (S90/01696).

Andrew Refshauge MP
Deputy Premier
Minister for Urban Affairs and Planning
Minister for Aboriginal Affairs
Minister for Housing

Sydney, 3 April 2000

ABBREVIATIONS AND INTERPRETATION

The Director-General	Director-General of the Department of Urban Affairs and Planning
The Council	Lithgow City Council
The Applicant	Delta Electricity
DLWC	Department of Land and Water Conservation
EPA	New South Wales Environment Protection Authority
SCA	Sydney Catchment Authority
The Site	Mount Piper Power Station
Relevant Authority	EPA, DLWC or SCA

SCHEDULE 1

Development consent granted by the Minister for Planning and Environment on 1 April 1982, in respect of a development application made by the Applicant, the Electricity Commission of New South Wales, to the Greater Lithgow City Council for construction and operation of a power station known as the Mount Piper Power Station, as modified on 18 March 1991 and 21 June 1996 and 18 January 1999.

SCHEDULE 2

Delete Condition 34 of the development consent.

Renumber Condition 38 as Condition 49.

Insert the following Conditions 38 to 48, inclusive.

38) The Applicant shall carry out modifications to the development generally in accordance with the Statement of Environmental Effects (SEE) dated August 1999, prepared by Environmental Services, Pacific Power International for Delta Electricity, and as modified by the following conditions. Any alteration, variation or extension of the development shall require the further consent of the Minister for Urban Affairs and Planning.

39) The Applicant shall, prior to the first placement of brine-conditioned flyash, apply to the EPA for a modification to the EPA licence for the Site. The licence modification shall address conditions for the continued on-site storage of brine, the placement of brine-conditioned flyash, and any reasonable requirements of the EPA.

WATER MONITORING PROGRAMS

40) The Applicant shall, at least one month prior to the first placement of brine-conditioned flyash, consult with the EPA, DLWC and SCA to establish the requirements for Water Monitoring Programs for groundwater and surface water. The Water Monitoring Programs shall:

(i) be based on the monitoring programs presented in the Statement of Environmental Effects for this modification;
(ii) include water quality testing at a minimum frequency of every three months;
(iii) be at the expense of the Applicant.

41) The Applicant shall expand the groundwater and surface water monitoring programs, including, if so required, the establishment of additional groundwater monitoring bores and surface water sampling points, in accordance with any reasonable requirements of the EPA, DLWC or SCA.

42) The Applicant shall, prior to the construction or operation of any monitoring bore on or in the vicinity of the development, consult with DLWC regarding the licensing of any bore on or in the vicinity of the development, under the provisions of the *Water Act 1912*.

WATER MANAGEMENT PLAN

43) At least one month prior to the placement of brine-conditioned flyash, or within such further period as the Director-General may agree, the Applicant shall prepare and submit for the approval of the EPA, the Sydney Catchment Authority, DLWC, Council, and the Director-General, a Water Management Plan (WMP) which shall include, but not be limited to:

a) Details of the monitoring programs for surface water and groundwater required under conditions 40 and 41.
b) Details of measures to be employed to control surface water run-off from the site.

c) Contingency plans for the mitigation of environmental impacts should run-off or leachate from the site be found to be negatively impacting on natural surface water or groundwater.
d) Brine management objectives and strategies, with specific reference to measures aimed at reducing the volume of brine produced at the Mount Piper Power Station.

ENVIRONMENTAL MONITORING REPORT

44) The Applicant shall provide to the Director-General, EPA, DLWC SCA and Council, an Environmental Monitoring Report (EMR) on a yearly basis, with the first EMR to be submitted no later than six months after the first placement of brine-conditioned flyash on-site. The Applicant shall agree to Council making the Environmental Monitoring Reports available on request for public inspection.

45) The Environmental Monitoring Report shall include, but not be limited to:

(a) a summary and discussion of all available results and analyses from Water Monitoring Programs;
(b) a discussion of the aims of the Water Management Plan and to what degree these aims have been attained in the context of results and analyses of the Water Monitoring Programs;
(c) actions taken, or intended to be taken, if any, to mitigate any adverse environmental impacts; and to meet the reasonable requirements of the Director-General, EPA, DLWC, Sydney Catchment Authority or Council.

GROUNDWATER MODELLING

46) The Director-General, EPA, DLWC, SCA or Council may, based on the results and analyses presented in the Environmental Monitoring Report, or any other information that may be reasonably interpreted as indicating significant impacts on the groundwater quality in the vicinity of the Site as a result of the placement of brine-conditioned flyash, request the preparation of a Groundwater Modelling Report.

47) The Groundwater Modelling Report shall be an update of the groundwater modelling presented in the Statement of Environmental Effects for this modification and will employ the results and analyses of the Water Monitoring Programs to calibrate the groundwater contaminant transport model. The Groundwater Modelling Report shall be prepared by a qualified person approved by the Director-General or relevant Authority.

48) The Applicant shall comply with any reasonable requirement of the Director-General, DLWC, EPA, SCA or Council with regard to the content or scope of the Groundwater Modelling Report, or actions to be taken in response to the results of the report.

Attachment 3

Modification of the Development Consent to Increase the Capacity of Mt Piper Power Station
3rd June, 2006

Modification Approval

Section 96(2) of the *Environmental Planning and Assessment Act 1979*

I, the Minister for Planning, pursuant to section 96(2) of the *Environmental Planning and Assessment Act 1979*, modify the development consent referred to in Schedule 1 in the manner set out in Schedule 2.

Frank Sartor MP
Minister for Planning

Sydney 3 June 2006 File No: S90/01696

SCHEDULE 1

Development consent:	granted by the Minister for Planning and Environment on 1 April 1982.
In respect of:	Lot 1 DP 325532, Lot 1 DP 400022, Lot 15 DP 626299, Part Lot 191 DP 629212, Lot 2 DP 702619, Lots 362 and 366 DP 740604, Part Lot 10 and Lots 18, 59, 260 and 261 DP 751636, Part Lot 1 DP 803655, Lots 1-7 and Part Lot 13 DP 804929, Lot 1 DP 813288, Lot 1 DP 816420, Lots 40, 41 and 46-52 DP 827626, Lot 1 DP 829065, Lot 21 DP 832446 and Lot 1 DP 920999.
For the following:	The construction and operation of a power station known as the Mount Piper Power Station
Modification Application:	Modification of the development consent to increase the capacity of the power station in two phases: • initially operating the power station at a capacity factor of up to 90%, to generate up to a nominal capacity of 1400 megawatts; and • undertaking equipment upgrade works or replacements to provide a nominal capacity of 1500 megawatts when operating at a capacity factor of up to 90%.

SCHEDULE 2

The development consent is modified by:

1) inserting the following immediately after existing condition 49:

Expansion and Upgrade of the Power Station

50. The Applicant is permitted to upgrade and expand the development in two stages:
    a) stage 1 being the operation of the development at a capacity factor of up to 90%, to generate up to a nominal capacity of 1400 megawatts; and
    b) stage 2 being the implementation of equipment upgrade works or replacements to provide a nominal capacity of 1500 megawatts when operating at a capacity factor of up to 90%.

51. Expansion and upgrade of the development, as defined under condition 50 of this consent shall be undertaken generally in accordance with *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005.

Air Quality Impacts

52. The Applicant shall design, construct, commission, operate and maintain the expanded and upgraded development to ensure that the concentration of each pollutant listed in Table 1 does not exceed the maximum allowable discharge concentration for that pollutant when measured at discharge monitoring point 11 and 12 (as defined under the Environment Protection Licence (No. 766) for the site). For the purpose of monitoring and determining compliance with this condition, "dioxins and furans" shall be polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), presented as 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) equivalent and calculated in accordance with the procedures included in Part 4, clause 29 of the *Protection of the Environment Operations (Clean Air) Regulation 2002.*

Table 1 – Maximum Allowable Discharge Concentration Limits (Air)

Pollutant	Maximum Allowable Discharge Concentration Limit	Reference Conditions
Nitrogen dioxide (NO_x) or nitric oxide (NO) or both	1500 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Sulfuric acid mist (H_2SO_4) or sulfur trioxide (SO_3), or both, as (SO_3)	100 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Solid particles	50 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Total fluoride	50 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Chlorine	200 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Hydrogen chloride	100 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Total of Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn and V	1 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Cadmium	0.2 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Mercury	0.2 mgm^{-3}	dry, 273K, 101.3 kPa, 7% O_2
Dioxins and furans	0.1 ngm^{-3}	I-TEQ, dry, 273K, 101.3 kPa, 11% O_2
Total volatile organic compounds	40 mgm^{-3} (as VOC) or 125 mgm^{-3} (as CO)	dry, 273K, 101.3 kPa, 7% O_2

53. The Applicant shall determine the pollutant concentrations and emission parameters specified in Table 2 below, at discharge monitoring points 11 and 12 (as defined under the Environment Protection Licence (No. 766) for the site), and employing the sampling

and analysis method specified. Monitoring shall be undertaken at the frequency specified in the Table.

Table 2 –Pollutant and Parameter Monitoring (Air)

Pollutant/ Parameter	Units of Measure	Frequency	Method
Nitrogen oxides	gm^{-3}	continuously	CEM-2
Sulfur dioxide	mgm^{-3}		CEM-2
Solid particles	mgm^{-3}	quarterly during the first 12 months following commissioning of Stage 1 and Stage 2, then annually or as otherwise specified by Environment Protection Licence conditions thereafter	TM-15
Sulfuric acid mist and sulfur trioxide (as SO_3)	mgm^{-3}		TM-3
Chlorine	mgm^{-3}		TM-7 & TM-8
Total fluoride	mgm^{-3}		TM-9
Hydrogen chloride	mgm^{-3}		TM-7 & TM-8
Total of Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn and V	mgm^{-3}		TM-12, TM-13 & TM-14
Cadmium	mgm^{-3}		
Mercury	mgm^{-3}		TM-12, TM-13 & TM-14
Copper	mgm^{-3}		TM-12, TM-13 & TM-14
Dioxins and furans	ngm^{-3}		TM-18
Carbon dioxide	%		TM-24
Oxygen	%		CEM-3
Dry gas density	kgm^{-3}		TM-23
Moisture content	%		TM-22
Molecular weight of stack gases	$gmol^{-1}$		TM-23
Temperature	°C		TM-2
Velocity	ms^{-1}		TM-2
Volumetric flowrate	m^3s^{-1}		TM-2

54. Notwithstanding conditions 52 and 53, nothing in this consent relieves the Applicant from the requirement to comply with the Environment Protection Licence for the site issued under the *Protection of the Environment Operations Act 1997.* In the event that the Environment Protection Licence for the site is modified from time to time to be inconsistent with or more stringent than the requirements of this consent, the requirements of the Licence shall prevail over this consent to the extent of any such inconsistency.

Air Quality Performance Verification

55. Within 90 days of commissioning Stage 2 of the expanded and upgraded development, or as may be directed by the Director-General, and during a period in which the upgraded and expanded development is operating under design loads and normal operating conditions, the Applicant shall undertake a program to confirm the air emission performance of the development and update air quality modelling. The program shall include, but not necessarily be limited to:
    a) point source emission sampling and analysis subject to the requirements listed under condition 54;
    b) an update of the air quality impact assessment presented in *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005, using actual air emission data collected under a). The assessment shall be undertaken strictly in accordance with the methods outlined in *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) and to meet the requirements of the DEC with respect to updating the air quality impact assessment;

c) a comparison of the results of the air quality impact assessment required under b) above, and the predicted air quality impacts detailed in *Statement of Environmental Effects: Mount Piper Power Station Units 1 and 2 Upgrade*, prepared by Connell Wagner PPI and dated December 2005; and

d) a comparison of the results of the air quality impact assessment required under b) above, and the impact assessment criteria detailed in *Approved Methods and Guidance for the Sampling and Analysis of Air Pollutants in New South Wales* (EPA, 2005).

A report providing the results of the program shall be submitted to the Director-General and the DEC with 28 days of completion of the testing required under a).

Construction Environmental Management

56. Prior to the commencement of construction of each Stage of the expanded and upgraded development, the Applicant shall prepare and implement a Construction Environmental Management Protocol to outline environmental management practices and procedures to be followed during the construction of the development. The Protocol(s) shall be prepared in accordance with *Guideline for the Preparation of Environmental Management Plans* (DIPNR 2004) and shall focus on the management of erosion and sedimentation, dust, heavy vehicle movements and noise during the construction works.

Attachment 4

Modification of the Development Consent for Extension of the Existing Brine and Ash Co-placement Area, April, 2008

NSW GOVERNMENT
Department of Planning

Contact: Swati Sharma
Phone: (02) 9228 6221
Fax: (02) 9228 6355
Email: swati.sharma@planning.nsw.gov.au

Our ref: S90/01696

Mr Stephen Saladine
Delta Electricity
350 Boulder Road
PORTLAND NSW 2847

Dear Mr Saladine

Expansion of the Existing Brine and Ash Co-placement Area, Mount Piper Power Station, Lithgow (MOD-77-9-2007-i)

On 23 March 2008, the Executive Director, Major Project Assessments Division of the Department, approved the Modification Application for the expansion of the existing brine and ash co-placement area of the Mount Piper Power Station. I have attached a copy of the Executive Director's approval for your information. The Executive Director's approval can also be viewed on the Department's website under "Notices of Determination" in the "Major Project Assessments" section.

If you are dissatisfied with this decision, section 96(6) of the *Environmental Planning and Assessment Act 1979*, gives you a right to appeal to the Land and Environment Court.

If you have any enquiries about the proposal, please contact Swati Sharma on 9228 6221 or via email at swati.sharma@planning.nsw.gov.au.

Yours sincerely

Scott Jeffries
Director
Major Infrastructure Assessments

28/03/08

Bridge St Office 23-33 Bridge St Sydney NSW 2000 GPO Box 39 Sydney NSW 2001
Telephone (02) 9228 6111 Facsimile (02) 9228 6191 DX 10181 Sydney Stock Exchange
Website www.planning.nsw.gov.au

Modification Approval

Section 96(2) of the *Environmental Planning and Assessment Act 1979*

I, the Executive Director, Major Project Assessments Division of the Department of Planning, in accordance with the Instrument of Delegation issued by the Minister for Planning, on 19 December 2007, pursuant to section 96(2) of the *Environmental Planning and Assessment Act 1979*, modify the development consent referred to in Schedule 1 in the manner set out in Schedule 2.

Chris Wilson
Executive Director
Major Project Assessments
As delegate for the Minister for Planning

Sydney 23 MARCH 2008 File No: S90/01696

SCHEDULE 1

Development consent:	granted by the Minister for Planning and Environment on 1 April 1982.
In respect of:	Lot 1 DP 325532, Lot 1 DP 400022, Lot 15 DP 626299, Part Lot 191 DP 629212, Lot 2 DP 702619, Lots 362 and 366 DP 740604, Part Lot 10 and Lots 18, 59, 260 and 261 DP 751636, Part Lot 1 DP 803655, Lots 1-7 and Part Lot 13 DP 804929, Lot 1 DP 813288, Lot 1 DP 816420, Lots 40, 41 and 46-52 DP 827626, Lot 1 DP 829065, Lot 21 DP 832446 and Lot 1 DP 920999.
For the following:	The construction and operation of a power station known as Mount Piper Power Station
Modification Application:	Modification of the development consent to extend the brine and ash co-placement area.

SCHEDULE 2

The development consent is modified by:

1) Inserting the following conditions immediately after Condition 38

Extension of the Existing Brine and Ash Co-placement Area

38 A Notwithstanding the provisions of Condition No. 38, the brine and ash co-placement area may be extended and shall be undertaken generally in accordance with the *Statement of Environmental Effects: Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area*, prepared by Connell Wagner Pty Ltd and dated June 2007. This includes:

I. The extended area must lie within the existing ash placement area;
II. Co-placement activities in the proposed extended area must use existing facilities and methods;
III. The placement of brine conditioned ash may only occur between the levels of RL 946 metres (the end-point of the water conditioned ash layer) and RL 980 metres.

38 B The groundwater and surface water monitoring programs required by Condition No. 40 and 41 apply to the extension of the brine and ash co-placement area, permitted by Condition 38 A.

38 C The Applicant must update the Water Management Plan (WMP) required by Condition No. 43, and obtain the approval of the Director-General for the update, prior to undertaking any works permitted by Condition No. 38 A. In determining whether to grant approval, the Director-General must consult with the Department of Environment and Climate Change, the Sydney Catchment Authority, the Department of Water and Energy, and Council.

38 D The spray irrigation system of the ash disposal area must be automated to operate when conditions indicate the potential for dust movement to occur, with a manual override function, in order to reduce the likelihood of non-compliant dust emissions from the ash placement area. The implementation of the automated system must occur no later than 30 June 2008 or as otherwise agreed by the Director-General.

2) Replace Condition 47 with the following:

47 The Groundwater Modelling Report shall be an update of the groundwater modelling presented in the *Mount Piper Power Station Extension of Brine Conditioned Ash Placement Area - Statement of Environmental Effects* (dated June 2007). The report must also employ the results and analyses of the Water Monitoring Programs to calibrate the groundwater contaminant transport model. The Groundwater Modelling Report shall be prepared by a qualified person approved by the Director-General or relevant Authority.

Attachment 5:
Bilfinger Berger Services Ash Placement Area - Daily Inspection Record Sheet

ASH PLACEMENT AREA - DAILY INSPECTION RECORD SHEET

Site : MT PIPER

Date:

Inspected by:

Wind Speed, Direction and Temperature						
Wind speed	Nil	Light	Moderate	Strong	Reading	Comment
Windspeed meter reading (km/hr)						
Temperature reading (deg celcius)						
Wind direction						
Irrigation Rates						
Weather Conditions	>25° >20km/hr	15-24° <20km/hr	15° <20km/hr	Pump start time	Pump stop time	Total Irrigation Hrs
Sprinkler hours/day	10	8	6			
Rainfall (mm)						
On the Pad (mm)						
At the crib hut (mm)				Ref APA log		
On the western batter (mm)						
Water Usage (Pumps and meters)						
Pump	*Service area*	*Hours*		*Volume (L)*	*Comment*	
Return Water Pump Blue	NA pads					
Return Water Pump Yellow	Brine area					
HP Pump	Bottom ash & haul roads					
HP Pump at silo	To calculate APA use					
Water at the bins	Fly ash moisture content					
Water cart fill point	Gravity					
Water cart fill point	Pump					
Piezometer Readings						
BH2/1:		BH2/2:				
BH3/1:		BH3/2:				
BH4/1:		BH4/2:				
BH5/1:		BH5/2:				
Environmental conditions						
		OK (y/n)	Comment			
Bottom ash tipping area						
Emergency pad						
Working pad						
Perimeter drains in place & functioning						
Internal haul road drains						

Brine dam (s)		
Surface water drainage on pads		
Water seepage through bund wall (external perimeter)		
Presence of fugitive dust		
If dust present: how much?		
Which areas dusting up?		
Sprinkler operation		
Number of water carts operating		
Actions - Notes - General		

Annex C

BoM Data

Lithgow, New South Wales
August 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	6.6	13.3	0						7.6	63	2	W	22							
2	Th	-4.9	14.6	0.1						1.0	80	0		Calm							
3	Fr	-1.8	16.5	0.2						8.3	69	1	NNW	11							
4	Sa	5.0	11.1	7.0						5.6	72	5	WSW	22							
5	Su	-3.0	15.6	0						6.0	63	3		Calm							
6	Mo	6.3	9.9	6.0						6.8	91	8	W	11							
7	Tu	3.4	7.8	3.6						3.5	85	7	WNW	7							
8	We	1.3	10.9	0						6.4	56	6	W	19							
9	Th	1.7	12.6	0						6.5	79	1	SSW	4							
10	Fr	-4.6	16.8	0.1						7.3	62	1	NNW	7							
11	Sa	7.5	17.3	0						12.9	61	1	NNW	28							
12	Su	1.4	6.0	1.8						2.1	85	7	SW	7							
13	Mo	0.8	9.2	0						4.3	86	7	SW	15							
14	Tu	1.5	15.9	0						5.8	77	0	N	4							
15	We	-0.2	16.8	0						9.6	50	0	WNW	22							
16	Th	8.0	12.4	0						9.0	62	0	WSW	19							
17	Fr	-5.1	10.4	0						4.0	53	0		Calm							
18	Sa	0.1	13.5	0						8.6	48	0	WNW	15							
19	Su	1.4	6.5	2.8						3.0	71	5	W	22							
20	Mo	-0.9	8.7	1.0						2.2	65	0	SW	11							
21	Tu	2.0	6.6	0						3.3	76	7	SW	15							
22	We	3.4	10.6	0						4.9	83	7	SW	7							
23	Th	-0.5	10.0	0						7.0	77	6	ESE	7							
24	Fr	1.9	14.6	0						7.1	84	3	NE	4							
25	Sa	7.4	10.9	0						9.2	85	8	N	11							
26	Su	3.0	9.6	4.4						7.5	99	8		Calm							
27	Mo	2.2	13.3	8.8						6.5	99	6		Calm							
28	Tu	1.2	10.6	0						4.6	76	5	NNE	7							
29	We	-5.5	11.0	0						2.6	59	0		Calm							
30	Th	-6.6	15.6	0						1.9	68	0		Calm							
31	Fr	1.4	12.8	0						10.1	38	8	NNW	11							
Statistics for August 2018																					
	Mean	1.1	12.0							6.0	71	3		9							
	Lowest	-6.6	6.0							1.0	38	0		Calm							
	Highest	8.0	17.3	8.8						12.9	99	8	NNW	28							
	Total			35.8																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201808 Prepared at 13:00 UTC on 10 Jun 2019

Lithgow, New South Wales
September 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	6.4	10.8	10.4						8.1	74	7	W	11							
2	Su	1.1	13.0	0						7.9	63	2	SW	7							
3	Mo	4.1	9.3	1.0						5.4	84	8	SSE	11							
4	Tu	5.5	10.9	3.0						6.2	91	8	SE	11							
5	We	6.3	12.1	2.4						8.4	80	7	E	7							
6	Th	5.4	15.0	0.4						10.8	74	5	NNW	4							
7	Fr	9.4	14.5	10.6						12.0	86	7	NNW	19							
8	Sa	8.5	10.9	8.6						8.5	92	8	SE	7							
9	Su	1.2	13.9	9.2						7.4	63	5	WSW	7							
10	Mo	1.1	19.3	0						9.8	73	0	SSW	4							
11	Tu	1.6	20.6	0						11.5	66	0	NNW	7							
12	We	11.5	22.3	0						15.9	46	2	NNW	19							
13	Th	3.5	22.6	0						16.4	53	1	NW	15							
14	Fr	5.2	21.3	0.1						13.2	62	0	NNW	11							
15	Sa	4.2	23.8	0						19.4	21	2	NNW	28							
16	Su	0.7	11.5	0						4.8	46	0	SW	11							
17	Mo	-3.8	14.8	0						7.1	70	1	NNW	4							
18	Tu	-0.3	19.0	0						12.1	41	0	NNW	19							
19	We	6.5	19.6	0						15.4	26	7	NNW	7							
20	Th	-3.4	13.8	0						7.6	54	1	ENE	4							
21	Fr	-3.0	17.7	0						7.2	58	0	SSW	4							
22	Sa	-1.7	18.1	0						15.7	36	6	W	7							
23	Su	-0.7	19.5	0						13.4	49	0	SSW	11							
24	Mo	5.2	9.7	0						6.1	86	8	SE	7							
25	Tu	4.7	14.3	0						8.5	64	6	ESE	11							
26	We	3.8	10.4	5.2						6.8	91	8	SE	4							
27	Th	1.3	18.2	3.0						9.2	75	1	NNW	7							
28	Fr	1.8	22.5	0						17.0	36	6	NNW	15							
29	Sa	7.7	12.8	1.4						9.0	58	5	WSW	15							
30	Su	2.1	15.8	0						7.9	55	1	E	7							
Statistics for September 2018																					
Mean		3.2	15.9							10.3	62	3		10							
Lowest		-3.8	9.3							4.8	21	0	#	4							
Highest		11.5	23.8	10.6						19.4	92	8	NNW	28							
Total				55.3																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201809 Prepared at 13:00 UTC on 9 Jun 2019

Lithgow, New South Wales
October 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	0.8	20.0	0						10.7	70	0		Calm							
2	Tu	1.9	23.2	0						14.0	63	1		Calm							
3	We	6.1	18.0	0.1						15.1	55	8	NW	4							
4	Th	10.5	12.6	4.8						11.4	95	8	E	7							
5	Fr	7.6	9.3	24.2						7.6	92	8	SSE	15							
6	Sa	6.3	13.4	2.0						8.3	88	7	ESE	11							
7	Su	0.6	13.6	0.2						7.6	96	7	SSE	7							
8	Mo	7.7	18.5	1.4						11.4	83	5	WSW	7							
9	Tu	3.9	20.7	0.3						12.0	91	5		Calm							
10	We	8.1	10.9	1.4						10.3	96	8	SE	7							
11	Th	5.2	10.0	28.0						5.9	91	8	SE	15							
12	Fr	5.8	10.5	1.8						7.9	95	8	SSE	11							
13	Sa	7.3	15.2	2.4						9.6	80	7	E	4							
14	Su	9.7	14.8	5.0						11.7	92	7	ENE	11							
15	Mo	10.8	18.4	0.6						12.5	82	8	NE	11							
16	Tu	12.4	19.2	2.6						14.5	84	7	ENE	7							
17	We	12.7	19.2	3.0						13.6	91	8	N	4							
18	Th	8.3	21.0	7.4						13.7	94	8	NNW	7							
19	Fr	8.5	24.0	4.4						16.9	81	1	N	7							
20	Sa	10.0	23.0	0						19.1	69	7	NNW	7							
21	Su	9.7	20.9	0.8						11.2	93	8	SW	4							
22	Mo	10.8	22.8	0						14.2	74	6	NNE	7							
23	Tu	7.8	25.2	0.1						16.1	80	5	NNW	11							
24	We	6.8	17.8	0						13.9	78	3	ESE	7							
25	Th	8.4	23.2	0						10.6	86	8	ENE	7							
26	Fr	3.2	21.6	0						13.4	58	1		Calm							
27	Sa	7.4	23.2	0						12.4	77	2	NNW	15							
28	Su	6.4	18.0	0						12.9	83	7	ENE	4							
29	Mo	8.6	19.7	0						9.3	91	8	N	4							
30	Tu	6.0	25.1	0						12.5	82	0	NNW	15							
31	We	6.3	27.1	0						16.1	74	3		Calm							
Statistics for October 2018																					
	Mean	7.3	18.7							12.1	82	5		6							
	Lowest	0.6	9.3							5.9	55	0		Calm							
	Highest	12.7	27.1	28.0						19.1	96	8	#	15							
	Total			90.5																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201810 Prepared at 13:00 UTC on 8 Jun 2019

Lithgow, New South Wales
November 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	10.0	28.1	0						17.1	83	2	NNW	19							
2	Fr	13.5	29.1	0						19.6	67	6	NNW	7							
3	Sa	16.4	25.5	15.2						20.6	80	4	NNW	22							
4	Su	6.6	25.4	0						13.8	86	5	N	7							
5	Mo	7.5	25.1	0						17.2	71	5	NW	4							
6	Tu	14.3	26.5	0.3						20.2	82	7		Calm							
7	We	14.3	20.2	0.8						19.0	82	8	NNW	7							
8	Th	5.9	15.1	8.0						7.6	85	5	SW	11							
9	Fr	2.2	18.1	0						9.8	83	6	NNW	7							
10	Sa	2.6	20.2	0						11.7	78	1	SE	4							
11	Su	2.3	23.1	0						13.7	70	1	NNW	7							
12	Mo	4.1	22.9	0						13.1	72	0		Calm							
13	Tu	8.5	25.9	0						17.6	68	5	N	4							
14	We	11.5	20.0	0.4						14.5	93	8		Calm							
15	Th	7.4	25.3	0						18.0	81	1		Calm							
16	Fr	9.1	18.7	1.2						10.4	90	8	SSE	7							
17	Sa	10.5	17.5	0						12.0	91	7	SSE	7							
18	Su	9.7	16.8	0.4						9.7	95	8	SE	11							
19	Mo	3.9	21.0	0						10.9	85	4	ESE	4							
20	Tu	7.6	26.5	0						15.1	83	1	N	4							
21	We	14.8	21.2	2.0						19.4	84	7	NW	28							
22	Th	11.7	15.7	17.6						12.8	80		WNW	19							
23	Fr	5.7	12.5	2.0						6.5	86	7	WNW	28							
24	Sa	6.6	17.0	0.2						8.4	88	7	WSW	11							
25	Su	4.9	19.9	0						11.6	81	7	W	7							
26	Mo	4.4	22.0	0						13.4	70	1	S	7							
27	Tu	11.1	23.3	0						14.5	78	6	NNW	4							
28	We	13.4	13.8	36.0						13.4	94	8	E	4							
29	Th	9.2	19.3	49.2						13.2	74	5	SSE	7							
30	Fr	10.7	22.7	0.1						13.7	82	6	N	7							
Statistics for November 2018																					
	Mean	8.7	21.3							13.9	81	5		8							
	Lowest	2.2	12.5							6.5	67	0		Calm							
	Highest	16.4	29.1	49.2						20.6	95	8	#	28							
	Total			133.4																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201811 Prepared at 13:00 UTC on 8 Jul 2019

Lithgow, New South Wales
December 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	5.2	25.6	0.2						18.2	49	0	N	7							
2	Su	8.7	25.0	0						24.0	48	3	WNW	19							
3	Mo	5.6	21.8	0.2						13.7	64	0	WSW	28							
4	Tu	7.9	24.5	0						17.9	66	1	SW	7							
5	We	12.3	19.0	0.2						13.6	89	8	ESE	4							
6	Th	11.8	21.9	0						15.4	80	7	ESE	7							
7	Fr	10.0	25.0	0						14.9	75	1	NE	4							
8	Sa	7.2	28.6	0						19.0	69	1	NW	7							
9	Su	10.4	29.6	0						22.9	64	5	S	4							
10	Mo	10.8	24.4	0						17.8	74	6	SSE	11							
11	Tu	13.1	17.4	1.0						14.4	90	8	SE	4							
12	We	11.4	18.4	1.4						14.0	87	8	SE	4							
13	Th	14.0	25.2	5.0						17.9	85	7	NNW	15							
14	Fr	15.0	21.2	1.2						18.7	79	8	NE	4							
15	Sa	12.0	25.0	29.0						20.2	63	3	NNE	7							
16	Su	13.4	27.6	1.2						21.6	51	1	NNW	11							
17	Mo	11.9	28.4	0						21.5	44	0	WNW	7							
18	Tu	12.0	27.1	0						20.2	70	0	ESE	4							
19	We	16.7	25.8	0.2						18.6	86	7	SE	4							
20	Th	16.2	31.2	64.6						24.8	57	1	NW	11							
21	Fr	14.9	22.6	16.0						16.0	74	8	E	7							
22	Sa	10.2	18.9	1.6						12.0	89	8	SSE	7							
23	Su	10.2	19.5	0						12.4	72	7	SSE	11							
24	Mo	6.4	26.0	0						12.1	83	1	NNW	4							
25	Tu	9.2	29.4	0						18.9	67	0		Calm							
26	We	10.7	30.0	0						22.6	52	0		Calm							
27	Th	12.6	32.6	0						24.0	39	1	N	7							
28	Fr	14.9	33.8	4.8						25.1	37	4	N	7							
29	Sa	13.0	33.8	0						26.0	36	1	WNW	4							
30	Su	14.9	31.6	0						25.0	34	1	NNW	4							
31	Mo	16.4	31.2	0						24.6	48	5	N	4							
Statistics for December 2018																					
	Mean	11.6	25.9							19.0	65	3		7							
	Lowest	5.2	17.4							12.0	34	0		Calm							
	Highest	16.7	33.8	64.6						26.0	90	8	WSW	28							
	Total			126.6																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201812 Prepared at 16:00 UTC on 7 Jul 2019

