

Mt Piper Ash Placement Project Lamberts North
Annual Operation Compliance Report
September 2023 – August 2024

Annual Operation Compliance Report

Project Name	Mt Piper Ash Placement Project Lamberts		
	North		
Project Application Number	09_0186		
Description of Project			
Project Address	Mt Piper Power Station, 350 Boulder Road,		
	Portland 2847		
Proponent	EnergyAustralia NSW		
Title of Compliance Report	Annual Operation Compliance Report		
Reporting Period	1 September 2023 – 31 August 2024		
Version	1.0		
Date	27 November 2024		

I declare that I have reviewed the contents of the attached Compliance Report and to the best of my knowledge:

- i. the Compliance Report has been prepared in accordance with all relevant conditions of consent;
- ii. the Compliance Report has been prepared in accordance with the Compliance Reporting Requirements;
- iii. the findings of the Compliance Report are reported truthfully, accurately and completely; iv. due diligence and professional judgement have been exercised in preparing the Compliance Report; and
- v. the Compliance Report is an accurate summary of the compliance status of the development.

 Notes:
 - Under section 10.6 of the Environmental Planning and Assessment Act 1979 a person must not include false or misleading information (or provide information for inclusion in) a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows that the information is false or misleading in a material respect. The proponent of an approved project must not fail to include information in (or provide information for inclusion in) a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows that the information is materially relevant to the monitoring or audit. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000; and
 - The Crimes Act 1900 contains other offences relating to false and misleading information: section 307B (giving false or misleading information maximum penalty 2 years' imprisonment or 200 penalty units, or both).

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This report may be cited as:

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1. Summary of compliance

EnergyAustralia NSW (EA NSW) owns and operates the Mt Piper Ash Placement Project (PA 09_0186), comprising two separate ash repositories including the Lamberts North Ash Repository (LNAR) and the Lamberts South Ash Repository (LSAR) in accordance with Project Approval 09_0186, granted by the Minister for Planning on 12 February 2012. The installation of the first stage of the Leachate Barrier Management System was completed in April 2022, with the first Brine Conditioned Ash being placed within the lined area in May 2022. Annual Operations Compliance Report (AOCR) includes a summary of the environmental performance at the LNAR over the September 2023 to August 2024 reporting period. The LNAR is located approximately 18 kilometres north-west of the city of Lithgow and is situated adjacent to the Mount Piper Ash Repository (MPAR) and 700 meters to the east of the Mt Piper Power Station (MPPS). The MPAR is authorised under a separate consent (DA 80/10060) and is not the subject of this report.

The AOCR has been prepared pursuant to Schedule 2, Condition A10 of the Project Approval 09_0186. The AOCR has been prepared in accordance with the NSW Government's Post-approval requirements for Compliance Reporting dated May 2020.

A summary of the LNAR compliance achieved during the reporting period is provided in Table 1. There was one non-compliance identified during the reporting period relating to the reporting of compliants. A detailed review of compliance with the Conditions of Approval (CoA) is presented in Appendix A.

The AOCR contains a summary of monitoring carried out under the conditions of Project Approval 09_0186 during the reporting period.

The groundwater and surface water monitoring performed during the reporting period identified some elevated results above the surface water and groundwater environmental goals, identified in the relevant sub-plans contained in the approved Lamberts North Ash Placement Project Operation Environmental Management Plan dated April 2022 (OEMP). Based on the analysis of historical data and trends, these elevated results are most likely not linked to activities at LNAR and have been deemed more likely to be associated with other adjacent, approved activities in the area. EA NSW has completed an independent groundwater investigation into these elevated results which is outlined in section 7.1.2.

Table 1 Details on Non-Compliance

Relevant	Condition	Condition	Compliance	Comment	Section
Approval	No.	Summary	Status		where
					addressed
					within
					AOCR

In assessing compliance with CoAs, the key for compliance assessment provided in Table 2 Compliance Status Key was used, in accordance with the NSW Government's Independent Audit Guideline.

Table 2 Compliance Status Key

Risk Level	Colour Code	Description	
Compliant		The proponent has collected sufficient verifiable evidence to demonstrate that all elements of the requirement have been complied with.	
Non-compliant		The proponent has identified a non-compliance with one or more elements of the requirement.	
Not triggered		A requirement has an activation or timing trigger that has not been met at the phase of the development when the compliance assessment is undertaken, therefore an assessment of compliance is not relevant.	

An acceptable standard of environmental performance has been achieved during the reporting period as evidenced by the following:

- Noise from the LNAR site was largely inaudible or unable to be measured at sensitive receivers during the
 reporting period. One location that was occasionally audible which was within the limits, they were unable to
 be measured due to continuous road traffic noise. Overall, the noise levels were deemed compliant with the
 development consent limits.
- Analysis of the air quality data indicates emissions from the LNAR have been managed effectively during the reporting period and comply with CoA D3 (d) and E18.
- There were no incidents associated with the LNAR site that caused or threatened material harm to the environment during the reporting period.

2. Introduction

2.1 Background

The MPPS comprises of two coal-fired steam turbine generators, with a generating capacity of 700 and 730 MW, built over two stages in 1992 and 1993. The power station (along with the MPAR) is located approximately 17 km northwest of Lithgow and five kilometers east of Portland (Figure 1) and was originally authorised in 1990 by the Lithgow City Council (DA 80/10060). The approved footprint of the LNAR is adjacent to the MPAR, near the MPPS (Figure 2). EA NSW acquired MPPS and associated land holdings and infrastructure from the state-owned Delta Electricity (DE) in September 2013.

Ash from the power station is placed in a dry ash repository (either MPAR or LNAR) as required. Approximately 680,000 m³ of ash is placed on an annual basis into the ash repositories at MPPS, depending on electricity demand and generation.

The AOCR specifically relates to the Lamberts North Ash Placement Project which authorises the operation of two separate ash placement areas referred to the LNAR and the LSAR.

The LNAR is the active ash placement area and this AOCR reports on the environmental performance associated with it over the 2023 – 2024 reporting period. The LSAR is yet to be constructed.

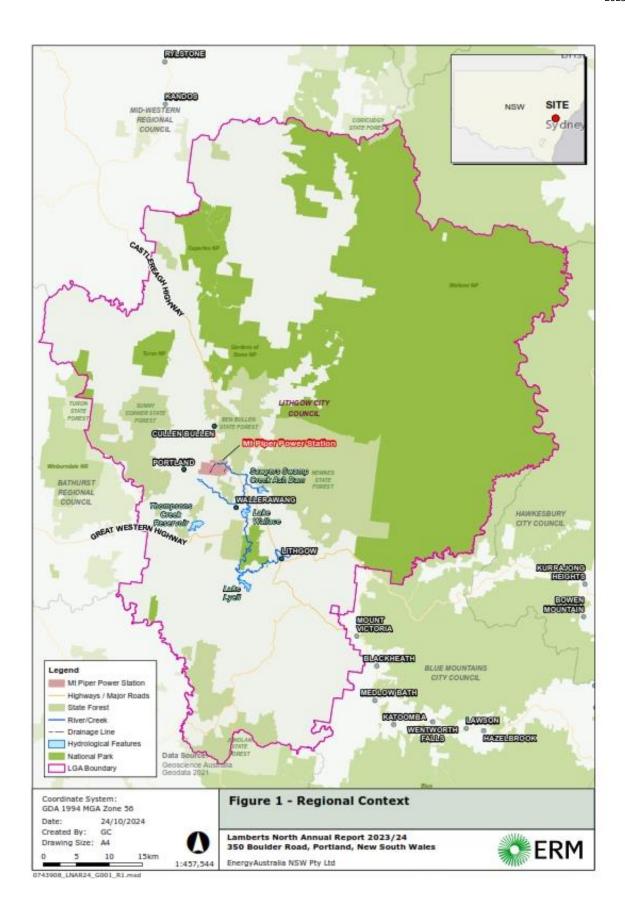


Figure 1 Regional context map

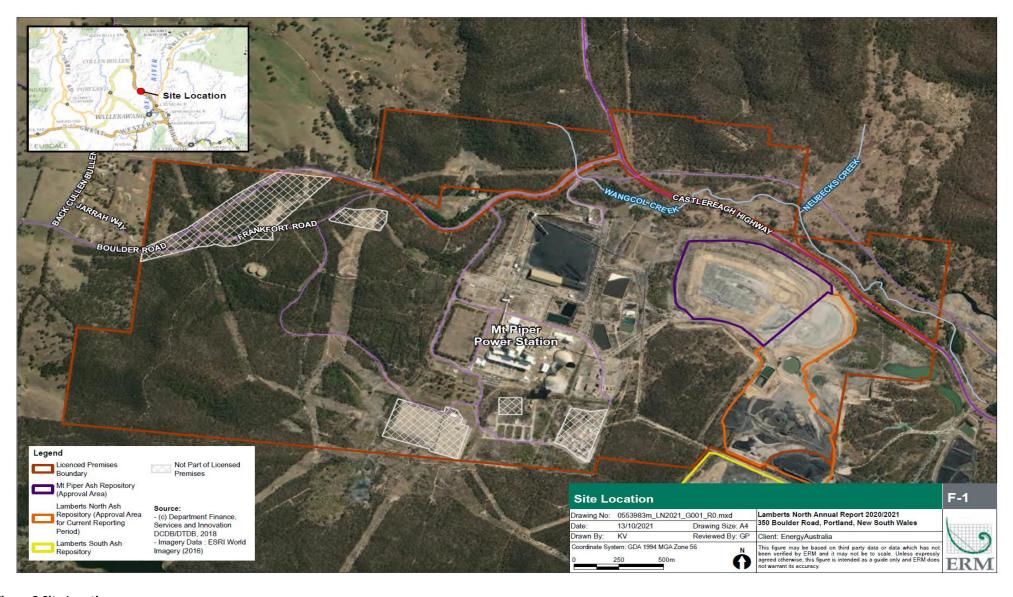


Figure 2 Site Location

2.2 Purpose of the AOCR

The Project Approval (PA 09_0186) contains conditions with which EA NSW needs to comply, as the proponent, at different stages of the Project (Section 3). This report has been prepared in accordance with the NSW Government's, *Post-approval requirements for Compliance Reporting Guideline* (NSW Government, 2020) as required under Condition A10 of the project approval (PA 09_0186).

Section 1 of the Compliance Reporting guidelines (NSW Government, 2020) states that the aim of compliance reporting is to ensure that:

- The Project's performance in terms of compliance with Conditions of Consent is evaluated on the basis of monitoring data and is communicated at various stages during the carrying out of the development;
- The reporting obligations required by the conditions of consent are met; and
- Opportunities for improvement are identified and adopted.

This AOCR has been prepared in order to satisfy CoA A10 of the Project Approval 09_0186 (DPE, 2021). This report covers the operations, environmental and community performance of the LNAR from 1 September 2023 to 31 August 2024 (reporting period).

2.3 Project contacts

The contact details for LNAR are listed in Table 3.

Table 3 Lamberts North Ash Placement Contact

Contact Person	Position	Telephone
Ben Eastwood	NSW Environment Leader	(02) 63548111

Consents, Leases and Licences

This AOCR has been prepared to demonstrate the sites performance and compliance with the relevant conditions of PA 09_0186 and the Statement of Commitments (SoC). Licences and approvals applicable to LNAR are summarised in Table 4:

Table 4 Key Consents, Leases, Licenses and Permits

Approval/Lease/Licence	Issue Date	Expiry Date	Details/Comments
Project Approval 09_0186	16 February 2012 MOD 1: 21 September 2021	-	Granted by the Minister for Department of Planning and the Environment (DPE), under Section 75J of the Environmental Planning and Assessment Act (EP&A Act).
Environment Protection License (EPL) No. 13007	1 March 2024	-	EPL held by EA NSW for MPPS, granted by the Environment Protection Authority (EPA), under Section 55 of the Protection of the Environment Operations Act (POEO Act).
Water Access Licence No. 27428 (WAL)	24 March 2022	-	Granted by Department of Primary Industries-Water (DPE-Water), under the Water Management Act 2000
Water Supply Work and Water Use Approval 10CA117220	24 March 2022	30 June 2031	Granted by DPE-Water, under the Water Management Act 2000

3.1 LNAR Project Approval 09_0186 - Modification 2

EnergyAustralia NSW applied to the DPHI on 3 June 2024 to modify Project Approval 09_0186 for the extension of operating hours on the LNAR. The Modification will support the construction of the lined areas within the LNAR and keep up with ash placement demands, EnergyAustralia is seeking to extend the operational hours of the LNAR. The modification aims to enhance the efficiency and flexibility of the sites operations while maintaining the same ash management activities that are currently authorised under the existing approval. The extended hours will ensure more continuous and streamlined management without altering the scope of the works currently being undertaken.

3.2 Operations Environmental Management Plan

The OEMP provides the framework to manage the environmental aspects associated with the operation of the LNAR. The OEMP (EA NSW, 2022) outlines the requirements associated with the project as stipulated in the relevant provisions of the Project Approval 09_0186 issued by the now DPE, the EPL 13007 issued by the NSW EPA, and the SoC presented in the Submissions Report (SKM, 2011).

The scope of the OEMP covers the operations involving the movement and placement of ash from Mt Piper Power Station (MTPPS) to Lamberts North Ash Repository. The environmental performance against the OEMP is provided in Sections 6 - 10. The OEMP (EA NSW, 2022) has been prepared in consultation with the EPA, WaterNSW, DPE-Water, and DPI-Fisheries. The OEMP was approved by the DPE on the 6 June 2022. The LNAR stage 2 area was commenced, with ash placement starting near the end of the reporting period.

3.3 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) for the LNAR was developed in consultation with EA NSW's Western Environment Section and approved by the DPE in December 2012. The CEMP meets the requirements of CoA B4, providing the framework to manage the environmental aspects associated with construction works during LNAR operations. The CEMP has been prepared to address the requirements associated with the project as stipulated in the relevant provisions under Project Approval 09_0186 issued by the DPE (CDM Smith, 2012a).. There were no construction activities undertaken throughout the reporting period.

4. Operations during reporting period

Ash placement operations for MPPS, including LNAR, are undertaken by contracted specialists in the handling and management of ash. Service Stream is the current service provider for EA NSW regarding ash and dust management associated with the repository. The LNAR is currently managed under an 'operate and maintain' contract.

A summary of operations at the LNAR within the reporting period can be found in Table 5. It is noted that there will be an increase in ash delivered to the LNAR. This is due to the MPAR approaching its approved capacity but will ultimately depend upon actual electricity generation.

Table 5 Operations Summary

Activity	Previous reporting period	This reporting period	Next reporting period
Fly Ash delivered (T)	421,768	526,109	
Total ash produced at MPPS (T)	655,330	736,447	
Total Ash Footprint (ha)	16.7	16.7	
Area of repository capped (ha)	1.3	1.3	

[†] Estimate figure based on current year. *Figure based on average of previous years.

4.1 Normal operating hours

The normal hours of operation for the Project are between 6 am and 8 pm Monday to Friday, and 6 am to 5 pm Saturday and Sunday in accordance with CoA E1. Operations outside these hours are defined as abnormal or emergency operating conditions and are subject to specific requirements in accordance with E2 (Section 2.2.1 OEMP). As discussed in section 3.1 modification to the LNAR consent to extend the operating hours is in progress.

4.2 Abnormal or emergency operating conditions

Conditions under which operations outside the normal hours of operation can occur have been specified in the Project Approval and can be described as follows:

- Where it is required to avoid the loss of lives, property and/or to prevent environmental harm; or
- Where a breakdown of plant and/or equipment at the repository or the MPPS and the MPPS Extension project with the effect of limiting or preventing ash storage at the power station outside the normal operating hours Condition E1 (Section 3.1 OEMP).
- Where a breakdown of an ash haulage truck(s) or the conveyor belts prevents haulage during the operating hours stipulated under Condition E1 combined with insufficient storage capacity at MPPS to store ash outside of the normal operating hours; or

• In the event that the National Electricity Market Management Company (NEMMCO), or a person authorised by NEMMCO, directs EA NSW (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 MPPS to allow for the ash to be stored.

Under these circumstances, EA NSW is required to notify the EPA, and nearby sensitive receivers prior to any emergency ash haulage or placement operations outside of the 'normal operation' hours, and the Secretary of the DPE within 7 days after the emergency operations have occurred. All works were undertaken within the CoA specified hours of operation during the current reporting period.

4.3 Activities conducted during the current reporting period

The following activities were undertaken during the reporting period:

- 526,109 tonnes of Fly Ash was placed in LNAR during the reporting period.
- Brine condition ash was place in LNAR the stage 1 area (see Plates 1-2)
- The Stage 2 Leachate Barrier System area was prepared, constructed and commissioned, with ash placement beginning toward the end of the reporting period (see Plates 3-6)
- The engineering design works for Stage 2B of the leachate management system were commenced.
- The spraying and removal of targeted weed species in the LNAR.
- Planning and organisation of tree plantings within the Biodiversity Offset Area, as detailed in section 6.3.1



Plate 1 Installation of the leachate barrier in LNAR Stage 1A (Photo taken during Q3 2022)



Plate 2 Aerial view of Mount Piper Ash Repository (MPAR) and LNAR Stage 1 (A and B) areas (Photo taken 16 August 2023)





Plate 3 Linear Pipework Installation at LNAR Stage 2

Plate 4 Installation of Linear





Plate 5 LNAR Stage 2 Set-up

Plate 6 Geosynthetic Lining Materials Placement

5. No further Action Required for the previous AOCR

Table 6 Actions required from last AOCR

Item	Action required from 2023 AOCR	Requested by	Action taken	Status	Where discussed in AOCR
1	Upload a copy of the Annual Review to the EnergyAustralia website.	DPE	Annual Review uploaded onto EA website 1 st January 2024	С	5

6. Environmental management and performance

Environmental monitoring of the operations at LNAR is designed to comply with the regulatory requirements specified in Section 3 of the AOCR, and to provide an ongoing analysis of the condition of the environment surrounding the operations. Environmental monitoring is performed at the sites indicated within Figure 3 and the results are used to determine the effectiveness of the environmental controls and management practices at the LNAR.

Detailed procedures outlining the environmental monitoring responsibilities of key stakeholders and the impacts to be mitigated are described in the relevant sub-plans of the OEMP. Details regarding the environmental responsibilities, key stakeholders, and the impacts to be mitigated regarding construction activities are described in the CEMP. A summary of the environmental management measures and associated performance are provided in Table 7.

Table 7 Environmental Performance

Aspect	Approval Criteria / EIS prediction	Status	Trends / Management Implications	Management Actions
Noise	Criteria Day 42 dB(A) Evening 38 dB(A) Night 35 dB(A)	Compliant	The noise associated with LNAR was largely inaudible/unable to be measured. Any measurements obtained were compliant.	No action required
Air Quality	PM10 annual <30ug/m³ 24 hour <50ug/m³ Depositional dust Increase in total 2g/m²/month to maximum of 3.5g/m²/month	Compliant	PM ₁₀ results are reflective of background conditions and below the daily standard limit for entire reporting period. Minor increase in depositional dust trends.	No additional action required

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Lamberts North Ash Placement Project 2023-24

Biodiversity Submit a biodiversity of plan for approval	fset Compliant	The 2017 & 2020 revegetation works continue to establish. Plantings activities are scheduled for September 2024 Biennial flora & fauna monitoring will take place in October 2024	Area managed in accordance with the Biodiversity Conservation Agreement
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Performance against contract requirements is provided by Service Stream as a monthly Client Service Report (Service Stream, 2023; 2024) and through external consultant and internal data and reports. Summaries of these reports are provided in the sections below (1.1-7.2) and in Appendix C-F.

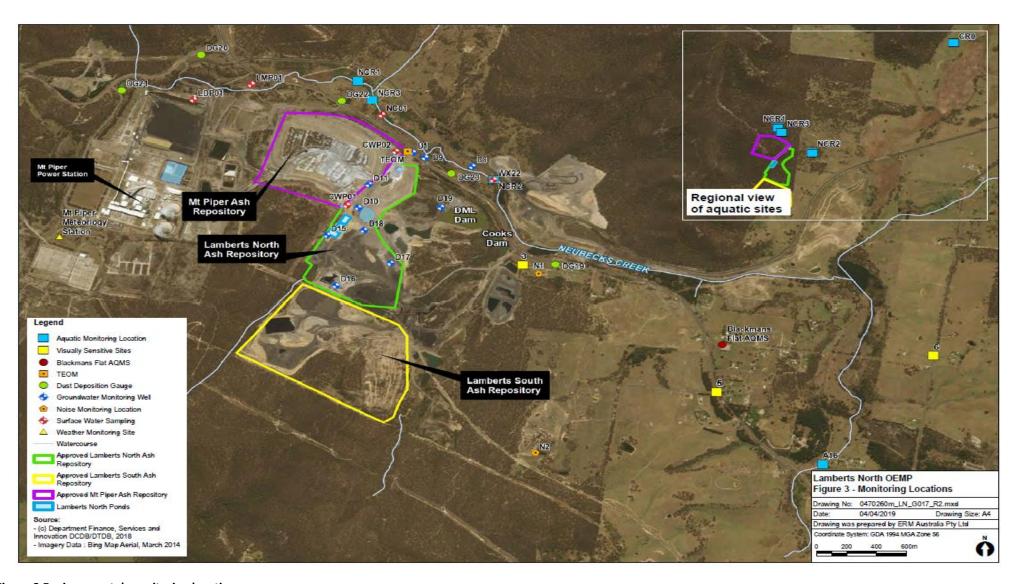


Figure 3 Environmental monitoring locations

6.1 Ash delivery and placement

6.1.1 Environmental Management

Ash generated as a by-product from the operation of MPPS is transported by conveyer from the MPPS to ash silos at the MPAR as part of the existing approved operations. Ash is then transported by heavy haulage vehicles (generally one to two trucks) from the silos to either the MPAR, or the LNAR. Transport to LNAR is facilitated via the southern boundary haulage road in the existing ash repository. On delivery to the LNAR, the water conditioned ash is deposited at the working face where compactors and bulldozers are then used to place the ash in stable landforms with appropriate drainage infrastructure. Ash placement can be broadly described as including the following processes (see also Figure 4):

- Identifying the current operational location for placement of ash.
- Placing ash at the existing face using truck and shaping of ash with a bulldozer.
- The ash is treated to achieve an average compaction of 95%, relative to its maximum standard compaction, through controlled combination of water addition and machine compaction with the use of rollers and rubbertyred vehicles.
- Ash is placed in layers and stepped to produce an overall batter slope of approximately 1(V):4(H), with benches
 added every 10 m in vertical height change. This process of ash placement produces an average batter length of
 40 m
- The sequence of ash placement will entail initially placing ash across the site starting from the most northerly part, then towards the east and south of LNAR, working to reach a final design height of 980 metres (m) Australia Height Datum (AHD) through abutment with the MPAR.
- Boundary faces are sequentially covered with material to be sourced from locally available material. Once the
 cover material is placed, vegetation replanting and restoration activities are undertaken. The process is repeated
 until LNAR is filled to its maximum permissible height and extent.
- Ash will be placed to the desired height (0.5 m to 1 m lifts) in pads, with materials that have been moisture-conditioned with water placed in the lower layers to an elevation as specified in approved design drawings, with corresponding heights of 10 m.
- Methods for the placement of ash materials to optimise compaction and stability of the emplacement areas include target moisture contact, compaction density, and progressive capping and vegetation.

