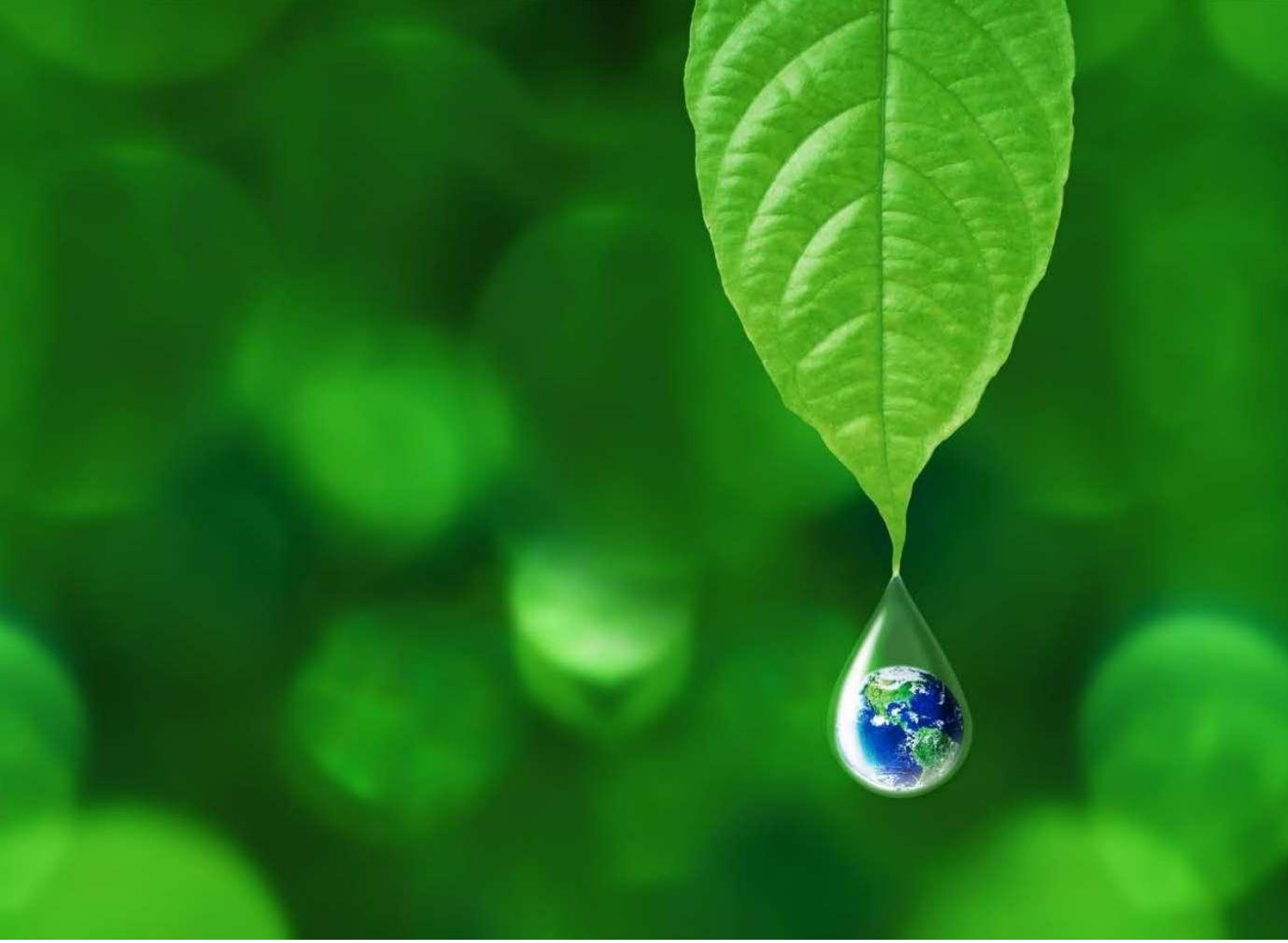
APPENDIX F

Lamberts North Ash Repository Water Quality Report 2018-2019



Lamberts North Ash Placement Water Quality Monitoring

Annual Water Quality Monitoring Report 2018/19

EnergyAustralia NSW Pty Ltd

November 2019

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Lamberts North Ash Placement Water Quality Monitoring

Annual Water Quality Monitoring Report 2018/19

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Position:	*Project Manager*
Signed:	
Date:	*13 November 2019*
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Date:	*13 November 2019*

EnergyAustralia NSW Pty Ltd

November 2019

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CONTENTS

FIGURES

LIST OF ANNEXES

EXECUTIVE SUMMARY

Environmental Resources Management Pty Ltd (ERM) was engaged by EnergyAustralia NSW Pty Limited (EnergyAustralia) to prepare a Water Quality Monitoring Annual Report (WQMAR) for the Lamberts North Ash Repository at the Mount Piper Power Station facility located at 350 Boulder Road, Portland, New South Wales (the Site) over the period of 1 September 2018 to 31 August 2019. Refer to *Figure 1* showing the location of the site.

The Lamberts North Ash Repository is authorised under project approval 09_0186 granted under the Environmental Planning and Assessment Act 1979 (NSW) on 16 February 2012 (Project Approval). The conditions of the Project Approval relevantly operate to require:

- implementation of Lamberts North Ash Placement Project Operation Environmental Management Plan dated May 2013 (OEMP) which includes a Groundwater Management Plan and a Surface Water Management Plan; and
- the carrying out of groundwater and surface water monitoring programs as specified in the OEMP.

Results from the monitoring programs 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 Lamberts North Ash Repository for the 2018/19 reporting period, the following conclusions are made:

- the water quality trigger values set out in the OEMP 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 Environmental Goals were identified at LMP01, NC01 and WX22, however, these exceedances are considered to be predominately unrelated to the Lamberts North Ash Repository;
- groundwater from multiple bores, including bore D9, which is located towards Neubecks Creek, reported elevated concentrations of various constituents that were above the Environmental Goals. Although there is the potential that activities at the Lamberts North Ash Repository may have contributed to these Environmental Goal exceedances in groundwater, these concentrations (particularly chloride) are unlikely to be predominately related to the Lamberts North Ash Repository given that no brine conditioned ash has been placed in the Lamberts North Ash Repository; and
- it is noted that the reported groundwater levels have generally remained below the maximum predicted groundwater level (912.0 mAHD) from CDM Smith (2013) and below the base of the ash placement (917 m AHD) at the Lamberts North Ash Repository.

While the exceedances of the Environmental Goals noted in this report are considered to be predominately unrelated to the Lamberts North Ash Repository, a separate and broader investigation into surface and groundwater impacts associated with the Mt Piper Ash Repository and the Lamberts North Ash repository at Mt Piper Power Station is currently underway. As part of this investigation an updated Conceptual Site Model has been prepared and presented to key stakeholders. Further investigations to address the data gaps identified are being carried out and a Numerical Groundwater Model is being prepared to inform assessment of reasonable and feasible management and mitigation options. Once this investigation is completed, the OEMP, including the Groundwater Management Plan and Surface Water Management Plan, will be updated to reflect the key findings and the further contingency measures proposed.

1. INTRODUCTION

Environmental Resources Management Pty Ltd (ERM) was engaged by EnergyAustralia NSW Pty Limited (EnergyAustralia) to prepare a Water Quality Monitoring Annual Report (WQMAR) for the Lamberts North Ash Repository at the Mount Piper Power Station facility located at 350 Boulder Road, Portland, New South Wales (the Site) over the period of 1 September 2018 to 31 August 2019. Refer to *Figure 1* showing the location of the site.

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

This Lamberts North Ash Repository WQMAR has been prepared in accordance with Conditions E15 and E16 of project approval 09_0186 granted under the Environmental Planning and Assessment Act 1979 (NSW) on 16 February 2012 (Project Approval).

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

1.1 PROJECT BACKGROUND

EnergyAustralia owns and operates the Mt Piper Power Station, including the Lamberts North Ash Repository.

The Lamberts North Ash Repository is located adjacent to and to the east of the Mt Piper Brine in Ash Co-Placement Project Area. The Lamberts North Ash Repository is located approximately 18 kilometres north-west of the City of Lithgow and is situated approximately 900 m to the east of the Mt Piper Power Station. Refer to *Figure 2* for a plan showing the site setting.

In 2010, a Preliminary Environmental Assessment (PEA) was prepared in support of the Concept Application (CA) for the future development of four (4) proposed ash placement sites including Lamberts North, Lamberts South, Neubecks Creek and Ivanhoe No. 4 (SKM, 2009). The Lamberts North and Lamberts South sites were noted as being historical coal workings including both underground and open-cut coal mining, with Centennial Coal undertaking coal mining and washery operations at the Lamberts North site prior to 2012 (CDM Smith, 2012).

To facilitate an increase in the power station's power generation capacity, and therefore an increase in the associated ash generation, development of the new ash placement facilities in Lamberts North was first proposed by Delta Electricity in 2009 to ensure the ongoing operation of the Mt Piper Power Station beyond 2015 (SKM, 2009).

The Lamberts North site is approximately 53 ha and is located adjacent to and to the east of the Mt Piper Ash Repository which includes the placement of brine conditioned fly ash.

The Project Approval granted to Delta Electricity on 16 February 2012 authorised the "construction and operation of new ash placement areas at the Lamberts South and Lamberts North sites to cater for the ash generated from the existing Mt Piper Power Station and the proposed Mt Piper Power Station Extension" subject to conditions.

EnergyAustralia acquired the Piper Power Station in 2013.

Ash emplacement has occurred under the Project Approval at the Lamberts North Ash Repository since 2013 but not yet at the Lamberts South Ash Repository. No brine conditioned ash has been emplaced in the Lamberts North Ash Repository to date.

The conditions of the Project Approval relevantly operate to require:

- implementation of Lamberts North Ash Placement Project Operation Environmental Management Plan dated May 2013 (OEMP; CDM Smith, 2013) which contains detailed environmental management framework, practices and procedures to be adopted as part of operations at the Lamberts North ash repository. This includes a Groundwater Management Plan and a Surface Water Management Plan; and

- the carrying out of groundwater and surface water monitoring programs as specified in the OEMP.

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 our understanding of the project requirements:

- review of monitoring data (dissolved oxygen, turbidity, sulphate, salinity, boron, manganese, iron, chloride, total phosphorus and total nitrogen) at the existing surface water quality monitoring sites (weekly data for 1 site);

- assessment and reporting on the year of monitoring of groundwater quality and depth of the water table at all monitoring sites (undertaken on a monthly frequency for 9 groundwater monitoring sites);

- assessment and reporting on the year of monitoring at the Mt Piper surface water discharge/monitoring point (LMP01 (also referred to as LDP01 and LDP6) and in Neubecks Creek at NC01 and WX22;

- comparison of data with the predictions in the OEMP;

- assessment of trends in groundwater and surface water quality and groundwater levels (comparison between years); and
- preparation of this factual report on results of the surface and groundwater water quality monitoring required under the Lamberts North Project Approval, including
  - interpretations and discussion of results,
  - a list of occasions in the twelve month reporting period when the Environmental Goals have not been achieved, and
  - an update on the contingency measures currently being implemented in accordance with the OEMP.

1.3 DOCUMENTATION REVIEWED

A review of information provided in the reports listed below has been undertaken as part of this Annual Water Quality Monitoring Report and that information has been relied upon:

- Project Approval (*Annex G*);
- Sinclair Knight Merz, September 2009. *Mt Piper Power Station Ash Placement Project, Project Description and Preliminary Environmental Assessment*;
- Sinclair Knight Merz, August 2010, *Mt Piper Power Station Ash Placement Project Environmental Assessment;*
- Sinclair Knight Merz, March 2011, *Mt Piper Power Station Ash Placement Project Submissions Report*;
- CDM Smith, December 2012, *Delta Electricity, Lamberts North Ash Placement Project Plan, Construction Environmental Management Plan (CEMP).*
- CDM Smith, May 2013. *Lamberts North Ash Placement Project Operation Environmental Management Plan*;
- Aurecon, November 2017. *Lamberts North Water Conditioned Fly Ash Placement Water Quality Monitoring, Annual Update Report 2016/17,* Revision 3, 21 November 2017*;*
- ERM, March 2019. *Lamberts North Ash Placement Water Quality Monitoring, Annual Water Quality Monitoring Report 2017/2018*. Final Version 02 15 March 2019;
- Local climate data from Lithgow (Cooerwull) Weather Station No: 063226 obtained from the Bureau of Meteorology (*Annex H*);

- Gauging data, presented as hydrographs, for groundwater bores supplied by EnergyAustralia for the reporting period (*Annex F*); and

- Ecolab/Nalco Quality Assurance/Quality Control Program (*Annex I*).

In addition to the above it is acknowledged that the information presented in this report was prepared with input by EnergyAustralia.

2 LAMBERTS NORTH PROJECT APPROVAL

The operation of the Lamberts North Ash Repository must comply with the statutory requirements outlined in *Table 1* below.

Table 1 Summary of Approvals – Lamberts North Ash Repository

Approval/Lease/Licence	Issue Date	Expiry Date	Details/Comments
Project Approval 09_0186	16 February 2012	-	Granted by the delegate of the Minister for Planning and Infrastructure under, Section 75J of the EP&A Act.

The groundwater and surface water monitoring programs are required under conditions E15 and E16 of the Project Approval. Refer the *Annex G* for a copy of the Project Approval. The OEMP sets out the surface water and groundwater monitoring requirements.

No changes to the Project Approval with respect to the surface water or groundwater monitoring programs were noted during the 2018/19 reporting period.

3 OPERATIONS SUMMARY

All ash placement operations for Mt Piper Power Station, including within the Lamberts North Ash Repository authorised by the Project Approval, are undertaken by a 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 provided for EnergyAustralia in relation to all aspects of ash placement and dust management.

A summary of operations at the Lamberts North Ash Repository area for the 2018/19 reporting period is presented in *Table 2*.

Table 2 Lamberts North Ash Repository – Operations Summary

Activity	Previous Reporting Period 2017/18	This Reporting Period 2018/19
Ash delivered to site (T)	555,354	153,217
Volume of water co-placed (ML)	89.90	Unknown
Total ash footprint (ha)[2]	19.8	19.8
Area of repository capped (ha)	0	0

3.1 ASH PLACEMENT AND GEOMETRY

The Lamberts North Ash Repository is built to the south of an embankment of compacted mine spoil which was constructed in the northern end of Huon Gully to retain ash from Mt Piper Power Station facility. The Lamberts North Ash Repository has approval for the placement of brine-conditioned or water-conditioned fly-ash and furnace bottom ash from Mt Piper Power Station. However, EnergyAustralia have advised that only water-conditioned fly ash and furnace bottom ash has been handled and placed within Lamberts North since operations commenced. EnergyAustralia have also indicated that the water that is used to condition the ash is sourced from the cooling towers at the Mount Piper Power Station. The conditioning of the ash occurs at the Mt Piper Power Station facility, where the water conditioned ash is then transferred via trucks to Lamberts North for disposal (as per CDM Smith, 2013).

The OEMP states that brine conditioned ash is to be placed only above an RL of 946 m AHD, in accordance with the groundwater modelling completed (CDM Smith 2013). However, as noted above, no brine conditioned ash has been emplaced within the Lamberts North Ash Repository to date.

Under the OEMP the ash at Lamberts North is to be placed in 0.5 m to 1 m lifts, in pads with materials that have been moisture-conditioned with water placed into the lower layers to an elevation specified in the approved design drawings. The sequence of ash placement was initially in the most northerly part of the site, continuing towards the eastern and southern parts of Lamberts North.

The ash deposited at Lamberts North is to be treated to achieve an average compaction of 95%, relative to its maximum standard compaction, through the controlled combination of water addition and mechanical compaction with the use of rollers and rubber-tyred vehicles. The ash is to be deposited in layers and stepped to produce an overall batter slope of an approximate measurement of 1(V):4(H), with benches added to every 10 m in change of the height vertically (as per CDM Smith, 2013). Aurecon (2017) noted that once the repository reaches an elevation of 937 m AHD it is to be joined with the adjacent Mt Piper Ash Repository water conditioned ash area to the east. Once the Lamberts North Ash Repository has met its maximum RL of 960 m AHD it is to be capped (CDM Smith 2013).

It is understood that water conditioned ash continued to be deposited across the Lamberts North Ash Repository during the September 2018 to August 2019 reporting period; refer to *Figure 4* for a plan showing the areas where fresh water conditioned ash was placed. Based on information supplied by EnergyAustralia NSW, a total of 153,217 tonnes of ash was placed in the ash repository.

The ash repository elevations were reported to be approximately 940 m AHD by CEH Survey (2018) during the 2017/18 reporting period. The elevation of the top of the ash repository area as at July 2019 was approximately 944 m AHD, refer to *Annex J.* With this increase in elevation, the Lamberts North Ash Repository is now contiguous with the separately approved Mt Piper Ash Repository to the west which receives brine conditioned ash. The plan provided by EnergyAustralia is provided below.

4 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 in *Sections 6* and *7*.

4.1 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 was the closest operational weather station to the site for the 2018/19 reporting period. A summary of the climate data is presented in *Table 3* below and a copy of the data is presented in *Annex H*.

Table 3 Local Climate Data for 2018/19 Reporting Period[1] (BoM 2019)

Month	Rainfall Total (mm)	Min. Temperature (°C)	Max. Temperature (°C)
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
July 2019	18.1	-5.7	16.9
August 2019	27.1	-6.7	19.0
TOTAL/MIN/MAX	788.4	-6.7	36.1

The results show the total rainfall for the reporting period was 788.4 mm. This is higher than the total reported rainfall for the 2017/2018 reporting period of 484.6 mm (ERM, 2019) and is generally 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 65.7 mm/month is higher than the average rainfall of 40.38 mm/month reported in the previous reporting period. The current monthly average of 65.7 mm/month is relatively consistent with the long-term average of 72 mm/month reported by Aurecon (2017).

[1] Reporting period 01 September 2018 to 31 August 2019.

4.2 GEOLOGY

The Lamberts North Ash Repository is adjacent to the Mt Piper Ash Repository and 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.

4.3 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 indicate a component of groundwater flow to the south and south-east from the Lamberts North Ash Repository. Additionally, the groundwater elevation contours indicate a component of groundwater flow to the east and north-east, towards Neubecks Creek. Groundwater elevations in the vicinity of D11 and D10 to the north, west and south-west of the repository respectively in the order of 911 m AHD (with an anomalous reading of 906 m AHD at D10 in August 2019), declining to below 909 m AHD to the south and south-east of the repository (e.g. D19) and to approximately 904 m AHD in the vicinity of Neubecks Creek at D8. The groundwater flow directions have remained relatively consistent throughout the monitoring period based on groundwater contour plans prepared for each season. Groundwater contour plans are presented in *Figures 6a* to *6d*.

Historically groundwater seepage from beneath the Mt Piper Ash Repository would have been collected in the Groundwater Collection Basin located to the east of the Mt Piper Ash Repository (SKM, 2010). In 2012, this basin was filled in with mine workings as part of the construction of the adjacent Lamberts North ash repository. Aurecon (2017) noted that prior to the placement of ash in the Groundwater Collection Basin, the bottom of the basin was covered with mine spoil to a maximum level of RL 917 mAHD (4 m above the maximum estimated groundwater level), with ash placed above this RL.

4.4 HYDROLOGY

The Lamberts North Ash Placement Area is within the Upper Coxs River Catchment. The main drainage in this area is Neubecks Creek which drains from the area west and north of Mt Piper Power Station towards the east and south-east. Mount Piper Power Station and associated ash storage areas are within the catchment of Neubecks and Wangol Creek, tributaries of the Coxs River. Neubecks Creek is located approximately 150 m from the north-eastern edge of the ash storage area. Neubecks Creek joins Wangol Creek (also known as Neubecks Creek in this area) which runs the length of the north-eastern edge of the ash storage area. Wangol Creek joins Coxs River approximately 3.16 km east of the Site.

Coxs River makes up part of the Warragamba water catchment, Sydney's largest of 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 ENVIRONMENTAL GOALS

5.1 SURFACE WATER ENVIRONMENTAL GOALS

In order to assess for potential effects on surface water quality in receiving surface waters adjacent to the Lamberts North Ash Repository, Surface Water Environmental Goals have been set out in the OEMP. The Surface Water Environmental Goals apply to the following surface water monitoring sites: the Final Holding Pond Weir (LMP01); Upstream Neubecks Creek (NC01); and Neubecks Creek (WX22), as shown on *Figure 5*.

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 (eastern 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.

Aurecon (2017) also presented a set of additional baseline values for copper and nickel which were developed based on the dataset from October 2012 to August 2013 at WX22, to capture potential changes which have occurred to the surface water environment since the operation of the Mt Piper Ash Repository, but prior to the commencement of operation of the Lamberts North Ash Repository.

The Surface Water Environmental Goals adopted for this assessment[2] are as per the OEMP and are presented in *Annex B*.

5.2 GROUNDWATER ENVIRONMENTAL GOALS

In order to assess for potential effects on groundwater which may potentially discharge to nearby surface waters adjacent to the ash repository site, Groundwater Environmental Goals have been set out in the OEMP.

The Groundwater Environmental Goals are generally based on the ANZECC water quality guidelines, which are applicable to receiving waters rather than directly to groundwater. The Groundwater Environmental Goals have therefore been applied to the groundwater monitoring sites located cross-gradient/south of the Lamberts North Ash Repository, up-gradient/adjacent the Lamberts North Ash Repository (down-gradient of the Mt Piper Ash Repository), down-gradient/adjacent to the Lamberts North Ash Repository and adjacent to Neubecks Creek with the objective of identifying where impacts above the Groundwater Environmental Goals exist.

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[2] The drinking water guidelines referenced in ANZECC (2000), NHMRC (1996) have since been superseded by the *Australian Drinking Water Guidelines 6, 2011* (revised 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 as part of the update proposed to the OEMP.

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 OEMP.

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 Ash Repository, but prior to the commencement of operation of the Lamberts North Ash Repository.

The Groundwater Environmental Goals adopted for this assessment[3] are presented in *Annex C*.

5.3 *OPERATIONAL ENVIRONMENTAL MONITORING PLAN (OEMP)*

The OEMP outlines the framework to manage environmental aspects associated with the operation of the Lamberts North Ash Repository. With respect to the management of surface water and groundwater at the site, the plan outlines the following sub-plans:

- Section 6.4 (of OEMP): Groundwater Management and Monitoring Plan (GMMP), to address Conditions D3 (b), E15 and E17 of the Project Approval; and

- Section 6.5 (of OEMP): Soil and Surface Water Management Plan to address Conditions D3 (c) and E16 of the Project Approval.

5.4 *GROUNDWATER MODEL PREDICTIONS*

The groundwater modelling prepared by CDM Smith (2012) outlined the following predictions with respect to the groundwater model:

- Ash placement was considered highly unlikely to adversely affect the two aquifers underlying the ash repository, with the project design modified to prevent any groundwater contamination from occurring including provision of a sufficient separation distance between maximum groundwater level and the ash placement (CDM Smith, 2013);

[3] The drinking water guidelines referenced in ANZECC (2000), NHMRC (1996) have since been superseded by the *Australian Drinking Water Guidelines 6, 2011* (revised 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 as part of the update proposed to the OEMP.

- Groundwater modelling demonstrated that the water present in Huon Drain is largely groundwater from the intersection of Huon Void with the water table (CDM Smith, 2013);

- The maximum groundwater level in the southern end of the ash repository was identified as 912.5 m AHD, 2.5 m above the nominal or normal RL 910 m AHD (CDM Smith, 2012);

- The model suggested that groundwater levels across the site were at maximum levels during monitoring due to wet weather patterns. Accordingly the model suggests that groundwater will not rise any further than predicted and will therefore remain at least 4 m below the base of the ash repository under a 1 in 100 year Average Recurrence Interval (ARI) event and steady state normal conditions (CDM Smith, 2012);

- The model indicated that no impact on normal groundwater and surface water quality parameters is expected (CDM Smith, 2012); and

- Preliminary predictions of sulphate and TDS levels indicated that there were also unlikely to be impacts associated with compounds such as boron, manganese, nickel, zinc, molybdenum, copper, arsenic and barium (CDM Smith, 2012).

A separate environmental investigation into the surface and groundwater impacts associated with the ash repositories at Mt Piper Power Station is currently underway. As part of this investigation an updated Conceptual Site Model has been prepared and presented to key stakeholders. Further investigations to address the data gaps identified are being carried out and a Numerical Groundwater Model is being prepared to inform assessment of reasonable and feasible management and mitigation options. Once this investigation is completed, the OEMP, including the Groundwater Management Plan and Surface Water Management Plan, will be updated to reflect the key findings and the further contingency measures proposed.

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 Project Approval on Neubecks Creek and Lamberts Gully 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 is presented in *Table* 4 below and shown on *Figure 5*.

Table 4 Surface Water Monitoring Site Network and Frequency

Site ID	Location Description	Monitoring Frequency
LMP01 (also referred to as LDP01 and LDP6)	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[1,2]
NC01	Located in Neubecks Creek. This monitoring site is located upstream to the Lamberts North Ash Placement Area and to the north of the Mt Piper Ash Repository and is an aquatic life background site.	Weekly[1]/Monthly[2]
WX22	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 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 was 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).

Eskies 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 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 measurement (LMP01 only) and monthly field measurement;
- Electrical Conductivity (EC) - monthly field measurement (WX22, LMP01 and NC01) and weekly lab measurement at LMP01;
- Dissolved Oxygen (DO) - monthly field measurement;
- Total Dissolved Solids (TDS) - monthly laboratory analysis;
- Temperature (°C) - monthly field measurement at WX22 only (and one occasion in September 2018 at NC01);
- Redox – field measurement on one occasion at LMP01 and NC01 in September 2018;
- Total Suspended Solids (TSS) - weekly laboratory analysis (LMP01 only);
- Major anions including chloride, fluoride and alkalinity – monthly laboratory analysis;
- Sulphate (as SO_4) – weekly laboratory analysis (LMP01 only) and monthly laboratory analysis (WX22 and NC01);
- Major cations including calcium, potassium, magnesium, sodium – monthly laboratory analysis;
- Nutrients including nitrate, nitrite and nitrogen (and on occasion ammonia for LDP01) – monthly laboratory analysis; and
- Metals (including Al, Sb, As, Ba, Be, B, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, V 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 all surface water monitoring points (LMP01, NC01 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 I* 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 5* below. Tabulated results along with summary statistics for each monitoring point (minimum, maximum, 50th percentile and 90th percentile) are presented in *Annex B* and shown on *Figure 7a*.

Table 5 Surface Water Monitoring Results – 2018/19

Analyte/Location	Surface Water Concentration Range				
	Neubecks Creek (WX22)	Final Holding Pond Weir (LMP01)	Lamberts North Upstream Background (NC01)	Neubecks Creek at WX22 Pre-placement 90th Percentile[a]	Surface Water Environmental Goal
pH (field)	6.8 – 7.7	6.8 – 7.7	**6.2** – 7.6	6.7-7.8	6.5 – 8.0[k]
pH (laboratory)	NA	6.9 – **8.2**	NA	6.7-7.8	6.5 – 8.0[k]
Conductivity (µS/cm)	272 – 1240	0.1 -980	211 - 607	894	2,200[c]
TDS and Major Ions (mg/L)					
TDS	218 - 805	140 - 554	119 - 369	580	1,500[d]
Sulphate (as SO_4)	37.9 – 429	13 -340	15.3 - 175	332	1,000[e]
Chloride	6.9 – 95.5	4.1 – 40.5	1.88 – 24.1	22	350[f]
Fluoride	<0.1 – 1.1	0.088 – 0.288	0.08 – 0.22	0.338	1.5[g]
Trace Metals (ug/L)					
Arsenic	<1	<1 – 2	<1 - 1	<1	24[b]
Barium	10 - 50	19 - 64	22 - 43	29	700[g]
Beryllium	NA	<1	<1	<1	100[i]
Boron	<50 - 150	60 - 210	<50 - 130	90	370[b]
Cadmium	<0.1	<0.1	<0.1	<1	0.85[h]
Chromium (total)	<1	<1 – **3**	<1	<1	2[h]
Copper	<1 - **4**	3 - **33**	<1 - **5**	<1	3.5[h] / 5[m]
Iron (filtered)[l]	75 – 216	31 - 220	110 - **484**	281	300[f]
Iron	105 - **986**	251 - **1300**	**490 - 1480**	281	300[f]
Mercury	<0.04	<0.04 - **<0.1**	<0.04 – **<0.1**	-	0.06[b]
Manganese (filtered)[l]	73 - 1440	8 - 561	103 - 598	720	1,900[b]
Molybdenum	<1 - 1	1 – 5	<1 - 2	<1	10[i]
Nickel	9 - **46**	3 - 13	2 - 10	5	17[b] / 15[m]
Lead	<1	<1 - 2	<1	<1	5[b]
Selenium	<0.2	0.2 – 0.6	<0.2 – **<10**	<1	5[b]
Silver	<1	<1	<1	-	0.05[b]
Zinc	<5 -13	11 - 63	<5 - 34	116	116[j]

Notes:
NA Not Available
All metals concentrations presented are from unfiltered samples, as per the OEMP
Shaded cell indicates value is equal to or exceeds the adopted criterion (Environmental Goal)
Bold indicates result is 1 - <10 times the adopted criterion
Bold and italicised indicates result is >10 times the adopted criterion
[a] Values adopted from OEMP
[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 µS/cm
[d] 1,500 mg/L based on a conversion factor of 0.68 and an EC of 2200 µS/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 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
[l] Concentrations of iron and manganese are filtered
[m] Lamberts North pre-placement 90th percentile baseline data from October 2012 to August, 2013 and Neubecks Creek at WX22 as presented in Aurecon (2017).

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 LDP01 and 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. The Final Holding Pond Weir is a pollution control structure which is generally open at all times to allow for natural flow to Neubecks Creek. However, EnergyAustralia does have the ability to shut the structure to stop flows if required. This monitoring location is located upstream of the Lamberts North Ash Repository (and upstream of the Mt Piper Ash Repository) and is not considered to be impacted by the ash repositories.

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 6.8 to 7.7 standard pH units, with laboratory measured values reported between 6.9 and 8.2 standard pH units. The higher values were 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 0.1 µS/cm (which is likely to be an erroneous reading/recording) and 980 µS/cm and were generally consistent with laboratory determined values ranging between 170 µS/cm and 670 µS/cm. The reported EC values were generally consistent[4] with Total Dissolved Solids (TDS) concentrations (measured monthly), which ranged from 140 mg/L to 554 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 12.6 mg/L and were generally lower between November 2018 and March 2019. There are no Surface Water Environmental Goals for DO;
- Total suspended solids (TSS) were measured weekly and were generally variable with higher concentrations noted in January and February 2019. TSS ranged from 2 mg/L to 200 mg/L. There are no Surface Water Environmental Goals for TSS; and

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

- Turbidity generally ranged from 7.8 to 100 NTU. There are no Surface Water Environmental Goals for turbidity.

Major and Minor Ions

Major and minor ion concentrations in surface water from LMP01 were below the relevant Surface Water Environmental Goals.

Metals

Throughout the reporting period, various metals were identified at concentrations above the Surface Water Environmental Goals (the ANZECC (2000) or local guideline concentration) in surface water samples from 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 33 µg/L, consistently exceeding the pre-placement level of 1 µg/L during the reporting period, with a peak concentration of 33 µg/L noted in July 2019. Copper concentrations did not exceed the Surface Water Environmental Goal of 3.5 µg/L during November 2018, March 2019 and April 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. Available unfiltered iron results from every month between September 2018 and November 2018 and February 2019 and September 2019 exceeded the Surface Water Environmental Goal;

- Mercury concentrations were consistently below the lab limits of reporting; however, the higher limit of reporting (<0.1 µg/L) exceeded the Surface Water Environmental Goal of 0.06 µg/L in September 2018.

- 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, strontium and vanadium 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.

Results for surface water samples from LMP01 were below the adopted Surface Water Environmental Goals, with the exception of copper (up to 33 µg/L), chromium (single event reported at 3 µg/L), unfiltered iron (up to 1,300 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 Up-Stream – Neubecks Creek

The surface water field and analytical results obtained from sample point NC01 located in Neubecks Creek, for the 2018/19 reporting period are discussed below and presented in *Annex B*. This monitoring location is located up-stream of the Lamberts North Ash Repository.

Field Parameters

Field parameters in surface water monitored at NC01 are summarised below:

- pH (field) ranged from 6.2 to 7.6, with only one pH reading, in September 2018, occurring outside the environmental goal range of 6.5 – 7.6;
- Field electrical conductivity (EC) values ranged between 211 µS/cm to 607 µS/cm and were generally consistent with laboratory determined TDS values ranging between 119 mg/L and 369 mg/L. EC and TDS were all below the Surface Water Environmental Goals of 2,200 µS/cm and 1,500 mg/L, respectively.
- DO (field) ranged from 4.1 mg/L to 11.8 mg/L throughout the monitoring period. No Surface Water Environmental Goals apply to DO; and
- Turbidity ranged from 6.4 NTU to 24.4 NTU across the monitoring period and was generally variable. No Surface Water Environmental Goals apply to turbidity.

Major and Minor Ions

Major and minor ion concentrations in surface water from NC01 were below the relevant Surface Water Environmental Goals.

Metals

Throughout the monitoring period elevated concentrations of various metals were identified at concentrations above Surface Water Environmental Goals (the ANZECC (2000) or local guideline concentrations). A summary of the results reported above the Surface Water Environmental Goals during 2018/19 reporting period is presented below:

- Copper concentrations ranged between <1 µg/L and 5 µg/L, with only the one sample from July 2019 exceeding the Surface Water Environmental Goal of 3.5 µg/L;

- Concentrations of iron (filtered) ranged between 116 µg/L and 484 µg/L, with results from September, November and December 2018 and April, May and July 2019 exceeding the Surface Water Environmental Goal of 300 µg/L. Available unfiltered iron results from every month between September 2018 and August 2019 exceeded the Surface Water Environmental Goal.

- Silver concentrations were reported below the limit of report (of <1 µg/L) for the entire reporting period, noting that the limit of reporting exceeds the Surface Water Environmental Goal of 0.05 µg/L. No pre-placement data is available for silver.

Concentrations of aluminium, phosphorus, vanadium and strontium were tested for. Of these, aluminium, phosphorus and strontium were measured at concentrations above the limits of reporting in the surface water samples collected from the NC01; however, no Surface Water Environmental Goals apply to these parameters for comparison.

6.5.3 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 B*. This monitoring location is located down-stream of the Mt Piper and the Lamberts North Ash Repositories.

Field Parameters

Field parameters monitored at WX22 are summarised below:

- pH (field) ranged from 6.8 to 7.7 standard pH units, 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 1240 µS/cm and were generally consistent with laboratory determined TDS values ranging between 218 mg/L and 805 mg/L[5]. 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 14.8 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.

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

Major and Minor Ions

Major and minor ion concentrations in surface water from WX22 were below the relevant Surface Water Environmental Goals.

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 local guideline concentration). A summary of the results reported above the Surface Water Environmental Goals during the 2018/19 reporting period is presented below:

- 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. Available unfiltered iron results from September 2018 to April 2019 exceeded the Surface Water Environmental Goal;
- Nickel concentrations ranged from 9 µg/L to 46 µg/L, with the highest concentration reported in August 2019. Exceedances of the Surface Water Environmental Goal of 17 µg/L, were also reported in September 2018, March 2019, April 2019 and July 2019; and
- Silver concentrations were all reported below the laboratory limit of reporting of <1 µg/L, noting that the limit of reporting exceeds the Surface Water Environmental Goal of 0.05 µg/L. No pre-placement data is 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 46 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 surface water quality in the area, based on the background surface water results from LMP01 and NC01. The elevated concentrations of manganese are also in part considered to be associated with background conditions, with concentrations above the limits of reporting identified at LMP01, NC01 and WX22.

Higher concentrations of calcium, magnesium and bicarbonate were reported in the same samples as increased concentrations of barium, boron, manganese and nickel during March, April, July and August 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. It is noted that concentrations of calcium, magnesium and bicarbonate exist at the upstream sampling location at similar concentrations to the downstream sampling location, therefore, these results are not considered to be associated with the Lamberts North Repository.

6.6.1 *Early Warning 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), NC01 (upstream) and WX22 (downstream) is presented in *Table 6* below and shown on *Figure 7b*. A requirement of the OEMP, this assessment serves to provide an early indication of changes in surface water quality as part of contingency planning.

Table 6 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	NC01	LMP01	
pH	7.3	7.1	7.3	6.7-7.8
Conductivity (µS/cm)	549	312	390	894
TDS (mg/L)	341	182	246	580
Sulphate (as SO_4) (mg/L)	124	40.1	66.5	332
Chloride (mg/L)	**31.8**	8.29	8.9	22
Fluoride (mg/L)	0.14	0.18	0.15	0.338
Arsenic (µg/L)	<1	**1**	**2**	<1
Barium (µg/L)	19	28	**30**	29
Beryllium (µg/L)	NA	<1	<1	<1
Boron (µg/L)	**90**	80	**115**	90
Cadmium (µg/L)	<0.1	<0.1	<0.1	<1
Chromium (total) (µg/L)	<1	<1	**1**	<1
Copper (µg/L)	**2**	**2**	**8**	<1
Iron (µg/L)[b]	**481**	**969**	**506**	281
Iron (µg/L)[c]	118	269	92	281
Mercury (µg/L)	<0.04	<0.04	<0.04	-
Manganese (µg/L) [b]	311	341	130	720
Manganese (µg/L) [c]	238	223	60	720
Molybdenum (µg/L)	**1**	**1**	**2**	<1
Nickel (µg/L)	**16**	3	**5**	5
Lead (µg/L)	<1	<1	**2**	<1
Silver (µg/L)	<1	<1	<1	-
Selenium (µg/L)	<0.2	0.2	0.4	<1
Zinc (µg/L)	10	7.5	28	116

Notes

[a] Neubecks Creek at WX22 Pre-placement 90th Percentile values for analytes (OEMP)

[b] Unfiltered concentration value used for iron and manganese.

Analyte/Location	Surface Water Concentrations (50% percentile)			Neubecks Creek at WX22 Pre-placement 90th Percentile [a]
	WX22	NC01	LMP01	

[c] Filtered concentration value used for iron and manganese.

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

Bold and italicised indicates result is >10 times the adopted criterion

The 50th percentile concentrations (for the 2018/19 period) for arsenic, barium boron, chromium, copper, iron (unfiltered), molybdenum, nickel and lead at up-stream monitoring location LMP01 were at or above the 90th percentile pre-placement levels. At up-stream monitoring location NC01 the 50th percentile concentrations for arsenic, copper, iron (unfiltered), and molybdenum were reported at or above the 90th percentile levels. Down-stream of the ash repository at WX22, the 50th percentile concentrations for chloride, boron, copper, iron (unfiltered), molybdenum and nickel were identified above the 90th percentile pre-placement levels.

The elevated concentrations (50th percentile for the 2018/19 period) of boron, copper, iron 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, as noted in *Section 6.6*.

Concentrations of nickel were found to be higher in downstream site WX22 (16 µg/L) relative to the up-stream locations LMP01 (5 µg/L) and NC01 (3 µg/L).

Chloride concentrations (50th percentile) were almost four times higher in down-stream monitoring location WX22 compared to the background chloride 50th percentile results at LMP01 and NC01. However, these concentrations are unlikely to be related to the Lamberts North Ash Repository given that no brine conditioned ash has been emplaced in the Lamberts North Ash Repository.

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" but is considered unrelated to the Lamberts North Ash Repository.As outlined above, a separate and broader investigation into surface and groundwater impacts associated with the Mt Piper Ash Repository and the Lamberts North Ash Repository at Mt Piper Power Station is currently underway. As part of this investigation an updated Conceptual Site Model has been prepared and presented to key stakeholders. Further investigations to address the data gaps identified are being carried out and a Numerical Groundwater Model is being prepared to inform assessment of reasonable and feasible management and mitigation options. Once this investigation is completed, the OEMP, including the Water Management and Monitoring Plan, will be updated to reflect the key findings and the further contingency measures proposed.

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 down-stream of the ash repository and/or previous trend analysis presented in previous reports. Graphs generated and reviewed as part of the trend analysis are presented in *Annex D*.

Chloride

Chloride concentrations were consistently below the Surface Water Environmental Goal of 350 mg/L throughout the monitoring period 2010-2019. Chloride concentrations in some samples at WX22 during the 2018/19 monitoring period appear to be generally comparable with previous years with the last couple of sampling events in the period showing an upward trend. Spikes in concentrations have been recorded at WX22 in February 2018 (164 mg/L) and February 2014 (130 mg/L). Chloride concentrations at LMP01 have remained relatively stable and low since 2010. At location NC01, chloride concentrations have followed a similar low and stable reading as at location LMP01.

TDS

TDS contents in surface water at LMP01 and NC01 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 correlate with the maximum chloride concentrations.

Sulphate

Sulphate concentrations at LMP01 and NC01 have remained relatively stable since 2010, consistently below the Surface Water Environmental Goals of 1,000 mg/L. The sulphate concentrations at WX22, down-stream of the ash repository, were generally stable between 2010 and 2012, with fluctuations in sulphate concentrations evident after this time. Post 2012, the sulphate concentrations at WX22 have been reported equal to or above the Surface Water Environmental Goal on two occasions, in 2014 and 2018.

Nickel

Nickel concentrations at LMP01 and NC01 have been generally stable since 2012, with one exceedance at LMP01 above the adopted Surface Water Environmental Goal of 17 µg/L. Concentrations of 115 and 136 µg/L were reported in surface water samples from WX22 in January and February 2018, at a similar magnitude to a peak of 150 µg/L reported in February 2014. These peaks are potentially associated with low stream flows. Nickel concentrations in surface water from WX22 exceeded the pre-placement trigger level on numerous occasions during the 12 months of the monitoring period. During the current reporting period nickel concentrations exceeded the Environmental Goal of 17 mg/L in September 2018, March 2019, April 2019, July 2019 and August 2019.

7 GROUNDWATER

7.1 OBJECTIVE

The objective of the groundwater monitoring program is to monitor the impacts of ash placement activities occurring under the Project Approval on local groundwater quality and hydrology having regard to the 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 5*.

Table 7 Groundwater Monitoring Network and Frequency

Bore ID	Location Description	Screened Material [1]	Monitoring Frequency	Required under OEMP
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	Fill beneath the ash	Monthly[2]	Yes
MPGM4/D11	Inside of Mt Piper ash repository	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/D19	down-gradient of ash repository	Fill beneath the ash	Monthly[2]	Yes

[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 was 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 are 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 I* 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.

7.5 GROUNDWATER RESULTS

7.5.1 Groundwater Levels and Inferred Flow Direction

Water levels in the nine groundwater monitoring bores were relatively stable across the monitoring period. Some exceptions were noted at bores D16, where water levels fluctuated between 904.48 and 910.28 mAHD during the monitoring period and D11, where water levels peaked at 914.08m AHD in 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).

As discussed in *Section 4.3*, groundwater elevation contours indicate a component of groundwater flow to the south and south-east from the Lamberts North Ash Repository. Additionally, the groundwater elevation contours indicate a component of groundwater flow to the east and north-east, towards Neubecks Creek. Groundwater elevations in the vicinity of D11 and D10 to the north, west and south-west of the repository respectively in the order of 911 m AHD, declining to below 909 m AHD to the south and south-east of the repository (i.e. D19) and to approximately 904 m AHD in the vicinity of Neubecks Creek at D8. The groundwater flow directions have remained relatively consistent throughout the monitoring period based on groundwater contour plans prepared for each season. Groundwater contour plans are presented in *Figures 6a* to *6d*.