Lithgow, New South Wales
January 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	14.5	31.4	3.4						23.0	64	0	N	2							
2	We	14.3	33.0	0						21.8	68	3		Calm							
3	Th	18.4	29.1	0.4						22.4	70	7	WSW	4							
4	Fr	12.4	32.5	1.4						22.4	57	0	NW	4							
5	Sa	20.1	32.9	0.6						24.2	59	3	NW	11							
6	Su	16.1	17.5	8.2						16.1	93	8	E	7							
7	Mo	13.5	20.3	0.8						14.9	97	8	SSE	4							
8	Tu	15.0	25.8	2.2						19.8	87	7	SSE	4							
9	We	14.5	28.9	4.4						21.1	75	3	NNW	7							
10	Th	16.9	24.9	0						18.0	89	8		Calm							
11	Fr	16.0	27.9	8.6						20.4	82	4	NNE	7							
12	Sa	15.1	30.6	27.4						21.4	71	0	NNW	11							
13	Su	14.2	25.6	0						20.8	80	2	S	4							
14	Mo	14.8	32.5	0						19.0	79	2	NNW	4							
15	Tu	17.6	35.1	0						26.4	50	1	NNW	7							
16	We	16.4	35.2	0						25.1	62	0	SW	4							
17	Th	14.1	36.1	0						21.4	79	0		Calm							
18	Fr	18.0	35.5	0						21.4	75	2	S	4							
19	Sa	17.8	29.9	0						23.0	74	8		Calm							
20	Su	17.4	29.2	0						19.0	89	8	E	4							
21	Mo	16.8	24.6	20.8						18.2	88	7		Calm							
22	Tu	14.7	31.4	1.0						22.3	77	1	N	4							
23	We	18.5	31.2	1.6						23.3	66	5	NW	4							
24	Th	15.9	27.5	19.8						16.5	89	8		Calm							
25	Fr	16.6	33.5	0						21.8	80	0	NNE	4							
26	Sa	18.9	35.3	0						25.6	61	5	NNW	7							
27	Su	18.3	33.9	0						24.9	68	3	N	7							
28	Mo	16.1	27.4	5.2						19.8	87	7	SE	4							
29	Tu	17.6	31.8	3.4						21.7	84	0	NW	11							
30	We	18.9	28.9	0						23.4	77	7	NW	7							
31	Th	20.8	30.8	0						24.3	52	6	WNW	15							
Statistics for January 2019																					
	Mean	16.5	30.0							21.4	75	3		4							
	Lowest	12.4	17.5							14.9	50	0		Calm							
	Highest	20.8	36.1	27.4						26.4	97	8	WNW	15							
	Total			109.2																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201901 Prepared at 13:00 UTC on 6 Jul 2019

Lithgow, New South Wales
February 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	13.8	17.6	0.2						14.3	88	8	SSE	11							
2	Sa	14.5	22.2	1.8						17.0	96	8	S	4							
3	Su	13.8	29.3	0.4						20.2	74	1	NNW	7							
4	Mo	16.8	28.9	0						21.5	77	4	NNW	4							
5	Tu	16.5	25.8	2.8						19.9	83	7	SE	11							
6	We	16.2	26.0	0						19.1	75	4	NE	9							
7	Th	13.2	27.0	0						18.4	80	1	N	4							
8	Fr	16.9	28.4	0						19.7	76	7	NNW	7							
9	Sa	15.4	22.8	5.4						20.0	76	2	WNW	19							
10	Su	6.4	23.7	1.0						13.0	66	0	WSW	11							
11	Mo	6.6	26.6	0						14.9	82	0	NNW	7							
12	Tu	8.0	28.1	0						20.0	53	0	NNW	15							
13	We	14.6	21.8	0						14.9	67		SW	4							
14	Th	12.3	23.6	0						14.4	80	7	ENE	7							
15	Fr	9.3	23.7	0						15.6	77	2	NE	11							
16	Sa	9.1	26.4	0						15.6	79	6	NE	7							
17	Su	8.6	30.0	0						17.0	79	0		Calm							
18	Mo	11.2	32.3	0						19.5	72	0	N	4							
19	Tu	16.1	31.5	0.6						22.2	68	3	NNW	7							
20	We	15.5	24.0	0.4						15.9	96	8	SE	4							
21	Th	15.5	19.4	0.8						16.0	92	8	SE	7							
22	Fr	13.4	19.0	6.2						13.4	97	8	SE	15							
23	Sa	11.9	18.7	0.2						13.1	92	7	SE	11							
24	Su	11.8	19.4	0.5						13.1	83	7	SE	19							
25	Mo	11.9	20.4	0.2						13.0	93	8	ENE	7							
26	Tu	6.5	26.4	0.1						11.2	97	3	N	4							
27	We	8.4	23.4	0						16.0	84	6	SE	4							
28	Th	15.6	25.0	0						18.0	71	5	E	7							
Statistics for February 2019																					
	Mean	12.5	24.7							16.7	80	4		8							
	Lowest	6.4	17.6							11.2	53	0		Calm							
	Highest	16.9	32.3	6.2						22.2	97	8	#	19							
	Total			20.6																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201902 Prepared at 13:00 UTC on 5 Jul 2019

Lithgow, New South Wales
March 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	10.9	24.9	0						15.4	91	6		Calm							
2	Sa	12.9	23.7	0						15.5	80	4	SSW	4							
3	Su	10.7	26.9	0						10.8	97	1		Calm							
4	Mo	10.4	29.9	0						14.9	94	1		Calm							
5	Tu	11.4	30.5	0						17.9	78	4	NE	4							
6	We	14.9	27.5	0						23.0	46	5	NNW	11							
7	Th	6.7	15.9	1.8						11.2	82	7	SE	4							
8	Fr	11.4	27.6	0						14.4	86	8	NNW	7							
9	Sa	14.4	25.0	0						19.8	73	7	NNW	11							
10	Su	13.8	28.0	0.8						17.8	83	1	NNW	11							
11	Mo	11.9	29.2	0						17.9	65	0	WSW	4							
12	Tu	10.1	26.1	0						15.7	76	0		Calm							
13	We	12.6	19.5	0.3						14.0	94	8	SE	4							
14	Th	14.2	26.4	0.1						17.3	91	8	ENE	4							
15	Fr	12.9	19.3	0						14.4	84	7	SSE	7							
16	Sa	12.5	15.3	3.8						13.6	98	8		Calm							
17	Su	13.4	17.5	27.2						13.4	99	8	SSE	7							
18	Mo	12.6	17.1	7.6						14.4	81	7	WNW	15							
19	Tu	14.5	21.0	16.4						15.5	91	7	SSE	4							
20	We	15.1	23.2	0.1						15.5	91	7	S	4							
21	Th	14.3	23.6	0						15.6	88	6	SE	7							
22	Fr	13.2	23.8	0						14.2	97	6		Calm							
23	Sa	7.4	28.2	10.2						10.9	96	5	N	4							
24	Su	10.9	27.4	2.6						17.4	91	3		Calm							
25	Mo	14.4	20.2	6.8						14.4	94	8	NNW	7							
26	Tu	9.4	17.7	2.8						9.5	72	3	W	11							
27	We	6.1	18.5	0						11.0	87	5	E	4							
28	Th	7.5	22.6	0						10.0	97	5		Calm							
29	Fr	9.0	23.6	0						11.9	95	6		Calm							
30	Sa	11.9	16.7	27.6						13.4	97	8	NNW	7							
31	Su	4.7	12.7	0.3						5.7	74	5	WSW	15							
Statistics for March 2019																					
	Mean	11.5	22.9							14.4	86	5		5							
	Lowest	4.7	12.7							5.7	46	0		Calm							
	Highest	15.1	30.5	27.6						23.0	99	8	#	15							
	Total			108.4																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201903 Prepared at 13:00 UTC on 4 Jul 2019

Lithgow, New South Wales
April 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	1.5	18.6	0						6.1	96	1		Calm							
2	Tu	6.3	16.2	2.0						11.9	89	7	SE	7							
3	We	8.2	22.2	0.6						10.6	99	0		Calm							
4	Th	8.1	16.2	0						13.3	96	7	E	4							
5	Fr	12.2	16.4	1.2						12.2	97	8	SE	4							
6	Sa	12.1	23.5	0.4						14.2	87	1	NNW	7							
7	Su	12.5	25.0	0						19.9	50	0	WNW	15							
8	Mo	14.0	26.2	0						20.9	48	4	NNW	7							
9	Tu	11.3	21.2	0						20.6	47	4	WNW	15							
10	We	2.4	15.9	0						10.3	66	3	ESE	11							
11	Th	4.0	17.0	0						11.6	79	7	N	7							
12	Fr	7.8	19.6	0						13.2	72	5	NNW	11							
13	Sa	6.4	20.7	0.1						11.0	95	7	N	4							
14	Su	5.9	18.4	0						11.4	90	8		Calm							
15	Mo	8.7	18.5	0						13.5	75	5	SE	4							
16	Tu	4.7	19.1	0.1						11.4	100	5	S	4							
17	We	5.9	20.0	0						14.6	76	7	ENE	7							
18	Th	6.9	22.7	0.1						12.0	95	2	ENE	4							
19	Fr	10.4	21.6	0						15.1	79	5	E	7							
20	Sa	7.7	21.6	0.1						13.0	99	3	NE	4							
21	Su	8.6	23.3	0						15.4	80	1		Calm							
22	Mo	10.8	22.8	15.2						13.0	100	6		Calm							
23	Tu	13.0	20.9	0.1						16.6	75	4	NNE	11							
24	We	12.2	22.6	1.4						15.3	73	3	NNE	11							
25	Th	6.1	23.2	0						14.5	85	7		Calm							
26	Fr	8.1	19.6	0						15.8	69	1	NW	15							
27	Sa	0.0	17.2	0						6.8	75	1	SSW	4							
28	Su	1.4	18.8	0						8.0	62	0	SSE	4							
29	Mo	-0.3	18.0	0						7.8	89	6		Calm							
30	Tu	7.0	19.2	0						12.7	85	7	NNW	7							
Statistics for April 2019																					
	Mean	7.5	20.2							13.1	80	4		5							
	Lowest	-0.3	15.9							6.1	47	0		Calm							
	Highest	14.0	26.2	15.2						20.9	100	8	#	15							
	Total			21.3																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201904 Prepared at 13:00 UTC on 3 Jul 2019

Lithgow, New South Wales
May 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	7.5	18.9	0						12.8	90	8	NNW	4							
2	Th	10.4	19.6	0						17.4	77	5	NNW	11							
3	Fr	12.2	17.1	0						16.2	75	7	N	19							
4	Sa	7.9	15.1	24.8						9.6	83	6	W	7							
5	Su	-0.2	13.5	0						8.5	75	1	S	11							
6	Mo	-0.3	14.9	0						7.3	88	1	E	4							
7	Tu	1.3	15.6	0.1						9.0	74	1	SSW	7							
8	We	4.8	11.8	1.0						6.7	86	7	NW	4							
9	Th	-1.6	16.3	0.1						5.9	84	1		Calm							
10	Fr	4.8	10.7	0.2						9.1	75	7	NNW	11							
11	Sa	3.9	10.3	3.6						6.9	77	7	SW	19							
12	Su	-2.0	16.7	0						3.3	95	0		Calm							
13	Mo	-1.7	16.7	0.1						6.2	93	3		Calm							
14	Tu	2.1	17.2	0						10.1	77	1	N	4							
15	We	-0.8	18.0	0.1						4.6	99	8		Calm							
16	Th	2.4	17.4	0						10.0	87	1	NNE	4							
17	Fr	2.6	17.2	0.1						8.5	95	1		Calm							
18	Sa	2.2	18.1	0.2						6.4	99	3	W	4							
19	Su	4.3	17.0	0.2						7.2	99	8	NE	4							
20	Mo	4.4	18.1	0.2						6.8	99	6		Calm							
21	Tu	3.5	19.1	0						8.1	93	1		Calm							
22	We	3.8	19.4	0						7.7	96	1		Calm							
23	Th	4.5	18.7	0.2						9.5	97	8	E	4							
24	Fr	0.4	17.9	0.1						7.5	93	3		Calm							
25	Sa	-0.6	18.2	0						5.9	83	0		Calm							
26	Su	6.2	14.2	0.8						8.7	84	7	SW	15							
27	Mo	5.6	9.7	0.1						7.7	72	5	WNW	15							
28	Tu	1.5	8.4	4.0						4.4	74	5	NW	11							
29	We	3.5	8.9	0						7.2	82	8	WNW	28							
30	Th	0.3	6.7	2.0						1.5	81	6	SW	7							
31	Fr	1.5	9.0	0						4.0	83	4	N	4							
Statistics for May 2019																					
	Mean	3.0	15.2							7.9	85	4		6							
	Lowest	-2.0	6.7							1.5	72	0		Calm							
	Highest	12.2	19.6	24.8						17.4	99	8	WNW	28							
	Total			37.9																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201905 Prepared at 16:00 UTC on 2 Jul 2019

Lithgow, New South Wales
June 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	-3.4	12.1	0.1						1.9	74	0		Calm							
2	Su	-2.1	14.5	0.2						1.1	82	3		Calm							
3	Mo	1.1	9.0	0.2						6.9	89	7	WNW	6							
4	Tu	0.4	8.2	6.4						3.8	75	4	SSW	19							
5	We	3.9	9.6	5.6						5.4	75	7	SSE	15							
6	Th	-4.3	14.9	0.1						-0.2	87	0		Calm							
7	Fr	-3.3	12.0	0.1						1.1	76	1		Calm							
8	Sa	1.6	10.7	0.6						5.8	97	8	NW	4							
9	Su	-0.7	14.7	0.1						3.5	99	1		Calm							
10	Mo	3.3	15.0	0.1						9.2	88	4	NNW	11							
11	Tu	9.2	17.4	0						11.4	90	7	SSW	9							
12	We	1.6	17.9	0.1						8.9	90	7	NW	6							
13	Th	8.9	14.2	0						13.9	56	7	WNW	17							
14	Fr	0.6	12.3	1.0						3.5	85	6		Calm							
15	Sa	-4.0	11.9	0						-0.3	92	1	WNW	2							
16	Su	-1.6	8.8	2.0						7.0	97	8		Calm							
17	Mo	5.6	9.6	6.0						6.4	94	8	SSE	9							
18	Tu	5.6	11.4	0.4						7.7	97	7	SE	2							
19	We	-0.4	10.1	1.2						2.6	87	1	NE	4							
20	Th	-5.3	10.1	0						-0.6	90	2		Calm							
21	Fr	-3.9	7.8	0						-0.5	83	0	SW	4							
22	Sa	-6.3	8.7	0						2.9	56	1	SW	4							
23	Su	-5.7	8.0	0.1						3.3	87	7	SSE	7							
24	Mo	3.4	10.5	5.6						5.9	93	8	SSE	15							
25	Tu	5.9	11.3	3.8						7.6	93	8	ESE	7							
26	We	7.2	10.0	2.0						7.4	96	8	SSE	6							
27	Th	5.7	13.4	0.4						7.1	97	7		Calm							
28	Fr	1.6	15.8	0.1						4.8	99	2		Calm							
29	Sa	-0.1	15.1	0.2						4.8	95	2		Calm							
30	Su	3.8	8.9	3.6						5.2	73	5	W	11							
Statistics for June 2019																					
	Mean	0.9	11.8							4.9	86	4		5							
	Lowest	-6.3	7.8							-0.6	56	0		Calm							
	Highest	9.2	17.9	6.4						13.9	99	8	SSW	19							
	Total			40.0																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201906 Prepared at 13:00 UTC on 7 Jul 2019

Lithgow, New South Wales
July 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	-4.5	11.9	0						-0.1	87	2		Calm							
2	Mo	0.2	8.5	2.4						5.9	93	8	ESE	11							
3	Tu	3.5	12.8	0.4						6.0	99	7	N	4							
4	We	-0.9	16.1	0.2						5.2	100	8	N	4							
5	Th	1.8	17.6	0.1						10.6	74	1	NNW	11							
6	Fr	10.7	16.3	0						13.2	73	6	NW	19							
7	Sa	3.1	7.0	1.0						5.3	61	7	WNW	22							
8	Su	2.9	6.9	1.6						3.3	81	8	WSW	7							
9	Mo	3.4	10.9	0.1						4.8	75	1	WSW	7							
10	Tu	-5.4	12.6	0						-0.2	94	0		Calm							
11	We	-4.3	11.6	0.1						0.2	94	5		Calm							
12	Th	-4.2	11.1	0						0.3	91	4		Calm							
13	Fr	0.4	7.5	0						2.4	76	6	SW	11							
14	Sa	-6.7	10.5	0						-3.4	97	0		Calm							
15	Su	-9.3	10.1	0						-3.6	90	0		Calm							
16	Mo	-7.6	9.9	0.1						2.5	62	0	N	4							
17	Tu	0.4	14.2	0						9.5	30	0	NNW	11							
18	We	3.9	13.2	0						6.9	61	0	NNE	4							
19	Th	0.8	14.5	0						7.9	52	3	NNW	11							
20	Fr	8.0	10.6	0						10.1	35	7	WNW	7							
21	Sa	2.7	9.4	0.2						3.4	73	4	WSW	15							
22	Su	-7.9	11.9	0						-1.0	92	1		Calm							
23	Mo	-6.3	13.6	0						3.7	49	0	N	4							
24	Tu	3.9	15.8	0						10.4	38	0	NW	19							
25	We	6.9	14.8	0						9.9	56	0	WNW	11							
26	Th	0.4	12.9	0						6.6	81	1	SE	7							
27	Fr	-4.6	13.7	0						0.0	89	0		Calm							
28	Sa	-0.7	15.9	0						6.4	74	7		Calm							
29	Su	6.6	15.4	1.8						12.5	64	1	WNW	22							
30	Mo	3.4	9.0	0						4.3	68	5	WSW	19							
31	Tu	1.4	12.9	0						8.0	55	2	NW	19							
Statistics for July 2018																					
	Mean	0.1	12.2							4.9	73	3		8							
	Lowest	-9.3	6.9							-3.6	30	0		Calm							
	Highest	10.7	17.6	2.4						13.2	100	8	WNW	22							
	Total			8.0																	

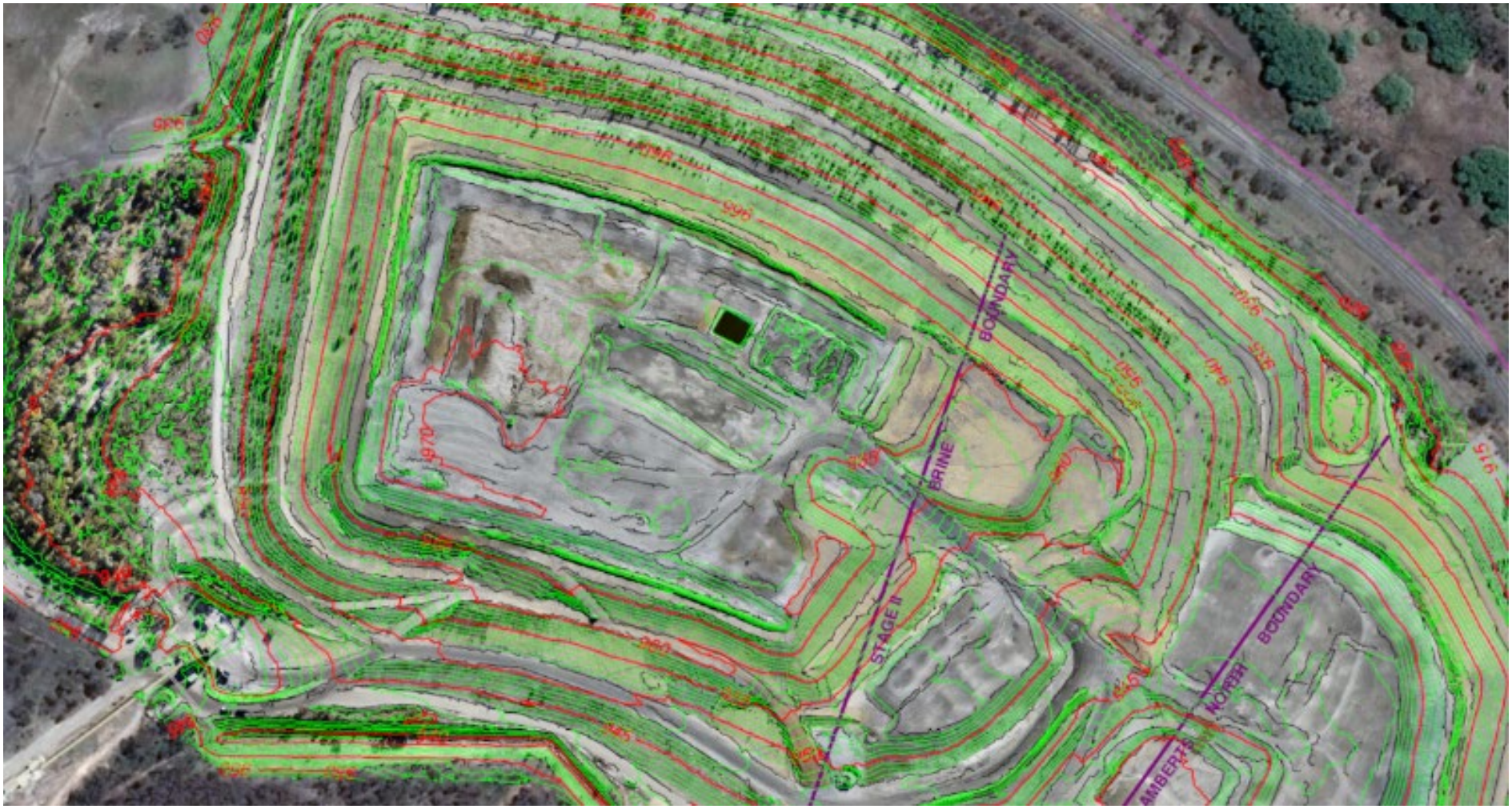
Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201807 Prepared at 13:00 UTC on 11 Jun 2019

Annex D

Ash Repository Survey

Mt Piper Ash Repository Lidar Survey (Source: EnergyAustralia, via email correspondence, received 22 September 2019)



Annex E

Brine Composition Data

ANNEX E BRINE COMPOSITION

Table E1 Brine Composition Average Data

Parameter	Values from 1999 SEE Average[b]	2003 – 2006 Average[b]	July 2017 - Dec 2017 Average[a]
	mg/L		
pH	7.9	8.1	7.9
Cond (us/cm)	63,664	127,982	88,556
TDS	116,650	137,170	118,500
Alk (CaCO3)	1,360	1,346	976
Cl	19,864	23,889	10,390
SO4	49,670	66,767	67,378
Na	25,678	30,103	37,400
K	4,258	7,362	3,460
Ca	645	606	780
Mg	5,480	9,010	4,010
	ug/L		
As	409^^^	143	438
Ag	1.4^^	<50	10
Ba	272*	30	1,000
Be	17^	5.8	-
B	73,560*	115,000	35,800
Cd	19+	42	5.3
Cr ***	49+	<50	1,050
Cu	7,858*	7,197	12,400
F	21,178*	125,656	64,650
Fe	833*	-	1,580
Hg	1.35^^	-	0.04
Mn	17,530*	34,000	7,210
Mo	2,600^^	-	-
Ni	4,187*	4,017	3,880
Pb	6^^	-	10
Se	245*	-	130
Zn	2,020*	-	1,050

a Brine composition data provided by EA on 01 August 2018;
b Connell Wagner (2007). Statement of Environmental Effects, Mount Piper Power Station, Extension of Brine Conditions Ash Placement Area. Prepared by Environmental Services, Pacific Power International for Delta Electricity, 21 June 2007.

Notations relate to Average Trace element values, from 1999 Statement of Environmental Effects including:
* mostly 10 – 15 analyses (sources Hodgson, 1999) – AWT, 1996
** EPA (1999a) ^ one analysis ^^ 3 analyses ^^^ 5 analyses + 6 analyses
*** Total chromium reported (CrVI <25ug/l)

Annex F

Tabulated Surface Water Data

				Field Parameters			Anions and Cations										Nutrients					
				Dissolved Oxygen (Field)	Electrical Conductivity (Field)	pH (Field)	Bicarbonate Alkalinity (as CaCO3)	Calcium	Chloride	Magnesium	Phenolphthalein Alkalinity (CaCO3)	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride	Ammonia (NH3-N)	Nitrate (as N)	Nitrite (as N)	Nitrite + Nitrate (as N)	Nitrogen (N) - Kjeldahl	Nitrogen (N)
				mg/L	uS/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL							1		1						1	0.1		0.01	0.01	0.01		
Surface Water Environmentla Goals (ANZECC (2000) or Local Guidelines - Surface Water)					2200	6.5-8			350[#1]					1000[#2]		1.5[#3]						
Neubecks Creek at WX22 Pre-placement 90th Percentile					894	6.7-7.8			22					332		0.338						
LocCode	Sampled_Date-Time	Sample_Type	Matrix_Type																			
LMP01	3/07/2018	Normal	Surf.Water	-	-	-	-	-	11	-	-	-	-	59	-	-	-	-	-	-	-	-
LMP01	10/07/2018	Normal	Surf.Water	-	-	-	-	-	11	-	-	-	-	54	-	-	-	-	-	-	-	-
LMP01	17/07/2018	Normal	Surf.Water	-	-	-	-	-	18	-	-	-	-	46	-	-	-	-	-	-	-	-
LMP01	19/07/2018	Normal	Surf.Water	13.3	252	7.34	70	18.4	10.5	8.04	<1	3.88	18.5	40.9	70	0.122	<0.1	0.15	<0.01	0.15	0.4	0.6
LMP01	24/07/2018	Normal	Surf.Water	-	-	-	-	-	12	-	-	-	-	49	-	-	-	-	-	-	-	-
LMP01	31/07/2018	Normal	Surf.Water	-	-	-	-	-	14	-	-	-	-	42	-	-	-	-	-	-	-	-
LMP01	7/08/2018	Normal	Surf.Water	-	-	-	-	-	10	-	-	-	-	53	-	-	-	-	-	-	-	-
LMP01	14/08/2018	Normal	Surf.Water	-	-	-	-	-	14	-	-	-	-	67	-	-	-	-	-	-	-	-
LMP01	15/08/2018	Normal	Surf.Water	11.8	322	7.32	123	24	9.72	9.25	<1	4.82	25.3	60.2	123	0.2	<0.1	0.18	<0.01	0.18	0.3	0.5
LMP01	21/08/2018	Normal	Surf.Water	-	-	-	-	-	13	-	-	-	-	77	-	-	-	-	-	-	-	-
LMP01	28/08/2018	Normal	Surf.Water	-	-	-	-	-	11	-	-	-	-	58	-	-	-	-	-	-	-	-
LMP01	4/09/2018	Normal	Surf.Water	-	-	-	-	-	7.3	-	-	-	-	66	-	-	-	-	-	-	-	-
LMP01	11/09/2018	Normal	Surf.Water	-	-	-	-	-	6	-	-	-	-	43	-	-	-	-	-	-	-	-
LMP01	18/09/2018	Normal	Surf.Water	-	-	-	-	-	7.3	-	-	-	-	59	-	-	-	-	-	-	-	-
LMP01	20/09/2018	Normal	Surf.Water	10	261	7.36	62	22.4	7.07	8.04	<1	3.81	18.4	47.2	62	0.129	0.1	0.2	<0.01	0.2	0.4	0.6
LMP01	25/09/2018	Normal	Surf.Water	-	-	-	-	-	9.3	-	-	-	-	61	-	-	-	-	-	-	-	-
LMP01	3/10/2018	Normal	Surf.Water	-	-	-	-	-	11	-	-	-	-	85	-	-	-	-	-	-	-	-
LMP01	9/10/2018	Normal	Surf.Water	-	-	-	-	-	10	-	-	-	-	69	-	-	-	-	-	-	-	-
LMP01	16/10/2018	Normal	Surf.Water	-	-	-	-	-	8.6	-	-	-	-	50	-	-	-	-	-	-	-	-
LMP01	17/10/2018	Normal	Surf.Water	8.6	231	7.63	66	20.4	5.89	7.62	<1	3.59	13.8	44.6	66	0.21	<0.1	0.15	<0.01	0.15	0.2	0.4
LMP01	23/10/2018	Normal	Surf.Water	-	-	-	-	-	8	-	-	-	-	54	-	-	-	-	-	-	-	-
LMP01	30/10/2018	Normal	Surf.Water	-	-	-	-	-	13	-	-	-	-	62	-	-	-	-	-	-	-	-
LMP01	6/11/2018	Normal	Surf.Water	-	-	-	-	-	8.1	-	-	-	-	64	-	-	-	-	-	-	-	-
LMP01	13/11/2018	Normal	Surf.Water	-	-	-	-	-	9.4	-	-	-	-	56	-	-	-	-	-	-	-	-
LMP01	19/11/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	20/11/2018	Normal	Surf.Water	-	-	-	-	-	12	-	-	-	-	72	-	-	-	-	-	-	-	-
LMP01	21/11/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	22/11/2018	Normal	Surf.Water	4.9	347	6.88	112	29.8	5.15	11.7	<1	4.23	23.4	54.8	112	0.211	0.3	0.14	<0.01	0.14	0.4	0.5
LMP01	27/11/2018	Normal	Surf.Water	-	-	-	-	-	8.1	-	-	-	-	59	-	-	-	-	-	-	-	-
LMP01	3/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	4/12/2018	Normal	Surf.Water	-	-	-	-	-	7.4	-	-	-	-	49	-	-	-	-	-	-	-	-
LMP01	5/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	6/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	7/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	10/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	11/12/2018	Normal	Surf.Water	-	-	-	-	-	13	-	-	-	-	110	-	-	-	-	-	-	-	-
LMP01	13/12/2018	Normal	Surf.Water	6.5	390	7.3	85	30.9	7.97	17.3	<1	5.78	24.4	84.6	85	0.183	<0.1	0.01	<0.01	0.01	0.4	0.4
LMP01	17/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	18/12/2018	Normal	Surf.Water	-	-	-	-	-	7.7	-	-	-	-	65	-	-	-	-	-	-	-	-
LMP01	19/12/2018	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	24/12/2018	Normal	Surf.Water	-	-	-	-	-	4.9	-	-	-	-	50	-	-	-	-	-	-	-	-
LMP01	2/01/2019	Normal	Surf.Water	-	-	-	-	-	9.8	-	-	-	-	70	-	-	-	-	-	-	-	-
LMP01	3/01/2019	Normal	Surf.Water	6.5	390	7.3	85	30.9	7.97	17.3	<1	5.78	24.4	84.6	85	0.183	<0.1	0.01	<0.01	0.01	0.4	0.4
LMP01	8/01/2019	Normal	Surf.Water	-	-	-	-	-	5.6	-	-	-	-	77	-	-	-	-	-	-	-	-
LMP01	15/01/2019	Normal	Surf.Water	-	-	-	-	-	6.3	-	-	-	-	42	-	-	-	-	-	-	-	-
LMP01	16/01/2019	Normal	Surf.Water	6	229	7.3	60	21.5	4.54	9.39	<1	4.77	12.2	37	60	0.088	<0.1	0.07	<0.01	0.07	0.4	0.5
LMP01	17/01/2019	Normal	Surf.Water	-	-	-	-	-	6.3	-	-	-	-	42	-	-	-	-	-	-	-	-
LMP01	22/01/2019	Normal	Surf.Water	-	-	-	-	-	5.6	-	-	-	-	41	-	-	-	-	-	-	-	-
LMP01	30/01/2019	Normal	Surf.Water	-	-	-	-	-	7	-	-	-	-	53	-	-	-	-	-	-	-	-
LMP01	5/02/2019	Normal	Surf.Water	-	-	-	-	-	4.1	-	-	-	-	13	-	-	-	-	-	-	-	-
LMP01	12/02/2019	Normal	Surf.Water	-	-	-	-	-	8.9	-	-	-	-	68	-	-	-	-	-	-	-	-
LMP01	19/02/2019	Normal	Surf.Water	6.9	476	7.57	-	-	18	-	-	-	-	120	-	-	-	-	-	-	-	-
LMP01	26/02/2019	Normal	Surf.Water	-	-	-	-	-	17	-	-	-	-	140	-	-	-	-	-	-	-	-
LMP01	6/03/2019	Normal	Surf.Water	-	-	-	-	-	16	-	-	-	-	150	-	-	-	-	-	-	-	-
LMP01	12/03/2019	Normal	Surf.Water	6.9	476	7.57	114	34.8	11.3	20.8	<1	6.78	33.2	109	114	0.151	<0.1	0.19	<0.01	0.19	0.3	0.5
LMP01	14/03/2019	Normal	Surf.Water	-	-	-	-	-	19	-	-	-	-	170	-	-	-	-	-	-	-	-
LMP01	22/03/2019	Normal	Surf.Water	-	-	-	-	-	16	-	-	-	-	120	-	-	-	-	-	-	-	-
LMP01	27/03/2019	Normal	Surf.Water	6.4	630	7.6	143	39.9	17.3	26.5	<1	8.46	57	159	143	0.14	<0.1	0.16	<0.01	0.16	0.4	0.6
LMP01	17/04/2019	Normal	Surf.Water	8.3	356	7.11	76	28	10.9	16	<1	5.11	21.8	74.9	76	0.154	0.1	0.12	<0.01	0.12	0.3	0.4
LMP01	7/05/2019	Normal	Surf.Water	-	-	-	-	-	14	-	-	-	-	100	-	-	-	-	-	-	-	-
LMP01	14/05/2019	Normal	Surf.Water	-	-	-	-	-	18	-	-	-	-	120	-	-	-	-	-	-	-	-
LMP01	15/05/2019	Normal	Surf.Water	12	451	7.46	63	26.7	14	13.8	<1	6.79	45	120	63	0.141	<0.1	0.2	<0.01	0.2	0.2	0.4
LMP01	21/05/2019	Normal	Surf.Water	-	-	-	-	-	17	-	-	-	-	110	-	-	-	-	-	-	-	-
LMP01	28/05/2019	Normal	Surf.Water	-	-	-	-	-	16	-	-	-	-	77	-	-	-	-	-	-	-	-
LMP01	4/06/2019	Normal	Surf.Water	-	-	-	-	-	19	-	-	-	-	80	-	-	-	-	-	-	-	-
LMP01	20/06/2019	Normal	Surf.Water	12.6	409	7.2	57	20.6	17.8	10.7	<1	5.88	45	103	57	0.197	0.1	0.14	<0.01	0.14	0.4	0.5