Capping of exposed ash areas has been undertaken progressively as LNAR reaches its approved design height. Progressive revegetation of batters will commence once the final perimeter batters are constructed and keyed into the adjoining MPAR.

6.1.2 Environmental Performance

During the reporting period a total of 526,109 tonnes of fly ash was placed in the LNAR, consisting of 142,214 tonnes (T) of water-conditioned fly ash placed in LNAR Stage 2 and 383,895 T of brine-conditioned ash placed in lined LNAR Stages 1A and 1B. Furnace bottom ash generated during the reporting period has been utilised in the construction of the LNAR.

Inspections on the ash repository are performed monthly by the contractor and the results are summarised in Appendix B. The management and mitigation measures specified in the approved OEMP were found to be generally complied with.

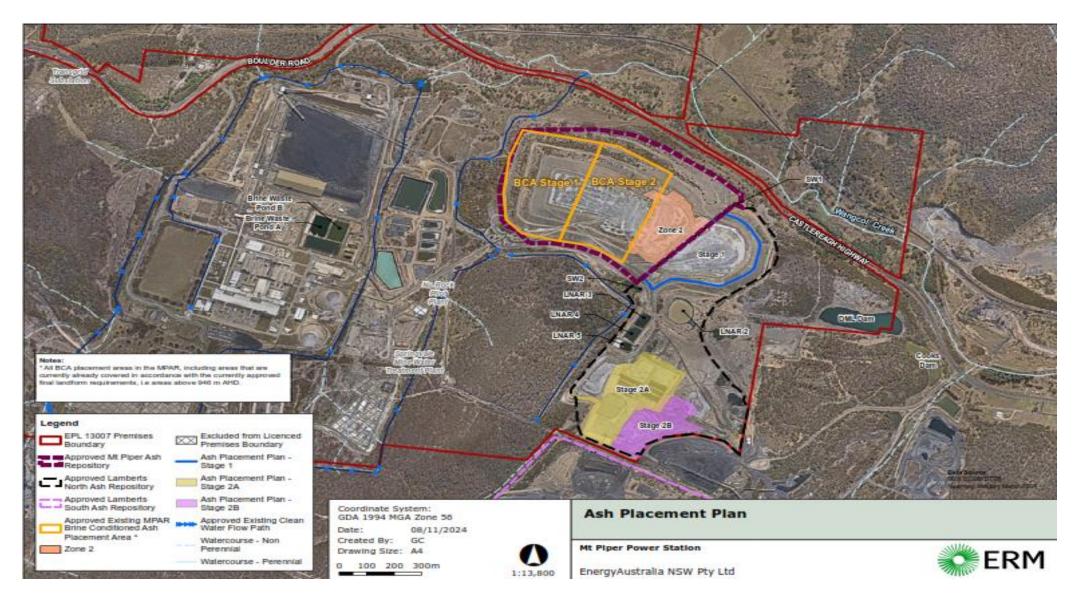


Figure 4 Ash Placement Plan

6.1.3 Reportable Incidents

No reportable incidents have been recorded against ash delivery and placement for the reporting period.

6.1.4 Further Improvements

- Continue installing and managing the leachate barrier management system. Stage 2A is currently in progress, and preparations for Stage 2B are underway, with mobilisation planned for October 2024.
- Mt Piper is continuing to work with NuRock, who are utilising fly-ash from Mt Piper to manufacture bricks, pavers
 and concrete blocks. NuRock are currently constructing a new plant on site and are continuing to develop their
 operations. It is expected that the new plant will be commissioned by the end of 2024. During stage one it is
 estimated that the plant will re-use an estimated 150k T of fly ash, per year.
- Mt Piper will continue to supply and market the reuse of fly ash to cement manufacturers.

6.2 Operational Noise Monitoring

6.2.1 Environmental Management

The LNAR Operational Noise Management & Monitoring Plan (ONMMP) has been developed to address the specific requirements of the CoA D3(a) and E7 to E14 for the Project. The ONMMP provides the framework to manage operational noise emissions and minimise potential noise impacts to sensitive receivers during the operation of the Project. The level of noise received by a sensitive receiver will depend on the location of the receiver, the type and duration of works and intervening topography, and existing building structures between the noise emission source and receiver.

The residential community of Blackmans Flat is located to the east of the private haul road and ash repository site. The following residential properties, located within 1100 m from LNAR, have been identified as the nearest potentially affected sensitive receivers to noise from the repository site (Table 8):

Table 8 Representative noise measurement locations

Sensitive Receiver		Distance to Haulage Road (m)		
1.	Blackmans Flat (east of Lamberts North)	1100		
2.	Blackmans Flat (west of Castlereagh Highway)	1100		

During the reporting period compliance monitoring was conducted in April 2024 during the early morning and evening periods as per the requirements outlined in the ONMMP. The applicable operational noise criteria are outlined in the Project Approval (No. 09_0186), the OEMP and ONMMP. The criteria are summarised as follows:

The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed a Laeq (15 minute) dB(A) as defined in condition E7 and identified in Table 9.

Table 9 Operational Noise Criterion (LAeq(15 minutes) dB(A))

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

This criterion applies under all meteorological conditions except for any of the following:

- a) Wind speeds greater than 3 m/s at 10 m above ground.
- b) Stability category F temperature inversion conditions and wind speed greater than 2m/s at 10m above ground level; and
- c) Stability category G temperature inversion conditions.

6.2.2 Environmental Performance

EMM Consulting Pty Ltd (EMM) were engaged by EnergyAustralia NSW to conduct an independent annual noise survey, of operations at the LNAR (EMM Consulting, 2024). The noise measurements were performed during April 2024 (Appendix C). Noise monitoring was performed in accordance with the methods described in the approved ONMMP. The results of the measured noise levels at the sensitive receivers stipulated in the CoA (Location 1 and Location 2) can be found in Appendix C.

The maximum 15-minute daytime equivalent sound pressure levels (LA_{eq}) at both locations during the recording period were dominated by traffic noise from the Castlereagh Highway. Other frequently mentioned noise sources included ongoing industrial activities from a neighbouring mining operation and the nearby air quality monitoring station. The daytime survey at location 1 indicated that whilst reverse alarms and impact noise from LNAR were occasionally audible at very low levels, they were unable to be measured due to continuous road traffic noise. The LNAR was inaudible during the measurement. The primary sources of the total measured noise levels were the local conveyors and the breeze rustling through nearby foliage. Birds contributed minimally to the measured LA1 and LAeq levels (EMM Consulting, 2024).

The total measured noise levels for both locations were in excess of the noise targets set for LNAR. However, due to the presence of other surrounding simultaneous noise sources at Location 1, it was not possible to conclusively determine the noise contribution from LNAR, during all the recorded time periods. Other commonly noted sources of noise included other industrial activities in the area, birds, bats, insects, dogs and breeze in the foliage.

To quantify the likely noise contribution from the LNAR at location 1 and 2, calculations were undertaken to estimate the noise emissions. The measurements are based on a worst-case operational scenario at both assessment locations and include adjustments for activities as outlined in Fact Sheet C of the EPA's *Noise Policy for Industry* (EPA, 2017).

Based on the worst–case noise modelling predictions undertaken, the noise resulting from the operations at the LNAR are below the $LA_{eq(15min)}$ 42dBA CoA criterion and are therefore deemed to comply with the OEMP (and PA 09_0186) at the representative residential receivers Location 1 and Location 2 (Table 10). The distances shown in Table 8 are considered minimum between the operational works and the respective receiver zones. (EMM Consulting, 2024)

Table 10 Summary of Cumulative Noise Emissions against the Noise Criteria (dBA)

Location	Description	Maximum predicted noise	Day limit 42 dBA (07:00-18:00)	Evening limit 38 dBA (18:00-22:00) ^	Night limit 35 dBA (22:00-07:00) ^
1	Blackmans Flat (approx. 1.4km)	Inaudible	Inaudible	Not Measurable	Inaudible
2	Wallerawang (approx. 2.5km)	Inaudible	Inaudible	Inaudible	Inaudible

6.2.3 Reportable Incidents

No reportable incidents have been recorded against operational noise for the reporting period.

6.2.4 Further Improvements

No further improvements have been identified for the next reporting period.

6.3 Biodiversity Offset Area (BOA)

An area of land adjacent to Thompsons Creek Reservoir was identified as a suitable BOA for LNAR (Figure 5). In confirming the BOA, various government and community organisations were consulted and the BOA was selected to build upon existing revegetation programs undertaken at Thompsons Creek Reservoir, with the aim of improving native vegetation connectivity in the region.

The BOA is a 6.8 ha land parcel comprised of two lots:

- Lot 243 of DP 801915 east site estimated 4.7 ha with approximately 605 m of foreshore.
- Lot 432 of DP 803501 south side estimated 2.1 ha with 200 m of foreshore.

The BOA is located on the eastern foreshore of Thompsons Creek Reservoir which is owned and operated by EA NSW for water storage purposes. The BOA is bounded by EA NSW landholdings except for private landholdings along the southern boundary.

EA NSW secured the Thompsons Creek Reservoir BOA in perpetuity during the 2021-22 reporting period. Guidance was sought from the Biodiversity Conservation Trust (BCT) for the suitability of managing the BOA under a formal conservation agreement. The intention of this was to secure the BOA and provide the financial and management resources required to enhance its biodiversity values. An application for a Conservation Agreement was submitted to the BCT in March 2021. The Conservation Agreement was granted by the BCT in March 2022.

The Biodiversity Conservation Agreement (BCA) (BCT, 2022) details the management actions to be performed within the BOA to enhance habitat for native flora and fauna species through site rehabilitation and revegetation. Biennial, flora and fauna monitoring within the BOA is required to be performed in accordance with the BCA, the next monitoring will be carried out in 2024.

A Landholder Report for the Thompsons Creek BOA is required to be prepared and submitted annually to the BCT in accordance with Attachment 3, Part 4, Clauses 2 (a) and (c) of the BCA. The first Landholder report was submitted to the BCT on 28 February 2024, which was reviewed by the BCT following their site visit on 13 March 2024 and approved 23 October 2024.

6.3.1 Environmental Management

Revegetating works were undertaken across the BOA in 2017, with approximately 2,000 seedlings planted across a 1 ha (approximate) section of the BOA (Plate 7 & Plate 8). To improve the native vegetation connectivity in the BOA, EA NSW engaged a contractor in October 2020 to undertake direct seeding works in areas devoid of native tree cover after the required flora and fauna monitoring was performed. A total area of 1.5 hectares was directly sown with a tree, shrub, and groundcover seed mixture in Spring 2020. An exclusion zone of 30-40 metres from the Thompson Creek Reservoir high-water level was created to maintain access along the foreshore for recreational fishing activities. Thinning works were conducted in August 2023, in accordance with recommendations from the Biodiversity Conservation Trust. The tree planting conducted in September 2023 continues to progress and develop well. The newly established trees are establishing well, demonstrating robust growth and resilience, contributing overall success of the revegetation efforts.



Figure 5 Biodiversity Offset Area



Plate 7 Developing tubestock plantings from 2017 – Polygon 4 (Photo Credit: Tom Kelly, 2022)



Plate 8 Established plantings within BOA (Photo taken July 2024)





Plate 9 Growth from Last Year's Tree Planting (Photo taken July 2024)

Eco Logical Australia (ELA) were engaged by EA NSW to perform the biennial flora and fauna monitoring within the BOA. The monitoring was performed in October 2022, in accordance with the requirements within the BOMP and the report is provided as Appendix D (Eco Logical Australia, 2022).

The 2022 flora monitoring found an overall increase in total flora and native species diversity, with a total of 67 flora species (47 native species, 20 exotic species) being recorded. Above average rainfall in 2020 is believed to have influenced these results. Revegetation and natural regeneration have continued to develop, in regard to height and stem density, as well as species diversity. Since the 2020 assessment, the height of 2017 tubestock plantings have grown significantly, with overall height now ranging from 1.5-3 metres tall, whilst the direct seeding plantings conducted in 2021 have grown up to 1 m in height. The presence of exotic species has remained variable throughout the area, however it is currently not affecting the re-establishment of native woodland species. Previously recorded priority weeds, Blackberry and St Johns Wort were still present within the BOA, whilst Serrated Tussock was no longer recorded during this monitoring period (Eco Logical Australia, 2022).

The fauna monitoring recorded a total of 33 bird species, which was the highest abundance of birds since the commencement of the monitoring program. The Australian Magpie was the most commonly recorded species with 17 individuals identified, whilst the Yellow-Rumped Thornbill was the most abundant, with 19 individuals recorded. Overall, there was an increase in the diversity of native woodland bird species with five species from the Honeyeater family being recorded. Four threatened bird species were identified, including two newly identified species, being the Dusky Woodswallow (Plate 10) and the Speckled Warbler. One pest bird species, the Common Starling was also recorded. An additional 13 bird species, 3 amphibian, 3 mammal and 3 reptile species were recorded opportunistically. The previously identified pest, the European Rabbit was not recorded during this period, whilst the Eastern Grey Kangaroo was frequently recorded, however there was no indication that the species was negatively impacting the plantings or natural regeneration (Eco Logical Australia, 2022).

The next flora and fauna monitoring period is scheduled for Spring 2024 (October), these surveys have been completed, with the results to be included in the 2025 AOCR.



Plate 10 Threatened species the Dusky Woodswallow (Photo Credit: Tom Kelly, 2022)

6.3.2 Reportable Incidents

No reportable incidents have been recorded against the BOA for the reporting period.

6.3.3 Further Improvements

- Perform targeted herbicide treatment of the two listed weed species (Blackberry & St John's Wort).
- Perform manual removal of Blackberry post-herbicide treatment to avoid the potential of re-shooting.
- Implement Management Plan Actions as required by the Biodiversity Conservation Agreement.
- Consult the adjoining landholder on fence design improvement, monitor for any wildlife entrapment or injury to enhance wildlife safety.

6.4 Ecological Monitoring

6.4.1 Environmental Management

The Ecological Monitoring Program (EMP) of the OEMP seeks to address the specific requirements of the CoA. The EMP provides for the requirements for the monitoring of aquatic ecology, in particular macro-invertebrates' aquatic habitat in accordance with CoA B7. EA NSW will maintain the EMP for a minimum of five years after the final capping of the LNAR in accordance with approval conditions.

The EMP was implemented in November 2012 prior to construction activities and then during construction in April 2013. In December 2023, the sample sites (Figure 3) included in the program were as follows:

- NCR1 on Wangcol Creek, upstream of the project area
- NCR2 on Wangcol Creek, adjacent to the project area
- NCR3 on Wangcol Creek upstream of the project area
- Control A16 on the Cox River at Lidsdale, downstream of the confluence with Wangcol Creek

The EMP aims to monitor and quantify the impacts on the ecology of Wangcol Creek and the associated riparian environment.

The specific objectives of the 2023-2024 study was to:

- Assess whether any impacts to the aquatic ecology of Wangcol Creek were detected in the vicinity of LNAR and determine whether any such impacts were attributable to the project
- Provide recommendations on actions, to minimize or improve impacts to the aquatic environment, as well as inform whether or not any changes need to be made to subsequent monitoring events to improve the effectiveness of the EMP.

6.4.2 Environmental Performance

EA NSW engaged Stantec to conduct the EMP in accordance with the requirements of the OEMP. The assessment of aquatic habitat, water quality and macroinvertebrate assemblages were undertaken on 5 December 2023 during the Spring sampling season (Appendix E).

The biotic indices used in the monitoring program included the following:

- The total number of taxa
- The number of pollution sensitive Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa
- The OE50 taxa score
- SIGNAL2 score

These indices were utilised in order to determine whether any changes had occurred to macroinvertebrates, that may relate to the project.

There was no evidence of any change in spring 2023 data compared with previous sampling events that would suggest an impact due to the Project. None of the statistical tests indicated any change through time at NCR2 that could have indicated an impact (Stantec, 2024).

There was no evidence of a change in SIGNAL2 Score in spring of 2020, 2021, 2022 and 2023 following the reduction in this indicator observed previously in autumn 2020. A native mountain galaxiid fish was captured at one of the control sites in autumn and spring 2018 and 2021, indicating that Wangcol Creek provides habitat for at least one native species of fish. Some differences in the macroinvertebrate multivariate assemblage structure were detected following the most recent analysis in spring 2022 and in spring 2021, however this did not provide evidence of any impact related to the project (Stantec, 2024).

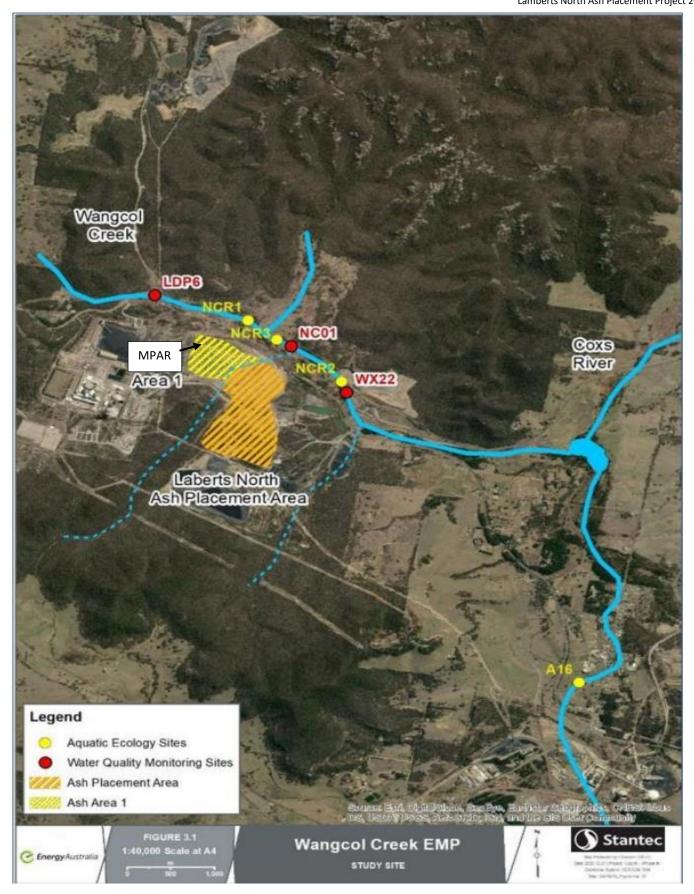


Figure 6 Aquatic ecology monitoring sites and long-term water quality monitoring sites

The OE50 Taxa Score is a biotic index of aquatic habitat and water quality, the score ranges are outlined below:

- Band A 0.84 to 1.16 indicate habitat equivalent to reference condition
- Band B 0.52 to 0.83 significantly impaired habitat
- Band C 0.20 to 0.51 severely impaired habitat
- Below 0.20 extremely impaired habitat

The OE50 Taxa Score for each location is listed in Table 11.

Table 11 OE50 Taxa Score for Spring 2023

Location	OE50 Taxa Score
NCR1	0.36 to 0.95
NCR2	0.2 to 1.04
NCR3	0.19 to 0.85
A16	0.34 to 0.91

These results indicated that on all but one occasion (NCR2 in Spring 2012) the macroinvertebrate assemblages sampled were less diverse than predicted (i.e., OE50 Taxa Score < 1.0). There was limited evidence to suggest a decrease in OE50 Taxa score between spring 2012 and spring 2016 at NCR2, however the OE50 Taxa score in spring 2018 was relatively high. OE50 Taxa Scores at control sites NCR1 and NCR3 in spring 2020 were also the lowest recorded during the EMP, though there was an apparent increase in the OE50 Taxa Score at these sites in subsequent surveys (Stantec, 2024).

Figure 7 OE50 results for impact and control sites for the period of 2012-2023

The SIGNAL2 Score is a biotic index of water pollution. The scores for Spring 2023 are listed in Table 12.

Table 12 SIGNAL2 Score for Spring 2023

Location	SIGNAL2 score	Pollution Level
NCR1	3.1 to 4.6	Indicative of severe to moderate pollution
NCR2	3.4 to 5.0	indicative of severe to moderate pollution
NCR3	2.9 to 5.2	indicative of severe to mild pollution
A16	3.6 to 5.2	Indicative of severe to mild pollution

These results suggest that all monitoring sites experience some degree of environmental stress due to poor water quality. However, there were no obvious trends in the SIGNAL2 data that indicate an impact related to the project (Stantec, 2024).

SIGNAL2 Score

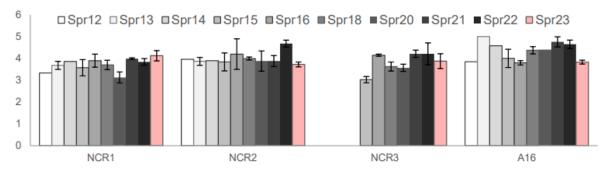


Figure 8 Signal2 results for impact and control sites for the period of 2012-2023

The complex interaction that exists between the various types of disturbances (e.g., those to habitat, water quality and flow) experienced in Wangcol Creek make any changes in water quality, and thus associated changes in macroinvertebrates, difficult to distinguish from those that could be due to the Project. Nevertheless, the EMP adds value to the wider monitoring program, and it is expected that any large magnitude and / or cumulative impacts to aquatic biota would be detected, allowing appropriate management actions to be implemented. Recent changes to the monitoring of aquatic ecology, including the addition of two further macroinvertebrate control sites, will assist in identifying any potential future impacts and help inform remediation efforts as necessary (Stantec, 2024).

6.4.3 Reportable Incidents

No reportable incidents have been recorded against ecological monitoring for the reporting period.

6.4.4 Further Improvements

- As per the project approval, ongoing monitoring should continue throughout the life of the project and for at least two (2) sampling periods following ash placement. This will maximise the validity of data and allow for more accurate comparisons between baseline data. Data from ongoing surveys will allow more confident conclusions to be made on the presence and duration of any potential impact in Wangcol Creek that could be attributed to the project. It is recommended that sampling continue with the next event to be undertaken in Spring 2024 (Stantec, 2024).
- Sampling should continue at the additional control sites established on Wangcol Creek (NCR3). While no baseline data is available from this site, control data collected here during future surveys would improve the power of statistical tests and aid in the detection of impacts (Stantec, 2024).
- Three replicate AUSRIVAS samples should continue to be collected from each site during future surveys. This will provide a measure of the variation present in each indicator at each site, thereby, improving the ability to detect any future impact by enabling the use of appropriate statistical analysis (Stantec, 2024).
- At this stage no project specific mitigation, impact minimisation or ameliorative actions are recommended (Stantec, 2024).

6.5 Air Quality Monitoring

6.5.1 Environmental Management

The OEMP (EA NSW, 2022) outlines the Air Quality Monitoring Program, as required under the CoA (CoA D3 (d) and E18) as stipulated by PA 09_0186. The Air Quality Monitoring Program includes specific site management pertaining to the transport and emplacement of ash, managing dust within the ash repository using an extensive sprinkler system and water cart applications, meteorological monitoring and continuous monitoring for dust/airborne particulates. Sprinklers and compaction are used to minimise fugitive dust from the LNAR. Water trucks are used to manage fugitive dust from the haul roads.