Hydrographs for each of the key areas are presented in *Annex F.* 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 910.5m AHD in October 2018 to approximately 912m AHD in June 2019 for D10 and 910.5m AHD in October 2018 to approximately 914 m AHD in February 2019 for D11. Potential causes of these increases in groundwater levels 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 8* below. Tabulated results along with summary statistics for each monitoring point (minimum, maximum, 50th percentile and 90th percentile) are presented in *Annex C* and shown on *Figures 8a* and *8b.*

Table 8 Summary of Groundwater Concentrations - 2018/19 Reporting Period

Analyte/Location	Groundwater Concentration Range					
	South/ Cross-Gradient[1]	Up-gradient /Adjacent to Mt Piper[2]	At boundary of Lamberts North Ash Repository[3]	Down-gradient/Adjacent to Neubecks Creek[4]	Groundwater Collection Basin Pre-Ash Placement 90th Percentile[a]	Groundwater Environmental Goal[a b,c,e]
pH	**4.8** – 6.5	**5.5** – 6.8	**5.5 – 6.0**	**5.3 – 6.2**	-	6.5 – 8.0[a]
Conductivity (µS/cm)	660 – **3,790**	**4,050 – 10,230**	1,750 – ***45,010***	207 – **8,580**	1,576	2,600[a]
TDS (mg/L)	1,090 – **6,010**	**2,900 – 9,400**	**1,160 – 7,490**	204 – **7,770**	1,306	1,500[a]
Sulphate (as SO_4) (mg/L)	548 – **3,660**	989 – **5,140**	721 – **4,330**	79.6 – **4,390**	824	1,000[a]
Chloride (mg/L)	49.9 - **558**	191 – **1,110**	101 – **1,010**	2.14 – **1,110**	31.5	350[a]
Arsenic (µg/L)	<1 – 5	<1 – 10	<1 – 19	<1 – 6	1	24[b]
Silver (µg/L)	**<1**	**<1**	**<1**	**<1**	<1	0.05[b]
Barium (µg/L)	10 - 19	14 – 116	13 – 42	25 – 58	37	700[f]
Boron (µg/L)	<50 – **2,710**	290 – **3,250**	**1,040 – 3,510**	<50 – **1,680**	244	370[b]
Cadmium (µg/L)	<0.1 – **3.8**	<0.1 – **4.5**	<0.1 – 0.4	<0.1 – 0.4	2	2[d,e]
Chromium (total) (µg/L)	<1 - ***88***	<1 – ***156***	<1 – **47**	<1 – 1	1	5[d]
Copper (µg/L)	<1 - **7**	<1 – 11	**<1 – 6**	<1 – **20**	1	5[a]
Fluoride (mg/L)	<0.1 – 0.4	<0.01 – 0.461	<0.1 – <0.5	0.024 – **2.52**	0.435	1.5[d]
Iron (µg/L)	2 – **32,200**	**5,890 – *130,000***	506 – **59,300**	78 – ***70,000***	664	664[e] / 15,900[g]
Mercury (µg/L)	<0.04	<0.04	<0.04	<0.04 – **0.43**	<0.1	0.06[c]
Manganese (µg/L)	36 – 5,520	1,970 – **20,800**	769 – **28,600**	60 – **25,000**	5,704	5,704[e]/ 8,570 [g]
Molybdenum (µg/L)	<1 - 4	<1 – 6	<1 - 4	<1 – 3	1	10[a]
Nickel (µg/L)	6 – **963**	157 – **1,060**	133 – **1,940**	30 – **1,620**	550.9	550.9[e]
Lead (µg/L)	<1 - **6**	<1 – **9**	<1 – **18**	<1 – 3	1	5[f]
Selenium (µg/L)	<0.2 – 1.2	<0.2 – 1.7	<0.2 – 3.7	<0.2 – 0.4	2	5[c]
Zinc (µg/L)	<5 – **1,670**	53 – **1,690**	55 – 749	48 - 256	908	908[e]

Notes:

1. Monitoring bores south and cross-gradient of ash repository: MPGM4/D15, MPGM4/D16, MPGM4/D17
2. Monitoring bores adjacent to the Mt Piper ash repository and up-gradient of the site MPGM4/D10 and MPGM4/D11 targeting the southern coal mine groundwater inflows to the area between the southern brine placement and bore D10.
3. Monitoring bores at boundary of the ash repository MPGM4/D1 and MPGM4/D19.
4. Monitoring bores adjacent to Neubecks Creek MPGM4/D8 (north of Neubecks Creek) and MPGM4/D9 (south of Neubecks Creek).

Shaded and bold cells indicate values are equal to or exceed the Groundwater Environmental Goals.

a Criteria from OEMP.

b OEMP Criteria - ANZECC (2000) 95% Level of species protection for freshwater aquatic ecosystems.

c OEMP Criteria - ANZECC (2000) 99% Level of species protection for freshwater aquatic ecosystems.

d OEMP Criteria - NHMRC (2011) Australian Drinking Water Guidelines.

e OEMP Criteria - adopted from Groundwater Collection Basin Pre-Ash Placement 90th Percentile.

f OEMP Criteria - NHMRC (2008) Guidelines for Managing Risks in Recreational Waters.

g Lamberts North pre-placement 90th Percentile baseline data from October 2012 to August, 2013 and Neubecks Creek at WX22 (Aurecon, 2017).

7.5.3 *Groundwater Quality South/Cross-Gradient of Lamberts North Ash Repository*

Data obtained from bores D15, D16 and D17 located to the south of the Lamberts North Ash Repository, in a cross-hydraulic gradient position are outlined below. The criteria pertinent to this assessment are the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 4.8 to 6.5, with the pH (field) levels in groundwater from D15 tending towards acidic conditions, ranging between in 4.8 to 5.0 throughout the reporting period. The pH levels remained generally stable in groundwater from all bores in this area, however, were generally consistently lower than the Groundwater Environmental Goal range of 6.5 – 8.0 standard pH units.

- EC (field) values ranged between 660 µS/cm and 3,790 µS/cm, remaining generally stable throughout the monitoring period. EC values in groundwater from D15 and D17 exceeded the Groundwater Environmental Goal of 2,600 µS/cm, with values up to 3,790 µS/cm and 3,780 µS/cm, respectively. EC values in groundwater from D16 were below the Groundwater Environmental Goal.

- TDS contents in groundwater from each of D15, D16 and D17 were relatively consistent, ranging between 1,090 mg/L and 6,010 mg/L, of which, D15 and D17 consistently exceeded the Groundwater Environmental Goal of 1,500 mg/L. The TDS of groundwater from D16 did not exceed the Groundwater Environmental Goal during the reporting period.

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 3,660 mg/L, 1,060 mg/L and 2,040 mg/L, respectively were reported in groundwater from D15, D16 and D17 throughout the reporting period. The D16 result in April 2019 was an isolated exceedance of the Groundwater Environmental Goal, while D15 and D17 consistently exceeded the Groundwater Environmental Goal of 1,000 mg/L;

- Concentrations of chloride in groundwater ranged between 49.9 mg/L and 558 mg/L. A single elevated chloride concentration was identified in groundwater from D15 (up to 558 mg/L) exceeding the Groundwater Environmental Goal of 350 mg/L during the September 2019 monitoring event.

Concentrations of fluoride, calcium, magnesium, sodium and potassium were detected at concentrations above the laboratory limits of reporting; however, no Groundwater Environmental Goal exceedances apply to these analytes. It is noted that the concentrations of the major cations were generally higher in groundwater from D15 and D17.

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:

- Boron concentrations reported in groundwater from D15 were between 160 µg/L and 2,710 µg/L and were above the Groundwater Environmental Goal (370 µg/L ANZECC (2000)/Local Guideline) in August 2019 only;

- Chromium concentrations ranged between <1 µg/L and 88 µg/L in groundwater from D15, D16 and D17, and exceeded the Groundwater Environmental Goal of 5 µg/L. It is noted that the peak concentration of chromium of 88 µg/L was reported in March 2019 in groundwater from D15, along with two consecutive monitoring events in April and May of 2019 from D15 reaching similar concentrations, all other chromium concentrations were generally below 60 µg/L. Significantly lower chromium concentrations (<9 µg/L) were reported in groundwater from D16 and D17;

- Concentrations of copper ranged between <1 µg/L and 7 µg/L in groundwater from D15, D16 and D17. The Groundwater Environmental Goal of 5 µg/L was exceeded for the monitoring events in March, April and May of 2019 in groundwater from D15 only, with the highest concentration of copper noted in April 2019. All other copper concentrations in groundwater from D15, D16 and D17 were reported less than the Environmental Goal of 5 µg/L;

- Iron (filtered) concentrations (up to 32,200 µg/L) consistently exceeded the Groundwater Environmental Goal of 664 µg/L throughout the period of monitoring in groundwater from D15, D16 and D17, with the exception of two concentrations reported in groundwater from D16. Concentrations of iron were generally higher in groundwater from D17 and D15 than from D16. The maximum concentration of 32,200 µg/L was reported in groundwater from D15 in November 2018;

- Lead concentrations up to 6 µg/L were reported in groundwater from D15 only, and exceeded the Groundwater Environmental Goal of 5 µg/L throughout the majority of the reporting period. Lead concentrations were below laboratory detection limits in groundwater from D16 and D17;

- Nickel concentrations up to 963 µg/L were reported in groundwater from D15, consistently exceeding the Groundwater Environmental Goal of 550.9 µg/L. Nickel concentrations were below the Groundwater Environmental Goal of 550.9 µg/L in groundwater from D16 and D17;

- Mercury concentrations reported in groundwater from D9 were reported below the Groundwater Environmental Goal (0.06 µg/L ANZECC (2000)/Local Guideline) with the exception of results January 2019 and August 2019;

- Molybdenum concentrations ranged from <1 µg/L to 4 µg/L, with no exceedances of the Groundwater Environmental Goal of 10 µg/L in groundwater from D15, D16 and D17. The maximum concentration of 4 µg/L was reported in groundwater from D15 in April 2019;

- 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 in all monitoring events of 2018 and 2019; and

- Zinc concentrations in groundwater from D15 were consistently above the Groundwater Environmental Goal of 908 µg/L, and ranged between 966 µg/L and 1670 µg/L. Zinc concentrations were below the Groundwater Environmental Goal in groundwater from D16 and D17.

Vanadium and aluminium were also analysed for in the groundwater samples collected from D15, D16 and D17; however, no Groundwater Environmental Goals apply to these analytes. Concentrations of aluminium were higher in groundwater from D15 compared to concentrations in groundwater from D16 and D17, with the majority of concentrations below laboratory limits of reporting for the monitoring period noted in groundwater from D16. Concentrations of vanadium were below the limit of reporting of 10 µg/L.

The above exceedances of the Groundwater Environmental Goals are considered unlikely to be a result of impacts of the Lamberts North Ash Repository as these bores are located to the south, predominantly cross-gradient, of the Lamberts North Ash Repository. It is noted that the Lamberts South area (where these bores are all located) has been reported as being significantly disturbed by historical mining activities (CDM Smith 2013). Therefore, a component of the concentrations in groundwater from these bores may relate to background conditions.

7.5.4 *Groundwater Quality Up-gradient /Adjacent to Lamberts North Ash Repository*

Data obtained from groundwater water monitoring bores D10 and D11 located adjacent and up-gradient of the Lamberts North Ash Repository are outlined below. These bores are located adjacent to and down-gradient of the Mt Piper Ash Repository, and are between the Mt Piper Ash Repository and the Lamberts North Ash Repository. The criteria pertinent to this assessment are the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 5.51 to 6.8, 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) levels ranged between 4,050 µS/cm and 10,230 µS/cm, remaining generally stable throughout the monitoring period at each location. The EC results exceeded the Groundwater Environmental Goal of 2,600 µS/cm consistently throughout the reporting period in groundwater from these bores; and

- Laboratory determined TDS concentrations ranged between 2,900 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 5,140 mg/L) in groundwater from each of these monitoring bores exceeded the Groundwater Environmental Goal for sulphate of 1000 mg/L, with the exception of groundwater from D11 in March 2019 monitoring event. The maximum concentration of 5,140 µg/L was reported in groundwater from D11 in August 2019;

- Chloride concentrations up to 1,110 mg/L were reported in groundwater from bores D10 and D11. These concentrations exceeded the Groundwater Environmental Goal of 350 mg/L throughout the reporting period with one exception in groundwater from D10 in August 2019;

- Fluoride concentrations up to 0.461 mg/L were reported in groundwater from D10 and D11. All reported concentrations were below the Groundwater Environmental Goal of 1.5 mg/L, with the majority of concentrations above the laboratory limit of reporting of 0.1 mg/L

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. Calcium, magnesium, sodium, and potassium concentrations were relatively consistent throughout reporting period in groundwater from D10 and D11.

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 (up to 3,250 µg/L) exceeded the Groundwater Environmental Goal of 370 µg/L for the entire reporting period;

- Concentrations of iron (up to 130,000 µg/L) in groundwater from these bores exceeded the Groundwater Environmental Goal (664 µg/L) through the entire reporting period. The maximum concentration of 32,200 µg/L was reported in groundwater from D11 in September 2018;

- Concentrations of cadmium were reported to exceed the Groundwater Environmental Goal of 2 µg/L in D10 for each month during the reporting period apart from March 2019 and September 2019.

- Manganese concentrations exceeded the Groundwater Environmental Goal of 5,704 µg/L during the monitoring period in groundwater from bore D10 in November 2018 and for D11, with the exception of the result from March 2019;

- A lead concentration of 9 µg/L in groundwater from bore D10 exceeded the Groundwater Environmental Goal of 5 µg/L in September 2019. A lead concentration of 8 µg/L in groundwater from bore D11 exceeded the Groundwater Environmental Goal of 5 µg/L in March 2019;

- Concentrations of nickel in groundwater from bore D10 (up to 994 µg/L) and from bore D11 (up to 1,060 µg/L) consistently exceeded the Groundwater Environmental Goal of 550.9 µg/L throughout the period of reporting, with the exception of the March 2019 nickel result for D11;

- Zinc concentrations exceeded the Groundwater Environmental Goal of 908 µg/L in groundwater from bore D10 periodically throughout the reporting period; and

- All silver concentrations were below the laboratory limit of reporting of 1 µg/L, with this limit of reporting 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 580 µg/L in groundwater from bore D10. Vanadium concentrations were below the laboratory detection limits of 10 µg/L.

The exceedances listed above of the Groundwater Environmental Goals are considered unlikely to be a result of impacts of the Lamberts North Ash Repository as these bores are located to the west, up-gradient of the Lamberts North Ash Repository, and down-gradient of the Mt Piper Ash Repository.

7.5.5 Groundwater Quality at Boundary of Lamberts North Ash Repository

Data obtained from groundwater bores D1 and D19 located at the boundaries, and down gradient of the Lamberts North Ash Repository, are summarised below. The criteria pertinent to this assessment are the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) values ranged from 5.5 to 6.0, indicating slightly acidic conditions in groundwater from D1 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 1,750 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 at these locations; and

- Laboratory determined TDS concentrations ranged between 1,160 mg/L and 7,490 mg/L, with almost all reported TDS contents exceeding the Environmental Goal of 2,000 mg/L in groundwater from these bores.

Major and Minor Ions

Throughout the reporting period concentrations of major and minor ions in groundwater from 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 4,330 mg/L) were consistently above the Groundwater Environmental Goal of 1,000 mg/L in groundwater from these bores; and

- Chloride concentrations were reported at up to 1,010 mg/L in groundwater from D1 and 538 mg/L in groundwater from D19, exceeding the Groundwater Environmental Goal of 350 mg/L consistently during the second half of the monitoring period in groundwater from D1.

Calcium, magnesium, sodium and potassium were reported 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:

- Concentrations of boron (up to 3,510 µg/L), iron (filtered) (up to 59,300 µg/L), manganese (up to 28,600 µg/L) and nickel (up to 1,940 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. A generally increasing trend was noted in boron, manganese and nickel concentrations in groundwater from D1 throughout the reporting period, and a generally decreasing trend was noted in boron and iron concentrations in groundwater from D19 throughout the reporting period;

- Concentrations of chromium (up to 47 µg/L), copper (up to 6 µg/L) and lead (up to 18 µg/L) in groundwater from D19 exceeded the Groundwater Environmental Goals (of 5 µg/L for each of these analytes) intermittently through the reporting period. Chromium, copper and lead concentrations were consistently reported below the Groundwater Environmental Goals in groundwater from D1;

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

Aluminium and vanadium were also tested throughout the reporting period; however, no Groundwater Environmental Goals apply to these analytes. Aluminium concentrations peaked at 580 µg/L in groundwater from D1 and 730 µg/L in groundwater from D19. The vanadium concentrations in groundwater from these bores were below the laboratory limit of reporting.

Although these bores are located down gradient of the Lamberts North Ash Repository, given the concentrations of chloride and nickel in groundwater from these bores and the concentrations of these analytes in groundwater from bores located up gradient, the above exceedances of the Groundwater Environmental Goals are considered unlikely to be primarily a result of impacts from the Lamberts North Ash Repository.

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. The criteria pertinent to this assessment are the Groundwater Environmental Goals.

Field Parameters

Field parameters monitored are summarised below:

- pH (field) ranged from 5.3 to 6.2, 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 207 µS/cm and 8,580 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. A generally increasing trend in EC concentrations was noted in groundwater from bore D9 during the reporting period; and

- Laboratory determined TDS concentrations ranged between 204 mg/L and 7,770 mg/L, with concentrations exceeding the Groundwater Environmental Goal of 2,000 mg/L in groundwater from bore D9.

Major and Minor Ions

Throughout the reporting period elevated concentrations of 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:

- Exceedances of the Groundwater Environmental Goals for sulphate and chloride in groundwater were noted in groundwater from D9 (up to 4,390 mg/L and 1,110 mg/L, respectively), while sulphate and chloride concentrations in groundwater from D8 were below the Groundwater Environmental Goals. A generally increasing sulphate and chloride concentration trend was noted in groundwater from D9 over the monitoring period; and

- Fluoride (2.52 mg/L in May 2019 only) was reported above the Groundwater Environmental Goals of 1.5 mg/L respectively in groundwater from monitoring bore D9 only.

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. Concentrations of calcium, magnesium, sodium and potassium were noted to be generally increasing over the monitoring period in both D8 and D9.

Metals

Throughout the reporting period various metals were identified at concentrations above the adopted 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 (up to 1,680 µg/L), iron (filtered) (up to 70,000 µg/L), manganese (up to 25,000 µg/L) and nickel (up to 1,620 µg/L) in groundwater from bore D9 exceeded the Groundwater Environmental Goals through the entire reporting period. Generally increasing concentration trends were noted for boron, iron, manganese and nickel in this bore during the reporting period and since 2012 (trends discussed further in *Section 7.6.2* below). Reported iron (filtered) concentrations in groundwater from D8 in March 2019 and September 2019 were reported to exceed the Groundwater Environmental Goal.

- Copper concentrations up to 7 µg/L (D8) and 20 µg/L (D9) were reported in groundwater to exceed the Groundwater Environmental Goal. Copper was reported to exceed the Groundwater Environmental Goal four times during the monitoring period in groundwater from bore D8 and two times in groundwater from bore D9; and

- All 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 780 µg/L in groundwater from bore D8 in January 2019 then declined 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.

Bores South/Cross Gradient of the Lamberts North Ash Repository

Metals including boron, chromium, copper, iron, lead, nickel, molybdenum and zinc, acidic pH levels and elevated EC, TDS, sulphate and fluoride were identified in groundwater from bores D15, D16 and D17 at concentrations above the Groundwater Environmental Goals. These exceedances are considered unlikely to be a result of impacts of the Lamberts North Ash Repository as these bores are located cross-gradient/south of the Lamberts North Ash Repository and are located in the Lamberts South area, which has been significantly disturbed by historical mining activities (CDM Smith, 2013).

Bores Up gradient/Adjacent to Lamberts North Ash Repository

As noted above, elevated EC and TDS levels as well as concentrations of anions including chloride, sulphate, and metals including boron, cadmium, chromium, lead, nickel, manganese, iron and zinc were identified at concentrations at or above the Groundwater Environmental Goals in groundwater from bores up-gradient of the Lamberts North Ash Repository. These bores are located directly down-gradient of the eastern extent of the Mt Piper Ash Repository. Low pH levels (more acidic than the Groundwater Environmental Goal) were also evident in groundwater from this area. The detections of chromium, lead and zinc are considered likely to be related to the background groundwater quality in the area, based on the positioning of bores with respect to the Lamberts North ash repository and the similarity in concentrations to those identified in groundwater to the south of the ash repository (i.e. at monitoring bores D15 – D17).

The reported TDS and EC levels and concentrations of sulphate, chloride, boron, iron, manganese and nickel in groundwater from bores in this area exceeded the Groundwater Environmental Goals. Overall the highest concentrations of these constituents were noted in groundwater from bores D10 and D11 which are located immediately down gradient of the Mount Piper Ash Repository.

Bores Down-gradient/Adjacent to the Lamberts North Ash Repository

Concentrations of boron, iron, manganese and nickel (D1 and D19) and chromium, copper and lead (at D19) consistently exceeded the Groundwater Environmental Goals in groundwater from bores along the down-gradient boundary of the Lamberts North Ash Repository. These detections are considered to be related to the groundwater conditions that were present up gradient of the Lamberts North Ash Repository (i.e. bores D10 and D11) and to be largely unrelated to the Lamberts North Ash Repository.

Bores Adjacent to Neubecks Creek

At times during the monitoring period, EC and TDS values, sulphate, chloride, fluoride, boron, copper, iron, manganese, mercury and nickel concentrations, and low pH values in groundwater exceeded the Groundwater Environmental Goals. Of these, low pH levels and elevated iron and manganese concentrations are considered to be associated with background concentrations. Elevated copper concentrations (D8 and D9) and mercury (D9) were sporadic and do not demonstrate clear trends.

The elevated EC and TDS, sulphate, and boron concentrations that exceeded the Groundwater Environmental Goals were identified in groundwater from D9 (south side of Neubecks Creek) rather than in groundwater from D8, to the north of Neubecks Creek. Elevated nickel and chloride levels were identified in groundwater from D9 consistently and may indicate an emerging increasing trend; however, this trend is considered to be unrelated to groundwater quality from the Lamberts North Ash Repository.

There was no clear evidence of trends 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 9* below and in *Annex C*. The results are also presented on *Figures 7c* and *7d*.

This assessment serves to provide an early indication of changes in groundwater quality. As outlined above, a separate and broader investigation into surface and groundwater impacts associated with the Mt Piper Ash Repository and the Lamberts North Ash Repository at Mt Piper Power Station is currently underway. As part of this investigation an updated Conceptual Site Model has been prepared and presented to key stakeholders. Further investigations to address the data gaps identified are being carried out and a Numerical Groundwater Model is being prepared to inform assessment of reasonable and feasible management and mitigation options. Once this investigation is completed, the OEMP, including the Water Management and Monitoring Plan, will be updated to reflect the key findings and the further contingency measures proposed.

Table 9 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]
	South/Cross Gradient			Up-gradient/Adjacent to Ash Repository		Adjacent to Repository		Down-gradient		
	D15	D16	D17	D10	D11	D1	D19	D8	D9	
pH	4.9	6.4	6.1	5.58	6.2	6.0	5.9	5.6	6.0	-
Conductivity (µS/cm)	**3,665**	**1,980**	**3,650**	**6,070**	**9,995**	**5,700**	**5,420**	880	**6,455**	1,576
TDS (mg/L)	**2,850**	**1,490**	**2,850**	**4,540**	**8,380**	**4,230**	**4,210**	626	**5,540**	1,306
Sulphate (as SO_4) (mg/L)	**1,920**	**836.5**	**1,750**	**3,010**	**4,900**	**2,880**	**2,800**	359	**3,310**	824
Chloride (mg/L)	**196.5**	**96.3**	**226**	***430***	***1,025***	***598***	***364***	**52.7**	***686.5***	31.5
Fluoride (mg/L)	0.214	0.166	0.196	0.267	0.136	0.407	0.312	0.026	0.2	0.435
Arsenic (µg/L)	**3**	<1	**2**	**7**	**6.5**	**5**	**3.5**	<1	**2**	1
Barium (µg/L)	14	10.5	16	16	23	34	15	**40**	**40**	37
Boron (µg/L)	220	80	130	**1,500**	***2,990***	**1,820**	**2,090**	140	**1,520**	244
Cadmium (µg/L)	0.55	<0.1	<0.1	**2.4**	0.1	0.1	0.2	<0.1	0.25	2
Chromium (total) (µg/L)	***23***	**4**	**3**	***79***	**2**	**2.5**	***5***	<1	**1**	1
Copper (µg/L)	**3**	**1**	**2**	**7.5**	**2**	**1**	**4**	**5**	**3.5**	1
Iron (µg/L)	***30,950***	**2,890**	***19,200***	***17,800***	***95,650***	***34,300***	***16,900***	586	***42,550***	664
Mercury (µg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	**0.245**	<0.1
Manganese (µg/L)	2,260	56	3,360	**4,160**	**17,250**	**18,600**	**9,220**	2,000	**17,950**	5,704
Molybdenum (µg/L)	**2**	**1**	**2**	**4**	**2.5**	<1	**2.5**	**<1**	**3**	1
Nickel (µg/L)	**912**	16.5	110	**619**	**982**	**430**	**646**	93	**1,240**	550.9
Lead (µg/L)	**6**	<1	<1	**2**	**8**	**2**	**5**	<1	**2.5**	1
Selenium (µg/L)	0.5	<0.02	<0.2	1	0.3	0.3	0.55	<0.2	0.3	2
Silver (µg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	**<1**
Zinc (µg/L)	**1,620**	6	81	**923**	103	91	342	103	110	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.

To the south and cross-hydraulic gradient of the ash repository, the 50th percentile levels of EC and TDS and concentrations of sulphate, chloride, fluoride, arsenic, barium, boron, chromium (total), copper, iron, molybdenum, nickel, lead and zinc from the 2018/19 reporting period exceeded the pre-placement trigger levels. Based on the location of these bores relative to the Lamberts North Ash Repository, and on the analytes that exceeded the 50th percentile levels, the concentrations of these analytes in groundwater are not considered to be related to the Lamberts North Ash Repository.

Up gradient monitoring bores located adjacent to the Lamberts North Ash Repository show a clear change in the groundwater quality relative to the groundwater monitoring bores located to the south/cross gradient of the ash repository. These monitoring bores are located down gradient of the Mt Piper Ash Repository, between the Mt Piper and the Lamberts North Ash Repositories. In groundwater from bores in this area, increases are evident in the 50th percentile concentrations for EC, TDS, sulphate, chloride, boron, arsenic (minor change evident), cadmium, chromium (to a degree), iron, manganese, and nickel relative to the up-gradient/background bores. These increased concentrations suggest a change in groundwater quality within groundwater bores monitoring the Mt Piper Ash Repository. Increased concentrations of cadmium, fluoride, lead and selenium were also evident in groundwater from bore D10 in this area. Based on the location of these bores up gradient of the Lamberts North Ash Repository, and on the analytes that exceeded the 50th percentile levels, the concentrations of these analytes in groundwater are not considered to be related to the Lamberts North Ash Repository.

Adjacent to the Lamberts North Ash Repository 50th percentile concentrations for EC, TDS, sulphate, chloride, boron, arsenic, barium, boron, chromium, copper (D19 only), iron, lead (D19 only), manganese, molybdenum (D19 only) and nickel that exceeded the 90th percentile pre-placement levels were identified in groundwater from D1 to the north of the ash repository and in groundwater from D19 to the east of the ash repository. Based on the analytes that exceeded the 50th percentile levels and their presence in groundwater from bores up gradient of the Lamberts North Ash Repository, the concentrations of these analytes in groundwater from bores D1 and D19 are not considered to be related primarily to the Lamberts North Ash Repository.

50th percentile results for the 2018/19 reporting period for EC, TDS, sulphate, chloride, arsenic, boron, copper, iron, manganese, molybdenum and lead in groundwater from bore D9 (and some instances D8) exceeded the 90th percentile pre-placement levels. Elevated concentrations of iron are considered to be associated with background groundwater quality. The elevated manganese is also considered to be associated with background concentrations with the identified 50th percentile concentrations consistent with data from background monitoring bores D4 and D5 in the region (ERM, 2018). As in other areas where groundwater concentrations exceeded the trigger levels and are not considered to be related to background concentrations, the concentrations of these analytes in groundwater are not considered to be related primarily to the Lamberts North Ash Repository.

7.6.2 Trend Analysis

A review of concentration trends with respect to key indicators including EC, TDS, sulphate, chloride, boron, iron, nickel and manganese is presented below. These indicators were selected based on their exceedances above the adopted Groundwater Environmental Goals. Graphs were generated for select bores from the areas south/cross gradient of the ash repository (D15), adjacent to Mt Piper and up-gradient of Lamberts North Ash Repository (D11), the boundary of the Lamberts North Ash Repository (D20) and south of Neubecks Creek (D9). These graphs are presented in *Annex E*.

Electrical Conductivity

EC levels in groundwater from D11, to the east and up gradient of the Lamberts North Ash Repository, have been increasing since at least September 2015 and were above the Groundwater Environmental Goal during the monitoring period. To the south of the Lamberts North Ash Repository, EC in groundwater from D15 has varied over time and remains above the Environmental Goal. It is noted that in September 2017, EC values in groundwater from D15 reached a maximum, and have since marginally dropped, remaining relatively consistent although above the Groundwater Environmental Goal.

To the north of the Lamberts North Ash Repository, EC values in groundwater from bore D20 had remained relatively constant since February 2016; however, a gradual increase was noted from April 2017 through to January 2019 after which time concentrations appear to have stabilised. The EC values in groundwater from bore D20 were above the Groundwater Environmental Goal. Further to the north, in groundwater from bore D9, EC values were lower; however, they were also just above the Groundwater Environmental Goal. An increasing trend in EC in groundwater from D9 was noted from November 2017 and has continued in an upward trend during this monitoring period.

TDS

A generally increasing trend in TDS concentrations is noted in groundwater from bore D11 since September 2013, especially between 2013 and 2016. TDS concentrations have generally been more variable in groundwater from D11 since March 2016. TDS concentrations in groundwater from D15, D20 and D9 have been relatively consistent up until July 2018. Beyond July 2018 bore D9 has demonstrated an increasing trend and peaked at its highest reported concentration in August 2019, bore D20 dropped between July 2018 and September 2018 to their lowest values but since then it has increased to values consistent with those before July 2018. The peak in bore D15 at the end of the monitoring period is comparable with peaks identified for boron, chloride, sulphate and manganese. During the monitoring period, TDS concentrations in groundwater from D15, D11, D20 and D9 were mostly above the Groundwater Environmental Goal.

Sulphate

In December 2017, an increase in sulphate concentrations was noted in groundwater from D11; however, concentrations have since remained relatively consistent. Increasing sulphate concentration trends were also identified in groundwater from bore D15 to the south of the repository, and in bore D9, north of the repository, which have continued during this reporting period. The peak in bore D15 at the end of the monitoring period is comparable with peaks identified for boron, chloride, TDS and manganese. Bore Sulphate concentrations in groundwater from bore D20, located between the ash repository and bore D9, have remained generally consistent and stable. During the monitoring period, sulphate concentrations in groundwater from bores D11, D15, D20 and D9 were above the Groundwater Environmental Goal.

Chloride

Generally increasing chloride trends, particularly from the end of October 2013, were noted in groundwater from D11, located up gradient of the Lamberts North Ash Repository.

To the south, chloride concentrations in groundwater from bore D15 have varied from at least May 2017 to July 2019, with the final result from the monitoring period indicating a spike in concentration above the Groundwater Environmental Goal, similar to boron, sulphate, TDS and manganese.

To the north of the repository, chloride concentrations in groundwater from bore D20 have remained generally stable, with a slight incline during this monitoring period. The chloride concentrations were below the Groundwater Environmental Goal.

In groundwater from bore D9, chloride concentrations were generally stable from November 2013 to May 2018. However, the concentration then increased in June 2018 to the highest value recorded since January 2010. Since the reported peak in June 2018 concentrations dipped to below the Groundwater Environmental Goal in November 2018, before increasing again to above the Groundwater Environmental Goal and the highest reported peak in concentration which was reported in July 2019. Concentrations in D9 are now comparable with concentrations being reported in D11.

Boron

Boron concentrations in groundwater from bore D20 have increased since January 2018. In January 2019 the boron concentration was the highest reported, with concentrations since stabilising at approximately 4000 ug/L. A significant increase in boron concentrations was noted in D11 as well in November 2013.

Boron concentrations have generally been lower in groundwater from D9; however, they have increased since December 2016 and are continuing in an upward trend. Concentrations remain above the Groundwater Environmental Goal.

To the south of the Lamberts North Ash Repository, boron concentrations in groundwater from bore D15 have varied but, since June 2017, the boron concentration have remained stable at or above the pre-placement trigger value. It is noted that the final result from the monitoring period indicates a spike in concentration above the Groundwater Environmental Goal, similar to chloride, sulphate, TDS and manganese.

Iron

Increases in iron concentrations in groundwater from bore D11 were noted from November 2013 but concentrations have varied over time. Iron concentrations in groundwater from both D9 to the north and D15 to the south were also variable, and with generally increasing trends. The maximum iron concentrations where noted in groundwater from D9 in July 2019 and in groundwater from D15 in February 2019. Iron concentrations in groundwater from D20, between D11 and D9, have been steadily increasing and exceed the Groundwater Environmental Goal.

Manganese

Manganese concentrations in groundwater from D11, D15, D20 and D9 have generally increased over time and exceed the Groundwater Environmental Goal. The rate of increase declined from approximately January 2015 in groundwater from D11. Manganese concentrations have been consistently increasing in D9, while concentrations in D11 have mostly stabilised, and concentrations in D20 have continued to increase since February 2016.

Manganese concentrations in groundwater from D15 are increasing yet remain under the Groundwater Environmental Goal. Manganese peaked in bore D15 during the final sampling event of the period, this reported peak is comparable with peaks identified for similar to boron, chloride, TDS and sulphate.

Nickel

Nickel concentrations have generally increased over time in groundwater from bores D11 and D20. In groundwater from bore D20 in January 2018 the concentration of nickel exceeded the Groundwater Environmental Goal. Nickel concentrations have since remained above the Groundwater Environmental Goal in groundwater from D20.

Nickel concentrations in groundwater from bore D9 had been generally stable since October 2013; however, in the July and August 2018 monitoring events the nickel concentration in groundwater from bore D9 exceeded the Groundwater Environmental Goal and have increased during the 2018/19 monitoring period.

To the south of the Lamberts North Ash Repository, historical nickel concentrations in groundwater from bore D15 have fluctuated above and below the Groundwater Environmental Goal. However since October 2017 nickel concentrations have consistently remained above the groundwater environmental goal.

8 CONCLUSIONS

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

- Exceedances of the adopted Environmental Goals (as set out in the OEMP) were recorded during the reporting period with respect to surface water and groundwater;

- In surface water samples collected at locations described in the OEMP, sporadic exceedances of the Surface Water Environmental Goals (as set out in the OEMP) were identified at LMP01, NC01 and WX22. Although there is the potential that activities at Lamberts North Ash Repository may have contributed to these exceedances in surface water, these concentrations are unlikely to be predominately related to the Lamberts North Ash Repository;

- Concentrations of several 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 OEMP). Although there is the potential that activities at the Lamberts North Ash Repository may have contributed to these exceedances in groundwater, these concentrations (particularly chloride and nickel) are unlikely to be predominately related to the Lamberts North Ash Repository; and

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

While the exceedances of the Environmental Goals noted in this report are considered to be predominately unrelated to the Lamberts North Ash Repository, a separate and broader investigation into surface and groundwater impacts associated with the Mt Piper Ash Repository and the Lamberts North Ash repository at Mt Piper Power Station is currently underway. As part of this investigation an updated Conceptual Site Model has been prepared and presented to key stakeholders. Further investigations to address the data gaps identified are being carried out and a Numerical Groundwater Model is being prepared to inform assessment of reasonable and feasible management and mitigation options. Once this investigation is completed, the OEMP, including the Water Management and Monitoring Plan, will be updated to reflect the key findings and the further contingency measures proposed.

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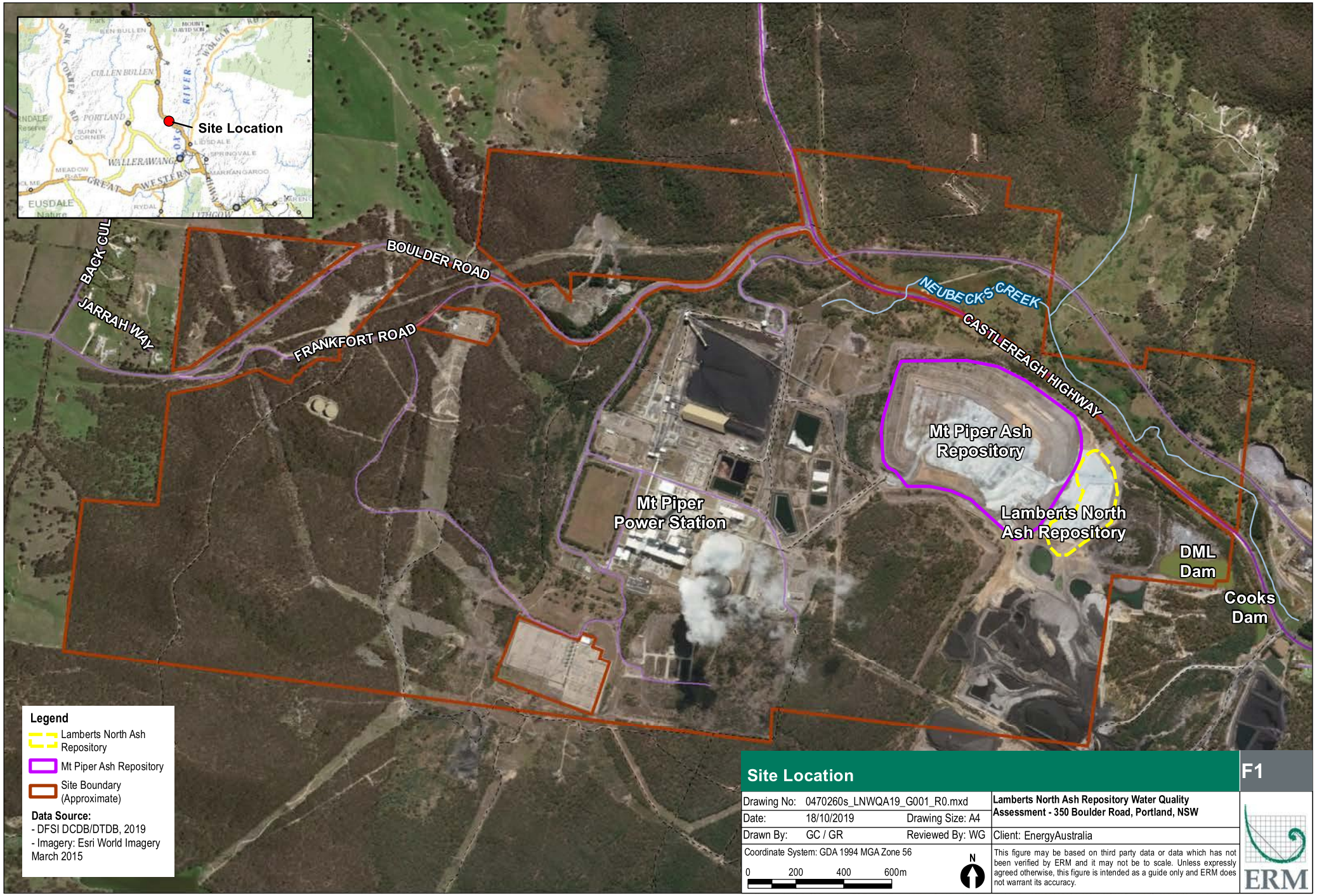
Figures