		Physical Parameters					Metals																			
		Electrical Conductivity (Lab)	pH (Lab)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Turbidity	Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silver	Strontium	Vanadium	Zinc
		µS/cm	pH units	mg/L	mg/L	NTU	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L
EQL				10			10	1	1	1	50	0.1	1	1	50	1	1	0.1	1	1		10	1		10	5
Surface Water Environmentla Goals (ANZECC (2000) or Local Guidelines - Surface Water)			6.5-8	1500[#4]				24	700[#3]	100	370	0.85[#5]	2[#5]	3.5[#5]	300[#3]	5[#5]	1900	0.06	10[#6]	17[#5]		5	0.05			116[#7]
Neubecks Creek at WX22 Pre-placement 90th Percentile				580				1	29	1	90	1	1	1	281	1	720		1	5		1				116
LocCode	Sampled_Date-Time																									
LMP01	3/07/2018	280	8	-	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	10/07/2018	270	8	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	17/07/2018	250	7.9	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	19/07/2018	-	-	158	<5	9.3	110	<1	15	<1	<50	<0.1	<1	5	58	<1	34	<0.04	1	3	<0.01	0.3	<1	0.062	<10	22
LMP01	24/07/2018	270	8	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	31/07/2018	250	7.8	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	7/08/2018	300	8	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	14/08/2018	330	8	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	15/08/2018	-	-	234	12	20.9	300	<1	24	<1	<50	<0.1	<1	7	41	<1	31	<0.04	3	3	<0.01	0.4	<1	0.072	<10	27
LMP01	21/08/2018	380	8	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	28/08/2018	310	8.1	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	4/09/2018	290	8	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	11/09/2018	180	7.9	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	18/09/2018	250	7.7	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	20/09/2018	-	-	199	8	51	690	2	20	<1	<50	<0.1	<1	8	214	2	50	<0.04	1	6	0.03	0.5	<1	0.057	<10	31
LMP01	25/09/2018	270	7.9	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	3/10/2018	360	7.9	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	9/10/2018	290	7.8	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	16/10/2018	230	7.9	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	17/10/2018	-	-	191	20	52.7	710	<1	19	<1	70	<0.1	<1	8	220	1	26	<0.04	1	6	0.04	0.5	<1	0.059	<10	34
LMP01	23/10/2018	260	7.8	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	30/10/2018	360	7.4	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	6/11/2018	320	7.7	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	13/11/2018	300	7.9	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	19/11/2018	340	7.9	-	28	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	20/11/2018	350	7.7	-	29	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	21/11/2018	370	7.7	-	30	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	22/11/2018	-	-	218	9	12.9	300	<1	38	<1	<50	<0.1	<1	3	86	<1	561	<0.04	3	8	<0.01	0.3	<1	0.092	<10	21
LMP01	27/11/2018	320	7.7	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	3/12/2018	200	7.7	-	23	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	4/12/2018	210	7.8	-	23	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	5/12/2018	220	7.7	-	49	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	6/12/2018	260	7.6	-	6	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	7/12/2018	260	7.6	-	7	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	10/12/2018	430	7.6	-	1	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	11/12/2018	440	7.7	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	13/12/2018	-	-	250	8	42.3	140	<1	40	<1	160	<0.1	<1	4	92	<1	92	<0.04	2	5	<0.01	0.3	<1	0.107	<10	11
LMP01	17/12/2018	300	7.6	-	8	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	18/12/2018	300	7.8	-	20	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	19/12/2018	300	7.7	-	19	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	24/12/2018	220	7.7	-	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	2/01/2019	320	7.8	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	3/01/2019	-	-	250	8	42.3	140	<1	40	<1	160	<0.1	<1	4	92	<1	92	<0.04	2	5	<0.01	0.3	<1	0.107	<10	11
LMP01	8/01/2019	330	7.9	-	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	15/01/2019	180	7.8	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	16/01/2019	-	-	180	30	80.9	1120	2	29	<1	<50	<0.1	1	10	139	2	75	<0.04	2	7	0.08	0.3	<1	0.06	<10	30
LMP01	17/01/2019	180	7.8	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	22/01/2019	180	7.6	-	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	30/01/2019	230	7.8	-	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	5/02/2019	230	7.9	-	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	12/02/2019	310	7.8	-	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	19/02/2019	440	8	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	26/02/2019	510	7.9	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	6/03/2019	540	7.9	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	12/03/2019	-	-	295	11	13.2	200	<1	38	<1	130	<0.1	<1	3	33	<1	60	<0.04	2	4	0.04	0.4	<1	0.116	<10	11
LMP01	14/03/2019	610	7.9	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	22/03/2019	440	8	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	27/03/2019	-	-	464	18	19.7	120	2	64	<1	60	<0.1	3	6	31	<1	48	<0.04	3	4	0.02	0.4	<1	0.125	<10	18
LMP01	17/04/2019	-	-	226	16	20.6	280	<1	32	<1	100	<0.1	<1	3	45	<1	35	<0.04	2	3	<0.01	0.2	<1	0.088	<10	12
LMP01	7/05/2019	340	7.8	-	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	14/05/2019	430	7.8	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	15/05/2019	-	-	284	17	39.1	440	1	31	<1	80	<0.1	<1	13	87	2	31	<0.04	3	6	-	0.4	<1	0.098	<10	26
LMP01	21/05/2019	400	7.8	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	28/05/2019	320	7.8	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	4/06/2019	300	7.8	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMP01	20/06/2019	-	-	259	<5	7.8	170	<1	26	<1	60	<0.1	<1	15	117	<1	8	<0.04	4	4	-	0.2	<1	0.097	<10	24

LocCode	Sampled_Date-Time	Sample_Type	Matrix_Type	Field Parameters			Anions and Cations										Nutrients					
				Dissolved Oxygen (Field)	Electrical Conductivity (Field)	pH (Field)	Bicarbonate Alkalinity (as CaCO3)	Calcium	Chloride	Magnesium	Phenolphthalein Alkalinity (CaCO3)	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride	Ammonia (NH3-N)	Nitrate (as N)	Nitrite (as N)	Nitrite + Nitrate (as N)	Nitrogen (N) - Kjeldahl	Nitrogen (N)
				mg/L	uS/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL							1		1						1	0.1		0.01	0.01	0.01		
Surface Water Environmentla Goals (ANZECC (2000) or Local Guidelines - Surface Water)					2200	6.5-8			350[#1]					1000[#2]		1.5[#3]						
Neubecks Creek at WX22 Pre-placement 90th Percentile					894	6.7-7.8			22					332		0.338						
		Count Detects		14	14	14	13	13	57	13	0	13	13	57	13	13	4	13	0	13	13	13
		Average		8.62143	372.86	7.35286	85.8	26.8	10.9	13.6	-	5.36	27.9	73.54	85.8	0.1622	0.15	0.132	-	0.132	0.35	0.48
		50th Percentile		7.6	373	7.33	76	26.7	10	11.7	-	5.11	24.4	64	76	0.154	0.1	0.15	-	0.15	0.4	0.5
		90th Percentile		12.42	476	7.591	121	34	17.5	20.1	-	6.79	45	120	121	0.208	0.24	0.198	-	0.198	0.4	0.6
		Minimum		4.9	229	6.88	57	18.4	4.1	7.62	-	3.59	12.2	13	57	0.088	0.1	0.01	-	0.01	0.2	0.4
		Maximum		13.3	630	7.63	143	39.9	19	26.5	-	8.46	57	170	143	0.211	0.3	0.2	-	0.2	0.4	0.6
WX22	26/07/2018	Normal	Surf.Water	16.1	484	6.74	36	29.1	27.8	18.5	<1	4.53	33.9	158	36	0.844	-	0.03	<0.01	0.03	0.1	0.1
WX22	22/08/2018	Normal	Surf.Water	13.1	529	6.99	36	33.6	33.6	20.9	<1	4.59	37.9	158	36	0.064	-	<0.01	0.02	0.02	0.2	0.2
WX22	26/09/2018	Normal	Surf.Water	11.1	498	6.81	55	31.5	28.6	20.7	<1	4.84	33.7	151	55	<0.1	-	0.01	<0.01	0.01	0.3	0.3
WX22	24/10/2018	Normal	Surf.Water	9.6	357	6.99	81	24.9	13.3	14.6	<1	5.37	26.8	73.6	81	0.123	-	<0.01	<0.01	<0.01	<0.1	<0.1
WX22	28/11/2018	Normal	Surf.Water	9.7	304	6.97	52	20.9	14.9	12.8	<1	3.96	18	71.4	52	0.1	-	0.06	<0.01	0.06	0.7	0.8
WX22	19/12/2018	Normal	Surf.Water	8.5	379	7.36	112	29.2	10.4	17.4	<1	2.8	27.3	63.7	112	0.165	-	<0.01	<0.01	<0.01	0.2	0.2
WX22	23/01/2019	Normal	Surf.Water	7.9	272	7.36	84	22.8	6.9	11.3	<1	3.18	15.4	37.9	84	0.157	-	<0.01	<0.01	<0.01	0.3	0.3
WX22	27/02/2019	Normal	Surf.Water	9.3	621	7.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WX22	13/03/2019	Normal	Surf.Water	9.3	621	7.36	146	48.6	31.8	29.3	<1	4.68	42.7	118	146	0.144	-	0.03	<0.01	0.03	0.1	0.1
WX22	11/04/2019	Normal	Surf.Water	10.4	610	7.06	111	45.8	35.9	29.5	<1	7.59	53.9	124	111	0.136	-	<0.01	<0.01	<0.01	0.1	0.1
WX22	22/05/2019	Normal	Surf.Water	13.1	594	7.56	103	40.9	40.8	26.2	<1	6.09	45.2	159	103	0.232	-	<0.01	<0.01	<0.01	-	0.2
WX22	26/06/2019	Normal	Surf.Water	14.8	549	7.29	74	34.5	33.7	21.7	<1	5.36	46.2	129	74	0.126	-	<0.01	<0.01	<0.01	-	0.2
		Count Detects		12	12	12	11	11	11	11	0	11	11	11	11	10	0	4	1	5	8	10
		Average		11.075	484.83	7.15417	80.9	32.9	25.2	20.3	-	4.82	34.6	113.1	80.9	0.2091	-	0.033	0.02	0.03	0.25	0.25
		50th Percentile		10.05	513.5	7.175	81	31.5	28.6	20.7	-	4.68	33.9	124	81	0.14	-	0.03	0.02	0.03	0.2	0.2
		90th Percentile		14.63	619.9	7.36	112	45.8	35.9	29.3	-	6.09	46.2	158	112	0.2932	-	0.051	0.02	0.048	0.42	0.35
		Minimum		7.9	272	6.74	36	20.9	6.9	11.3	-	2.8	15.4	37.9	36	0.064	-	0.01	0.02	0.01	0.1	0.1
		Maximum		16.1	621	7.56	146	48.6	40.8	29.5	-	7.59	53.9	159	146	0.844	-	0.06	0.02	0.06	0.7	0.8

LocCode	Sampled_Date-Time	Sample_Type	Matrix_Type	Physical Parameters					Metals																			
				Electrical Conductivity (Lab)	pH (Lab)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Turbidity	Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silver	Strontium	Vanadium	Zinc
				µS/cm	pH units	mg/L	mg/L	NTU	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L
EQL						10			10	1	1	1	50	0.1	1	1	50	1	1	0.1	1	1		10	1		10	5
Surface Water Environmentla Goals (ANZECC (2000) or Local Guidelines - Surface Water)					6.5-8	1500[#4]				24	700[#3]	100	370	0.85[#5]	2[#5]	3.5[#5]	300[#3]	5[#5]	1900	0.06	10[#6]	17[#5]		5	0.05			116[#7]
Neubecks Creek at WX22 Pre-placement 90th Percentile						580				1	29	1	90	1	1	1	281	1	720		1	5		1				116
		Count Detects		53	53	13	64	25	13	4	13	0	8	0	2	13	13	4	13	0	13	13	5	13	0	13	0	13
		Average		312.5	7.81698	246.8	23.9	42.43	363.1	1.75	32	-	102.5	-	2	6.85	96.54	1.75	87.9231	-	2.23	4.92	0.042	0.3462	-	0.088	-	21.4
		50th Percentile		300	7.8	234	17	39	280	2	31	-	90	-	2	6	87	2	48	-	2	5	0.04	0.3	-	0.092	-	22
		90th Percentile		438	8	292.8	50.4	86.36	706	2	40	-	160	-	2.8	12.4	199	2	92	-	3	6.8	0.064	0.48	-	0.114	-	30.8
		Minimum		180	7.4	158	1	7.8	110	1	15	-	60	-	1	3	31	1	8	-	1	3	0.02	0.2	-	0.057	-	11
		Maximum		610	8.1	464	160	130	1120	2	64	-	160	-	3	15	220	2	561	-	4	8	0.08	0.5	-	0.125	-	34
WX22	26/07/2018	Normal	Surf.Water	-	-	270	-	1.1	20	<1	15	-	90	<0.1	<1	1	122	<1	167	<0.04	<1	12	<0.01	<0.2	<1	0.103	<10	7
WX22	22/08/2018	Normal	Surf.Water	-	-	641	-	1.4	20	<1	16	-	50	<0.1	<1	1	115	<1	160	<0.04	<1	15	<0.01	<0.2	<1	0.123	<10	11
WX22	26/09/2018	Normal	Surf.Water	-	-	341	-	13.3	310	<1	15	-	100	<0.1	<1	2	156	<1	372	<0.04	1	20	<0.01	<0.2	<1	0.12	<10	13
WX22	24/10/2018	Normal	Surf.Water	-	-	218	-	3.9	110	<1	12	-	<50	<0.1	<1	<1	118	<1	162	<0.04	<1	10	<0.01	<0.2	<1	0.094	<10	<5
WX22	28/11/2018	Normal	Surf.Water	-	-	290	-	50.9	700	<1	13	-	80	<0.1	<1	2	216	<1	220	<0.04	<1	12	0.02	<0.2	<1	0.075	<10	8
WX22	19/12/2018	Normal	Surf.Water	-	-	270	-	5.6	110	<1	10	-	<50	<0.1	<1	<1	209	<1	388	<0.04	<1	16	<0.01	<0.2	<1	0.099	<10	10
WX22	23/01/2019	Normal	Surf.Water	-	-	261	-	11.4	190	<1	10	-	60	<0.1	<1	1	156	<1	342	<0.04	<1	9	<0.01	<0.2	<1	0.079	<10	<5
WX22	27/02/2019	Normal	Surf.Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WX22	13/03/2019	Normal	Surf.Water	-	-	393	-	2.6	50	<1	26	-	150	<0.1	<1	<1	101	<1	1440	<0.04	<1	27	<0.01	<0.2	<1	0.174	<10	13
WX22	11/04/2019	Normal	Surf.Water	-	-	399	-	2.1	20	<1	25	-	90	<0.1	<1	4	175	<1	1000	<0.04	<1	22	<0.01	<0.2	<1	0.154	<10	10
WX22	22/05/2019	Normal	Surf.Water	-	-	353	-	1.3	20	<1	19	-	<50	<0.1	<1	<1	75	<1	154	<0.04	<1	15	-	<0.2	<1	0.127	<10	<5
WX22	26/06/2019	Normal	Surf.Water	-	-	328	-	1.1	<10	<1	19	-	<50	<0.1	<1	<1	75	<1	73	<0.04	<1	14	-	<0.2	<1	0.118	<10	<5
		Count Detects		0	0	11	0	11	10	0	11	0	7	0	0	6	11	0	11	0	1	11	1	0	0	11	0	7
		Average		-	-	342.2	-	8.61	155	-	16.4	-	88.57	-	-	1.83	138	-	407.091	-	1	15.6	0.02	-	-	0.115	-	10.3
		50th Percentile		-	-	328	-	2.6	80	-	15	-	90	-	-	1.5	122	-	220	-	1	15	0.02	-	-	0.118	-	10
		90th Percentile		-	-	399	-	13.3	349	-	25	-	120	-	-	3	209	-	1000	-	1	22	0.02	-	-	0.154	-	13
		Minimum		-	-	218	-	1.1	20	-	10	-	50	-	-	1	75	-	73	-	1	9	0.02	-	-	0.075	-	7
		Maximum		-	-	641	-	50.9	700	-	26	-	150	-	-	4	216	-	1440	-	1	27	0.02	-	-	0.174	-	13

Env Stds Comments
#1:Irrigation water; moderately tolerant crops.
#2:Livestock
#3:Drinking water
#4:Low land river conductivity; 0.68 x 2200 uS/cm.
#5:Adjusted for effects of hardness.
#6:Irrigation water; moderately tolerant crops. Note: Molybdenum drinking water Screening Level is 0.05 mg/L.
#7:Local guideline based upon 90th percentile pre-brine placement; Adjusted for effects of hardness

Annex G

Tabulated Groundwater Data

					Field Parameters		Anions and Cations									Metals																				
					Electrical Conductivity (Field)	pH (Field)	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride	Total Dissolved Solids (TDS)	Aluminium	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Selenium	Silver	Vanadium	Vanadium (Filtered)	Zinc
					uS/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								1					1	0.1	10								50		1							5	
Groundwater Environmental Goal (ANZECC (2000) or Local Guidelines - Groundwater)					2600[#1]	6.5-8		350				1000		1.5	2000		24	700	370	2[#2]	5[#2]	5[#2]	664[#3]	5[#2]	5704[#3]	0.06	10	550.9[#4]	5	0.05			908[#4]
Groundwater Collection Basin Pre-placement 90th Percentile					**1576**			**31.5**				**824**		**0.435**	**1306**		**1**	**37**	**244**	**2**	**1**	**1**	**664**	**1**	**5704**	**0.1**	**1**	**550.9**	**2**	**1**			**908**
LocCode	**Sampled_Date-Time**	**Sample_Type**	**SampleCode**	**Matrix_Type**																															
D1	25/07/2018	Normal	MPW022786	G.Water	4250	5.91	334	376	244	30.4	393	1930	160	3.99	3520	80	5	23	1600	<0.1	<1	<1	31900	<1	14000	<0.04	<1	720	<0.2	<1	<10	<10	75
D1	22/08/2018	Normal	MPW023193	G.Water	4110	5.92	308	361	239	29	346	1940	163	<0.2	3510	110	5	24	1700	<0.1	<1	<1	28300	<1	13000	<0.04	<1	716	<0.2	<1	<10	<10	71
D1	26/09/2018	Normal	MPW023748	G.Water	3700	5.96	289	330	223	26.2	317	1760	156	<0.1	2370	110	5	22	1480	<0.1	<1	<1	25800	<1	11400	<0.04	<1	601	<0.2	<1	<10	<10	63
D1	24/10/2018	Normal	MPW024171	G.Water	3640	5.96	299	270	235	28.4	337	1660	160	<0.2	2820	140	6	22	1440	<0.1	<1	<1	22500	<1	11700	<0.04	<1	581	<0.2	<1	<10	<10	55
D1	28/11/2018	Normal	MPW024646	G.Water	3860	5.96	312	322	241	27	352	1970	161	<0.5	3000	580	19	28	1490	<0.1	4	1	23600	2	13100	<0.04	<1	655	0.3	<1	<10	<10	91
D1	19/12/2018	Normal	MPW025004	G.Water	3810	5.95	298	270	232	29.1	343	1660	166	<0.2	2710	90	4	22	1450	<0.1	<1	<1	19700	<1	9100	<0.04	<1	585	<0.2	<1	<10	<10	66
D1	24/01/2019	Normal	MPW025473	G.Water	4480	6	344	399	262	32.8	406	1890	120	<0.2	3940	50	4	26	1630	0.1	<1	<1	34300	<1	14400	<0.04	<1	822	<0.2	<1	<10	<10	76
D1	28/02/2019	Normal	MPW026055	G.Water	5700	5.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1	13/03/2019	Normal	D1_13 Mar 19_-	G.Water	5700	5.98	458	598	348	40.9	518	2880	179	<0.1	4230	20	4	34	1820	<0.1	<1	<1	46800	<1	18600	<0.04	<1	1130	<0.2	<1	<10	<10	90
D1	11/04/2019	Normal	MPW026788	G.Water	6730	5.91	555	821	422	51.8	734	3420	136	<0.5	5930	50	3	34	1840	<0.1	<1	2	37600	<1	20300	<0.04	<1	1370	0.4	<1	<10	<10	103
D1	23/05/2019	Normal	D1_23 May 19_-	G.Water	7330	5.94	581	873	442	48.9	848	3760	102	0.343	6580	250	6	37	2050	<0.1	<1	<1	58100	<1	28600	<0.04	<1	1510	<0.2	<1	<10	<10	126
D1	26/06/2019	Normal	6295525	G.Water	7840	5.94	608	954	481	53	974	3880	77	<0.5	6550	260	7	42	2180	<0.1	1	<1	5430	<1	27000	<0.04	<1	1670	<0.2	<1	<10	<10	150
		Average			**5095.8333**	**5.95083333**	**398.7**	**506.7**	**306.3**	**36.14**	**506.2**	**2431.82**	**143.6**	**2.1665**	**4105.5**	**158.18**	**6.182**	**28.55**	**1698.2**	**0.1**	2.5	**1.5**	**30366.36**	**2**	**16473**	**-**	**-**	**941.818**	**0.35**	**-**	**-**	**-**	**87.82**
		50th Percentile			**4365**	**5.955**	**334**	**376**	**244**	**30.4**	**393**	**1940**	**160**	**2.1665**	**3520**	**110**	**5**	**26**	**1630**	**0.1**	2.5	**1.5**	**28300**	**2**	**14000**	**-**	**-**	**720**	**0.35**	**-**	**-**	**-**	**76**
		90th Percentile			**7270**	**5.98**	**581**	**873**	**442**	**51.8**	**848**	**3760**	**166**	**3.6253**	**6550**	**260**	**7**	**37**	**2050**	**0.1**	3.7	**1.9**	**46800**	**2**	**27000**	**-**	**-**	**1510**	**0.39**	**-**	**-**	**-**	**126**
		Minimum			**3640**	**5.91**	**289**	**270**	**223**	**26.2**	**317**	**1660**	**77**	**0.343**	**2370**	**20**	**3**	**22**	**1440**	**0.1**	1	**1**	**5430**	**2**	**9100**	**0**	**0**	**581**	**0.3**	**0**	**0**	**0**	**55**
		Maximum			**7840**	**6**	**608**	**954**	**481**	**53**	**974**	**3880**	**179**	**3.99**	**6580**	**580**	**19**	**42**	**2180**	**0.1**	4	**2**	**58100**	**2**	**28600**	**0**	**0**	**1670**	**0.4**	**0**	**0**	**0**	**150**
D3	26/07/2018	Normal	MPW022798	G.Water	950	6.13	79.4	33.7	47.8	9.11	39.1	288	135	0.589	600	10	<1	25	150	<0.1	<1	<1	10800	<1	656	<0.04	<1	3	<0.2	<1	<10	<10	<5
D3	22/08/2018	Normal	MPW023205	G.Water	920	6.01	84.8	27.3	47.4	8.75	36.9	333	120	0.196	664	<10	<1	24	<50	<0.1	<1	<1	12900	<1	760	<0.04	<1	2	<0.2	<1	<10	<10	<5
D3	27/09/2018	Normal	MPW023760	G.Water	870	6.01	78.8	28.4	44.4	8.49	33.4	313	99	<0.1	546	50	<1	25	150	<0.1	<1	<1	8710	1	745	<0.04	1	9	<0.2	<1	<10	<10	<5
D3	24/10/2018	Normal	MPW024183	G.Water	630	5.87	48.4	19	30.6	6.01	29.5	221	57	<0.5	414	20	<1	38	<50	<0.1	<1	<1	2680	<1	371	<0.04	<1	4	<0.2	<1	<10	<10	<5
D3	28/11/2018	Normal	MPW024658	G.Water	930	6.02	78.5	38.2	49.1	8.71	36.8	303	126	<0.5	796	60	<1	36	110	<0.1	<1	<1	6280	<1	709	<0.04	<1	4	<0.2	<1	<10	<10	<5
D3	19/12/2018	Normal	MPW025016	G.Water	930	5.98	81.8	38.1	49.3	8.82	43.1	324	107	<0.5	644	20	<1	30	160	<0.1	<1	2	5180	<1	943	<0.04	<1	6	<0.2	<1	<10	<10	<5
D3	24/01/2019	Normal	MPW025485	G.Water	940	6.09	80.9	41.2	47.4	8.73	49	295	125	<0.1	568	40	<1	39	140	<0.1	<1	1	6400	<1	624	<0.04	<1	4	<0.2	<1	<10	<10	10
D3	28/02/2019	Normal	MPW026067	G.Water	980	6.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D3	13/03/2019	Normal	D3_13 Mar 19_-	G.Water	980	6.07	87.7	36.7	51.9	9.38	44.6	320	134	<0.1	750	20	<1	32	100	<0.1	<1	4	10700	<1	676	<0.04	<1	4	<0.2	<1	<10	<10	<5
D3	11/04/2019	Normal	MPW026800	G.Water	1010	5.97	94.9	29.5	53.6	10.7	42.5	404	94	<1	783	60	<1	26	80	<0.1	<1	5	8620	1	730	<0.04	<1	3	<0.2	<1	<10	<10	9
D3	23/05/2019	Normal	D3_23 May 19_-	G.Water	960	6.11	86.2	44.8	50.5	10.3	28.7	295	119	<0.1	588	40	<1	28	<50	<0.1	<1	<1	11800	<1	855	<0.04	<1	2	<0.2	<1	<10	<10	6
D3	26/06/2019	Normal	6295646	G.Water	970	6.06	86.2	27.5	50.8	10.2	37.6	321	104	<0.1	516	40	<1	23	<50	<0.1	<1	<1	3020	<1	798	<0.04	<1	2	<0.2	<1	<10	<10	<5
		Average			**922.5**	**6.0325**	**80.69**	**33.13**	**47.53**	**9.018**	**38.29**	**310.636**	**110.9**	**0.3925**	**624.45**	**36**	**-**	**29.64**	**127.14**	**-**	-	**3**	**7917.273**	**1**	**715.18**	**-**	**1**	**3.90909**	**-**	**-**	**-**	**-**	**8.333**
		50th Percentile			**945**	**6.04**	**81.8**	**33.7**	**49.1**	**8.82**	**37.6**	**313**	**119**	**0.3925**	**600**	**40**	**-**	**28**	**140**	**-**	-	**3**	**8620**	**1**	**730**	**-**	**1**	**4**	**-**	**-**	**-**	**-**	**9**
		90th Percentile			**980**	**6.108**	**87.7**	**41.2**	**51.9**	**10.3**	**44.6**	**333**	**134**	**0.5497**	**783**	**60**	**-**	**38**	**154**	**-**	-	**4.7**	**11800**	**1**	**855**	**-**	**1**	**6**	**-**	**-**	**-**	**-**	**9.8**
		Minimum			**630**	**5.87**	**48.4**	**19**	**30.6**	**6.01**	**28.7**	**221**	**57**	**0.196**	**414**	**10**	**0**	**23**	**80**	**0**	0	**1**	**2680**	**1**	**371**	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**6**
		Maximum			**1010**	**6.13**	**94.9**	**44.8**	**53.6**	**10.7**	**49**	**404**	**135**	**0.589**	**796**	**60**	**0**	**39**	**160**	**0**	0	**5**	**12900**	**1**	**943**	**0**	**1**	**9**	**0**	**0**	**0**	**0**	**10**
D4	11/07/2018	Normal	MPW022577	G.Water	890	3.39	14	13.9	8.41	6.39	16.3	454	<1	0.172	738	17100	52	13	<50	0.5	2	1	104000	24	746	<0.04	<1	18	<0.2	<1	10	<10	182
D4	8/08/2018	Normal	MPW022985	G.Water	920	3.37	16.3	12	9.45	7.38	20.2	418	<1	0.119	802	15600	50	12	<50	0.5	2	1	90600	23	708	<0.04	<1	18	0.2	<1	10	<10	179
D4	12/09/2018	Normal	MPW023481	G.Water	920	3.34	16.4	10.9	9.64	8.12	20	421	<1	0.149	723	16600	50	11	<50	0.7	3	<1	90100	23	653	<0.04	<1	19	0.2	<1	10	<10	194
D4	10/10/2018	Normal	MPW023953	G.Water	900	3.41	16.7	12.1	9.75	7.36	16.5	387	<1	<0.1	736	16200	48	12	<50	0.6	2	<1	86600	26	710	<0.04	<1	18	<0.2	<1	<10	<10	186
D4	7/11/2018	Normal	MPW024360	G.Water	880	3.38	16.4	12.9	9.59	8.07	18.8	398	<1	0.108	773	15200	48	12	<50	0.6	2	<1	92200	23	744	<0.04	<1	16	<0.2	<1	10	<10	197
D4	13/12/2018	Normal	MPW024891	G.Water	820	3.33	16.5	14.2	9.77	7.41	18	362	<1	0.055	710	15100	52	13	50	0.5	2	<1	92500	25	771	<0.04	<1	16	0.2	<1	<10	<10	179
D4	10/01/2019	Normal	MPW025257	G.Water	840	3.41	17	15.1	9.93	7.33	19.3	380	<1	0.171	894	13600	49	11	<50	0.5	<1	<1	74000	23	1040	<0.04	<1	17	0.2	<1	<10	<10	150
D4	13/02/2019	Normal	MPW025827	G.Water	880	3.4	15.1	12	9.01	7.14	19	405	<1	<0.1	861	15300	43	11	<50	0.6	2	<1	96800	20	793	<0.04	<1	20	0.2	<1	<10	<10	186
D4	27/03/2019	Normal	D4_27 Mar 19_-	G.Water	900	3.39	15.5	11.2	9.27	7.74	18.9	426	<1	0.105	833	14700	43	11	<50	0.6	2	<1	107000	18	787	<0.04	<1	18	<0.2	<1	10	10	199
D4	4/04/2019	Normal	MPW026675	G.Water	880	3.36	16	13.2	9.26	8.37	19.6	421	<1	<0.1	704	15100	43	13	<50	0.6	2	1	92200	19	730	<0.04	<1	17	<0.2	<1	<10	<10	181
D4	9/05/2019	Normal	D4_09 May 19_-	G.Water	900	3.41	14.8	15.8	8.84	8.25	18.6	493	<1	0.047	729	13500	44	13	<50	0.6	2	<1	121000	20	808	<0.04	<1	17	<0.2	<1	<10	<10	192
		Average			**884.54545**	**3.38090909**	**15.88**	**13.03**	**9.356**	**7.596**	**18.65**	**415**	**-**	**0.11575**	**773**	**15273**	**47.45**	**12**	**50**	**0.573**	**2.1**	**1**	**95181.82**	**22.182**	**771.82**	**-**	**-**	**17.6364**	**0.2**	**-**	**10**	**10**	**184.1**
		50th Percentile			**890**	**3.39**	**16.3**	**12.9**	**9.45**	**7.41**	**18.9**	**418**	**-**	**0.1135**	**738**	**15200**	**48**	**12**	**50**	**0.6**	**2**	**1**	**92200**	**23**	**746**	**-**	**-**	**18**	**0.2**	**-**	**10**	**10**	**186**
		90th Percentile			**920**	**3.41**	**16.7**	**15.1**	**9.77**	**8.25**	**20**	**454**	**-**	**0.1713**	**861**	**16600**	**52**	**13**	**50**	**0.6**	**2.1**	**1**	**107000**	**25**	**808**	**-**	**-**	**19**	**0.2**	**-**	**10**	**10**	**197**
		Minimum			**820**	**3.33**	**14**	**10.9**	**8.41**	**6.39**	**16.3**	**362**	**0**	**0.047**	**704**	**13500**	**43**	**11**	**50**	**0.5**	**2**	**1**	**74000**	**18**	**653**	**0**	**0**	**16**	**0.2**	**0**	**10**	**10**	**150**
		Maximum			**920**	**3.41**	**17**	**15.8**	**9.93**	**8.37**	**20.2**	**493**	**0**	**0.172**	**894**	**17100**	**52**	**13**	**50**	**0.7**	**3**	**1**	**121000**	**26**	**1040**	**0**	**0**	**20**	**0.2**	**0**	**10**	**10**	**199**
D5	11/07/2018	Normal	MPW022587	G.Water	1220	5.94	93.7	26	66.8	8.5	25.3	516.8	109	<0.1	898	40	2	18	100	<0.1	<1	<1	53400	<1	9110	<0.04	<1	42	0.2	<1	<10	<10	17
D5	8/08/2018	Normal	MPW022995	G.Water	1260	5.96	104	22.9	73	9	29.8	579	127	0.11	999	40	1	17	110	<0.1	<1	<1	46800	<1	7410	<0.04	<1	48	0.4	<1	<10	<10	18
D5	12/09/2018	Normal	MPW023491	G.Water	1270	5.95	108	22.3	76.9	9.8	30.3	557	105	0.124	900	50	1	17	120	<0.1	<1	<1	47800	<1	7200	<0.04	<1	48	0.3	<1	<10	<10	21
D5	10/10/2018	Normal	MPW023963	G.Water	1180	5.91	95.1	21.5	66.4	8.84	25.1	519	129	<0.1	942	40	1	18	50	<0.1	<1	<1	49600	<1	7370	<0.04	<1	40	0.2	<1	<10	<10	13
D5	7/11/2018	Normal	MPW024370	G.Water	1190	5.93	95.1	22	66.9	9.69	28.5	565	78	0.04	952	50	1	18	100	<0.1	3	<1	48000	<1	7580	<0.04	<1	44	0.2	<1	<10	<10	18
D5	3/01/2019	Normal	D5_03 Jan 19_-	G.Water	1280	5.92	103	24.1	73.6	8.88	27.2	615	77	0.077	1010	80	2	20	<50	0.2	<1	<1	45400	1	8910	<0.04	<1	323	0.3	<1	<10	<10	345
D5	21/01/2019	Normal	D5_21 Jan 19_-	G.Water	1180	6.02	102	23.1	70.4	9.08	29.5	541	100	0.184	934	30	2	20	110	<0.1	<1	<1	39400	<1	7690	<0.04	<1	54	0.2	<1	<10	<10	11
D5	13/02/2019	Normal	MPW025837	G.Water	1180	5.93	98	-	68.5	8.26	26.5	-	-	-	972	60	1	16	90	<0.1	<1	3	48200	<1	7430	-	<1	45	0.2	<1	<10	<10	12
D5	12/03/2019	Normal	D5_12 Mar 19_-	G.Water	1180	5.93	98	22	68.5	8.26	26.5	536	72	0.14	972	60	1	16	90	<0.1	<1	3	48200	<1	7430	<0.04	<1	45	0.2	<1	<10	<10	12
D5	27/03/2019	Normal	D5_27 Mar 19_-	G.Water	1260	5.95	107	24.6	80	9.44	29.6	593	86	<0.1	940	30	<1	17	90	<0.1	<1	<1	30600	<1	8670	<0.04	<1	47	0.3	<1	<10	<10	23
D5	4/04/2019	Normal	MPW026685	G.Water	1170	5.87	95.6	23	66.4	9.61	28.6	525	67	0.128	822	30	<1	19	90	<0.1	<1	<1	31600	<1	7050	<0.04	<1	36	<0.2	<1	<10	<10	20
D5	8/05/2019	Normal	D5_08 May 19_-	G.Water	1290	5.96	95.5	27.2	69.5	8.96	30.6	629	74	0.187	1020	50	<1	18	120	<0.1	<1	<1	53000	<1	8410	<0.04	<1	48	0.3	<1	<10	<10	24