Dust management at the LNAR is included in the responsibilities of all activities, including:

• Daily monitoring from weather station.

- Fly ash conditioning.
- Mobile sprinkler system
- Use of perimeter sprays at the ash placement area
- Wash-down of security roadways, haul road/s and vehicle access roads water carts
- Static dust monitors
- Ash placement operations
- Final and temporary capping of ash; and
- General maintenance of the ash placement area (Lend Lease, 2012)

6.5.1.1.1 Sprinklers and Pumps

Dust suppression is a key performance objective for ash placement activities. Dust suppression concerns all aspects of exposed ash and ancillary aspects of vehicular traffic during permanent capping and other activities. The main dust suppression method on exposed ash is the use of sprinklers with water sourced from wash down ponds and the blow down towers from Mount Piper's cooling water system – no clean water is used in this application. Water application (measured in sprinkler hours) is based on wind velocity, humidity and temperature. Sprinklers are also used for haul roads. Water source, volumes and sprinkler numbers are monitored daily by Service Stream and reported to EA NSW monthly.

The OEMP (EA NSW, 2022) provides a guide for sprinkler hours at an optimum of 4 hours per day during low evaporation at less than 3 mm per day to ensure that a target of 5 mm by irrigation application is not exceeded (Table 13).

Table 13 Water use guideline

Water use guidelines based on temperature and wind speed	Water use guidelines	
>25° >20km/hr (10hrs/day)		
15-24° <20km/hr (8 hrs/day)	15° <20km/hr (<4 hours/day)	
15° <20km/hr (4 hours/day)		
Evaporation 3 – 7 mm per day	Evaporation < 3 mm per day	
Oct, Nov, Dec, Jan, Feb, Mar	April, May, June, July, Aug, Sept	

^{*}Operation of sprinklers in extreme hot and dry conditions requires extended irrigation hours

6.5.1.1.2 Air quality monitoring

Air quality impacts at LNAR are managed pursuant to PA 09_0186 and the approved Air Quality Management Plan (AQMP). The AQMP provides the assessment criteria for the LNAR which are monitored through a network of dust monitors.

The monitoring network consists of

- 5 dust deposition gauges (Figure 3), including Dust Gauges 19, 20, 21, 22 and 23
- 1 Tapered Element Oscillating Microbalance (TEOM) measuring <10 μm (PM₁₀) as shown on Figure 3.
- Air Quality Monitoring Station (AQMS) located at Blackmans Flat.

Dust monitoring results are recorded monthly with colour and textural observations.

Performance indicators recommended in the OEMP for air quality monitoring are as follows:

- Increase in Total Suspended Particulates (TSP) by > 2g/m²/month to a maximum of 3.5g/m²/month at dust deposition gauges outside the ash placement area
- PM₁₀ annual average is <30μg/ m³ and 24 hour maximum does not exceed 50μg/m³

The installed dust gauges meet the requirements for the methods for sampling and analysis of ambient air (AS/NZS 3580.10.1:2003).

6.5.2 Environmental Performance

6.5.2.1.1 Dust suppression – Lamberts North Sprinkler system

Figure 9 reflects a relationship between sprinkler application and evaporation to identify that the target or maximum application rates for irrigation at 5 mm / day was achieved. Net irrigation was calculated by subtracting the daily evaporation from the daily sprinkler irrigation rate.

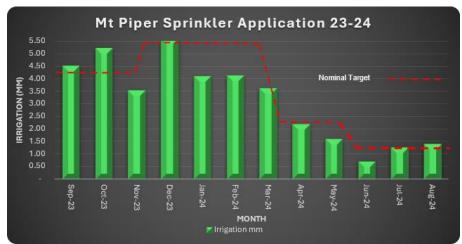


Figure 9 Efficacy of irrigation operations September 2023 – August 2024

6.5.2.1.2 Air quality monitoring

The 2023/2024 reporting period was characterised by slightly above average temperatures during winter and summer. Summer 2023-2024 experienced rainfall 10% above the average, coupled with above average temperatures, making it the 10th warmest summer in record since 1910. Winter 2024 saw below average rainfall and temperature higher than usual, placing it as the 10th warmest winter on record since 1910 (Bureau of Meteorology, 2024).

Dust activity across the state was greatly varied throughout the reporting period. The Department of Climate Change, Energy, the Environment and Water DustWatch reports highlighted an increase in dust during October, driven by higher winds and rainfall. However, in November there was a notable decrease in wind strength and rainfall, contributing to higher dust level, while January reported a decrease in dust activity due to lower wind speeds and increased rainfall and continued to vary through April. The remainder of the 2024 reporting period had varying dust levels with several spikes occurring largely due to unstable rainfall, groundcover variability and soil stability (DECCEW, 2023-2024).

Climatic conditions, state-wide dust activity and localised bushfires can influence air quality near the LNAR as reflected in previous Annual Reports. These extreme events can impact on air quality in the Lithgow Local Government Area and are not related to impacts or activities at the LNAR.

Depositional dust results across gauges DG19-DG23 from September 2023 to August 2024 are shown in Table 14 (Amp Control Group, September 2023- August 2024). The results for all gauges across the reported months, except for DG21 in January 2024, were below the assessment criteria of 3.5 g/m^2 .

The results remained variable throughout the reporting period which is largely in line with the 2023-2024 DustWatch Reports released by DECCEW (DECCEW, 2023-2024). The spike in depositional dust results during January 2024 is less than half the January average DustWatch results reported for the state. However, the Bureau of Meteorology (2024) stated that the rainfall total for January 2024 was 28.3% above the 1961–1990 average. With the northeast winds brought humid air, drier condition contributed to localized dust activity in parts of western New South Wales. Furthermore, the average wind direction for January was generally south. Gauge DG22 is located Northeast of the Repository, whilst the

other gauges are also located generally to the North of LNAR. Therefore, it appears unlikely that increased dust levels during that period would have been because of activities at LNAR.

Comparative annual average depositional dust data for the previous seven-year period is also presented in Table 14.

The increase in annual averages from September 2017 through to January 2020 is generally reflective of the extended drought conditions, increased frequency of dust storms and bush fires experienced statewide over that period. The annual average for most of the gauges began to increase from 2021 – 2023, coinciding with increased rainfall, that broke the extended drought conditions experienced in previous years. The 2024 annual averages have again increased across most of the gauges, which is likely attributed to the above average rainfall and warmer weather conditions experienced during the reporting period.

Table 14 Annual depositional dust summaries

Date	Total Insoluble solids (g/m²/month)				
1 st September 2023 – 31 st August 2024	DG 19	DG 20	DG 21	DG 22	DG 23
	Insol.	Insol.	Insol.	Insol.	Insol.
Sep-23	0.75	1.64	1.11	1	0.99
Oct-23	0.5	0.9	0.8	0.7	0.4
Nov-23	0.6	0.4	0.9	0.1	2.1
Dec-23	1	0.6	1	0.4	0.7
Jan-24	0.2	0.3	5.1	0.3	0.6
Feb-24	1.2	0.4	0.5	0.7	0.6
Mar-24	1.2	1.5	2.2	1.4	1.8
Apr-24	0.86	0.69	0.94	0.56	0.49
May-24	0.2	0.3	0.9	0.2	0.1
Jun-24	1.4	1.4	2	1.3	1.3
Jul-24	1.4	1.4	1.4	0.4	0.1
Aug-24	0.3	0.8	0.9	0.6	0.3
	Annual av	erages			
2024	0.8	0.9	1.5	0.6	0.8
2023	1.0	0.9	0.9	0.7	0.6
2022	0.7	0.5	0.9	0.6	1.1
2021	0.6	0.4	1.2	0.8	1.1
2020	1.8	1.8	2.1	1.1	2.3
2019	1.7	1.8	2.4	2.2	2.7
2018	0.9	1.4	1.4	1.1	1.0
2017	0.4	0.7	1.1	1.4	1.0
2016	0.6	0.7	1.5	0.6	0.7

Comparative depositional dust data for each of the five OEMP dust deposition gauges are presented in Figure 10-Figure 14.

Depositional dust concentrations from September 2020 – August 2023 remained relatively consistent, with three separate anomalous peaks above the 3.5 μ g/m² per month limit – These peaks recorded in gauge DG21 in July 2021 (Figure 12), gauge DG23 in February 2022 (Figure 14) and gauge DG19 February 2023 (Figure 10). All three anomalies were determined to be unrelated to activities at LNAR.

During the current reporting period, depositional dust concentrations, continued to remain relatively consistent across all the gauges. There was one anomalous peak recorded at dust gauge D21 during January 2024 (Figure 12). This high result has been deemed to not be associated with operations at Lamberts North, due to drier weather conditions and the average wind direction during the period was not travelling from LNAR towards the impacted gauge. The

consistently low results surrounding January 2024 and the dust suppression management strategies in place at LNAR, also indicate that spikes in dust results are unlikely to be associated with activities at LNAR.

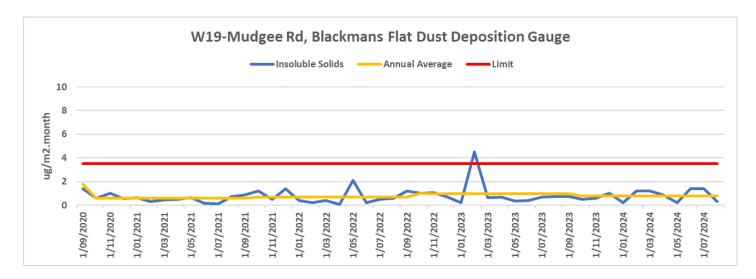


Figure 10 Depositional Dust Summary for Dust Gauge 19

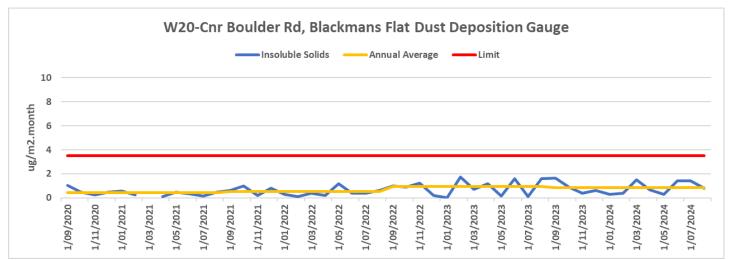


Figure 11 Depositional Dust Summary for Dust Gauge 20

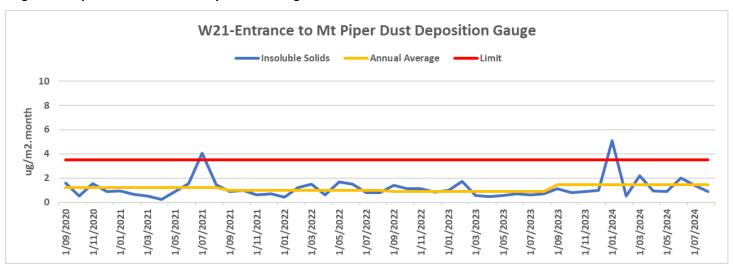


Figure 12 Depositional Dust Summary for Dust Gauge 21

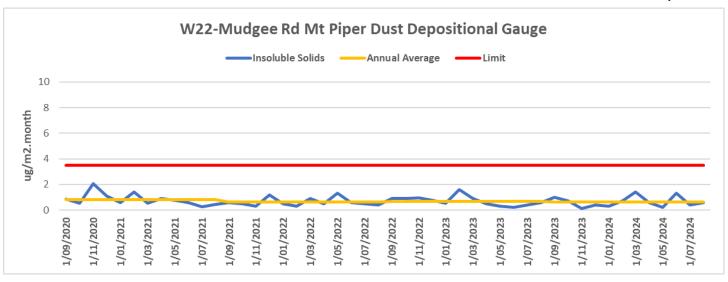


Figure 13 Depositional Dust Summary for Dust Gauge 22

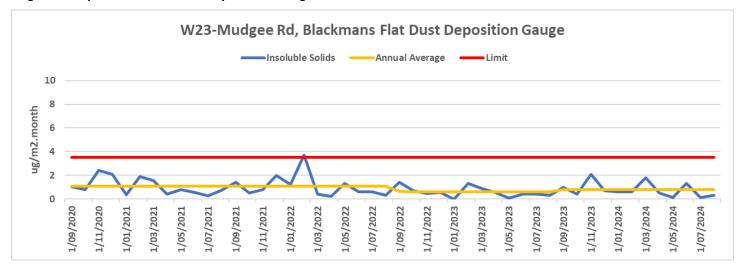


Figure 14 Depositional Dust Summary for Dust Gauge 23

EA NSW monitors fine particulates at LNAR, Blackmans Flat and Wallerawang air quality stations. These are located to the northwest, east and southern directions from the LNAR. Analysis of continuous air quality (PM₁₀) monitoring data from the Blackmans Flat, Wallerawang and LN air quality stations was undertaken for the reporting period (Figure 15).

The results show a generally consistent trend of fine particulate matter over the reporting period, with all results below the National Environment Protection Measures (NEPM) Daily Standard Limit for PM_{10} (Figure 15). Above average rainfall has likely attributed to the fine particulate concentration levels remaining at the typically background levels for the region throughout the reporting period.

During the 2023-24 reporting period, the annual average PM_{10} result for LNAR was 8.5 $\mu g/m^3$, which is well below the annual average criteria of 30 $\mu g/m^3$. The other local monitoring sites recorded PM_{10} results of 6.4 $\mu g/m^3$ at Blackmans Flat and 13.1 $\mu g/m^3$ at Wallerawang. Dust suppression systems were operating and functional at LNAR during the reporting period, therefore it appears more likely that any anomalies in PM_{10} concentrations would be attributed to sources external to LNAR.

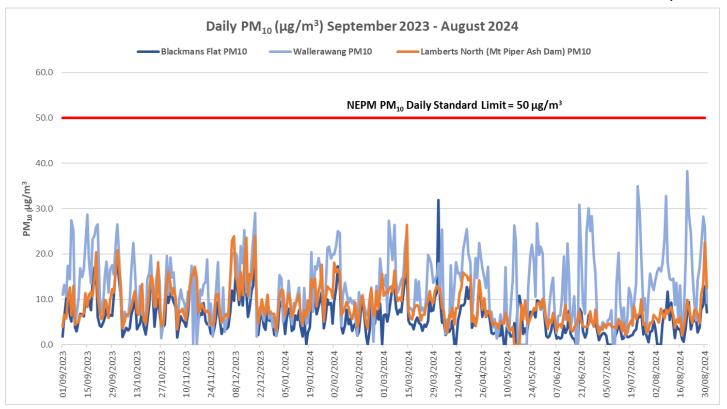


Figure 15 Average PM₁₀ from the Mt Piper TEOM from September 2023 to August 2024

6.5.3 Reportable Incidents

No reportable incidents have been recorded against air quality management for the reporting period.

6.5.4 Further Improvements

Pontoon pumps are being installed into LNAR ponds to provide a wider range for pumping. This means more water will be available for dust suppression. It has been operating as per design.

6.6 Waste Management

6.6.1 Environmental Management

Waste disposal practices at the LNAR are managed in accordance with Environmental Protection Licence 13007 and the Waste Management Sub-Plan (WMP, OEMP Section 5.9). Waste materials are assessed and classified in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and managed as required by the POEO Act. The WMP addresses waste management on site, and satisfies CoA D2 (g), E23, E24 and E25.

The WMP provides a framework for EA NSW, its contractors and vendors to manage waste and to minimise the potential for adverse impacts to sensitive receivers during the operation of the Project and is comprised of the following targets:

- To ensure waste at the LNAR is managed in accordance with the conditions of EPL 13007.
- To ensure that all Staff and associated contractors involved in the LNAR operations are made aware of the
 waste management measures contained in the WMP, that waste generated on LNAR is recycled or disposed
 of in accordance with the WMP.

EA NSW and associated contractors:

- Are not to cause, permit or allow any waste generated outside the ash repository to be received at the ash
 repository for storage, treatment, processing, reprocessing or disposal, including no wastes except as
 permitted by the licence or an exemption certificate.
- Waste generated by site personnel (including maintenance wastes such as oils and greases) are collected on a regular basis to be recycled or disposed of at an appropriate facility.
- Evidence of a recycling system in use and site-generated waste being disposed of to an appropriate facility.
- Waste management details are recorded in the monthly environmental report.

Waste-related documents and records reflect adherence to these protocols, thereby providing the foundations for a transparent approach to waste management. The WMP provides further guidance and detail on specific waste streams and applicable management measures (OEMP Section 5.9).

6.6.2 Environmental Performance

The activities at the LNAR were deemed to have met the WMP targets for waste management for the 2023-2024 reporting year. There were no non-conformances identified and the WMP requirements were found to be compliant.

6.6.3 Reportable Incidents

No reportable incidents have been recorded against waste management for the reporting period.

6.6.4 Further Improvements

No further improvements are planned for the next reporting year.

6.7 Heritage Management (Aboriginal & non-Aboriginal)

6.7.1 Environmental Management

Project Approval 09_186 contains CoA's concerning heritage management in Part B - Prior to Construction (B5 (f)) and Part C - During Construction (C8 - 9). These conditions are managed under Section 5.6 of the CEMP. The LNAR has progressed into the operational phase and CoA Part B and C no longer apply.

Whilst there are no specific CoAs for Project Approval 09_0186 for Part E – During Operations, regarding heritage management, contract personnel are educated on their due diligence duties in respect of the protection of Aboriginal and non-indigenous heritage sites and items.

6.7.2 Environmental Performance

No additional heritage sites have been recorded within the vicinity of the LNAR.

6.7.3 Reportable Incidents

No reportable incidents have been recorded against heritage management for the reporting period.

6.7.4 Further Improvements

No further improvements have been identified for the next reporting period.

7. Water management

7.1 Surface Water Quality Monitoring.

7.1.1 Environmental Management

The Soil and Surface Water Management Plan (SSWMP) is a sub-plan as outlined in the OEMP and addresses the specific requirements of the CoA D3 I and E16. The SSWMP addresses soil and water cycle management on site, including a surface water monitoring program at receiving waters that is comprised of the following targets:

- The water quality at Wangcol Creek is not impacted by LNAR operations;
- Zero environmental incidents that relate to pollution of waters at Wangcol Creek.
- Erosion to be effectively managed on site and not have an influence and/or impact on surrounding lands outside the boundary of LNAR.

Performance criteria:

- The Environmental Goals adopted have taken into consideration local baseline surface water conditions in Wangcol Creek prior to the commencement of ash placement in the eastern side of the MPAR (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 Wangcol Creek. An early warning is triggered when the post-ash placement 50th percentiles for the various water quality indicators at each of the surface water monitoring sites, exceed the pre-placement 90th percentiles (Aurecon 2017).
- Ecological results at Wangcol Creek will indicate no significant variation from historical baseline data.
- No visual evidence of erosion and sedimentation impacts on Wangcol Creek following significant rainfall events.

Runoff water from the LNAR is contained in clean and dirty water sediment ponds and forms the primary source of water for dust suppression on exposed ash and capped areas as well as irrigation of the revegetated areas. The CoAs stipulate that a monitoring program must be implemented to record and observe water quality and potential impacts from repository operations on regional surface waters. The OEMP for the LNAR requires sampling at three locations which are outlined in Figure 3 and Table 15.

Table 15 Location of Surface Water Monitoring Points

Site ID	Location Description	Monitoring Frequency
LMP01	Final Holding Pond Weir – monitoring point is located north-west of the MPAR. This monitoring site is located in an upstream position relative to the LNAR.	Monthly ¹ /Quarterly ²
NC01	Located in Wangcol Creek. This monitoring site is located upstream to the LNAR and to the north of the MPAR and is an aquatic life background site.	Monthly¹/Quarterly²
WX22	Located in Wangcol Creek at a stream gauge to the east/down-stream of the MPAR and LNAR and monitoring site LDP01. This monitoring site is also situated down-stream of monitoring bore D8.	Monthly¹/Quarterly²
	Selected field parameters monitored on a monthly basis as required Monitoring undertaken by analytical laboratory Nalco Water – Ecolab	

Changes in the water quality and trace metals at Wangcol Creek receiving water site (WX22), from pre-ash placement (October 2012 to August 2013) to the post-ash placement period (September 2013 to August 2017) was examined in the past by Aurecon reported within their Water Quality Monitoring Reports. For the 2023-24 reporting period Environmental Resources Management Australia (ERM) was commissioned by EA NSW to carry out the Water Quality Monitoring Report (WQMR), refer to Appendix F.

7.1.2 Environmental Performance

ERM was commissioned to assess the results from the surface water monitoring program as set out in the OEMP and as required by Project Approval 09_0186 during the reporting period. A copy of the WQMR is contained in Appendix F. The surface water monitoring carried out monitors for changes in water quality in Wangcol Creek, caused by multiple land uses in the area and is not restricted to LNAR activities.

Concentrations for the last 12 months, including those above the Environmental Goals, are presented in the tabulated surface water results in the annual water quality monitoring report in Appendix F.

Over the reporting period, concentrations of target analyst in surface water at midstream monitoring location, particularly (SW_E) and downstream of LNAR were reported above the Environment Goal. These elevated concentrations align with previous reporting period, and historical reporting and trend analysis, they are unlikely to be related to ash placement activities at LNAR. Since the last reporting period, EA NSW have completed an independent groundwater investigation, aimed at evaluating groundwater and surface water conditions in the vicinity of MPAR and LNAR and assessing the potential for groundwater to interact with surface water in Wangcol Creek. The findings of the investigation indicate that any impacts to the surface water, are most likely associated with legacy impacts from MPAR, rather than the LNAR. The results of the independent groundwater investigation will be discussed further in section 7.2.2

During the reporting period, surface water results from locations upstream of the Ash repositories (LMP01) remained below the of the Environmental Goals. Given the location of the LNAR relative to these surface water monitoring locations, activities at the LNAR are not considered to have contributed to exceedances at these locations. Concentrations of EC and TDS at upstream monitoring locations, demonstrated mostly stable trend throughout the reporting period remaining below the Environmental Goal and generally with in the historical ranges. All metals concentration at LMP01 were within historical ranges except for boron (filtered), which recorded its highest concentration during January 2024 monitoring event. Based on the outcomes from the independent investigation these results are unlikely to be related to activities at LNAR.

A review of concentration trends in surface water with respect to key indicators including chloride (Figure 16), nickel (Figure 17), sulfate (Figure 18) and TDS (Figure 19) are presented below. These indicators were selected based on the results being above the Environmental Goals for surface water, the potential increase in concentration observed downstream of the Ash Repositories and/or trend analysis presented in previous annual monitoring reports. The detailed surface water analysis is presented in full in Appendix F.

At the Mid-stream monitoring locations, sampling results from NCO1 and SW_C were generally similar to each other, however SW_E showed higher concentration of certain key analytes over the monitoring period. Historic data over the last 10 years shows that EC and TDS concentration at NCO1 And SW_C have remained low and stable, below the Environmental goals for surface water.

Consistent with increased TDS and EC values, chloride and sulfate concentration at SW_E spiked during 2019/20, however returned to concentrations below the environmental goal during the 2020/21 reporting period. Although the concentrations of chloride and sulfate did not exceed the environmental goals during this reporting period, EC and TDS values at SW_E remained higher than those further upstream at NC01 and SW_C. This increase is deemed to not be associated with activities at LNAR.