Site Location
BACK CUL
JARRAH WAY
BOULDER ROAD
FRANKFORT ROAD
NEUBECKS CREEK
CASTLEREAGH HIGHWAY
Mt Piper Ash Repository
Mt Piper Power Station
Lamberts North Ash Repository
DML Dam
Cooks Dam
Legend
Lamberts North Ash Repository
Mt Piper Ash Repository
Site Boundary (Approximate)
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- DFSI DCDB/DTDB, 2019
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Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW
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.
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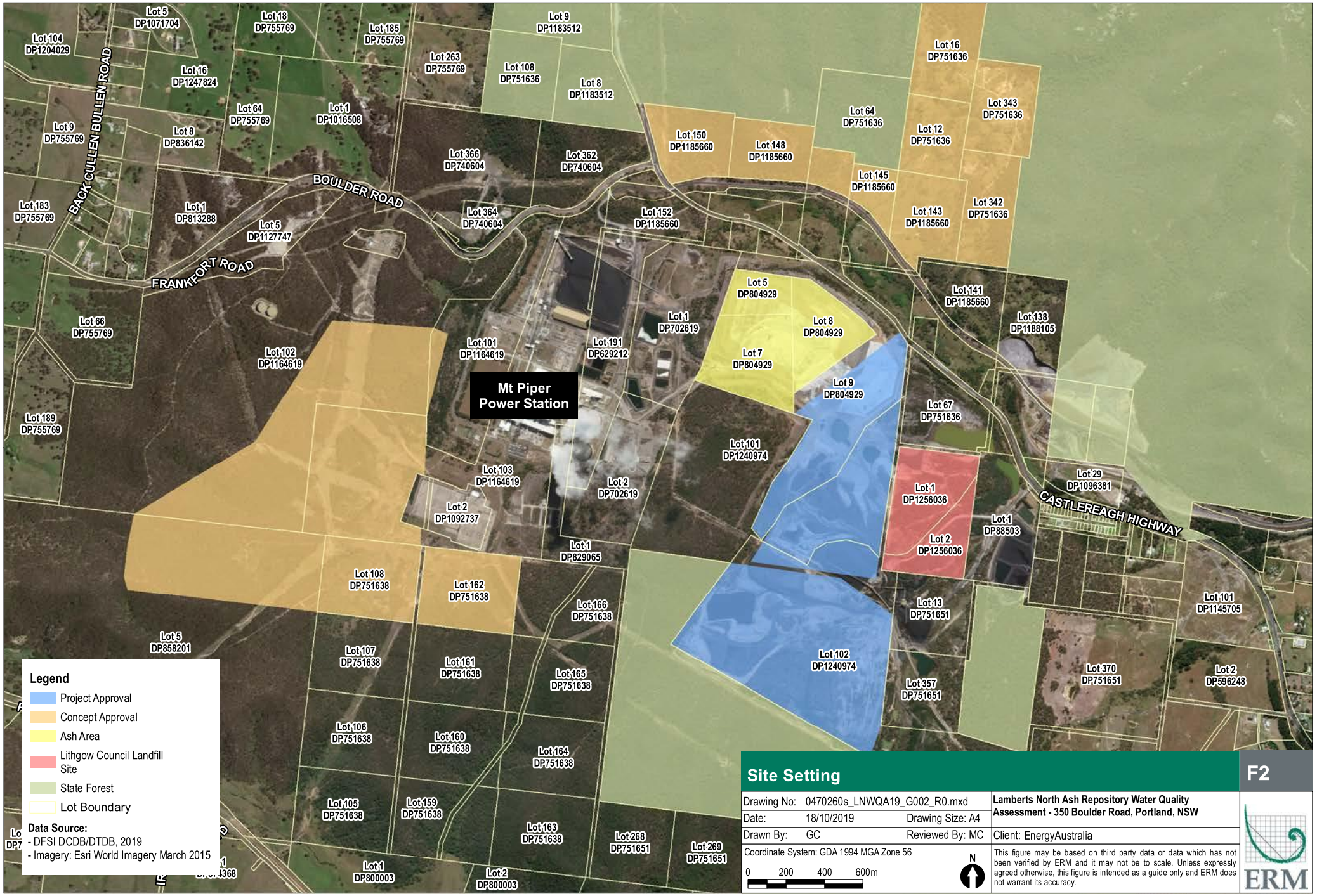
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BOULDER ROAD
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Lot 101 DP1164619
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Lot 7 DP804929
Mt Piper Power Station
Lot 9 DP804929
Lot 189 DP755769
Lot 67 DP751636
Lot 101 DP1240974
Lot 103 DP1164619
Lot 2 DP702619
Lot 29 DP1096381
Lot 1 DP1256036
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Project Approval
Concept Approval
Ash Area
Lithgow Council Landfill Site
State Forest
Lot Boundary
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Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW
Client: EnergyAustralia
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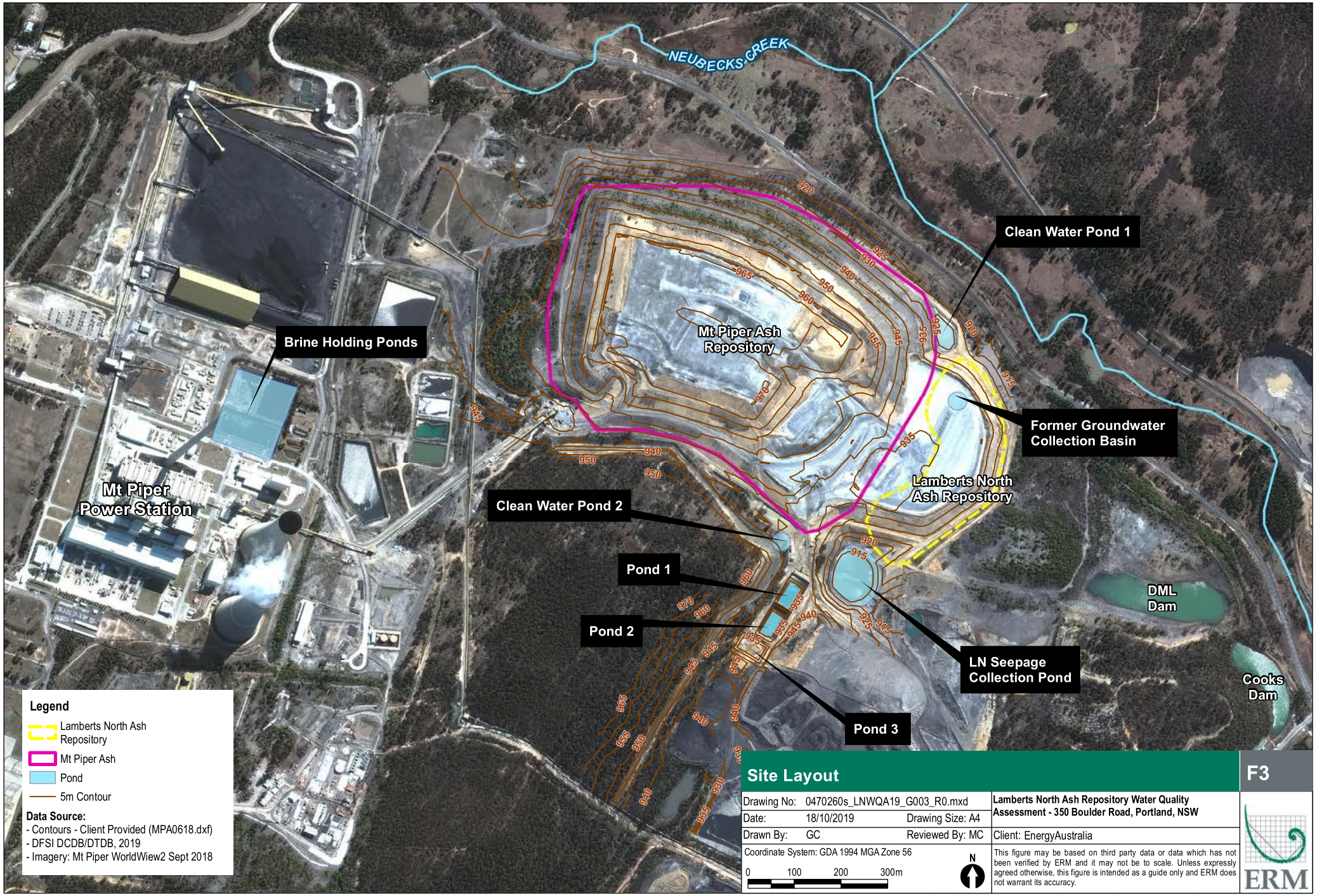
NEUBECKS CREEK
Clean Water Pond 1
Brine Holding Ponds
Mt Piper Ash Repository
Former Groundwater Collection Basin
Mt Piper Power Station
Clean Water Pond 2
Lamberts North Ash Repository
Pond 1
DML Dam
Pond 2
LN Seepage Collection Pond
Cooks Dam
Pond 3
Legend
Lamberts North Ash Repository
Mt Piper Ash
Pond
5m Contour
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Client: EnergyAustralia
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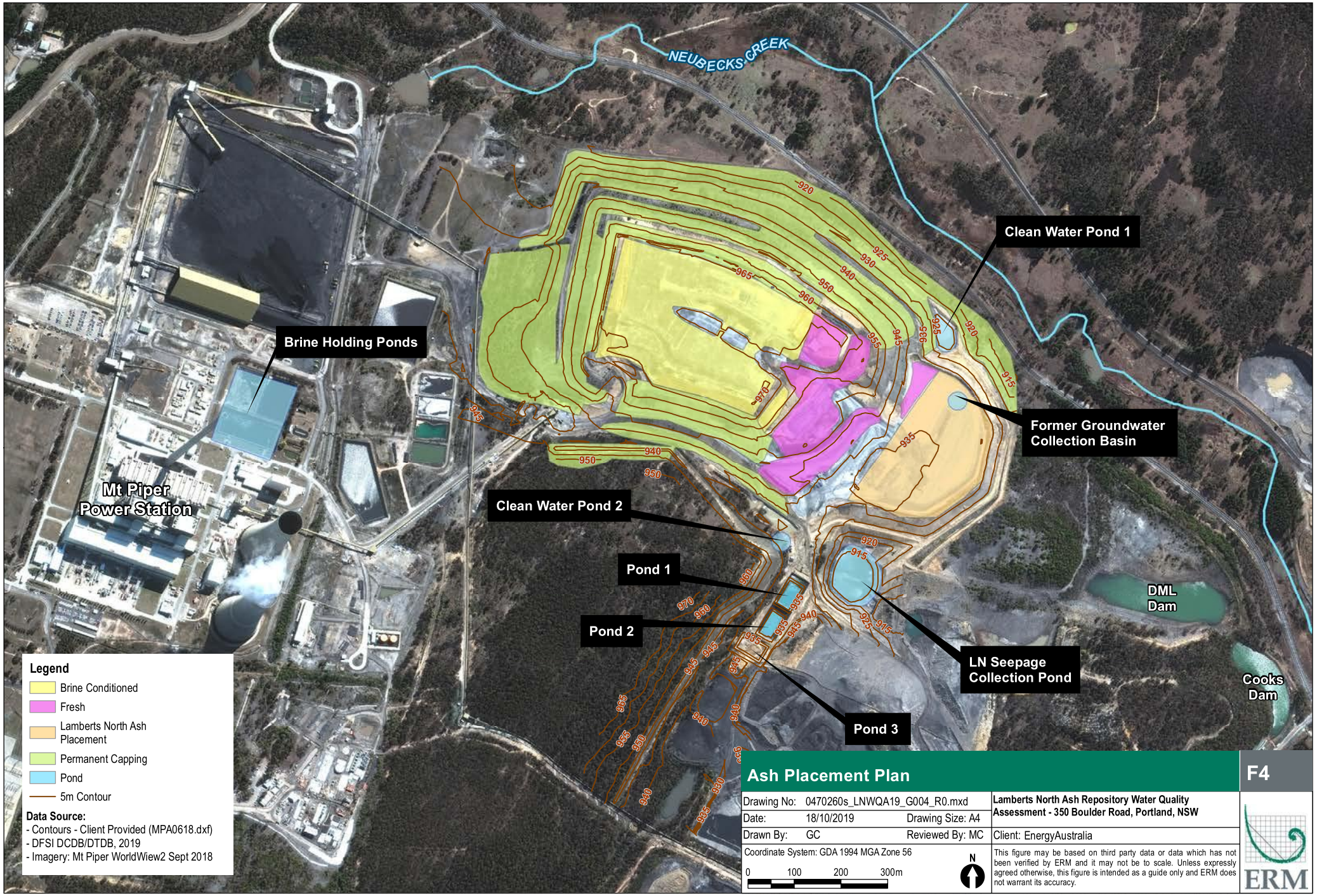
NEUBECKS CREEK
Clean Water Pond 1
Brine Holding Ponds
Former Groundwater Collection Basin
Mt Piper Power Station
Clean Water Pond 2
Pond 1
Pond 2
Pond 3
LN Seepage Collection Pond
DML Dam
Cooks Dam
Legend
Brine Conditioned
Fresh
Lamberts North Ash Placement
Permanent Capping
Pond
5m Contour
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Ash Placement Plan
F4
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Client: EnergyAustralia
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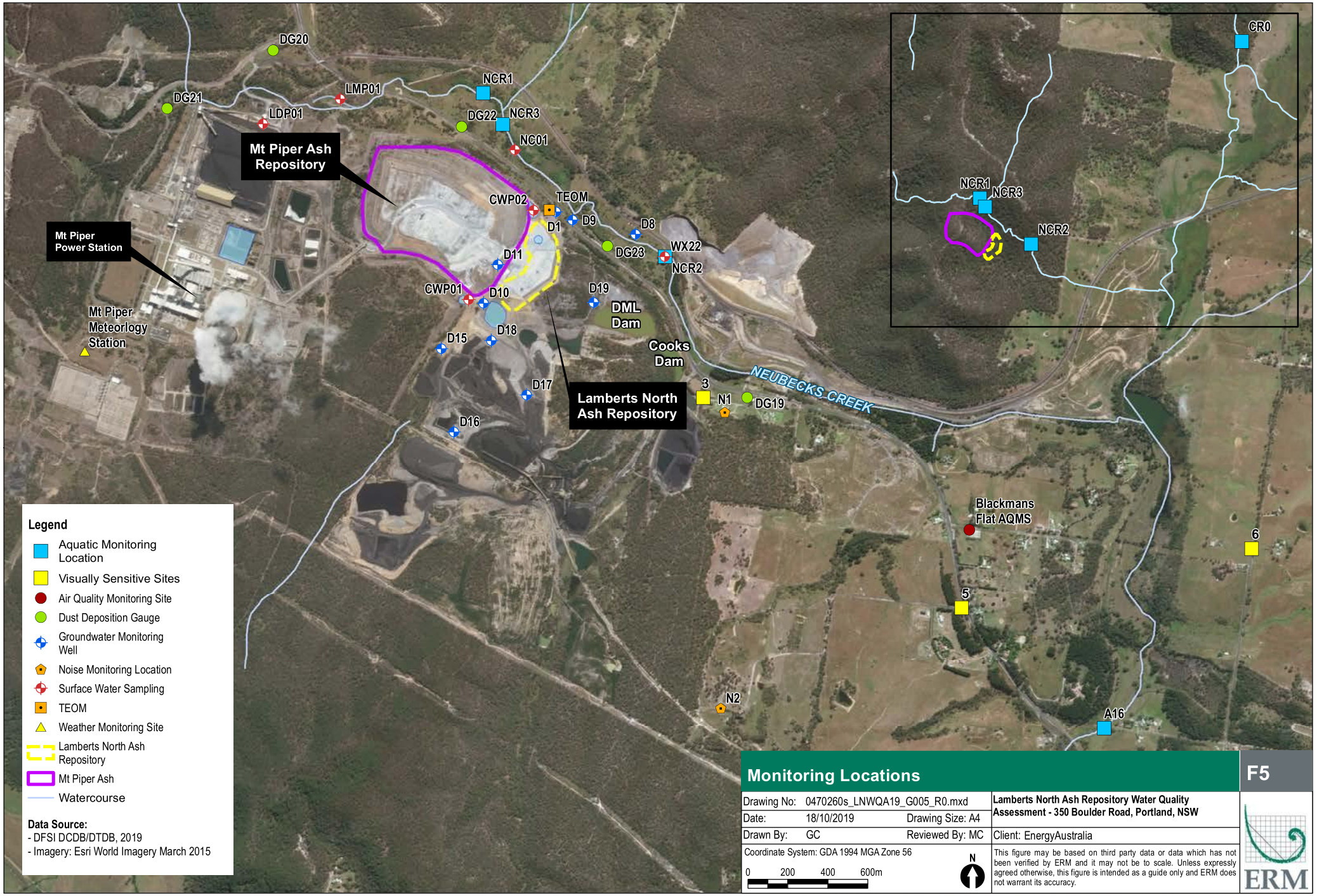
DG20
DG21
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LDP01
NCR1
DG22
NCR3
NC01
Mt Piper Ash Repository
CWP02
TEOM
D1
D9
D8
Mt Piper Power Station
D11
DG23
WX22
NCR2
CWP01
D10
D19
DML Dam
Mt Piper Meteorlogy Station
D15
D18
Cooks Dam
NEUBECKS CREEK
3
N1
DG19
D17
Lamberts North Ash Repository
D16
Blackmans Flat AQMS
6
5
N2
A16
CR0
NCR1
NCR3
NCR2
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Aquatic Monitoring Location
Visually Sensitive Sites
Air Quality Monitoring Site
Dust Deposition Gauge
Groundwater Monitoring Well
Noise Monitoring Location
Surface Water Sampling
TEOM
Weather Monitoring Site
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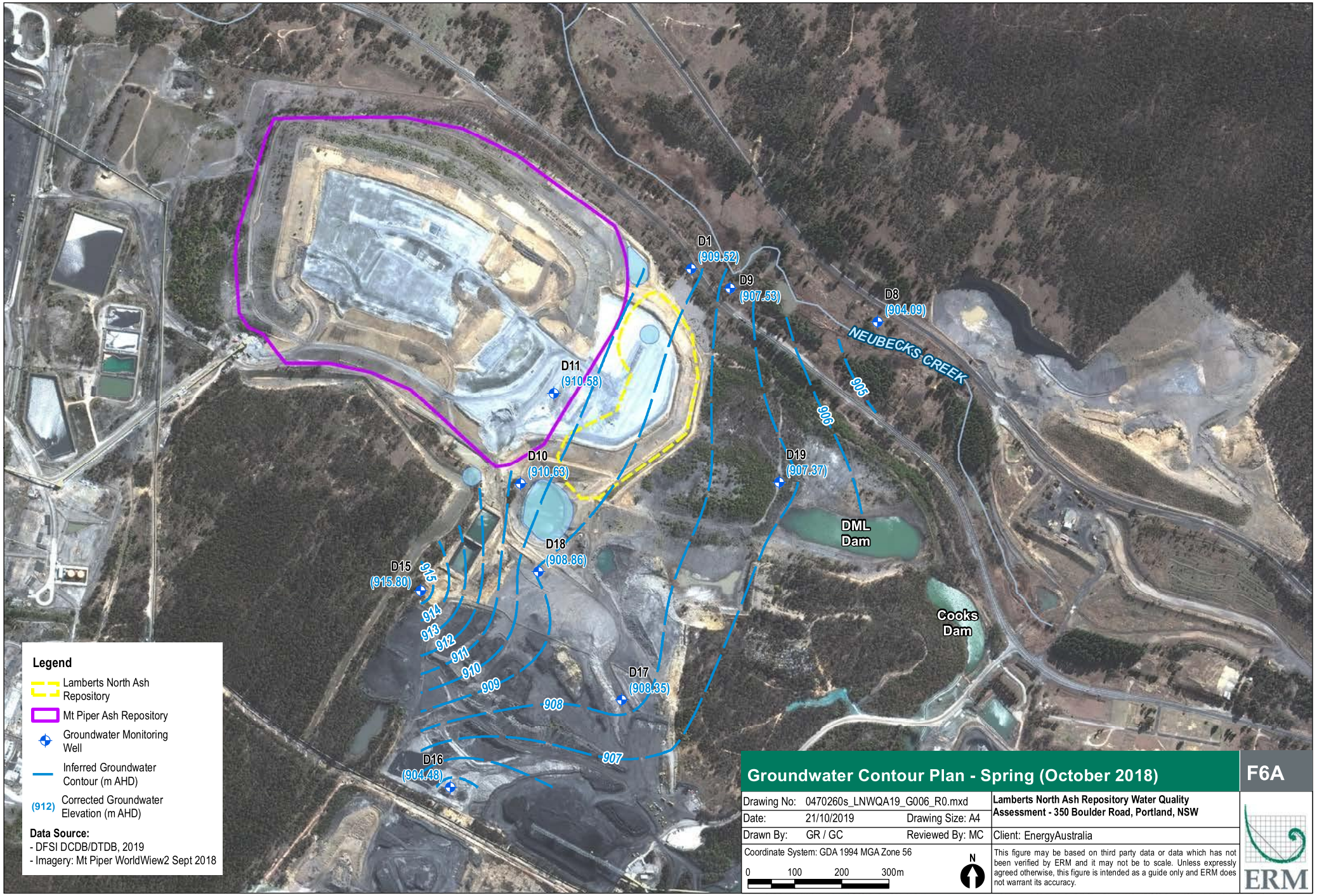
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(907.53)
D8
(904.09)
NEUBECKS CREEK
D11
(910.58)
905
906
D10
(910.63)
D19
(907.37)
DML
Dam
D18
(908.86)
D15
(915.80)
915
914
913
912
911
910
909
908
907
Cooks
Dam
D17
(908.35)
D16
(904.48)
Legend
Lamberts North Ash Repository
Mt Piper Ash Repository
Groundwater Monitoring Well
Inferred Groundwater Contour (m AHD)
(912) Corrected Groundwater Elevation (m AHD)
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- Imagery: Mt Piper WorldWiew2 Sept 2018
Groundwater Contour Plan - Spring (October 2018)
F6A
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Client: EnergyAustralia
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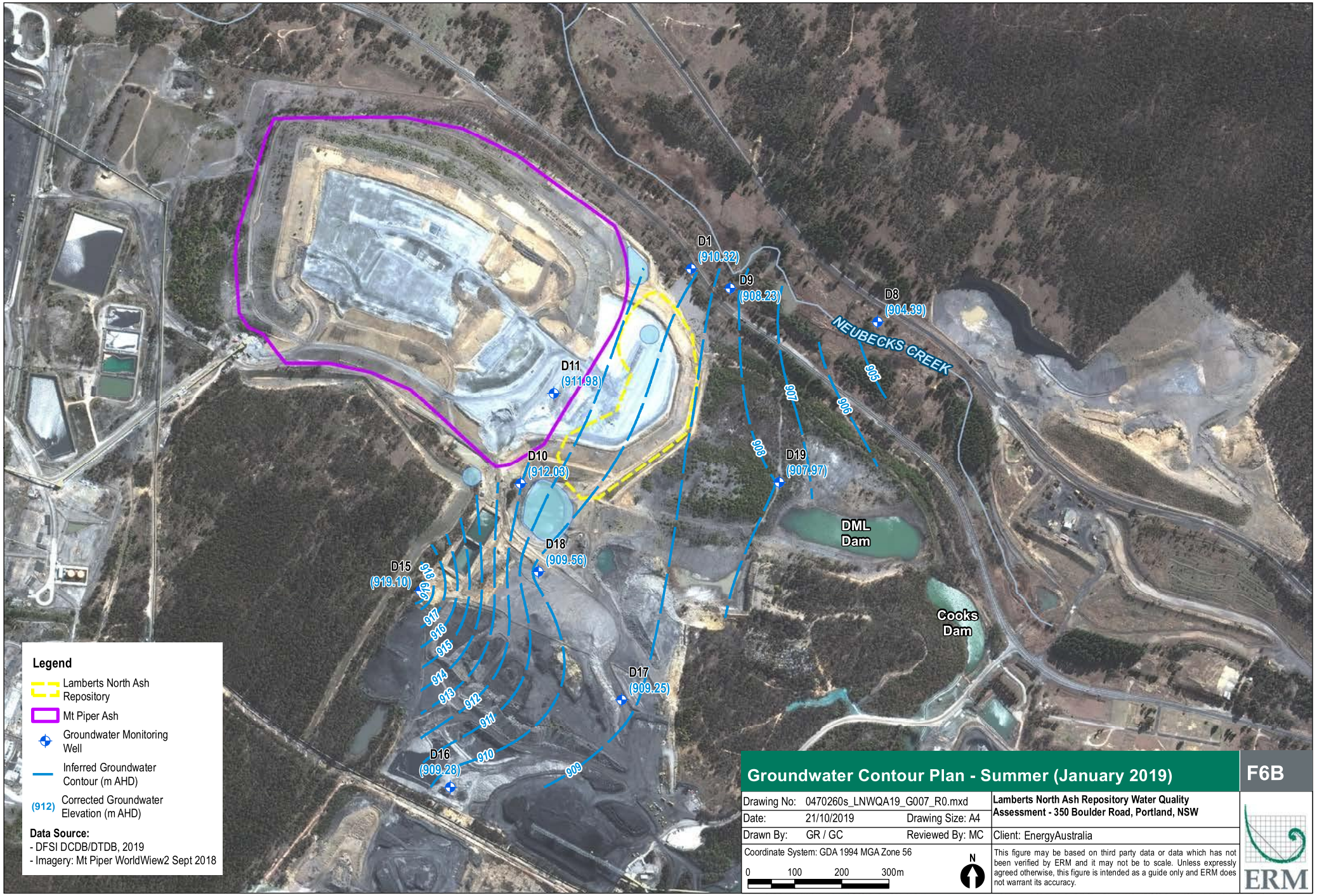
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D9
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D8
(904.39)
NEUBECKS CREEK
D11
(911.98)
D10
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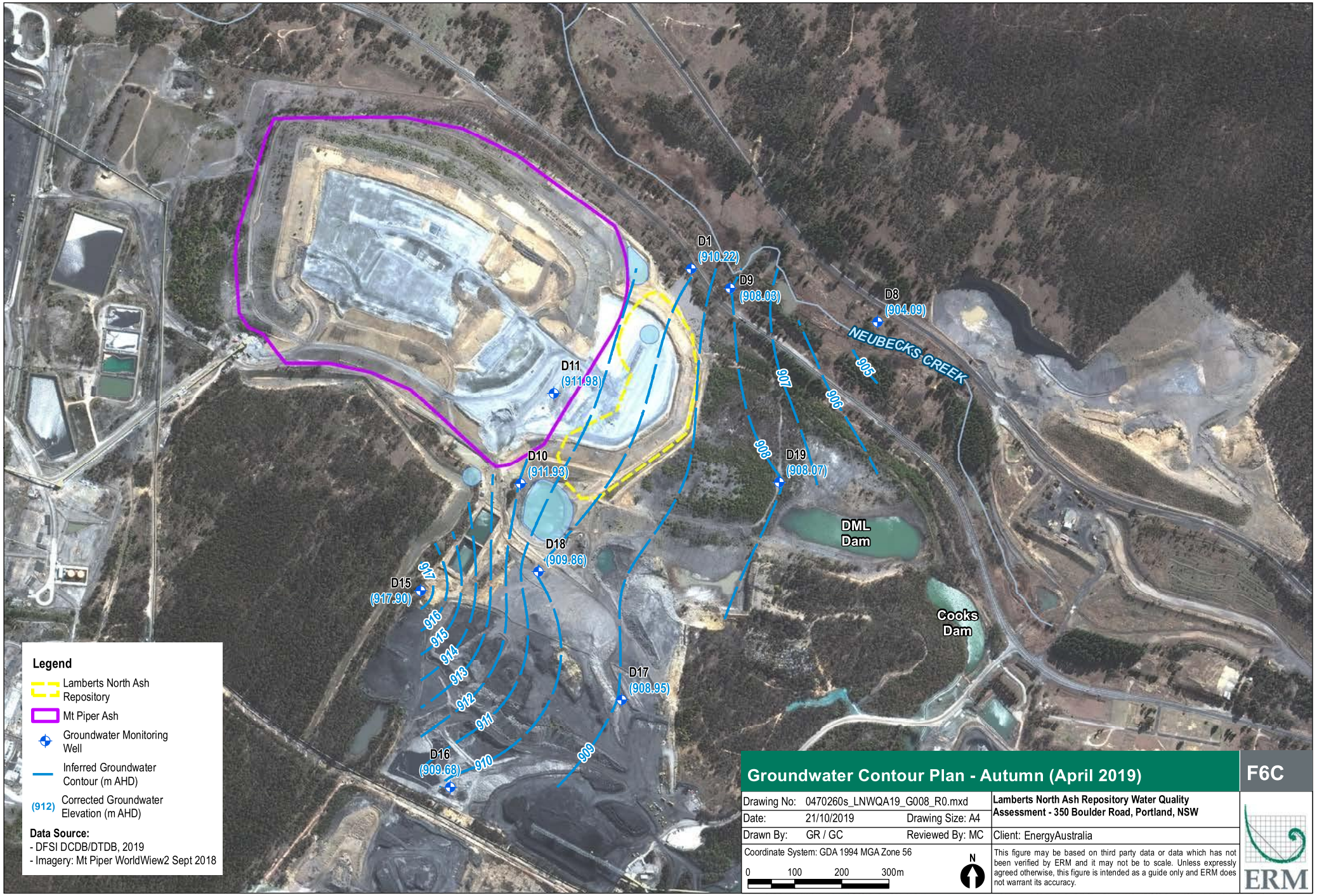
D19
(907.97)
DML
Dam
D18
(909.56)
D15
(919.10)
Cooks
Dam
D17
(909.25)
D16
(909.28)
918
917
916
915
914
913
912
911
910
909
908
907
906
905
Legend
Lamberts North Ash Repository
Mt Piper Ash
Groundwater Monitoring Well
Inferred Groundwater Contour (m AHD)
(912) Corrected Groundwater Elevation (m AHD)
Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018
Groundwater Contour Plan - Summer (January 2019)
F6B
Drawing No: 0470260s_LNWQA19_G007_R0.mxd
Date: 21/10/2019
Drawing Size: A4
Drawn By: GR / GC
Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
0 100 200 300m
N
Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW
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


D1
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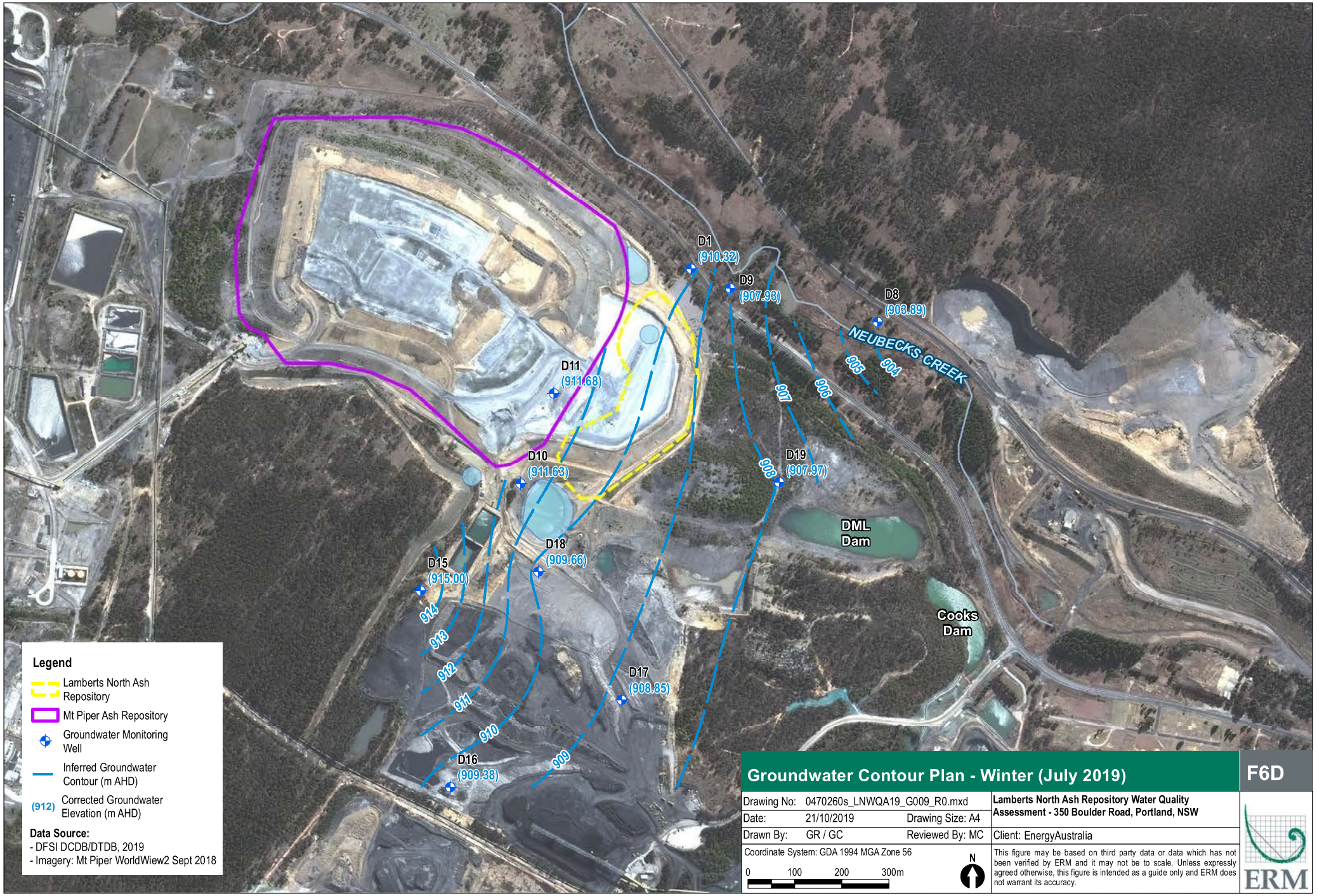
D9
(908.03)
D8
(904.09)
NEUBECKS CREEK
D11
(911.98)
D10
(911.93)
D19
(908.07)
DML
Dam
D18
(909.86)
D15
(917.90)
Cooks
Dam
D17
(908.95)
D16
(909.68)
905
906
907
908
909
910
911
912
913
914
915
916
917
Legend
Lamberts North Ash Repository
Mt Piper Ash
Groundwater Monitoring Well
Inferred Groundwater Contour (m AHD)
(912) Corrected Groundwater Elevation (m AHD)
Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018
Groundwater Contour Plan - Autumn (April 2019)
F6C
Drawing No: 0470260s_LNWQA19_G008_R0.mxd
Date: 21/10/2019
Drawing Size: A4
Drawn By: GR / GC
Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
0 100 200 300m
N
Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW
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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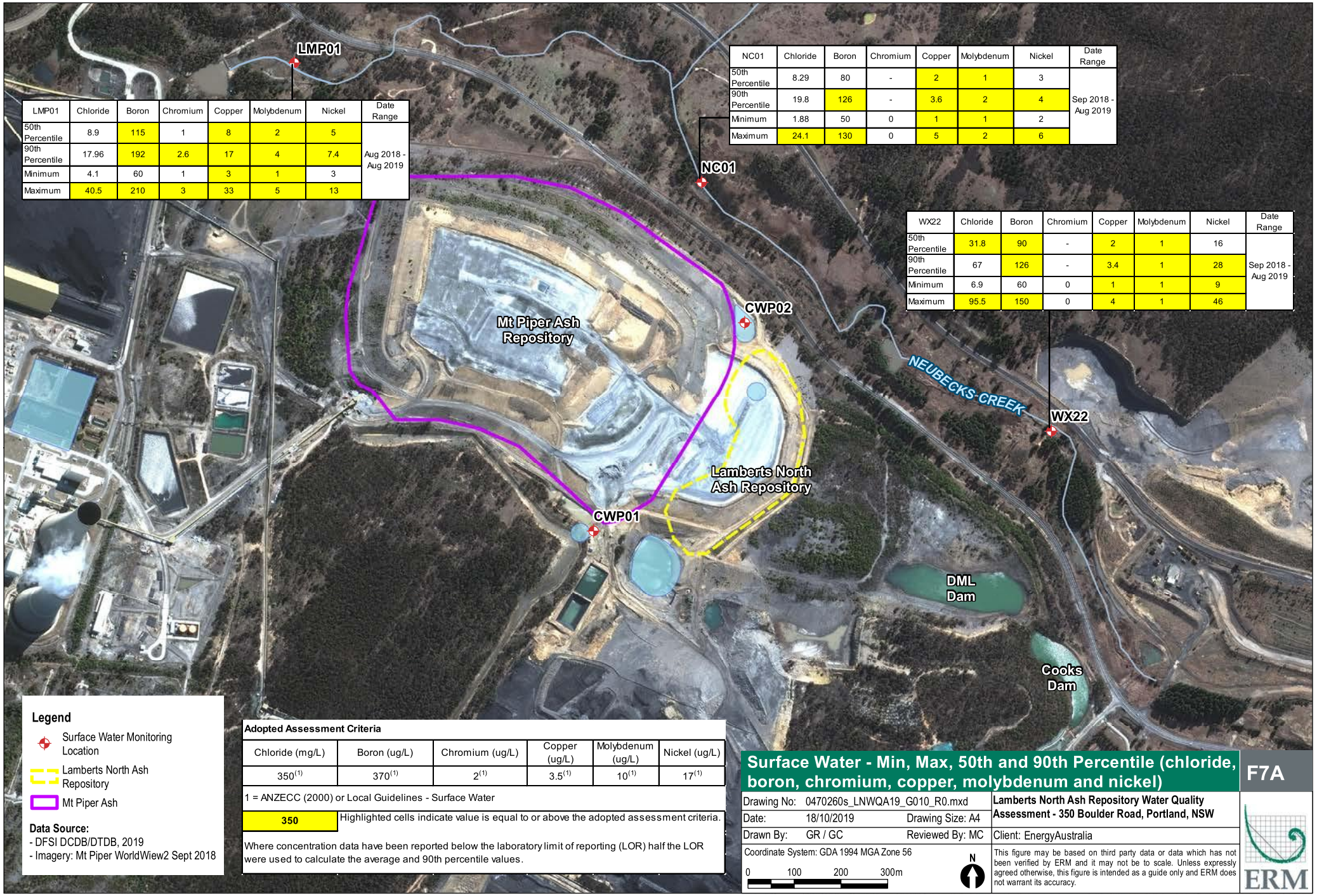
D8
(903.89)
NEUBECKS CREEK
905
904
907
906
D11
(911.68)
D10
(911.63)
D19
(907.97)
903
DML
Dam
D18
(909.66)
D15
(915.00)
914
913
912
911
910
909
Cooks
Dam
D17
(908.85)
D16
(909.38)
Legend
Lamberts North Ash Repository
Mt Piper Ash Repository
Groundwater Monitoring Well
Inferred Groundwater Contour (m AHD)
(912) Corrected Groundwater Elevation (m AHD)
Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018
Groundwater Contour Plan - Winter (July 2019)
F6D
Drawing No: 0470260s_LNWQA19_G009_R0.mxd
Date: 21/10/2019
Drawing Size: A4
Drawn By: GR / GC
Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56
0 100 200 300m
N
Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW
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



LMP01	Chloride	Boron	Chromium	Copper	Molybdenum	Nickel	Date Range
50th Percentile	8.9	115	1	8	2	5	Aug 2018 - Aug 2019
90th Percentile	17.96	192	2.6	17	4	7.4	
Minimum	4.1	60	1	3	1	3	
Maximum	40.5	210	3	33	5	13	

NC01	Chloride	Boron	Chromium	Copper	Molybdenum	Nickel	Date Range
50th Percentile	8.29	80	-	2	1	3	Sep 2018 - Aug 2019
90th Percentile	19.8	126	-	3.6	2	4	
Minimum	1.88	50	0	1	1	2	
Maximum	24.1	130	0	5	2	6	

WX22	Chloride	Boron	Chromium	Copper	Molybdenum	Nickel	Date Range
50th Percentile	31.8	90	-	2	1	16	Sep 2018 - Aug 2019
90th Percentile	67	126	-	3.4	1	28	
Minimum	6.9	60	0	1	1	9	
Maximum	95.5	150	0	4	1	46	

Legend

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

Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018

Adopted Assessment Criteria

Chloride (mg/L)	Boron (ug/L)	Chromium (ug/L)	Copper (ug/L)	Molybdenum (ug/L)	Nickel (ug/L)
350(1)	370(1)	2(1)	3.5(1)	10(1)	17(1)

1 = ANZECC (2000) or Local Guidelines - Surface Water

350 Highlighted cells indicate value is equal to or above 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.

Surface Water - Min, Max, 50th and 90th Percentile (chloride, boron, chromium, copper, molybdenum and nickel)

F7A

Drawing No:	0470260s_LNWQA19_G010_R0.mxd		
Date:	18/10/2019	Drawing Size: A4	
Drawn By:	GR / GC	Reviewed By: MC	

Coordinate System: GDA 1994 MGA Zone 56

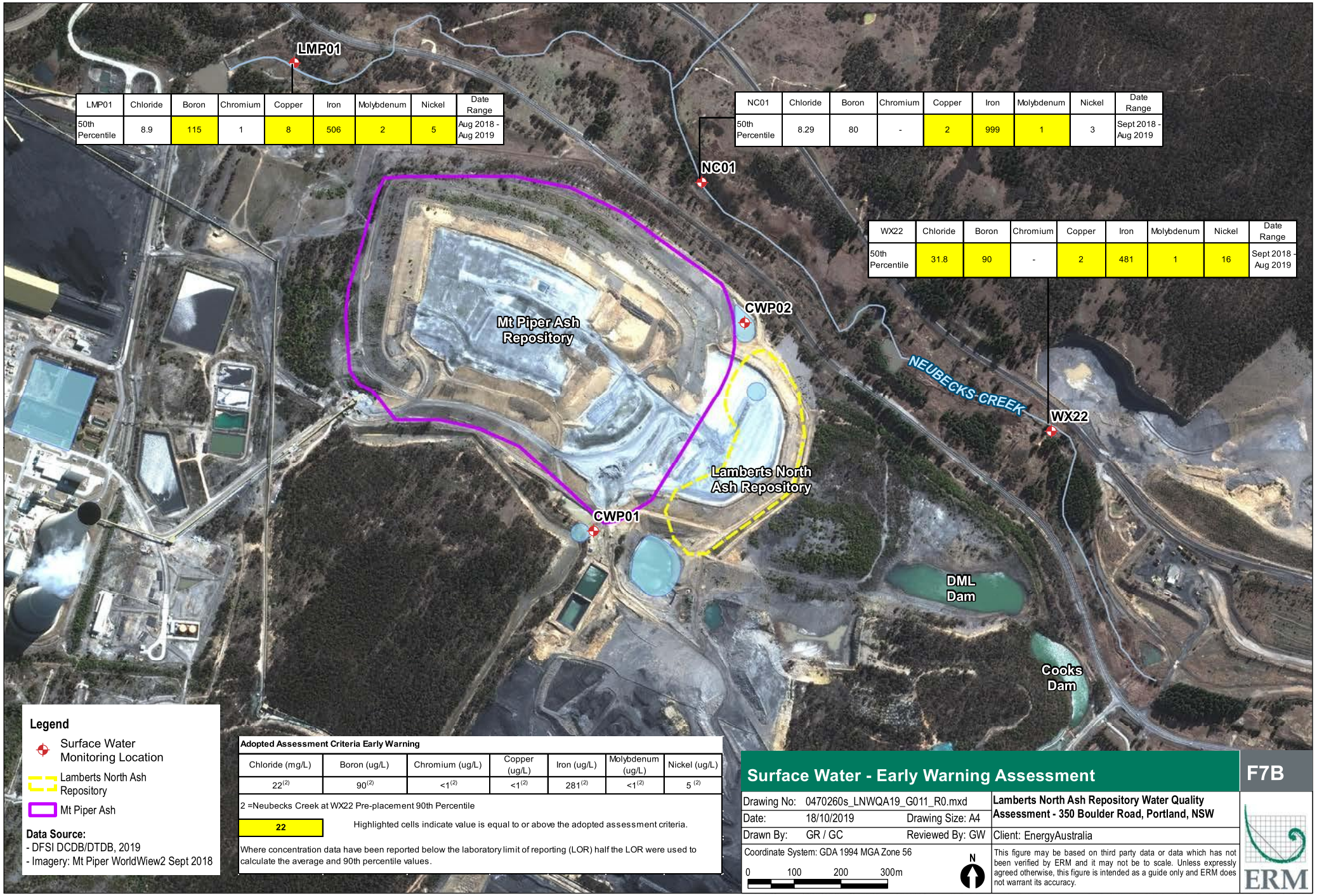
0 100 200 300m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

ERM



LMP01	Chloride	Boron	Chromium	Copper	Iron	Molybdenum	Nickel	Date Range
50th Percentile	8.9	115	1	8	506	2	5	Aug 2018 - Aug 2019

NC01	Chloride	Boron	Chromium	Copper	Iron	Molybdenum	Nickel	Date Range
50th Percentile	8.29	80	-	2	999	1	3	Sept 2018 - Aug 2019

WX22	Chloride	Boron	Chromium	Copper	Iron	Molybdenum	Nickel	Date Range
50th Percentile	31.8	90	-	2	481	1	16	Sept 2018 - Aug 2019

Legend

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

Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018

Adopted Assessment Criteria Early Warning

Chloride (mg/L)	Boron (ug/L)	Chromium (ug/L)	Copper (ug/L)	Iron (ug/L)	Molybdenum (ug/L)	Nickel (ug/L)
22(2)	90(2)	<1(2)	<1(2)	281(2)	<1(2)	5(2)

2 =Neubecks Creek at WX22 Pre-placement 90th Percentile

22 Highlighted cells indicate value is equal to or above 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.

Surface Water - Early Warning Assessment

F7B

Drawing No:	0470260s_LNWQA19_G011_R0.mxd		
Date:	18/10/2019	Drawing Size: A4	
Drawn By:	GR / GC	Reviewed By: GW	

Coordinate System: GDA 1994 MGA Zone 56

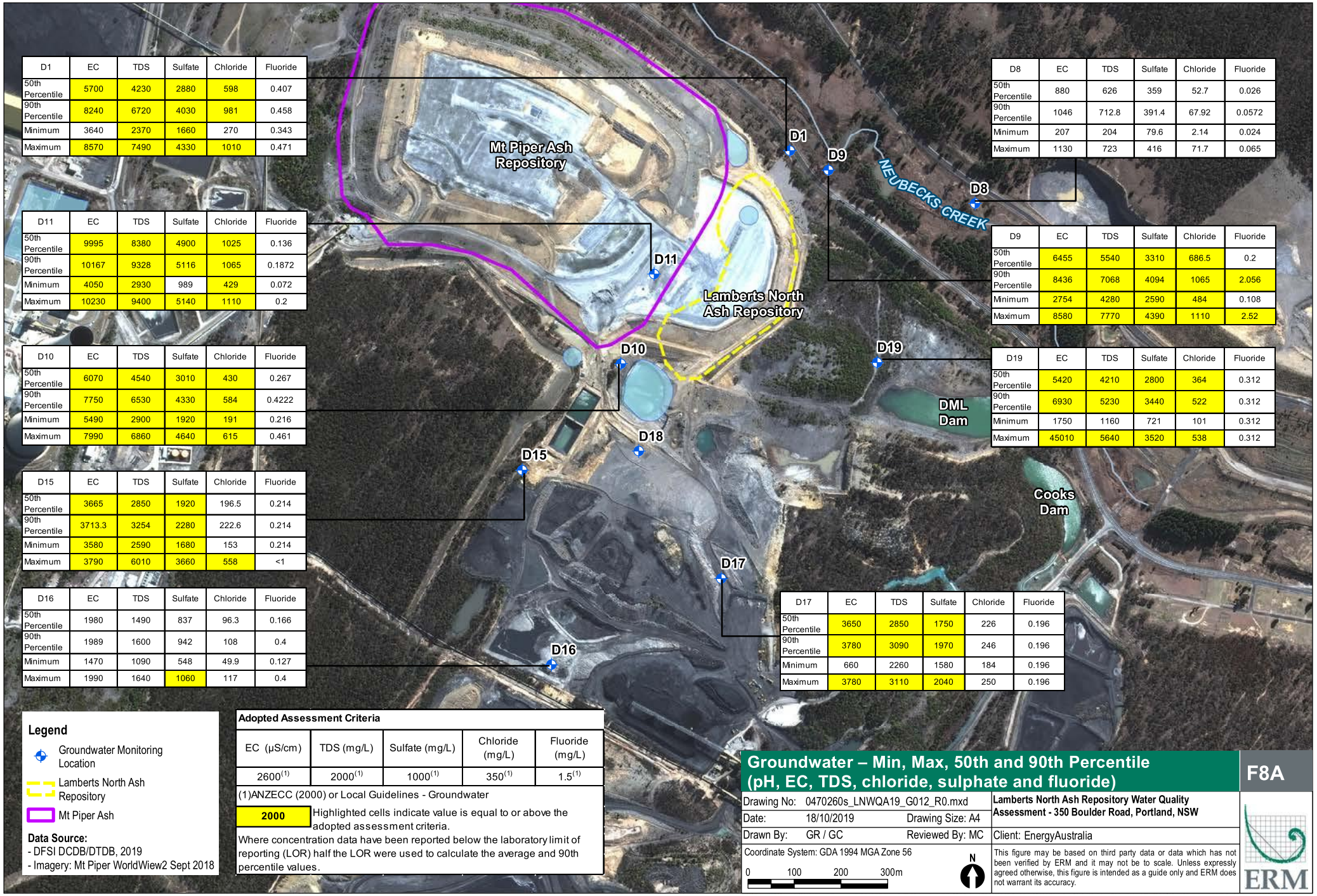
0 100 200 300m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

ERM



D1	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	5700	4230	2880	598	0.407
90th Percentile	8240	6720	4030	981	0.458
Minimum	3640	2370	1660	270	0.343
Maximum	8570	7490	4330	1010	0.471

D8	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	880	626	359	52.7	0.026
90th Percentile	1046	712.8	391.4	67.92	0.0572
Minimum	207	204	79.6	2.14	0.024
Maximum	1130	723	416	71.7	0.065

D11	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	9995	8380	4900	1025	0.136
90th Percentile	10167	9328	5116	1065	0.1872
Minimum	4050	2930	989	429	0.072
Maximum	10230	9400	5140	1110	0.2

D9	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	6455	5540	3310	686.5	0.2
90th Percentile	8436	7068	4094	1065	2.056
Minimum	2754	4280	2590	484	0.108
Maximum	8580	7770	4390	1110	2.52

D10	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	6070	4540	3010	430	0.267
90th Percentile	7750	6530	4330	584	0.4222
Minimum	5490	2900	1920	191	0.216
Maximum	7990	6860	4640	615	0.461

D19	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	5420	4210	2800	364	0.312
90th Percentile	6930	5230	3440	522	0.312
Minimum	1750	1160	721	101	0.312
Maximum	45010	5640	3520	538	0.312