					Field Parameters		Anions and Cations									Metals																				
					Electrical Conductivity (Field)	pH (Field)	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride	Total Dissolved Solids (TDS)	Aluminium	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Selenium	Silver	Vanadium	Vanadium (Filtered)	Zinc
					uS/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								1					1	0.1	10								50		1							1	
Groundwater Environmental Goal (ANZECC (2000) or Local Guidelines - Groundwater)					2600[#1]	6.5-8		350				1000		1.5	2000		24	700	370	2[#2]	5[#2]	5[#2]	664[#3]	5[#2]	5704[#3]	0.06	10	550.9[#4]	5	0.05			908[#4]
Groundwater Collection Basin Pre-placement 90th Percentile					**1576**			**31.5**				**824**		**0.435**	**1306**		**1**	**37**	**244**	**2**	**1**	**1**	**664**	**1**	**5704**	**0.1**	**1**	**550.9**	**2**	**1**			**908**
LocCode	**Sampled_Date-Time**	**Sample_Type**	**SampleCode**	**Matrix_Type**																															
		Average			**1221.6667**	**5.93916667**	**99.58**	**23.52**	**70.58**	**9.027**	**28.13**	**561.436**	**93.09**	**0.12375**	**946.75**	**46.667**	**1.333**	**17.83**	**97.273**	**0.2**	**3**	**3**	**45166.67**	**1**	**7855**	**-**	**-**	**68.3333**	**0.254545455**	**-**	**-**	**-**	**44.5**
		50th Percentile			**1205**	**5.935**	**98**	**23**	**69**	**8.98**	**28.55**	**557**	**86**	**0.126**	**947**	**45**	**1**	**18**	**100**	**0.2**	**3**	**3**	**47900**	**1**	**7505**	**-**	**-**	**46**	**0.2**	**-**	**-**	**-**	**18**
		90th Percentile			**1279**	**5.96**	**106.7**	**26**	**76.57**	**9.682**	**30.25**	**615**	**127**	**0.1849**	**1008.9**	**60**	**2**	**19.9**	**120**	**0.2**	**3**	**3**	**52660**	**1**	**8886**	**-**	**-**	**53.4**	**0.3**	**-**	**-**	**-**	**23.9**
		Minimum			**1170**	**5.87**	**93.7**	**21.5**	**66.4**	**8.26**	**25.1**	**516.8**	**67**	**0.04**	**822**	**30**	**1**	**16**	**50**	**0.2**	**3**	**3**	**30600**	**1**	**7050**	**0**	**0**	**36**	**0.2**	**0**	**0**	**0**	**11**
		Maximum			**1290**	**6.02**	**108**	**27.2**	**80**	**9.8**	**30.6**	**629**	**129**	**0.187**	**1020**	**80**	**2**	**20**	**120**	**0.2**	**3**	**3**	**53400**	**1**	**9110**	**0**	**0**	**323**	**0.4**	**0**	**0**	**0**	**345**
D8	26/07/2018	Normal	MPW022787	G.Water	990	5.46	57.7	57.3	46.4	6.05	73.2	397	22	0.68	672	90	<1	37	150	<0.1	2	2	440	<1	1610	<0.04	<1	87	<0.2	<1	<10	<10	105
D8	23/08/2018	Normal	MPW023194	G.Water	900	5.63	50.6	54	40.1	5.2	63.2	370	22	<0.1	509	90	<1	31	100	<0.1	<1	2	428	<1	1400	<0.04	<1	83	<0.2	<1	<10	<10	90
D8	27/09/2018	Normal	MPW023749	G.Water	574	5.46	35.2	28.2	27.7	3.74	33.9	225	15	0.049	407	190	<1	34	90	<0.1	<1	<1	61	<1	492	<0.04	2	42	<0.2	<1	<10	<10	62
D8	25/10/2018	Normal	MPW024172	G.Water	277	5.58	18.3	5.92	14.3	2.69	12.9	107	11	<0.05	209	510	<1	25	<50	<0.1	<1	1	151	<1	105	0.05	<1	31	<0.2	<1	<10	<10	70
D8	29/11/2018	Normal	MPW024647	G.Water	113	5.51	10.4	1.32	5.46	2.26	1.88	31.8	16	0.031	159	1920	<1	30	<50	<0.1	1	50	650	3	24	0.2	<1	15	<0.2	<1	<10	<10	26
D8	20/12/2018	Normal	MPW025005	G.Water	183	5.61	14.3	2.4	9.64	2.64	4.51	58.6	12	0.024	147	1470	<1	36	<50	<0.1	1	11	538	2	52	<0.04	<1	24	0.2	<1	<10	<10	33
D8	24/01/2019	Normal	MPW025474	G.Water	207	5.37	14.9	2.14	11	2.2	5.08	79.6	12	0.024	204	780	<1	32	50	<0.1	<1	5	128	<1	60	<0.04	<1	30	<0.2	<1	<10	<10	48
D8	28/02/2019	Normal	MPW026056	G.Water	800	5.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D8	11/04/2019	Normal	MPW026789	G.Water	620	5.28	42.4	29.1	32.8	4.48	40.3	247	11	<0.1	456	190	<1	53	100	<0.1	<1	5	78	<1	801	<0.04	<1	70	<0.2	<1	<10	<10	116
D8	23/05/2019	Normal	D8_23 May 19_-	G.Water	880	5.58	56.9	52.7	46.5	6.03	59.8	359	20	0.026	622	290	<1	47	120	<0.1	<1	1	392	<1	2220	<0.04	<1	94	<0.2	<1	<10	<10	86
D8	27/06/2019	Normal	6295532	G.Water	1130	5.78	67.6	71.7	55.9	7.88	98.7	416	28	<0.1	706	210	<1	40	160	<0.1	<1	4	586	<1	2230	<0.04	<1	102	<0.2	<1	<10	<10	103
		Average			**606.72727**	**5.51363636**	**36.83**	**30.48**	**28.98**	**4.317**	**39.35**	**229.1**	**16.9**	**0.139**	**409.1**	**574**	**-**	**36.5**	**110**	**-**	**1.333**	**9**	**345.2**	**2.5**	**899.4**	**0.125**	**2**	**57.8**	**0.2**	**-**	**-**	**-**	**73.9**
		50th Percentile			**620**	**5.51**	**38.8**	**28.65**	**30.25**	**4.11**	**37.1**	**236**	**15.5**	**0.0285**	**431.5**	**250**	**-**	**35**	**100**	**-**	**1**	**4**	**410**	**2.5**	**646.5**	**0.125**	**2**	**56**	**0.2**	**-**	**-**	**-**	**78**
		90th Percentile			**990**	**5.63**	**58.69**	**58.74**	**47.44**	**6.233**	**75.75**	**398.9**	**22.6**	**0.3645**	**675.4**	**1515**	**-**	**47.6**	**154**	**-**	**1.8**	**18.8**	**592.4**	**2.9**	**2221**	**0.185**	**2**	**94.8**	**0.2**	**-**	**-**	**-**	**106.1**
		Minimum			**113**	**5.28**	**10.4**	**1.32**	**5.46**	**2.2**	**1.88**	**31.8**	**11**	**0.024**	**147**	**90**	**0**	**25**	**50**	**0**	**1**	**1**	**61**	**2**	**24**	**0.05**	**2**	**15**	**0.2**	**0**	**0**	**0**	**26**
		Maximum			**1130**	**5.78**	**67.6**	**71.7**	**55.9**	**7.88**	**98.7**	**416**	**28**	**0.68**	**706**	**1920**	**0**	**53**	**160**	**0**	**2**	**50**	**650**	**3**	**2230**	**0.2**	**2**	**102**	**0.2**	**0**	**0**	**0**	**116**
D9	26/07/2018	Normal	MPW022784	G.Water	4360	5.84	357	342	302	21.9	339	1970	114	3.02	3710	200	1	44	860	<0.1	<1	2	32500	1	15400	<0.04	3	665	0.2	<1	<10	<10	171
D9	23/08/2018	Normal	MPW023191	G.Water	4630	5.89	390	425	302	25.4	376	2250	89	<0.1	3690	420	3	45	940	<0.1	<1	2	30600	4	15100	0.05	5	657	0.3	<1	<10	<10	234
D9	27/09/2018	Normal	MPW023746	G.Water	5220	5.97	430	552	319	28.5	473	2630	116	0.108	4580	20	<1	41	1150	<0.1	<1	2	38600	<1	13800	<0.04	3	774	<0.2	<1	<10	<10	131
D9	25/10/2018	Normal	MPW024169	G.Water	5120	6.04	418	484	316	30.2	509	2830	106	<1	4280	360	<1	46	1260	0.4	1	20	34900	2	14800	<0.04	3	996	0.3	<1	<10	<10	193
D9	29/11/2018	Normal	MPW024644	G.Water	3520	5.88	253	331	191	21.5	362	1550	72	0.074	2690	140	1	29	1000	<0.1	1	10	17000	1	9600	<0.04	2	544	<0.2	<1	<10	<10	96
D9	20/12/2018	Normal	MPW025002	G.Water	5410	6.05	432	543	323	36.7	563	2760	129	0.553	4530	70	1	40	1490	<0.1	<1	<1	30500	<1	15200	<0.04	1	844	<0.2	<1	<10	<10	112
D9	24/01/2019	Normal	MPW025471	G.Water	5420	6.06	424	528	315	34.3	512	2590	88	<0.2	4860	150	2	35	1570	0.1	<1	<1	43100	<1	16600	0.06	<1	908	<0.2	<1	<10	<10	129
D9	28/02/2019	Normal	MPW026092	G.Water	5930	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D9	13/03/2019	Normal	D9_13 Mar 19_-	G.Water	5930	6	490	592	361	39.3	564	2870	155	<0.5	5140	30	1	36	1540	<0.1	<1	<1	46400	<1	17600	<0.04	<1	993	<0.2	<1	<10	<10	104
D9	10/04/2019	Normal	MPW026786	G.Water	6980	5.94	586	781	417	46.5	729	3310	118	<0.5	5940	40	1	36	1450	<0.1	<1	5	42000	<1	18300	<0.04	<1	1240	0.4	<1	<10	<10	105
D9	22/05/2019	Normal	D9_22 May 19_-	G.Water	7460	6.04	640	956	450	44.2	855	3910	95	2.52	6840	480	6	40	1520	<0.1	<1	1	55800	3	25000	<0.04	<1	1280	0.2	<1	<10	<10	256
D9	26/06/2019	Normal	6295511	G.Water	8050	5.97	664	987	486	45.3	942	3880	49	<0.5	6380	10	1	40	1430	<0.1	<1	<1	12200	<1	23600	<0.04	<1	1480	<0.2	<1	<10	<10	103
		Average			**5669.1667**	**5.97333333**	**462.2**	**592.8**	**343.8**	**33.98**	**565.8**	**2777.27**	**102.8**	**1.255**	**4785.5**	**174.55**	**1.889**	**39.27**	**1291.8**	**0.25**	**1**	**6**	**34872.73**	**2.2**	**16818**	**0.055**	**2.8333**	**943.727**	**0.28**	**-**	**-**	**-**	**148.5**
		50th Percentile			**5415**	**5.985**	**430**	**543**	**319**	**34.3**	**512**	**2760**	**106**	**0.553**	**4580**	**140**	**1**	**40**	**1430**	**0.25**	**1**	**2**	**34900**	**2**	**15400**	**0.055**	**3**	**908**	**0.3**	**-**	**-**	**-**	**129**
		90th Percentile			**7412**	**6.049**	**640**	**956**	**450**	**45.3**	**855**	**3880**	**129**	**2.82**	**6380**	**420**	**3.6**	**45**	**1540**	**0.37**	**1**	**14**	**46400**	**3.6**	**23600**	**0.059**	**4**	**1280**	**0.36**	**-**	**-**	**-**	**234**
		Minimum			**3520**	**5.84**	**253**	**331**	**191**	**21.5**	**339**	**1550**	**49**	**0.074**	**2690**	**10**	**1**	**29**	**860**	**0.1**	**1**	**1**	**12200**	**1**	**9600**	**0.05**	**1**	**544**	**0.2**	**0**	**0**	**0**	**96**
		Maximum			**8050**	**6.06**	**664**	**987**	**486**	**46.5**	**942**	**3910**	**155**	**3.02**	**6840**	**480**	**6**	**46**	**1570**	**0.4**	**1**	**20**	**55800**	**4**	**25000**	**0.06**	**5**	**1480**	**0.4**	**0**	**0**	**0**	**256**
D10	25/07/2018	Normal	MPW022800	G.Water	10830	5.58	358	727	393	204	1900	4420	81	<0.5	9330	120	<1	15	4350	7	<1	1	5390	5	8310	<0.04	<1	1050	4	<1	<10	<10	1050
D10	23/08/2018	Normal	MPW023207	G.Water	10680	5.53	368	871	424	236	2340	6370	80	0.775	8740	100	<1	16	4750	7	<1	<1	5060	5	8610	<0.04	2	1040	3	<1	<10	<10	1030
D10	26/09/2018	Normal	MPW023762	G.Water	7440	5.59	269	615	252	162	1290	3900	76	0.461	6200	60	<1	14	2350	4	<1	<1	15000	3	5140	<0.04	<1	719	1	<1	<10	<10	1060
D10	24/10/2018	Normal	MPW024185	G.Water	7750	5.7	280	566	265	151	1390	4640	81	0.267	6530	90	<1	16	2630	5	<1	<1	14400	4	5700	<0.04	2	804	1	<1	<10	<10	1040
D10	29/11/2018	Normal	MPW024660	G.Water	7990	5.58	306	584	288	159	1460	4330	84	<0.2	6860	70	<1	16	2760	4	<1	<1	16500	4	6220	<0.04	<1	843	2	<1	<10	<10	1050
D10	19/12/2018	Normal	MPW025018	G.Water	5870	5.53	237	389	188	108	1030	3010	77	0.216	4600	50	<1	14	1490	2	<1	<1	21200	2	4070	<0.04	<1	600	0.6	<1	<10	<10	900
D10	23/01/2019	Normal	MPW025487	G.Water	5660	5.56	234	395	171	95.4	933	2710	43	<0.5	4540	60	<1	14	1500	2	<1	<1	19900	2	4080	<0.04	<1	618	0.4	<1	<10	<10	915
D10	28/02/2019	Normal	MPW026069	G.Water	5490	5.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D10	13/03/2019	Normal	D10_13 Mar 19_-	G.Water	5490	5.58	226	366	172	90	850	2640	69	<0.5	4370	50	<1	17	1380	1.9	<1	<1	21500	2	4160	<0.04	<1	627	0.5	<1	<10	<10	1000
D10	11/04/2019	Normal	MPW026802	G.Water	5910	5.49	226	465	183	106	1050	3030	68	<0.5	4360	50	<1	16	1460	2.2	<1	4	17800	2	3930	<0.04	<1	619	1	<1	<10	<10	923
D10	23/05/2019	Normal	D10_23 May 19_-	G.Water	6070	5.61	229	488	188	97.9	1130	3350	66	<0.5	5000	40	<1	14	1750	2.4	<1	<1	16800	2	5250	<0.04	<1	600	0.8	<1	<10	<10	789
D10	26/06/2019	Normal	6295659	G.Water	6080	5.63	228	426	182	94.9	1160	2800	49	<0.5	4210	40	<1	16	1480	2.6	2	<1	11900	2	4550	<0.04	<1	603	0.7	<1	<10	<10	829
		Average			**7105**	**5.58**	**269.2**	**535.6**	**246**	**136.7**	**1321**	**3745.45**	**70.36**	**0.42975**	**5885.5**	**66.364**	**-**	**15.27**	**2354.5**	**3.645**	**2**	**2.5**	**15040.91**	**3**	**5456.4**	**-**	**2**	**738.455**	**1.36**	**-**	**-**	**-**	**962.4**
		50th Percentile			**6075**	**5.58**	**237**	**488**	**188**	**108**	**1160**	**3350**	**76**	**0.364**	**5000**	**60**	**-**	**16**	**1750**	**2.6**	**2**	**2.5**	**16500**	**2**	**5140**	**-**	**2**	**627**	**1**	**-**	**-**	**-**	**1000**
		90th Percentile			**10411**	**5.628**	**358**	**727**	**393**	**204**	**1900**	**4640**	**81**	**0.6808**	**8740**	**100**	**-**	**16**	**4350**	**7**	**2**	**3.7**	**21200**	**5**	**8310**	**-**	**2**	**1040**	**3**	**-**	**-**	**-**	**1050**
		Minimum			**5490**	**5.49**	**226**	**366**	**171**	**90**	**850**	**2640**	**43**	**0.216**	**4210**	**40**	**0**	**14**	**1380**	**1.9**	**2**	**1**	**5060**	**2**	**3930**	**0**	**2**	**600**	**0.4**	**0**	**0**	**0**	**789**
		Maximum			**10830**	**5.7**	**368**	**871**	**424**	**236**	**2340**	**6370**	**84**	**0.775**	**9330**	**120**	**0**	**17**	**4750**	**7**	**2**	**4**	**21500**	**5**	**8610**	**0**	**2**	**1050**	**4**	**0**	**0**	**0**	**1060**
D11	25/07/2018	Normal	MPW022799	G.Water	10150	6.2	608	803	422	106	1510	4280	164	<0.5	9010	20	7	18	2850	<0.1	<1	<1	81600	<1	18800	<0.04	<1	988	0.3	<1	<10	<10	136
D11	22/08/2018	Normal	MPW023206	G.Water	9960	6.18	628	929	466	103	1820	4840	158	0.628	7800	<10	10	15	3260	<0.1	<1	<1	106000	<1	18400	<0.04	2	936	0.2	<1	<10	<10	178
D11	27/09/2018	Normal	MPW023761	G.Water	9900	6.21	593	998	436	118	1550	4920	194	<0.1	9400	<10	10	20	3070	<0.1	<1	<1	99800	<1	16100	<0.04	3	958	0.2	<1	<10	<10	123
D11	25/10/2018	Normal	MPW024184	G.Water	10230	6.15	621	912	449	100	1590	4720	175	<0.5	9320	<10	4	23	3200	<0.1	<1	<1	80200	<1	17100	<0.04	<1	1060	<0.2	<1	<10	<10	77
D11	29/11/2018	Normal	MPW024659	G.Water	10240	6.22	604	953	456	106	1610	4910	156	<0.5	9380	10	7	31	3100	<0.1	<1	3	60300	<1	17300	<0.04	1	1060	0.2	<1	<10	<10	101
D11	19/12/2018	Normal	MPW025017	G.Water	10320	6.14	600	982	451	113	1590	5760	157	<0.2	8150	<10	6	16	3030	<0.1	<1	<1	75600	<1	16400	<0.04	<1	1000	<0.2	<1	<10	<10	109
D11	24/01/2019	Normal	MPW025486	G.Water	10110	6.27	579	1040	430	113	1500	4900	58	<0.5	9310	30	9	26	3250	<0.1	<1	<1	106000	<1	16200	<0.04	<1	1060	<0.2	<1	<10	<10	70
D11	28/02/2019	Normal	MPW026068	G.Water	4050	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D11	13/03/2019	Normal	D11_13 Mar 19_-	G.Water	4050	6.7	326	429	168	71.4	398	989	682	<0.5	2930	220	<1	116	770	0.1	2	2	5890	8	1970	<0.04	2	157	0.4	<1	<10	<10	53
D11	10/04/2019	Normal	MPW026801	G.Water	10160	6.12	622	1040	448	115	1550	4930	126	<0.5	8460	20	6	21	2820	<0.1	<1	2	51700	<1	16200	<0.04	<1	1040	0.5	<1	<10	<10	120
D11	23/05/2019	Normal	D11_23 May 19_-	G.Water	10020	6.19	618	1110	440	96.7	1540	4720	106	<0.01	9160	<10	6	18	2960	<0.1	<1	<1	105000	<1	20800	<0.04	<1	939	0.2	<1	<10	<10	100
D11	26/06/2019	Normal	6295656	G.Water	9920	6.24	610	1010	436	97.4	1580	4800	50	<0.5	8220	<10	6	26	2670	<0.1	<1	<1	27000	<1	19100	<0.04	<1	964	<0.2	<1	<10	<10	103

					Field Parameters		Anions and Cations									Metals																				
					Electrical Conductivity (Field)	pH (Field)	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride	Total Dissolved Solids (TDS)	Aluminium	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Selenium	Silver	Vanadium	Vanadium (Filtered)	Zinc
					uS/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								1					1	0.1	10								50		1							5	
Groundwater Environmental Goal (ANZECC (2000) or Local Guidelines - Groundwater)					2600[#1]	6.5-8		350				1000		1.5	2000		24	700	370	2[#2]	5[#2]	5[#2]	664[#3]	5[#2]	5704[#3]	0.06	10	550.9[#4]	5	0.05			908[#4]
Groundwater Collection Basin Pre-placement 90th Percentile					**1576**			**31.5**				**824**		**0.435**	**1306**		**1**	**37**	**244**	**2**	**1**	**1**	**664**	**1**	**5704**	**0.1**	**1**	**550.9**	**2**	**1**			**908**
LocCode	**Sampled_Date-Time**	**Sample_Type**	**SampleCode**	**Matrix_Type**																															
		Average			**9092.5**	**6.27666667**	**582.6**	**927.8**	**418.4**	**103.6**	**1476**	**4524.45**	**184.2**	**0.628**	**8285.5**	**60**	**7.1**	**30**	**2816.4**	**0.1**	**2**	**2.33**	**72644.55**	**8**	**16215**	**-**	**2**	**923.818**	**0.285714286**	**-**	**-**	**-**	**106.4**
		50th Percentile			**10065**	**6.205**	**608**	**982**	**440**	**106**	**1550**	**4840**	**157**	**0.628**	**9010**	**20**	**6.5**	**21**	**3030**	**0.1**	**2**	**2**	**80200**	**8**	**17100**	**-**	**2**	**988**	**0.2**	**-**	**-**	**-**	**103**
		90th Percentile			**10239**	**6.657**	**622**	**1040**	**456**	**115**	**1610**	**4930**	**194**	**0.628**	**9380**	**144**	**10**	**31**	**3250**	**0.1**	**2**	**2.8**	**106000**	**8**	**19100**	**-**	**2.7**	**1060**	**0.44**	**-**	**-**	**-**	**136**
		Minimum			**4050**	**6.12**	**326**	**429**	**168**	**71.4**	**398**	**989**	**50**	**0.628**	**2930**	**10**	**4**	**15**	**770**	**0.1**	**2**	**2**	**5890**	**8**	**1970**	**0**	**1**	**157**	**0.2**	**0**	**0**	**0**	**53**
		Maximum			**10320**	**6.7**	**628**	**1110**	**466**	**118**	**1820**	**5760**	**682**	**0.628**	**9400**	**220**	**10**	**116**	**3260**	**0.1**	**2**	**3**	**106000**	**8**	**20800**	**0**	**3**	**1060**	**0.5**	**0**	**0**	**0**	**178**
D19	25/07/2018	Normal	MPW022797	G.Water	6570	5.91	343	487	283	67.4	987	3250	116	3	5610	1110	14	52	2870	0.2	21	15	26200	50	13700	<0.04	2	1040	2	<1	<10	<10	498
D19	22/08/2018	Normal	MPW023204	G.Water	6710	5.93	296	478	254	58.6	903	3230	130	0.917	6180	1760	6	38	3330	<0.1	96	6	31700	22	14900	<0.04	6	1100	0.9	<1	<10	<10	1960
D19	26/09/2018	Normal	MPW023759	G.Water	6690	5.91	320	538	279	82	1060	3440	118	<0.1	5000	340	4	20	3230	0.2	18	5	26300	17	11900	<0.04	4	972	1	<1	<10	<10	749
D19	24/10/2018	Normal	MPW024182	G.Water	6930	5.86	307	522	272	84.8	1160	3520	130	<0.5	5230	730	7	33	3510	0.4	47	6	35700	18	12700	<0.04	3	1040	0.6	<1	<10	<10	554
D19	29/11/2018	Normal	MPW024657	G.Water	6530	5.92	277	469	254	88.1	1120	3130	135	<0.5	5640	120	2	19	3030	0.2	4	1	22800	8	11000	<0.04	2	898	0.5	<1	<10	<10	418
D19	19/12/2018	Normal	MPW025015	G.Water	5570	5.99	220	334	194	86.6	947	2800	143	0.312	4210	100	2	14	2420	0.1	7	<1	18200	5	7850	<0.04	<1	624	<0.2	<1	<10	<10	310
D19	23/01/2019	Normal	MPW025484	G.Water	5190	5.91	205	354	176	82.2	915	2380	122	<0.2	4480	210	5	13	2560	0.2	8	2	16000	9	8080	<0.04	<1	666	<0.2	<1	<10	<10	346
D19	27/02/2019	Normal	MPW026066	G.Water	4690	5.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D19	13/03/2019	Normal	D19_13 Mar 19_-	G.Water	4690	5.94	177	282	162	80.8	696	2160	158	<0.5	3650	90	3	15	2050	0.2	1	<1	14300	4	6940	<0.04	1	531	<0.2	<1	<10	<10	286
D19	10/04/2019	Normal	MPW026799	G.Water	45010	5.86	204	400	185	85.6	790	2890	129	<1	3700	110	2	13	2010	0.2	3	6	17300	4	7610	<0.04	<1	608	0.2	<1	<10	<10	320
D19	23/05/2019	Normal	D19_23 May 19_-	G.Water	5150	6	218	364	192	80	570	3340	111	<0.5	4180	220	4	15	2090	0.2	3	3	15300	5	10300	<0.04	<1	612	<0.2	<1	<10	<10	311
D19	26/06/2019	Normal	6295631	G.Water	5290	6.04	238	355	202	83.8	926	2440	112	<0.5	3970	180	3	20	1810	0.2	2	<1	15100	5	9220	<0.04	<1	646	<0.2	<1	<10	<10	344
		Average			**9085**	**5.93416667**	**255**	**416.6**	**223**	**79.99**	**915.8**	**2961.82**	**127.6**	**1.40967**	**4713.6**	**451.82**	**4.727**	**22.91**	**2628.2**	**0.21**	**19.09**	**5.5**	**21718.18**	**13.364**	**10382**	**-**	**3**	**794.273**	**0.866666667**	**-**	**-**	**-**	**554.2**
		50th Percentile			**6050**	**5.925**	**238**	**400**	**202**	**82.2**	**926**	**3130**	**129**	**0.917**	**4480**	**210**	**4**	**19**	**2560**	**0.2**	**7**	**5.5**	**18200**	**8**	**10300**	**-**	**2.5**	**666**	**0.75**	**-**	**-**	**-**	**346**
		90th Percentile			**6908**	**5.999**	**320**	**522**	**279**	**86.6**	**1120**	**3440**	**143**	**2.5834**	**5640**	**1110**	**7**	**38**	**3330**	**0.22**	**47**	**8.7**	**31700**	**22**	**13700**	**-**	**5**	**1040**	**1.5**	**-**	**-**	**-**	**749**
		Minimum			**4690**	**5.86**	**177**	**282**	**162**	**58.6**	**570**	**2160**	**111**	**0.312**	**3650**	**90**	**2**	**13**	**1810**	**0.1**	**1**	**1**	**14300**	**4**	**6940**	**0**	**1**	**531**	**0.2**	**0**	**0**	**0**	**286**
		Maximum			**45010**	**6.04**	**343**	**538**	**283**	**88.1**	**1160**	**3520**	**158**	**3**	**6180**	**1760**	**14**	**52**	**3510**	**0.4**	**96**	**15**	**35700**	**50**	**14900**	**0**	**6**	**1100**	**2**	**0**	**0**	**0**	**1960**
D23	25/07/2018	Normal	MPW022789	G.Water	3820	5.5	227	201	117	41.3	553	1920	53	3.18	3080	1820	3	24	420	0.4	7	4	27400	6	2940	<0.04	<1	476	0.7	<1	<10	<10	789
D23	22/08/2018	Normal	MPW023196	G.Water	4060	5.36	243	233	127	46.4	553	1970	44	2.03	3030	1260	2	17	430	0.4	2	2	27900	4	2800	<0.04	<1	559	0.5	<1	<10	<10	959
D23	26/09/2018	Normal	MPW023751	G.Water	4740	5.86	274	320	150	43.1	758	2370	132	0.125	3040	160	<1	18	320	0.3	<1	<1	5290	1	2870	<0.04	<1	418	0.3	<1	<10	<10	434
D23	28/09/2018	Normal	ES1828974006	G.Water	3495	5.95	-	324	-	-	-	-	130	0.2	3710	-	-	-	-	-	-	-	3670	-	2940	-	-	-	-	-	-	<10	-
		Average			**4028.75**	**5.6675**	**248**	**269.5**	**131.3**	**43.6**	**621.3**	**2086.67**	**89.75**	**1.38375**	**3215**	**1080**	**2.5**	**19.67**	**390**	**0.367**	4.5	**3**	**16065**	**3.6667**	**2887.5**	**-**	**-**	**484.333**	**0.5**	**-**	**-**	**-**	**727.3**
		50th Percentile			**3940**	**5.68**	**243**	**276.5**	**127**	**43.1**	**553**	**1970**	**91.5**	**1.115**	**3060**	**1260**	**2.5**	**18**	**420**	**0.4**	4.5	**3**	**16345**	**4**	**2905**	**-**	**-**	**476**	**0.5**	**-**	**-**	**-**	**789**
		90th Percentile			**4536**	**5.923**	**267.8**	**322.8**	**145.4**	**45.74**	**717**	**2290**	**131.4**	**2.835**	**3521**	**1708**	**2.9**	**22.8**	**428**	**0.4**	6.5	**3.8**	**27750**	**5.6**	**2940**	**-**	**-**	**542.4**	**0.66**	**-**	**-**	**-**	**925**
		Minimum			**3495**	**5.36**	**227**	**201**	**117**	**41.3**	**553**	**1920**	**44**	**0.125**	**3030**	**160**	**2**	**17**	**320**	**0.3**	2	**2**	**3670**	**1**	**2800**	**0**	**0**	**418**	**0.3**	**0**	**0**	**0**	**434**
		Maximum			**4740**	**5.95**	**274**	**324**	**150**	**46.4**	**758**	**2370**	**132**	**3.18**	**3710**	**1820**	**3**	**24**	**430**	**0.4**	**7**	**4**	**27900**	**6**	**2940**	**0**	**0**	**559**	**0.7**	**0**	**0**	**0**	**959**