Graphs showing the concentration trends over the last 10 years for WX22 and SW_G show EC and TDS levels at this location have fluctuated over time and have typically decreased during summer months. Chloride and sulfate concentration have also varied over time and tend to align with TDS trends, specifically November 2023. Although the EC and TDS concentration at both downstream locations were above the Environmental goals they remained within the historical ranges throughout the reporting period. Additionally, boron (total and filtered) and nickel (total and filtered) concentrations exceeded the relevant Environmental Goal for surface water at WX22 and/or SW_G on certain occasion The increasing trends identified are considered to reflect the drier conditions experienced during the reporting period where surface water flows were lower and are not considered to be related to operations at LNAR.

The WQMR (ERM, 2024) outlines the relationship between surface water in the area and the associated impacts from MPAR. Therefore, based on the independent groundwater investigation, the historical data and the location and design of LNAR, it is unlikely that activities at LNAR are impacting the surface water.

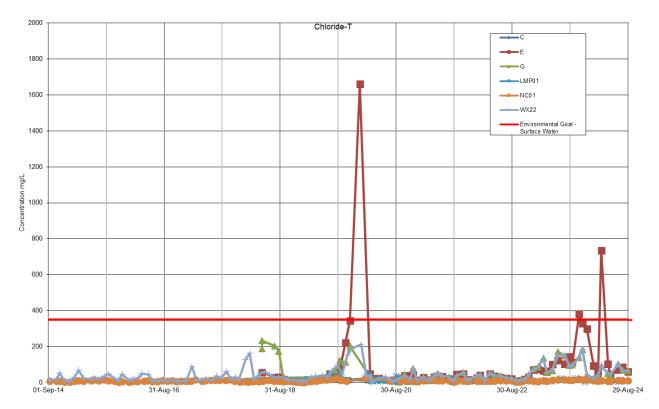


Figure 16 Chloride Concentrations in Surface Water

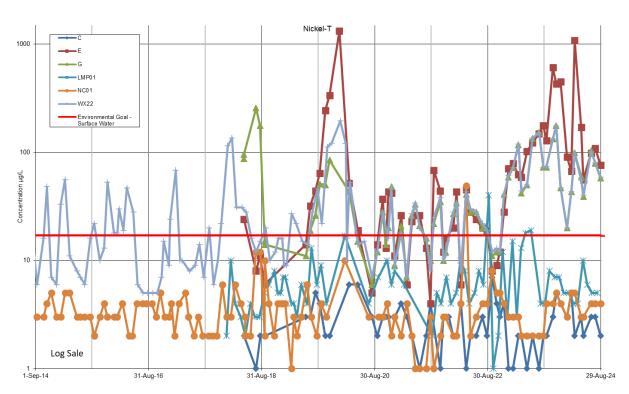


Figure 17 Nickel Concentrations in Surface Water

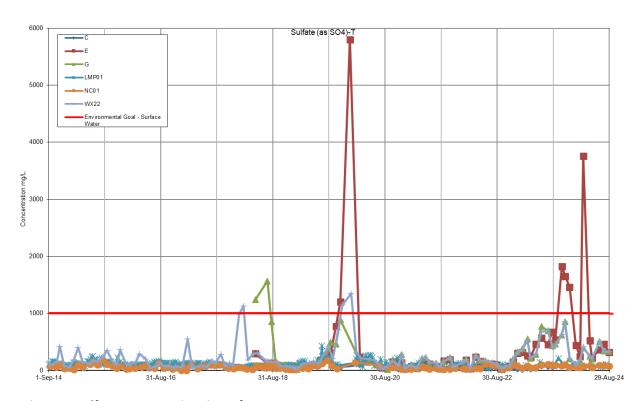


Figure 18 Sulfate Concentrations in Surface Water

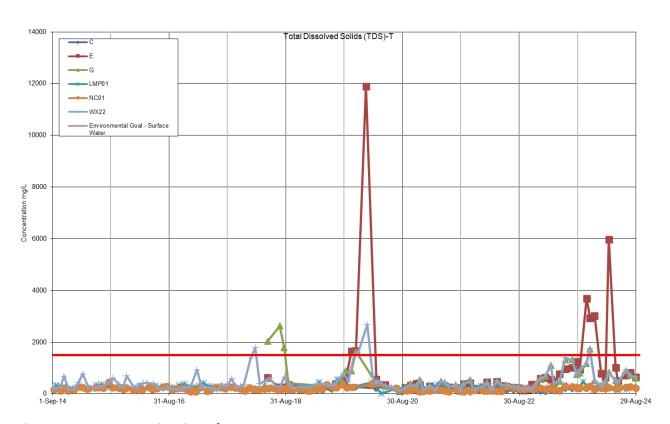


Figure 19 TDS Concentrations in Surface Water

7.1.3 Reportable Incidents

No reportable incidents have been recorded against surface water management for the reporting period.

7.1.4 Further Improvements

- Surface water will continue to be monitored and appropriate action taken to mitigate potential impacts to Wangcol Creek.
- The results of the independent groundwater investigation will be utilised to advise on future management and mitigation options for MPAR and will inform the continued design and implementation of the liner for INAR
- The stage 2 Leachate Barrier Management System area were prepared, constructed and commissioned towards the end of the reporting period.

7.2 Groundwater Monitoring

7.2.1 Environmental Management

The Groundwater Management and Monitoring Plan (GMMP) is a sub-plan of the OEMP and seeks to address the specific requirements of the CoA D3 (b), E15 and E17. The objective of the GWMP is to assess compliance with the CoAs. The GMMP provides for the requirements for the ongoing groundwater monitoring program in accordance with CoA E15. The GMMP was established and implemented in October 2012 prior to construction activities and in addition to the existing monitoring regime for MPAR.

In terms of performance criteria, water quality trigger values set out in the OEMP (CDM Smith 2013), as modified by Aurecon (2017), have been adopted as Environmental Goals for the analytes. In addition to the Environmental Goals outlined above, an early warning is triggered when the post-ash placement 50th percentiles for the various water quality indicators, exceed the pre-ash placement 90th percentiles (Aurecon 2017) (for further details, see Appendix F).

The GMMP provides the procedures and protocols that apply to the monitoring and testing of water quality and involves quarterly sampling of existing long-term bores associated with MPAR and new bores located south of Huon Gully. The locations of the groundwater monitoring sites are presented in Figure 3 and listed below:

- Bore D9: East of Huon Gully and south of Wangcol Creek, located outside the ash placement area. Used to monitor groundwater quality and potential influence on Wangcol Creek
- Bore D8: North of Wangcol Creek. Used to monitor groundwater quality and potential influence on Wangcol Creek
- Bore D10 & D11: Located on the western side of the ash placement area monitor groundwater quality in the former Huon Gully area. Bore D11 was decommissioned in February 2023 as part of the LNAR 1B Liner Installation works. Final water sample and level checks were completed prior to capping.
- Bore D1: North of Huon Gully, used to detect seepage from the north-eastern MPAR where BCA is emplaced and monitor groundwater quality and potential influence on Wangcol Creek.
- Bore D15: Inside of LNAR approval area, south and cross-hydraulic gradient of the currently active LNAR
 ash placement area and south of multipurpose storage ponds Pond BWA Pond BWC
- Bores D16 & D17: Inside of LNAR approval area, south and cross-hydraulic gradient of the currently active
 LNAR ash placement area and north of the Centennial Coal reject emplacement areas
- Bore D18: Inside of LNAR approval area, south and cross-hydraulic gradient of the currently active LNAR
 ash placement area
- Bore D19: Downgradient of LNAR approval area, adjacent to Centennial's DML Dam

Bores D10 and D11 are considered to be upgradient of the LNAR with the results used to indicate groundwater contributions from the MPAR. Exceedances of the Environmental Goals for these bores are considered to be unrelated to either background groundwater conditions in the region or to potential impacts resulting from activities at the LNAR. These groundwater conditions are currently subject to review and management as part of the independent groundwater investigation.

Bores D15, D16 and D17 in the southern portion of the LNAR are considered to be south of and across gradient of the LNAR, with the results used to indicate baseline groundwater contributions. The Environmental Goal exceedances in this area are considered unlikely to be a result of activities at the LNAR based on the inferred direction of groundwater flow.

Bores D1, and D8 and D9, are considered to be downgradient of the LNAR and the MPAR. Elevated detections of Environmental Goals in these bores are also elevated relative to concentrations in bores to the south/across gradient of the LNAR and are considered to be reflective of the same groundwater conditions reported at D10 and D11 (i.e. upgradient relative to groundwater flow direction). It is considered that exceedances of Environmental Goals are not a result of activities at LNAR. These groundwater conditions are currently subject to review and management as part of the independent groundwater investigation.

7.2.2 Environmental Performance

ERM was commissioned to assess the results from the groundwater monitoring program required by the OEMP and Project Approval 09_0186 during the reporting period. A copy of the WQMR is contained in Appendix F. Previous groundwater monitoring identified a number of exceedances of water quality goals contained in the GMMP, this therefore triggered contingency measures that required the commencement of an independent groundwater investigation. Between 2018 and 2023, an independent groundwater investigation (ERM, 2024)was conducted to investigate elevated chloride levels in groundwater at Bore D10 and the associated impacts on surface water in the area. In summary, the investigation found that elevated concentrations of some analytes in surface water and groundwater, were most likely linked to legacy impacts associated with the nearby MPAR. There was no indication that activities at LNAR were contributing to these elevated levels. The results of the investigation have been used to advise on future management and mitigation options for MPAR and have been used to inform the redesign and lining of the LNAR (ERM, 2024).

During the reporting period, concentrations of target analytes in groundwater were reported above the Environmental Goals, at monitoring locations within the LNAR and cross- and downgradient of LNAR. Elevated concentration if key analysts including EC, TDS, chloride, sulfate, boron and nickel are not considered to be related to operations at the LNNAR and have been assessed as part of an independent investigation. During the reporting period concentration of key analytes in ground water from several wells increased, however they remained within the historical ranges.

A review of concentration trends over the last 10 years with respect to key indicators including chloride (Figure 20), nickel (Figure 21), sulfate (Figure 22) and TDS (Figure 23) are presented for locations downgradient of the LNAR. Concentrations of the key analytes in groundwater have fluctuated over time and several bores have had concentrations above the environmental goals. However, based on review of the historical data and the conclusions outlined in the WQMR (ERM, 2024) it is apparent that increased concentrations were present prior to ash placement at LNAR.

During the reporting period, concentrations of chloride (Figure 20) at bores D1, D9, D102 were above the environmental goals, which is consistent with historical data. Concentrations of chloride at D2, D8, D19, D103, D104, D105 and D113 have decreased in previous years and have remained below the environmental goals during the period.

Nickel concentrations (Figure 21) at bores D1, D9, D102, D103, D105, D113 and D19 were above the environmental goals during the period, however this is consistent with historical data. D1 and D102 showed slight decrease compared to previous year. These increases are deemed to not be associated with LNAR. Concentrations at bores

D2, D8, D19 and D104 were below the environmental goals during the period and concentrations at D103 and D19 and D113 have decreased since 2020.

Sulfate concentrations (Figure 22) in groundwater from bores D2, D8 and D104 were below the environmental goals during the period, with concentrations at D2 decreasing since 2020. All other bores downgradient were above the environmental goals, this is consistent with historical data and not associated with LNAR.

TDS concentrations (Figure 23) at bores D2, D8 and D104 were below the environmental goals during the period, whilst the remaining downgradient bores were above the environmental goals. Data from the last 10 years shows that TDS in groundwater from several wells has increased over time, starting with D1 and D9 around 2011, however these increases are deemed not to be associated with LNAR. TDS concentrations in wells D19, D102, D103, D105 and D113 have remained above the Environmental Goal for the last ten years, meanwhile TDS concentrations in well D2 decreased in 2020, to below the environmental goal.

Although the groundwater results indicate that several key analytes are above the environmental goals these results are deemed not to be related to activities at LNAR. The WQMR (ERM, 2024) outlines the relationship between the flow of groundwater and the associated impacts from MPAR. Overall, the historical data demonstrates that there were elevated concentrations of analytes in groundwater prior to the placement of BCA in LNAR. Therefore, there is strong evidence that elevated results are not associated with activities at LNAR.

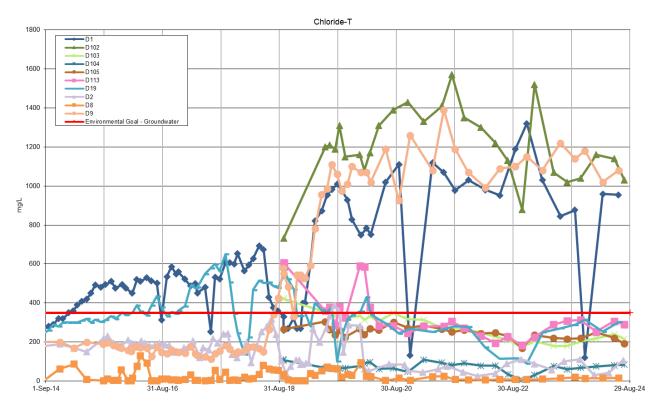


Figure 20 Chloride Concentrations in Groundwater

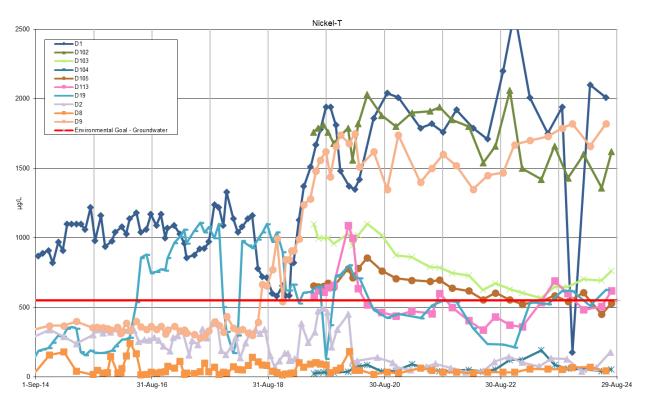


Figure 21 Nickel Concentrations in Groundwater

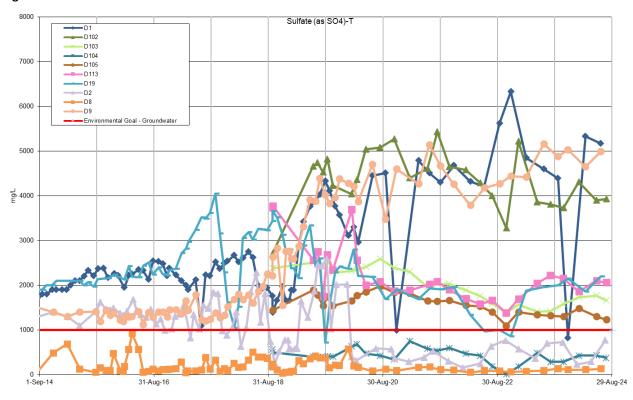


Figure 22 Sulfate Concentrations in Groundwater

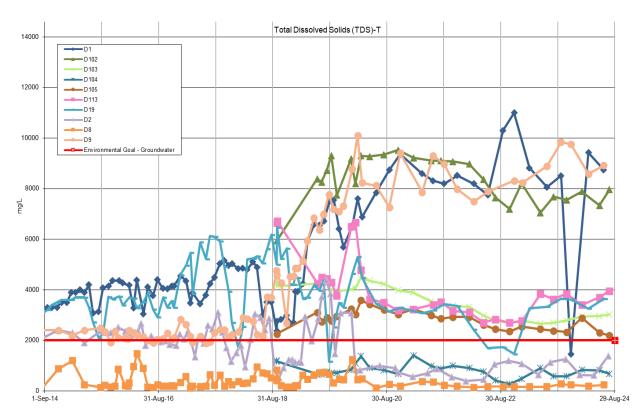


Figure 23 TDS Concentrations in Groundwater

7.2.3 Reportable Incidents

No reportable incidents have been recorded against groundwater managed for the reporting period.

7.2.4 Further Improvements

- The results of the independent groundwater investigation will be utilised to advise on future management and mitigation options for MPAR and inform the continued design and implementation of the liner for LNAR.
- A leachate barrier management system is being installed to prevent any potential leachate impacts to groundwater from the LNAR.

7.3 Hydrological Monitoring

The hydrological monitoring program, required by CoA E17, was incorporated into the GMMP because of the change in design to LNAR addressed in the Consistency Report (SKM, 2012). It is noted that this condition relates to assessing and quantifying the impacts and effectiveness of the transformed section of Huons Creek into a subsurface drainage line. Monitoring was undertaken for a period of five years and is now completed.

7.4 Erosion and Sediment Control

7.4.1 Environmental Management

The LNAR catchment area uses external batters and laybacks to stabilise the ash placement and direct runoff to swale drains that are situated parallel to the batters. The swale directs the water towards a controlled point, being an off-flow structure placed approximately every 100m along the batter. The off-flow structure, which is typically a rock-lined chute, directs the water to a containment pond.

The trucks deliver ash to the working face and create a number of piles next to each other, prior to final placement. The piles of ash allow for any runoff to be directed to the dirty water sediment pond(s). The ash is then graded into its final position and compacted by rollers to specific compaction criteria to mitigate erosion and infiltration.

7.4.2 Environmental Performance

Management of the ash benches is the primary principle of eliminating uncontrolled runoff over any batter. All benches associated with the LNAR area are graded west to ensure security against a breach from any external boundary. All surface water runoff from the ash footprint of the LNAR is managed within the boundary of the ash placement area.

The completion of the LNAR Stage 1 Leachate Barrier introduces a 100% Surface Water Retention to the Brine Conditioned Ash (BCA) Footprint. Surface Water is collected adjacent to Collection Sump 4 and pumped to the LNAR Lined Pond System (Plate 11 and Plate 12) for storage and reticulated onto the Repository BCA Active Placement Pad.

Based on site observations and information reviewed, potential impacts from the operation of the LNAR regarding erosion and sediment control, have been effectively mitigated and managed.

7.4.3 Reportable Incidents

No reportable incidents have been recorded regarding erosion and sediment controls for the reporting period.

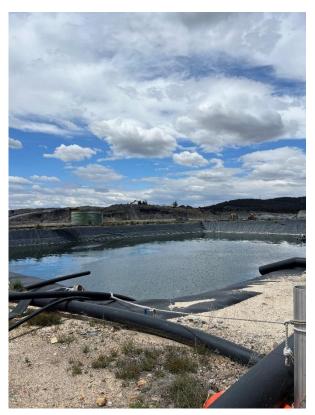


Plate 11 Lined LNAR Pond 3 (Photo taken November 2023)



Plate 12 Lined LNAR Ponds 4 and 5 (left to right) (Photo taken November 2023)

7.4.4 Further Improvements

- Implementation of LNAR stage 1 perimeter bund, which will maintain brine and salt water, separating it from clean water.
- Additional pond interconnector piping works.
- Construction of Eastern Boundary Windrow (adjacent to Western Coal Services)

8. Landscape and Revegetation

8.1.1 Environmental Management

During the reporting year, no rehabilitation work was undertaken due to the construction of the Geomembrane system. Rehabilitation works at the LNAR is planned to occur when the 937m contour layback has been constructed around the perimeter of the ash repository.

8.1.2 Environmental Performance

Ash Placement activities at the LNAR were undertaken within the existing capping levels. As such no additional land preparation or rehabilitation work was required during the reporting period. The rehabilitation status of the LNAR is detailed in Table 16. The rehabilitation status of the Lamberts North and the adjoining Mt Piper Ash Repository is shown in Appendix G.

Table 16 Rehabilitation Status

Area Type	Prev. Reporting Period Sept 2022 – Aug 2023 Hectares	This Reporting Period Sept 2023 – Aug 2024 Hectares	Next Reporting Period Sept 2024 – Aug 2025 Hectares
Total Footprint	19.8	19.8	19.8
Total active disturbance	16.7	16.7	16.7
Land being prepared for rehabilitation	0	0	0
Land under active rehabilitation	1.3	1.3	1.3
Completed rehabilitation	0	0	0

8.1.3 Reportable Incidents

No reportable incidents have been recorded against landscape and revegetation management for the reporting period.

8.1.4 Further Improvements

- Stage 2a bulk excavation component is scheduled for the next reporting period. This will work toward capping more of the repository.
- Water Conditioned Ash Area 2 (WCA2) bulk excavation
- Batter rehabilitation in progress Zone 2

9. Community

9.1 Community Engagement

During the reporting period Community Consultation Committee (CCC) meetings were held on 5 December 2023, 13 February 2024 and 11 June 2024. The CCC comprises representatives from the local community and EA NSW. The CCC meets three times per year to discuss matters relating to operations at MPPS, including activities at the ash repositories – MPAR and LNAR. The CCC minutes are made publicly available via the Mt Piper Community page on EA NSW website Mt Piper Community page-EnergyAustralia.

9.2 Community Contributions

The MPPS and the associated LNAR has contributed to the economy of the district and State through the purchase of materials and services from local and regional suppliers, and by direct and indirect employment. EA NSW continues to support several community groups and organisations through in-kind support and financial sponsorship programs. During the reporting period, EA NSW had the opportunity to support up to 38 different_community organisations and events during the reporting period. A list of these organisations and events are included in Appendix H.

9.3 Community Complaints

There were no community complaints reported to EA NSW relating to the LNAR during the reporting period (Appendix I). EA NSW maintains a 24-hour hotline for the public to report incidents, complaints or enquiries with contact details available on the EnergyAustralia website. EA NSW records the details of all complaints received in a Complaints Register.

9.4 Website Information

A project specific webpage has been developed to keep the broader community up to date with recent activities at the LNAR in accordance with CoA B10. Copies of the following documents are made publicly available on the EA NSW website:

https://www.energyaustralia.com.au/about-us/what-we-do/generating-energy/lamberts-north-ash-repository

- Environment Assessment
- Project Approval 09 0186
- Modification 1 Report and Response to Submissions
- Construction Environment Management Plan
- Operation Environmental Management Plan
- Annual Reports
- Environment Protection Licence 13007
- Pollution Incident Response Management Plan
- CCC Minutes

10. Independent Environmental Audit

10.1 Independent Environmental Audit

An independent environmental audit was performed in October 2018 (SLR, 2018) and all the recommendations and findings have been completed.

10.2 Environmental Representative Audit

The audit focused on compliance with the Leachate Barrier Management System in Stage 1 and Stage 2 areas, ensuring alignment with the Lamberts North Ash Placement Project Approval and the Operation Environmental Management Plan (OEMP). The audit reviewed Leachate Barrier System 2.2.4, Linear Installation 5.11.2.1 and Leachate Management 5.11.3 (OEMP, 2022). No non-compliances were found, and the detailed audit report is available in Appendix J.

The installation of the Leachate Barrier Management system in the LNAR demonstrates EnergyAustralia's commitment to achieve environment compliance. The installation of this type of lined ash repository is a large undertaking and requires detailed planning, construction and operational commitment. The lined ash repository is an environmental control measure and improvement to previous practices that are being successfully executed on the LNAR.