D15	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	3665	2850	1920	196.5	0.214
90th Percentile	3713.3	3254	2280	222.6	0.214
Minimum	3580	2590	1680	153	0.214
Maximum	3790	6010	3660	558	<1

D16	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	1980	1490	837	96.3	0.166
90th Percentile	1989	1600	942	108	0.4
Minimum	1470	1090	548	49.9	0.127
Maximum	1990	1640	1060	117	0.4

D17	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	3650	2850	1750	226	0.196
90th Percentile	3780	3090	1970	246	0.196
Minimum	660	2260	1580	184	0.196
Maximum	3780	3110	2040	250	0.196

Legend

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

Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018

Adopted Assessment Criteria

EC (µS/cm)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)
2600(1)	2000(1)	1000(1)	350(1)	1.5(1)

(1)ANZECC (2000) or Local Guidelines - Groundwater

2000 Highlighted cells indicate value is equal to or above 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, EC, TDS, chloride, sulphate and fluoride)

F8A

Drawing No: 0470260s_LNWQA19_G012_R0.mxd
Date: 18/10/2019 Drawing Size: A4
Drawn By: GR / GC Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56

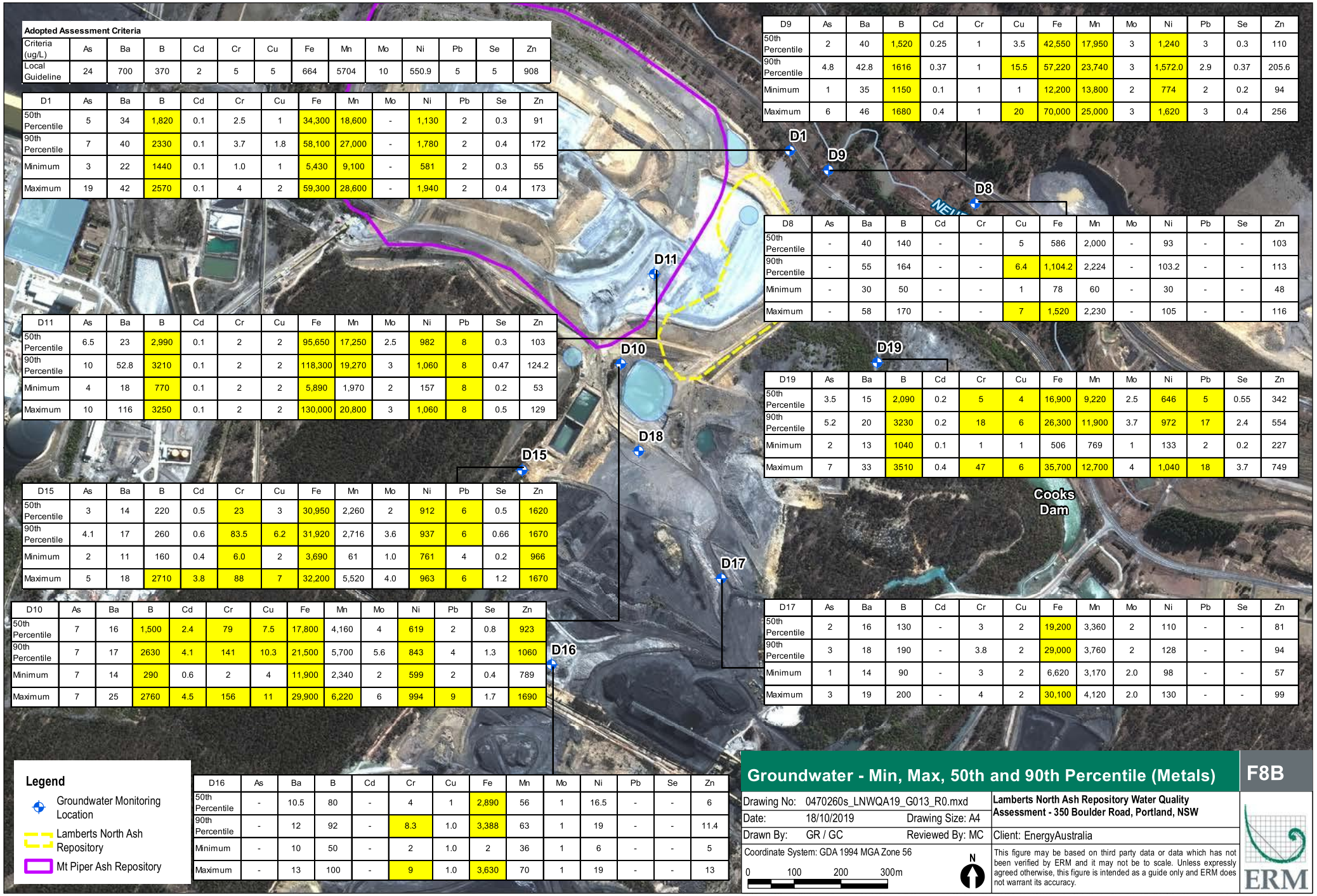
0 100 200 300m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

ERM



Adopted Assessment Criteria

Criteria (ug/L)	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
Local Guideline	24	700	370	2	5	5	664	5704	10	550.9	5	5	908

D1	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	5	34	1,820	0.1	2.5	1	34,300	18,600	-	1,130	2	0.3	91
90th Percentile	7	40	2330	0.1	3.7	1.8	58,100	27,000	-	1,780	2	0.4	172
Minimum	3	22	1440	0.1	1.0	1	5,430	9,100	-	581	2	0.3	55
Maximum	19	42	2570	0.1	4	2	59,300	28,600	-	1,940	2	0.4	173

D9	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	2	40	1,520	0.25	1	3.5	42,550	17,950	3	1,240	3	0.3	110
90th Percentile	4.8	42.8	1616	0.37	1	15.5	57,220	23,740	3	1,572.0	2.9	0.37	205.6
Minimum	1	35	1150	0.1	1	1	12,200	13,800	2	774	2	0.2	94
Maximum	6	46	1680	0.4	1	20	70,000	25,000	3	1,620	3	0.4	256

D8	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	-	40	140	-	-	5	586	2,000	-	93	-	-	103
90th Percentile	-	55	164	-	-	6.4	1,104.2	2,224	-	103.2	-	-	113
Minimum	-	30	50	-	-	1	78	60	-	30	-	-	48
Maximum	-	58	170	-	-	7	1,520	2,230	-	105	-	-	116

D11	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	6.5	23	2,990	0.1	2	2	95,650	17,250	2.5	982	8	0.3	103
90th Percentile	10	52.8	3210	0.1	2	2	118,300	19,270	3	1,060	8	0.47	124.2
Minimum	4	18	770	0.1	2	2	5,890	1,970	2	157	8	0.2	53
Maximum	10	116	3250	0.1	2	2	130,000	20,800	3	1,060	8	0.5	129

D19	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	3.5	15	2,090	0.2	5	4	16,900	9,220	2.5	646	5	0.55	342
90th Percentile	5.2	20	3230	0.2	18	6	26,300	11,900	3.7	972	17	2.4	554
Minimum	2	13	1040	0.1	1	1	506	769	1	133	2	0.2	227
Maximum	7	33	3510	0.4	47	6	35,700	12,700	4	1,040	18	3.7	749

D15	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	3	14	220	0.5	23	3	30,950	2,260	2	912	6	0.5	1620
90th Percentile	4.1	17	260	0.6	83.5	6.2	31,920	2,716	3.6	937	6	0.66	1670
Minimum	2	11	160	0.4	6.0	2	3,690	61	1.0	761	4	0.2	966
Maximum	5	18	2710	3.8	88	7	32,200	5,520	4.0	963	6	1.2	1670

D10	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	7	16	1,500	2.4	79	7.5	17,800	4,160	4	619	2	0.8	923
90th Percentile	7	17	2630	4.1	141	10.3	21,500	5,700	5.6	843	4	1.3	1060
Minimum	7	14	290	0.6	2	4	11,900	2,340	2	599	2	0.4	789
Maximum	7	25	2760	4.5	156	11	29,900	6,220	6	994	9	1.7	1690

D17	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	2	16	130	-	3	2	19,200	3,360	2	110	-	-	81
90th Percentile	3	18	190	-	3.8	2	29,000	3,760	2	128	-	-	94
Minimum	1	14	90	-	3	2	6,620	3,170	2.0	98	-	-	57
Maximum	3	19	200	-	4	2	30,100	4,120	2.0	130	-	-	99

D16	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	-	10.5	80	-	4	1	2,890	56	1	16.5	-	-	6
90th Percentile	-	12	92	-	8.3	1.0	3,388	63	1	19	-	-	11.4
Minimum	-	10	50	-	2	1.0	2	36	1	6	-	-	5
Maximum	-	13	100	-	9	1.0	3,630	70	1	19	-	-	13

Legend

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

Groundwater - Min, Max, 50th and 90th Percentile (Metals)

F8B

Drawing No: 0470260s_LNWQA19_G013_R0.mxd
Date: 18/10/2019 Drawing Size: A4
Drawn By: GR / GC Reviewed By: MC
Coordinate System: GDA 1994 MGA Zone 56

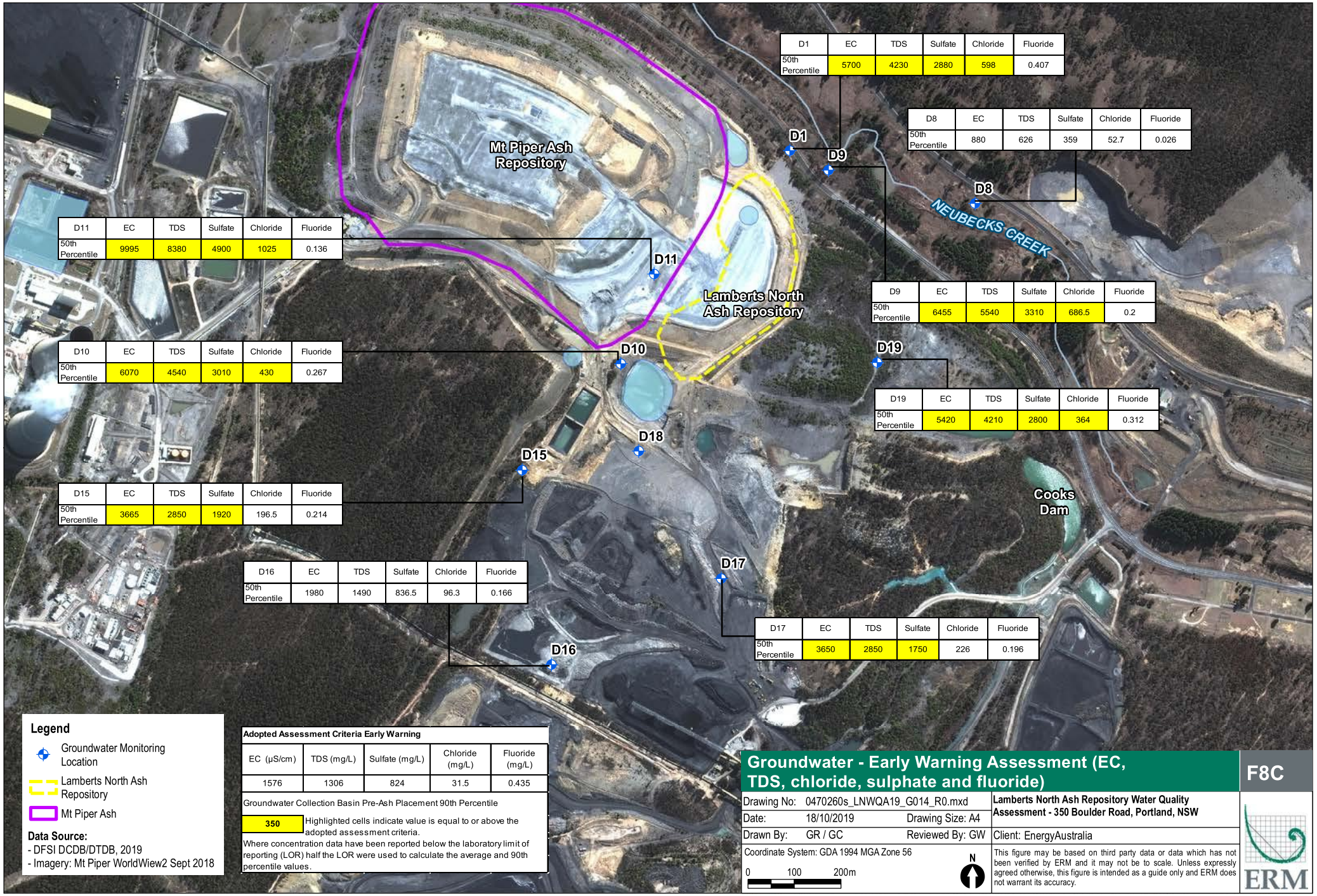
0 100 200 300m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

ERM



D1	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	5700	4230	2880	598	0.407

D8	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	880	626	359	52.7	0.026

D11	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	9995	8380	4900	1025	0.136

D9	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	6455	5540	3310	686.5	0.2

D10	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	6070	4540	3010	430	0.267

D19	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	5420	4210	2800	364	0.312

D15	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	3665	2850	1920	196.5	0.214

D16	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	1980	1490	836.5	96.3	0.166

D17	EC	TDS	Sulfate	Chloride	Fluoride
50th Percentile	3650	2850	1750	226	0.196

Legend

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

Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018

Adopted Assessment Criteria Early Warning

EC (µS/cm)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)
1576	1306	824	31.5	0.435

Groundwater Collection Basin Pre-Ash Placement 90th Percentile

350 Highlighted cells indicate value is equal to or above 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 - Early Warning Assessment (EC, TDS, chloride, sulphate and fluoride)

F8C

Drawing No:	0470260s_LNWQA19_G014_R0.mxd		
Date:	18/10/2019	Drawing Size: A4	
Drawn By:	GR / GC	Reviewed By: GW	

Coordinate System: GDA 1994 MGA Zone 56

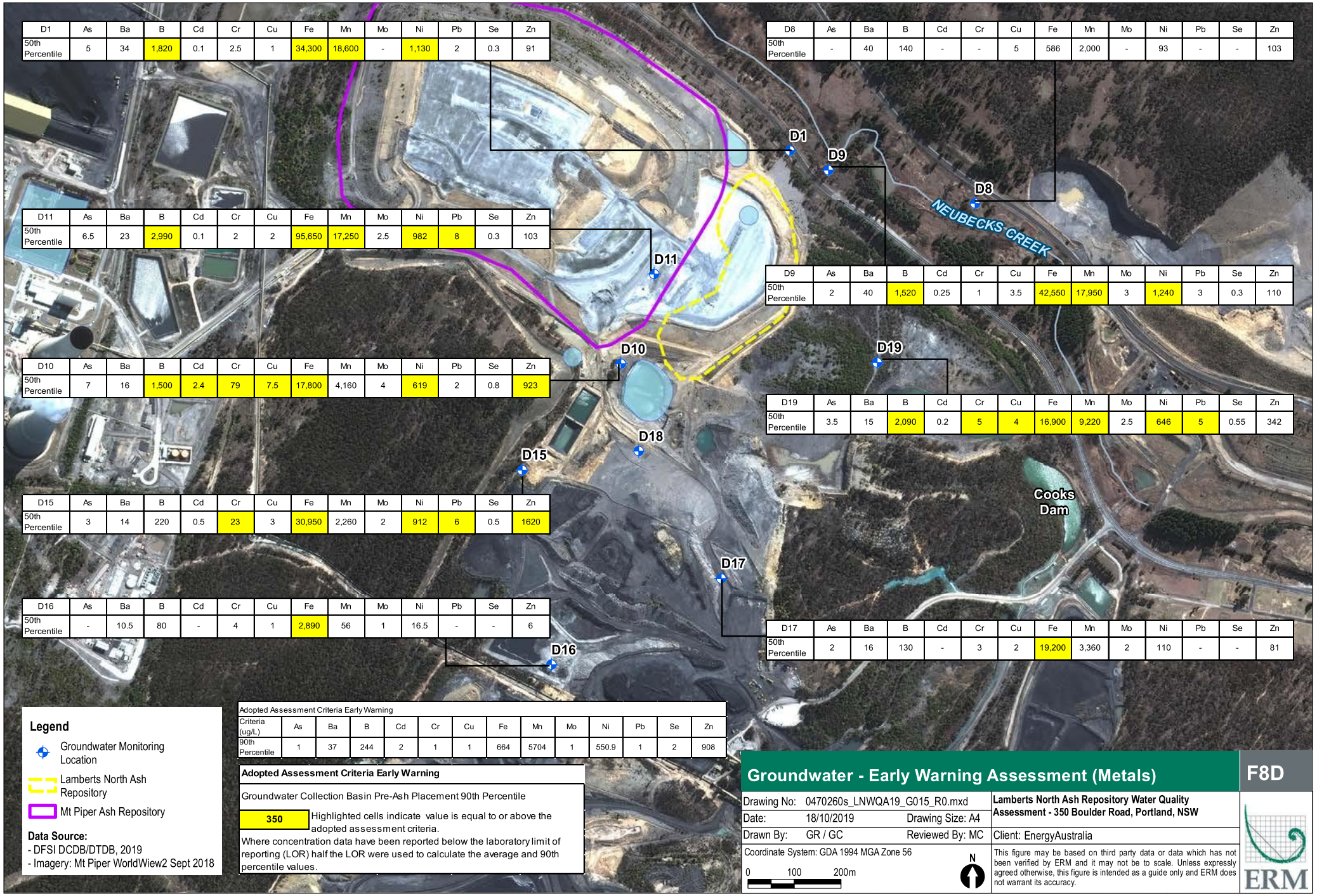
0 100 200m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

ERM



D1	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	5	34	1,820	0.1	2.5	1	34,300	18,600	-	1,130	2	0.3	91

D8	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	-	40	140	-	-	5	586	2,000	-	93	-	-	103

D11	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	6.5	23	2,990	0.1	2	2	95,650	17,250	2.5	982	8	0.3	103

D9	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	2	40	1,520	0.25	1	3.5	42,550	17,950	3	1,240	3	0.3	110

D10	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	7	16	1,500	2.4	79	7.5	17,800	4,160	4	619	2	0.8	923

D19	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	3.5	15	2,090	0.2	5	4	16,900	9,220	2.5	646	5	0.55	342

D15	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	3	14	220	0.5	23	3	30,950	2,260	2	912	6	0.5	1620

D17	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	2	16	130	-	3	2	19,200	3,360	2	110	-	-	81

D16	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
50th Percentile	-	10.5	80	-	4	1	2,890	56	1	16.5	-	-	6

Legend

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

Data Source:
- DFSI DCDB/DTDB, 2019
- Imagery: Mt Piper WorldWiew2 Sept 2018

Adopted Assessment Criteria Early Warning

Criteria (ug/L)	As	Ba	B	Cd	Cr	Cu	Fe	Mn	Mo	Ni	Pb	Se	Zn
90th Percentile	1	37	244	2	1	1	664	5704	1	550.9	1	2	908

Adopted Assessment Criteria Early Warning

Groundwater Collection Basin Pre-Ash Placement 90th Percentile

350 Highlighted cells indicate value is equal to or above 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 - Early Warning Assessment (Metals)

F8D

Drawing No:	0470260s_LNWQA19_G015_R0.mxd		
Date:	18/10/2019	Drawing Size: A4	
Drawn By:	GR / GC	Reviewed By: MC	

Coordinate System: GDA 1994 MGA Zone 56

0 100 200m

N

Lamberts North Ash Repository Water Quality Assessment - 350 Boulder Road, Portland, NSW

Client: EnergyAustralia

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 27 September 2019 and 17 October 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

Tabulated Surface Water Data

ERM

				Field Parameters					Major Anions and Cations																Minor Anions and Cation
				Dissolved Oxygen (Field)	Electrical Conductivity (Field)	pH (Field)	Redox (Field)	Temperature (Field)	Bicarbonate Alkalinity (as CaCO3)	Anions (Total)	Calcium	Calcium (Filtered)	Chloride	Carbonate Alkalinity (as CaCO3)	Cations (Total)	Hydroxide Alkalinity (as CaCO3)	Magnesium	Magnesium (Filtered)	Phenolphthalein Alkalinity (CaCO3)	Potassium	Potassium (Filtered)	Sodium	Sodium (Filtered)	Sulfate (as SO4)	Sulfate (as SO4) (Filtered)	Silica, Molybdate Reactive (Dissolved)	Bromide	
				mg/L	uS/cm	pH units	mV	oC	mg/L	meq/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg
EQL									1	0.01		1	1	1	0.01	1		1			1		1			0.01	0
ANZECC (2000) or Local Guidelines - Surface Water					2200	6.5-8							350										1000	1000			1
Neubecks Creek at WX22 Pre-placement 90th Percentile					894	6.7-7.8							22										332	332			0.3
Field_ID	**LocCode**	**WellCode**	**Sampled_Date-Time**																								
	LDP01			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1 Final Holding Pond	LDP01		28/08/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	59	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		28/08/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	58	-	-	-	
1 Final Holding Pond	LDP01		4/09/2018	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	61	-	2400	-	
2 Downstream Final Holding Pond	LDP6-1		4/09/2018	-	-	-	-	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-	66	-	-	-	
1 Final Holding Pond	LDP01		11/09/2018	-	-	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	45	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		11/09/2018	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	43	-	-	-	
Final Holding Pond	LDP01		17/09/2018	-	-	-	-	-	-	-	18.7	18.8	-	-	-	-	7.29	7.31	-	3.89	3.67	16.6	16.8	-	-	-	-	
1 Final Holding Pond	LDP01		18/09/2018	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	58	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		18/09/2018	-	-	-	-	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-	59	-	-	-	
Final Holding Pond	LDP01		19/09/2018	-	-	-	-	-	-	-	21.9	21.4	-	-	-	-	7.6	7.42	-	3.78	3.57	17.9	17.9	-	-	-	-	
LDP06	LDP6-1		19/09/2018	7.24	0	7.7	173	14.9	88	2.68	-	19	6	<1	2.16	<1	-	6	-	-	3	-	12	-	36	-	0.028	0
LDP6	LDP6-1		20/09/2018	10	261	7.4	-	-	62	-	22.4	-	7.07	-	-	-	8.04	-	<1	3.81	-	18.4	-	47.2	-	-	-	0.1
1 Final Holding Pond	LDP01		25/09/2018	-	-	-	-	-	-	-	-	-	8.6	-	-	-	-	-	-	-	-	-	64	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		25/09/2018	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	-	-	-	-	61	-	-	-	
1 Final Holding Pond	LDP01		3/10/2018	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	93	-	2600	-	
2 Downstream Final Holding Pond	LDP6-1		3/10/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	85	-	-	-	
1 Final Holding Pond	LDP01		9/10/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	67	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		9/10/2018	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	69	-	-	-	
1 Final Holding Pond	LDP01		16/10/2018	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	-	-	-	-	49	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		16/10/2018	-	-	-	-	-	-	-	-	-	8.6	-	-	-	-	-	-	-	-	-	50	-	-	-	
LDP6	LDP6-1		17/10/2018	8.6	231	7.6	-	-	66	-	20.4	-	5.89	-	-	-	7.62	-	<1	3.59	-	13.8	-	44.6	-	-	-	0.
1 Final Holding Pond	LDP01		23/10/2018	-	-	-	-	-	-	-	-	-	8.6	-	-	-	-	-	-	-	-	-	54	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		23/10/2018	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	54	-	-	-	
1 Final Holding Pond	LDP01		30/10/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	65	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		30/10/2018	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	62	-	-	-	
1 Final Holding Pond	LDP01		6/11/2018	-	-	-	-	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-	66	-	2900	-	
2 Downstream Final Holding Pond	LDP6-1		6/11/2018	-	-	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-	-	64	-	-	-	
1 Final Holding Pond	LDP01		13/11/2018	-	-	-	-	-	-	-	-	-	8.7	-	-	-	-	-	-	-	-	-	58	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		13/11/2018	-	-	-	-	-	-	-	-	-	9.4	-	-	-	-	-	-	-	-	-	56	-	-	-	
1 Final Holding Pond	LDP01		20/11/2018	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	70	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		20/11/2018	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	72	-	-	-	
LDP6	LDP6-1		22/11/2018	4.9	347	6.9	-	-	112	-	29.8	-	5.15	-	-	-	11.7	-	<1	4.23	-	23.4	-	54.8	-	-	-	0.2
1 Final Holding Pond	LDP01		27/11/2018	-	-	-	-	-	-	-	-	-	7.4	-	-	-	-	-	-	-	-	-	62	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		27/11/2018	-	-	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-	-	59	-	-	-	
1 Final Holding Pond	LDP01		4/12/2018	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	48	-	4800	-	
2 Downstream Final Holding Pond	LDP6-1		4/12/2018	-	-	-	-	-	-	-	-	-	7.4	-	-	-	-	-	-	-	-	-	49	-	-	-	
1 Final Holding Pond	LDP01		11/12/2018	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	90	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		11/12/2018	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	110	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		13/12/2018	6.5	390	7.3	-	-	85	-	30.9	-	7.97	-	-	-	17.3	-	<1	5.78	-	24.4	-	84.6	-	-	-	0.1
1 Final Holding Pond	LDP01		18/12/2018	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	67	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		18/12/2018	-	-	-	-	-	-	-	-	-	7.7	-	-	-	-	-	-	-	-	-	65	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		19/12/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1 Final Holding Pond	LDP01		24/12/2018	-	-	-	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	52	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		24/12/2018	-	-	-	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	50	-	-	-	
1 Final Holding Pond	LDP01		2/01/2019	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	80	-	3800	-	
2 Downstream Final Holding Pond	LDP6-1		2/01/2019	-	-	-	-	-	-	-	-	-	9.8	-	-	-	-	-	-	-	-	-	70	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		3/01/2019	6.5	390	7.3	-	-	85	-	30.9	-	7.97	-	-	-	17.3	-	<1	5.78	-	24.4	-	84.6	-	-	-	0.1
2 Downstream Final Holding Pond	LDP6-1		4/01/2019	-	-	-	-	-	-	-	-	-	9.8	-	-	-	-	-	-	-	-	-	70	-	-	-	
1 Final Holding Pond	LDP01		8/01/2019	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	76	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		8/01/2019	-	-	-	-	-	-	-	-	-	5.6	-	-	-	-	-	-	-	-	-	77	-	-	-	
1 Final Holding Pond	LDP01		15/01/2019	-	-	-	-	-	-	-	-	-	8.4	-	-	-	-	-	-	-	-	-	45	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		15/01/2019	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	42	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		16/01/2019	6	229	7.3	-	-	60	-	21.5	-	4.54	-	-	-	9.39	-	<1	4.77	-	12.2	-	37	-	-	-	0.0
2 Downstream Final Holding Pond	LDP6-1		17/01/2019	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	42	-	-	-	
1 Final Holding Pond	LDP01		22/01/2019	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	47	-	-	-	

ERM

				Field Parameters					Major Anions and Cations																Minor Anions and Cation		
				Dissolved Oxygen (Field)	Electrical Conductivity (Field)	pH (Field)	Redox (Field)	Temperature (Field)	Bicarbonate Alkalinity (as CaCO3)	Anions (Total)	Calcium	Calcium (Filtered)	Chloride	Carbonate Alkalinity (as CaCO3)	Cations (Total)	Hydroxide Alkalinity (as CaCO3)	Magnesium	Magnesium (Filtered)	Phenolphthalein Alkalinity (CaCO3)	Potassium	Potassium (Filtered)	Sodium	Sodium (Filtered)	Sulfate (as SO4)	Sulfate (as SO4) (Filtered)	Silica, Molybdate Reactive (Dissolved)	Bromide	
				mg/L	uS/cm	pH units	mV	oC	mg/L	meq/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg
EQL									1	0.01		1	1	1	0.01	1		1			1			1		0.01	0
ANZECC (2000) or Local Guidelines - Surface Water					2200	6.5-8							350											1000	1000			1
Neubecks Creek at WX22 Pre-placement 90th Percentile					894	6.7-7.8							22											332	332			0.3
Field_ID	**LocCode**	**WellCode**	**Sampled_Date-Time**																										
1 Final Holding Pond	LDP01		7/05/2019	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	100	-	4400	-	
1 Final Holding Pond	LDP01		14/05/2019	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	130	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		14/05/2019	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	120	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		15/05/2019	12	451	7.5	-	-	63	-	26.7	-	14	-	-	-	13.8	-	<1	6.79	-	45	-	120	-	-	-	0.1
1 Final Holding Pond	LDP01		21/05/2019	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	92	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		21/05/2019	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	110	-	-	-	
1 Final Holding Pond	LDP01		28/05/2019	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	79	-	-	-	
2 Downstream Final Holding Pond	LDP6-1		28/05/2019	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	77	-	-	-	
1 Final Holding Pond	LDP01		4/06/2019	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	80	-	<2500	-	
2 Downstream Final Holding Pond	LDP6-1		20/06/2019	12.6	409	7.2	-	-	57	-	20.6	-	17.8	-	-	-	10.7	-	<1	5.88	-	45	-	103	-	-	-	0.1
2 Downstream Final Holding Pond	LDP01		18/07/2019	12.4	980	6.8	-	-	71	-	39.2	-	40.5	-	-	-	20.2	-	<1	10.6	-	151	-	340	-	-	-	0.
2 Downstream Final Holding Pond	LDP01		22/07/2019	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	230	-	-	-	
2 Downstream Final Holding Pond	LDP01		22/08/2019	8.7	624	7.5	-	-	78	-	27.3	-	23.3	-	-	-	13.9	-	<1	7.66	-	83.6	-	189	-	-	-	0.2
2 Downstream Final Holding Pond	LDP01		27/08/2019	-	-	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	230	-	-	-	
		Count Detects		**15**	**15**	**15.0**	**1**	**1**	**15**	**1**	**16**	**3**	**83**	**0**	**1**	**0**	**16**	**3**	**0**	**16**	**3**	**16**	**3**	**82**	**1**	**7**	**1**	**1**
		Average		**8.202667**	**400**	**7.3**	**173**	**14.9**	**81.33333**	**2.68**	**27.15625**	**19.73333**	**10.96301**	**-**	**2.16**	**-**	**13.59563**	**6.91**	**-**	**5.73**	**3.413333**	**37.49375**	**15.56667**	**81.93537**	**36**	**3785.714**	**0.028**	**0.1**
		50th Percentile		**7.24**	**390**	**7.3**	**173**	**14.9**	**76**	**2.68**	**27**	**19**	**8.9**	**-**	**2.16**	**-**	**12.75**	**7.31**	**-**	**5.445**	**3.57**	**23.9**	**16.8**	**66.5**	**36**	**3800**	**0.028**	**0.1**
		90th Percentile		**12.24**	**628**	**7.6**	**173**	**14.9**	**113.2**	**2.68**	**37**	**20.92**	**17.96**	**-**	**2.16**	**-**	**20.5**	**7.398**	**-**	**8.06**	**3.65**	**70.3**	**17.68**	**129**	**36**	**5120**	**0.028**	**0.2**
		Minimum		**4.9**	**0**	**6.8**	**173**	**14.9**	**57**	**2.68**	**18.7**	**18.8**	**4.1**	**0**	**2.16**	**0**	**7.29**	**6**	**0**	**3.59**	**3**	**12.2**	**12**	**13**	**36**	**2400**	**0.028**	**0.0**
		Maximum		**12.6**	**980**	**7.7**	**173**	**14.9**	**143**	**2.68**	**39.9**	**21.4**	**40.5**	**0**	**2.16**	**0**	**26.5**	**7.42**	**0**	**10.6**	**3.67**	**151**	**17.9**	**340**	**36**	**5600**	**0.028**	**0.2**
219 Neubecks Creek	NC01		20/09/2018	6.2	263	7.0	-	-	82	-	21.8	-	7.16	-	-	-	9.34	-	<1	3.63	-	17.7	-	39.1	-	-	-	0.1
219 Neubecks Creek	NC01		17/10/2018	5.9	267	6.7	-	-	86	-	22.5	-	7.73	-	-	-	9.39	-	<1	3.72	-	15.7	-	40.1	-	-	-	0.
219 Neubecks Creek	NC01		21/11/2018	5.6	306	7.1	-	-	130	-	26	-	6.51	-	-	-	11.2	-	<1	3.92	-	20.7	-	27.1	-	-	-	0.1
219 Neubecks Creek	NC01		13/12/2018	4.1	238	6.9	-	-	89	-	22.3	-	3.99	-	-	-	9.41	-	<1	3.76	-	13.9	-	21.2	-	-	-	0.1
219 Neubecks Creek	NC01		16/01/2019	4.7	211	7.1	-	-	88	-	22.2	-	1.88	-	-	-	9.12	-	<1	3.22	-	11.2	-	15.3	-	-	-	0.1
219 Neubecks Creek	NC01		20/02/2019	5.2	318	7.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
219 Neubecks Creek	NC01		27/03/2019	5.6	479	7.3	-	-	152	-	40	-	11	-	-	-	21.6	-	<1	6.54	-	33.7	-	79	-	-	-	0.2
219 Neubecks Creek	NC01		17/04/2019	5.8	306	7.1	-	-	99	-	26.5	-	8.29	-	-	-	13.2	-	<1	5.18	-	20.2	-	34	-	-	-	0.1
219 Neubecks Creek	NC01		15/05/2019	8.9	387	7.2	-	-	74	-	26.3	-	13.3	-	-	-	13.8	-	<1	5.78	-	33.8	-	86.2	-	-	-	0.
219 Neubecks Creek	NC01		20/06/2019	11.8	370	6.8	-	-	62	-	20.9	-	16.5	-	-	-	10.8	-	<1	4.83	-	36.1	-	82.2	-	-	-	0.
219 Neubecks Creek	NC01		17/07/2019	10.3	490	7.6	-	-	72	-	25.6	-	19.8	-	-	-	13.1	-	<1	5.76	-	53.3	-	122	-	-	-	0.1
219 Neubecks Creek	NC01		22/08/2019	10.1	607	6.8	-	-	81	-	29.1	-	24.1	-	-	-	14.9	-	<1	6.37	-	72.7	-	175	-	-	-	0.
		Count Detects		**12**	**12**	**12.0**	**0**	**0**	**11**	**0**	**11**	**0**	**11**	**0**	**0**	**0**	**11**	**0**	**0**	**11**	**0**	**11**	**0**	**11**	**0**	**0**	**0**	**1**
		Average		**7.016667**	**354**	**7.1**	**-**	**-**	**92.27273**	**-**	**25.74545**	**-**	**10.93273**	**-**	**-**	**-**	**12.35091**	**-**	**-**	**4.791818**	**-**	**29.90909**	**-**	**65.56364**	**-**	**-**	**-**	**0.17**
		50th Percentile		**5.85**	**312**	**7.1**	**-**	**-**	**86**	**-**	**25.6**	**-**	**8.29**	**-**	**-**	**-**	**11.2**	**-**	**-**	**4.83**	**-**	**20.7**	**-**	**40.1**	**-**	**-**	**-**	**0.1**
		90th Percentile		**10.28**	**489**	**7.3**	**-**	**-**	**130**	**-**	**29.1**	**-**	**19.8**	**-**	**-**	**-**	**14.9**	**-**	**-**	**6.37**	**-**	**53.3**	**-**	**122**	**-**	**-**	**-**	**0.2**
		Minimum		**4.1**	**211**	**6.7**	**0**	**0**	**62**	**0**	**20.9**	**0**	**1.88**	**0**	**0**	**0**	**9.12**	**0**	**0**	**3.22**	**0**	**11.2**	**0**	**15.3**	**0**	**0**	**0**	**0.**
		Maximum		**11.8**	**607**	**7.6**	**0**	**0**	**152**	**0**	**40**	**0**	**24.1**	**0**	**0**	**0**	**21.6**	**0**	**0**	**6.54**	**0**	**72.7**	**0**	**175**	**0**	**0**	**0**	**0.**
3 Stream Gauge	WX22		26/09/2018	11.1	498	6.8	-	8.7	55	-	31.5	-	28.6	-	-	-	20.7	-	<1	4.84	-	33.7	-	151	-	-	-	<0
3 Stream Gauge	WX22		24/10/2018	9.6	357	7.0	-	13.2	81	-	24.9	-	13.3	-	-	-	14.6	-	<1	5.37	-	26.8	-	73.6	-	-	-	0.1
3 Stream Gauge	WX22		28/11/2018	9.7	304	7.0	-	13.3	52	-	20.9	-	14.9	-	-	-	12.8	-	<1	3.96	-	18	-	71.4	-	-	-	0
3 Stream Gauge	WX22		19/12/2018	8.5	379	7.4	-	19.1	112	-	29.2	-	10.4	-	-	-	17.4	-	<1	2.8	-	27.3	-	63.7	-	-	-	0.1
3 Stream Gauge	WX22		23/01/2019	7.9	272	7.4	-	20.3	84	-	22.8	-	6.9	-	-	-	11.3	-	<1	3.18	-	15.4	-	37.9	-	-	-	0.1
3 Stream Gauge	WX22		13/03/2019	9.3	621	7.4	-	13.8	146	-	48.6	-	31.8	-	-	-	29.3	-	<1	4.68	-	42.7	-	118	-	-	-	0.1
3 Stream Gauge	WX22		11/04/2019	10.4	610	7.1	-	20.2	111	-	45.8	-	35.9	-	-	-	29.5	-	<1	7.59	-	53.9	-	124	-	-	-	0.1
3 Stream Gauge	WX22		22/05/2019	13.1	594	7.6	-	7.9	103	-	40.9	-	40.8	-	-	-	26.2	-	<1	6.09	-	45.2	-	159	-	-	-	0.2
3 Stream Gauge	WX22		26/06/2019	14.8	549	7.3	-	6.8	74	-	34.5	-	33.7	-	-	-	21.7	-	<1	5.36	-	46.2	-	129	-	-	-	0.1
3 Stream Gauge	WX22		24/07/2019	13.4	880	7.7	-	4.5	76	-	55.3	-	67	-	-	-	38	-	<1	6.86	-	80.2	-	264	-	-	-	<0
3 Stream Gauge	WX22		28/08/2019	12.9	1240	7.0	-	6.8	68	-	76.6	-	95.5	-	-	-	52.3	-	<1	10	-	107	-	429	-	-	-	1
		Count Detects		**11**	**11**	**11.0**	**0**	**11**	**11**	**0**	**11**	**0**	**11**	**0**	**0**	**0**	**11**	**0**	**0**	**11**	**0**	**11**	**0**	**11**	**0**	**0**	**0**	**5**
		Average		**10.97273**	**573**	**7.2**	**-**	**12.2363636**	**87.45455**	**-**	**39.18182**	**-**	**34.43636**	**-**	**-**	**-**	**24.89091**	**-**	**-**	**5.520909**	**-**	**45.12727**	**-**	**147.3273**	**-**	**-**	**-**	**0.25**
		50th Percentile		**10.4**	**549**	**7.3**	**-**	**13.2**	**81**	**-**	**34.5**	**-**	**31.8**	**-**	**-**	**-**	**21.7**	**-**	**-**	**5.36**	**-**	**42.7**	**-**	**124**	**-**	**-**	**-**	**0.1**
		90th Percentile		**13.4**	**880**	**7.6**	**-**	**20.2**	**112**	**-**	**55.3**	**-**	**67**	**-**	**-**	**-**	**38**	**-**	**-**	**7.59**	**-**	**80.2**	**-**	**264**	**-**	**-**	**-**	**0.4**
		Minimum		**7.9**	**272**	**6.8**	**0**	**4.5**	**52**	**0**	**20.9**	**0**	**6.9**	**0**	**0**	**0**	**11.3**	**0**	**0**	**2.8**	**0**	**15.4**	**0**	**37.9**	**0**	**0**	**0**	**0**
		Maximum		**14.8**	**1240**	**7.7**	**0**	**20.3**	**146**	**0**	**76.6**	**0**	**95.5**	**0**	**0**	**0**	**52.3**	**0**	**0**	**10**	**0**	**107**	**0**	**429**	**0**	**0**	**0**	**1**

ERM

				Nutrients										Metals																	
				Nitrite (as N)	Nitrite + Nitrate (as N)	Nitrogen (N) - Kjeldahl	Nitrogen (N) - Kjeldahl (Filtered)	Nitrogen (N)	Electrical Conductivity (Lab)	pH (Lab)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Turbidity	Aluminium	Aluminium (Filtered)	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Manganese	Manganese (Filtered)
				mg/L	mg/L	mg/L	mg/L	mg/L	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	µg/L	µg/L
EQL				0.01	0.01						10			10	10	1	1	1	50	0.1	1	1	1	50	50	1	1	1
ANZECC (2000) or Local Guidelines - Surface Water										6.5-8	1500					24	700	100	370	0.85	2	3.5	3.5	300	300	5	1900	1900
Neubecks Creek at WX22 Pre-placement 90th Percentile											580					1	29	1	90	1	1	1	1	281	281	1	720	720
Field_ID	**LocCode**	**WellCode**	**Sampled_Date-Time**																											
	LDP01			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		28/08/2018	-	-	-	-	-	300	8.2	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		28/08/2018	-	-	-	-	-	310	8.1	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		4/09/2018	-	-	-	-	-	280	8	140	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		4/09/2018	-	-	-	-	-	290	8	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		11/09/2018	-	-	-	-	-	190	7.9	-	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		11/09/2018	-	-	-	-	-	180	7.9	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Final Holding Pond	LDP01		17/09/2018	-	-	-	-	-	240	7.7	-	-	67.2	660	20	1	19	-	<50	<0.1	<1	9	4	1140	91	2	72	20
1 Final Holding Pond	LDP01		18/09/2018	-	-	-	-	-	260	7.9	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		18/09/2018	-	-	-	-	-	250	7.7	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Final Holding Pond	LDP01		19/09/2018	-	-	-	-	-	260	7.7	-	-	65.1	860	110	1	23	-	<50	<0.1	<1	10	4	1140	143	2	181	110
LDP06	LDP6-1		19/09/2018	<0.01	0.21	-	-	-	-	-	242	-	-	680	<10	<1	21	<1	<50	<0.1	<1	7	7	760	<50	2	163	119
LDP6	LDP6-1		20/09/2018	<0.01	0.2	0.4	-	0.6	-	-	199	8	51	690	120	2	20	<1	<50	<0.1	<1	8	4	778	214	2	77	50
1 Final Holding Pond	LDP01		25/09/2018	-	-	-	-	-	240	7.7	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		25/09/2018	-	-	-	-	-	270	7.9	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		3/10/2018	-	-	-	-	-	370	8	274	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		3/10/2018	-	-	-	-	-	360	7.9	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		9/10/2018	-	-	-	-	-	290	7.9	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		9/10/2018	-	-	-	-	-	290	7.8	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		16/10/2018	-	-	-	-	-	220	8	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		16/10/2018	-	-	-	-	-	230	7.9	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LDP6	LDP6-1		17/10/2018	<0.01	0.15	0.2	-	0.4	-	-	191	20	52.7	710	200	<1	19	<1	70	<0.1	<1	8	4	1300	220	1	62	26
1 Final Holding Pond	LDP01		23/10/2018	-	-	-	-	-	250	7.8	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		23/10/2018	-	-	-	-	-	260	7.8	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		30/10/2018	-	-	-	-	-	300	8	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		30/10/2018	-	-	-	-	-	360	7.4	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		6/11/2018	-	-	-	-	-	290	8	227	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		6/11/2018	-	-	-	-	-	320	7.7	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		13/11/2018	-	-	-	-	-	290	7.8	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		13/11/2018	-	-	-	-	-	300	7.9	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		20/11/2018	-	-	-	-	-	380	7.9	-	34	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		20/11/2018	-	-	-	-	-	350	7.7	-	29	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LDP6	LDP6-1		22/11/2018	<0.01	0.14	0.4	-	0.5	-	-	218	9	12.9	300	20	<1	38	<1	<50	<0.1	<1	3	2	439	86	<1	577	561
1 Final Holding Pond	LDP01		27/11/2018	-	-	-	-	-	300	7.8	-	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		27/11/2018	-	-	-	-	-	320	7.7	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		4/12/2018	-	-	-	-	-	190	7.9	157	13	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		4/12/2018	-	-	-	-	-	210	7.8	-	23	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		11/12/2018	-	-	-	-	-	440	7.8	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		11/12/2018	-	-	-	-	-	440	7.7	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		13/12/2018	<0.01	0.01	0.4	-	0.4	380	6.9	250	8	42.3	140	20	<1	40	<1	160	<0.1	<1	4	3	251	92	<1	120	92
1 Final Holding Pond	LDP01		18/12/2018	-	-	-	-	-	290	8	-	31	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		18/12/2018	-	-	-	-	-	300	7.8	-	20	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		19/12/2018	-	-	-	-	-	300	7.7	-	19	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		24/12/2018	-	-	-	-	-	220	7.9	-	99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		24/12/2018	-	-	-	-	-	220	7.7	-	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		2/01/2019	-	-	-	-	-	340	7.7	288	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		2/01/2019	-	-	-	-	-	320	7.8	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		3/01/2019	<0.01	0.01	0.4	-	0.4	-	-	250	8	42.3	140	20	<1	40	<1	160	<0.1	<1	4	3	251	92	<1	120	92
2 Downstream Final Holding Pond	LDP6-1		4/01/2019	-	-	-	-	-	320	7.8	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		8/01/2019	-	-	-	-	-	320	7.9	-	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		8/01/2019	-	-	-	-	-	330	7.9	-	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		15/01/2019	-	-	-	-	-	200	7.9	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		15/01/2019	-	-	-	-	-	180	7.8	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		16/01/2019	<0.01	0.07	0.4	-	0.5	-	-	180	30	80.9	1120	70	2	29	<1	<50	<0.1	1	10	4	1190	139	2	144	75
2 Downstream Final Holding Pond	LDP6-1		17/01/2019	-	-	-	-	-	180	7.8	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		22/01/2019	-	-	-	-	-	170	7.6	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ERM