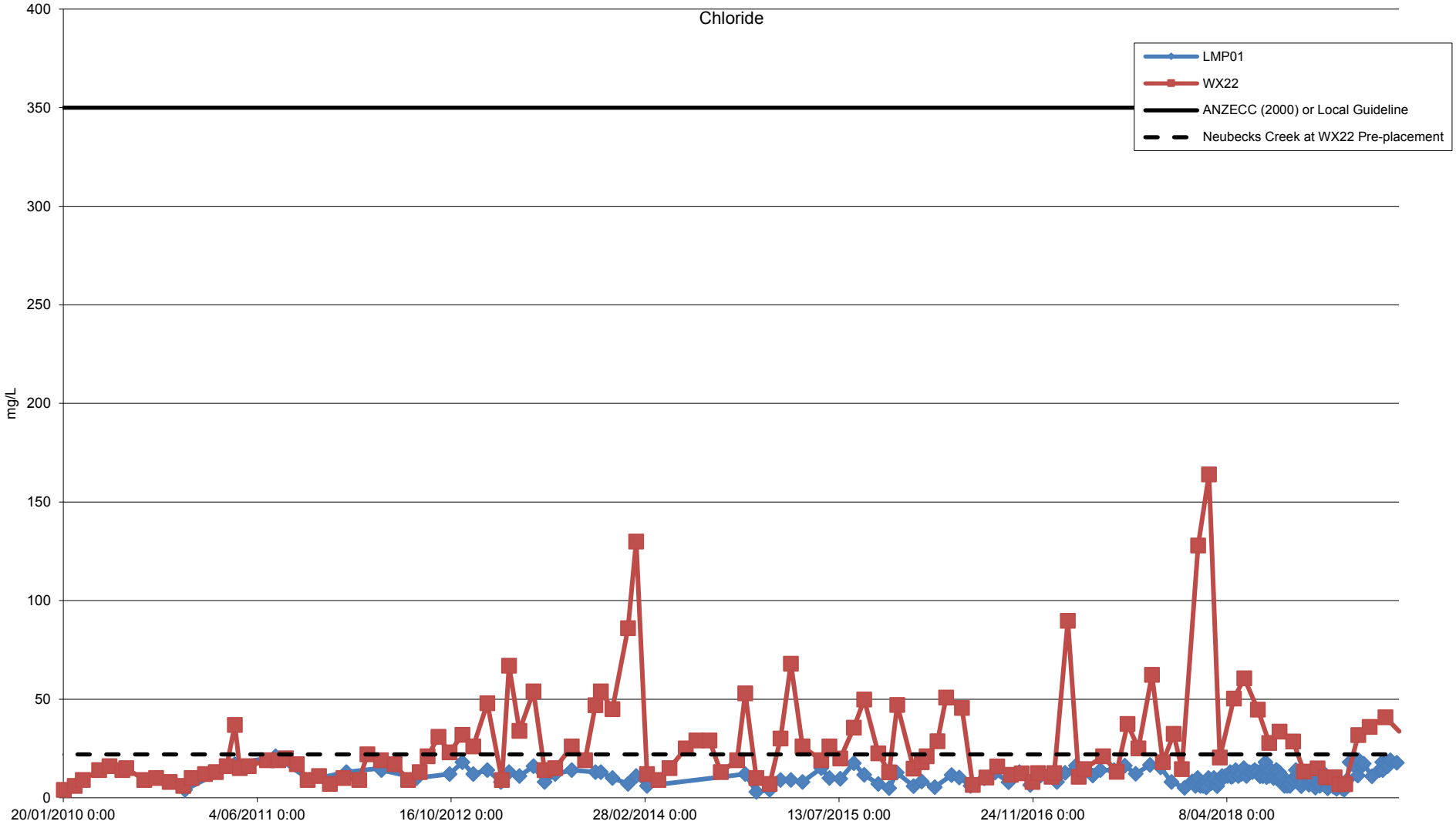
Env Stds Comments
#1:2000 mg/L TDS/0.77
#2:Adjusted for effects of hardness.
#3:Local guideline based upon 90th percentile pre-brine placement.
#4:Local guideline based upon 90th percentile pre-brine placement; Adjusted for effects of hardness.

Data Comments
#1 ED009x: Samples required dilution due to matrix interferences. LOR values for Fluoride have been adjusted accordingly.
#2 TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter
#3 Reported Analyte LOR is higher than Requested Analyte LOR

Annex H

Trend Graphs - Surface Water

Figure 1a. Choride Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260



Annual 50th Percentile

Figure 1b. Choride Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

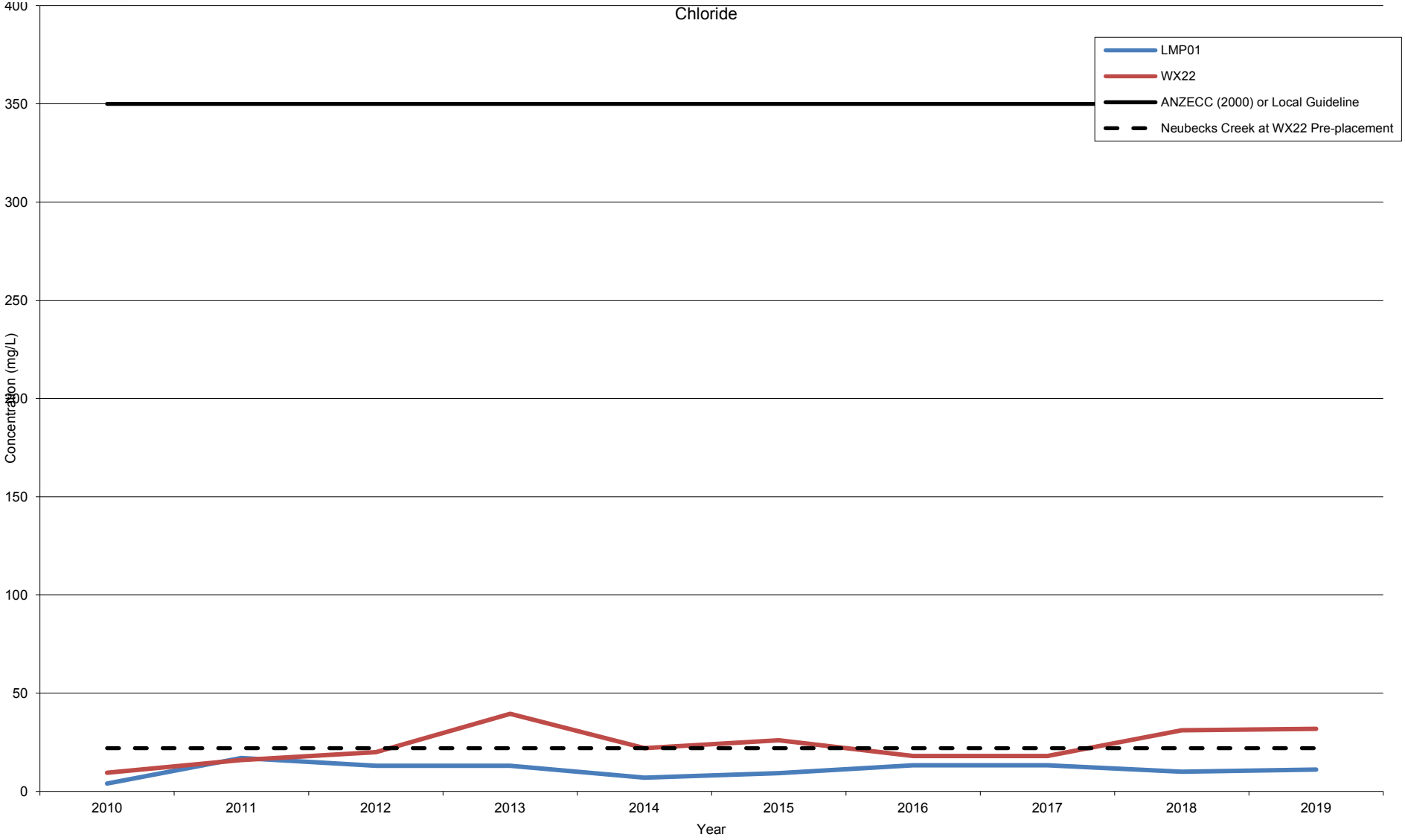


Figure 2a. Nickel Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

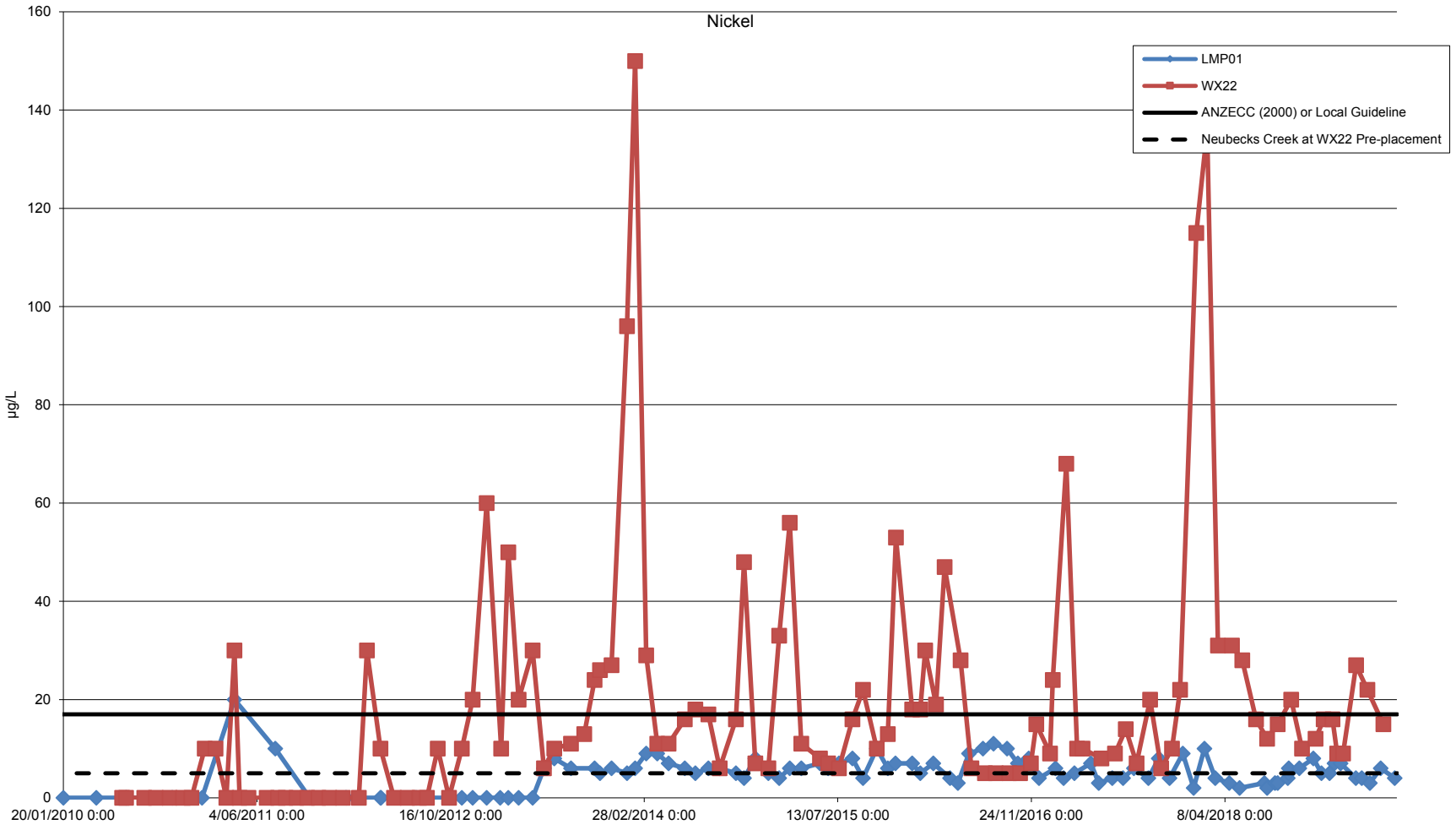


Figure 2b. Nickel Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

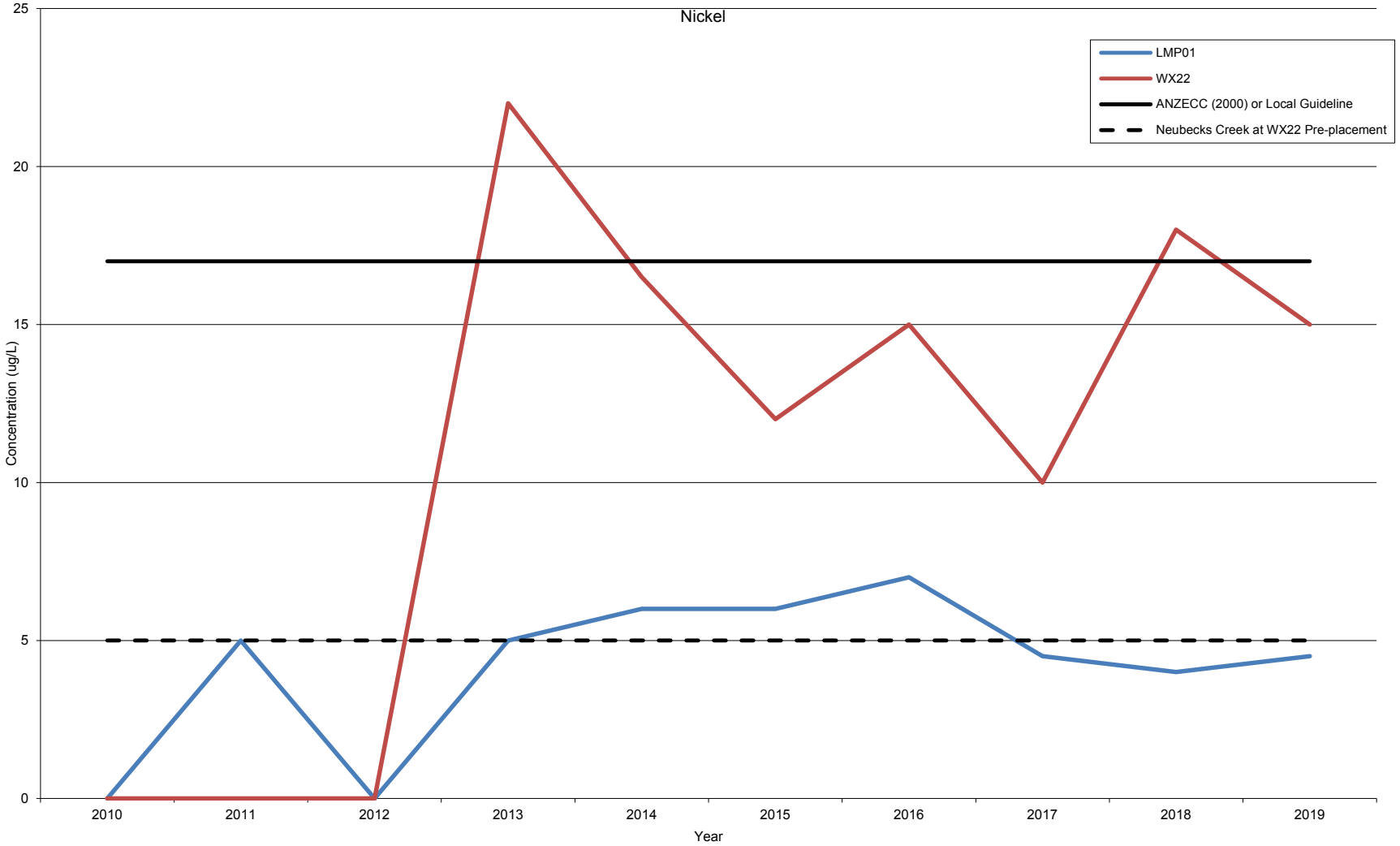


Figure 3a. Sulfate Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

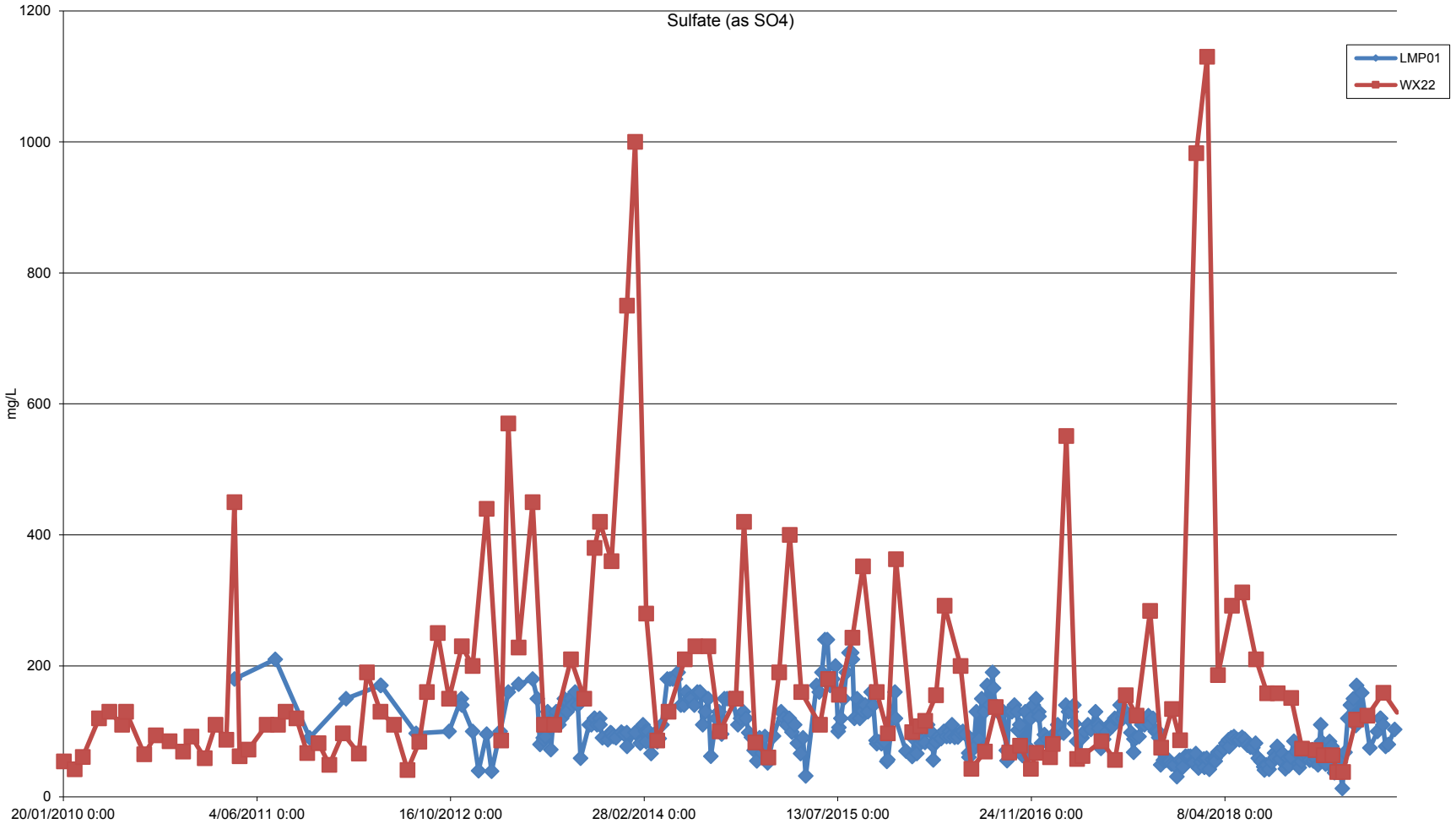


Figure 3b. Sulfate Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

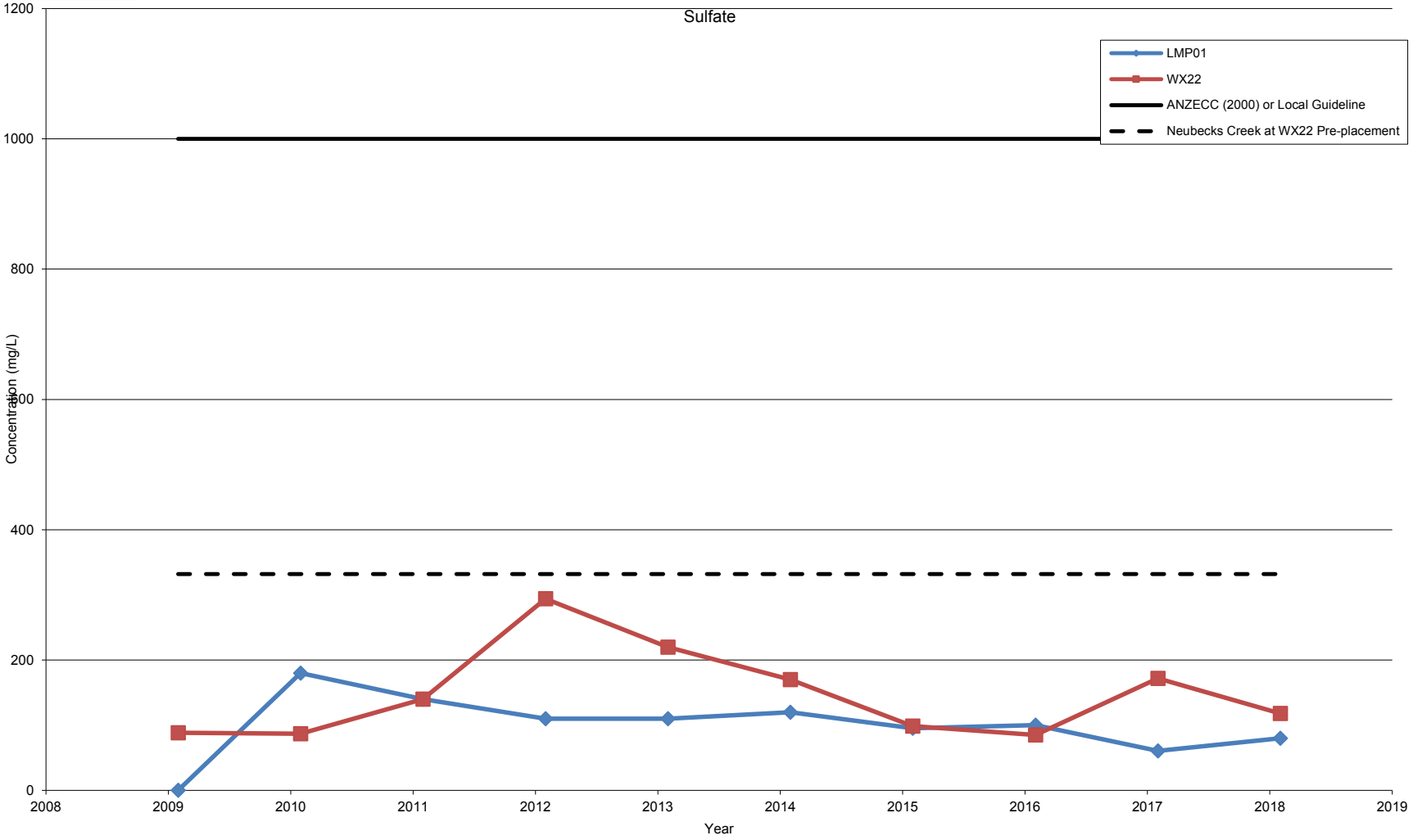


Figure 4a. Total Dissovled Solids (TDS) Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

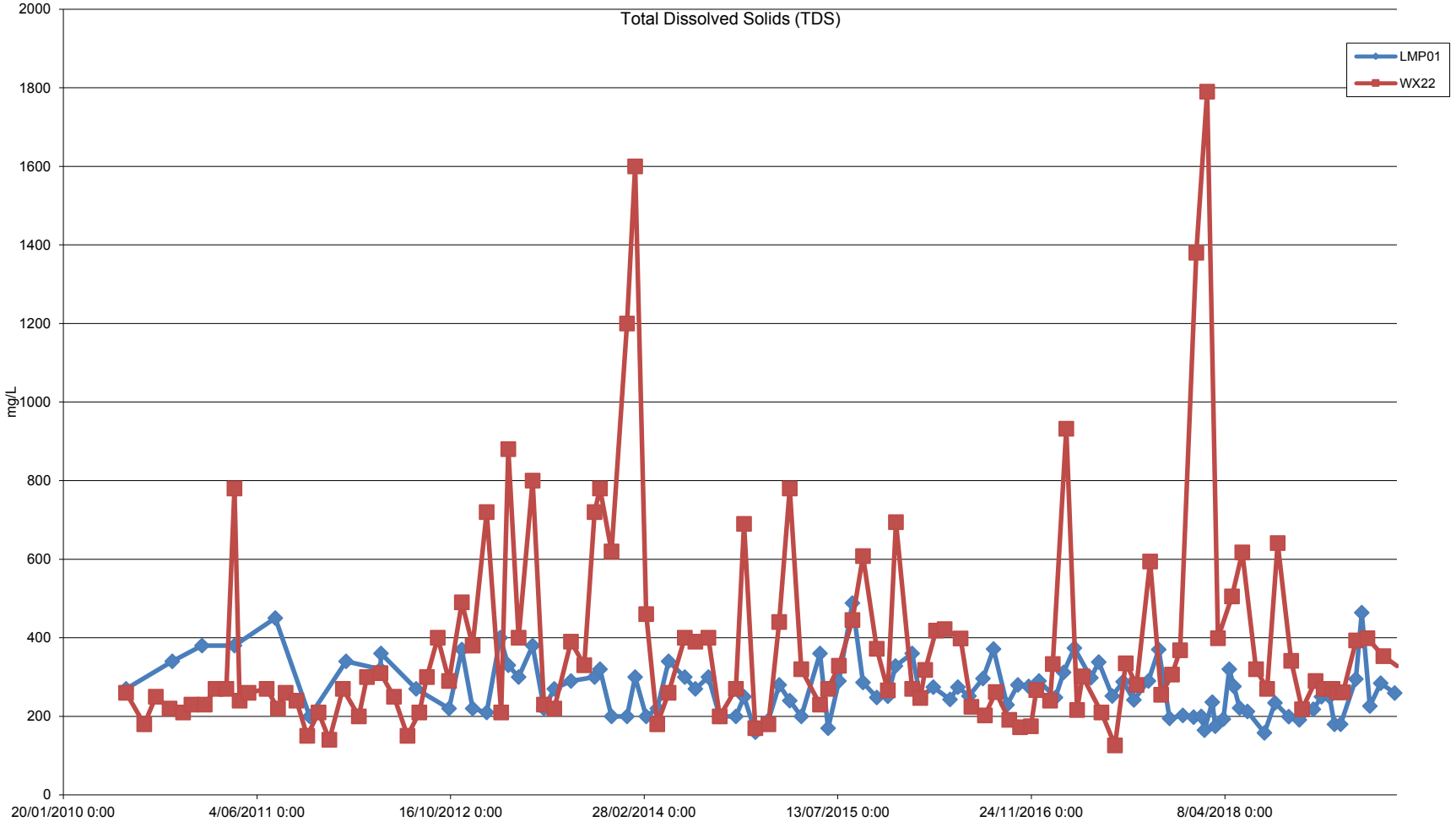
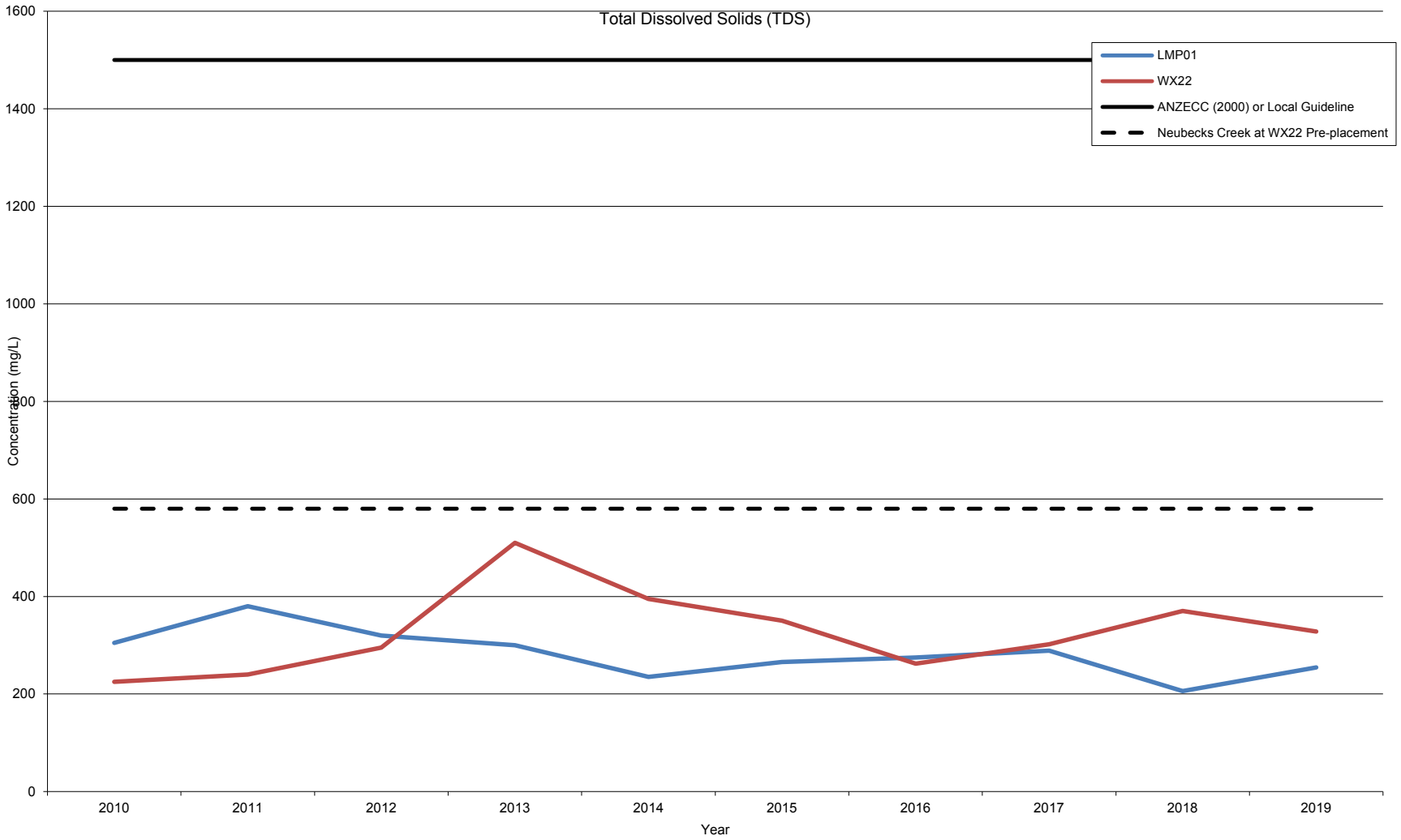