11. Activities Proposed in the next reporting period

Activities to be conducted in the next reporting period will include:

- Stage 2 design and liner implementation.
- Continued dust suppression activities to minimise potential air quality impacts from the LNAR Stage 1 and Stage 2.
- Water management works, including the maintenance of sediment and erosion control structures.
- Further tree plantings and management of the Biodiversity Offset Area.
- Continued execution of the Conservation Agreement management actions as outlined and required by the Conservation Agreement.
- Continue marketing the reuse of fly ash to cement manufacturers and other potential users.
- Environmental compliance monitoring for noise emissions, air quality and water quality.
- Continue monitoring the ecological health of Wangcol Creek throughout the life of the Project. The
 monitoring will continue after final capping of the LNAR for a minimum of five years in accordance with
 approval conditions.

11.1 Environmental Management Targets and Strategies for the Next Year

Environmental measures to be implemented in the next reporting period are detailed in 17.

Table 17 Measures to be implemented in the next reporting period.

Environment Management Area	Target / Strategy	Timeframe
Ash Delivery and Placement	Continue installing and managing the leachate barrier management system. Stage 2A is currently in progress, and preparations for Stage 2B are underway, with mobilisation planned for October 2024.	2024 onwards
	Mt Piper is continuing to work with NuRock, who are utilising fly-ash from Mt Piper to manufacture bricks, pavers and concrete blocks. NuRock are currently constructing a new plant on site and are continuing to develop their operations. It is expected that the new plant will be commissioned by the end of 2023. During stage one it is estimated that the plant will re-use an estimated 250-280 T of fly ash, per day.	
	Mt Piper will continue to supply and market the reuse of fly ash to cement manufacturers.	
Biodiversity Offset Area	Perform targeted herbicide treatment of the two listed weed species (Blackberry & St John's Wort).	2024 onwards
	Perform manual removal of Blackberry post-herbicide treatment to avoid the potential of re-shooting.	
	Implement Management Plan Actions as required by the Biodiversity Conservation Agreement	

Ecological Monitoring	As per the Project Approval, ongoing monitoring should continue throughout the life of the project and for at least two (2) sampling periods following ash placement. This will maximise the validity of data and allow for more accurate comparisons between baseline data. Data from ongoing surveys will allow more confident conclusions to be made on the presence and duration of any potential impact in Wangcol Creek that could be attributed to the project. It is recommended that sampling continue with the next event to be	2024 onwards
	undertaken in Spring 2024 (Stantec, 2024). Sampling should continue at the additional control sites established on Wangcol Creek (NCR3). While no baseline data is available from this site, control data collected here during future surveys would improve the power of statistical tests and aid in the detection of impacts (Stantec, 2024).	
	Three replicate AUSRIVAS samples should continue to be collected from each site during all future surveys. This will provide a measure of the variation present in each indicator at each site, thereby, improving the ability to detect any future impact by enabling the use of appropriate statistical analysis (Stantec, 2024).	
	At this stage no project specific mitigation, impact minimisation or ameliorative actions are recommended (Stantec, 2024).	
Water Quality	The results of the independent groundwater investigation and ongoing monitoring will be utilised to advise on future management and mitigation options for LNAR.	2024 onwards
	Complete the installation of the leachate barrier management system in Stage 2 area to prevent any potential leachate impacts to groundwater from the LNAR.	2024 onwards.

12. References

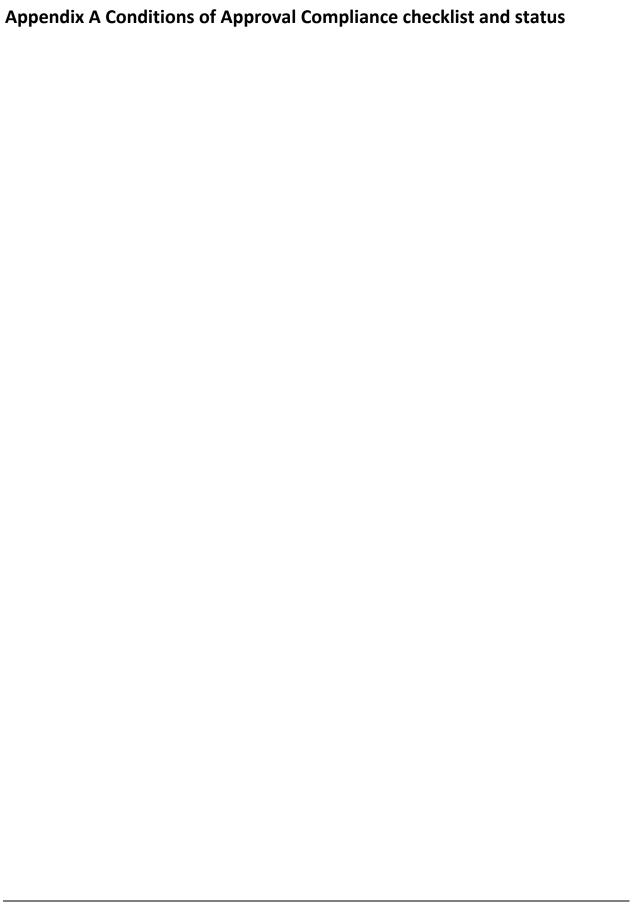
- Amp Control Group. (September 2023- August 2024). *Energy Australia Air Monitoring Network Environmental Report.*
- ANZECC. (2000). National Water Quality Management Strategy. Paper No. 4. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1: The Guidelines (Chapter 1-7). Australian & New Zealand Environment & Conservation Council.
- BCT. (2022). Lamberts North Biodiversity Offset Management Plan. Biodiversity Conservation Trust.
- Bureau of Meteorology. (2024). *Australian climate history Climate summaries*. Retrieved from Bureau of Meteorology:
 - http://www.bom.gov.au/climate/current/statement archives.shtml?region=nsw&period=season
- Cardno. (2017). Neubecks Creek Ecological Monitoring Program Spring 2012-Spring 2016. Cardno Pty Ltd, NSW.
- Cardno. (2018). Neubecks Creek Ecological Monitoring Program -Spring 2012-Autumn 2018. NSW: Cardno Pty Ltd.
- Cardno. (2019). Neubecks Creek Ecological Monitoring Program Spring 2012-Spring 2018. Cardno Pty Ltd, NSW.
- Cardno. (2020). Neubecks Creek Ecological Monitoring Program Autumn 2013-Autumn 2020. Cardno Pty Ltd, NSW.
- Cardno. (2021). Wangcol Creek Ecological Monitoring Program Spring 2012 to Spring 2020. Cardno Pty Ltd, NSW.
- Cardno. (2022). Wangcol Creek Ecological Monitoring Program Spring 2012 to Spring 2021. Cardno Pty Ltd, NSW.
- CDM Smith. (2012a). *Lambert North Ash Placement Project Construction Environmental Management Plan.* CDM Smith Pty Ltd, NSW.
- CDM Smith. (2012b). Lamberts North Groundwater Model Report. CDM Smith Pty Ltd, NSW.
- CDM Smith. (2013). Lamberts North Ash Placement Project Operation Environmental Management Plan. CDM Smith Pty Ltd, NSW.
- DECCEW. (2023-2024). *Dust Watch Reports*. Retrieved from Department of Climate Change, Energy , the Environment and Water: https://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/wind-erosion/community-dustwatch/dustwatch-publications
- Delta Electricity. (2012). Ash Management Strategy. Delta Electricity Pty Ltd, NSW.
- Delta Electricity. (2012). Lamberts North Ash Placement Project Project Biodiversity Offset Management Plan. Delta Electricity Pty Ltd, NSW.
- DPE. (2021). Conditions of Approval for Mt Piper Ash Placement Lamberts North Mod 1. NSW: Department of Planning & Environment.
- DPI. (2012). Conditions of Approval for Mt Piper Ash Placement Lamberts North. Department of Planning & Infrastructure, NSW.
- DPIE. (2020). Compliance Reporting Post Approval Requirements. NSW: Department of Planning, Industry and Environment.
- EA NSW. (2015). Lamberts North Ash Placement Project Project Biodiversity Offset Management Plan. EnergyAustralia NSW Pty Ltd, NSW.
- EA NSW. (2016). Mt Piper Ash Management Strategy 2016 update. NSW: EnergyAustralia NSW Pty Ltd.
- EA NSW. (2018). Mt Piper Ash Management Strategy 2018 Update. NSW: EnergyAustralia NSW Pty Ltd.
- EA NSW. (2019b). Lamberts North Biodiversity Offset Management Plan. EnergyAustralia NSW, NSW.
- EA NSW. (2020). Mt Piper Ash Management Strategy 2020 Update. EnergyAustralia NSW Pty Ltd, NSW.
- EA NSW. (2021). Mt Piper Ash Placement Project Lamberts North. EnergyAustralia NSW, NSW.
- EA NSW. (2022). Lamberts North Ash Placement Project Operation Environmental Management Plan. EnergyAustralia NSW, NSW.

- EA NSW. (2022). Lamberts North Ash Placement Project Operation Environmental Management Plan. EnergyAustralia NSW, NSW.
- Eco Logical Australia. (2022). Lamberts North Biodiversity Offset Area Flora and Fauna Monitoring Report 2022. Prepared for Energy Australia NSW.
- ELA. (2018). Lamberts North Biodiversity Offset Area Flora and Fauna Monitoring Report. Eco Logical Australia, NSW.
- ELA. (2020). Lamberts North Biodiversity Offset Area Flora and Fauna Monitoring Report 2020. Eco Logical Australia, NSW.
- EMM Consulting. (2024). Lamberts North Ash Repository Environmental noise monitoring 2024.
- EPA. (2014). Waste Classification Guidelines. Environment Protection Authority, NSW.
- EPA. (2017). Noise Policy for Industry. Environment Protection Authority, NSW.
- ERM. (2022). Lamberts North Ash Repository: Leachate Management System Water. NSW: Environmental Resources Management Pty Ltd.
- ERM. (2023). Mt Piper Power Station, Independent Groundwater Investigation, Project Summary. Sydney, NSW, Australia: ERM.
- ERM. (2024). Mt Piper Power Station Ash Repositories Water Assessment, Numerical Groundwater Modelling-Groundwater Flow Model Report.
- https://www.energyaustralia.com.au/sites/default/files/2022-12/220426%20LNAR%20OEMP%20Mod%201.pdf. (2022). *OEMP*.
- Lend Lease. (2015a). Mount Piper & Lamberts North Ash, Dust, Brine Repository Management Plan. Lend Lease Industrial Pty. Ltd.
- LLS. (2017). Central Tablelands Regional Strategic Weed Management Plan. Central Tablelands Local Land Services, NSW.
- NSW Government. (2020, May). Compliance Reporting Post Approval Requirements. Retrieved from NSW Government Planning: https://www.planning.nsw.gov.au/sites/default/files/2023-02/compliance-reporting-par-202005.pdf
- Service Stream. (2023). *E0003 Monthly Contractor Reports September-December 2022.* NSW: Service Stream Pty Ltd.
- Service Stream. (2024). E0003 Monthly Contractor Reports January-August 2023. NSW: Service Stream Pty. Ltd.
- SKM. (2010). *Mt Piper Power Station Ash Placement Project Environment Assessment Project 09_0186.* Sinclair Knight Merz Pty Ltd, NSW.
- SKM. (2011). Mt Piper Power Station Ash Placement Project Submissions Report Project 09_0186. Sinclair Knight Merz Pty Ltd, NSW.
- SKM. (2012). *Mt Piper Power Station Ash Placement Project Consistency Report-Project approval 09_0186.* Sinclair Knight Merz Pty Ltd, NSW.
- SLR. (2018). Lamberts North-Mt Piper Independent Environmental Audit. NSW: SLR Consulting Australia Pty Ltd.
- Stantec. (2023). Wangcol Creek Ecological Monitoring Program Spring 2012 to Spring 2022. NSW: Stantec Pty Ltd. Stantec. (2024). Wangcol Creek EMP 2012 to 2022.

13. Glossary of Terms

μg/m³	Microgram per cubic metre
AHD	Australian Height Datum
ANZECC	Australian & New Zealand Environmental & Conservation Council
AOCR	Annual Operation Compliance Report
AQMP	Air Quality Management Plan
AQMS	Air Quality Monitoring Station
BCA	Brine-conditioned Ash
BCT	Biodiversity Conservation Trust
BOA	Biodiversity Offset Area
BOM	Bureau of Meteorology
ВОМР	Biodiversity Offset Management Plan
CCC	Community Consultative Committee
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval (Project Approval 09_0186)
dB	decibel
DE	Delta Electricity
DECCEWOEH	Office of Environment & Heritage Department of Climate Change, Energy, the Environment and Water
DPE-Water	– Department of Planning & Environment – Water
DPHIE	Department of Planning Housing & Infrastructure Environment
DPI-Fisheries	Department of Primary Industries - Fisheries
EA NSW	EnergyAustralia NSW
ELA	Eco Logical Australia
EMP	Ecological Monitoring Program
EP&A Act	Environment Planning & Assessment Act 1979
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ERM	Environmental Resources Management Australia Pty Ltd
GMMP	Groundwater Management & Monitoring Plan
ha	hectares
LLS	Local Land Services
LN	Lamberts North
LNAR	Lamberts North Ash Repository
LSAR	Lamberts South Ash Repository
m	metres
m/s	Metres per second
Mod	Modification
MPAR	Mt Piper Ash Repository

MPPS	Mt Piper Power Station
MW	Megawatt
NEMMCO	National Electricity Markey Management Company
NEPM	National Environmental Protection Measures
NRAR	Natural Resource Access Regulator
NSW	New South Wales
OEMP	Operational Environmental Management Plan
ONMMP	Operational Noise Management & Monitoring Plan
PM	Particulate Matter
POEO Act	Protection of the Environment Operations Act 1997
SoC	Statement of Commitments
SPL	Sound Power Level
SSWMP	Soil & Surface Water Management Plan
Т	tonnes
TEOM	Tapered Element Oscillating Membrane
TSP	Total Suspended Particulates
WAL	Water Access Licence
WMP	Waste Management Plan
WQMR	Water Quality Monitoring Report



Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
Terms of	A1	The Proponent must carry out the project:	phase	Based on the review undertaken, the Lamberts North operations have been carried out in accordance	
Approval	a)	in accordance with the conditions of this approval granted with respect to the Mt Piper Ash Placement Project (09 0186);	At all times	with the requirements.	Compliant
	b)	in accordance with all written direction of the Secretary; and			
	c)	generally in accordance with the EA.			
	A2	The conditions of this approval and direction of the Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and the document listed in condition A1(c). In the event of an inconsistency, ambiguity or conflict between any of the documents listed in condition A1(c), the most recent document prevails to the extent of any inconsistency, ambiguity or conflict.	At all times	No inconsistencies were observed between the listed documents during implementation of the project or during the course of the review of operations for the AOCR	Compliant
	А3	The Proponent shall comply with the reasonable requirements of the Secretary arising from the Department's assessment of:	At all times	This has been addressed in Section 5 of the 2023-2024 AOCR	Compliant
	a)	any documents that are submitted in accordance with this approval; and	Ac an enrics		Compilant
	b)	the implementation of any actions or measures contained in these documents.		A request was made by the Convetory of the DDF in Amil 2010 for EA to have an Independent	
	A4	The Proponent shall meet the requirements of the Secretary 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(c) of this approval.	At all times	A request was made by the Secretary of the DPE in April 2018 for EA to have an Independent Environmental Audit (IEA) commissioned by June 2019. The IEA was performed in October 2018 (SLR, 2018)	Compliant
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.	Prior to construction	The Project Approval for Lamberts North Ash Repository (DPI, 2012) is dated 16 February 2012 with construction works on the Lamberts North Ash Repository project commencing 7 January 2013, following approval of the CEMP by DPE in December 2012. Ash placement commenced in September 2013, well before the 'deadline' date.	Compliant
Statutory Requirements	А6	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.	At all times	Based on the Environmental Assessment (SKM, 2010) and OEMP (EA NSW, 2022), no permits were required during the operational phase of the project. Prior to construction licences for sinking boreholes were obtained from the NSW Office of Water. No Commonwealth permits, licences or approvals have been identified for the project. The project complies with the requirements of EnergyAustralia NSW's EPL 13007 (See Section 1 of the 2023-24 AOCR)	Compliant
Staging	А7	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, D4, D5 and D6 separately for each stage.	Prior to construction	A CEMP (CDM Smith, 2012a) for construction (CoA B4) including the relevant sub-plans outlined within CoA B5 was approved by the DPI 1 December 2012. An OEMP (CDM Smith, 2013) for operation (CoA D2) of Lamberts North, including the relevant operational sub-plans as outlined in CoA D3 was approved by the DPI in May 2013. The OEMP was reviewed and updated by EnergyAustralia NSW (2022)which was approved by the DPIE on 6 June 2022. An evaluation of ground water levels at Lamberts North (CDM Smith, 2012b) was provided to DPE in May 2013, in accordance with CoA D5. The Leachate Management System Water Balance Assessment (CoA D6) provided to the DPE in February 2022 was approved in April 2022. The above-mentioned conditions are compliant for the Lamberts North stage. They have not been applied to the Lamberts South stage as no construction works have commenced for this stage to date.	Compliant
Incident Notification, Reporting and Response	A8	The Secretary must be notified in writing via the Major Projects website immediately after the Proponent becomes aware of an incident. The notification must identify the project (including the application number and the name of the project if it has one) and set out the location and nature of the incident. Subsequent notification requirements must be given, and reports submitted in accordance with the requirements set out in Appendix 2.	As required	No incidents requiring notification of the Secretary occurred during the reporting period.	Not triggered
Non- Compliance Notification	А9	The Secretary must be notified in writing via the Major Projects website within seven days after the Proponent becomes aware of any non-compliance. A noncompliance notification must identify the project and the application number for it, set out the condition of approval that the project is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the noncompliance. Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.	As required	No non-compliances requiring notification of the Secretary occurred during the reporting period.	Not triggered
	A10	Compliance Reports of the project must be carried out in accordance with the Compliance Reporting Requirements outlined in the Compliance Reporting Post Approval Requirements (2020)	At all times	The 2023-24 AOCR had been developed in accordance with the requirements of the Compliance Reporting Post Approval Requirements (2020).	Compliant
Access to Information	A11 a)	Until the completion of all rehabilitation required under this approval, the Proponent must: make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this approval) publicly available on its website:		A project website is available for the project: https://www.energyaustralia.com.au/about-us/energy-generation/lamberts-north-ash-repository the webpage hosts the Environmental Assessment, Submissions report and approvals, as well and	
	i	The EA;		Environmental Management Plans, Annual Environmental Management Reports & Compliance	
	ii	all current statutory approvals for the project;		Reports and Compliance Tracking. Progress on operations and outcomes of compliance tracking are detailed within the Quarterly Community meeting and the minutes from this meeting are available	
	iii	all approved strategies, plans and programs required under the conditions of this approval;		from the following website:	
	iv v	staging plans for the project if the construction, operation or decommissioning of the project is to be staged; regular reporting on the environmental performance of the project in accordance with the reporting requirements in any plans or programs approved under the conditions of this approval;		https://www.Energyaustralia.com.au/about-us/energy-generation/mt-piper-power-station/mt-piper-community All documentation is current and up to date.	Compliant
	vi	a comprehensive summary of the monitoring results of the project, reported in accordance with the specifications in any conditions of this approval, or any approved plans and programs;	At all times	An internal audit conducted during the 2023-24 reporting period identified no non-conformance relating to Leachate Barrier Management System in stage 1 and stage 2. No complaints have been	
	vii	a summary of the current phase and progress of the project;		received regarding operations of the Ash Repositories, including LNAR, for the life of the project. The	
	viii	contact details to enquire about the project or to make a complaint;		website has since been updated to include a complaints register section stating that 'Our complaints	
	ix x	a Complaints Register, updated monthly; audit reports prepared as part of any Independent Environmental Audit of the project and the Proponent's response to the recommendations in any audit report;		register will be reviewed monthly and uploaded as received'.	
	xi b)	any other matter required by the Secretary; and keep such information up to date, to the satisfaction of the Secretary.			

Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
Environmental Representative	B1	Prior to the commencement of any construction activities, or as otherwise agreed by the Secretary, the Proponent shall nominate for the approval of the Secretary 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 Secretary. The Environmental Representative(s) shall:	,	In April 2018, EnergyAustralia NSW advised the DPE of Mrs. Skye Zorz's nomination for the role of Environmental Representative for the Mount Piper Ash Placement Project. This was approved by the Secretary and Mrs. Zorz was approved for the role of Environmental Representative.	
	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;	At all times		Compliant
	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, as referred to under condition A1(c); and	At all tilles		Compliant
	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 develop and maintain an up to date groundwater model for Lamberts North. The model should be calibrated to site-specific data. The Proponent shall consult with Water NSW in the preparation of the groundwater model and the model shall be provided to Water NSW within five months of project approval, unless otherwise agreed by the Secretary. The model shall address but not necessarily be limited to the following: to the following: (a) the findings of the groundwater monitoring of existing ash placement areas and be based on		A Groundwater modelling report was prepared by CDM Smith in November 2012 (CDM Smith, 2012b). The report was prepared in consultation with SCA and evaluated the potential impacts of construction and operational activities at the site and to assist in determining appropriate surface and groundwater management measures. No construction work has commenced at Lamberts South Ash Repository. EnergyAustralia NSW maintains an up-to-date groundwater model. The most recent	
	b)	average groundwater quality data; updated predictions of the long term behaviour, fate and impacts of ash placement, in particular for water quality		update to the model was undertaken as part of the independent groundwater investigation completed in August 2023. The model is maintained by independent experts ERM.	
	c)	parameters such as sulphates, chlorides, boron, manganese, nickel, zinc, molybdenum copper, arsenic and barium; updated risk assessment for ground and surface water quality impacts under a range of rainfall events of differing	Prior to construction	Tompleton magast 2025. The model is maintained by independent experts Envir	Compliant
	d)	duration and intensities (including up to a 100 year ARI event); 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 Water NSW, to apply to Lamberts South.			
Groundwater Monitoring	В3	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 Water NSW 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	At all times	Groundwater bores were installed in July 2012 and were licenced for their construction with NSW Office of Water. The first sampling event for baseline testing was performed upon installation and prior to construction. The location and parameters to be undertaken were done in consultation with SCA. Existing historical groundwater bores that were established since the construction of Mt Piper are used to supplement the newly installed groundwater bores. Additional groundwater monitoring bores were installed as part of the independent groundwater investigation in 2018 and 2020.	Compliant
Construction Environmental Management Plan	В4	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 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		A CEMP (CDM Smith, 2012a) for construction at Lamberts North was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	
	a)	necessarily be limited to: 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;	Prior to & during		
	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;	construction		Compliant
	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(c);			
	i)	a complaints handling procedure during construction;			
	k)	emergency management measures including measures to control bushfires; 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.			