				Nutrients										Metals																	
				Nitrite (as N)	Nitrite + Nitrate (as N)	Nitrogen (N) - Kjeldahl	Nitrogen (N) - Kjeldahl (Filtered)	Nitrogen (N)	Electrical Conductivity (Lab)	pH (Lab)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Turbidity	Aluminium	Aluminium (Filtered)	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Manganese	Manganese (Filtered)
				mg/L	mg/L	mg/L	mg/L	mg/L	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	µg/L
EQL				0.01	0.01						10			10	10	1	1	1	50	0.1	1	1	1	50	50	1	1	1
ANZECC (2000) or Local Guidelines - Surface Water										6.5-8	1500					24	700	100	370	0.85	2	3.5	3.5	300	300	5	1900	1900
Neubecks Creek at WX22 Pre-placement 90th Percentile											580					1	29	1	90	1	1	1	1	281	281	1	720	720
Field_ID	**LocCode**	**WellCode**	**Sampled_Date-Time**																												
1 Final Holding Pond	LDP01		7/05/2019	-	-	-	-	-	340	7.7	266	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		14/05/2019	-	-	-	-	-	420	7.7	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		14/05/2019	-	-	-	-	-	430	7.8	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		15/05/2019	<0.01	0.2	-	0.2	0.4	-	-	284	17	39.1	440	30	1	31	<1	80	<0.1	<1	13	6	687	87	2	101	31
1 Final Holding Pond	LDP01		21/05/2019	-	-	-	-	-	360	7.8	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		21/05/2019	-	-	-	-	-	400	7.8	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		28/05/2019	-	-	-	-	-	320	7.8	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		28/05/2019	-	-	-	-	-	320	7.8	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Final Holding Pond	LDP01		4/06/2019	-	-	-	-	-	300	7.5	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP6-1		20/06/2019	<0.01	0.14	-	0.4	0.5	-	-	259	<5	7.8	170	20	<1	26	<1	60	<0.1	<1	15	9	347	117	<1	130	8
2 Downstream Final Holding Pond	LDP01		18/07/2019	<0.01	0.1	0.8	-	0.9	-	-	554	7	8.9	140	<10	<1	53	<1	210	<0.1	<1	33	25	506	152	<1	286	260
2 Downstream Final Holding Pond	LDP01		22/07/2019	-	-	-	-	-	670	7.9	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Downstream Final Holding Pond	LDP01		22/08/2019	<0.01	0.14	0.4	-	0.5	-	-	293	6	21.9	250	60	<1	30	<1	190	<0.1	<1	20	10	406	91	<1	112	23
2 Downstream Final Holding Pond	LDP01		27/08/2019	-	-	-	-	-	650	7.8	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Count Detects		**0**	**15**	**12**	**2**	**14**	**72**	**72**	**22**	**82**	**23**	**17**	**14**	**7**	**17**	**0**	**10**	**0**	**3**	**17**	**17**	**17**	**16**	**8**	**17**	**17**
		Average		**-**	**0.127333**	**0.4**	**0.3**	**0.507143**	**317.2222**	**7.816667**	**255.5455**	**31.87805**	**47.58696**	**471.7647**	**55.71429**	**1.571429**	**32.47059**	**-**	**122**	**-**	**1.666667**	**9.764706**	**5.647059**	**677.1176**	**110.75**	**1.875**	**165.5882**	**99.117**
		50th Percentile		**-**	**0.14**	**0.4**	**0.3**	**0.5**	**300**	**7.8**	**246**	**18.5**	**42.3**	**300**	**25**	**2**	**30**	**-**	**115**	**-**	**1**	**8**	**4**	**506**	**92**	**2**	**130**	**60**
		90th Percentile		**-**	**0.2**	**0.4**	**0.38**	**0.6**	**440**	**8**	**294.8**	**85.7**	**88.18**	**964**	**117**	**2**	**45.2**	**-**	**192**	**-**	**2.6**	**17**	**9.4**	**1190**	**183**	**2**	**258.4**	**175.4**
		Minimum		**0**	**0.01**	**0.2**	**0.2**	**0.4**	**170**	**6.9**	**140**	**2**	**7.8**	**120**	**10**	**1**	**19**	**0**	**60**	**0**	**1**	**3**	**1**	**251**	**31**	**1**	**62**	**8**
		Maximum		**0**	**0.21**	**0.8**	**0.4**	**0.9**	**670**	**8.2**	**554**	**200**	**100**	**1120**	**200**	**2**	**64**	**0**	**210**	**0**	**3**	**33**	**25**	**1300**	**220**	**2**	**577**	**561**
219 Neubecks Creek	NC01		20/09/2018	<0.01	<0.01	0.6	-	0.6	-	-	164	-	22.3	220	20	<1	23	<1	130	<0.1	<1	2	<1	1480	379	<1	253	225
219 Neubecks Creek	NC01		17/10/2018	<0.01	0.05	<0.1	-	<0.1	-	-	182	-	20.9	330	50	<1	26	<1	120	<0.1	<1	2	<1	939	222	<1	166	151
219 Neubecks Creek	NC01		21/11/2018	<0.01	0.01	0.2	-	0.2	-	-	178	-	7	180	20	<1	32	<1	<50	<0.1	<1	<1	<1	1310	484	<1	443	442
219 Neubecks Creek	NC01		13/12/2018	<0.01	<0.01	0.5	-	0.5	-	-	172	-	19.4	340	70	1	28	<1	<50	<0.1	<1	1	<1	1160	381	<1	428	400
219 Neubecks Creek	NC01		16/01/2019	<0.01	0.01	0.3	-	0.3	-	-	119	-	24.4	360	50	<1	25	<1	<50	<0.1	<1	2	1	999	198	<1	203	158
219 Neubecks Creek	NC01		20/02/2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
219 Neubecks Creek	NC01		27/03/2019	<0.01	0.05	0.3	-	0.4	-	-	296	-	11	40	<10	<1	43	<1	60	<0.1	<1	<1	<1	797	315	<1	1030	597
219 Neubecks Creek	NC01		17/04/2019	<0.01	0.01	0.3	-	0.3	-	-	168	-	8.2	50	<10	<1	28	<1	<50	<0.1	<1	<1	<1	1110	464	<1	536	598
219 Neubecks Creek	NC01		15/05/2019	<0.01	0.03	-	0.2	0.2	-	-	365	-	11.1	140	<10	<1	28	<1	<50	<0.1	<1	3	1	750	116	<1	234	221
219 Neubecks Creek	NC01		20/06/2019	<0.01	0.07	-	0.5	0.6	-	-	254	-	14.2	220	10	<1	29	<1	<50	<0.1	<1	3	2	1460	191	<1	889	182
219 Neubecks Creek	NC01		17/07/2019	<0.01	0.02	0.3	-	0.3	-	-	252	-	6.4	60	<10	<1	30	<1	50	<0.1	<1	5	2	788	365	<1	219	196
219 Neubecks Creek	NC01		22/08/2019	<0.01	<0.01	0.2	-	0.2	-	-	369	-	6.6	40	<10	<1	32	<1	80	<0.1	<1	2	<1	666	125	<1	150	103
		Count Detects		**0**	**8**	**8**	**2**	**10**	**0**	**0**	**11**	**0**	**11**	**11**	**6**	**1**	**11**	**0**	**5**	**0**	**0**	**8**	**4**	**11**	**11**	**0**	**11**	**11**
		Average		**-**	**0.03125**	**0.3375**	**0.35**	**0.36**	**-**	**-**	**229**	**-**	**13.77273**	**180**	**36.66667**	**1**	**29.45455**	**-**	**88**	**-**	**-**	**2.5**	**1.5**	**1041.727**	**294.5455**	**-**	**413.7273**	**297.54**
		50th Percentile		**-**	**0.025**	**0.3**	**0.35**	**0.3**	**-**	**-**	**182**	**-**	**11.1**	**180**	**35**	**1**	**28**	**-**	**80**	**-**	**-**	**2**	**1.5**	**999**	**315**	**-**	**253**	**221**
		90th Percentile		**-**	**0.056**	**0.53**	**0.47**	**0.6**	**-**	**-**	**365**	**-**	**22.3**	**340**	**60**	**1**	**32**	**-**	**126**	**-**	**-**	**3.6**	**2**	**1460**	**464**	**-**	**889**	**597**
		Minimum		**0**	**0.01**	**0.2**	**0.2**	**0.2**	**0**	**0**	**119**	**0**	**6.4**	**40**	**10**	**1**	**23**	**0**	**50**	**0**	**0**	**1**	**1**	**666**	**116**	**0**	**150**	**103**
		Maximum		**0**	**0.07**	**0.6**	**0.5**	**0.6**	**0**	**0**	**369**	**0**	**24.4**	**360**	**70**	**1**	**43**	**0**	**130**	**0**	**0**	**5**	**2**	**1480**	**484**	**0**	**1030**	**598**
3 Stream Gauge	WX22		26/09/2018	<0.01	0.01	0.3	-	0.3	-	-	341	-	13.3	310	10	<1	15	-	100	<0.1	<1	2	<1	556	156	<1	426	372
3 Stream Gauge	WX22		24/10/2018	<0.01	<0.01	<0.1	-	<0.1	-	-	218	-	3.9	110	10	<1	12	-	<50	<0.1	<1	<1	<1	481	118	<1	185	162
3 Stream Gauge	WX22		28/11/2018	<0.01	0.06	0.7	-	0.8	-	-	290	-	50.9	700	160	<1	13	-	80	<0.1	<1	2	<1	895	216	<1	311	220
3 Stream Gauge	WX22		19/12/2018	<0.01	<0.01	0.2	-	0.2	-	-	270	-	5.6	110	<10	<1	10	-	<50	<0.1	<1	<1	<1	898	209	<1	361	388
3 Stream Gauge	WX22		23/01/2019	<0.01	<0.01	0.3	-	0.3	-	-	261	-	11.4	190	30	<1	10	-	60	<0.1	<1	1	<1	495	156	<1	401	342
3 Stream Gauge	WX22		13/03/2019	<0.01	0.03	0.1	-	0.1	-	-	393	-	2.6	50	<10	<1	26	-	150	<0.1	<1	<1	<1	986	101	<1	1450	1440
3 Stream Gauge	WX22		11/04/2019	<0.01	<0.01	0.1	-	0.1	-	-	399	-	2.1	20	<10	<1	25	-	90	<0.1	<1	4	4	470	175	<1	1020	1000
3 Stream Gauge	WX22		22/05/2019	<0.01	<0.01	-	0.2	0.2	-	-	353	-	1.3	20	<10	<1	19	-	<50	<0.1	<1	<1	<1	184	75	<1	155	154
3 Stream Gauge	WX22		26/06/2019	<0.01	<0.01	-	0.2	0.2	-	-	328	-	1.1	<10	<10	<1	19	-	<50	<0.1	<1	<1	<1	155	75	<1	97	73
3 Stream Gauge	WX22		24/07/2019	<0.01	0.02	0.2	-	0.2	-	-	534	-	1.3	<10	<10	<1	34	-	80	<0.1	<1	<1	<1	168	95	<1	249	238
3 Stream Gauge	WX22		28/08/2019	<0.01	<0.01	0.2	-	0.2	-	-	805	-	1.7	<10	<10	<1	50	-	110	<0.1	<1	<1	<1	105	87	<1	198	192
		Count Detects		**0**	**4**	**8**	**2**	**10**	**0**	**0**	**11**	**0**	**11**	**8**	**4**	**0**	**11**	**0**	**7**	**0**	**0**	**4**	**1**	**11**	**11**	**0**	**11**	**11**
		Average		**-**	**0.03**	**0.2625**	**0.2**	**0.26**	**-**	**-**	**381.0909**	**-**	**8.654545**	**188.75**	**52.5**	**-**	**21.18182**	**-**	**95.71429**	**-**	**-**	**2.25**	**4**	**490.2727**	**133**	**-**	**441.1818**	**416.45**
		50th Percentile		**-**	**0.025**	**0.2**	**0.2**	**0.2**	**-**	**-**	**341**	**-**	**2.6**	**110**	**20**	**-**	**19**	**-**	**90**	**-**	**-**	**2**	**4**	**481**	**118**	**-**	**311**	**238**
		90th Percentile		**-**	**0.051**	**0.42**	**0.2**	**0.35**	**-**	**-**	**534**	**-**	**13.3**	**427**	**121**	**-**	**34**	**-**	**126**	**-**	**-**	**3.4**	**4**	**898**	**209**	**-**	**1020**	**1000**
		Minimum		**0**	**0.01**	**0.1**	**0.2**	**0.1**	**0**	**0**	**218**	**0**	**1.1**	**20**	**10**	**0**	**10**	**0**	**60**	**0**	**0**	**1**	**4**	**105**	**75**	**0**	**97**	**73**
		Maximum		**0**	**0.06**	**0.7**	**0.2**	**0.8**	**0**	**0**	**805**	**0**	**50.9**	**700**	**160**	**0**	**50**	**0**	**150**	**0**	**0**	**4**	**4**	**986**	**216**	**0**	**1450**	**1440**

Annex C

Tabulated Groundwater Data

				Field Parameters			Major Anions and Cations							Oth
				Electrical Conductivity (Field)	pH (Field)	Purge Volume	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride
				uS/cm	pH units	L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								1					1	0.1
ANZECC (2000) or Local Guidelines - Groundwater				2600	6.5-8			350				1000		1.5
Groundwater Collection Basin Pre-placement 90th Percentile				1576				31.5				824		0.435
6 Groundwater Bore MPGM4	D1		26/09/2018	3700	6.0	112	289	330	223	26.2	317	1760	156	<0.1
6 Groundwater Bore MPGM4	D1		24/10/2018	3640	6.0	114	299	270	235	28.4	337	1660	160	<0.2
6 Groundwater Bore MPGM4	D1		28/11/2018	3860	6.0	117	312	322	241	27	352	1970	161	<0.5
6 Groundwater Bore MPGM4	D1		19/12/2018	3810	6.0	120	298	270	232	29.1	343	1660	166	<0.2
6 Groundwater Bore MPGM4	D1		24/01/2019	4480	6.0	-	344	399	262	32.8	406	1890	120	<0.2
6 Groundwater Bore MPGM4	D1		13/03/2019	5700	6.0	-	458	598	348	40.9	518	2880	179	<0.1
6 Groundwater Bore MPGM4	D1		11/04/2019	6730	5.9	124	555	821	422	51.8	734	3420	136	<0.5
6 Groundwater Bore MPGM4	D1		23/05/2019	7330	5.9	125	581	873	442	48.9	848	3760	102	0.343
6 Groundwater Bore MPGM4	D1		26/06/2019	7840	5.9	125	608	954	481	53	974	3880	77	<0.5
6 Groundwater Bore MPGM4	D1		25/07/2019	8240	5.9	126	621	981	493	60.9	1030	4030	158	<0.5
6 Groundwater Bore MPGM4	D1		29/08/2019	8570	5.9	125	597	1010	498	84.1	1020	4330	150	0.471
	D1	**Count Detects**		**11**	**11.0**	**9**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**2**
	D1	**Average**		**5809.091**	**5.9**	**120.8889**	**451.0909**	**620.7273**	**352.4545**	**43.91818**	**625.3636**	**2840**	**142.2727**	**0.407**
	D1	**50th Percentile**		**5700**	**6.0**	**124**	**458**	**598**	**348**	**40.9**	**518**	**2880**	**156**	**0.407**
	D1	**90th Percentile**		**8240**	**6.0**	**125.2**	**608**	**981**	**493**	**60.9**	**1020**	**4030**	**166**	**0.4582**
	D1	**Minimum**		**3640**	**5.9**	**112**	**289**	**270**	**223**	**26.2**	**317**	**1660**	**77**	**0.343**
	D1	**Maximum**		**8570**	**6.0**	**126**	**621**	**1010**	**498**	**84.1**	**1030**	**4330**	**179**	**0.471**
13 Groundwater Bore MPGM4	D8		24/01/2019	207	5.4	-	14.9	2.14	11	2.2	5.08	79.6	12	0.024
13 Groundwater Bore MPGM4	D8		13/03/2019	800	5.4	-	53.9	38.2	42.7	4.72	51.1	319	11	<0.1
13 Groundwater Bore MPGM4	D8		11/04/2019	620	5.3	40	42.4	29.1	32.8	4.48	40.3	247	11	<0.1
13 Groundwater Bore MPGM4	D8		23/05/2019	880	5.6	44	56.9	52.7	46.5	6.03	59.8	359	20	0.026
13 Groundwater Bore MPGM4	D8		27/06/2019	1130	5.8	46	67.6	71.7	55.9	7.88	98.7	416	28	<0.1
13 Groundwater Bore MPGM4	D8		25/07/2019	990	5.7	43	58	65.4	48.1	6.91	81.9	373	28	<0.1
13 Groundwater Bore MPGM4	D8		29/08/2019	970	5.7	144	59.2	61.6	46.1	8.22	76.5	375	25	0.065
	D8	**Count Detects**		**7**	**7.0**	**5**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**3**
	D8	**Average**		**799.5714**	**5.6**	**63.4**	**50.41429**	**45.83429**	**40.44286**	**5.777143**	**59.05429**	**309.8**	**19.28571**	**0.038333**
	D8	**50th Percentile**		**880**	**5.6**	**44**	**56.9**	**52.7**	**46.1**	**6.03**	**59.8**	**359**	**20**	**0.026**
	D8	**90th Percentile**		**1046**	**5.8**	**104.8**	**62.56**	**67.92**	**51.22**	**8.016**	**88.62**	**391.4**	**28**	**0.0572**
	D8	**Minimum**		**207**	**5.3**	**40**	**14.9**	**2.14**	**11**	**2.2**	**5.08**	**79.6**	**11**	**0.024**
	D8	**Maximum**		**1130**	**5.8**	**144**	**67.6**	**71.7**	**55.9**	**8.22**	**98.7**	**416**	**28**	**0.065**
14 Groundwater Bore MPGM4	D9		25/09/2018	2754	6.0	-	-	578	-	-	-	-	112	0.2
14 Groundwater Bore MPGM4	D9		27/09/2018	5220	6.0	14	430	552	319	28.5	473	2630	116	0.108
14 Groundwater Bore MPGM4	D9		25/10/2018	5120	6.0	14	418	484	316	30.2	509	2830	106	<1
14 Groundwater Bore MPGM4	D9		24/01/2019	5420	6.1	-	424	528	315	34.3	512	2590	88	<0.2
14 Groundwater Bore MPGM4	D9		13/03/2019	5930	6.0	-	490	592	361	39.3	564	2870	155	<0.5
14 Groundwater Bore MPGM4	D9		10/04/2019	6980	5.9	17	586	781	417	46.5	729	3310	118	<0.5
14 Groundwater Bore MPGM4	D9		22/05/2019	7460	6.0	17	640	956	450	44.2	855	3910	95	2.52
D9	D9		26/06/2019	8050	6.0	16	664	987	486	45.3	942	3880	49	<0.5
D9	D9		24/07/2019	8420	6.2	16	712	1110	508	52.2	990	4390	134	<0.5
D9	D9		28/08/2019	8580	6.0	17	688	1060	506	71.4	970	4020	84	<0.5
	D9	**Count Detects**		**10.0**	**10.0**	**7**	**9**	**10**	**9**	**9**	**9**	**9**	**10**	**3**
	D9	**Average**		**6393.4**	**6.0**	**15.85714**	**561.3333**	**762.8**	**408.6667**	**43.54444**	**727.1111**	**3381.111**	**105.7**	**0.942667**
	D9	**50th Percentile**		**6455**	**6.0**	**16**	**586**	**686.5**	**417**	**44.2**	**729**	**3310**	**109**	**0.2**
	D9	**90th Percentile**		**8436**	**6.1**	**17**	**692.8**	**1065**	**506.4**	**56.04**	**974**	**4094**	**136.1**	**2.056**
	D9	**Minimum**		**2754**	**5.9**	**14**	**418**	**484**	**315**	**28.5**	**473**	**2590**	**49**	**0.108**
	D9	**Maximum**		**8580**	**6.2**	**17**	**712**	**1110**	**508**	**71.4**	**990**	**4390**	**155**	**2.52**
15 Groundwater Bore MPGM4	D10		26/09/2018	7440	5.6	153	269	615	252	162	1290	3900	76	0.461
15 Groundwater Bore MPGM4	D10		24/10/2018	7750	5.7	148	280	566	265	151	1390	4640	81	0.267
15 Groundwater Bore MPGM4	D10		29/11/2018	7990	5.6	162	306	584	288	159	1460	4330	84	<0.2
15 Groundwater Bore MPGM4	D10		19/12/2018	5870	5.5	164	237	389	188	108	1030	3010	77	0.216
15 Groundwater Bore MPGM4	D10		23/01/2019	5660	5.6	-	234	395	171	95.4	933	2710	43	<0.5
15 Groundwater Bore MPGM4	D10		13/03/2019	5490	5.6	-	226	366	172	90	850	2640	69	<0.5
15 Groundwater Bore MPGM4	D10		11/04/2019	5910	5.5	168	226	465	183	106	1050	3030	68	<0.5
15 Groundwater Bore MPGM4	D10		23/05/2019	6070	5.6	161	229	488	188	97.9	1130	3350	66	<0.5
15 Groundwater Bore MPGM4	D10		26/06/2019	6080	5.6	170	228	426	182	94.9	1160	2800	49	<0.5
15 Groundwater Bore MPGM4	D10		25/07/2019	5920	5.6	164	223	430	181	107	1150	2900	66	<0.5
15 Groundwater Bore MPGM4	D10		29/08/2019	7480	5.6	78	252	191	112	46.1	459	1920	10	<0.01
	D10	**Count Detects**		**11**	**11**	**9**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**3**
	D10	**Average**		**6514.545**	**5.580909**	**152**	**246.3636**	**446.8182**	**198.3636**	**110.6636**	**1082**	**3202.727**	**62.63636**	**0.314667**
	D10	**50th Percentile**		**6070**	**5.58**	**162**	**234**	**430**	**183**	**106**	**1130**	**3010**	**68**	**0.267**
	D10	**90th Percentile**		**7750**	**5.63**	**168.4**	**280**	**584**	**265**	**159**	**1390**	**4330**	**81**	**0.4222**
	D10	**Minimum**		**5490**	**5.49**	**78**	**223**	**191**	**112**	**46.1**	**459**	**1920**	**10**	**0.216**
	D10	**Maximum**		**7990**	**5.7**	**170**	**306**	**615**	**288**	**162**	**1460**	**4640**	**84**	**0.461**
16 Groundwater Bore MPGM4	D11		27/09/2018	9900	6.2	110	593	998	436	118	1550	4920	194	<0.1
16 Groundwater Bore MPGM4	D11		27/09/2018	5520	6.8	-	-	975	-	-	-	-	99	0.2
16 Groundwater Bore MPGM4	D11		25/10/2018	10,230	6.2	103	621	912	449	100	1590	4720	175	<0.5
16 Groundwater Bore MPGM4	D11		24/01/2019	10,110	6.3	-	579	1040	430	113	1500	4900	58	<0.5
16 Groundwater Bore MPGM4	D11		13/03/2019	4050	6.7	-	326	429	168	71.4	398	989	682	<0.5

				Field Parameters			Major Anions and Cations							Oth
				Electrical Conductivity (Field)	pH (Field)	Purge Volume	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate (as SO4)	Total Alkalinity (as CaCO3)	Fluoride
				uS/cm	pH units	L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								1					1	0.1
	D15	**Count Detects**		**12**	**12.0**	**9**	**11**	**12**	**11**	**11**	**11**	**11**	**12**	**1**
	D15	**Average**		**3667.25**	**5.0**	**29.22222**	**254**	**223.5833**	**125.1818**	**48.70909**	**600**	**2099.091**	**14.58333**	**0.214**
	D15	**50th Percentile**		**3665**	**4.9**	**32**	**253**	**196.5**	**114**	**39.2**	**541**	**1920**	**12**	**0.214**
	D15	**90th Percentile**		**3713.3**	**5.0**	**35.4**	**262**	**222.6**	**117**	**43.1**	**554**	**2280**	**21.3**	**0.214**
	D15	**Minimum**		**3580**	**4.8**	**4**	**240**	**153**	**109**	**38.1**	**469**	**1680**	**2**	**0.214**
	D15	**Maximum**		**3790**	**5.1**	**45**	**263**	**558**	**240**	**140**	**1290**	**3660**	**50**	**<1**
221 Groundwater Bore MPGM4	D16		27/09/2018	1470	6.4	136	201	60	71.4	23	20.4	584	214	0.231
221 Groundwater Bore MPGM4	D16		25/10/2018	1550	6.4	112	215	49.9	76.8	25.9	22.8	548	229	<0.5
221 Groundwater Bore MPGM4	D16		30/11/2018	1630	6.4	139	235	69.8	84.8	26.1	21.3	666	224	0.186
221 Groundwater Bore MPGM4	D16		30/11/2018		-	-	-	71	-	-	-	-	240	0.4
221 Groundwater Bore MPGM4	D16		30/11/2018	1563	6.5	6	-	65	-	-	-	-	238	0.4
221 Groundwater Bore MPGM4	D16		20/12/2018	1770	6.4	147	253	76	89.7	27.9	27	697	213	0.133
221 Groundwater Bore MPGM4	D16		23/01/2019	1870	6.3	-	265	93.6	91.6	27.8	29.2	815	194	0.187
221 Groundwater Bore MPGM4	D16		13/03/2019	1980	6.2	-	276	95.9	95.7	26.1	31.3	942	194	0.127
221 Groundwater Bore MPGM4	D16		10/04/2019	1990	6.3	143	302	117	104	29.9	32.2	1060	172	<1
D01_301118	D16		22/05/2019	1990	6.4	146	300	109	104	30.6	32.6	932	177	0.144
D16	D16		27/06/2019	1980	6.5	141	292	96.7	102	29.2	30.6	793	187	0.174
D16	D16		24/07/2019	1970	6.4	141	296	104	105	31.7	34.4	842	175	0.132
D16	D16		28/08/2019	1980	6.3	142	308	103	104	31.6	38.4	831	176	0.166
	D16	**Count Detects**		**12**	**12.0**	**10**	**11**	**13**	**11**	**11**	**11**	**11**	**13**	**11**
	D16	**Average**		**1811.917**	**6.4**	**125.3**	**267.5455**	**85.45385**	**93.54545**	**28.16364**	**29.10909**	**791.8182**	**202.5385**	**0.207273**
	D16	**50th Percentile**		**1980**	**6.4**	**142**	**294**	**96.3**	**103**	**29.55**	**31.75**	**836.5**	**190.5**	**0.166**
	D16	**90th Percentile**		**1989**	**6.5**	**146.1**	**302**	**108**	**104**	**31.6**	**34.4**	**942**	**236.2**	**0.4**
	D16	**Minimum**		**1470.0**	**6.2**	**6**	**201**	**49.9**	**71.4**	**23**	**20.4**	**548**	**172**	**0.127**
	D16	**Maximum**		**1990**	**6.5**	**147**	**308**	**117**	**105**	**31.7**	**38.4**	**1060**	**240**	**0.4**
222 Groundwater Bore MPGM4	D17		27/09/2018	3560	6.1	30	262	238	157	21.4	406	1870	120	<0.1
222 Groundwater Bore MPGM4	D17		25/10/2018	3500	6.1	32	278	184	161	21.6	405	1580	113	<0.5
222 Groundwater Bore MPGM4	D17		30/11/2018	3720	6.1	34	284	226	178	22.4	462	1690	128	<0.2
222 Groundwater Bore MPGM4	D17		20/12/2018	3680	6.1	34	283	215	170	23.3	438	1970	120	<0.1
222 Groundwater Bore MPGM4	D17		23/01/2019	3780	6.2	-	278	237	166	23	442	1920	92	<0.2
222 Groundwater Bore MPGM4	D17		13/03/2019	3630	6.1	-	269	199	160	22	362	1670	146	<0.5
222 Groundwater Bore MPGM4	D17		10/04/2019	3780	6.1	35	290	250	175	25.4	468	1960	110	<0.5
222 Groundwater Bore MPGM4	D17		22/05/2019	660	6.1	35	281	246	168	23.8	466	2040	88	0.196
222 Groundwater Bore MPGM4	D17		27/06/2019	3730	6.2	35	277	225	168	23	493	1750	93	<0.5
222 Groundwater Bore MPGM4	D17		24/07/2019	3650	6.2	35	266	226	165	24.5	462	1730	110	<0.1
222 Groundwater Bore MPGM4	D17		28/08/2019	3610	6.2	34	269	218	160	28.5	385	1740	98	<0.5
	D17	**Count Detects**		**11**	**11.0**	**9**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**1**
	D17	**Average**		**3390.909**	**6.1**	**33.77778**	**276.0909**	**224**	**166.1818**	**23.53636**	**435.3636**	**1810.909**	**110.7273**	**0.196**
	D17	**50th Percentile**		**3650**	**6.1**	**34**	**278**	**226**	**166**	**23**	**442**	**1750**	**110**	**0.196**
	D17	**90th Percentile**		**3780**	**6.2**	**35**	**284**	**246**	**175**	**25.4**	**468**	**1970**	**128**	**0.196**
	D17	**Minimum**		**660**	**6.1**	**30**	**262**	**184**	**157**	**21.4**	**362**	**1580**	**88**	**0.196**
	D17	**Maximum**		**3780**	**6.2**	**35**	**290**	**250**	**178**	**28.5**	**493**	**2040**	**146**	**0.196**
224 Groundwater Bore MPGM4	D19		26/09/2018	6690	5.9	11	320	538	279	82	1060	3440	118	<0.1
224 Groundwater Bore MPGM4	D19		24/10/2018	6930	5.9	11	307	522	272	84.8	1160	3520	130	<0.5
224 Groundwater Bore MPGM4	D19		29/11/2018	6530	5.9	14	277	469	254	88.1	1120	3130	135	<0.5
224 Groundwater Bore MPGM4	D19		19/12/2018	5570	6.0	15	220	334	194	86.6	947	2800	143	0.312
224 Groundwater Bore MPGM4	D19		23/01/2019	5190	5.9	-	205	354	176	82.2	915	2380	122	<0.2
224 Groundwater Bore MPGM4	D19		13/03/2019	4690	5.9	-	177	282	162	80.8	696	2160	158	<0.5
224 Groundwater Bore MPGM4	D19		10/04/2019	45,010	5.9	16	204	400	185	85.6	790	2890	129	<1
224 Groundwater Bore MPGM4	D19		23/05/2019	5150	6.0	15.5	218	364	192	80	570	3340	111	<0.5
224 Groundwater Bore MPGM4	D19		26/06/2019	5290	6.0	15	238	355	202	83.8	926	2440	112	<0.5
224 Groundwater Bore MPGM4	D19		24/07/2019	5420	5.9	15	234	377	208	94.3	938	2600	130	<0.5
224 Groundwater Bore MPGM4	D19		28/08/2019	1750	5.5	20	64.2	101	47.6	29.4	227	721	25	<0.1
	D19	**Count Detects**		**11**	**11.0**	**9**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**1**
	D19	**Average**		**8929.091**	**5.9**	**14.72222**	**224.0182**	**372.3636**	**197.4182**	**79.78182**	**849.9091**	**2674.636**	**119.3636**	**0.312**
	D19	**50th Percentile**		**5420**	**5.9**	**15**	**220**	**364**	**194**	**83.8**	**926**	**2800**	**129**	**0.312**
	D19	**90th Percentile**		**6930**	**6.0**	**16.8**	**307**	**522**	**272**	**88.1**	**1120**	**3440**	**143**	**0.312**
	D19	**Minimum**		**1750**	**5.5**	**11**	**64.2**	**101**	**47.6**	**29.4**	**227**	**721**	**25**	**0.312**
	D19	**Maximum**		**45010**	**6.0**	**20**	**320**	**538**	**279**	**94.3**	**1160**	**3520**	**158**	**0.312**

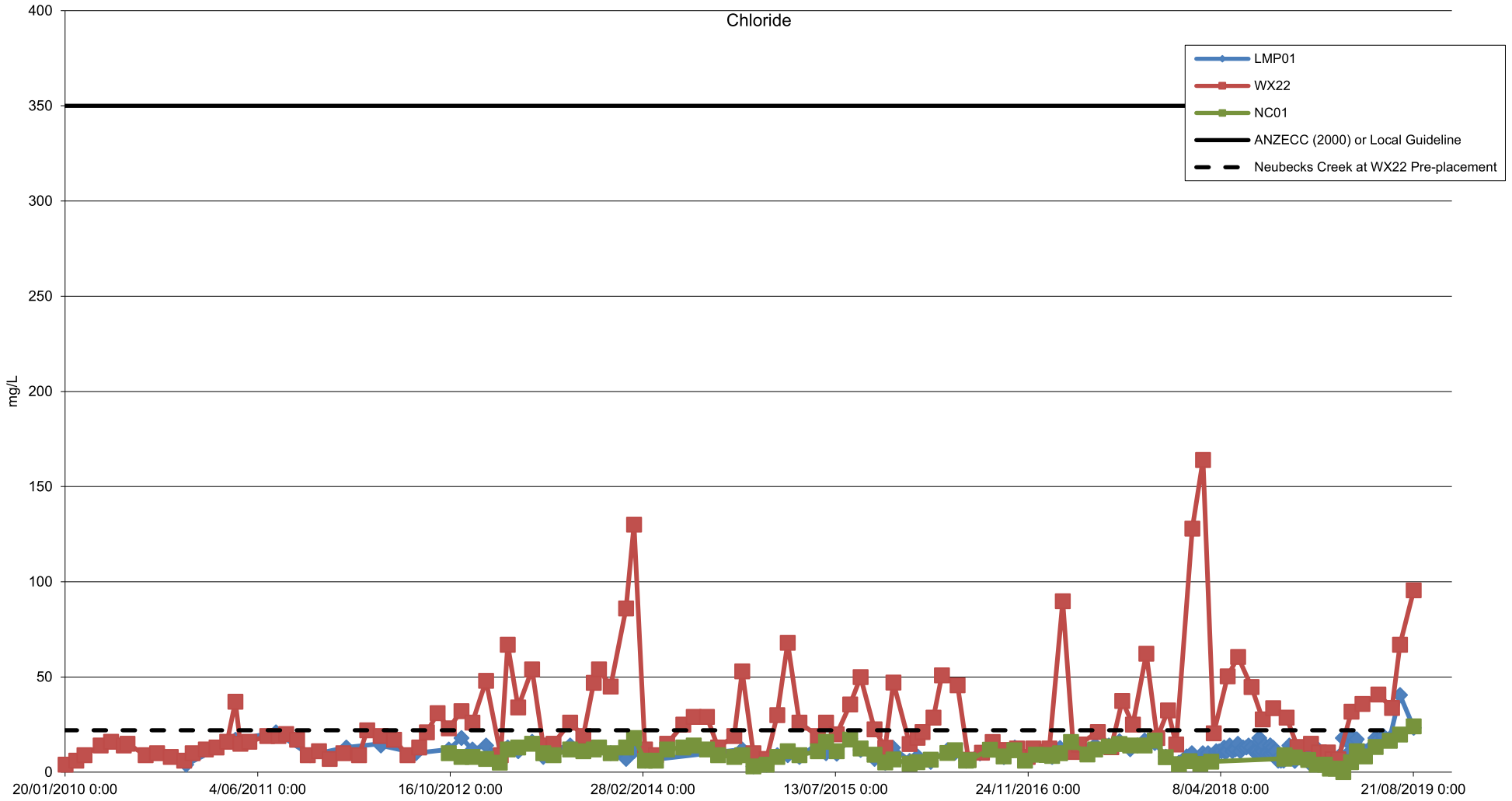
				Metals										
				Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Selenium	Silver	Vanadium
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				1	1	50	1	1	0.1	1	1	1	1	5
ANZECC (2000) or Local Guidelines - Groundwater				5	5	664	5	5704	0.06	10	550.9	5	0.05	
Groundwater Collection Basin Pre-placement 90th Percentile				1	1	664	1	5704	0.1	1	550.9	2	1	
6 Groundwater Bore MPGM4	D1		26/09/2018	<1	<1	25,800	<1	11,400	<0.04	<1	601	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		24/10/2018	<1	<1	22,500	<1	11,700	<0.04	<1	581	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		28/11/2018	4	1	23,600	2	13,100	<0.04	<1	655	0.3	<1	<10
6 Groundwater Bore MPGM4	D1		19/12/2018	<1	<1	19,700	<1	9100	<0.04	<1	585	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		24/01/2019	<1	<1	34,300	<1	14,400	<0.04	<1	822	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		13/03/2019	<1	<1	46,800	<1	18,600	<0.04	<1	1130	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		11/04/2019	<1	2	37,600	<1	20,300	<0.04	<1	1370	0.4	<1	<10
6 Groundwater Bore MPGM4	D1		23/05/2019	<1	<1	58,100	<1	28,600	<0.04	<1	1510	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		26/06/2019	1	<1	5430	<1	27,000	<0.04	<1	1670	<0.2	<1	<10
6 Groundwater Bore MPGM4	D1		25/07/2019	<1	<1	59,300	<1	26,000	<0.04	<1	1780	0.3	<1	<10
6 Groundwater Bore MPGM4	D1		29/08/2019	<1	1	39,900	<1	26,600	<0.04	<1	1940	<0.2	<1	<10
	D1	**Count Detects**		**2**	**3**	**11**	**1**	**11**	**0**	**0**	**11**	**3**	**0**	**0**
	D1	**Average**		**2.5**	**1.333333**	**33911.8182**	**2**	**18800**	**-**	**-**	**1149.455**	**0.333333**	**-**	**-**
	D1	**50th Percentile**		**2.5**	**1**	**34300**	**2**	**18600**	**-**	**-**	**1130**	**0.3**	**-**	**-**
	D1	**90th Percentile**		**3.7**	**1.8**	**58100**	**2**	**27000**	**-**	**-**	**1780**	**0.38**	**-**	**-**
	D1	**Minimum**		**1**	**1**	**5430**	**2**	**9100**	**-**	**-**	**581**	**0.3**	**-**	**-**
	D1	**Maximum**		**4**	**2**	**59300**	**2**	**28600**	**-**	**-**	**1940**	**0.4**	**-**	**-**
13 Groundwater Bore MPGM4	D8		24/01/2019	<1	5	128	<1	60	<0.04	<1	30	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		13/03/2019	<1	7	827	<1	1450	<0.04	<1	105	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		11/04/2019	<1	5	78	<1	801	<0.04	<1	70	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		23/05/2019	<1	1	392	<1	2220	<0.04	<1	94	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		27/06/2019	<1	4	586	<1	2230	<0.04	<1	102	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		25/07/2019	<1	6	612	<1	2000	<0.04	<1	93	<0.2	<1	<10
13 Groundwater Bore MPGM4	D8		29/08/2019	<1	4	1520	<1	2110	<0.04	<1	88	<0.2	<1	<10
	D8	**Count Detects**		**0**	**7**	**7**	**0**	**7**	**0**	**0**	**7**	**0**	**0**	**0**
	D8	**Average**		**-**	**4.571429**	**591.857143**	**-**	**1553**	**-**	**-**	**83.14286**	**-**	**-**	**-**
	D8	**50th Percentile**		**-**	**5**	**586**	**-**	**2000**	**-**	**-**	**93**	**-**	**-**	**-**
	D8	**90th Percentile**		**-**	**6.4**	**1104.2**	**-**	**2224**	**-**	**-**	**103.2**	**-**	**-**	**-**
	D8	**Minimum**		**-**	**1**	**78**	**-**	**60**	**-**	**-**	**30**	**-**	**-**	**-**
	D8	**Maximum**		**-**	**7**	**1520**	**-**	**2230**	**-**	**-**	**105**	**-**	**-**	**-**
14 Groundwater Bore MPGM4	D9		25/09/2018	-	-	47,600	-	16,100	-	-	-	-	-	-
14 Groundwater Bore MPGM4	D9		27/09/2018	<1	2	38,600	<1	13,800	<0.04	3	774	<0.2	<1	<10
14 Groundwater Bore MPGM4	D9		25/10/2018	1	20	34,900	2	14,800	<0.04	3	996	0.3	<1	<10
14 Groundwater Bore MPGM4	D9		24/01/2019	<1	<1	43,100	<1	16,600	0.06	<1	908	<0.2	<1	<10
14 Groundwater Bore MPGM4	D9		13/03/2019	<1	<1	46,400	<1	17,600	<0.04	<1	993	<0.2	<1	<10
14 Groundwater Bore MPGM4	D9		10/04/2019	<1	5	42,000	<1	18,300	<0.04	<1	1240	0.4	<1	<10
14 Groundwater Bore MPGM4	D9		22/05/2019	<1	1	55,800	3	25,000	<0.04	<1	1280	0.2	<1	<10
D9	D9		26/06/2019	<1	<1	12,200	<1	23,600	<0.04	<1	1480	<0.2	<1	<10
D9	D9		24/07/2019	<1	<1	70,000	<1	22,300	<0.04	2	1560	0.3	<1	<10
D9	D9		28/08/2019	<1	<1	40,000	<1	21,000	0.43	3	1620	<0.2	<1	<10
	D9	**Count Detects**		**1**	**4**	**10**	**2**	**10**	**2**	**4**	**9**	**4**	**0**	**0**
	D9	**Average**		**1**	**7**	**43060**	**2.5**	**18910**	**0.245**	**2.75**	**1205.667**	**0.3**	**-**	**-**
	D9	**50th Percentile**		**1**	**3.5**	**42550**	**2.5**	**17950**	**0.245**	**3**	**1240**	**0.3**	**-**	**-**
	D9	**90th Percentile**		**1**	**15.5**	**57220**	**2.9**	**23740**	**0.393**	**3**	**1572**	**0.37**	**-**	**-**
	D9	**Minimum**		**1**	**1**	**12200**	**2**	**13800**	**0.06**	**2**	**774**	**0.2**	**-**	**-**
	D9	**Maximum**		**1**	**20**	**70000**	**3**	**25000**	**0.43**	**3**	**1620**	**0.4**	**-**	**-**
15 Groundwater Bore MPGM4	D10		26/09/2018	<1	<1	15,000	3	5140	<0.04	<1	719	1.1	<1	<10
15 Groundwater Bore MPGM4	D10		24/10/2018	<1	<1	14,400	4	5700	<0.04	2	804	1.3	<1	<10
15 Groundwater Bore MPGM4	D10		29/11/2018	<1	<1	16,500	4	6220	<0.04	<1	843	1.7	<1	<10
15 Groundwater Bore MPGM4	D10		19/12/2018	<1	<1	21,200	2	4070	<0.04	<1	600	0.6	<1	<10
15 Groundwater Bore MPGM4	D10		23/01/2019	<1	<1	19,900	2	4080	<0.04	<1	618	0.4	<1	<10
15 Groundwater Bore MPGM4	D10		13/03/2019	<1	<1	21,500	2	4160	<0.04	<1	627	0.5	<1	<10
15 Groundwater Bore MPGM4	D10		11/04/2019	<1	4	17,800	2	3930	<0.04	<1	619	1	<1	<10
15 Groundwater Bore MPGM4	D10		23/05/2019	<1	<1	16,800	2	5250	<0.04	<1	600	0.8	<1	<10
15 Groundwater Bore MPGM4	D10		26/06/2019	2	<1	11,900	2	4550	<0.04	<1	603	0.7	<1	<10
15 Groundwater Bore MPGM4	D10		25/07/2019	<1	<1	19,400	2	4040	<0.04	<1	599	1.2	<1	<10
15 Groundwater Bore MPGM4	D10		29/08/2019	156	11	29,900	9	2340	<0.04	6	994	0.6	<1	<10
	D10	**Count Detects**		**2**	**2**	**11**	**11**	**11**	**0**	**2**	**11**	**11**	**0**	**0**
	D10	**Average**		**79**	**7.5**	**18572.7273**	**3.090909**	**4498.182**	**-**	**4**	**693.2727**	**0.9**	**-**	**-**
	D10	**50th Percentile**		**79**	**7.5**	**17800**	**2**	**4160**	**-**	**4**	**619**	**0.8**	**-**	**-**
	D10	**90th Percentile**		**140.6**	**10.3**	**21500**	**4**	**5700**	**-**	**5.6**	**843**	**1.3**	**-**	**-**
	D10	**Minimum**		**2**	**4**	**11900**	**2**	**2340**	**-**	**2**	**599**	**0.4**	**-**	**-**
	D10	**Maximum**		**156**	**11**	**29900**	**9**	**6220**	**-**	**6**	**994**	**1.7**	**-**	**-**
16 Groundwater Bore MPGM4	D11		27/09/2018	<1	<1	99,800	<1	16,100	<0.04	3	958	0.2	<1	<10
16 Groundwater Bore MPGM4	D11		27/09/2018	-	-	130,000	-	18,800	-	-	-	-	-	-
16 Groundwater Bore MPGM4	D11		25/10/2018	<1	<1	80,200	<1	17,100	<0.04	<1	1060	<0.2	<1	<10
16 Groundwater Bore MPGM4	D11		24/01/2019	<1	<1	106,000	<1	16,200	<0.04	<1	1060	<0.2	<1	<10
16 Groundwater Bore MPGM4	D11		13/03/2019	2	2	5890	8	1970	<0.04	2	157	0.4	<1	<10