Figure4b. Total Dissovled Solids (TDS) Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260



Annex I

Trend Graphs - Groundwater

Figure 1a. Boron Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

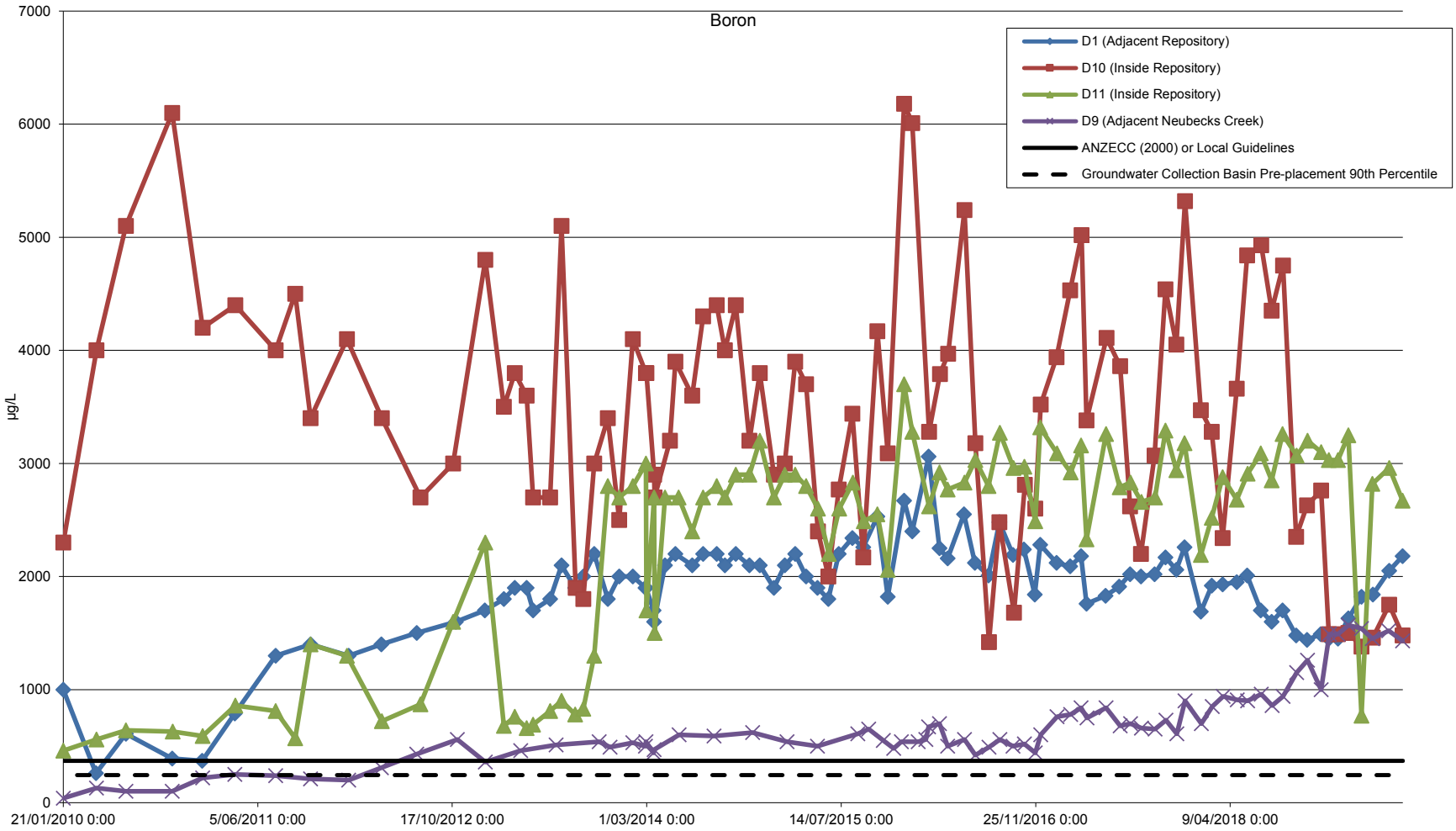


Figure 1b. Boron Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

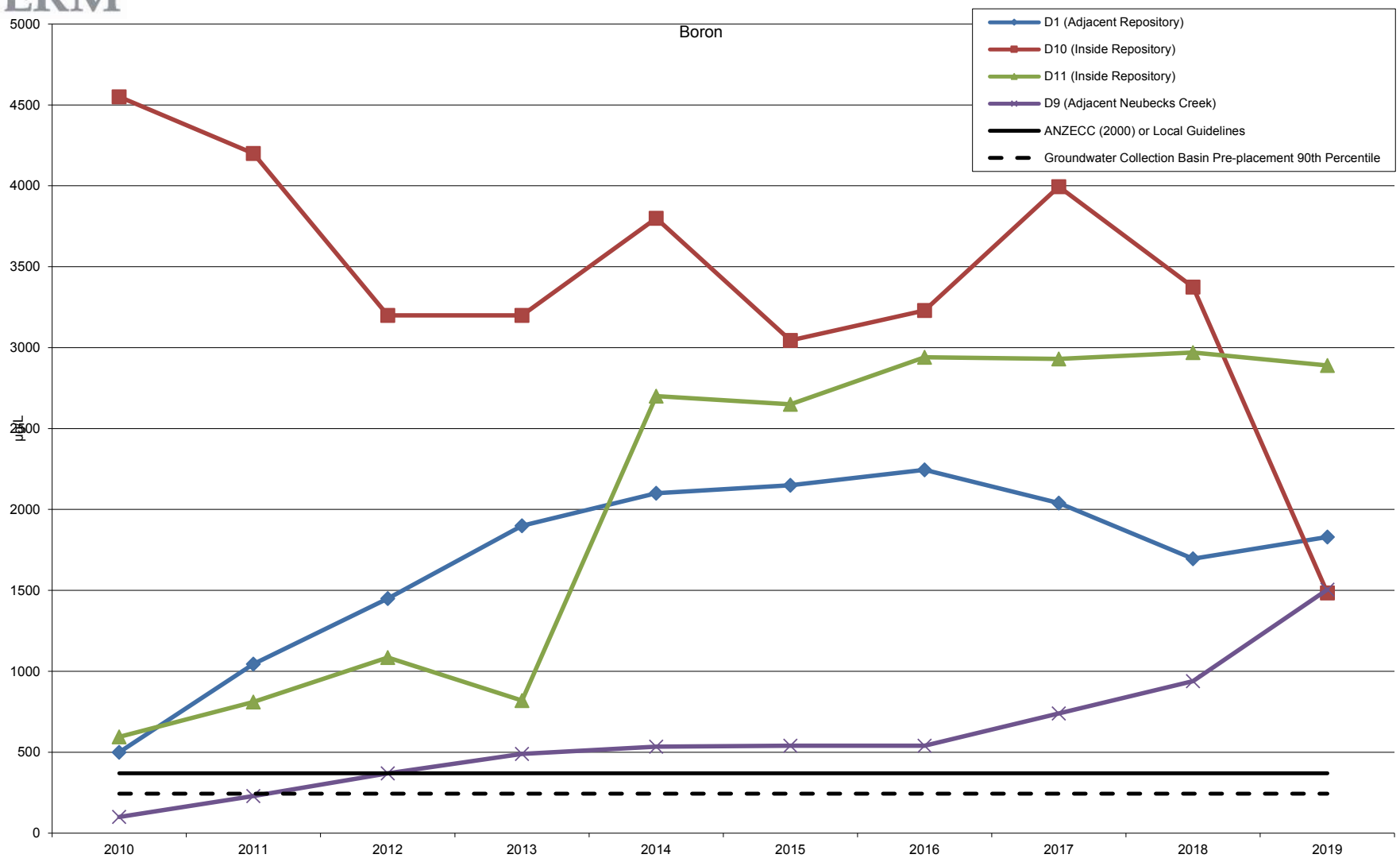


Figure 2a. Choride Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

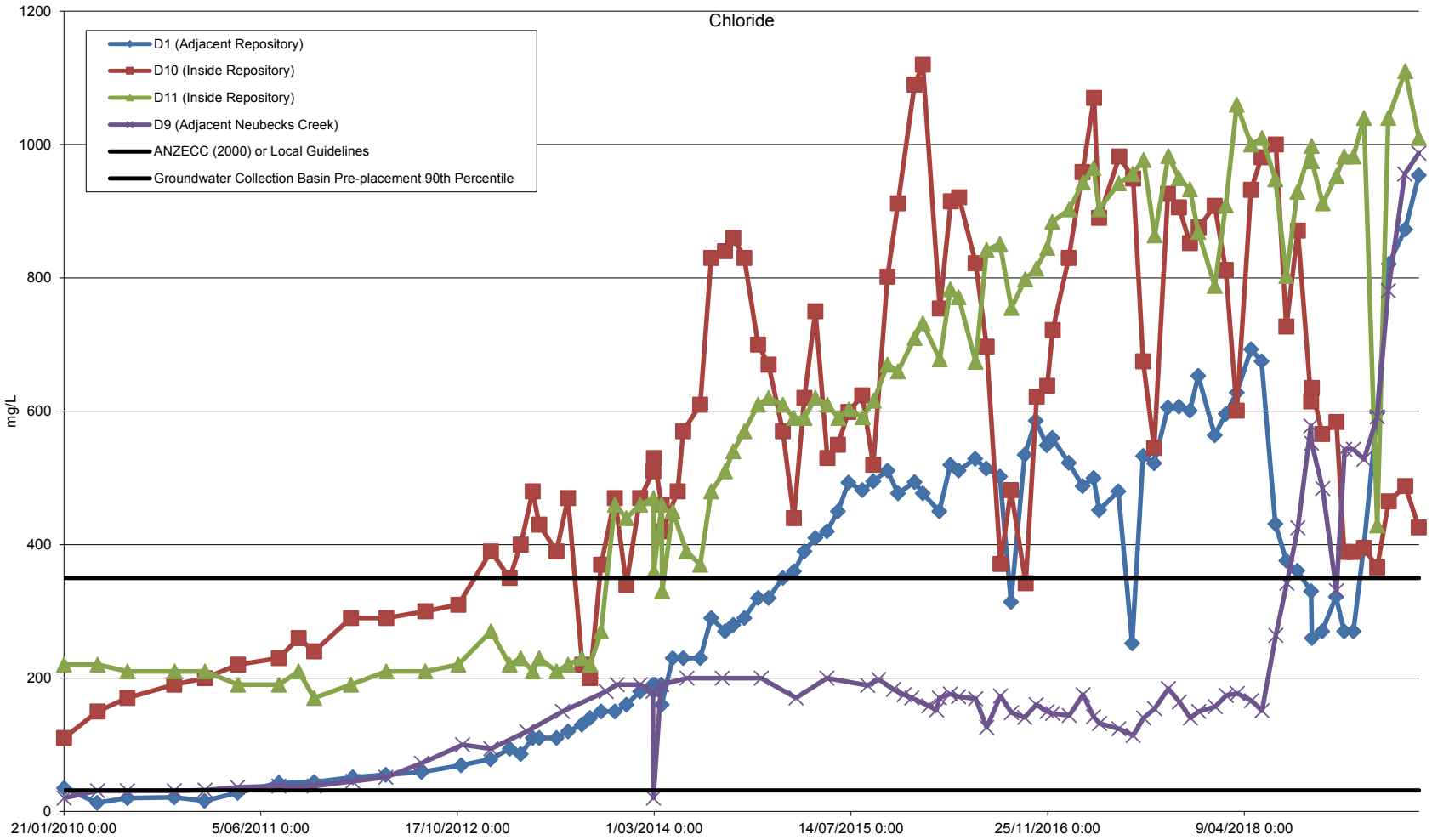


Figure 2b. Choride Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

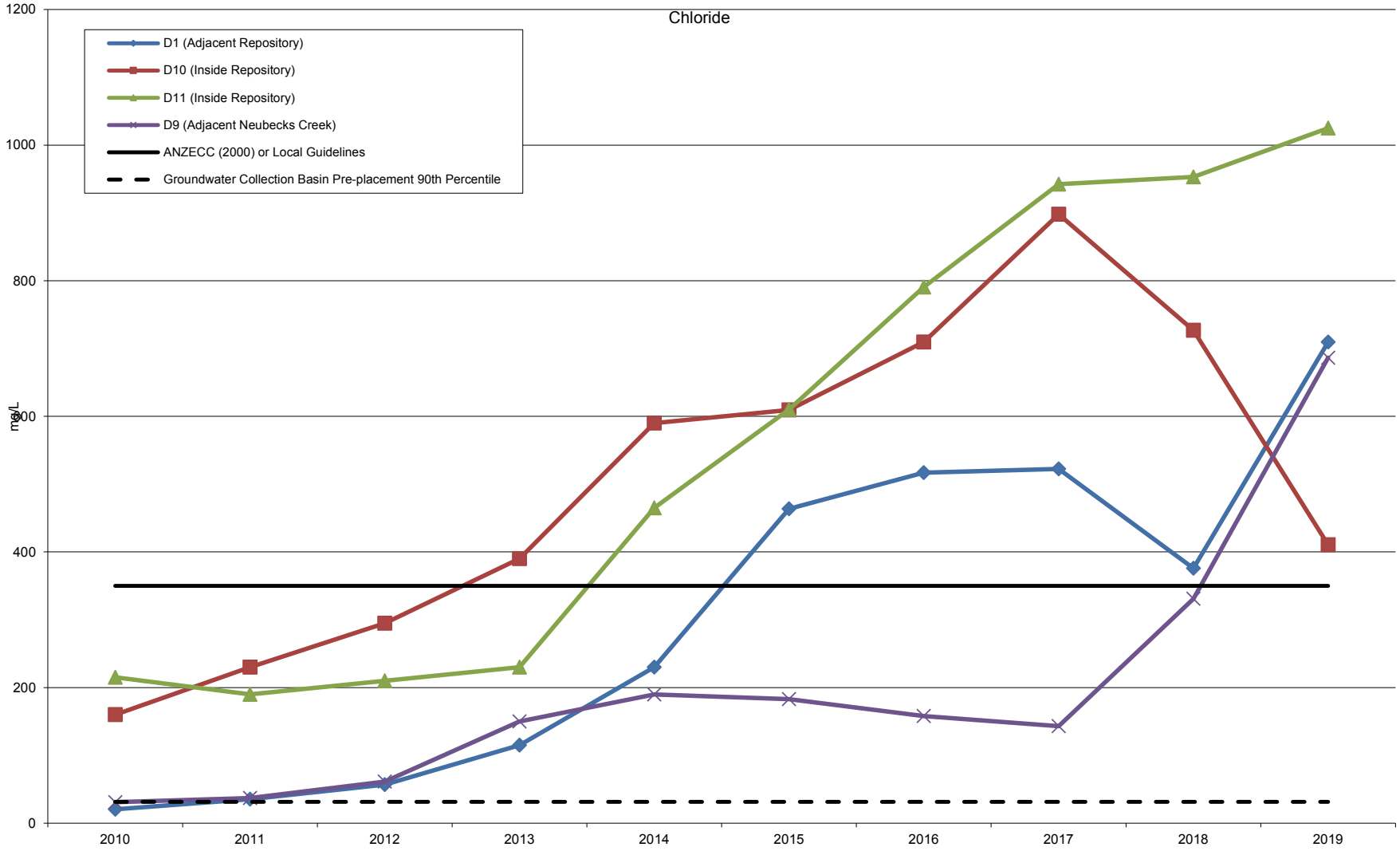


Figure 3a. Electrical Conductivity Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

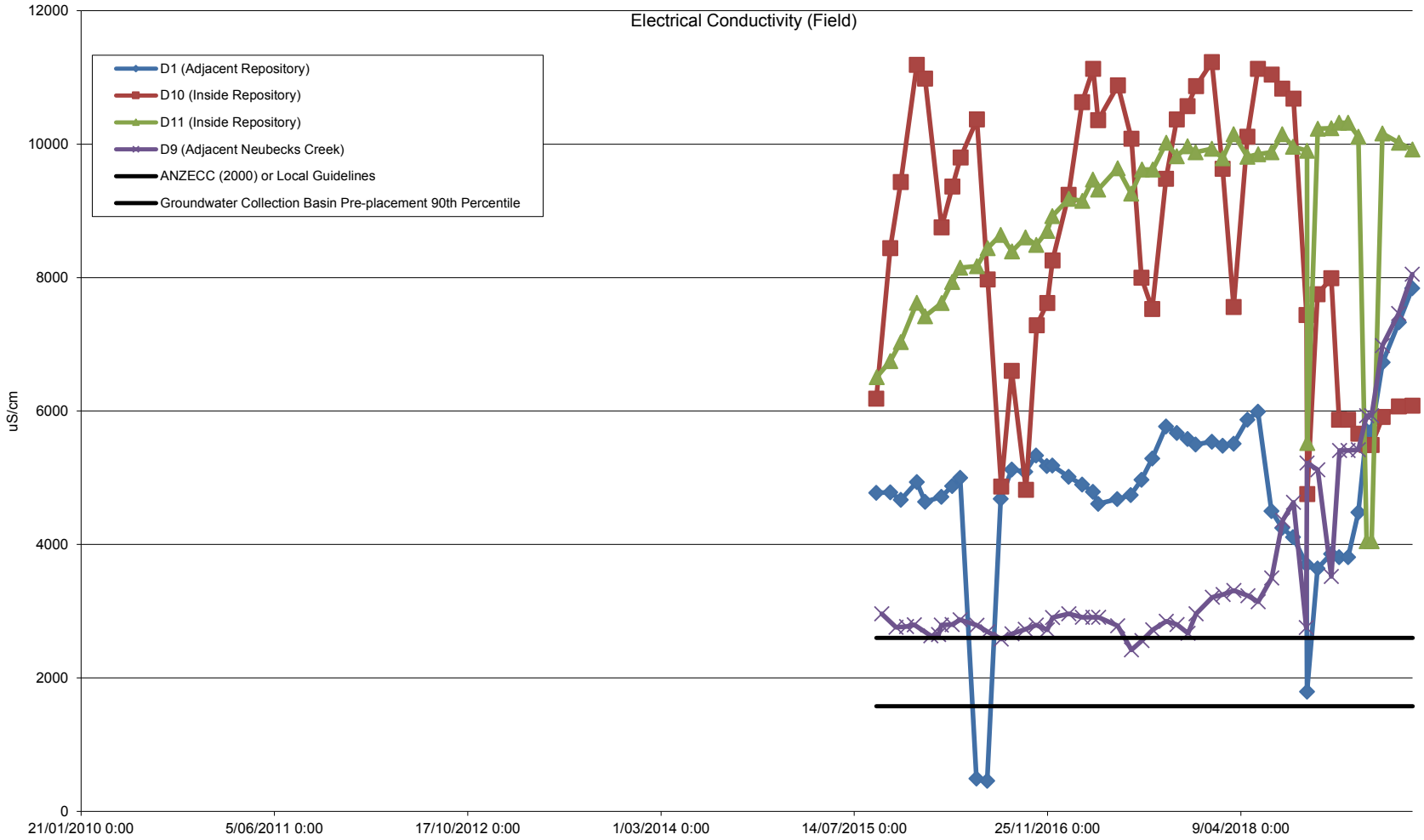


Figure 3b. Electrical Conductivity Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