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Construction Noise Management Plan Groundwater Management Plan	B5 a) i) ii) iii) iv) v) vi) b) ii) iii)	The CEMP for the project (or any stage of the project) shall be submitted to the Secretary 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 Secretary. Construction shall not commence until written approval has been received from the Secretary. As part of the CEMP for the project, the Proponent shall prepare and implement the following plans: 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: details of construction activities and an indicative schedule for construction works; identification of construction activities that have the potential to generate noise impacts on sensitive receivers; identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater interference and impacts to groundwater users and dependent species;	Prior to & during construction	A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing a Construction Noise Management Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	Compliant
Construction Noise Management Plan Groundwater Management Plan	a) i) ii) iii) iv) v) vi) b) ii) iii)	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: details of construction activities and an indicative schedule for construction works; identification of construction activities that have the potential to generate noise impacts on sensitive receivers; identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	•	Management Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	Compliant
Noise Management Plan Groundwater Management Plan	i) ii) iii) iii) v) vi) b) ii) iii)	The Plan shall be developed in consultation with the EPA and shall include, but not necessarily be limited to: details of construction activities and an indicative schedule for construction works; identification of construction activities that have the potential to generate noise impacts on sensitive receivers; identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	•	Management Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	Compliant
Management Plan Groundwater Management Plan	iii) iv) v) vi) b) ii) iii)	details of construction activities and an indicative schedule for construction works; identification of construction activities that have the potential to generate noise impacts on sensitive receivers; identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	•	and SCA. The CEMP was approved by the DPI in December 2012.	Compliant
Groundwater Management Plan	iii) iv) v) vi) b) ii) iii)	identification of construction activities that have the potential to generate noise impacts on sensitive receivers; identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	•		Compliant
Groundwater Management Plan	iii) iv) v) vi) b) ii) iii)	identification of noise criteria and procedures for assessing noise levels at sensitive receivers; details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	•		Compliant
Groundwater Management Plan	iv) v) vi) vi) b) ii) iii)	details of reasonable and feasible actions and measures to be implemented to minimise noise impacts; details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater	construction		
Groundwater Management Plan	v) vi) b) i) ii) iii)	details of noise monitoring and if any noise exceedance is detected, how any non-compliance would be rectified; and procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater			
Groundwater Management Plan	b) i) ii) iii)	procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity. a Groundwater Management Plan to detail measures to manage groundwater impacts. The Plan shall be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater			
Management Plan	i) ii) iii)	consultation with DPIE Water and Water NSW and include, but not necessarily be limited to: identification of the construction activities that could affect groundwater at the site, including groundwater			
Plan	iii)	identification of the construction activities that could affect groundwater at the site, including groundwater		A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing a Groundwater	
	iii)			Management Plan was developed in consultation with Delta Electricity Environment Section, NOW	
	iii)	interference and impacts to groundwater users and dependent species;		and SCA. The CEMP was approved by the DPI in December 2012.	
	iii)	a description of the management controls to minimise impacts to groundwater during construction;	Drior to 9 during		
	,	1 0 7	Prior to & during construction		Compliant
	:\	methods for monitoring groundwater during construction including a program to monitor groundwater flows and groundwater quality in the project area;	construction		
	iv)	a response program to address identified exceedances of existing groundwater quality criteria approved for Area 1 (the existing ash placement area); and			
	v)	provisions for periodic reporting of results to Water NSW during construction.			
-	c)	a Soil and Surface Water Management Plan to outline measures that will be employed to manage water on the site, to		A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing a Soil and Surface Water	
Water Management Plan		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 Water NSW and DPIE Water and any other relevant government agency. The Plan shall include, but not necessarily be limited to:		Management Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	
	i)	baseline data on the water quality and available flow data in Huons Creek, Lamberts Gully Creek and Wangcol Creek;			
	ii)	water quality objectives and impact assessment criteria for Huons Creek, Lamberts Gully Creek and Wangcol Creek;			
	iii)	a geomorphic assessment of the capacity of Lamberts Gully Creek to accommodate additional flow under a range of			
	iv)	rainfall events and duration, prior to commencement of construction works; 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;	Prior to & during		
	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);	construction		Compliant
	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 DPIE Water 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 DPIE Water 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 Wangcol 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) d)	provisions for periodic reporting of results to DPIE Water and Water NSW as per condition B8. 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		A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing an Air Quality Management Plan was developed in consultation with Delta Electricity Environment Section, NOW	
Plan	i)	necessarily be limited to: identification of sources of dust deposition including, truck movements, regrading, backfilling, stockpiles and other	Prior to & during	and SCA. The CEMP was approved by the DPI in December 2012.	Compliant
	ii)	exposed surfaces; identification of criteria, monitoring and mitigation measures for the above sources; and	construction		
	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.			
Flora and Fauna Management Plan	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 BCS and shall include, but not necessarily be limited to:	Prior to & during construction	A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing a Flora and Fauna Management Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	Compliant

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25/11/2024

Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
	i) ii)	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; procedures to accurately determine the total area, type and condition of vegetation community to be cleared;	phase		
	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 relocating hollows, installing nesting boxes and managing weeds; and			
Aboriginal Heritage Plan	iv) f)	a procedure to review management methods where they are found to be ineffective. an Aboriginal Heritage Plan to monitor and manage Aboriginal heritage impacts in consultation with registered Aboriginal stakeholders and prepared in consultation with Heritage NSW. The plan should include but not necessarily limited to:		A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing an Aboriginal Heritage Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The CEMP was approved by the DPI in December 2012.	
	i)	an updated Cultural Heritage Management Plan to cover the protection of sites previously recorded in the 2005 Aboriginal heritage assessment;	Prior to & during construction		Compliant
	ii) iii)	procedures for the management of unidentified objects and/or human remains, including ceasing work; 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.			
Ash Transportation	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:		A CEMP (CDM Smith, 2012a) for construction at Lamberts North containing an Ash Transportation Plan was developed in consultation with Delta Electricity Environment Section, NOW and SCA. The	
Plan	i)	justification of the proposed option for ash transportation (either haulage access roads and/or conveyor) for ash transportation;	Prior to & during construction	CEMP was approved by the DPI in December 2012.	Compliant
	ii) iii)	details of the proposed option, including construction requirements, impacts and mitigation measures;	construction		
	iv)	plans showing the location of the chosen option; and provision of mitigation measures should the conveyor breakdown			
Biodiversity Offsets	B6	The Proponent shall develop and submit for the approval of the Secretary, 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 Secretary. The Plan shall be developed in consultation with the BCS and shall:		A Biodiversity Offset Management Plan (BOMP) for Lamberts North in consultation with OEH was submitted 14 May 2013 to DPI. The BOMP (Delta Electricity, 2012) was not approved 18 June 2013 and DPI requested the BOMP to be revised to include an offset of 1:1 to the existing rehabilitation	
	a)	identify the objectives and outcomes to be met by the Biodiversity Offset Management Plan;		site and be resubmitted. The BOMP was revised in consultation with OEH and submitted 23 July 2015.	
	b) c)	describe the size and quality of the habitat/vegetation communities of the offset; 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;		The revised BOMP (EA NSW, 2015) was approved 24 August 2015. A Biodiversity Offset Strategic Outline (BOSO) was prepared for Lamberts South and was considered appropriate by the Department. The BOMP was further revised in consultation with OEH and submitted to DPE 3 May 2019. The revised BOMP (EA NSW, 2019b) was approved 19 December 2019.	
	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, Council) for long term management and funding of offsets and mitigation measures, and installation of identified mitigation measures;		The Biodiversity Offset Area (TCR) is managed in accordance with the conservation agreement (Made under the Biodiversity Conservation Act 2016) granted by Biodiversity Conservation Trust BCT on March 2022. The conservation agreement and associate management plan has been prepared to satisfy condition B6 (a-g).	Compliant
	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 detail contingency measures to be undertaken should monitoring against performance criteria indicate that the offset/			
	8)	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	В7	The Proponent shall prepare and implement an Ecological Monitoring Program prior to construction, in consultation with DPIE Water and BCS to monitor and quantify the impacts on the ecology of Wangcol Creek and the associated riparian environment. The Program shall include, but not necessarily be limited to:		The Ecological Monitoring Plan (EMP) was produced 31 November 2012 in consultation with NOW and DPI (Fisheries). Baseline data was sampled 7 November 2012 and autumn and spring sampling obtained for 2013 and 2014. Spring sampling has been performed in December 2016 (Cardno, 2017),	
	a)	a sampling, data collection and assessment regime to establish baseline ecological health and for ongoing monitoring of ecological health of the instream environment during construction and throughout the life of the project (including operation);	At all times	December 2018 (Cardno, 2019), November 2020 (Cardno, 2021), November 2021 (Cardno, 2022) and December 2023 (Stantec, 2023). Autumn sampling has been performed in May 2018 (Cardno, 2018) and May 2020 (Cardno, 2020).	Compliant
	b)	at least one in-stream sampling period prior to ash placement at Wangcol 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 must develop and implement a Compliance Tracking Program for the project, prior to commencing construction, to track compliance with the requirements of this approval and must include, but not necessarily be limited to:		A Compliance Tracking program (this document) was developed & implemented prior to commencing construction. The Compliance and Tracking document was approved by DPI on 13 December 2012.	
	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;	At all times		Compliant
	b) c)	provisions for periodic reporting of the compliance status to the Secretary; a program for independent environmental auditing in accordance with the Department's Independent Audit Post Approval Requirements (2020);			
	d)	procedures for rectifying any non-compliance identified during environmental auditing or review of compliance, complying with the requirements listed in condition A8 of this approval;			

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Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
	e)	mechanisms for recording environmental incidents and actions taken in response to those incidents, complying with	pilase		
		the requirements listed in condition A8 of this approval;			
	g)	provisions for reporting environmental incidents to the Secretary during construction and operation; and provisions for ensuring all employees, contractors and sub-contractors are aware of, and comply with, the conditions			
	8)	of this approval relevant to their respective activities.			
		The Compliance Tracking Program must be implemented prior to construction of the project with a copy submitted to			
		the Secretary for approval at least four weeks prior to the commencement of the project, unless otherwise agreed by			
		the Secretary.			
	В9	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 Secretary how these systems address the requirements and/or have been amended to comply			
		with the requirements of the condition.			
Community	B10	Prior to the construction of the project, the Proponent shall establish and maintain a website for the provision of		A project website is available for the project:	
Information and Complaints		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:		https://www.energyaustralia.com.au/about-us/energy-generation/lamberts-north-ash-repository the webpage hosts the Environmental Assessment, Submissions report and approvals, as well and	
Management	a)	the documents referred to under condition A1 of this approval;		Environmental Management Plans, Annual Environmental Management Reports & Compliance	
Provision of	b)	this project approval, Environment Protection Licence and any other relevant environmental approval, licence or	Prior to	Reports and Compliance Tracking. Progress on operations and outcomes of compliance tracking are	
Information		permit required and obtained in relation to the project;	construction	detailed within the Quarterly Community meeting and the minutes from this meeting are available	Compliant
	c)	all strategies, plans and programs required under this project approval, or details of where this information can be viewed;		from the following website:	

Heading	Number	Condition Requirement	Development		
cuumg			phase	2023-2024 Observation	Compliance Finding
	b)	8:00 am to 1:00 pm on Saturdays; and		Installation of the leachate barrier system is expressly defined within the consent as "operations".	
	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) C5	where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. The hours of construction activities specified under condition C3 of this approval may be varied with the prior writter	\dashv		
		approval of the Secretary. 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; a			
	c)	accompanied by information necessary for the Secretary 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	C6	The construction noise objective for the project is to manage noise from construction activities (as measured by LAec		No construction activities that trigger the requirements described under these conditions have	
Noise		(15 minute) descriptor) so as not to exceed:		occurred during the reporting period.	
				Installation of the leachate barrier system is expressly defined within the consent as "operations".	
		Location Day (LAeq (15 minute)) dB(A)			
		All private receivers within the township of Blackmans Flat 46	During		
		All other residences 43	construction		Not triggered
		53.5. (55.55.655	3552. 360.011		
		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, Jul			
		2009) (or its latest version), unless the Secretary agrees otherwise, including noise generated by heavy vehicle haulag and other construction traffic associated with the project.			
Dust	C7	The Proponent shall construct the project in a manner that minimises dust emissions from the site, including wind-		No construction activities that trigger the requirements described under these conditions have	
Generation	()	blown from earth works and stockpiles and traffic generated dust. All activities on the site shall be undertaken with t	e	occurred during the reporting period.	
		objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time,	During	Installation of the leachate barrier system is expressly defined within the consent as "operations".	Not triggered
		$the \ Proponent \ shall \ identify \ and \ implement \ all \ practicable \ dust \ mitigation \ measures, \ including \ cessation \ of \ relevant$	construction		
		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 Heritage NSW informed in accordance with the		The course of action for Aboriginal objects identified during construction is detailed in the CEMP Aboriginal sub-plan approved by DPI 1 December 2012. No aboriginal artefacts were discovered	
iiipacts		National Parks and Wildlife Act 1974. In addition, registered Aboriginal stakeholders shall be informed of the finds.	During	during construction.	
		Works shall not recommence until an appropriate strategy for managing the objects has been determined in	construction		Compliant
		$consultation\ with\ Heritage\ NSW\ and\ the\ registered\ Aboriginal\ stakeholders\ and\ written\ authorisation\ from\ Heritage$			
		NSW 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 notify Heritage NSW in accordance with the Heritage Act 1977. Wor	I DIIring	No historical relics were discovered during construction.	Compliant
		shall not recommence until the Proponent receives written authorisation from Heritage NSW.	construction		Compliant
Soil and Water	C10	The Proponent shall comply with section 120 of the Protection of the Environment Operations Act 1997 which		Compliance is achieved through the CEMP Soil and Surface Water sub-plan approved by DPI 1	
Quality Impacts		prohibits the pollution of waters.	_	December 2012 and EPL 13007.	
	C11	Soil and water management controls shall be employed to minimise soil erosion and the discharge of sediment and			
	a)	other pollutants to lands and/or waters during construction activities, in accordance with: Managing Urban Stormwater: Soils and Conservation (Landcom, 2004);	\dashv		Compliant
	b)	Managing Stormwater: Soils and Conservation (Landcom, 2004); Managing Stormwater: Urban Soils and Construction 2A Installation of Services (DECC 2008); and	At all times		
	c)	Managing Stormwater: Urban Soils and Construction Vol 2C Unsealed Roads (DECC 2008).	\dashv		
	C12	During construction, the Proponent shall maintain a buffer of 50 metres from the construction work to Wangcol Cree	r.	Buffer was maintained as documented in JK Williams Contractor meeting minutes.	Compliant
	C13	Surface water drainage must be appropriately engineered and stabilised to convey run off without collapse or erosion		Surface water drainage was engineered and stabilised as per CEMP Soil and Surface Water sub-plan	Compliant
Masts	64.4	Surface water run off collection ponds are to be lined. All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to	1	approved by DPI 1 December 2012.	•
Waste Generation and	C14	accept the materials.		EnergyAustralia NSW manages all site waste in accordance with EPL 13007, disposal and restricted waste area or via licenced waste contractor.	Compliant
Management	C15	The Proponent shall not cause, permit or allow any waste generated outside the site to be received at the site for	\dashv	No wastes generated outside the Lamberts North site were allowed to enter the area.	
-		storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by an EPL, if such	a	To prevent unlawful access to the repository area, regular security patrols are conducted across the	Compliant
		licence is required in relation to that waste.	At all times	site. Both the Principal Ash Contractor and EnergyAustralia NSW personnel are required to report if	Compliant
		The Decrease the Harrison that all Books and the Paris and	\dashv	they encounter any rubbish or wastes outside those that are allowed during routine operations.	
	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		EnergyAustralia NSW manages all site waste in accordance with EPL 13007, disposal and restricted waste area or via licenced waste contractor.	Compliant
		supersede that document.		waste area of via necricea waste contractor.	Compliant
Ash	D1	The Proponent shall prepare a long-term ash management strategy including a program for investigation and		Lamberts North Consistency Report (SKM, 2012) and Ash Management Strategy (Delta Electricity,	
Management		assessment of alternative ash management measures with a goal of 40% reuse of ash by 31 December 2020. The	Prior to & during	2012) approved by DPI 30 July 2012 details the long-term ash management strategy for ash re-use.	
		report shall be submitted to the Secretary six months prior to the commencement of operations. The Proponent shall	operations	EnergyAustralia have provided two yearly updates on the status of the Ash Management Strategy (EA	Compliant
		report on the status and outcomes of its investigations to the Secretary every two years from the commencement of		NSW, 2016; 2018; 2020)	
		the operation of the project, unless otherwise agreed by the Secretary.	1		

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Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
Operational Environmental Management Plan	D2	management framework, practices and procedures to be followed during operation of the project. The OEMP must be prepared to the satisfaction of the Secretary, and in consultation with the relevant government agencies and must 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;		The Operation Environmental Management Plan (CDM Smith, 2013) was approved by DPI in May 2013 and operations at Lamberts North commenced in September 2013. The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022.	
	a)				
	b)				
	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			
	e)	can be periodically reviewed and improved, where appropriate; 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;	1		
	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(c) of this approval;	Prior to operations		Compliant
	i)	, , , , , , , , , , , , , , , , , , , ,			
	j)	details of traffic management measures for public roads including managing vehicle movements, ensuring haul routes			
		proposed are communicated to contractors and staff and complied with, measures to reduce impacts during peak			
		hours and at intersections, scheduling heavy vehicle movements to minimise convoy or platoon lengths, identifying local climate conditions that may affect road safety and ensuring truckloads are covered at all times; and			
	k)	incorporation of traffic management measures into a Drivers Code of Conduct for transporting materials on public roads for all contractors and staff.			
		The OEMP must be submitted for the approval of the Secretary no later than four weeks prior to the commencement of operation of the project, unless otherwise agreed by the Secretary. Operation must not commence until written approval has been received from the Secretary.			
		Nothing in this approval precludes the Proponent from incorporating the requirements of the OEMP 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 must prepare and implement the following Management Plans:			
Operational Noise	a)	an Operational Noise Management Plan to detail measures to mitigate and manage noise during operation of the project. The Plan must be prepared in consultation with the EPA and include, but not necessarily be limited to:		The Operation Environmental Management Plan (CDM Smith, 2013) containing an Operational Noise Management Plan was approved by DPI in May 2013 and operations at Lamberts North commenced in September 2013 The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022.	
Management	i)	identification of activities that will be carried out in relation to the project and the associated noise sources;			
Plan	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;	Prior to operations		Compliant
	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.			
Groundwater Management	b)	a Groundwater Management Plan to detail measures to mitigate and manage groundwater impacts. The Plan must be prepared in consultation with DPIE Water and Water NSW and include, but not necessarily be limited to:		The Operation Environmental Management Plan (CDM Smith, 2013) containing a Groundwater Management Plan was approved by DPI in May 2013 and operations at Lamberts North commenced	
Plan	i)	consideration of the revised updated groundwater model as per condition B2;	1	in September 2013. The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it	
	ii)	baseline data on groundwater quality (including Huons Creek), location of groundwater monitoring wells, depth and available flow of groundwater in the project area;		reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022. For the 2024 reporting period, it is noted that ground water monitoring has remained compliant. All the necessary investigation and mitigation measures have been completed, ensuring compliance with	
	iii)	identification of potential sources of water pollutants and management measures, including the leachate management system which must be designed and constructed generally in accordance with the Environmental Guidelines, Solid Waste Landfills (EPA, 2016) and monitoring requirements;			
	iv)	groundwater assessment criteria including trigger levels for remedial measures;	1	reporting requirements.	
	v)	a contingency plan for events that have the potential to pollute or contaminate groundwater sources of water. The plan must include remediation actions and communication strategies (including notification of potentially affected	Prior to operations		Compliant
		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 must 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 Water NSW as per condition B8.			

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Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
Soil and Surface Water Management Plan	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 must be based on best environmental practice and must be prepared in consultation with the DPIE Water and Water NSW. The Plan must include, but not necessarily be limited to: baseline data on the surface water quality and available flow in Wangcol Creek and Lamberts Gully Creek		The Operation Environmental Management Plan (CDM Smith, 2013) containing a Soil and Surface Water Management Plan was approved by DPI in May 2013 and operations at Lamberts North commenced in September 2013. The OEMP was reviewed by EnergyAustralia NSW during the 2021-22 reporting period to ensure that it reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022.	
	i)				
	ii)	water quality objectives and impact assessment criteria for Wangcol 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;		For the 2024 reporting period, it is noted that soil and surface water monitoring has remained compliant. All the necessary investigation and mitigation measures have been completed, ensuring	
	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, minimise bank erosion and including the leachate management system which must be designed and constructed generally in accordance with the Environmental Guidelines, Solid Waste Landfills (EPA, 2016);		compliance with reporting requirements.	
	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);	Prior to operations		Compliant
	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;	1		
	viii)	ii) details of the lining for the surface water collection ponds;			
	ix)				
	x)	a flow and water quality monitoring program for Wangcol Creek and Lamberts Gully Creek that includes discharge	1		
		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 Water NSW as per condition B8.			
Air Quality	d)	a Air Quality Management Plan to outline measures to minimise impacts from the project on local air quality. The Plan		The Operation Environmental Management Plan (CDM Smith, 2013) containing an Air Quality	
Management		must be prepared in consultation with NSW Health and the EPA and include, but not necessarily be limited to:	-	Management Plan was approved by DPI in May 2013 and operations at Lamberts North commenced	
Plan	i)	baseline data on dust deposition levels;		in September 2013. The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022.	
	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;			
Í	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;	Prior to operations		Compliant
	vii)	a contingency plan to deal with high winds and dust suppression;	. The to operations		
	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 PM10, 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 the EPL limits under normal and adverse weather conditions at all stages of the ash placement process.			
Landscape / Revegetation Plan	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 must include, but not necessarily be limited to:		The Operation Environmental Management Plan (CDM Smith, 2013) containing a Landscape & Revegetation Plan was approved by DPI in May 2013 and operations at Lamberts North commenced in September 2013. The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it	
	i)	identification of design objectives and standards based on local environmental values, vistas, and land uses;	1	reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE	
	ii)	identification of the timing and progressive implementation of revegetation works for ash placement areas as they are	Deiant ''	on 6 June 2022.	Clii
		completed, including short-term and long term goals including landscape plans;	Prior to operations		Compliant
	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.	1		
Site Rehabilitation	f)	a Site Rehabilitation Management Plan to outline measures to stabilise and rehabilitate the site following project completion. The Plan must be prepared in consultation with Water NSW and DPIE Water. The Plan must include, but		The Operation Environmental Management Plan (CDM Smith, 2013) containing a Site Rehabilitation Management Plan was approved by DPI in May 2013 and operations at Lamberts North commenced in September 2013. The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it reflects the current activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE	
Plan		not necessarily be limited to:			
	i)	reinstatement of geomorphologic stable drainage lines on the rehabilitated areas and a timeframe for rehabilitation;	Prior to operations		Compliant
	ii)	restoration, rehabilitation and revegetation of the project's site;	-	on 6 June 2022.	
	iii)	measures to control water pollutants from rehabilitated areas; and	-	Based on the review undertaken, the Lamberts North operations have been carried out in accordance	
	iv)	a program and timeframe for monitoring rehabilitated areas. The Proponent must implement the OEMP as approved by the Secretary.			
	D3A	The Proponent must implement the Ocivir as approved by the Secretary.	At all times	with the OEMP.	Compliant