				Metals										
				Chromium	Copper	Iron (Filtered)	Lead	Manganese (Filtered)	Mercury	Molybdenum	Nickel	Selenium	Silver	Vanadium
				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	50	1	1	0.1	1	1	1	1	5
	D15	Count Detects		10	9	12	11	12	0	5	11	10	0	0
	D15	Average		40.2	3.777778	26816	5.363636	2370.083	-	2.4	890.5455	0.53	-	-
	D15	50th Percentile		23	3	30950	6	2260	-	2	912	0.5	-	-
	D15	90th Percentile		83.5	6.2	31920	6	2716	-	3.6	937	0.66	-	-
	D15	Minimum		6	2	3690	4	61	-	1	761	0.2	-	-
	D15	Maximum		88	7	32200	6	5520	-	4	963	1.2	-	-
221 Groundwater Bore MPGM4	D16		27/09/2018	<1	<1	2240	<1	36	<0.04	<1	6	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		25/10/2018	2	<1	286	<1	41	<0.04	<1	6	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		30/11/2018	2	<1	2520	<1	44	<0.04	<1	11	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		30/11/2018	-	-	3220	-	61	-	-	-	-	-	-
221 Groundwater Bore MPGM4	D16		30/11/2018	-	-	3100	-	70	-	-	-	-	-	-
221 Groundwater Bore MPGM4	D16		20/12/2018	2	<1	2930	<1	43	<0.04	<1	13	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		23/01/2019	2	<1	2630	<1	51	<0.04	<1	16	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		13/03/2019	4	<1	2	<1	57	<0.04	<1	19	<0.2	<1	<10
221 Groundwater Bore MPGM4	D16		10/04/2019	<1	1	3430	<1	54	<0.04	<1	14	<0.2	<1	<10
D01_301118	D16		22/05/2019	9	<1	2750	<1	55	<0.04	1	19	<0.2	<1	<10
D16	D16		27/06/2019	8	<1	1710	<1	54	<0.04	<1	19	<0.2	<1	<10
D16	D16		24/07/2019	4	<1	2850	<1	64	<0.04	<1	17	<0.2	<1	<10
D16	D16		28/08/2019	<1	<1	3630	<1	61	<0.04	<1	16	<0.2	<1	<10
	D16	Count Detects		8	1	13	0	13	0	1	11	0	0	0
	D16	Average		4.125	1	2407.53846	-	53.15385	-	1	14.18182	-	-	-
	D16	50th Percentile		4	1	2890	-	56	-	1	16.5	-	-	-
	D16	90th Percentile		8.3	1	3388	-	63.4	-	1	19	-	-	-
	D16	Minimum		2	1	2	-	36	-	1	6	-	-	-
	D16	Maximum		9	1	3630	-	70	-	1	19	-	-	-
222 Groundwater Bore MPGM4	D17		27/09/2018	<1	<1	28,800	<1	3170	<0.04	<1	103	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		25/10/2018	<1	<1	15,000	<1	3220	<0.04	2	98	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		30/11/2018	<1	<1	19,200	<1	3760	<0.04	<1	128	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		20/12/2018	<1	<1	12,300	<1	3250	<0.04	<1	108	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		23/01/2019	<1	<1	24,200	<1	3480	<0.04	<1	130	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		13/03/2019	<1	<1	30,100	<1	3360	<0.04	<1	104	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		10/04/2019	<1	2	14,300	<1	3360	<0.04	<1	127	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		22/05/2019	3	<1	20,500	<1	4120	<0.04	<1	110	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		27/06/2019	<1	<1	6620	<1	3660	<0.04	<1	118	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		24/07/2019	3	<1	29,000	<1	3360	<0.04	<1	106	<0.2	<1	<10
222 Groundwater Bore MPGM4	D17		28/08/2019	4	<1	10,300	<1	3260	<0.04	<1	113	<0.2	<1	<10
	D17	Count Detects		3	1	11	0	11	0	1	11	0	0	0
	D17	Average		3.333333	2	19120	-	3454.545	-	2	113.1818	-	-	-
	D17	50th Percentile		3	2	19200	-	3360	-	2	110	-	-	-
	D17	90th Percentile		3.8	2	29000	-	3760	-	2	128	-	-	-
	D17	Minimum		3	2	6620	-	3170	-	2	98	-	-	-
	D17	Maximum		4	2	30100	-	4120	-	2	130	-	-	-
224 Groundwater Bore MPGM4	D19		26/09/2018	18	5	26,300	17	11,900	<0.04	4	972	1.1	<1	<10
224 Groundwater Bore MPGM4	D19		24/10/2018	47	6	35,700	18	12,700	<0.04	3	1040	0.6	<1	<10
224 Groundwater Bore MPGM4	D19		29/11/2018	4	1	22,800	8	11,000	<0.04	2	898	0.5	<1	<10
224 Groundwater Bore MPGM4	D19		19/12/2018	7	<1	18,200	5	7850	<0.04	<1	624	<0.2	<1	<10
224 Groundwater Bore MPGM4	D19		23/01/2019	8	2	16,000	9	8080	<0.04	<1	666	<0.2	<1	<10
224 Groundwater Bore MPGM4	D19		13/03/2019	1	<1	14,300	4	6940	<0.04	1	531	<0.2	<1	<10
224 Groundwater Bore MPGM4	D19		10/04/2019	3	6	17,300	4	7610	<0.04	<1	608	0.2	<1	<10
224 Groundwater Bore MPGM4	D19		23/05/2019	3	3	15,300	5	10,300	<0.04	<1	612	<0.2	<1	<10
224 Groundwater Bore MPGM4	D19		26/06/2019	2	<1	15,100	5	9220	<0.04	<1	646	<0.2	<1	<10
224 Groundwater Bore MPGM4	D19		24/07/2019	8	<1	16,900	7	9450	<0.04	<1	653	0.3	<1	<10
224 Groundwater Bore MPGM4	D19		28/08/2019	5	<1	506	2	769	<0.04	<1	133	3.7	<1	<10
	D19	Count Detects		11	6	11	11	11	0	4	11	6	0	0
	D19	Average		9.636364	3.833333	18036.9091	7.636364	8710.818	-	2.5	671.1818	1.066667	-	-
	D19	50th Percentile		5	4	16900	5	9220	-	2.5	646	0.55	-	-
	D19	90th Percentile		18	6	26300	17	11900	-	3.7	972	2.4	-	-
	D19	Minimum		1	1	506	2	769	-	1	133	0.2	-	-
	D19	Maximum		47	6	35700	18	12700	-	4	1040	3.7	-	-

Annex D

Trend Graphs - Surface Water

Figure 1a. Chloride Concentrations Over Time
Mount Piper
Lamberts North AMER - 0470260



Annual 50th Percentile

Figure 1b. Chloride Concentrations Over Time - Annual 50th Percentile
Mount Piper
Lamberts North AMER - 0470260

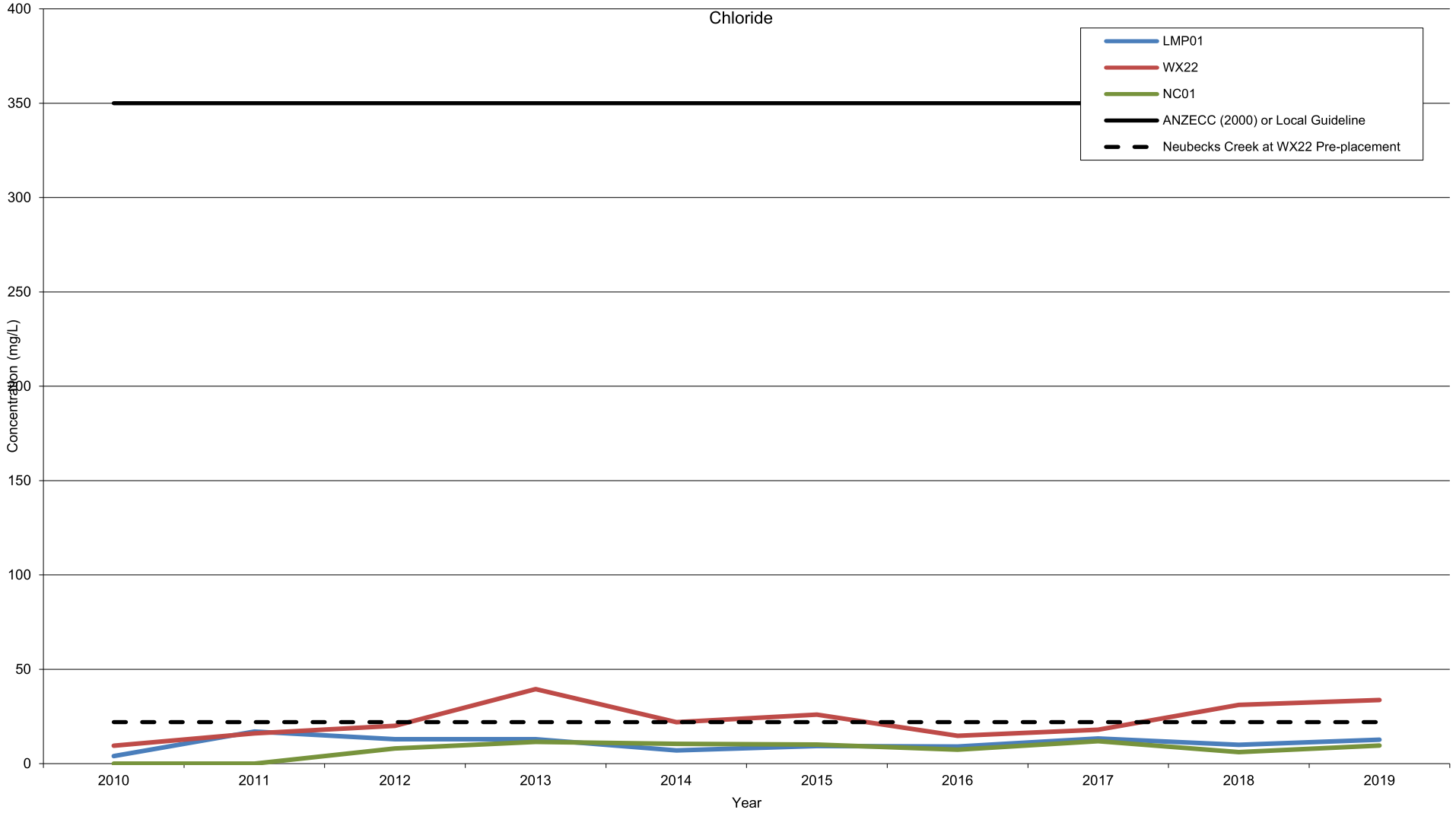


Figure 2a. Nickel Concentrations Over Time
Mount Piper
Lamberts North AMER - 0470260

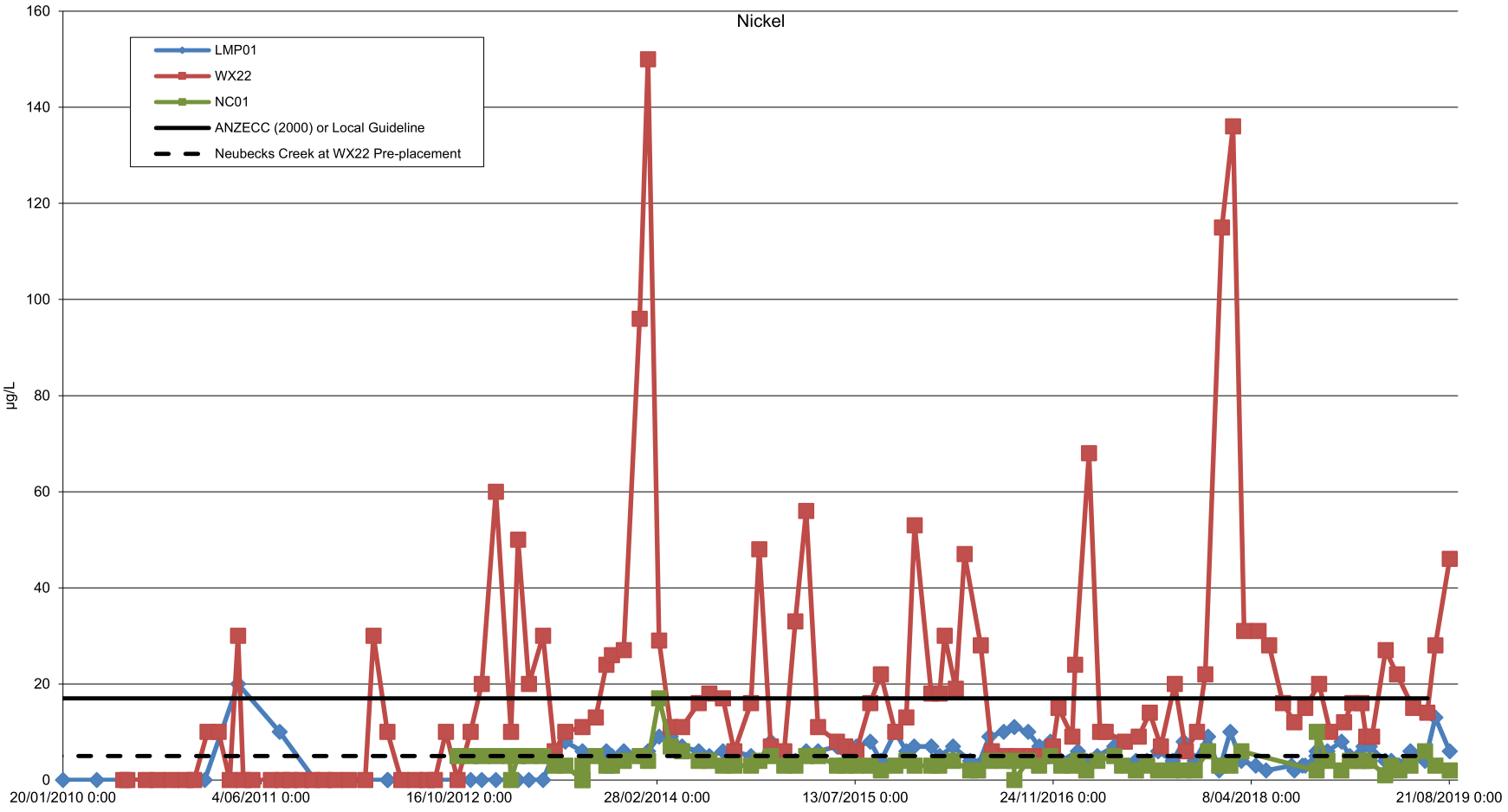


Figure 2b. Nickel Concentrations Over Time - Annual 50th Percentile
Mount Piper
Lamberts North AMER - 0470260

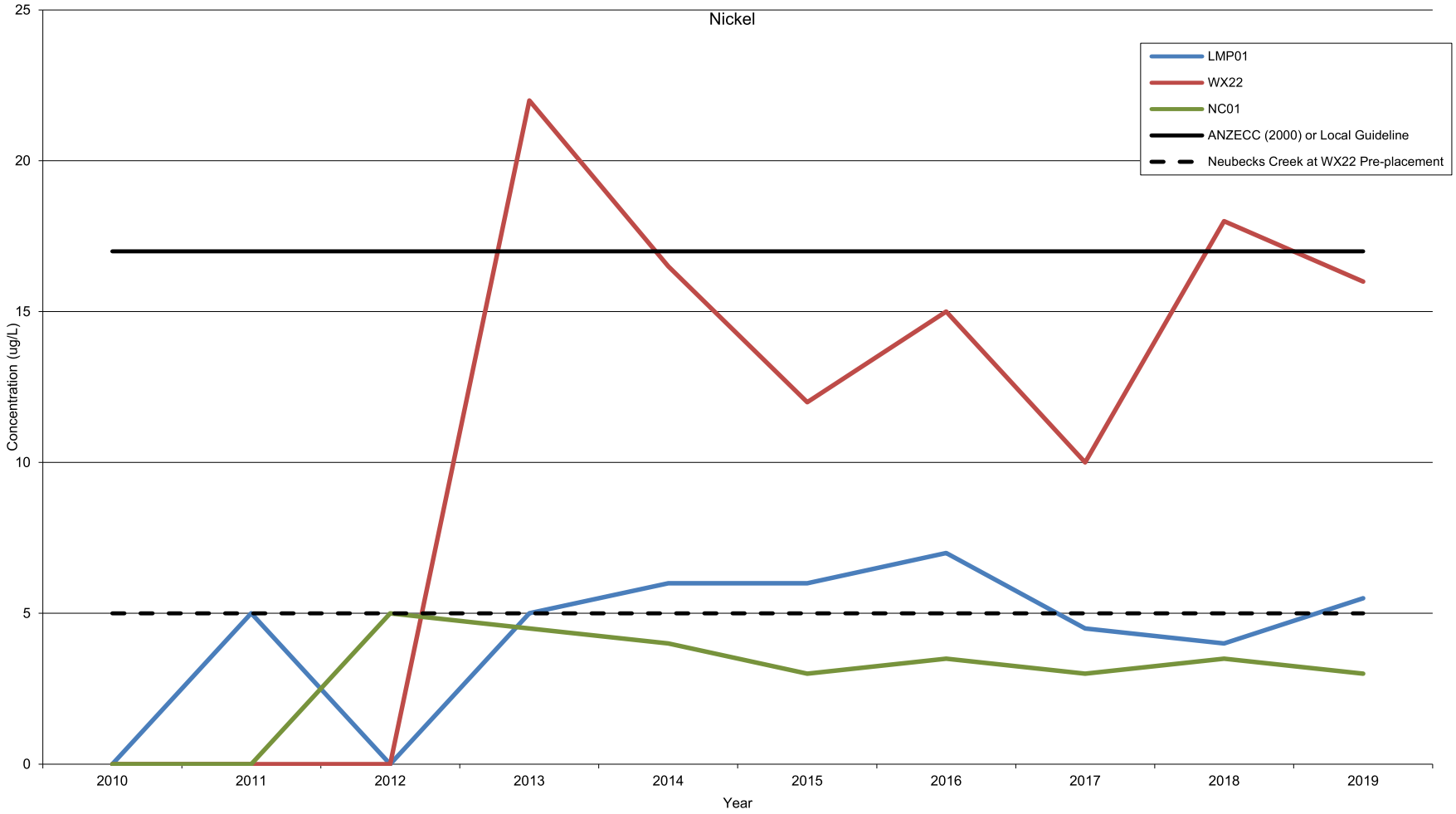


Figure 3a. Sulfate Concentrations Over Time
Mount Piper
Lamberts North AMER - 0470260

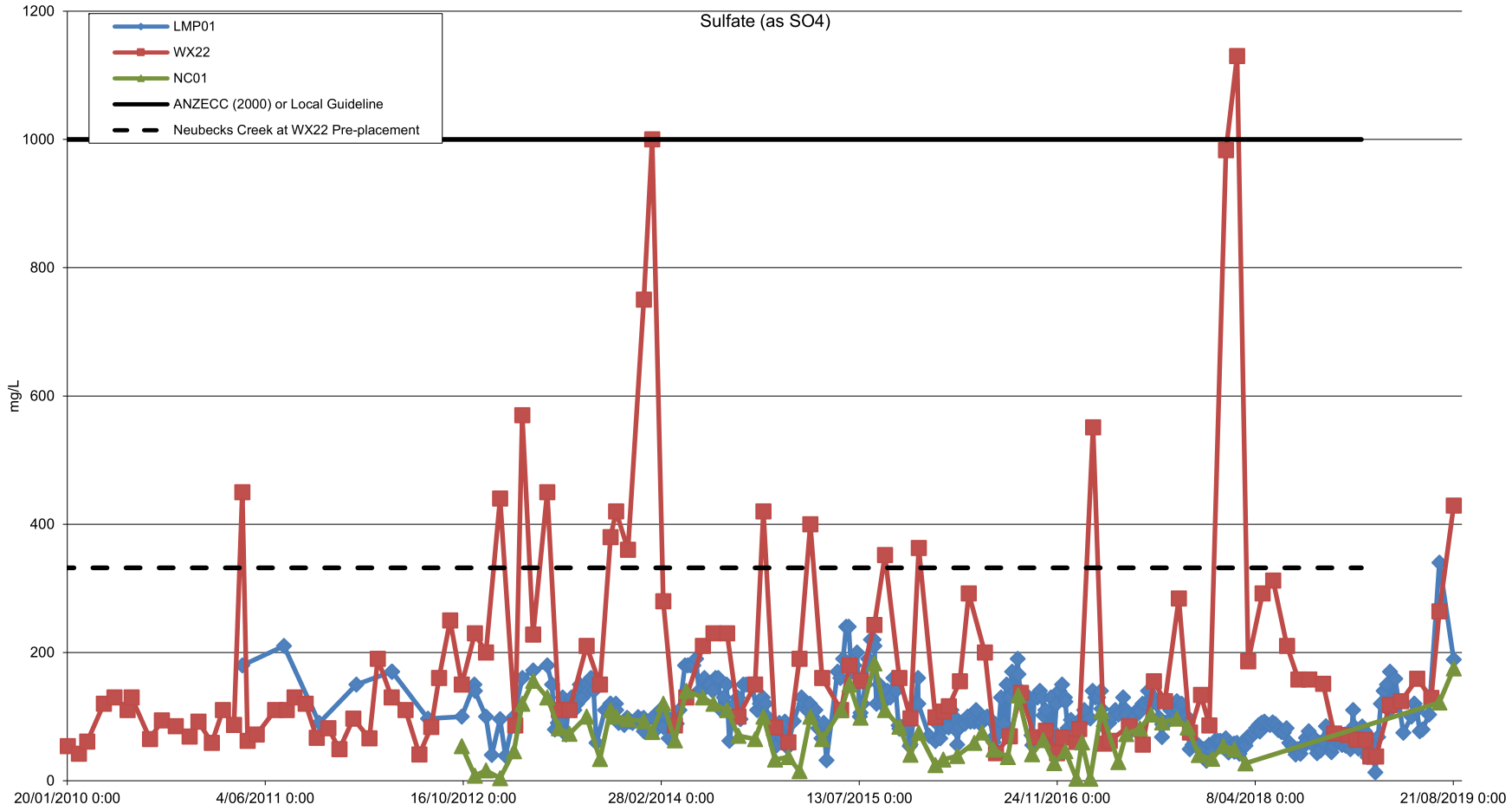


Figure 3b. Sulfate Concentrations Over Time - Annual 50th Percentile
Mount Piper
Lamberts North AMER - 0470260

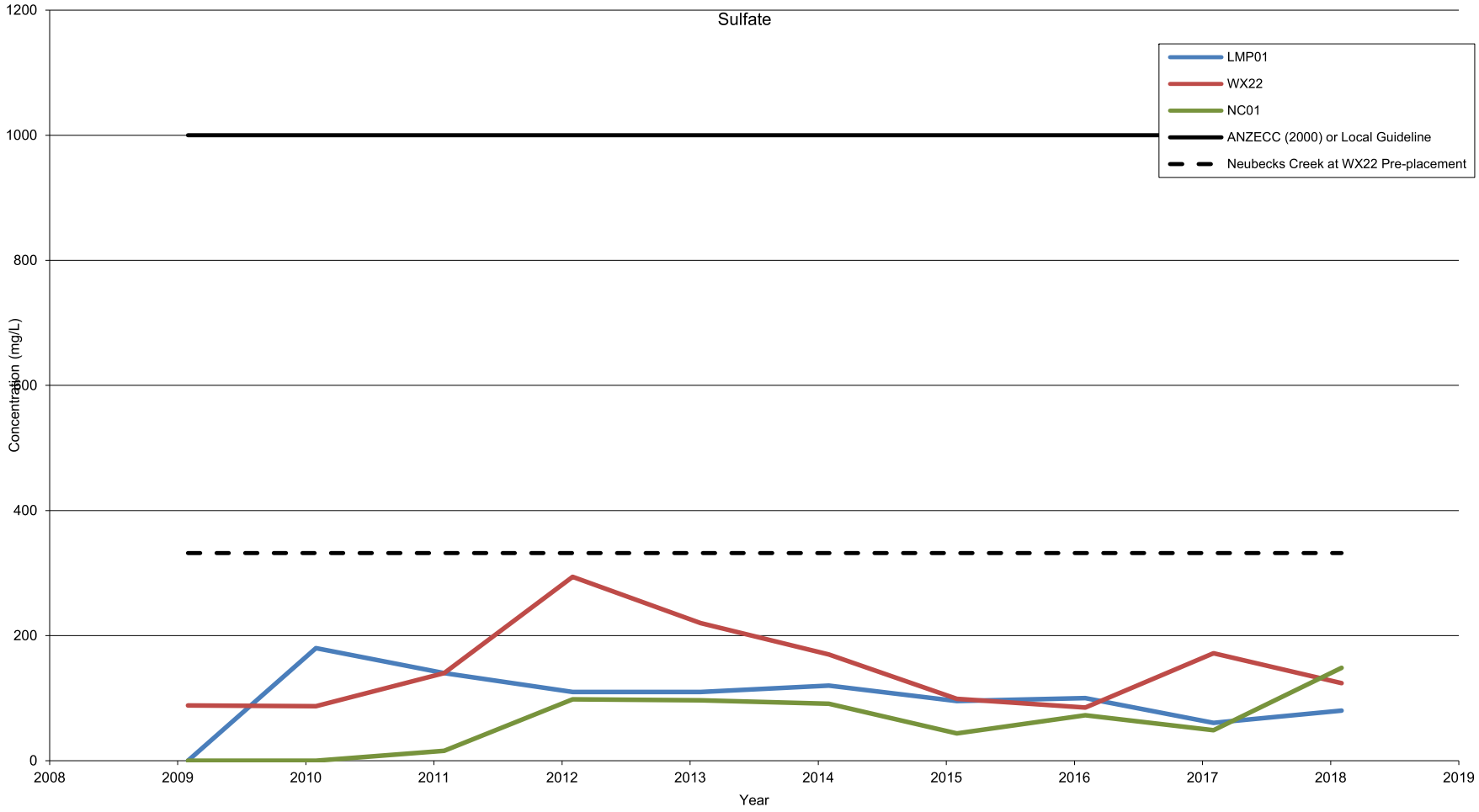


Figure 4a. Total Dissovled Solids (TDS) Concentrations Over Time
Mount Piper
Lamberts North AMER - 0470260

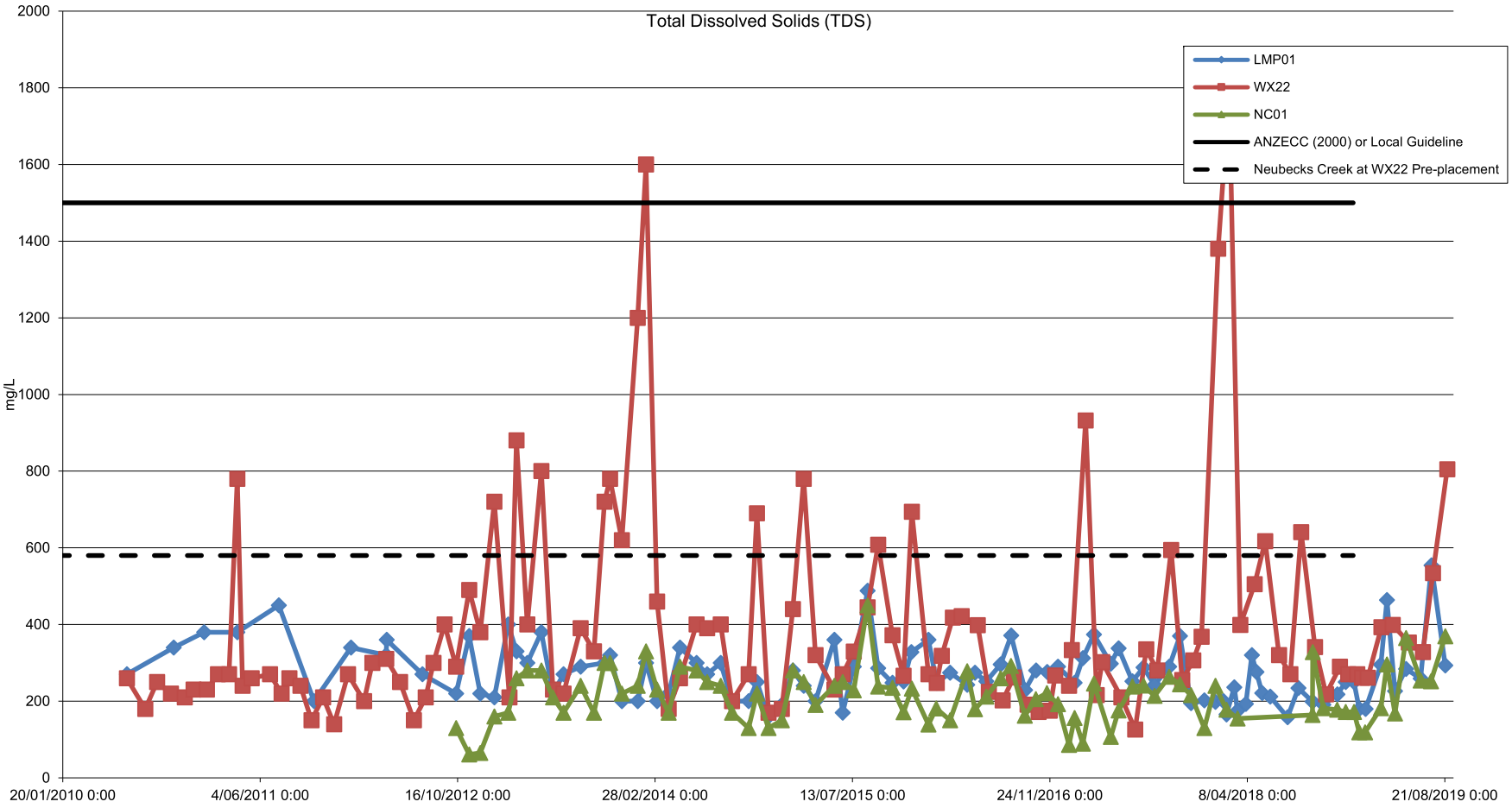
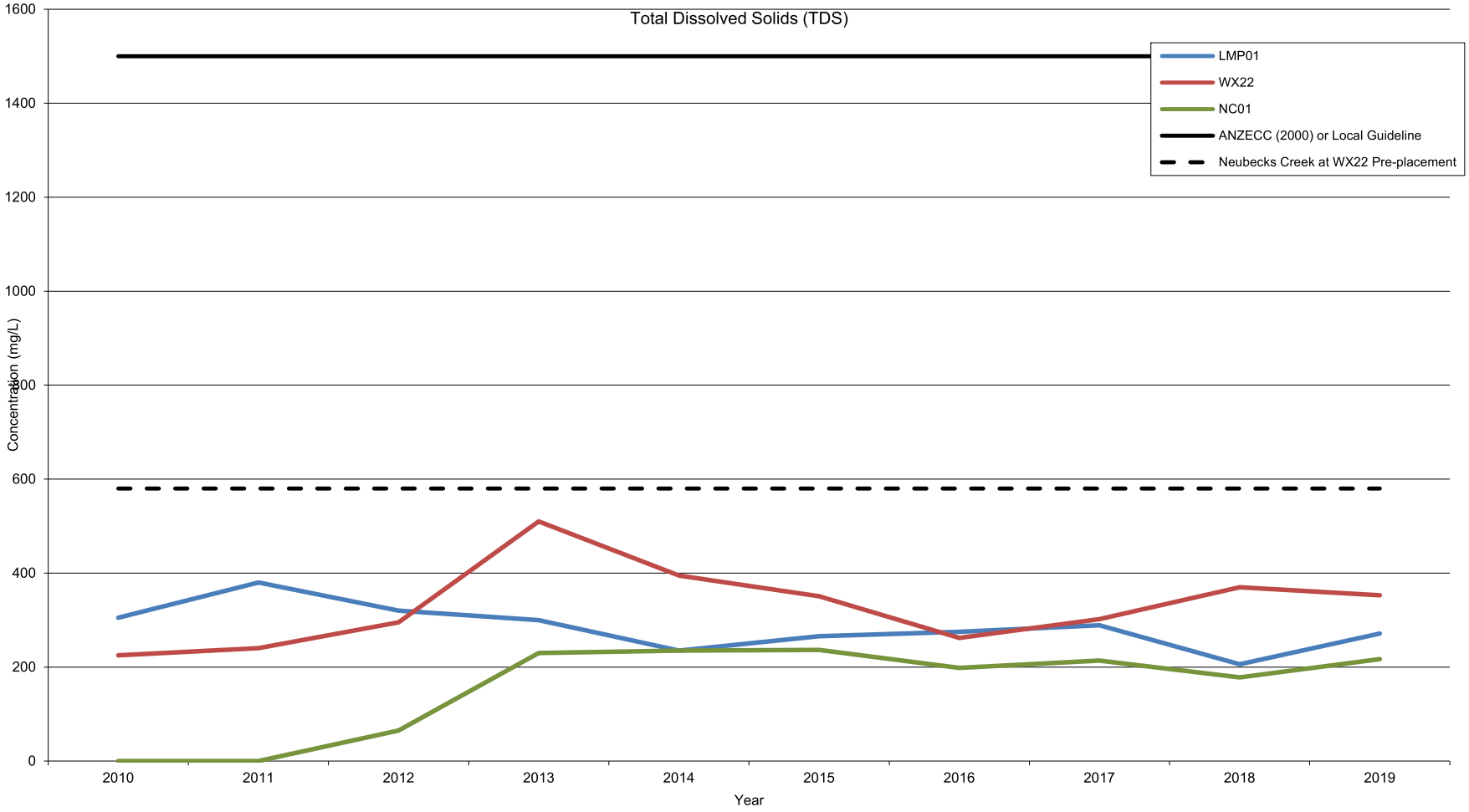


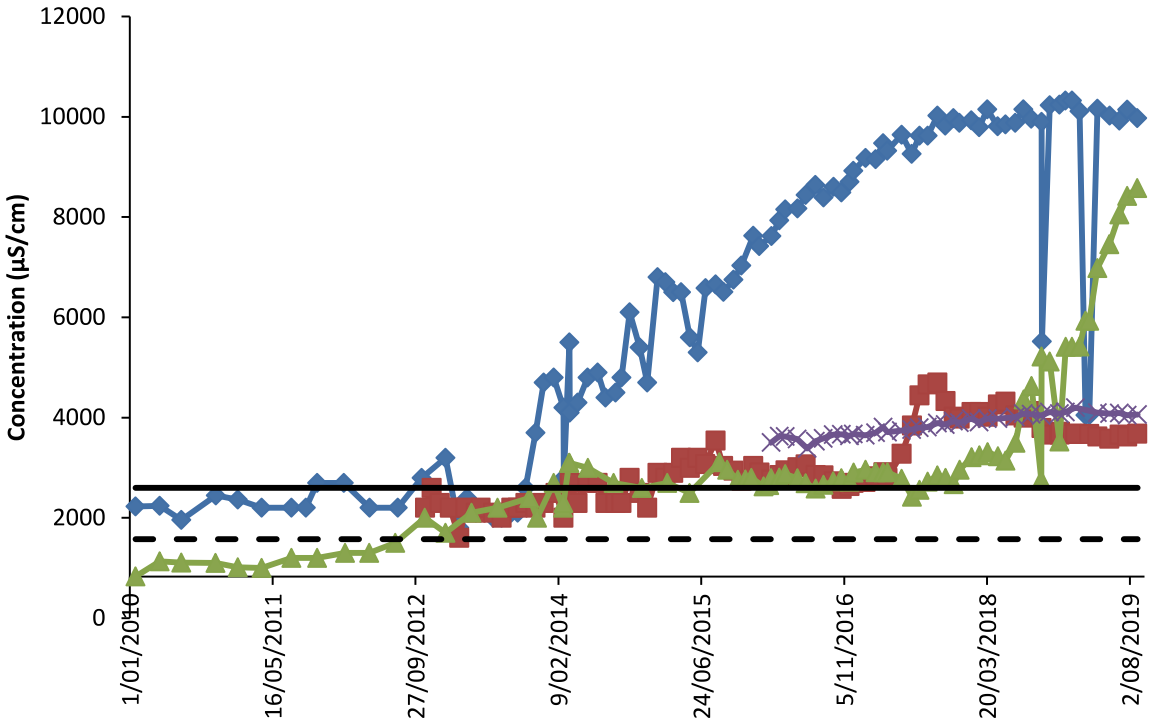
Figure4b. Total Dissovled Solids (TDS) Concentrations Over Time - Annual 50th Percentile
Mount Piper
Lamberts North AMER - 0470260



Annex E

Trend Graphs -Groundwater

Electrical Conductivity (Laboratory and Field)



Note:
Electrical conductivity (laboratory):
21 January 2010 - 26 August 2015

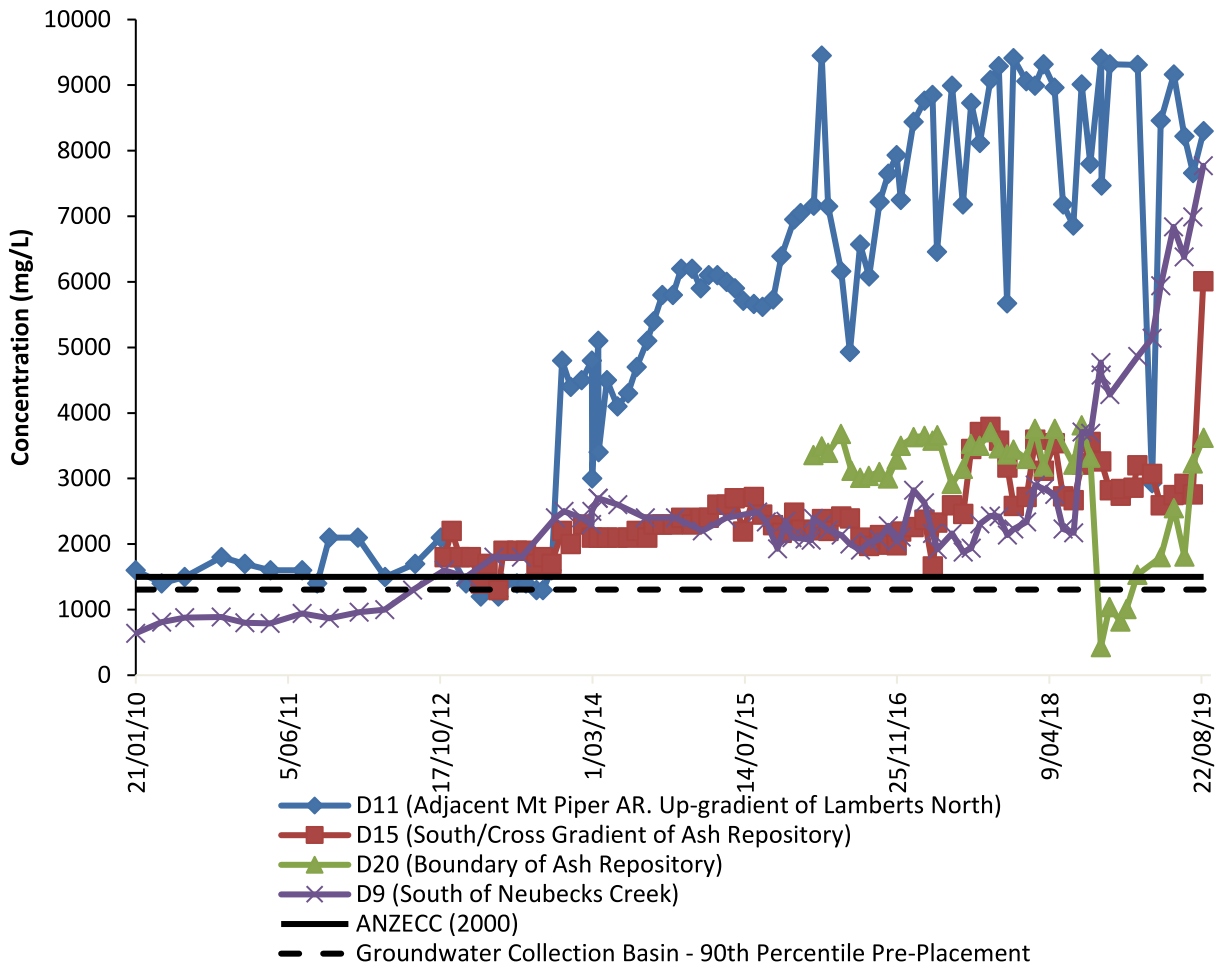
Electrical conductivity (field):
25 August 2015 - 29 August 2019

- D11 (Adjacent Mt Piper AR. Up-gradient of Lamberts North)
- D15 (South/Cross Gradient of Ash Repository)
- D9 (South of Neubecks Creek)
- D20 (Boundary of Ash Repository)
- ANZECC (2000)
- Groundwater Collection Basin - 90th Percentile Pre-Placement

Graph 1a - Electrical Conductivity (Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

ERM



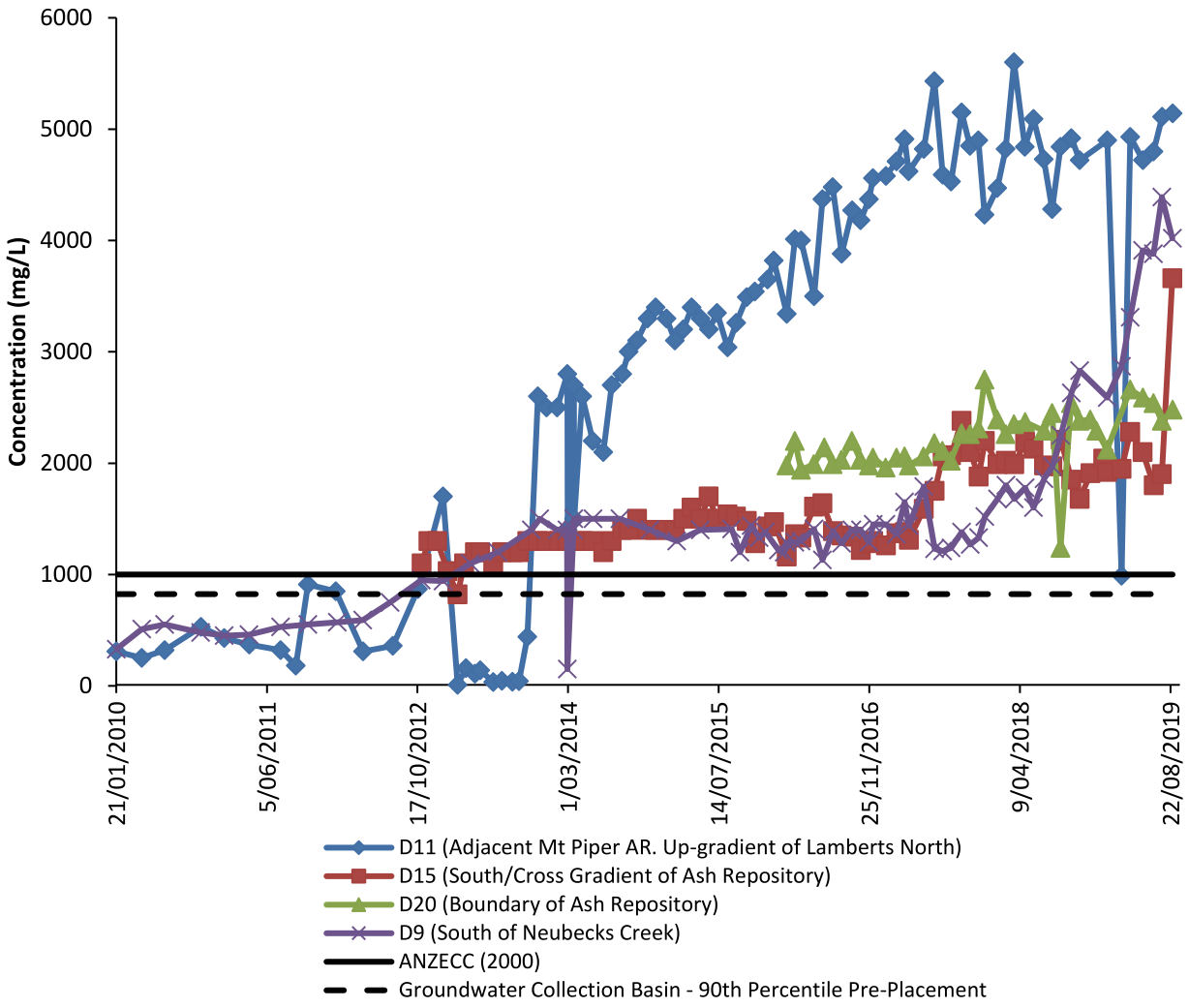
Graph 2a - TDS Concentrations

(Groundwater)