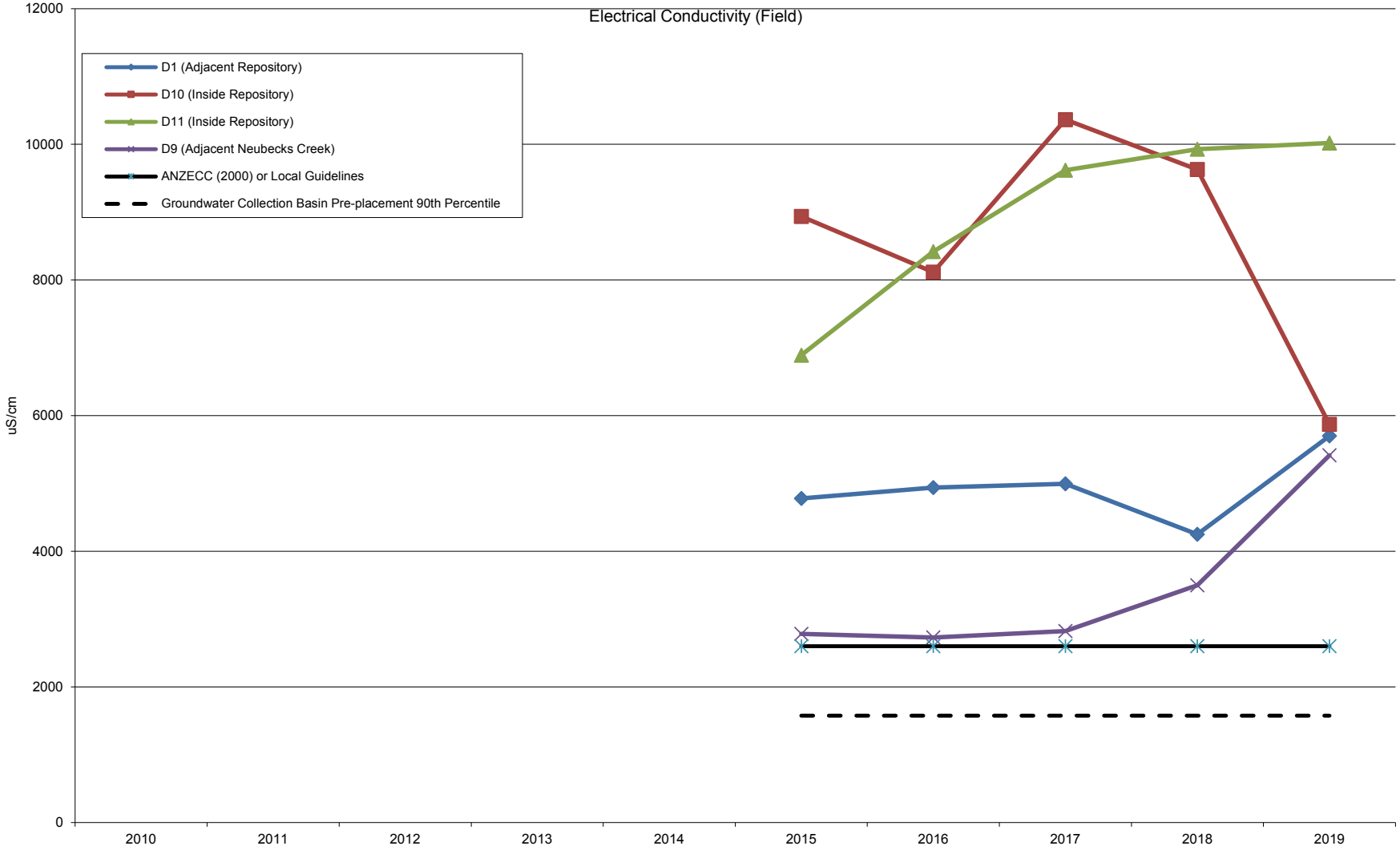


Figure 4a. Iron Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

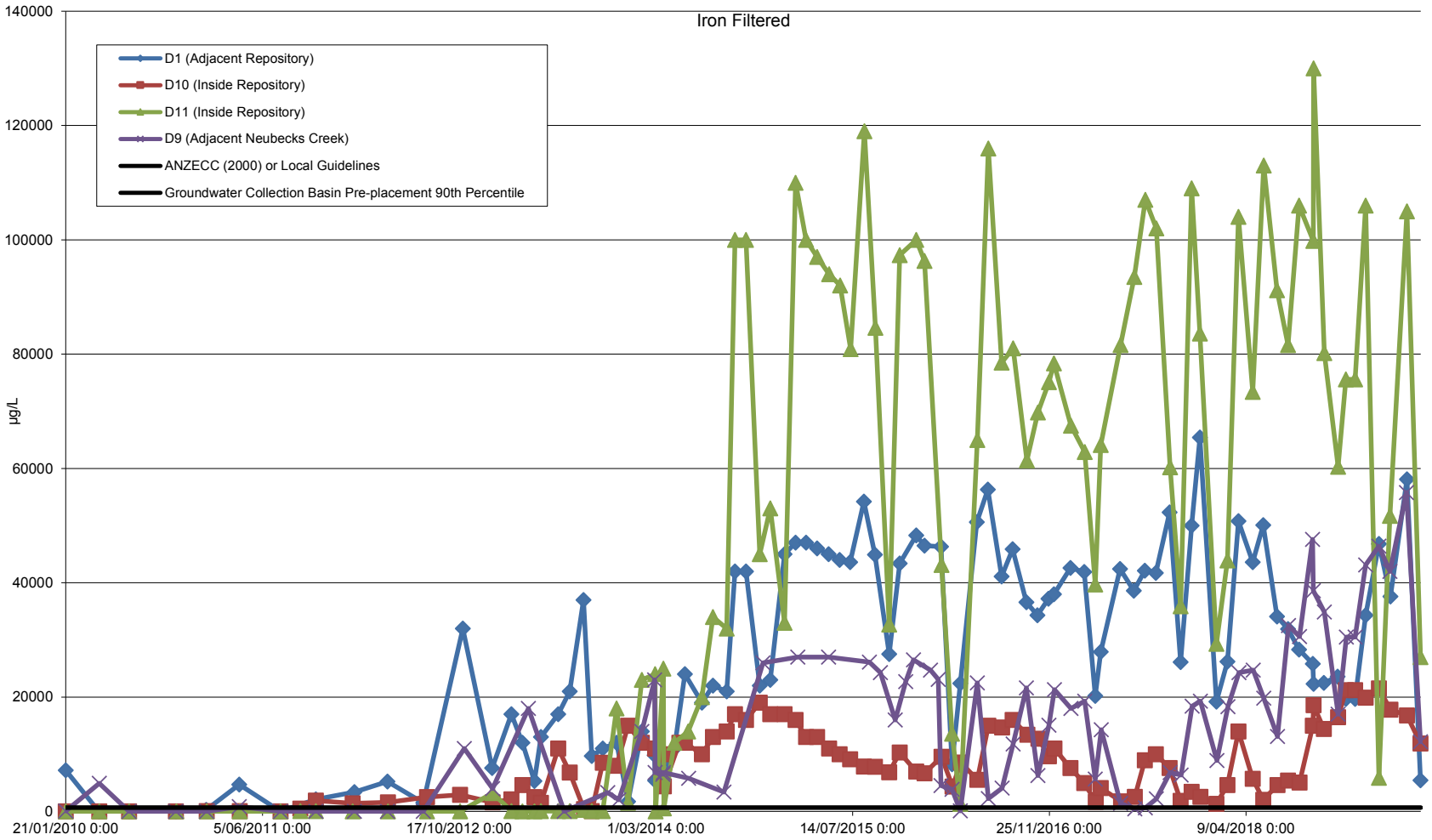


Figure 4b. Iron Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

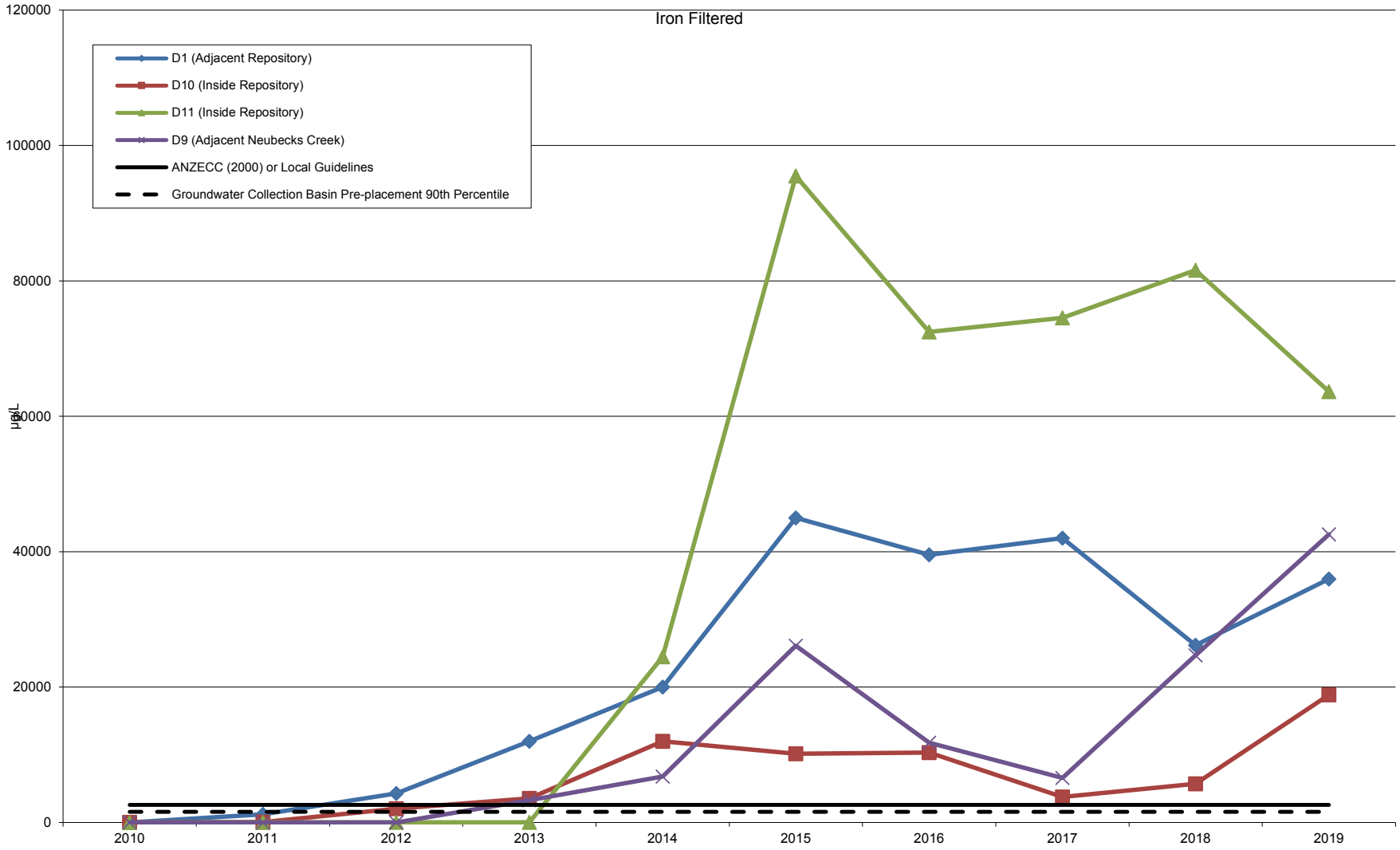


Figure 5a. Manganese Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

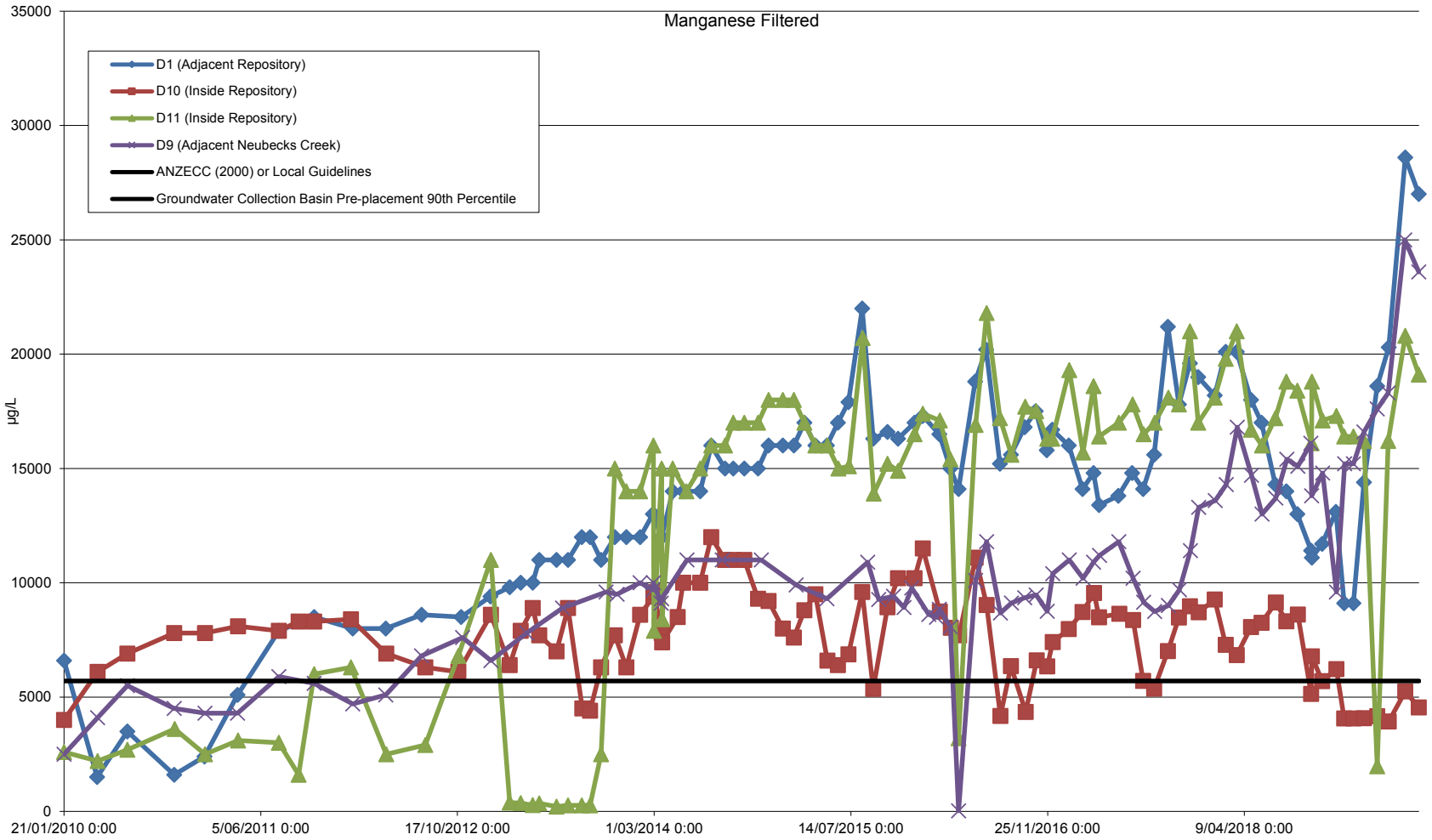


Figure 5b. Manganese Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

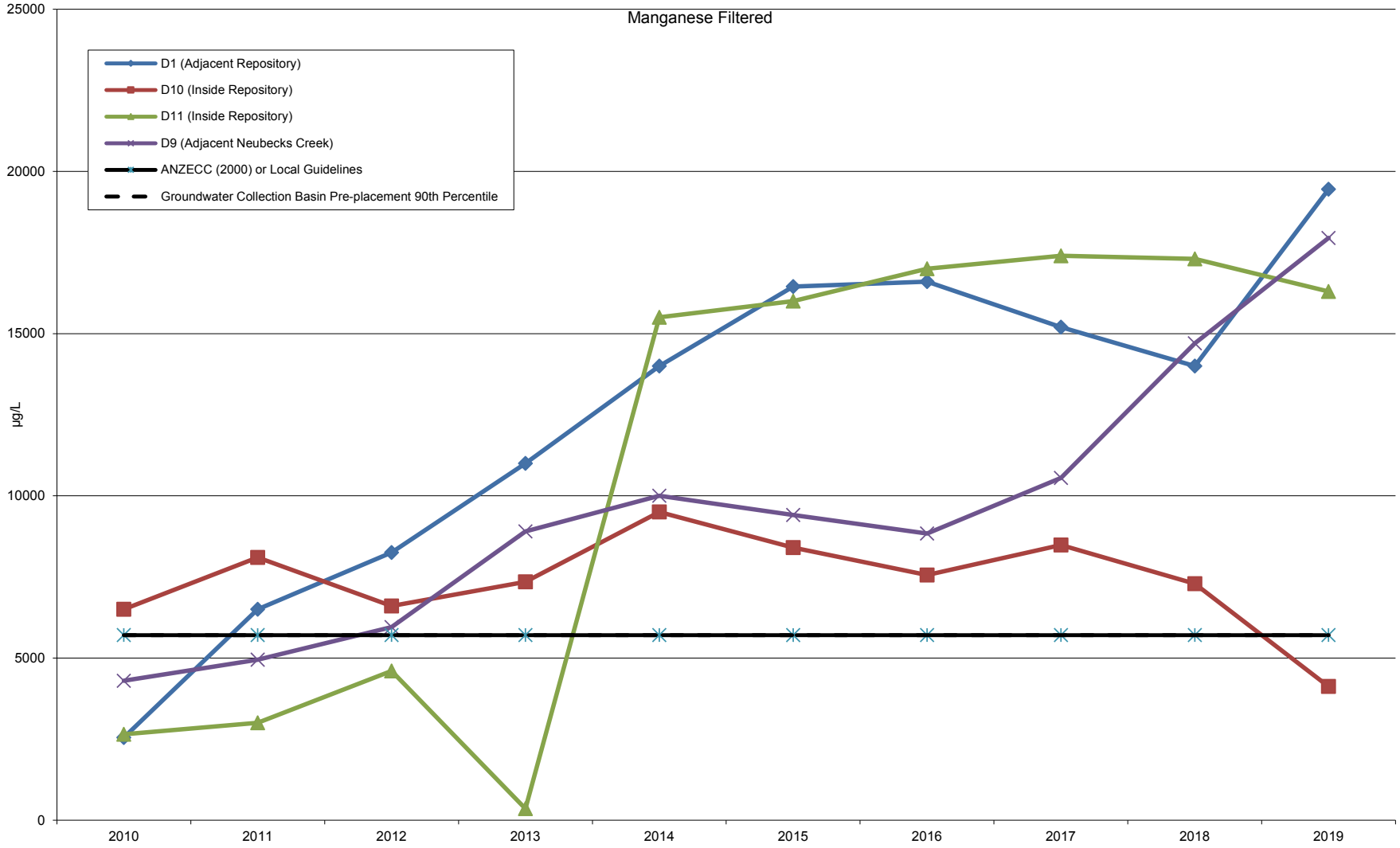


Figure 6a. Sulfate Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

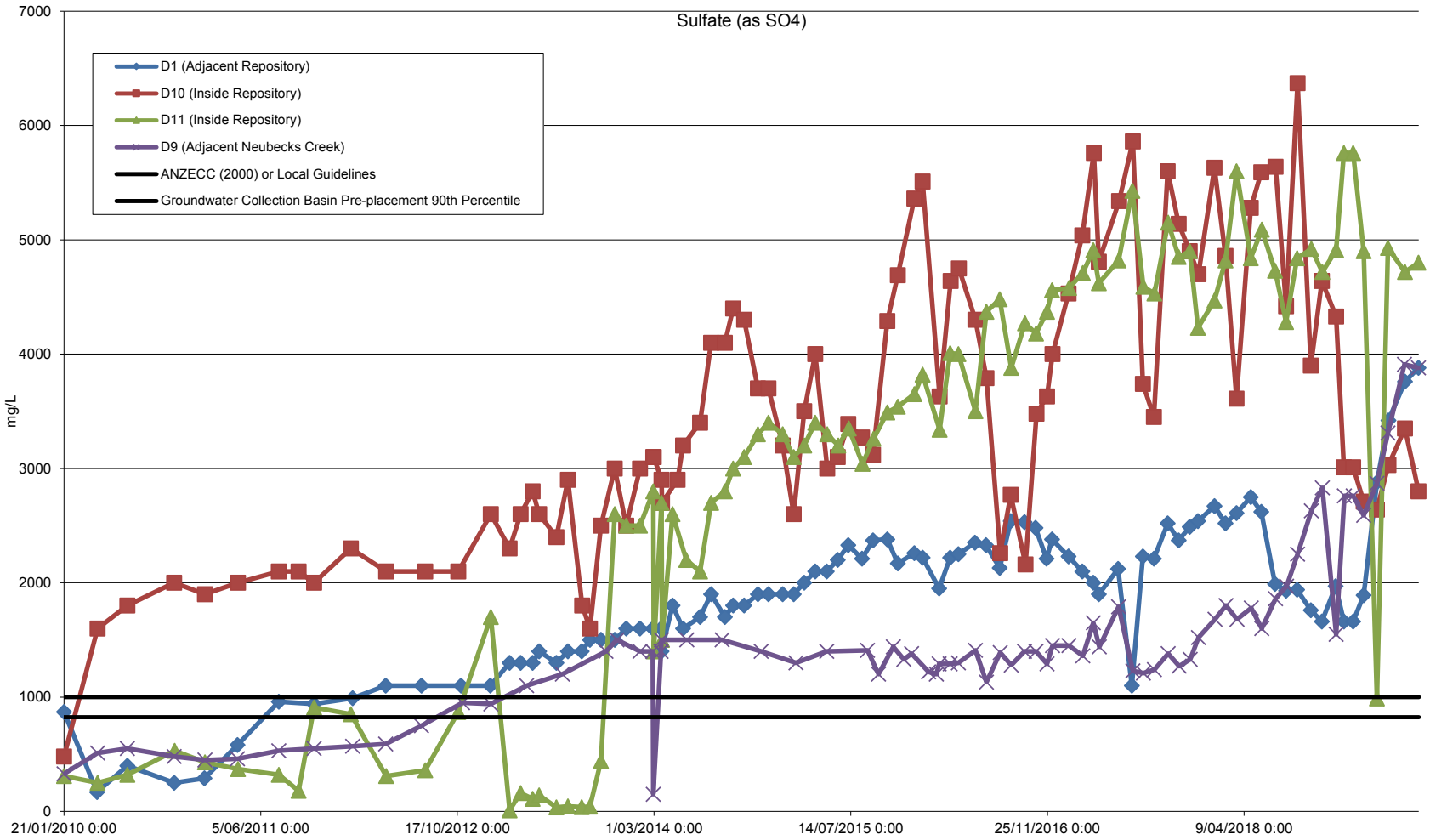


Figure 6b. Sulfate Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260

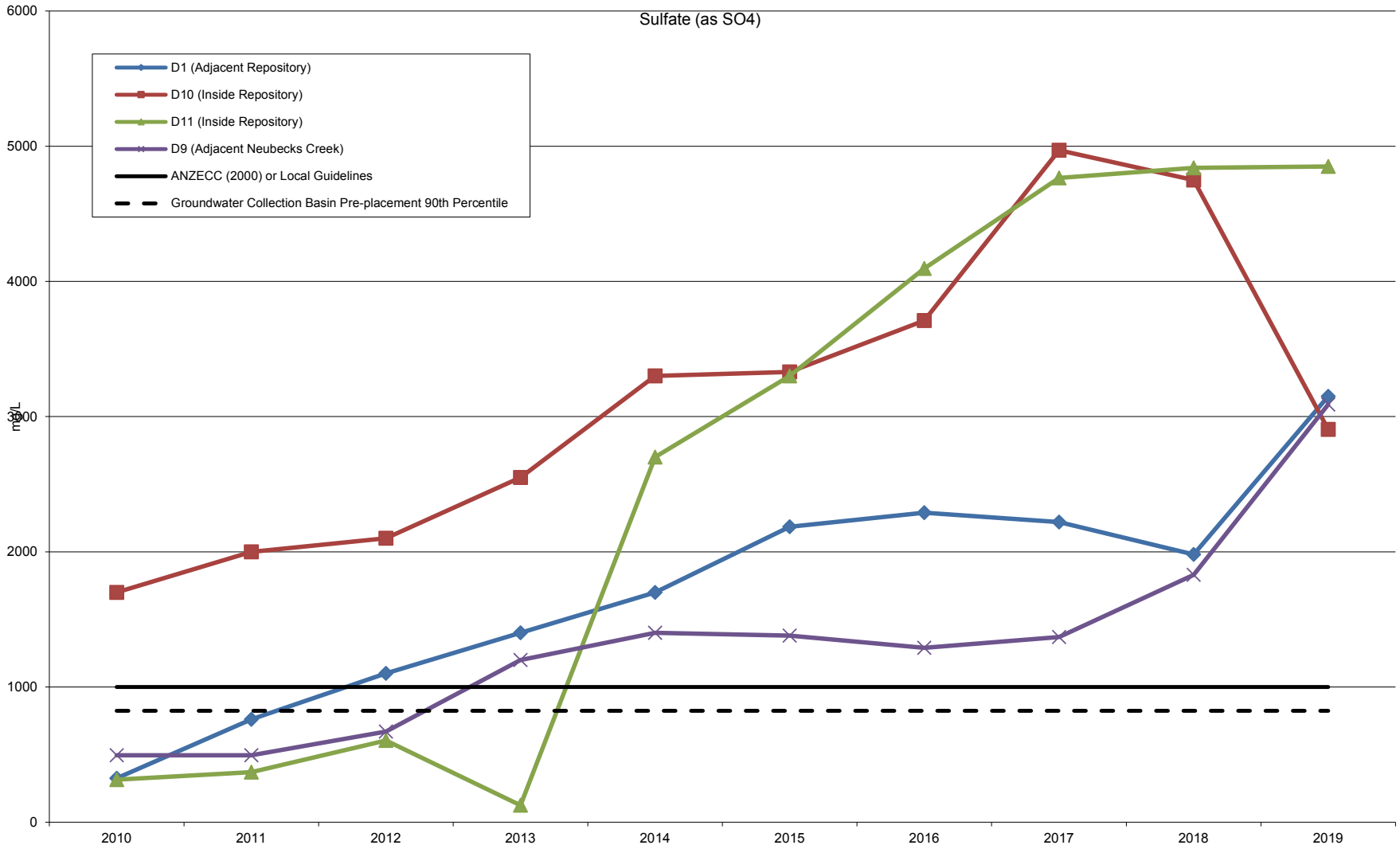


Figure 7a. Total Dissolved Solids (TDS) Concentrations Over Time
Mount Piper
Mount Piper AMER - 0470260

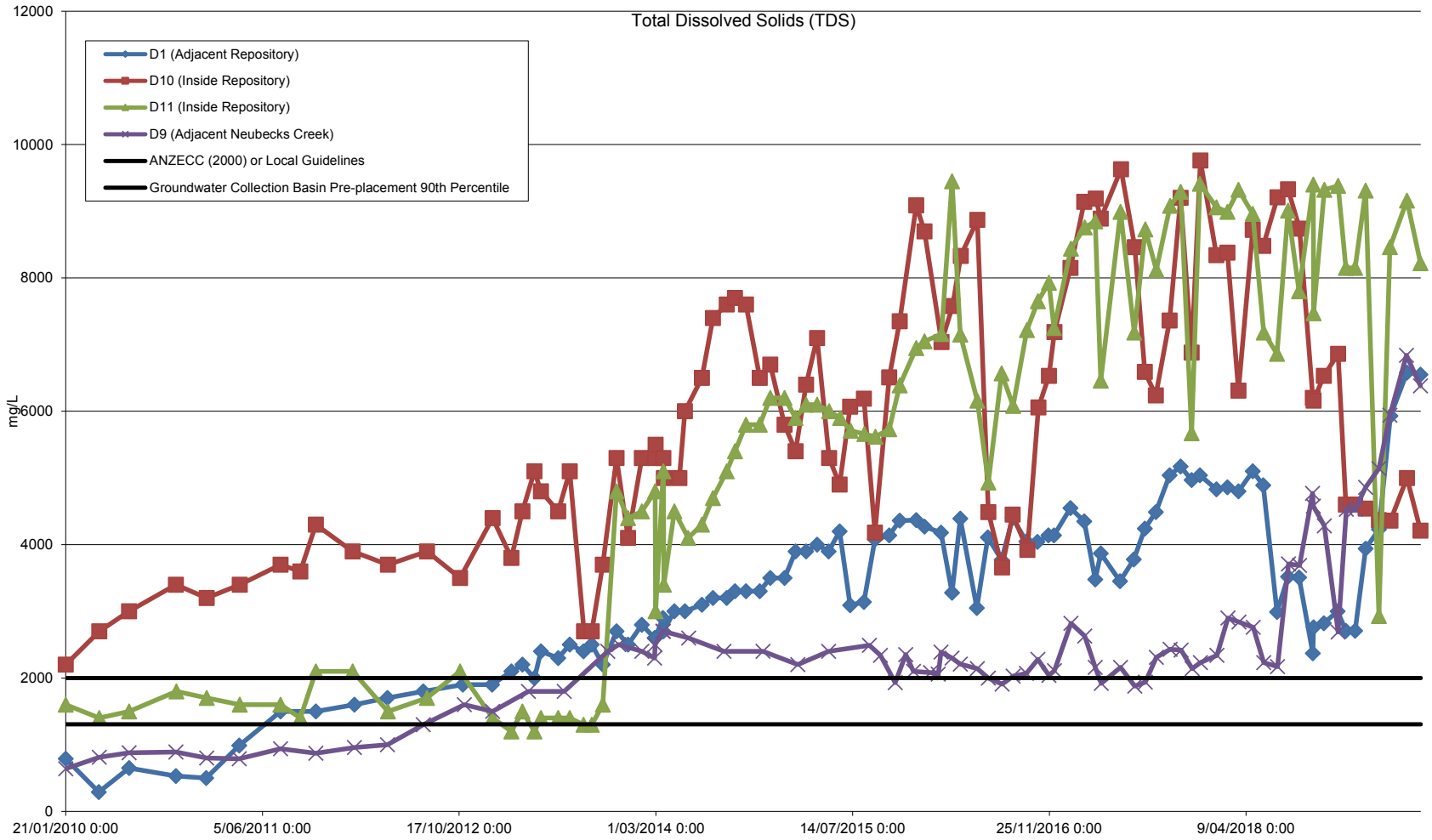
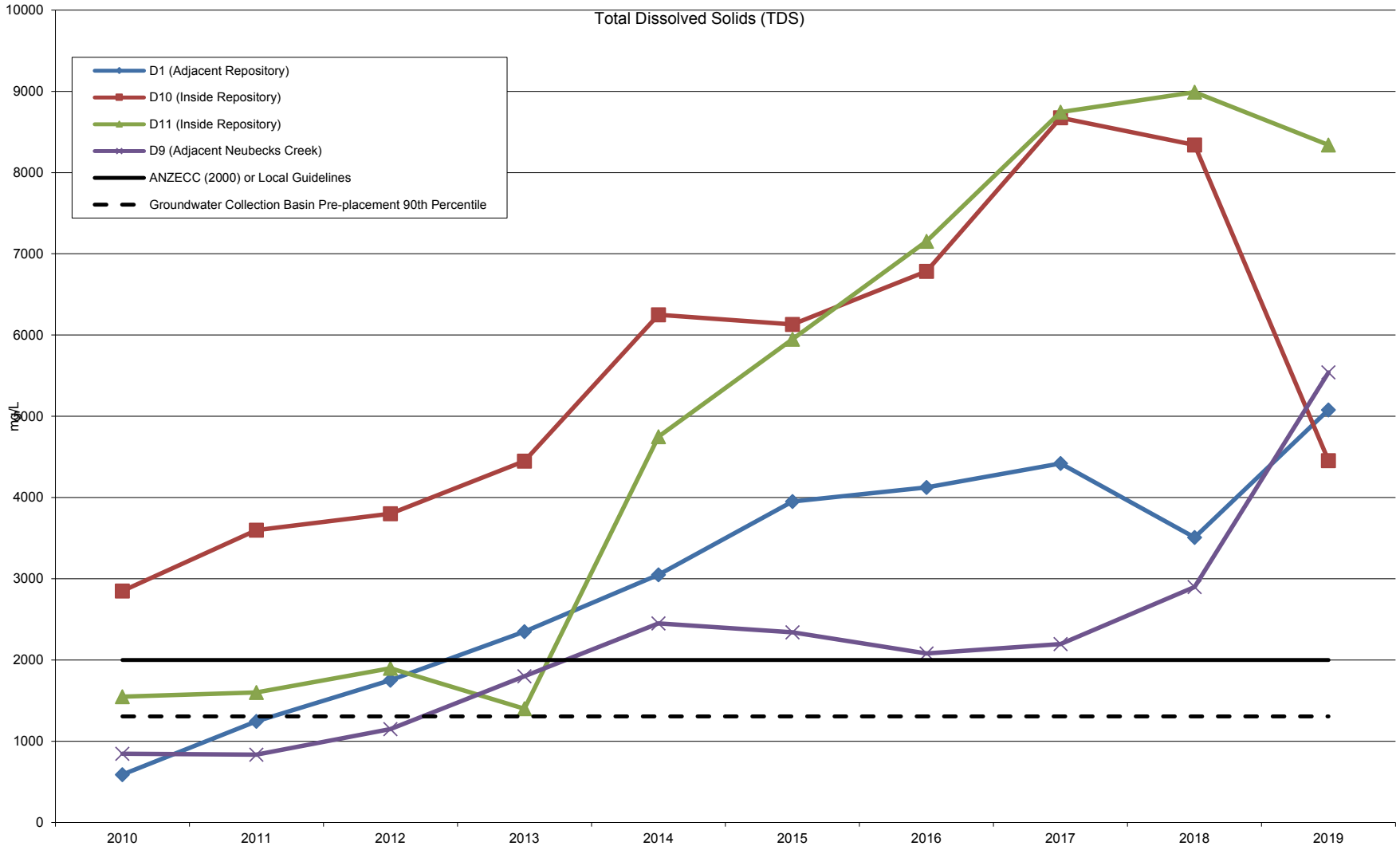


Figure 7b. Total Dissolved Solids (TDS) Concentrations Over Time - Annual 50th Percentile
Mount Piper
Mount Piper AMER - 0470260



Annex J

NALCO QA/QC Procedure

Unit 12, 2 Eden Park Drive
Macquarie Park 2113
Phone: +61 (0) 2 8870 8434

ABN: 41 000 424 788

Ecolab/Nalco Customer Analytical Services Laboratory

Quality assurance/quality control program

The laboratory's Quality assurance/quality control program ensures that sampling activities and analytical data is accurate, reliable and acceptable.

The Quality assurance/quality control program consists of both internal and external measures.

Internal

- Laboratory instrumentation and field equipment are calibrated at the correct intervals, as prescribed in the relevant NATA 'General equipment table'.
- Regular preventative maintenance is carried out on all key laboratory instrumentation and field equipment.
- Trip blanks (where appropriate) are supplied to monitor contamination.
- Certified reference materials are analysed routinely.
- Duplicate analysis is conducted to check precision.
- Spike analysis is conducted to check analyte recovery
- Laboratory blanks are analysed to monitor contamination.
- Quality control checks on media are performed.
- All records and subsequent reports are systematically checked.
- Quality control charts are used to statistically monitor trends in data.
- The laboratory is regularly internally audited.

External

- Ecolab Customer Analytical Services participates in regular chemical and microbiological external proficiency testing programs as well as NATA audits as per their surveillance program.

Sampling and data collection

- All sampling is performed by trained personnel in accordance with procedure A-2.18 and relevant parts of Australian Standard 5667, for which NATA accreditation is held.
- Site measurements (DO, pH, turbidity, temperature and conductivity) and sampling observations (water depth) are recorded and reported in accordance with procedure CA12125.

Sample bottles

- Pre-labeled sample containers are used for routine sampling and testing.
- The sample bottles are prepared so that samples are preserved in accordance with Australian Standard 5667.1:1998 and Standard Methods for the Examination of Water and Wastewater, 22nd Edition (APHA).

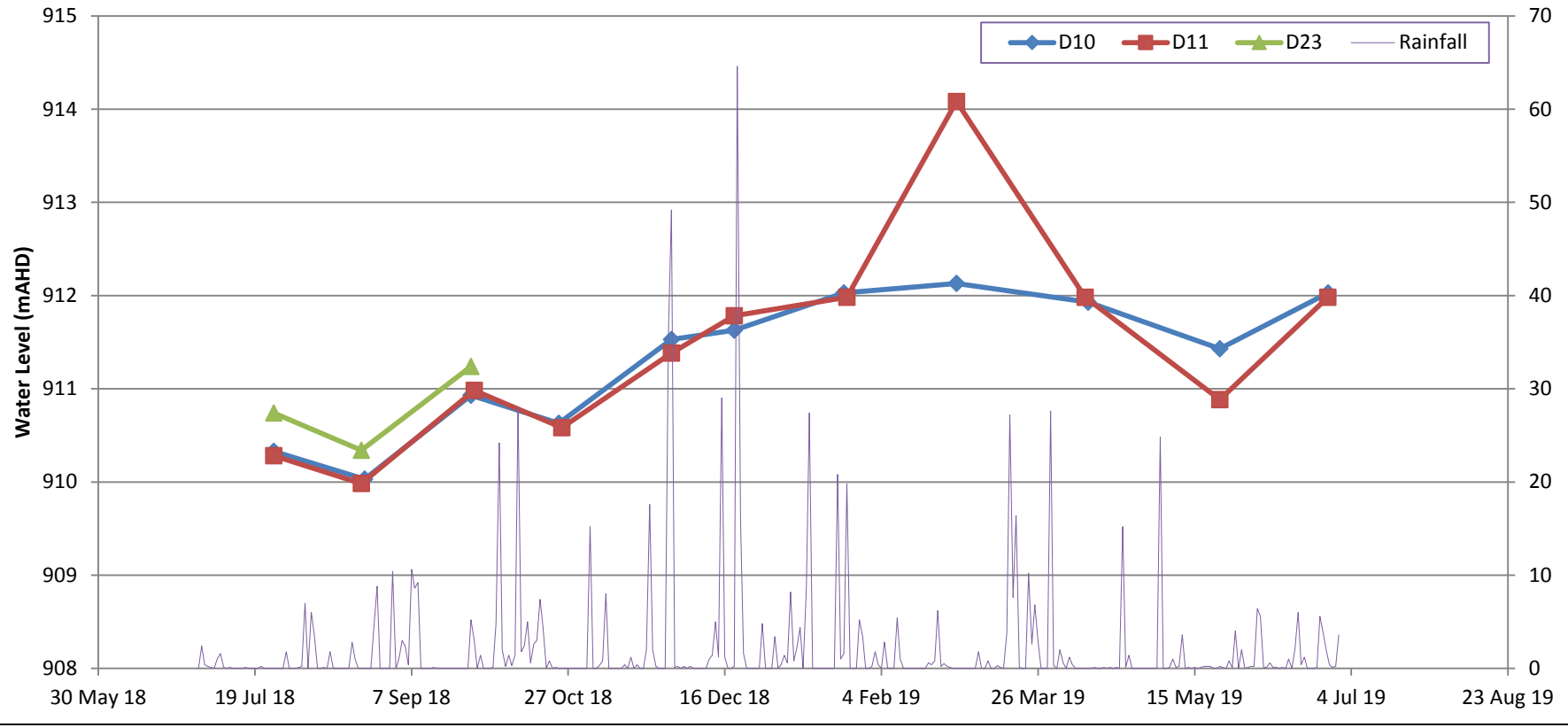
Delivery of samples

- Eskies and freezer packs are used to maintain the integrity of the samples during transport from the sampling sites to our Customer Analytical Services Laboratory.