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Heading	Number	Condition Requiren	nent				Development phase	2023-2024 Observation	Compliance Finding
Groundwater Quality and Geotechnical Impacts	D4	qualified expert that demonstrates the site has been engineered as being suitable for ash placement. The report must					Prior to operations	An evaluation of groundwater levels at Lamberts North (CDM Smith, 2012b) was provided to DPI May 2013. The groundwater level evaluation report demonstrated that the activities associated with preparation and re-profiling of Lamberts North area had minimal impact on groundwater levels on and immediately adjacent to the site.	
Leachate Management System	D5	Prior to the commencement of operation of each stage of the ash placement process, the Proponent must demonstrate to the satisfaction of the Secretary, in consultation with the EPA, that the design of the leachate management system is generally consistent with the Environmental Guidelines, Solid Waste Landfills (EPA, 2016), including: the leachate barrier system, including liner and leachate collection system; and						The Lamberts North Ash Repository Leachate Barrier System Water Balance Assessment (ERM, 2022 was approved by DPE 27 April 2022. Prior to operations of each stage	Compliant
	a) b)			I, appropriate sizing base		modelling and liner	-	!	
Operational Hours	E1	Operational activities ass and 6.00am to 5.00pm S	sociated with the project Saturday and Sunday.	ct shall only be undertake	en from 6.00 am to 8.00) pm Monday to Friday		Works were undertaken within the CoA specified hours of operation during the current reporting period. An application was submitted to DPHI during the reporting period to modify the operating	
	E2	E2 Operations outside the hours stipulated in condition E1 of this approval are only permitted in the following emergency situations:						hours to 24/7. The change to operating hours will be reflected into future reports following its approval by DPHI.	
	a)	where it is required to avoid the loss of lives, property and/or to prevent environmental harm; or						approvarity of the	
	b)			sh placement areas or the			1		
		limiting or preventing ash storage at the power station outside the operating hours defined in condition E1; or 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 to store ash outside of the							
	c)								Compliant
	d)	Proponent (as a licensee	stralian Energy Market (e) under the National Ele	Operator (AEMO), or a pe ectricity Rules to maintain officient ash storage capac	n, increase or be availab	ble to increase power			
		In the event of condition the breakdown in the sh	ortest time possible.	he Proponent is to take a		<u> </u>			
	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 Secretary for approval a report including, but not limited to:						Works were undertaken within the CoA specified hours of operation during the current reporting period.	
	a)	the dates and a description of the emergency situations;							
	b)			itigation measures to avo	id recurrence of the em	nergency situations;	_		
	c) d)	identification of a prefer	-	• • •	-1				
	u)	timing and responsibility for implementation of the mitigation measure(s). The report is to be submitted to the Secretary 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 Secretary.							Not triggered
	E4	The Proponent shall noti		ertaking any emergency and			situations		
	E5	The Proponent shall noti	-	-					
	E6	placement operations outside of the hours of operation stipulated in condition E1 of this approval. The Proponent shall notify nearby sensitive receivers (as defined in the OEMP 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					1		
						ons will be required		· ·	
Operational	E7	outside of the hours of operation stipulated in condition E1 of this approval. The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed the following						Noise criteria is included in Table 5-4 of the approved OEMP. Meteorological conditions to which the	
Noise	E7	LA _{eq(15 minute)} dB(A): Location	Day	Evening	Night	T exceed the following		above criteria apply are included in Section 5.4.5.2 of the OEMP.	
			(7am to 6pm)	(6pm to 10pm)	(10pm to 7am)				
		All private sensitive receivers within the township of	42	38	35				
		All other sensitive	42	38	35		During operations		Compliant
		receivers This noise criteria set ou	l It above applies under a	 all meteorological condition	I ons except for any of th	 ne following:			
	a)	This noise criteria set out above applies under all meteorological conditions except for any of the following: wind speed greater than 3 metres/second at 10 metres above ground level; stability category F temperature inversion conditions and wind speed greater than 2 metres/second at 10 metres above ground level; and stability category G temperature inversion conditions.]		
	b)								
	c)								
	-,			nt and an affected landov	vner have reached a ne	gotiated agreement in	 		
				as been forwarded to the			1		
	E8	the most affected:		nute) noise limits, the nois			During operations	Addressed in section 5.4.5.3 of the approved OEMP and section 6.2 of the 2023-24 AOCR.	Compliant
	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							

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Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
	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:		Addressed in section 5.4.5.3 of the approved OEMP.	
	a)	noise monitoring must be undertaken in accordance with the Noise Policy for Industry (NSW EPA, 2017), or its latest version, using equipment accepted by the EPA in writing;			
	b)	the meteorological data to be used for determining meteorological conditions is the data recorded by the meteorological weather station at the premises; and			Compliant
	c)	stability category temperature inversion conditions are to be determined in accordance with the Noise Policy for Industry (NSW EPA, 2017), or its latest version.			
	E10	The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are		The plant and equipment mitigation measures are included in Table 5-2 of the approved OEMP. No	
		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.	During operations	noise complaints have been received for Lamberts North within the reporting period.	Compliant
Operational Noise Review	E11	Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Secretary, the Proponent shall submit to the Secretary 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:		The Operation Noise Review Report was prepared in October 2013 by Aurecon. The report was submitted to the DPI on 9th October 2013 and the EPA 10th October 2013 for review. The report concluded that the noise resulting from Lamberts North operations comply with the criteria	
	a)	identify the appropriate operational noise objectives and levels for sensitive receivers;		specified in condition E7 at the representative residential receivers at Location 1 and Location 2.	
	b)	describe the methodologies for noise monitoring, including the frequency of measurements and location of monitoring sites;		No complaints regarding noise from Lamberts North have been recorded within the reporting period.	
	c)	document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program;	Prior to operations		Compliant
	d)	assess the noise performance of the project against the noise criteria specified in condition E7 of this approval and the			
	e)	predicted noise levels as detailed in the report referred to under condition A1 of this approval; and provide details of any entries in the Complaints Register relating to noise impacts.			
	C)	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 operational noise monitoring program is included in Table 5-4 of the approved OEMP. Monitoring was performed during the reporting period. The report states that the noise resulting from Lamberts North operations complies with the criteria specified under condition E7 at the representative residential receivers at Location 1 and Location 2.	
		The noise monitoring program shall be prepared in accordance with the requirements of the Noise Policy for Industry (NSW EPA, 2017), or its latest version, and shall include, but not be limited to:	Prior to & during operations		Compliance
	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.		ļ ·	
		The Proponent shall forward to the EPA and the Secretary 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 OEMP 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 Secretary a report including, but not limited to:		No non-compliances with the operational noise criteria specified under condition E7 has been reported during this reporting period	
	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; feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and	During operations		Compliant
	d)	location, type, timing and responsibility for implementation of the noise mitigation measure(s).	– if required		
		The report is to be submitted to the Secretary 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 Secretary. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.			
	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.	During operations – if required	No non-compliances with the operational noise criteria specified under condition E7 has been reported during this reporting period	Compliant
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 Water NSW, 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:	Prior to & during operations	The Groundwater Monitoring program is included as part of the Groundwater Management Plan as Section 6.4.3 of the approved OEMP. Monitoring has been carried out on a continual monthly basis including the first 12 months of operations to establish baseline data. Results of Groundwater monitoring during the reporting period have been addressed in Section 7.2 and can be found in Appendix E of the 2023-24 AOCR.	Compliant
	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.			

Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
		The monitoring program shall form part of the Groundwater Management Plan referred to in condition D3(b) of this	pridoc		
Surface Water Quality Monitoring	E16	approval. The Proponent shall prepare and implement a surface water quality monitoring program to monitor the impacts of the ash placement activities on Wangcol Creek and Lamberts Gully. The Program shall be developed in consultation with Water NSW, 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:		The Surface water monitoring programme is included in Table 6.21 of the approve OEMP. Monitoring is performed at the Final Holding Pond monitoring station to Wangcol Creek (LDP01), and at NC01 and WX22. Wet weather monitoring was performed in October 2013 and March 2014.	
	a)	monitoring at the existing water quality monitoring sites as described in the document referred to under condition A1c):		Results of Surface water monitoring during the reporting period have been addressed in Section 7.1. and can be found in Appendix E of the 2023-24 AOCR.	
	b)	monitoring at surface water discharge points from Lamberts Gully Creek	Prior to & during operations		Compliant
	c) d)	monitoring at surface water discharge points into Wangcol Creek; wet weather monitoring with a minimum of two events recorded within the first 12 months operation of the project;			
	u)	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 Water NSW and DPIE Water and any other relevant government agency. 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.	Prior to & during operations	Huons Creek was filled in during construction of the Lamberts North ash placement site commenced. As such, it was not developed as a sub-surface drain as was originally proposed. A Consistency report (SKM, 2012) was submitted to the DPI on 30 July 2012. The report states that groundwater modelling performed during construction demonstrated that the water contained within the creek was largely groundwater as a result of the Huon Void intersecting the groundwater table. Based on this finding, the hydrological monitoring program was incorporated into the Groundwater Management Plan.	Compliant
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.	Prior to & during operations	The Air Quality Monitoring Program is included in section 6.6.6 of the approved OEMP. It states that air quality monitoring will be undertaken for the life of the project. TEOM and dust gauge data has been collected monthly in the first 12 months of operation to determine whether additional monitoring stations are required as a result of the project. The results of Air Quality monitoring during the reporting period are addressed in Section 6.5 of the 2023-24 AOCR.	Compliant
Environmental Incident Reporting	E19	The Proponent shall notify the Secretary 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 Secretary within seven days of the date on which the incident occurred.		No environmental incidents requiring notification of the Director- General occurred within the 2023-2024 reporting period.	Nettriesend
	E20	The Proponent shall meet the requirements of the Secretary 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 Secretary may require.	At all times		Not triggered
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.	At all times	The Principal Ash Management Contractor utilises EnergyAustralia NSW's waste management facilities for wastes generated in the operation of the repository, including waste oils, general waste and materials for recycling. These are stored in intermediate storage facilities at Mt Piper Power Station and routinely removed by EnergyAustralia NSW's waste contractors. No additional waste materials were generated during the 2023-2024 reporting period.	Compliant
	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.	At all times	No wastes generated outside the Lamberts North site are allowed to enter the area. To prevent the unlawful access to the repository area, regular security patrols are conducted across the site. Both Lend Lease and EnergyAustralia NSW security personnel are required to report if they encounter wastes outside those that are allowed during routine operations	Compliant
	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.	At all times	The Principal Ash Management Contractor provides Monthly Ash Placement Work Instructions to address all issues of routine site maintenance as part of a monthly work program. Waste management is conducted in accordance with EPA guidelines.	Compliant
Revision of	E26	Within 3 months, unless the Secretary agrees otherwise, of:		The OEMP was reviewed by EnergyAustralia NSW in 2022 to ensure that it reflects the current	
Strategies,	a)	the submission of an incident report or independent audit report under condition B8 or B9; and		activities and management. The OEMP (EA NSW, 2022) was approved by the DPIE on 6 June 2022.	
Plans and Programs	b)	the approval of any modification to the conditions of this approval; or			
	c)	a direction of the Secretary under condition A1 of Schedule 2; the Proponent must review and, if necessary, revise the studies, strategies or plans required under the conditions of approval to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted to the Secretary for approval, unless otherwise agreed with the Secretary. Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.	At all times		Compliant
Project Completion Management Plan	a) b)	No later than one month prior to the decommissioning of the project, or as otherwise agreed by the Secretary, the Proponent is to prepare a Project Completion Management Plan, in consultation with Water NSW, for the approval of the Secretary. The Plan is to include but not necessarily be limited to: identification of structures to be removed and how they will be removed; measures to reduce impacts on the environment and surrounding sensitive land uses	Prior to decommissioning	The Project is still in operational phase.	Not triggered

Heading	Number	Condition Requirement	Development phase	2023-2024 Observation	Compliance Finding
	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 Wangcol 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.			

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Appendix B Annual Summar	y of Ash Repository	y Environment Ma	anagement
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Summary of Environmental Management at Lamberts North

Summary of Environmental Mana	igeilli	siit a	t Lai	iibei	13 110	I CII						
	September 2023	October 2023	November 2023	December 2022	January 2024	February 2024	March 2024	April 2024	May 2024	June 2024	July 2024	August 2024
Ash Moisture Fresh Water 23-26%												
Compaction Testing Dry density ratio 95% Fresh ash acceptable 93%												
Landform Stability No slumping or movement												
Weather station operational Irrigation system Operational												
Internal dust deposition gauges Insoluble solids = 4 g m ⁻² month												
Ash Contaminated Water contained within site boundary												
Geotechnical vibrating wire piezometers Stack stability												
No Community complaint												

Appendix C Lamberts North Operational Noise Assessment – April 203	Appendix C	Lamberts North	Operational Noise	Assessment - A	pril 202
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Lamberts North Ash Repository

Environmental noise monitoring - 2024

Prepared for EnergyAustralia NSW Pty Ltd

April 2024

Lamberts North Ash Repository

Environmental noise monitoring - 2024

EnergyAustralia NSW Pty Ltd

E230068 RP2

April 2024

Version	Date	Prepared by	Reviewed by	Comments
V1	02/05/2024	Will Moore	Jesse Tribby	Draft
V2	18/06/2024	Will Moore	Jesse Tribby	Final

Approved by

Jesse Tribby

Associate, Acoustics 18 June 2024

Level 3 175 Scott Street Newcastle NSW 2300

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1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by EnergyAustralia NSW Pty Ltd to conduct an annual noise survey of operations at the Lamberts North Ash Repository (LNAR, the site) associated with Mt Piper Power Station located near Wallerawang, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits, in accordance with the LNAR Operational Noise Management and Monitoring Plan (ONMMP).

Attended environmental noise monitoring described in this report was done during the day, evening, and night periods of 23/24 April 2024 at two monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

Location descriptor	Description	Coordinates (MGA 56)	
		Easting	Northing
N1	Noon Street, Blackmans Flat	226399	6304407
N2	End of Karawatha Drive, Wallerawang	226566	6302995

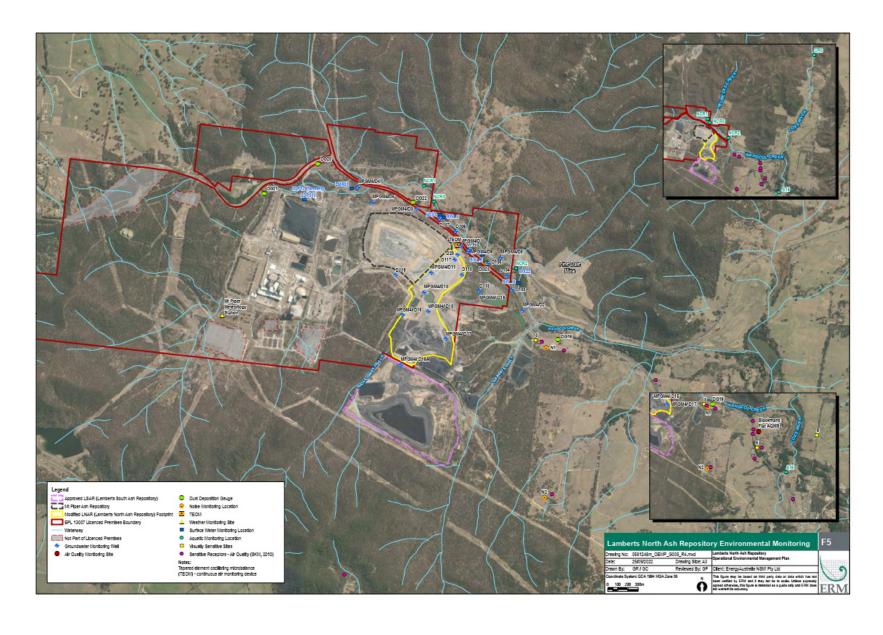


Figure 1.1 Attended noise monitoring locations

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L _{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L _{A1}	The A-weighted noise level which is exceeded for 1% of the time.
LA1,1minute	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L _{A10}	The A-weighted noise level which is exceeded for 10% of the time.
LAeq	The energy average A-weighted noise level.
LA50	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L _{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
LAmin	The minimum A-weighted noise level over a time period.
LCeq	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Project approval

The most current approval associated with activities at LNAR is Project Approval 09_0186 MOD 1 (September 2021), which encompasses activities at the LNAR and Lamberts South Ash Repository. Part E of the project approval details specific conditions relating to noise generated by activities in these areas. Relevant sections of the project approval are reproduced in Appendix B.1.

2.2 Noise management plan

Noise monitoring requirements are detailed in the ONMMP, which is contained within the LNAR Operational Environmental Management Plan (OEMP). The most recent version of the OEMP was issued in May 2022. Relevant sections are reproduced in B.2.

2.3 Noise limits

Noise impact limits based on the project approval are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Day L _{Aeq,} 15minute	Evening L _{Aeq,} 15minute	Night L _{Aeq,15minute}	
N1	42	38	35	
N2	42	38	35	

2.4 Meteorological conditions

Part E7 of the project approval outlines meteorological conditions required for criteria to be applicable. Noise criteria detailed in the project approval apply under all meteorological conditions except for the following:

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

Meteorological data was obtained from the Mt Piper Power Station automatic weather station (AWS), in accordance with the ONMMP, which allowed correlation of atmospheric parameters with measured site noise levels.

2.5 Additional requirements

Monitoring and reporting have been done in accordance with the NSW Environmental Protection Authority (EPA) 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

2.6 Very noise-enhancing meteorological conditions

In accordance with the Approved Methods, monthly noise monitoring for the site is scheduled to occur during forecast meteorological conditions where noise limits in Table 2.1 will be applicable. However, in cases where actual meteorological conditions do not align with forecasts and noise limits are subsequently not directly applicable, it is the expectation of regulators that noise impact still be managed.

The NPfI states that:

Noise limits derived for consents and licences will apply under the meteorological conditions used in the environmental assessment process, that is, standard or noise-enhancing meteorological conditions. For 'very noise-enhancing meteorological conditions' ... a limit is set based on the limit derived under standard or noise-enhancing conditions (whichever is adopted in the assessment) plus 5 dB. In this way a development is subject to noise limits under all meteorological conditions.

Therefore, if monthly noise monitoring occurs during meteorological conditions outside of those specified in Section 2.4, site noise limits will be adjusted based on Table 2.1 plus 5 dB.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirements.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the day, evening, and night periods at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range, but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1minute}$. The EPA accepts sleep disturbance analysis based on either the $L_{A1,1minute}$ or L_{Amax} metrics, with the L_{Amax} representing a more conservative assessment of site noise emissions.

3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfl. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq} .

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfl.

3.4 Instrumentation and personnel

Attended noise monitoring was conducted by Will Moore. Qualifications, experience, and/or demonstration of competence in accordance with the Approved Methods is available upon request.

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Measurement equipment

Item	Serial number	Calibration due date	Relevant standard
Rion NA28 sound level meter	00701424	01/06/2025	IEC 61672-1:2002
Pulsar Model 106 calibrator	81334	21/06/2025	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.1 Total measured noise levels, dB – 2024 ¹

Location	Start date and time	L _{Amax}	L _{A1}	L _{A10}	L _{Aeq}	L _{A50}	L _{A90}	L _{Amin}
N1 – Day	24/04/2024 09:34	68	64	59	56	55	45	41
N1 – Evening	23/04/2024 19:55	52	48	42	40	39	37	36
N1 – Night	23/04/2024 22:00	63	59	50	47	41	40	38
N2 – Day	24/04/2024 09:10	72	55	52	50	49	48	45
N2 – Evening	23/04/2024 19:28	49	46	44	43	43	41	40
N2 – Night	23/04/2024 22:24	47	44	39	37	36	33	31

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction of magnetic north 1	Cloud cover 1/8s
N1 – Day	24/04/2024 09:34	8	<0.5	-	0
N1 – Evening	23/04/2024 19:55	9	<0.5	-	0
N1 – Night	23/04/2024 22:00	16	1.1	310	8
N2 – Day	24/04/2024 09:10	12	1.1	240	0
N2 – Evening	23/04/2024 19:28	8	<0.5	-	0
N2 – Night	23/04/2024 22:24	16	1.6	310	8

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.2.2 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Noise limits are applicable under all weather conditions but are adjusted during very noise-enhancing weather conditions as defined by the NPfl.

Table 4.3 Site noise levels and limits – 2024

Location	Start date and time	Wind		Stability class	Very enhancing? 1	Site limits, dB	Site levels, dB	Exceedances, dB
		Speed m/s	Direction ³			L Aeq,15minute	L _{Aeq,15minute} ²	L _{Aeq,15minute}
N1 – Day	24/04/2024 09:34	2.8	282	А	No	42	IA	Nil
N1 – Evening	23/04/2024 19:55	1.6	262	D	No	38	NM	Nil
N1 – Night	23/04/2024 22:00	1.7	248	D	No	35	IA	Nil
N2 – Day	24/04/2024 09:10	3.5	282	В	Yes	47	IA	Nil
N2 – Evening	23/04/2024 19:28	1.4	271	D	No	38	IA	Nil
N2 – Night	23/04/2024 22:24	1.3	242	D	No	35	IA	Nil

Notes:

- 1. Noise limits are adjusted by +5 dB during 'very noise-enhancing meteorological conditions' in accordance with the NPfI.
- 2. Site-only L_{Aeq,15minute}, includes modifying factor penalties if applicable.
- 3. Degrees magnetic north, "-" indicates calm conditions.

5 Discussion

5.1 Noted noise sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are considered in each measurement via statistical descriptors. Analysis of 1/3 octave-band environmental noise levels was done at the time of monitoring. From these observations, summaries have been derived for the location and provided in this section. The following figures display frequency ranges of various noise sources at each location for L_{A1} , L_{A10} , $L_{Aeq'}$, $L_{A50'}$, and L_{A90} descriptors. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 5.1, where frogs and insects are seen to be generating noise at frequencies above 1,000 Hz, while industrial noise is observed at frequencies less than 1,000 Hz.

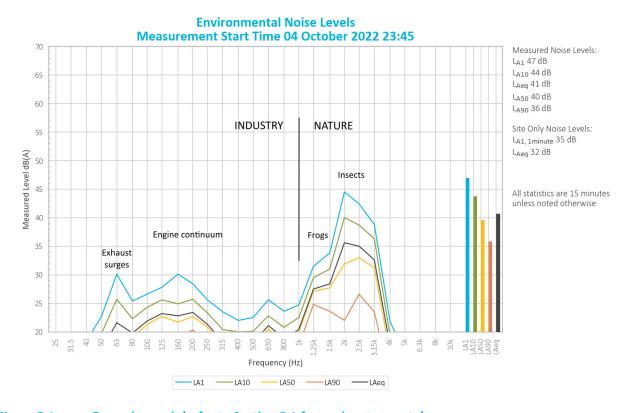


Figure 5.1 Example graph (refer to Section 5.1 for explanatory note)

5.2 N1 – Day

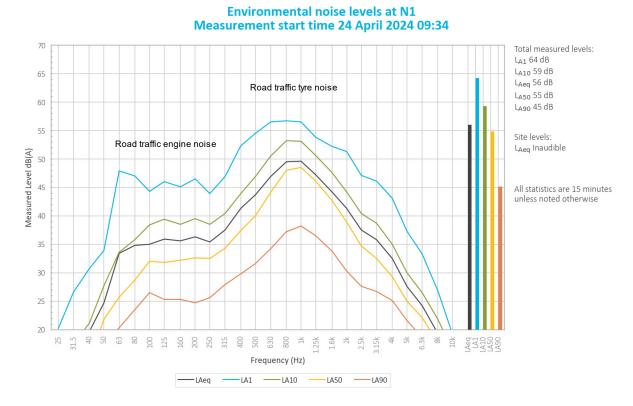


Figure 5.2 Environmental noise levels – N1, Noon Street

LNAR was inaudible during the measurement.