[Project_Name]

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

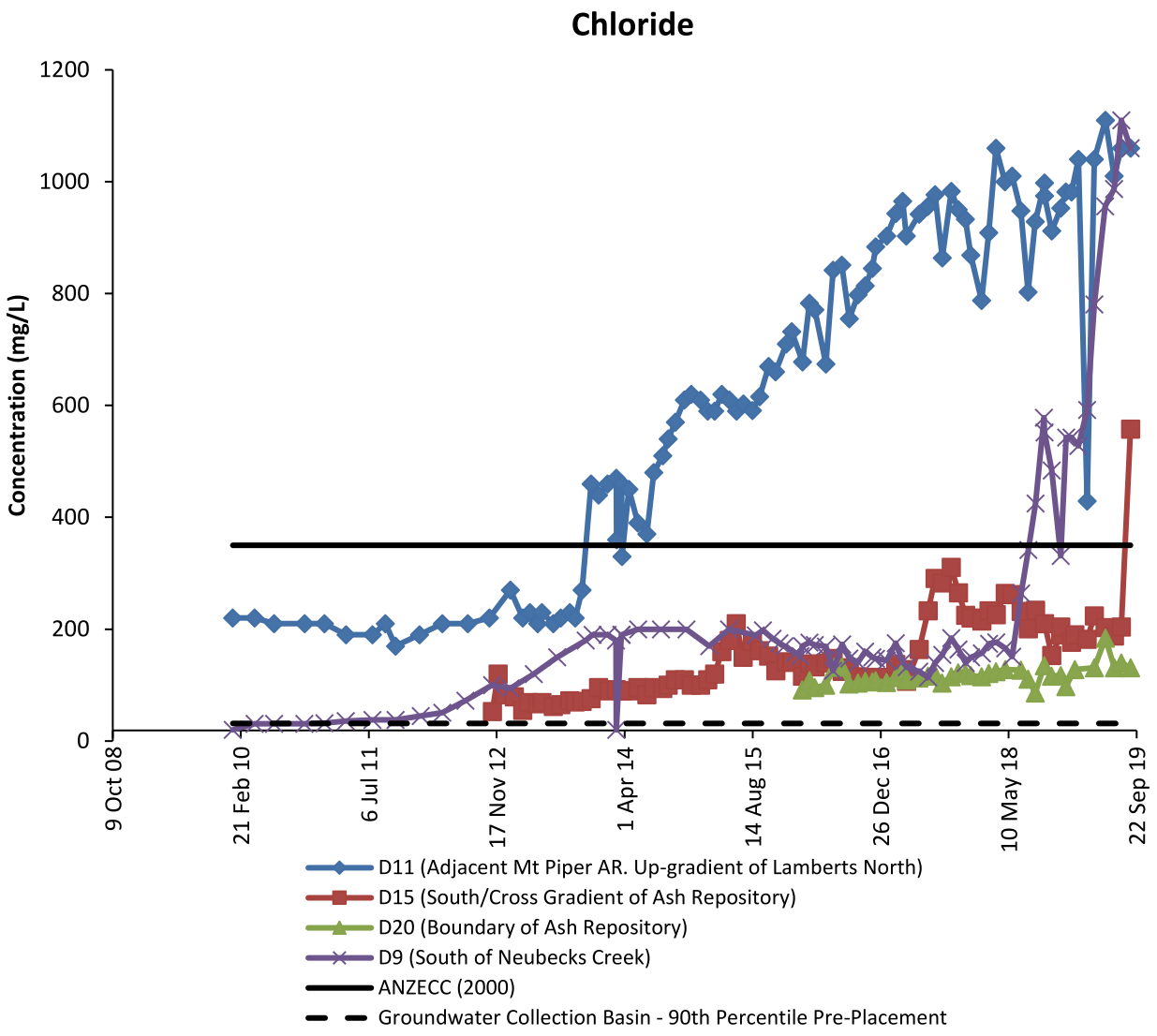
ERM



Graph 3a - Sulfate Concentrations (Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

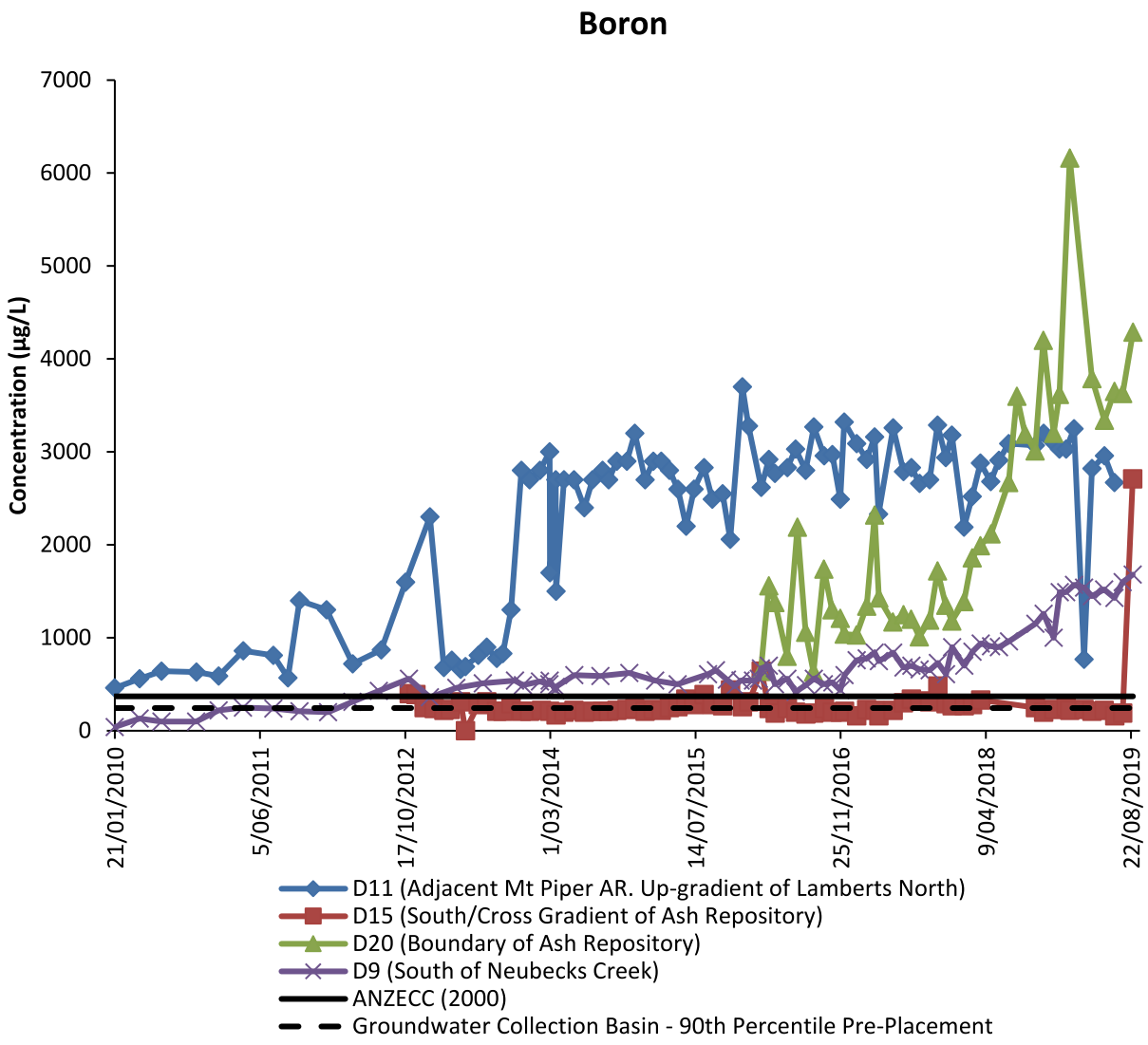
ERM



Graph 4a - Chloride Concentrations (Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

ERM

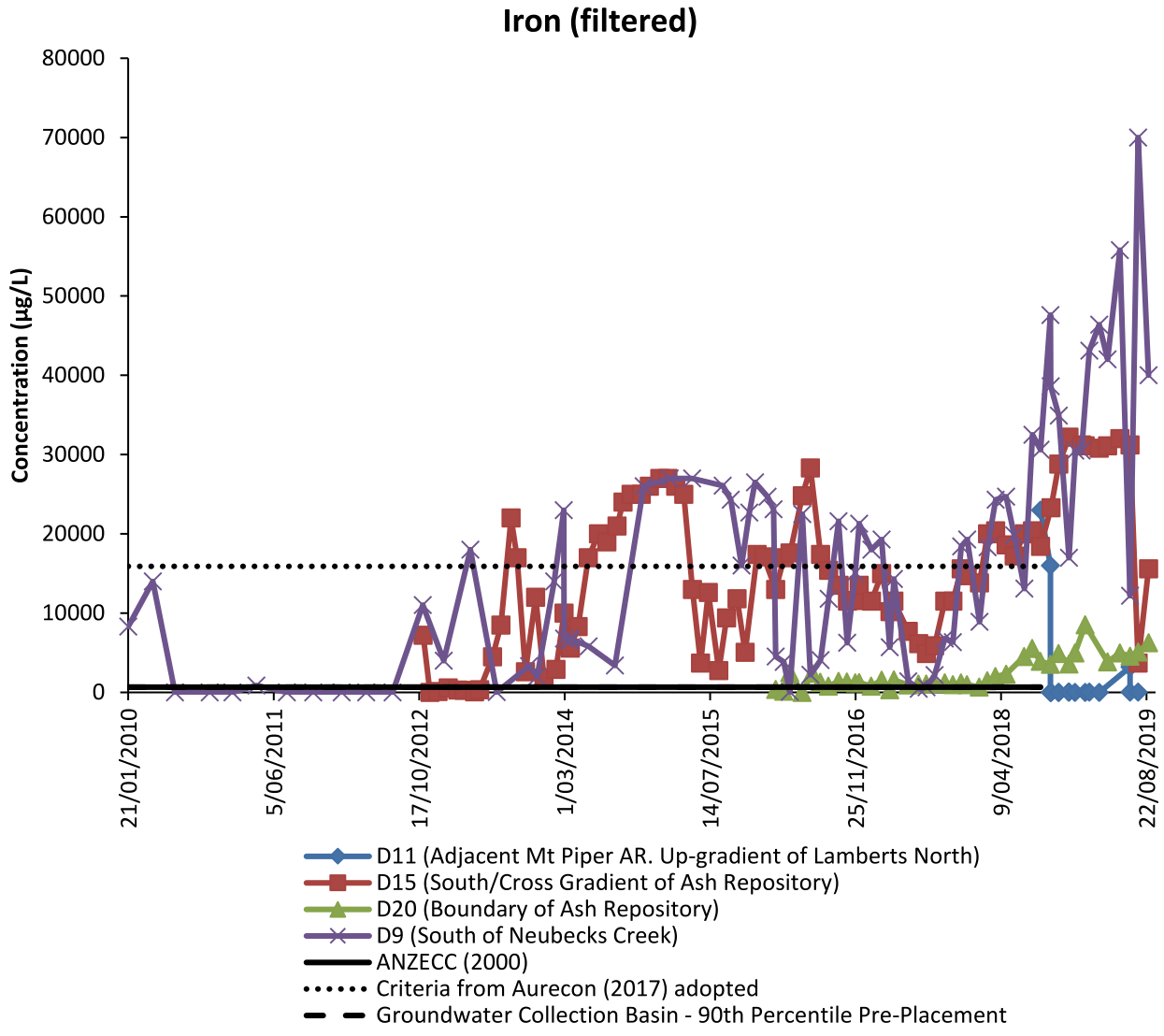


Graph 5a - Boron Concentrations

(Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

ERM

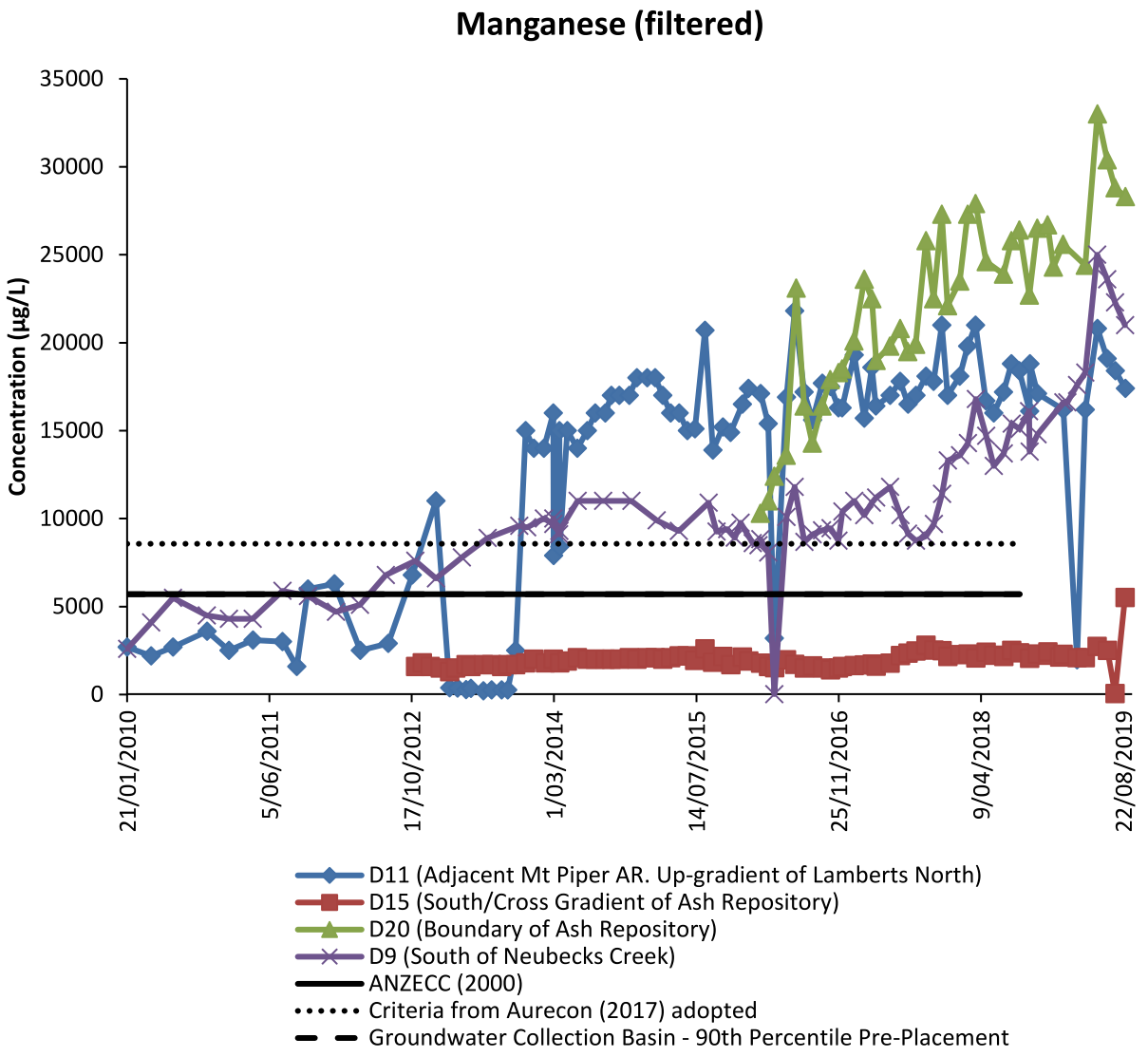


Graph 6a - Iron Concentrations

(Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

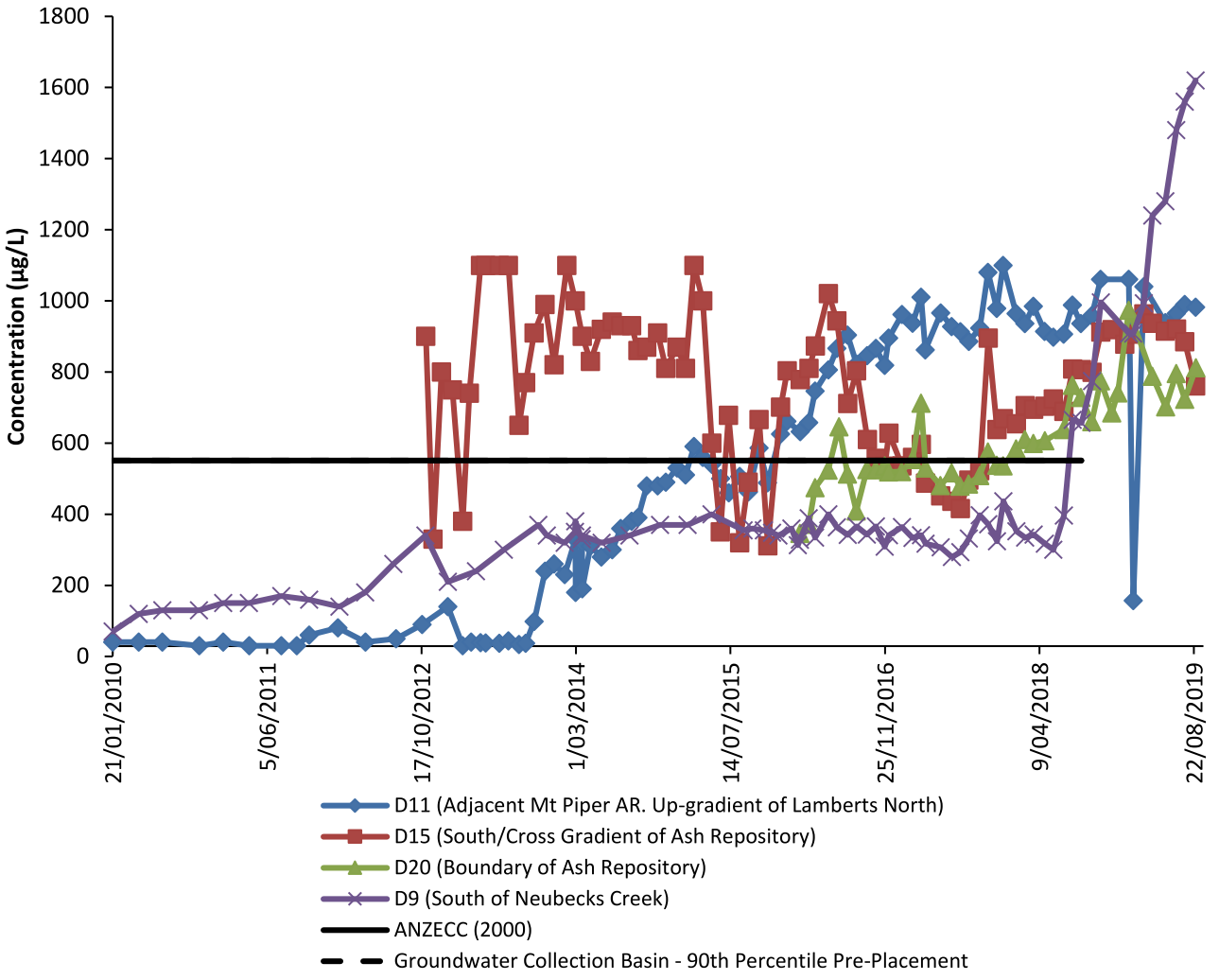
ERM



Graph 7a - Manganese Concentrations (Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

ERM



Graph 8a - Nickel Concentrations (Groundwater)

Date: Oct 19	Drawn:
Scale:	Chk'd:
Original:	Rev:
File Reference: 470260	

ERM

Annex F

Hydrographs

Figure 1. Water Level Over Time - Cross Gradient
Lamberts North
Annual Report September 2018 to August 2019 - 0470260

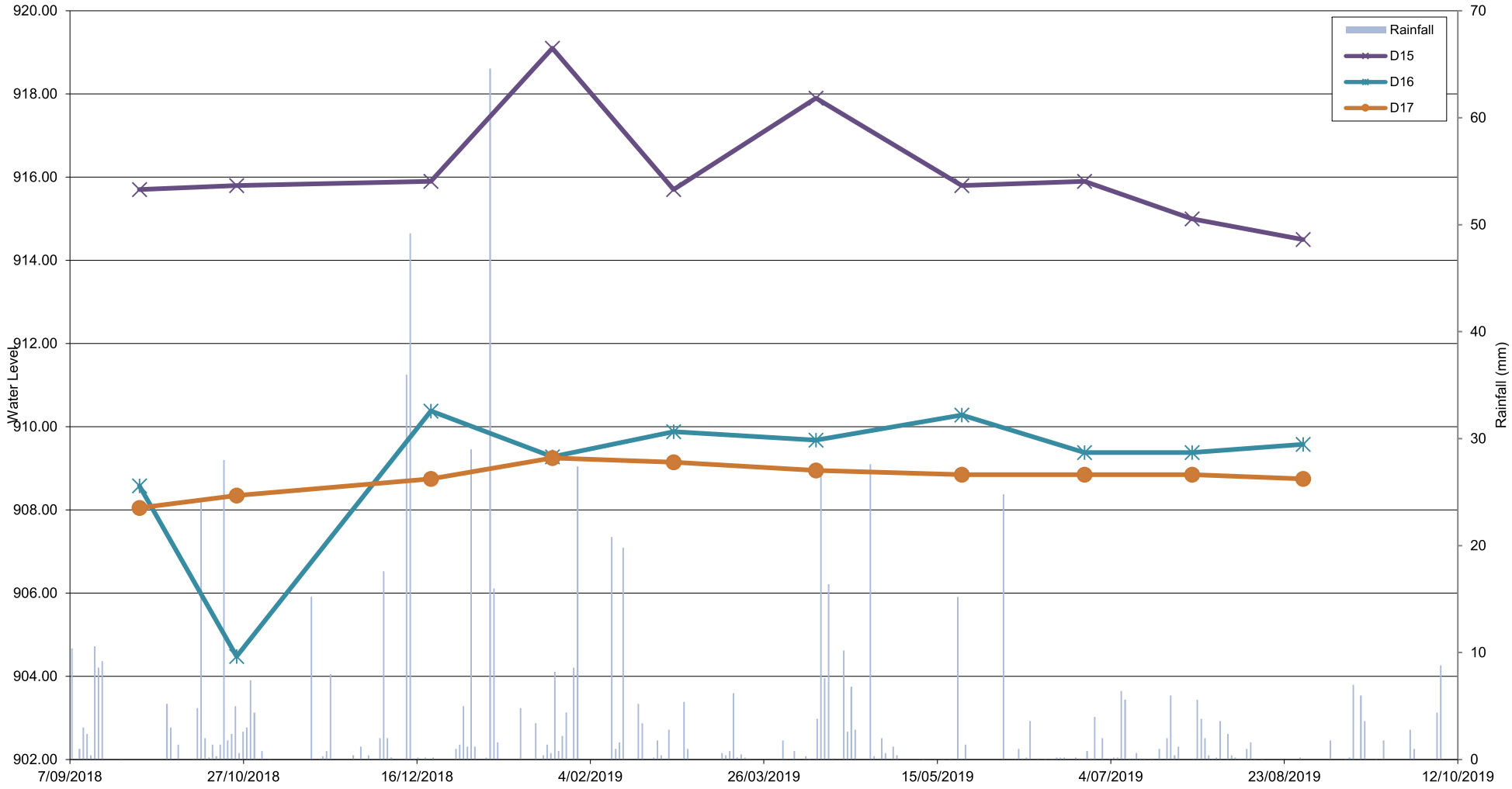


Figure 2. Water Level Over Time - Up-gradient/ Adjacent to Mt Piper
Lamberts North
Annual Report September 2018 to August 2019 - 0470260

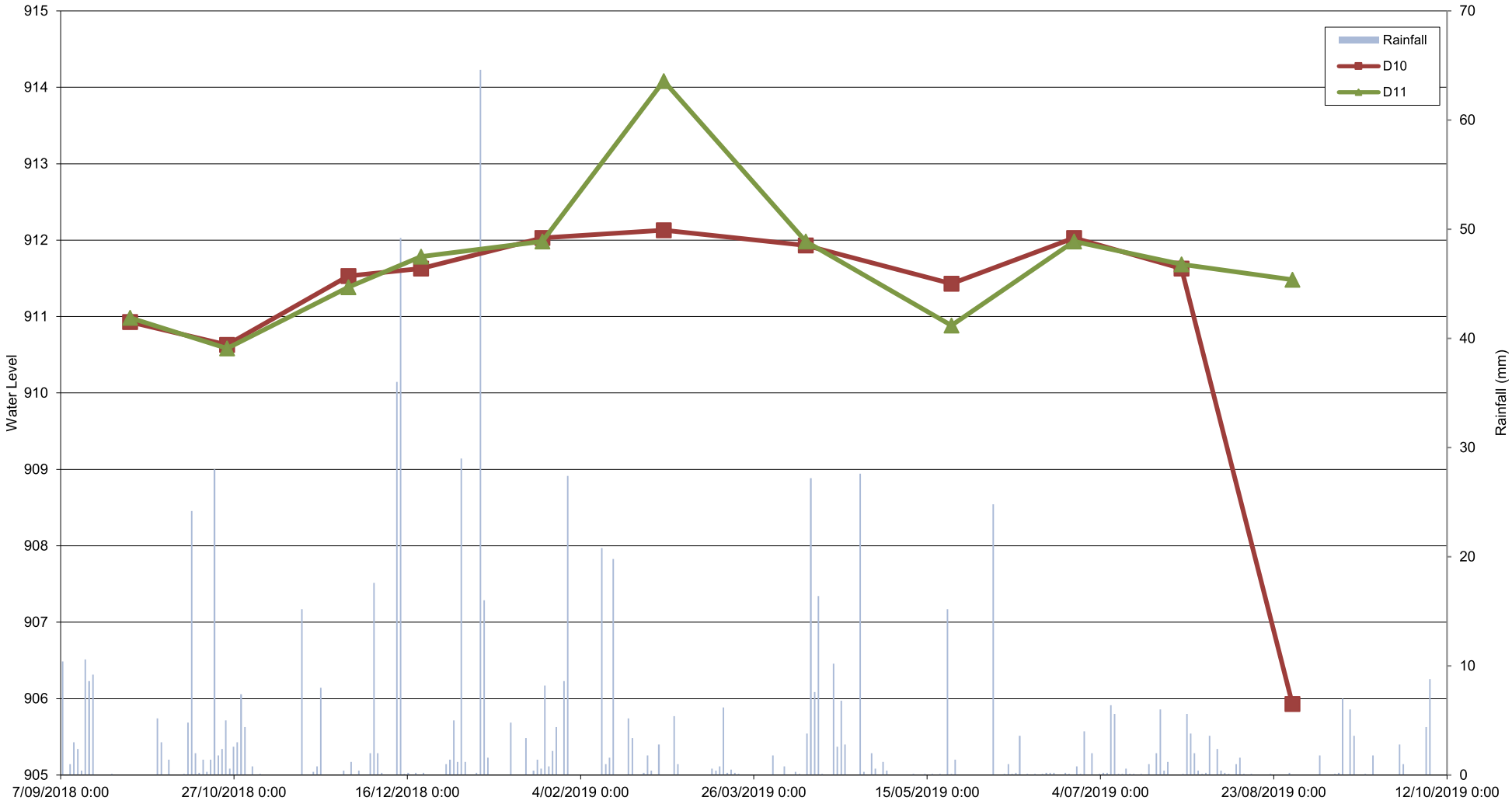


Figure 3. Water Level Over Time - Adjacent to Ash Repository
Lamberts North
Annual Report September 2018 to August 2019 - 0470260

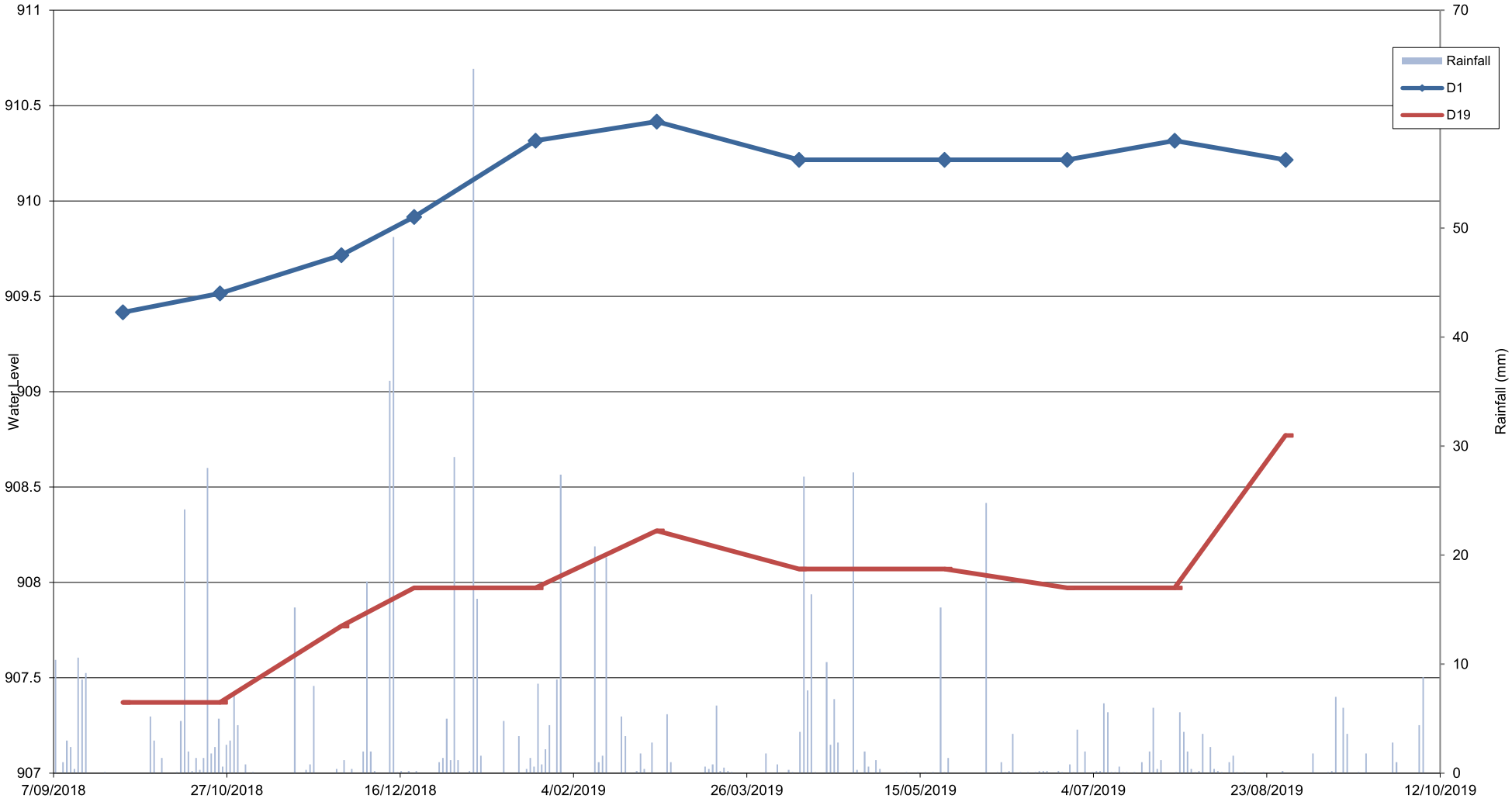
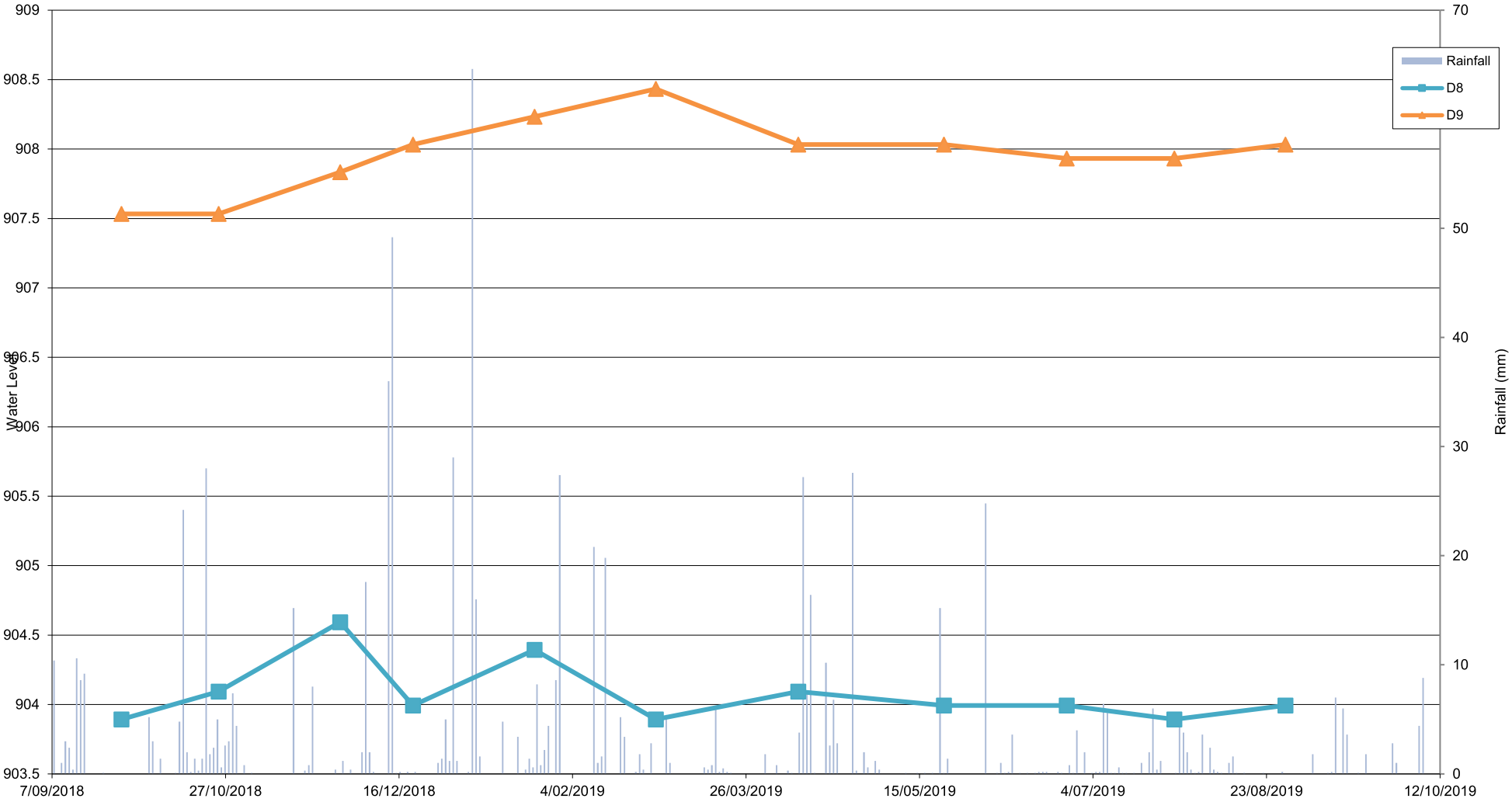


Figure 4. Water Level Over Time - Adjacent to Neubecks Creek
Lamberts North
Annual Report September 2018 to August 2019 - 0470260



Annex G

Project Approvals

Project Approval

Section 75J of the *Environmental Planning & Assessment Act 1979*

As delegate of the Minister for Planning and Infrastructure under delegation from the Minister enforced from 1 October 2011, I approve the project application referred to in Schedule 1, subject to the conditions in Schedule 2.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Richard Pearson
Deputy Director-General
Development Assessment and Systems Performance

Sydney 16 February 2012

SCHEDULE 1

Application No.:	09_0186
Proponent:	Delta Electricity
Approval Authority:	Minister for Planning and Infrastructure
Land:	The project site is located in the central-west of NSW, at 350 Boulder Road, Portland and located within Lot 9 DP804929, Lot 15 DP804929, Lot 501 DP 825541, Lot 13 DP 751651, Lot 357 DP751651.
Project:	The construction and operation of new ash placement areas at the Lamberts South and Lamberts North sites to cater for the ash generated from the existing Mt Piper Power Station and the proposed Mt Piper Power Station Extension.

TABLE OF CONTENTS

DEFINITIONS

Act, the	Environmental Planning and Assessment Act 1979
Ancillary Facility	Temporary facility for construction. Examples may include an office and amenities compound, construction compound, batch plant, materials storage compound and stockpile areas.
Conditions of Approval	The Minister's Conditions of Approval for the project.
Construction	Includes all work in respect of the project other than survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities, or other activities determined by the Environmental Representative to have minimal environmental impact (e.g. minor adjustments to utilities).
Department, the	NSW Department of Planning and Infrastructure
Director-General, the	Director-General of the NSW Department of Planning and Infrastructure (or delegate)
Director-General's Approval	A written approval from the Director-General (or delegate). Where the Director-General's approval is required by a condition, the Director-General will endeavour to provide a response within one month of receiving an approval request. The Director-General may ask for additional information if the approval request is considered incomplete. When further information is requested the time taken for the Proponent to respond in writing will be added to the one month period.
DPI	Department of Primary Industries
EA	Environmental Assessment
EPA	Environment Protection Authority
Environment Protection Licence	An Environment Protection Licence issued by the NSW Environment Protection Authority pursuant to the Protection of the Environment Operations Act 1997.
Environmental Incident	Any incident with actual or potential significant impacts on the biophysical environment and/or off-site impacts on people.
Minister, the	Minister for Planning and Infrastructure
NOW	NSW Office of Water
OEH	The Office of Environment and Heritage

Operation	Means the Operation of the Project, including ash haulage, ash truck movements, ash placement and management, operation of on-site water management systems, landscaping and revegetation/rehabilitation of the site but does not include commissioning trials of equipment or temporary use of parts of the project during construction.
Project	The project that is the subject of Major Project Application 09_0186.
Project Area	Lamberts North and Lamberts South ash disposal areas as identified in the Proponent's Environmental Assessment, August 2010.
Proponent	Delta Electricity
Publicly Available	Available for inspection by a member of the general public (for example, available on an internet site)
Reasonable and Feasible	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits, cost of mitigation versus benefits provided, community views, and nature and extent of potential improvements.
SCA	Sydney Catchment Authority
Sensitive Receiver	Residence, educational institution (e.g. school, TAFE college), health care facility (e.g. nursing home, hospital), religious facility (e.g. church), or child care facility.
Waste	For the purpose of this project, ash and brine are not considered waste.

SCHEDULE 2
PART A - ADMINISTRATIVE CONDITIONS

Terms of Approval

A1. The Proponent shall carry out the project generally in accordance with the:
   (a) Major Project Application 09_0186;
   (b) Mt Piper Ash Placement (two volumes) – Environmental Assessment (EA), prepared by Sinclair Knight Merz, August 2010;
   (c) Mt Piper Ash Placement – Submissions Report, prepared by Sinclair Knight Merz, March 2011;
   (d) Delta's Letter to the Department – Submissions Report Response to the Department and Agency Issues (dated 22 June 2011); and
   (e) the conditions of this approval.

A2. In the event of an inconsistency between:
   (a) the conditions of this approval and any document listed from condition A1a) to A1(d) inclusive, the conditions of this approval shall prevail to the extent of the inconsistency; and
   (b) any of the documents listed from conditions A1a) to A1(d) inclusive, the most recent document shall prevail to the extent of inconsistency.

A3. The Proponent shall comply with the reasonable requirements of the Director-General arising from the Department's assessment of:
   (a) any reports, plans or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans or correspondence.

A4. The Proponent shall meet the requirements of the Director-General in respect of the implementation of any measure necessary to ensure compliance with the conditions of this approval, and general consistency with the documents listed under condition A1 of this approval.

Limits of Approval

A5. This approval shall lapse five years after the date on which it is granted, unless the works that are the subject of this approval are physically commenced on or before that time.

Statutory Requirements

A6. The Proponent shall ensure that all licences, permits and approvals are updated and/or obtained as required by law and maintained as required with respect to the project. No condition of this approval removes the obligation for the Proponent to obtain, renew or comply with such licences, permits or approvals.

Staging

A7. Where the Proponent intends to construct and operate the project in discrete stages (i.e Lamberts North and Lamberts South) it may comply with the requirements in conditions B4, B5, D2, D3 and D4 separately for each stage.

PART B – PRIOR TO CONSTRUCTION

Environmental Representative

B1. Prior to the commencement of any construction activities, or as otherwise agreed by the Director-General, the Proponent shall nominate for the approval of the Director-General a suitably qualified and experienced Environmental Representative(s). The Proponent shall engage the Environmental Representative(s) during any construction activities, and throughout the life of the project, or as otherwise agreed by the Director-General. The Environmental Representative(s) shall:

(a) oversee the implementation of all environmental management plans and monitoring programs required under this approval, and advise the Proponent upon the achievement of these plans/programs;

(b) consider and advise the Proponent on its compliance obligations against all matters specified in the conditions of this approval and the Statement of Commitments; and

(c) have the authority and independence to recommend to the Proponent reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts and, failing the effectiveness of such steps, to recommend to the Proponent that relevant activities are to be ceased as soon as reasonably practicable if there is a significant risk that an adverse impact on the environment will be likely to occur.

Groundwater Modelling

B2. The Proponent shall undertake groundwater modelling by either adapting the existing UTS (2007) groundwater model to Lamberts North or developing a new groundwater model for Lamberts North. The updated model should be calibrated to site-specific data. In either case, the model shall incorporate the findings of groundwater monitoring of the existing ash placement areas. The Proponent shall consult with the SCA in the preparation of the groundwater model and the model shall be provided to the SCA within five months of project approval, unless otherwise agreed by the Director-General. The model shall address but not necessarily be limited to the following:

(a) the findings of the groundwater monitoring of existing ash placement areas and be based on average groundwater quality data;

(b) updated predictions of the long term behaviour, fate and impacts of ash placement, in particular for water quality parameters such as sulphates, chlorides, boron, manganese, nickel, zinc, molybdenum copper, arsenic and barium;

(c) updated risk assessment for ground and surface water quality impacts under a range of rainfall events of differing duration and intensities (including up to a 100 year ARI event);

(d) calibration to site-specific data; and

(e) identification of appropriate surface and groundwater management measures required in order to achieve a neutral or beneficial effect on water quality.

Prior to construction of Lamberts South, the Lamberts North groundwater model is to be updated as set out above in items (a) - (e) in consultation with the SCA, to apply to Lamberts South.

Groundwater Monitoring

B3. Baseline groundwater monitoring data, including groundwater quality, location of groundwater monitoring wells, depth and flow of groundwater in the project area should be obtained for a minimum of two sampling events prior to construction and a minimum of two sampling events after construction and prior to ash placement commencing. The baseline monitoring data along with the modelling predictions in B2 should be used in the consideration of the design of the ash placement facilities. The location of groundwater monitoring wells and parameters to be monitored should be undertaken in consultation with the SCA.

Prior to construction of Lamberts South the Proponent shall conduct baseline groundwater data collection as set out above, and use the results and the modelling predictions in B2 in the consideration of the design of the ash placement facilities.