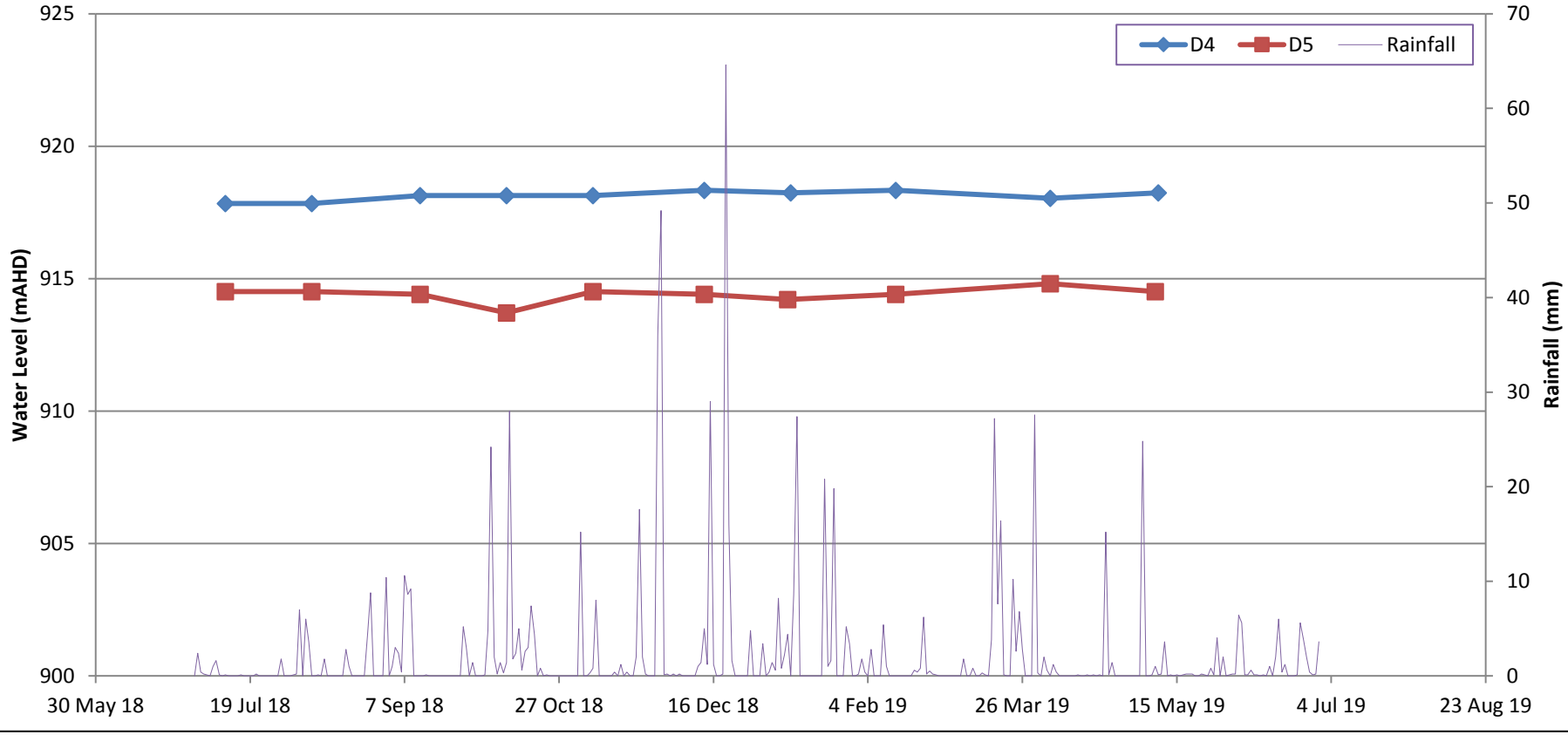
Annex K

Hydrographs

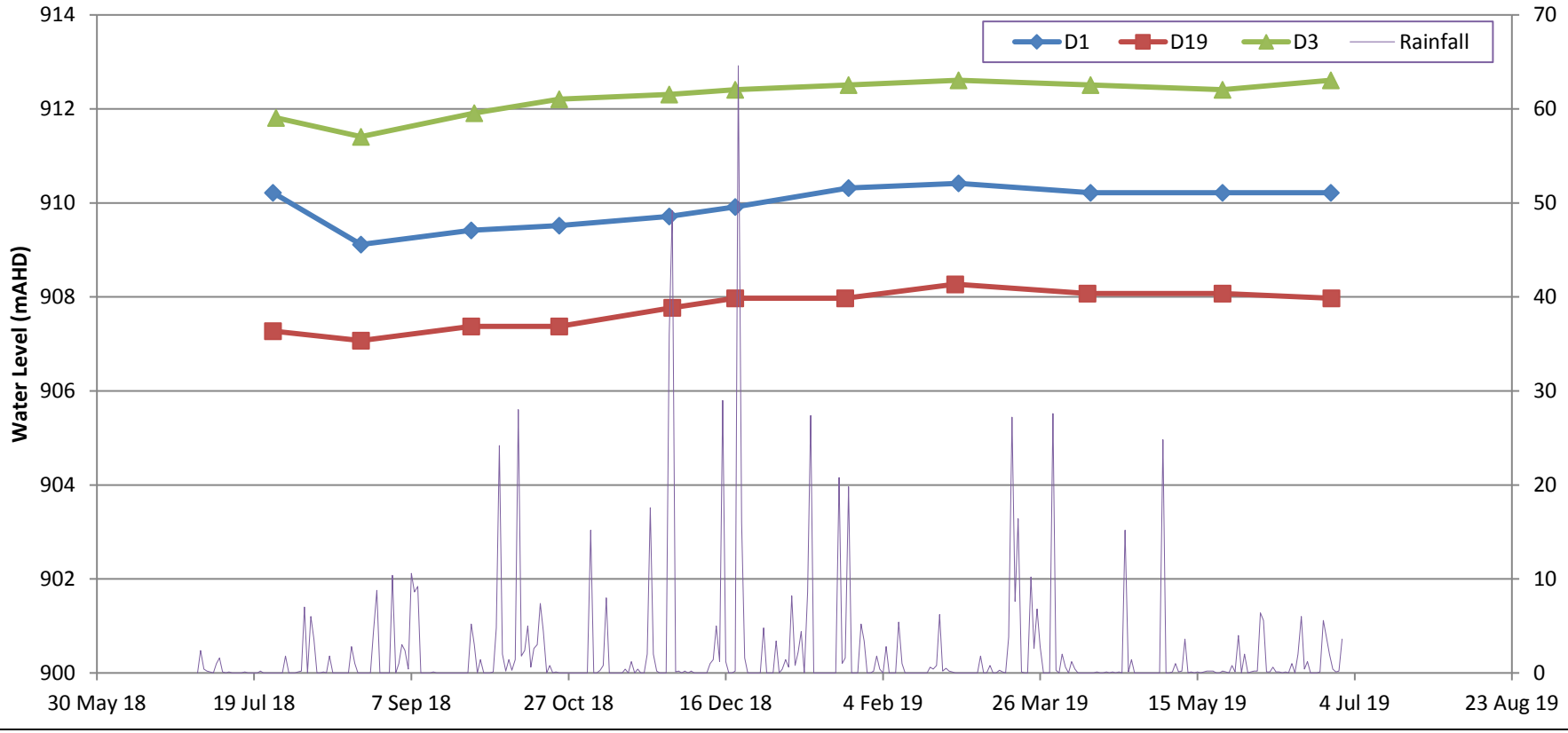
Graph 2. Water Level Over Time - Inside Ash Repository
Mt Piper
Annual Report July 2018 to July 2019- 0470260



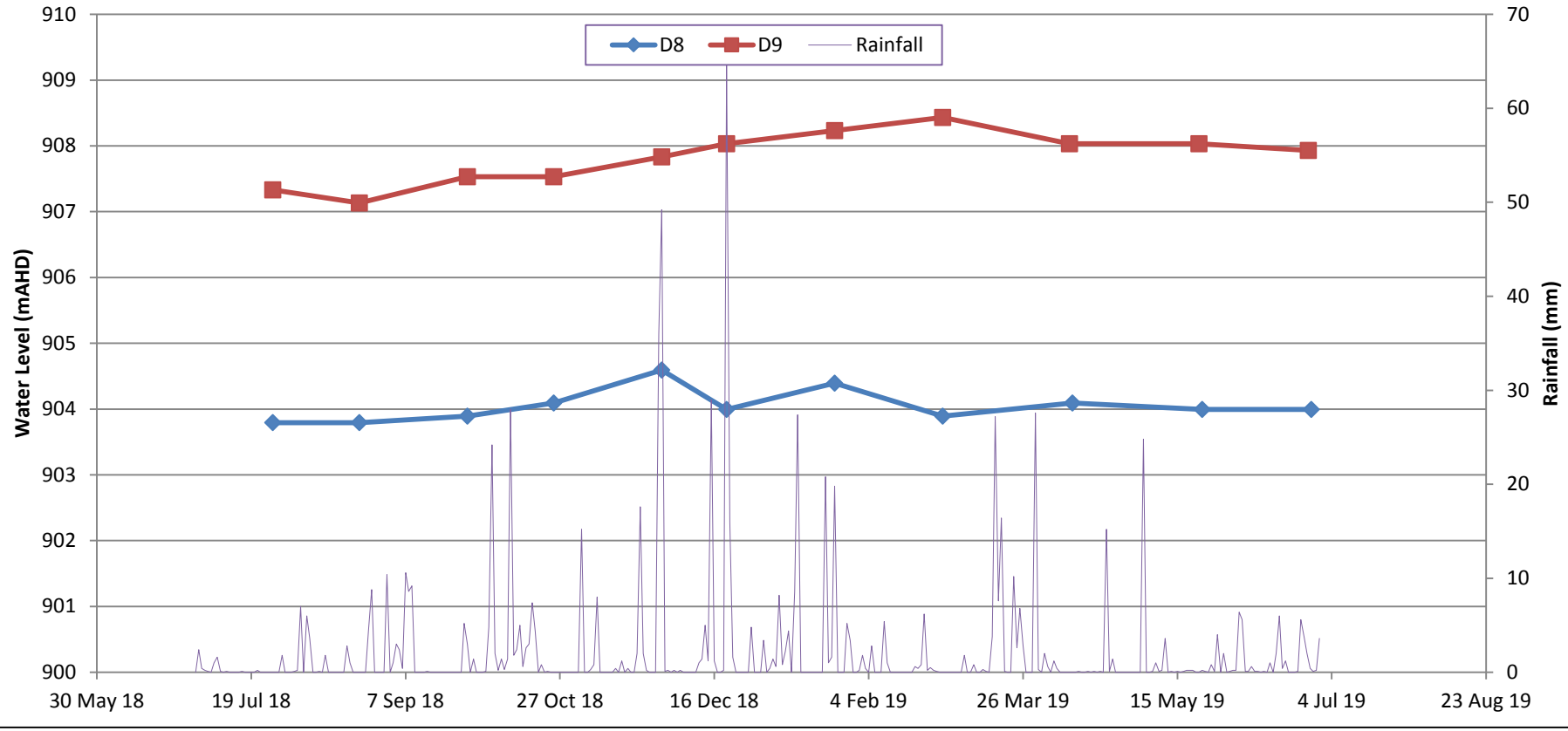
Graph 4. Water Level Over Time - Background and Upgradient
Mt Piper
Annual Report July 2018 to July 2019 - 0470260



Graph 2. Water Level Over Time - Adjacent to Ash Repository
Mt Piper
Annual Report July 2018 to July 2019 - 0470260



Graph 4. Water Level Over Time - Adjacent to Neubeck's Creek
Mt Piper
Annual Report July 2018 to July 2019 - 0470260



Annex L

Discharge Data - Final Holding Pond Weir

ANNEX L DISCHARGE DATA – FINAL HOLDING POND WIER

Table L1 Daily Volumes, Conductivity and pH Data

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
1-Jul-18	2.31E-06	27106.23	7.91
2-Jul-18	8.05E-06	27228.33	7.92
3-Jul-18	8.30E-06	27838.83	7.89
4-Jul-18	8.73E-01	27472.53	7.86
5-Jul-18	6.03E-01	26617.83	7.83
6-Jul-18	7.37E-02	26251.53	7.78
7-Jul-18	4.93E-06	25030.53	7.74
8-Jul-18	8.05E-03	25396.83	7.77
9-Jul-18	4.06E-06	26129.43	7.75
10-Jul-18	5.10E-06	26495.73	7.74
11-Jul-18	6.79E-06	26129.43	7.74
12-Jul-18	9.68E-01	25518.93	7.74
13-Jul-18	3.59E-06	26251.53	7.75
14-Jul-18	2.13E-01	25641.03	7.75
15-Jul-18	1.81E-01	25641.03	7.76
16-Jul-18	5.55E-06	25152.63	7.80
17-Jul-18	1.62E-01	24542.13	7.74
18-Jul-18	1.39E-01	24542.13	7.70
19-Jul-18	6.08E-02	25274.72	7.67
20-Jul-18	1.20E-01	25641.03	7.71
21-Jul-18	1.23E-01	25152.63	7.68

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
22-Jul-18	9.51E-02	26129.43	7.67
23-Jul-18	9.65E-02	26007.33	7.70
24-Jul-18	1.40E-01	26007.33	7.70
25-Jul-18	1.16E-01	26495.73	7.66
26-Jul-18	1.23E-01	26984.13	7.64
27-Jul-18	1.69E-01	26862.03	7.65
28-Jul-18	1.39E-01	26617.83	7.62
29-Jul-18	1.94E-01	26739.93	7.65
30-Jul-18	3.62E-05	24908.43	7.73
31-Jul-18	2.62E-01	24908.43	7.63
1-Aug-18	1.25E-01	25641.03	7.59
2-Aug-18	1.10E-01	26862.03	7.62
3-Aug-18	3.32E-01	27306.36	7.64
4-Aug-18	3.75E-01	30402.93	7.65
5-Aug-18	4.83E-06	28155.19	7.73
6-Aug-18	2.57E-01	28937.73	7.70
7-Aug-18	1.09E-05	28571.43	7.88
8-Aug-18	4.05E-01	30158.73	7.84
9-Aug-18	2.60E-01	30280.83	7.75
10-Aug-18	2.12E-01	30647.13	7.75
11-Aug-18	2.09E-01	30647.13	7.74
12-Aug-18	2.03E-01	31135.53	7.66
13-Aug-18	2.42E-01	31379.73	7.73

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
14-Aug-18	2.18E-01	31868.13	7.71
15-Aug-18	1.86E-01	32722.83	7.67
16-Aug-18	1.99E-01	33333.33	7.64
17-Aug-18	1.60E-01	34065.93	7.63
18-Aug-18	1.92E-01	34554.34	7.70
19-Aug-18	2.43E-01	34920.64	7.78
20-Aug-18	2.18E-01	35409.04	7.76
21-Aug-18	1.97E-01	36230.22	7.75
22-Aug-18	1.96E-01	37118.44	7.74
23-Aug-18	1.70E-01	37606.84	7.73
24-Aug-18	3.10E-01	37560.08	7.73
25-Aug-18	9.89E-01	38075.33	7.84
26-Aug-18	7.71E-01	37891.95	7.74
27-Aug-18	6.47E-06	29781.32	7.96
28-Aug-18	9.65E-07	31521.10	7.84
29-Aug-18	7.07E-01	31426.00	7.78
30-Aug-18	5.76E-01	31762.20	7.78
31-Aug-18	5.10E-01	32398.31	7.76
1-Sep-18	1.65E-04	31249.53	7.88
2-Sep-18	6.52E-06	28704.14	7.85
3-Sep-18	7.88E-01	28545.05	7.76
4-Sep-18	9.91E-01	28165.80	7.70
5-Sep-18	2.00E-06	28378.55	7.66

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
6-Sep-18	6.26E-01	30853.11	7.64
7-Sep-18	8.85E-01	29214.59	7.78
8-Sep-18	8.90E-05	21160.03	7.99
9-Sep-18	2.54E-05	17408.68	8.00
10-Sep-18	2.33E-05	18626.42	7.67
11-Sep-18	8.51E-01	19209.99	7.49
12-Sep-18	6.74E-01	19982.89	7.41
13-Sep-18	5.02E-01	19859.32	7.34
14-Sep-18	4.60E-01	21605.10	7.30
15-Sep-18	3.72E-01	22819.85	7.33
16-Sep-18	4.00E-01	23846.22	7.30
17-Sep-18	3.09E-01	24551.40	7.39
18-Sep-18	3.17E-01	24766.13	7.36
19-Sep-18	3.20E-01	25662.17	7.34
20-Sep-18	2.91E-01	26727.99	7.34
21-Sep-18	2.82E-01	27822.35	7.41
22-Sep-18	2.52E-01	28595.00	7.35
23-Sep-18	2.48E-01	27467.95	7.33
24-Sep-18	2.14E-01	27955.17	7.27
25-Sep-18	2.51E-01	27987.68	7.35
26-Sep-18	1.97E-01	28648.35	7.34
27-Sep-18	1.80E-03	32166.37	7.65
28-Sep-18	1.91E-01	33455.43	7.58

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
29-Sep-18	1.52E-01	33014.73	7.57
30-Sep-18	9.80E-02	34798.54	7.55
1-Oct-18	8.78E-02	35409.04	7.49
2-Oct-18	6.21E-02	36507.94	7.39
3-Oct-18	5.58E-02	36996.34	7.35
4-Oct-18	6.09E-02	38217.34	7.38
5-Oct-18	6.99E-05	31990.23	7.72
6-Oct-18	8.18E-06	28815.63	7.68
7-Oct-18	2.50E-02	30158.73	7.55
8-Oct-18	1.44E-01	30036.63	7.55
9-Oct-18	2.02E-01	30280.83	7.43
10-Oct-18	1.39E-01	30402.93	7.35
11-Oct-18	9.98E+00	18315.02	7.81
12-Oct-18	2.27E+00	20879.12	7.60
13-Oct-18	1.03E+00	20879.12	7.46
14-Oct-18	2.49E-01	21611.72	7.37
15-Oct-18	2.32E-01	22100.12	7.36
16-Oct-18	1.90E-01	23565.32	7.33
17-Oct-18	2.05E-01	24786.32	7.28
18-Oct-18	3.23E+00	21871.30	7.70
19-Oct-18	2.66E+00	23687.42	7.45
20-Oct-18	4.30E-01	25152.63	7.29
21-Oct-18	2.96E-01	25763.13	7.37

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
22-Oct-18	2.14E-01	26862.03	7.30
23-Oct-18	1.76E-01	26984.13	7.25
24-Oct-18	1.16E-01	25763.13	7.27
25-Oct-18	7.15E-02	26617.83	7.29
26-Oct-18	4.66E-02	27228.33	7.04
27-Oct-18	1.08E-01	27594.63	7.30
28-Oct-18	1.95E-01	35286.93	6.97
29-Oct-18	2.94E-01	36874.24	7.00
30-Oct-18	2.88E-01	35164.84	6.91
31-Oct-18	3.15E-01	33577.54	7.03
1-Nov-18	3.65E-01	32967.03	7.03
2-Nov-18	3.43E-01	32600.73	6.99
3-Nov-18	1.11E+00	25518.93	7.33
4-Nov-18	2.53E+00	28449.33	7.27
5-Nov-18	5.45E-01	28205.13	7.06
6-Nov-18	4.02E-01	28693.53	7.02
7-Nov-18	Bad Input	Bad Input	Bad Input
8-Nov-18	2.22E+00	27837.85	7.38
9-Nov-18	1.84E+00	28001.69	7.20
10-Nov-18	4.82E-01	27716.73	7.04
11-Nov-18	3.62E-01	27350.43	6.94
12-Nov-18	3.08E-01	27960.93	6.91
13-Nov-18	2.87E-01	28205.13	6.97

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
14-Nov-18	2.86E-01	28327.23	6.92
15-Nov-18	3.32E-01	28571.43	7.03
16-Nov-18	2.19E-01	29304.03	6.83
17-Nov-18	3.58E-01	30402.93	6.85
18-Nov-18	8.82E-02	29426.13	7.07
19-Nov-18	5.17E-02	29792.43	7.31
20-Nov-18	1.25E-01	33333.33	6.79
21-Nov-18	2.04E-01	34065.93	6.81
22-Nov-18	3.46E-01	33089.13	6.92
23-Nov-18	5.30E-02	33333.33	7.09
24-Nov-18	2.73E-02	31868.13	7.44
25-Nov-18	1.05E-02	34676.43	7.14
26-Nov-18	4.08E-02	30525.03	6.90
27-Nov-18	3.23E-01	29670.33	6.88
28-Nov-18	3.91E-01	29670.33	7.04
29-Nov-18	2.38E+01	8913.31	7.25
30-Nov-18	3.11E+00	10256.41	6.99
1-Dec-18	1.09E+00	14163.61	6.97
2-Dec-18	6.48E-01	16239.32	6.92
3-Dec-18	5.34E-01	17216.12	6.91
4-Dec-18	1.09E+00	20268.62	6.82
5-Dec-18	2.68E+00	19658.12	6.82
6-Dec-18	2.18E+00	24786.32	6.84

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
7-Dec-18	1.25E-01	24175.82	6.80
8-Dec-18	6.59E-02	25030.53	7.00
9-Dec-18	1.95E-01	38217.34	6.75
10-Dec-18	2.22E-01	41880.34	6.83
11-Dec-18	1.33E-01	41758.24	7.09
12-Dec-18	0.00E+00	40537.24	7.16
13-Dec-18	0.00E+00	38949.94	7.23
14-Dec-18	0.00E+00	35531.14	7.15
15-Dec-18	0.00E+00	29304.03	7.07
16-Dec-18	0.00E+00	27228.33	7.16
17-Dec-18	0.00E+00	28083.03	7.09
18-Dec-18	0.00E+00	28327.23	7.05
19-Dec-18	0.00E+00	28449.33	7.06
20-Dec-18	0.00E+00	16483.52	7.70
21-Dec-18	0.00E+00	18192.92	7.58
22-Dec-18	0.00E+00	19291.82	7.19
23-Dec-18	0.00E+00	21367.52	7.13
24-Dec-18	0.00E+00	21524.89	7.12
25-Dec-18	0.00E+00	22100.12	7.08
26-Dec-18	0.00E+00	22588.52	7.05
27-Dec-18	0.00E+00	23199.02	7.10
28-Dec-18	0.00E+00	23199.02	7.08
29-Dec-18	0.00E+00	23931.62	7.28

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
30-Dec-18	0.00E+00	24908.43	6.98
31-Dec-18	0.00E+00	27350.43	7.15
1-Jan-19	0.00E+00	28205.13	7.07
2-Jan-19	0.00E+00	29670.33	6.97
3-Jan-19	1.93E-01	30769.23	7.19
4-Jan-19	9.73E-01	35164.84	7.24
5-Jan-19	5.14E-01	34798.54	7.18
6-Jan-19	1.25E+00	28449.33	7.29
7-Jan-19	1.57E+00	33943.83	7.23
8-Jan-19	1.98E+00	28693.53	7.41
9-Jan-19	3.60E+00	25641.03	7.36
10-Jan-19	2.80E+00	26617.83	7.23
11-Jan-19	1.94E+00	23443.22	7.19
12-Jan-19	5.40E+00	11477.41	7.19
13-Jan-19	5.19E+00	13308.91	6.95
14-Jan-19	1.04E+00	15995.12	6.90
15-Jan-19	7.48E-01	18315.02	6.89
16-Jan-19	9.03E-01	21245.42	6.97
17-Jan-19	5.97E-01	23076.92	6.99
18-Jan-19	5.00E-01	25518.93	6.99
19-Jan-19	4.49E-01	27106.23	7.01
20-Jan-19	4.58E-01	28571.43	7.07
21-Jan-19	9.15E-01	29914.53	7.08

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
22-Jan-19	1.30E+01	16361.42	6.98
23-Jan-19	1.29E+00	18315.02	6.92
24-Jan-19	2.15E+00	20390.72	7.20
25-Jan-19	1.54E+00	22588.52	7.05
26-Jan-19	9.03E-01	23931.62	6.99
27-Jan-19	7.16E-01	26251.53	6.97
28-Jan-19	1.70E+00	23076.92	7.16
29-Jan-19	5.20E+00	20024.42	7.27
30-Jan-19	4.40E+00	21978.02	7.11
31-Jan-19	1.05E+00	23931.62	7.07
1-Feb-19	8.17E-01	25152.63	7.07
2-Feb-19	8.03E-01	25949.66	7.11
3-Feb-19	7.68E-01	26144.49	7.10
4-Feb-19	5.59E-01	27106.23	7.10
5-Feb-19	6.71E+00	22100.12	7.31
6-Feb-19	2.41E+00	22466.42	7.05
7-Feb-19	9.96E-01	23687.42	7.01
8-Feb-19	8.99E-01	24786.32	7.07
9-Feb-19	1.73E+00	25152.63	7.19
10-Feb-19	1.95E+00	27960.93	7.19
11-Feb-19	1.08E+00	28693.53	7.17
12-Feb-19	9.53E-01	29059.83	7.17
13-Feb-19	7.80E-01	30402.93	7.17

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
14-Feb-19	5.53E-01	31135.53	7.21
15-Feb-19	5.42E-01	31746.03	7.22
16-Feb-19	6.24E-01	32844.93	7.25
17-Feb-19	5.11E-01	35042.73	7.25
18-Feb-19	4.87E-01	36141.64	7.26
19-Feb-19	3.49E-01	38217.34	7.28
20-Feb-19	3.49E-01	43589.74	7.32
21-Feb-19	2.49E-01	44566.54	7.32
22-Feb-19	2.12E-01	44444.45	7.36
23-Feb-19	1.87E-01	45054.95	7.40
24-Feb-19	1.01E-01	45543.34	7.41
25-Feb-19	5.90E-02	46398.05	7.43
26-Feb-19	6.04E-01	47252.75	7.40
27-Feb-19	5.75E-01	47619.05	7.39
28-Feb-19	5.65E-01	48229.55	7.41
1-Mar-19	4.82E-01	48229.55	7.38
2-Mar-19	4.59E-01	48595.85	7.42
3-Mar-19	4.17E-01	49005.95	7.42
4-Mar-19	3.36E-01	49938.95	7.40
5-Mar-19	3.17E-01	49668.30	7.42
6-Mar-19	2.90E-01	50305.25	7.41
7-Mar-19	4.42E-01	49694.75	7.46
8-Mar-19	2.44E-01	53601.95	7.36

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
9-Mar-19	8.65E-02	53235.65	6.96
10-Mar-19	5.57E-02	52503.05	6.96
11-Mar-19	1.15E-01	52136.75	7.44
12-Mar-19	1.88E-01	52503.05	7.41
13-Mar-19	1.17E-01	57142.86	7.73
14-Mar-19	5.90E-02	60927.96	7.71
15-Mar-19	5.57E-01	58974.36	7.70
16-Mar-19	6.04E-01	59218.56	7.72
17-Mar-19	1.26E+00	55311.36	7.77
18-Mar-19	2.77E+00	50549.45	7.78
19-Mar-19	1.89E+00	42490.84	7.63
20-Mar-19	1.25E+00	40537.24	7.64
21-Mar-19	8.79E-01	40903.54	7.58
22-Mar-19	7.10E-01	40948.39	7.56
23-Mar-19	1.02E+00	42165.74	7.58
24-Mar-19	2.07E+00	38527.16	7.69
25-Mar-19	1.28E+00	37530.54	7.67
26-Mar-19	3.31E+00	34166.22	7.71
27-Mar-19	1.59E+00	33699.63	7.66
28-Mar-19	9.15E-01	33943.83	7.58
29-Mar-19	6.93E-01	34065.93	7.55
30-Mar-19	7.21E-01	33699.63	7.55
31-Mar-19	1.12E+01	19658.12	7.51

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
1-Apr-19	1.99E+00	20390.72	7.51
2-Apr-19	9.98E-01	20512.82	7.45
3-Apr-19	7.71E-01	20512.82	7.42
4-Apr-19	6.27E-01	21001.22	7.38
5-Apr-19	6.14E-01	21489.62	7.40
6-Apr-19	5.84E-01	22222.22	7.41
7-Apr-19	4.61E-01	23565.32	7.41
8-Apr-19	3.45E-01	24297.92	7.44
9-Apr-19	3.07E-01	25396.83	7.44
10-Apr-19	2.50E-01	25885.23	7.48
11-Apr-19	2.07E-01	26617.83	7.56
12-Apr-19	2.31E-01	27716.73	7.57
13-Apr-19	2.07E-01	28571.43	7.55
14-Apr-19	1.79E-01	29548.23	7.58
15-Apr-19	1.49E-01	30769.23	7.57
16-Apr-19	1.20E-01	31868.13	7.58
17-Apr-19	7.67E-02	32478.63	7.61
18-Apr-19	7.27E-02	33821.73	7.60
19-Apr-19	1.60E-02	35409.04	7.62
20-Apr-19	9.21E-01	36874.24	7.63
21-Apr-19	7.92E-01	38217.34	7.62
22-Apr-19	7.68E-01	38583.64	7.61
23-Apr-19	6.88E-01	38827.84	7.61

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
24-Apr-19	6.25E-01	38949.94	7.64
25-Apr-19	6.11E-01	39438.34	7.66
26-Apr-19	5.32E-01	41269.84	7.63
27-Apr-19	3.53E-01	42002.44	7.66
28-Apr-19	2.62E-01	42124.54	7.70
29-Apr-19	2.54E-01	42612.94	7.74
30-Apr-19	2.43E-01	43711.84	7.73
1-May-19	2.09E-01	44444.45	7.72
2-May-19	1.88E-01	45054.95	7.69
3-May-19	1.52E-01	44932.84	7.68
4-May-19	4.88E-05	39804.64	7.94
5-May-19	1.09E-05	31623.93	7.59
6-May-19	6.78E-06	31257.63	7.51
7-May-19	1.70E-01	31379.73	7.50
8-May-19	1.32E-01	32535.41	7.52
9-May-19	8.91E-02	33577.54	7.55
10-May-19	3.68E-02	34676.43	7.56
11-May-19	6.56E-06	35775.34	7.62
12-May-19	8.94E-01	36752.14	7.61
13-May-19	6.16E-01	37973.14	7.59
14-May-19	5.65E-01	38949.94	7.58
15-May-19	4.60E-01	40659.34	7.60
16-May-19	4.42E-01	43101.34	7.60

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
17-May-19	7.94E-01	44566.54	7.64
18-May-19	7.22E-07	45665.45	7.64
19-May-19	1.84E-05	44566.54	7.62
20-May-19	5.50E-06	43223.44	7.62
21-May-19	1.11E-01	40293.04	7.63
22-May-19	1.03E-05	35775.34	7.60
23-May-19	1.08E-06	32356.53	7.57
24-May-19	1.01E-05	31257.63	7.56
25-May-19	5.45E-02	30036.63	7.58
26-May-19	1.46E-05	29426.13	7.57
27-May-19	5.63E-06	28693.53	7.58
28-May-19	8.78E-06	29548.23	7.61
29-May-19	1.44E-05	29792.43	7.62
30-May-19	2.71E-01	28815.63	7.65
31-May-19	2.71E-02	28937.73	7.68
1-Jun-19	3.35E-06	28571.43	7.67
2-Jun-19	3.22E-06	27716.73	7.67
3-Jun-19	9.54E-06	27716.73	7.64
4-Jun-19	1.03E-05	27350.43	7.64
5-Jun-19	2.10E-05	28327.23	7.63
6-Jun-19	1.73E-05	28449.33	7.60
7-Jun-19	1.62E-01	28327.23	7.59
8-Jun-19	1.43E-01	28693.53	7.57

Date	Daily Flow Volume (ML)	Conductivity (µs/m)	pH
9-Jun-19	5.07E-06	29059.83	7.57
10-Jun-19	9.44E-07	29670.33	7.57
11-Jun-19	2.12E-01	30525.03	7.57
12-Jun-19	1.30E-05	30891.33	7.57
13-Jun-19	4.88E-06	31746.03	7.58
14-Jun-19	1.01E-06	32356.53	7.60
15-Jun-19	3.22E-06	32967.03	7.60
16-Jun-19	8.53E-07	33333.33	7.60
17-Jun-19	6.77E-06	35286.93	7.57
18-Jun-19	9.30E-06	36630.04	7.60
19-Jun-19	2.51E-05	36996.34	7.63
20-Jun-19	1.38E-05	37851.04	7.64
21-Jun-19	9.05E-01	38705.74	7.50
22-Jun-19	2.66E-01	38705.74	7.21
23-Jun-19	2.67E-01	41269.84	7.47
24-Jun-19	5.79E-02	44322.34	7.63
25-Jun-19	3.62E-06	45177.05	7.64
26-Jun-19	2.10E-06	45787.55	7.63
27-Jun-19	1.86E-05	46275.95	7.64
28-Jun-19	2.11E-06	46153.85	7.63
29-Jun-19	8.35E-01	47374.85	7.57
30-Jun-19	2.52E-01	46153.85	7.19
Total flow ML	**244.3728066**		

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