Construction Environmental Management Plan

B4. The Proponent shall prepare and implement a Construction Environmental Management Plan (CEMP) to outline environmental management practices and procedures to be followed during construction of the project. The Plan shall be prepared in consultation with Lithgow City Council and relevant government agencies, and be consistent with the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004 or its latest revision) and shall include, but not necessarily be limited to:

(a) a description of all relevant activities to be undertaken on the site during construction including an indication of stages of construction, where relevant;
(b) identification of the potential for cumulative impacts with other construction activities occurring in the vicinity and how such impacts would be managed;
(c) details of any site compounds and mitigation, monitoring, management and rehabilitation measures specific to the site compound(s) that would be implemented;
(d) statutory and other obligations that the Proponent is required to fulfil during construction including all relevant approvals, consultations and agreements required from authorities and other stakeholders, and key legislation and policies;
(e) evidence of consultation with relevant government agencies required under this condition and how issues raised by the agencies have been addressed in the plan;
(f) a description of the roles and responsibilities for all relevant employees involved in the construction of the project including relevant training and induction provisions for ensuring that all employees, contractors and sub-contractors are aware of their environmental and compliance obligations under these conditions of approval;
(g) details of how the environmental performance of construction will be managed and monitored, and what actions will be taken to address identified potential adverse environmental impacts;
(h) specific consideration of relevant measures to address any requirements identified in the documents referred to under conditions A1(b) and A1(d);
(i) a complaints handling procedure during construction;
(j) emergency management measures including measures to control bushfires;
(k) details of waste management including reuse and/or recycling of waste material, to minimise the need for treatment or disposal of those materials outside the site; and
(l) the additional requirements of this approval.

The CEMP for the project (or any stage of the project) shall be submitted to the Director-General for approval at least four weeks prior to the commencement of any construction work associated with the project (or stage as relevant), unless otherwise agreed by the Director-General. Construction shall not commence until written approval has been received from the Director-General.

B5. As part of the CEMP for the project, the Proponent shall prepare and implement the following plans:

a) a **Construction Noise Management Plan** to detail how construction noise impacts would be minimised and managed. The Plan shall be developed in consultation with the EPA and shall include, but not necessarily be limited to:
   i) details of construction activities and an indicative schedule for construction works;

ii) identification of construction activities that have the potential to generate noise impacts on sensitive receivers;
iii) identification of noise criteria and procedures for assessing noise levels at sensitive receivers;
iv) details of reasonable and feasible actions and measures to be implemented to minimise noise impacts;
v) details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and
vi) procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity.

b) a **Groundwater Management Plan** to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with the NOW and the SCA and include, but not necessarily be limited to:
i) identification of the construction activities that could affect groundwater at the site, including groundwater interference and impacts to groundwater users and dependent species;
ii) a description of the management controls to minimise impacts to groundwater during construction;
iii) methods for monitoring groundwater during construction including a program to monitor groundwater flows and groundwater quality in the project area;
iv) a response program to address indentified exceedances of existing groundwater quality criteria approved for Area 1 (the existing ash placement area); and
v) provisions for periodic reporting of results to the SCA during construction.

c) a **Soil and Surface Water Management Plan** to outline measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to lands and/or waters throughout the construction period. The Plan shall be based on best environmental practice and shall be prepared in consultation with the SCA and the NOW and any other relevant government agency. The Plan shall include, but not necessarily be limited to:
i) baseline data on the water quality and available flow data in Huons Creek, Lamberts Gully Creek and Neubecks Creek;
ii) water quality objectives and impact assessment criteria for Huons Creek, Lamberts Gully Creek and Neubecks Creek;
iii) a geomorphic assessment of the capacity of Lamberts Gully Creek to accommodate additional flow under a range of rainfall events and duration, prior to commencement of construction works;
iv) identification of the construction activities that could cause soil erosion or discharge sediment or water pollutants from the site;
v) description of stockpile locations and disposal methods;
vi) a description of the management methods to minimise soil erosion or discharge of sediment or water pollutants from the site, including a strategy to minimise the area of bare surfaces, stabilise disturbed areas, and minimise bank erosion;
vii) demonstration that the proposed erosion and sediment control measures will conform with, or exceed, the relevant requirements of Managing Urban Stormwater: Soils and Construction (Landcom, 2004);
viii) a site water management strategy identifying drainage design including the separation of clean and dirty water areas for the project, details of the lining of surface water collection ponds and the associated water management measures including erosion and sediment controls and provisions for recycling/reuse of water and the procedures for decommissioning water management structures on the site and

consideration to the treatment of water prior to discharge to the environment;

ix) measures to monitor and manage soil and water impacts in consultation with NOW and DPI (Fisheries) including: control measures for works close to or involving waterway crossings (including rehabilitation measures following disturbance and monitoring measures and completion criteria to determine rehabilitation success);

x) measures to monitor and manage flood impacts in consultation with NOW and shall include, but not necessarily be limited to a flood model for predicted water levels and contingency measures for the site during potential floods;

xi) a program to monitor surface water quality, including Lamberts Gully Creek and Neubecks Creek;

xii) a protocol for the investigation of identified exceedances in the impact assessment criteria;

xiii) a response plan to address potential adverse surface water quality exceedances; and

xiv) provisions for periodic reporting of results to the DPI (Fisheries), NOW and the SCA as per condition B8.

d) a **Air Quality Management Plan**, to provide details of dust control measures to be implemented during the construction of the project. The Plan shall be prepared in consultation with the EPA and should include, but not necessarily be limited to:

i) identification of sources of dust deposition including, truck movements, regrading, backfilling, stockpiles and other exposed surfaces;

ii) identification of criteria, monitoring and mitigation measures for the above sources; and

iii) a reactive management programme detailing how and when construction operations are to be modified to minimise the potential for dust emissions, should emissions exceed the relevant criteria.

e) a **Flora and Fauna Management Plan**, to outline measures to protect and minimise loss of native vegetation and native fauna habitat as a result of construction of the project. The Plan shall be prepared in consultation with the EPA and shall include, but not necessarily be limited to:

i) plans showing terrestrial vegetation communities; important flora and fauna habitat areas; locations of threatened flora and fauna and areas to be cleared. The plans shall also identify vegetation adjoining the site where this contains important habitat areas and/or threatened species, populations or ecological communities;

ii) procedures to accurately determine the total area, type and condition of vegetation community to be cleared;

iii) methods to manage impacts on flora and fauna species and their habitat which may be directly or indirectly affected by the project, procedures for vegetation clearing or soil removal/stockpiling and procedures for identifying and re-locating hollows, installing nesting boxes and managing weeds; and

iv) a procedure to review management methods where they are found to be ineffective.

f) an **Aboriginal Heritage Plan** to monitor and manage Aboriginal heritage impacts in consultation with registered Aboriginal stakeholders and prepared in consultation with the EPA. The plan should include but not necessarily limited to:

i) an updated Cultural Heritage Management Plan to cover the protection of sites previously recorded in the 2005 Aboriginal heritage assessment;
ii) procedures for the management of unidentified objects and/or human remains, including ceasing work;
iii) Aboriginal cultural heritage induction processes for construction personnel; and
iv) procedures for ongoing Aboriginal consultation and involvement should Aboriginal heritage sites or objects be found during construction.

g) an **Ash Transportation Plan** to provide details on the preferred option for the transportation of ash from the Mt Piper Power Station to the ash placement areas. The Plan shall include but not necessarily limited to:
i) justification of the proposed option for ash transportation (either haulage access roads and/or conveyor) for ash transportation;
ii) details of the proposed option, including construction requirements, impacts and mitigation measures;
iii) plans showing the location of the chosen option; and
iv) provision of mitigation measures should the conveyor breakdown.

Biodiversity Offsets

B6. The Proponent shall develop and submit for the approval of the Director-General, a Biodiversity Offset Management Plan. The Biodiversity Offset Management Plan is to be submitted within 12 months of the project approval, unless otherwise agreed to by the Director-General. The Plan shall be developed in consultation with the EPA and shall:
a) identify the objectives and outcomes to be met by the Biodiversity Offset Management Plan;
b) describe the size and quality of the habitat/vegetation communities of the offset;
c) identify biodiversity impacts, including impacts related to the loss of impacted flora and fauna including threatened Capertee Stringybark (*Eucalyptus cannonii*), nine (9) hectares of remnant vegetation (including, Red Stringy Bark Woodland, Scribbly Gum Woodland, Ribbon Gum Woodland), habitat for microbat and woodland bird species and the 31 ha of rehabilitated vegetation to be removed;
d) describe the decision-making framework used in selecting the priority ranking of compensatory habitat options available in the region. Where possible, this should include purchase of land, development of agreements with identified land management authorities (e.g EPA, local Council) for long term management and funding of offsets and mitigation measures, and installation of identified mitigation measures;
e) include an offset for direct and indirect impacts of the proposal which maintains or improves biodiversity values;
f) identify the mechanisms for securing the biodiversity values of the offset measures in perpetuity and identify a monitoring regime, responsibilities, timeframes and performance criteria; and
g) detail contingency measures to be undertaken should monitoring against performance criteria indicate that the offset/ rehabilitation measures have not achieved performance outcomes. Rehabilitation measures are required to be implemented to ensure that the biodiversity impacts are consistent with a maintain or improve biodiversity outcome.

Ecological Monitoring Program

B7. The Proponent shall prepare and implement an **Ecological Monitoring Program** prior to construction, in consultation with the NOW and the DPI (Fisheries), to monitor and quantify the impacts on the ecology of Neubecks Creek and the

associated riparian environment. The Program shall include, but not necessarily be limited to:

a) a sampling, data collection and assessment regime to establish baseline ecological health and for ongoing monitoring of ecological health of the in-stream environment during construction and throughout the life of the project (including operation);
b) at least one in-stream sampling period prior to ash placement at Neubecks Creek and at least two (2) sampling periods following ash placement at each of Lamberts North and Lamberts South;
c) an assessment regime for monitoring the ecological health of the riparian environment for a period of at least five (5) years after final capping; and
d) management measures to address any adverse ecological impacts.

Compliance Monitoring and Tracking

B8. The Proponent shall develop and implement a Compliance Tracking Program for the project, prior to commencing construction, to track compliance with the requirements of this approval and shall include, but not necessarily be limited to:

a) provisions for periodic review of the compliance status of the project against the requirements of this approval and the Statement of Commitments detailed in the document referred to in condition A1c) of this approval;
b) provisions for periodic reporting of the compliance status to the Director-General;
c) a program for independent environmental auditing in accordance with AS/NZ ISO 19011:2003 - Guidelines for Quality and/or Environmental Management Systems Auditing;
d) procedures for rectifying any non-compliance identified during environmental auditing or review of compliance;
e) mechanisms for recording environmental incidents and actions taken in response to those incidents;
f) provisions for reporting environmental incidents to the Director-General during construction and operation; and
g) provisions for ensuring all employees, contractors and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities.

The Compliance Tracking Program shall be implemented prior to construction of the project with a copy submitted to the Director-General for approval at least four weeks prior to the commencement of the project, unless otherwise agreed by the Director-General.

B9. Nothing in this approval restricts the Proponent from utilising any existing compliance tracking programs administrated by the Proponent to satisfy the requirements of condition B8. In doing so, the Proponent must demonstrate to the Director-General how these systems address the requirements and/or have been amended to comply with the requirements of the condition.

Community Information and Complaints Management Provision of Information

B10. Prior to the construction of the project, the Proponent shall establish and maintain a website for the provision of electronic information associated with the project. The Proponent shall, subject to confidentiality, publish and maintain up-to-date information on this website or dedicated pages including, but not necessarily limited to:

a) the documents referred to under condition A1 of this approval;
b) this project approval, Environment Protection Licence and any other relevant environmental approval, licence or permit required and obtained in relation to the project;
c) all strategies, plans and programs required under this project approval, or details of where this information can be viewed;

d) information on construction and operational progress; and
e) the outcomes of compliance tracking in accordance with the requirements of this project approval.

Complaints and Enquiries Procedure

B11. Prior to the construction of the project, the Proponent shall ensure that the following are available for community complaints and enquiries during construction and operation:

a) a 24 hour contact number(s) on which complaints and enquiries about construction and operational activities may be registered;
b) a postal address to which written complaints and enquiries may be sent; and
c) an email address to which electronic complaints and enquiries may be transmitted.

The telephone number, postal address and email address shall be published in a newspaper circulating in the local area prior to the commencement of the project. The above details shall also be provided on the website required by condition B11 of this approval.

B12. The Proponent shall record the details of complaints received through the means listed under condition B11 of this approval in a Complaints Register. The Register shall record, but not necessarily be limited to:

a) the date and time of the complaint;
b) the means by which the complaint was made (e.g. telephone, email, mail, in person);
c) any personal details of the complainant that were provided, or if no details were provided a note to that effect;
d) the nature of the complaint;
e) the time taken to respond to the complaint;
f) any investigations and actions taken by the Proponent in relation to the complaint;
g) any follow-up contact with, and feedback from, the complainant; and
h) if no action was taken by the Proponent in relation to the complaint, the reason(s) why no action was taken.

The Complaints Register shall be made available for inspection by the Director-General upon request.

Community Information Plan

B13. Prior to the commencement of construction of the project, the Proponent shall prepare and implement a Community Information Plan which sets out the community communications and consultation processes to be undertaken during construction and operation of the project. The Plan shall include but not be limited to:

a) measures for disseminating information on the development status of the project and methods for actively engaging with surrounding landowners, including Forests NSW and affected stakeholders regarding issues that would be of interest/ concern to them during the construction and operation of the project; and
b) procedures to inform the community where work has been approved to be undertaken outside the normal Construction hours, in particular noisy activities.

A copy of the Plan shall be provided to the Director-General one month prior to the commencement of construction.

Design

B14. The ash placement areas shall be designed by a suitably qualified expert to ensure structural stability of the ash placement areas.

PART C – DURING CONSTRUCTION

Environmental Incident Reporting

C1. The Proponent shall notify the Director-General of any environmental incident within 12 hours of becoming aware of the incident. The Proponent shall provide full written details of the incident to the Director-General within seven days of the date on which the incident occurred.

C2. The Proponent shall meet the requirements of the Director-General to address the cause or impact of any environmental incident, as it relates to this approval, reported in accordance with condition C1 of this approval, within such period as the Director-General may require.

Construction Hours

C3. Construction activities associated with the project shall only be undertaken during the following hours:

a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
b) 8:00 am to 1:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

C4. Construction outside the hours stipulated in condition C3 of this approval is permitted in the following circumstances:

a) where construction works do not cause audible noise at any sensitive receiver; or
b) for the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or
c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

C5. The hours of construction activities specified under condition C3 of this approval may be varied with the prior written approval of the Director-General. Any request to alter the hours of construction specified under condition C3 shall be:

a) considered on a case-by-case basis;
b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and
c) accompanied by information necessary for the Director-General to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.

Construction Noise

C6. The construction noise objective for the project is to manage noise from construction activities (as measured by $L_{Aeq\ (15\ minute)}$ descriptor) so as not to exceed:

Location	Day ($L_{Aeq\ (15\ minute)}$) dB(A)
All private receivers within the township of Blackmans Flat	46
All other residences	43

The Proponent shall implement reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective consistent with the requirements of the Interim Construction Noise Guideline (DECC, July 2009), including noise generated by heavy vehicle haulage and other construction traffic associated with the project. Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the

Construction Noise Management Plan (as referred to under condition B5a) of this approval).

Dust Generation

C7. The Proponent shall construct the project in a manner that minimises dust emissions from the site, including wind-blown from earth works and stockpiles and traffic-generated dust. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Proponent shall identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

Heritage Impacts

C8. If during the course of construction the Proponent becomes aware of any previously unidentified Aboriginal object(s), all work likely to affect the object(s) shall cease immediately and the EPA (OEH) informed in accordance with the *National Parks and Wildlife Act 1974*. In addition, registered Aboriginal stakeholders shall be informed of the finds. Works shall not recommence until an appropriate strategy for managing the objects has been determined in consultation with the EPA (OEH) and the registered Aboriginal stakeholders and written authorisation from the EPA (OEH) is received by the Proponent.

C9. If during the course of construction the Proponent becomes aware of any unexpected historical relic(s), all work likely to affect the relic(s) shall cease immediately and the EPA (OEH (Heritage Branch)) notified in accordance with the *Heritage Act 1977*. Works shall not recommence until the Proponent receives written authorisation from the EPA (OEH (Heritage Branch)).

Soil and Water Quality Impacts

C10. The Proponent shall comply with section 120 of the Protection of the Environment Operations Act 1997 which prohibits the pollution of waters.

C11. Soil and water management controls shall be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction activities, in accordance with:

(a) Managing Urban Stormwater: Soils and Conservation (Landcom, 2004);
(b) Managing Stormwater: Urban Soils and Construction 2A Installation of Services (DECC 2008); and
(c) Managing Stormwater: Urban Soils and Construction Vol 2C Unsealed Roads (DECC 2008).

C12. During construction, the Proponent shall maintain a buffer of 50 metres from the construction work to Neubecks Creek.

C13. Surface water drainage must be appropriately engineered and stabilised to convey run off without collapse or erosion. Surface water run off collection ponds are to be lined.

Waste Generation and Management

C14. All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to accept the materials.

C15. The Proponent shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the Protection of the Environment Operations Act 1997, if such a licence is required in relation to that waste.

C16. The Proponent shall ensure that all liquid and / or non-liquid waste generated and / or stored on the site is assessed and classified in accordance with the Waste Classification Guidelines (DECC, 2008), or any future guideline that may supersede that document.

PART D – PRIOR TO OPERATION

Ash Management

D1. The Proponent shall prepare a long-term ash management strategy including a program for investigation and assessment of alternative ash management measures with a goal of 40% reuse of ash by 31 December 2020. The report shall be submitted to the Director-General six months prior to the commencement of operations. The Proponent shall report on the status and outcomes of its investigations to the Director-General every two years from the commencement of the operation of the project, unless otherwise agreed by the Director-General.

Operational Environmental Management Plan

D2. The Proponent shall prepare and implement an Operational Environmental Management Plan (OEMP) to detail an environmental management framework, practices and procedures to be followed during operation of the project. The Plan shall be prepared in consultation with Lithgow City Council and relevant government agencies, and shall be consistent with the Guideline for the Preparation of Environmental Management Plans (DIPNR 2004) and shall include, but not necessarily be limited to:

a) identification of all statutory and other obligations that the Proponent is required to fulfil in relation to operation of the project, including all approvals, licences, approvals and consultations;
b) a description of the roles and responsibilities for all relevant employees (including contractors) involved in the operation of the project;
c) overall environmental policies and principles to be applied to the operation of the project;
d) standards and performance measures to be applied to the project, and a means by which environmental performance can be periodically reviewed and improved, where appropriate;
e) management policies to ensure that environmental performance goals are met and to comply with the conditions of this approval;
f) the environmental monitoring requirements outlined under conditions E12 to E18 inclusive;
g) details of waste management including reuse and/or recycling of waste material, to minimise the need for treatment or disposal of those materials outside the site;
h) specific consideration of relevant measures to address any requirements identified in the documents referred to under conditions A1(b) and A1(d) of this approval; and
i) the additional requirements of this approval.

The Plan shall be submitted for the approval of the Director-General no later than four weeks prior to the commencement of operation of the project, unless otherwise agreed by the Director-General. Operation shall not commence until written approval has been received from the Director-General.

Nothing in this approval precludes the Proponent from incorporating the requirements of the Operational Environmental Management Plan into existing environmental management systems and plans administered by the Proponent.

D3. As part of the OEMP for the project, required under condition D2 of this approval, the Proponent shall prepare and implement the following Management Plans:

a) an **Operational Noise Management Plan** to detail measures to mitigate and manage noise during operation of the project. The Plan shall be prepared in consultation with the EPA and include, but not necessarily be limited to:
    i) identification of activities that will be carried out in relation to the project and the associated noise sources;

ii) identification of all relevant sensitive receivers and the applicable criteria at those receivers commensurate with the noise limit specified under condition E7 of this approval;
iii) noise monitoring procedures (as referred to in condition E12 of this approval) for periodic assessment of noise impacts at the relevant receivers against the noise limits specified under this approval and the predicted noise levels as detailed in the EA;
iv) details of all management methods and procedures that will be implemented to control individual and overall noise emissions from the site during operation, including the feasibility of noise reducing benching;
v) procedures to ensure that all reasonable and feasible noise mitigation measures are applied during operation of the project and procedures and corrective actions to be undertaken if non-compliance against the operational noise criteria as detailed in condition E7 is detected at the sensitive receivers; and
vi) provisions for periodic reporting of results to the EPA as per condition B8.

b) a **Groundwater Management Plan** to detail measures to mitigate and manage groundwater impacts. The Plan shall be prepared in consultation with the NOW and the SCA and include, but not necessarily be limited to:
i) consideration of the revised updated groundwater model as per condition B2;
ii) baseline data on groundwater quality (including Huons Creek), location of groundwater monitoring wells, depth and available flow of groundwater in the project area;
iii) identification of potential sources of water pollutants and management measures;
iv) groundwater assessment criteria including trigger levels for remedial measures;
v) a contingency plan for events that have the potential to pollute or contaminate groundwater sources of water. The plan shall include remediation actions and communication strategies (including notification of potentially affected nearby bore users) for the effective management of such an event to prevent discharge of these pollutants from all sources within the project area;
vi) a monitoring program as per condition E15 for groundwater connectivity, water levels, groundwater flow and water quality over the short and long term that includes upstream and downstream locations. The program shall continue for a minimum of five years following final capping and landscaping;
vii) a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria; and
viii) provisions for periodic reporting of results to the SCA as per condition B8.

c) a **Soil and Surface Water Management Plan** to outline measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to lands and/or waters throughout the life of the project. The Plan shall be based on best environmental practice and shall be prepared in consultation with the NOW and the SCA and DPI (Fisheries). The Plan shall include, but not necessarily be limited to:
i) baseline data on the surface water quality and available flow in Neubecks Creek and Lamberts Gully Creek;
ii) water quality objectives and impact assessment criteria for Neubecks Creek and Lamberts Gully Creek;

iii) identification of the operation activities that could cause soil erosion or discharge sediment or water pollutants from the site;
iv) a description of the management controls to minimise soil erosion or discharge of sediment or water pollutants from the site, including a strategy to minimise the area of bare surfaces, stabilise disturbed areas and minimise bank erosion;
v) demonstration that the proposed erosion and sediment control measures will conform with, or exceed, the relevant requirements of Managing Urban Stormwater: Soils and Construction (Landcom, 2004);
vi) details of the water management system including separation of clean and contaminated/polluted water flows, provisions for the treatment, recycling/reuse and/or discharge of flows;
vii) site water balance including water usage for ash placement, sources of water and quantity of run-off generated;
viii) details of the lining for the surface water collection ponds;
ix) measures to minimise potential surface water infiltration;;
x) a flow and water quality monitoring program for Neubecks Creek and Lamberts Gully Creek that includes discharge points, upstream and downstream locations as per condition E16 and limits for identified pollutants;
xi) specified remedial actions and contingency plans to mitigate any water quality exceedances on receiving waters including identified trigger levels for remedial measures or the activation of contingency plans; and
xii) provisions for periodic reporting of results to the DPI (Fisheries) and the SCA as per condition B8.

d) a **Air Quality Management Plan** to outline measures to minimise impacts from the project on local air quality. The Plan shall be prepared in consultation with NSW Health and the EPA and include, but not necessarily be limited to:
i) baseline data on dust deposition levels;
ii) air quality objectives and impact assessment criteria;
iii) an assessment of alternative methods of ash placement to minimise the exposure of active placement areas to prevailing winds;
iv) mitigation measures to be incorporated during ash placement activities, haulage, etc;
v) an operating protocol for the ash placement irrigation system including activation rates, application rates and area of coverage and means of dealing with water shortages;
vi) detail how ash placement moisture levels will be maintained;
vii) a contingency plan to deal with high winds and dust suppression;
viii) a protocol for the investigation of visible emissions from the ash placement area;
ix) a response plan to address exceedances in visible emissions including $PM_{10,}$ TSP and deposited dust from the ash placement areas; and
x) an air quality monitoring program as referred to in condition E18 of this approval including identified air quality monitoring locations (including monitoring at sensitive receivers) and meteorological monitoring to predict high wind speed events;
xi) provisions for periodic reporting of results to the EPA as per condition B8; and
xii) a protocol for suppressing dust emissions within licence limits under normal and adverse weather conditions at all stages of the ash placement process.

e) a **Landscape/Revegetation Plan** to outline measures to minimise the visual impacts of the ash placement areas and ensure the long-term stabilisation of

the site and compatibility with the surrounding landscape and land use. The Plan shall include, but not necessarily be limited to:

i) identification of design objectives and standards based on local environmental values, vistas, and land uses;
ii) identification of the timing and progressive implementation of revegetation works for ash placement areas as they are completed, including short-term and long term goals including landscape plans;
iii) a schedule of species to be used in revegetation, including the use of local native species in revegetation works selected by a qualified expert to ensure the rehabilitation works do not compromise the long term integrity of the capping; and
iv) procedures and methods to monitor and maintain revegetated areas during the establishment phase and long-term.

f) a **Site Rehabilitation Management Plan** to outline measures to stabilise and rehabilitate the site following project completion. The Plan shall be prepared in consultation with the SCA. The Plan shall include, but not necessarily be limited to:

i) reinstatement of geomorphologic stable drainage lines on the rehabilitated areas and a timeframe for rehabilitation;
ii) restoration, rehabilitation and revegetation of the project's site;
iii) measures to control water pollutants from rehabilitated areas; and
iv) a program and timeframe for monitoring rehabilitated areas.

Groundwater Quality and Geotechnical Impacts

D4. Prior to commencement of operation the Proponent shall submit a geotechnical report prepared by a suitably qualified expert that demonstrates the site has been engineered as being suitable for ash placement. The report must also provide an evaluation of groundwater levels once re-profiling has been completed.

PART E – DURING OPERATIONS

Operational Hours

E1. Operational activities associated with the project shall only be undertaken from 6.00 am to 8.00 pm Monday to Friday and 6.00am to 5.00pm Saturday and Sunday.

E2. Operations outside the hours stipulated in condition E1 of this approval are only permitted in the following emergency situations:

a) where it is required to avoid the loss of lives, property and/or to prevent environmental harm; or

b) breakdown of plant and/or equipment at the ash placement areas or the Mt Piper Power Station and the proposed Mt Piper Power Station Extension project with the effect of limiting or preventing ash storage at the power station outside the operating hours defined in condition E1; or

c) a breakdown of an ash haulage truck(s) or the conveyor preventing haulage during the operating hours stipulated in condition E1 combined with insufficient storage capacity at the Mt Piper Power Station including the proposed Mt Piper Power Station Extension to store ash outside of the project operating hours; or

d) in the event that the Australian Energy Market Operator (AEMO), or a person authorised by AEMO, directs the Proponent (as a licensee) under the National Electricity Rules to maintain, increase or be available to increase power generation for system security and there is insufficient ash storage capacity at the Mt Piper Power Station to allow for the ash to be stored.

In the event of conditions E2b) or E2c) arising, the Proponent is to take all reasonable and feasible measures to repair the breakdown in the shortest time possible.

E3. In the event that an emergency situation as referred to under condition E2b) or E2c) occurs more than once in any two month period, the Proponent shall prepare and submit to the Director-General for approval a report including, but not limited to:

a) the dates and a description of the emergency situations;

b) an assessment of all reasonable and feasible mitigation measures to avoid recurrence of the emergency situations;

c) identification of a preferred mitigation measure(s); and

d) timing and responsibility for implementation of the mitigation measure(s).

The report is to be submitted to the Director-General within 60 days of the second emergency situation occurring. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Director-General.

E4. The Proponent shall notify the EPA prior to undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition E1 of this approval and keep a log of such operations.

E5. The Proponent shall notify the Director-General in writing within seven days of undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition E1 of this approval.

E6. The Proponent shall notify nearby sensitive receivers (as defined in the Operational Noise Management Plan required under condition D3(a) of this approval) prior to 8.00 pm where it is known that emergency ash haulage or placement operations will be required outside of the hours of operation stipulated in condition E1 of this approval.

Operational Noise

E7. The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed the following $L_{Aeq(15\ minute)}$ dB(A):

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
All private sensitive receivers within the township of Blackmans Flat	42	38	35
All other sensitive receivers	42	38	35

This noise criteria set out above applies under all meteorological conditions except for any of the following:

(a) wind speed greater than 3 metres/second at 10 metres above ground level;
(b) stability category F temperature inversion conditions and wind speed greater than 2 metres/second at 10 metres above ground level; and
(c) stability category G temperature inversion conditions.

This criteria does not apply where the Proponent and an affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Director-General and the EPA.

E8. To determine compliance with the $L_{Aeq(15\ minute)}$ noise limits, the noise monitoring equipment must be located at the most affected point:

a) within 30 metres of a dwelling façade where any dwelling on the property is situated more than 30 metres from the property boundary that is closest to the premises; or
b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises.

E9. For the purposes of monitoring noise from the premises to determine compliance with the noise limits:

a) Class 1 or 2 noise monitoring equipment as defined by AS IEC61672.1-2004 and ASIEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing, must be used;
b) the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment;
c) the meteorological data to be used for determining meteorological conditions is the data recorded by the meteorological weather station at the premises; and
d) stability category temperature inversion conditions are to be determined by the sigmatheta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.

E10. The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not necessarily limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression braking, and ensuring trucks operate in a one-way system at the ash placement areas where feasible.

Operational Noise Review

E11. Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Director-General, the Proponent shall submit to the Director-

General an **Operational Noise Review** to confirm the operational noise impacts of the project. The Operational Noise Review shall be prepared in consultation with the EPA. The Review shall:

a) identify the appropriate operational noise objectives and levels for sensitive receivers;
b) describe the methodologies for noise monitoring, including the frequency of measurements and location of monitoring sites;
c) document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program;
d) assess the noise performance of the project against the noise criteria specified in condition E7 of this approval and the predicted noise levels as detailed in the report referred to under condition A1(b) of this approval; and
e) provide details of any entries in the Complaints Register relating to noise impacts.

Where monitoring indicates noise levels in excess of the operational noise criteria specified in condition E7 of this approval, the Proponent shall prepare a report as required by condition E13 of this approval.

Ongoing Operational Noise Monitoring

E12. The Proponent shall prepare and implement an **Operational Noise Monitoring Program** to assess compliance against the operational noise criteria stipulated in condition E7 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with the EPA and must include the proposed frequency of monitoring and as a minimum must include monitoring when there are any significant changes in work locations or processes.

The noise monitoring program shall be prepared in accordance with the requirements of the *New South Wales Industrial Noise Policy* (EPA, 2000) and shall include, but not be limited to:

a) monitoring at Lamberts North, Lamberts South and Blackmans Flat during ash placement activities; and
b) monitoring of the effectiveness of any noise mitigation measures implemented under condition D3(a) of this approval, against the noise criteria specified in condition E7 of this approval.

The Proponent shall forward to the EPA and the Director-General a report containing the results of any non-compliance within 14 days of conducting a noise assessment. The monitoring program shall form part of the Operational Noise Management Plan referred to in condition D3 (a) of this approval.

E13. Where noise monitoring including as required by condition E11 and E12 of this approval identifies any non-compliance with the operational noise criteria specified under condition E7 of this approval the Proponent shall prepare and submit to the Director-General a report including, but not limited to:

a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source;
b) identification of the preferred measure(s) for reducing noise at the source;
c) feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and
d) location, type, timing and responsibility for implementation of the noise mitigation measure(s).

The report is to be submitted to the Director-General within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criteria specified under condition E7, unless otherwise agreed to by the Director-

General. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Director-General.

E14. If after the implementation of all reasonable and feasible source controls, as identified in the report required by condition E13, the noise generated by the project continues to exceed the criteria stipulated in condition E7 the Proponent shall implement at the receiver reasonable and feasible noise mitigation measures, such as double glazing, insulation, air conditioning and or other building acoustic treatments, in consultation with and with the agreement of the affected landowner.

Groundwater Monitoring

E15. The Proponent shall prepare and implement a **Groundwater Monitoring Program** to monitor the impacts of ash placement activities on local groundwater quality and hydrology. The Program shall be developed in consultation with the SCA, and shall describe the location, frequency, rationale and procedures and protocols for collecting groundwater samples as well as the parameters analysed and methods of analysis. The monitoring program shall be ongoing for the operation of the project and for a minimum of 5 years following project completion and include, but not be limited to:

a) monitoring at established bore sites (or replacement bore sites in the event that existing sites are damaged or lost) as described in the Groundwater Management Plan as per condition D3(b); and
b) a schedule for periodic monitoring of groundwater quality, depth and flow at all monitoring sites, at an initial frequency of no less than once every month for the first 12 months of operation.

The monitoring program shall form part of the Groundwater Management Plan referred to in condition D3(b) of this approval.

Surface Water Quality Monitoring

E16. The Proponent shall prepare and implement a surface water quality monitoring program to monitor the impacts of the ash placement activities on Neubecks Creek and Lamberts Gully. The Program shall be developed in consultation with the DPI (Fisheries) and the SCA, and shall describe the location, frequency, rationale and the procedures and protocols for collecting water samples as well as the parameters analysed and methods of analysis. The program shall include, but not necessarily be limited to:

a) monitoring at the existing water quality monitoring sites as described in the document referred to under condition A1b);
b) monitoring at surface water discharge points from Lamberts Gully Creek;
c) monitoring at surface water discharge points into Neubecks Creek;
d) wet weather monitoring with a minimum of two events recorded within the first 12 months operation of the project; and
e) a schedule for periodic monitoring of surface quality at all sites throughout the life of the project, at an initial frequency of no less than once every month for the first 12 months and must include, but not be limited to, monitoring of dissolved oxygen, turbidity, sulphates, salinity, boron, manganese, iron chloride, total phosphorus and total nitrogen.

Hydrological Monitoring Program

E17. A Hydrological Monitoring Program to assess and quantify the impacts and effectiveness of the transformed section of Huons Creek into a sub-surface drainage line in consultation with the DPI (Fisheries). Monitoring is to be undertaken for a period of five (5) years upon completion of the creek transformation. The program must include sampling for identified pollutants before and after the transformation works and include a sampling site downstream of the sub-surface section of Huons Creek. In the first 12 months following completion of the transformation, monitoring

is to be undertaken at least every three (3) months upon completion of the creek transformation and after any heavy wet weather event.

The monitoring program shall form part of the Soil and Surface Water Management Plan referred to in condition D3(c) of this approval.

Air Quality Monitoring

E18. The Proponent shall prepare an Air Quality Monitoring Program, in consultation with the EPA and NSW Health. The Program shall include, but not necessarily be limited to, monitoring for dust. Monitoring sites shall be identified as per condition D3 (d). The air quality monitoring program shall be ongoing for the life of the project, and during final rehabilitation and stabilisation of the site.

The monitoring program shall form part of the Air Quality Management Plan referred to in condition D3(d) of this approval.

Environmental Incident Reporting

E19. The Proponent shall notify the Director-General of any environmental incident within 12 hours of becoming aware of the incident. The Proponent shall provide full written details of the incident to the Director-General within seven days of the date on which the incident occurred.

E20. The Proponent shall meet the requirements of the Director-General to address the cause or impact of any environmental incident, as it relates to this approval, reported in accordance with condition E19 of this approval, within such period as the Director-General may require.

Annual Performance Reporting

E21. The Proponent shall, throughout the life of the project, prepare and submit to the Director-General, an Annual Environmental Management Report (AEMR). The AEMR shall review the performance of the project against the Operation Environmental Management Plan (refer to condition D2 of this approval) and the conditions of this approval. The AEMR shall include, but not necessarily be limited to:

a) details of compliance with the conditions of this approval;
b) a copy of the Complaints Register (refer to condition B11 of this approval) for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved;
c) identification of any circumstances in which the environmental impacts and performance of the project during the twelve month period have not been generally consistent with the environmental impacts and performance predicted in the documents listed under condition A1 of this approval, with details of additional mitigation measures applied to the project to address recurrence of these circumstances;
d) results of all environmental monitoring required under conditions of this approval, including interpretations and discussion by a suitably qualified person; and
e) a list of occasions in the twelve month period when environmental goals/objectives/impact assessment criteria for the project have not been achieved, indicating the reason for failure to meet the criteria and the action taken to prevent recurrence of that type of failure.

The Proponent shall submit a copy of the AEMR to the Director-General every year, with the first AEMR to be submitted no later than fourteen months after the commencement of operation of the project unless otherwise agreed by the Director-General. The Director-General may require the Proponent to address certain matters in relation to the environmental performance of the project in response to the Director-General's review of the Annual Environmental Management Report. Any action

required to be undertaken shall be completed within such period as the Director-General may require. The Proponent shall make copies of each AEMR available for public inspection on request. Copies of the AEMR shall be sent to the EPA and the SCA.

Independent Environmental Auditing

E22. Within 12 months of commencement of operation of Lamberts North and Lamberts South and then as may be directed by the Director-General, the Proponent shall commission an independent person or team to undertake an Environmental Audit of the project. The independent person or team shall be approved by the Director-General prior to the commencement of the Audit. The Audit shall:

a) be carried out in accordance with ISO 19011:2002 - Guidelines for Quality and or Environmental Management Systems Auditing;
b) assess compliance with the requirements of this approval, and other licences and approvals that apply to the project;
c) assess the environmental performance of the project against the predictions made and conclusions drawn in the documents referred to under condition A1 of this approval;
d) review the effectiveness of the environmental management of the project, including any environmental impact mitigation works; and
e) review the adequacy of the Proponent's response to any complaints made about the project identified in the Complaints Register.

The Environmental Audit Report shall be submitted to the Director-General within two months of the completion of the Audit, detailing the findings and recommendations of the Audit and including a detailed response from the Proponent to any of the recommendations contained in the Report.

Waste Generation and Management

E23. All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to accept the materials.

E24. The Proponent shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the Protection of the Environment Operations Act 1997, if such a licence is required in relation to that waste.

E25. The Proponent shall ensure that all liquid and / or non-liquid waste generated and / or stored on the site is assessed and classified in accordance with the Waste Classification Guidelines (DECC, 2008), or any future guideline that may supersede that document.

PART F – POST OPERATIONS

Project Completion Management Plan

F1. No later than one month prior to the decommissioning of the project, or as otherwise agreed by the Director-General, the Proponent is to prepare a Project Completion Management Plan, in consultation with the SCA, for the approval of the Director-General. The Plan is to include but not necessarily be limited to:

(a) identification of structures to be removed and how they will be removed;
(b) measures to reduce impacts on the environment and surrounding sensitive land uses;
(c) details of components to be recycled;
(d) details of rehabilitation and revegetation with reference to the biodiversity offset required under condition B6;
(e) groundwater assessment criteria including trigger levels for remedial measures;
(f) a groundwater monitoring program as per condition E15 for groundwater connectivity, water levels, groundwater flow and water quality over the short and long term that includes upstream and downstream locations. The program shall continue for a minimum of five years following final capping and landscaping;
(g) a contingency plan to address potential exceedances and mitigation measures in groundwater and groundwater quality impacts and if exceedances continue, implementation of further measures and groundwater monitoring to demonstrate compliance;
(h) surface water assessment criteria including trigger levels for remedial measures;
(i) available flow and water quality monitoring program for Neubecks Creek and Lamberts Gully Creek that includes discharge points, upstream and downstream locations as per condition E16 and limits for identified pollutants. The program shall continue for a minimum of five years following final capping and landscaping; and
(j) a contingency plan to address potential exceedances and mitigation measures in surface water and surface water quality impacts and if exceedances continue, implementation of further measures and surface water monitoring to demonstrate compliance.

Annex H

Local Climate Data

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 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	-4.1	16.2	0						-2.0	94	6		Calm							
2	Tu	-1.9	15.3	0						1.6	88	6		Calm							
3	We	-5.7	13.0	0						-0.1	83	3		Calm							
4	Th	0.2	10.0	0						8.0	91	7	SSE	7							
5	Fr	8.0	12.3	8.2						8.7	96	7	ESE	7							
6	Sa	7.6	12.8	1.8						8.6	84	7	ESE	4							
7	Su	4.4	15.1	0.1						8.3	85	7	NE	2							
8	Mo	5.5	12.1	1.8						8.4	93	7	NNW	7							
9	Tu	2.1	10.7	3.2						4.5	83	5	WNW	6							
10	We	1.6	9.4	0						4.6	81	4	WNW	6							
11	Th	4.2	10.3	0						7.2	71	5	NW	19							
12	Fr	6.2	10.3	0						8.0	72	7	NW	13							
13	Sa	2.5	6.6	2.0						2.6	89	8	WNW	15							
14	Su	1.2	6.2	0.2						2.2	72	5	NW	6							
15	Mo	1.8	8.5	0.2						4.9	76	7	WSW	15							
16	Tu	4.4	10.3	0						6.5	78	2	NW	9							
17	We	4.9	10.0	0						5.5	76	5	W	9							
18	Th	4.6	10.6	0						5.9	78	5	W	7							
19	Fr	0.9	11.6	0						4.8	77	1	SW	7							
20	Sa	-4.6	16.5	0.1						0.0	91	0		Calm							
21	Su	-0.5	15.4	0						11.1	37	0	NNW	7							
22	Mo	3.2	16.9	0						10.4	58	4	NNW	6							
23	Tu	-1.6	15.1	0						8.4	51	0	NW	9							
24	We	6.9	10.9	0						7.1	75	7	W	13							
25	Th	-3.9	16.2	0						1.2	75	0	WSW	4							
26	Fr	-1.8	13.9	0.1						2.7	71	6		Calm							
27	Sa	-1.6	13.5	0						2.6	96	2		Calm							
28	Su	-2.9	13.0	0.1						4.4	65	1	SE	2							
29	Mo	-3.4	13.5	0						4.4	48	7		Calm							
30	Tu	3.8	9.3	0.2						6.9	88	7	SE	4							
31	We	0.5	12.0	0.1						6.3	80	7	SE	6							
Statistics for July 2019																					
	Mean	1.4	12.2							5.3	77	4		6							
	Lowest	-5.7	6.2							-2.0	37	0		Calm							
	Highest	8.0	16.9	8.2						11.1	96	8	NW	19							
	Total			18.1																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201907 Prepared at 13:00 UTC on 3 Oct 2019

Lithgow, New South Wales
August 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	Th	-2.0	12.7	0.1						1.8	95	0		Calm							
2	Fr	-2.3	14.4	0						6.7	89	7	NNW	4							
3	Sa	-3.9	14.4	0						2.0	68	1	WSW	4							
4	Su	-6.0	15.7	0						1.3	75	1		Calm							
5	Mo	-0.7	16.1	0						4.3	95	2		Calm							
6	Tu	-5.1	15.8	0						5.5	27	0	N	6							
7	We	-5.0	15.4	0						9.8	35	0	NW	15							
8	Th	0.2	11.7	0						10.5	39	7	NW	9							
9	Fr	4.2	7.3	1.2						4.2	81	8	NNW	20							
10	Sa	0.8	4.5	3.0						1.0	91	8	WSW	9							
11	Su	0.7	4.1	3.2						1.0	93		WNW	7							
12	Mo	-0.7	11.0	6.2						3.4	84	0	WNW	2							
13	Tu	-2.6	10.2	0.1						3.2	57	0	SW	9							
14	We	-6.7	13.1	0						1.4	72	0		Calm							
15	Th	-6.1	12.8	0						7.3	41	0	WSW	7							
16	Fr	-3.6	16.4	0						9.9	36	5	NW	11							
17	Sa	0.9	15.3	0						8.0	61	1	SSE	7							
18	Su	-0.9	19.0	0.1						9.4	72	6	NNW	6							
19	Mo	2.2	5.7	0.2						3.9	67	6	NW	9							
20	Tu	1.0	10.7	0						4.3	71	2	E	7							
21	We	4.2	10.2	0						6.8	75	7	NW	7							
22	Th	6.6	11.1	0						6.7	78	7	WSW	9							
23	Fr	-4.9	15.4	0						1.5	72	0		Calm							
24	Sa	-4.3	16.8	0						11.7	36	0	WNW	19							
25	Su	5.0	17.3	0						11.5	33	0	SW	7							
26	Mo	5.9	13.9	0						9.1	83	7	E	7							
27	Tu	6.0	13.1	0.4						7.9	87	5	SE	6							
28	We	0.6	13.9	0						5.5	97	3		Calm							
29	Th	-1.9	7.6	0						5.5	91	8	SE	7							
30	Fr	4.2	7.8	12.0						5.7	84	8	SSE	11							
31	Sa	4.9	11.3	0.6						6.0	99	8	SE	6							
Statistics for August 2019																					
	Mean	-0.3	12.4							5.7	70	3		6							
	Lowest	-6.7	4.1							1.0	27	0		Calm							
	Highest	6.6	19.0	12.0						11.7	99	8	NNW	20							
	Total			27.1																	

Observations were drawn from Lithgow (Cooerwull) {station 063226}

IDCJDW2075.201908 Prepared at 16:00 UTC on 2 Oct 2019

Annex I

Nalco QAQC

Unit 12, 2 Eden Park Drive
Macquarie Park 2113
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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 J

CEH Repository Survey


NEW GROUNDWATER PIPE A
GRND 967.35
TOP 969.15
NEW GROUNDWATER PIPE B
GRND 968.16
TOP 968.38
NEW GROUNDWATER PIPE C
GRND 967.65
TOP 968.85
POND 1
(AS BUILT)
POND 2
(AS BUILT)
POND 3
(AS BUILT)
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BOUNDARY
STAGE II
NORTH

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