Road traffic engines and tyre noise generated total measured levels.

Continuum from another mining operation and a nearby air quality monitoring station was also noted.

5.3 N1 – Evening

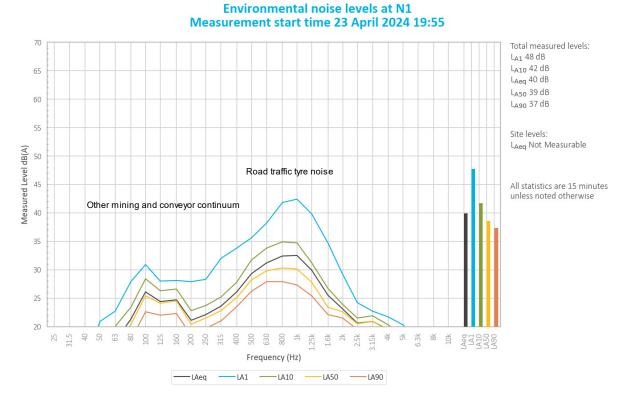


Figure 5.3 Environmental noise levels – N1, Noon Street

Continuum and track noise from LNAR were occasionally audible at very low levels that were not measurable due to interference from other industrial noise sources.

Continuum from another mining operation and conveyors were primarily responsible for generating total measured levels. Road traffic tyre noise generated the measured L_{A1} and contributed to the L_{A10} and L_{Aeq} .

Continuum from a nearby air quality monitoring station and noise from bats were also noted.

5.4 N1 – Night

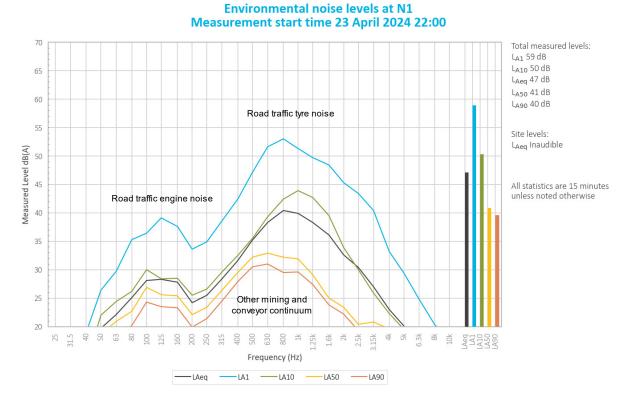


Figure 5.4 Environmental noise levels – N1, Noon Street

LNAR was inaudible during the measurement.

Road traffic tyre noise generated the measured L_{A1} , L_{A10} and L_{Aeq} . Continuum from another mining operation and conveyors generated the measured L_{A50} and L_{A90} .

Continuum from a nearby air quality monitoring station was also noted.

5.5 N2 – Day

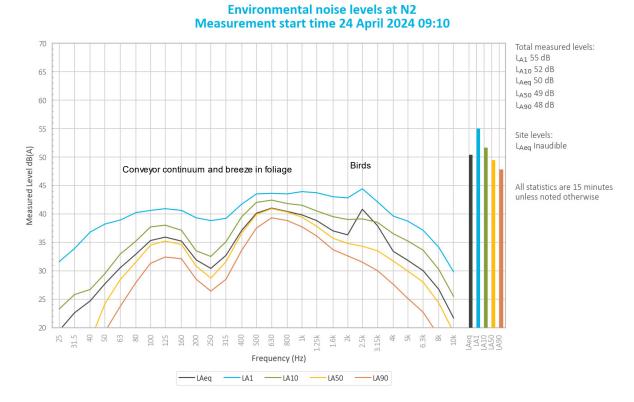


Figure 5.5 Environmental noise levels – N2, End of Karawatha Drive

LNAR was inaudible during the measurement.

Continuum from local conveyors and a breeze in nearby foliage were primarily responsible for total measured levels. Birds were a minor contributor to the measured L_{A1} and L_{Aeq} .

5.6 N2 – Evening

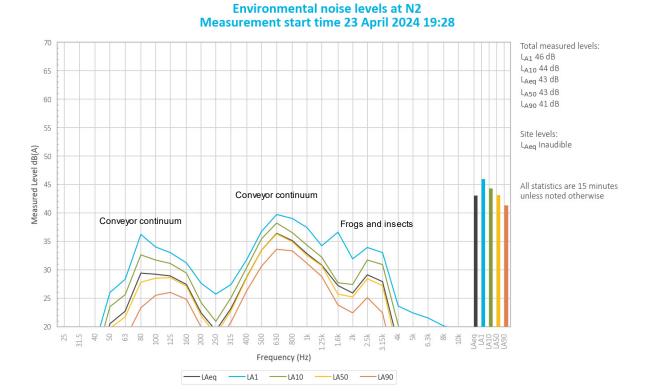


Figure 5.6 Environmental noise levels – N2, End of Karawatha Drive

LNAR was inaudible during the measurement.

Continuum from local conveyors generated total measured levels.

Noise from bats, birds, frogs, insects, and road traffic was also noted.

5.7 N2 – Night

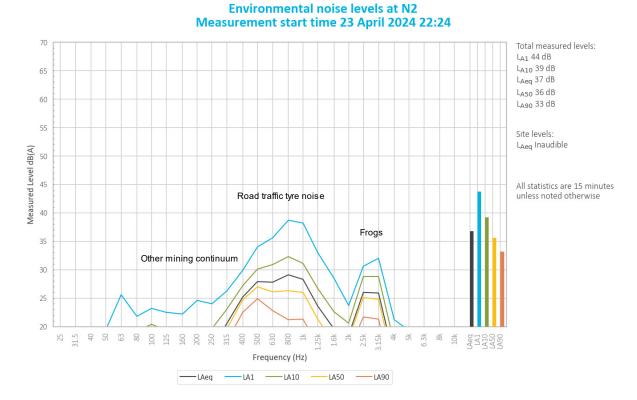


Figure 5.7 Environmental noise levels – N2, End of Karawatha Drive

LNAR was inaudible during the measurement.

Continuum from another mining operation and frogs were primarily responsible for generating measured noise levels. Road traffic tyre noise generated the measured L_{A1} and contributed to the L_{A10} .

Noise from bats was also noted.

6 Summary

EMM was engaged by EnergyAustralia NSW Pty Ltd to conduct an annual noise survey of operations at the LNAR. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits, in accordance with the LNAR ONMMP.

Attended environmental noise monitoring described in this report was done during the day, evening, and night periods of 23/24 April 2024 at two monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the 2024 survey.

Appendix A

Noise perception and examples



A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
Up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

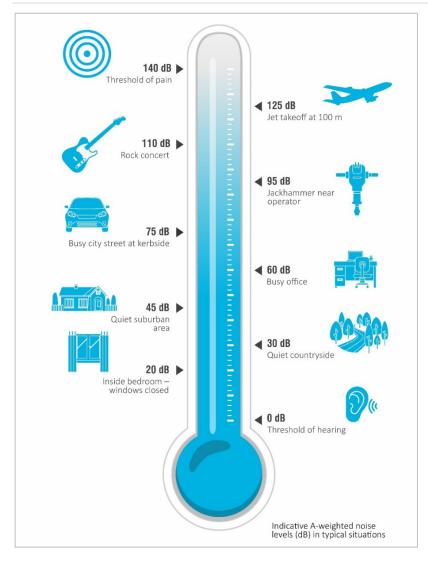


Figure A.1 Common noise levels

Appendix B Regulator documents



B.1 Project approval

D3. As part of the OEMP for the project, required under condition D2 of this approval, the

Proponent must 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 **must** be prepared in consultation with the EPA and include, but not necessarily be limited to:
 - vi)identification of activities that will be carried out in relation to the project and the associated noise sources:
 - vii) 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;
 - viii) 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;
 - ix)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;
 - x) 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
 - xi)provisions for periodic reporting of results to the EPA as per condition B8.

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	42	38	35
receivers within the township of Blackmans Flat			
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 **Secretary** 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) noise monitoring must be undertaken in accordance with the *Noise Policy* for *Industry* (NSW EPA, 2017), or its latest version, using equipment accepted by the EPA in writing;
 - (b) the meteorological data to be used for determining meteorological conditions is the data recorded by the meteorological weather station at the premises; and
 - (c) stability category temperature inversion conditions are to be determined in accordance with the *Noise Policy for Industry* (NSW EPA, 2017), or its latest version.
- 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.

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 *Noise Policy for Industry* (NSW EPA, 2017), or its latest version, 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 **Secretary** 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 **OEMP** 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 **Secretary** 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 **Secretary** 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 **Secretary**.

The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the **Secretary**.

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

B.2 Noise management plan

5.4 Operational Noise Management and Monitoring Plan

5.4.1 Introduction

This Operational Noise Management and Monitoring Plan (ONMMP) seeks to address the specific requirements of PA 09_0186 CoA relating to noise and vibration during operation. These conditions include CoA D3 (a), E6 and E7 - E14 (provided in Appendix C). It provides a framework for EA, its Contractors and vendors to manage operational noise emissions and minimise potential adverse impacts to sensitive receivers during the operation of the Project.

This ONMMP identifies in **Table 5-1** the performance targets (and performance criteria), reference documents, key issues, constraints and strategies and the mitigation measures that comply with the conditions of approval D3 (a), E6, E7, E8, E9, E10, E11,E12, E13, E14. **Table 5-2** sets out mitigation measures to manage potential noise impacts.

EA have prepared, and will implement the ONMMP to assess compliance against the operational noise criteria stipulated in CoA E7, throughout the life of the project.

5.4.2 Sensitive Receptors

The term 'sensitive receiver' used in this plan refers to nearby receivers, such as residents and businesses that may potentially be affected by noise emissions identified for the project. The Environmental Assessment (Appendix C Construction and Operational Noise Assessment (SKM, 2010)), identified two sensitive receivers which were then selected as noise monitoring locations. They are referred to as Noise Monitoring Locations 1 and 2 and are shown in **Figure 5**. Noise Monitoring Location 1 is located in Blackmans Flat approximately 1.1km east of the project. Noise Monitoring Location 2 is located on a rural property 1.1km west of Castlereagh Highway

5.4.3 Noise generating activity

5.4.3.1 Approved operational conditions

Operational activities shall be undertaken during the following hours (CoA E1):

- Monday to Friday: 6am 8pm
- · Saturday to Sunday: 6am 5pm.

CoA E2 stipulates emergency situations where operations outside these hours are permitted. <u>Section 2.2.1</u> of this OEMP lists these emergency situations.

5.4.3.2 Key potential noise impacts

Key potential noise impacts during operational activities are anticipated to include those listed below:

- Transporting fly ash and bottom ash to and from the ash repository using haulage trucks along the designated haul roads;
- · Placing ash in stockpiles in designated areas before being spread out by a dozer;
- Compacting the ash using a dozer and roller;
- Maintenance on the haulage roads using a grader, roller, dozers and water carts;
- Dust suppression across the site using a series of techniques including but not limited to water carts and sprinklers systems;
- Developing and maintaining water management structures (containments, drains and sumps) using an excavator;
- · Using variously sized pumps on site to pump water from various water sources;
- Using light vehicles on occasion to inspect the ash repository and carry out environmental monitoring;
- The machinery & plant generate noise from the engine & drive line, hydraulics and reverse warning devices;
- · Preparing for and installing the leachate barrier system;
- Development of various lined ponds including those associated with the leachate management system.

5.4.5 Operational Noise Monitoring Program

This section provides the requirements for the ongoing noise monitoring program and operational noise review in accordance with CoA E8, E9, E11 E12, E13, and E14. **Table 5-3** provides the operational noise criterion for LNAR activities. **Table 5-4** provides the details of the noise monitoring program. **Table 5-5** provides the standards and requirements that shall be considered during monitoring. The meteorological data recorded at the MPPS weather station will be used to interpret noise monitoring and investigate noise complaints (**Figure 5**).

The reporting requirements and corrective actions required in the event of noncompliance are listed in **Table 5-6** and **Table 5-7**, respectively.

5.4.5.1 Noise Criteria

EA have prepared, and will implement the ONMMP to assess compliance against the operational noise criteria stipulated in CoA E7, throughout the life of the project.

As specified in CoA E7, the operational noise criteria from LNAR activities shall not exceed the LAeq (15 minute) dB(A) identified in **Table 5-3**.

Table 5-3 Operations	Noise Criterion	(LAeq(15 minute) dB(A))
----------------------	-----------------	--------	-----------	----------

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

These criteria do not apply where the Proponent and an affected landowner have reached a negotiated agreement in regard to noise, and a copy of that agreement has been forwarded to the Secretary and the NSW EPA.

5.4.5.2 Meteorological Conditions

The noise criteria identified in **Table 5-3** applies under meteorological conditions except for any of the following:

- Wind speed greater than 3 m/second at 10 m above ground level;
- Stability category F temperature inversion conditions and wind speed greater than 2 m/second at 10 m above ground level; and
- · Stability category G temperature inversion conditions.

5.4.5.3 Determining Compliance

EA will engage a suitably qualified and experienced acoustic consultant to undertake noise monitoring of LNAR activities. The acoustic consultant will determine and confirm compliance with the noise criteria as set out in **Table 5-3**.

5.4.5.4 Monitoring

The Noise Monitoring Program, including the Operational Noise Review (as completed), is provided below in **Table 5-4**. **Table 5-5** provides the standards and requirements that shall be considered during monitoring.

	Plant and equipment used at LNAR shall meet the typical sound power levels as per its manufacturing standard. This will be checked following receipt of any ongoing noise complaints.	E10 D3(a)(viii)	Following complaint	Manufacturing standard	Contractor
4.	Ongoing noise monitoring shall be conducted from commencement of operation by a qualified noise specialist in accordance with Conditions of Approval E7, E8 & E9 and the EPA approved Operational Noise monitoring program.	E12 D3(a) (viii)	Annual	Noise monitoring Program	EA

Potential Impact	Location	Parameters	Frequency	Technique	Reporting	Responsibility	CoA and OEMP Reference
Ongoing Noise Monitoring	Two most affected sensitive receivers: Blackmans Flat Wallerawang (refer to Figure 5) Lamberts North (in accordance with CoA E12(a). Other locations as required, in response to a substantiated complaint.	LAeq, LA10, LA90 and LAMax. Noise levels shall not exceed the noise criteria (Table 5-3) at the nearest most affected receiver.	project or following a complaint as required Upon	Attended and unattended noise monitoring technique shall be undertaken adopting the following guidelines; **Noise Policy for Industry** (NSW EPA, 2017), or its latest version; **AS 1055: 1997 Acoustics** – Description and Measurement of Environmental Noise; **Approved Methods for the Measurement and Analysis of Environmental Noise in NSW (NSW EPA 2022) Ongoing attended monitoring using Class 1 or 2 noise monitoring equipment as defined by AS IEC61672.1-2004 and ASEIC61672.2- 2004, or other noise monitoring equipment accepted by the NSW EPA in writing.	Annual monitoring report. Non-compliances: If noise monitoring survey indicates non-compliance against compliance against compliance are report containing the results to the NSW EPA and the Secretary within 14 days of conducting a moise assessment. An additional investigation report shall be submitted to the Secretary within 60 days of undertaking noise monitoring and must include the criteria specified in CoA E13 within 60 days of undertaking the noise monitoring.		D3(a) (vii) D3(a) (viii), E7, E8, E9, E12 Approved Methods for the Measurem ent and Analysis of Environmental Noise in NSW (NSW EPA 2022 Noise Policy for Industry (NSW EPA, 2017), or its latest version AS1055 CoA E12 CoA E13

Appendix C Calibration certificates



C.1 Calibration certificates



Sound Level Meter IEC 61672-3:2013

Calibration Certificate

Calibration Number C23317

Client Details EMM Consulting

Level 3, 175 Scott Street Newcastle NSW 2300

Equipment Tested/ Model Number: NA-28

Instrument Serial Number: 00701424 Microphone Serial Number : 01916 Pre-amplifier Serial Number : 01463 Firmware Version: 2.0

Pre-Test Atmospheric Conditions Post-Test Atmospheric Conditions Ambient Temperature: 24°C Relative Humidity: 46% Barometric Pressure: 100 6kPa

Ambient Temperature: 22.6°C Relative Humidity: 46.6% Barometric Pressure: 100.6kPa

Calibration Technician : Max Moore Secondary Check: Dylan Selge Calibration Date: 1 Jun 2023 Report Issue Date: 2 Jun 2023

Approved Signatory : Malans

Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	Pass
Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	Pass
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

		Uncertainties of Measurement -	
Acoustic Tests		Environmental Conditions	
125Hz	±0.13dB	Temperature	±0.1°C
1kHz	±0.13dB	Relative Humidity	±1.9%
8kHz	±0.14dB	Barometric Pressure	$\pm 0.014kPa$
Flectrical Tests	+0 13dR		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172. Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

PAGE 1 OF 1



Acoustic Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119 Labs Pty Ltd | www.acousticresearch.com.au

Sound Calibrator IEC 60942:2017

Calibration Certificate

Calibration Number C23389

Client Details EMM Consulting

Level 3, 175 Scott Street Newcastle NSW 2300

Equipment Tested/ Model Number: Pulsar Model 106

Instrument Serial Number: 81334

Atmospheric Conditions

Ambient Temperature: 22.6°C Relative Humidity: 35.5% Barometric Pressure: 101.43kPa

Calibration Technician : Shaheen Boaz Secondary Check: Dhanush Bonu Calibration Date: 21 Jun 2023 Report Issue Date: 21 Jun 2023

Approved Signatory : Alle Ken Williams

Characteristic Tested Result Generated Sound Pressure Level Pass Frequency Generated Pass Total Distortion Pass

Nominal Level Nominal Frequency Measured Level Measured Frequency 94 1000 94.18 1000.30

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed...

Uncertainties of Measurement -Specific Tests Environmental Conditions

±0.10dB ±0.1°C Generated SPL Temperature ±0.07% ±0.20% ±1.9% ±0.014kPa Frequency Relative Humidity Distortion Barometric Pressure

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

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Appendix	D	Lamberts	North	Biodiversity	Offset	Area	Flora	&	Fauna
Monitorin	g R	eports 202	2						



Energy Australia NSW





DOCUMENT TRACKING

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Template 2.8.1

Executive Summary

The Lamberts North Biodiversity Offset Area (BOA) is located at Thompsons Creek Reservoir and was established as per the condition of approval for the Mt Piper Power Station Ash Placement Project. The BOA was formerly secured in perpetuity through a Biodiversity Conservation Agreement (BCA) with the NSW Biodiversity Conservation Trust (BCT) in March 2022. Along with the BCA, the Biodiversity Offset Management Plan (BOMP) for the Lamberts North BOA details the management actions to be undertaken within the BOA to enhance habitat for native flora and fauna species through site rehabilitation and revegetation.

Eco Logical Australia (ELA) has been engaged by Energy Australia NSW (EA) to undertake biennial flora and fauna monitoring to assess the progress of management actions undertaken within the BOA. This report details the results of monitoring undertaken in October 2022, which forms the fourth round of monitoring successfully completed to date.

The 2022 flora monitoring results demonstrated an increase in total flora species diversity as well as an increase in native species diversity when compared to the baseline results from 2016 and subsequent monitoring iterations. It is likely that above average rainfall since 2020 influenced these results, which had followed drought conditions experienced during the 2018 monitoring period. Exotic ground cover results recorded during 2022 remained variable, both across sites and monitoring years. As the BOA has a history of disturbance, it is likely that exotic groundcover will continue to fluctuate on a seasonal basis.

The 2022 fauna monitoring recorded the highest bird species richness since the commencement of monitoring. An increased diversity of native woodland bird species continue to be recorded within the BOA, with a total of four threatened species listed as vulnerable under the NSW Biodiversity Conservation Act 2016 (BC Act) and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) recorded during 2022. This includes two species recorded for the first time, *Artamus cyanopterus* (Dusky Woodswallow) and *Chthonicola sagittata* (Speckled Warbler). One pest animal species, *Sturnus vulgaris* (Common Starling), was recorded within the BOA and a total of 12 bird, three amphibian, three mammal and three reptile species were also recorded opportunistically.

An assessment of revegetation works undertaken in 2017 and 2021 was completed, along with an assessment of ongoing natural regeneration. Both revegetation and natural regeneration continues to develop with regards to structure (height and stem density) and composition (a diversity of characteristic native woodland species) across the BOA. Stem densities are well in excess of the target 160 stems/ha and have been observed to decline as plantings develop, which suggests a progression to a structure similar to surrounding native woodland over time. Whilst exotic species are present within revegetation and natural regeneration areas, they are not limiting the re-establishment of native woodland in these areas. Given the scale and success of revegetation and active natural regeneration to date, no further revegetation works are recommended for the BOA at this stage.

All BOMP performance and completion criteria are currently being achieved.

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Abbreviations

Abbreviation	Description
BC Act	NSW Biodiversity Conservation Act 2016
BCA	Biodiversity Conservation Agreement
ВСТ	NSW Biodiversity Conservation Trust
ВОА	Biodiversity Offset Area
ВоМ	Bureau of Meteorology
ВОМР	Biodiversity Offset Management Plan
EA	Energy Australia NSW
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ha	hectare

1. Introduction

Eco Logical Australia (ELA) was engaged by Energy Australia NSW (EA) to undertake flora and fauna monitoring at the Lamberts North Biodiversity Offset Area (BOA). The BOA was established as a requirement of Project Approval 09_0186 for the Mt Piper Power Station Lamberts North Ash Placement Project.

The Lamberts North BOA is located at Thompsons Creek Reservoir, 14 km north-west of Lithgow, comprising 6.8 ha, including:

- 4.7 ha of Lot 243 of DP 801915
- 2.1 ha of Lot 432 of DP 801915.

EA sought guidance from the NSW Biodiversity Conservation Trust (BCT) for the suitability of managing the BOA under a formal conservation mechanism. The intention of this was to secure the BOA and provide the financial and management resources required to enhance its biodiversity values. An application for a Biodiversity Conservation Agreement (BCA) was submitted to the BCT in March 2021, with the final signed BCA received in March 2022.

EA developed a Biodiversity Offset Management Plan (BOMP) for the Lamberts North BOA (Energy Australia, 2019) as per Schedule 2 Condition B6 of the Project Approval, which sets out the management actions to be undertaken within the BOA.

The objective of the flora and fauna monitoring program is to measure the progress of management actions undertaken within the Lamberts North BOA to enhance habitat for native flora and fauna, including threatened species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and NSW *Biodiversity Conservation Act 2016* (BC Act). The monitoring program also allows for the identification of any management issues requiring attention within the BOA and provides recommendations for addressing such issues. The 2022 monitoring forms the fourth round of data collection within the BOA, following baseline monitoring conducted in 2016 and subsequent monitoring in 2018 and 2020 (ELA 2016; ELA 2018; ELA 2020).

2. Methodology

2.1 Floristic monitoring

Four floristic monitoring plots that were established during 2016 were re-surveyed during spring 2022 (three sites within the BOA and one analogue site – site locations are shown in Appendix A). The floristic survey at each site included:

- Full floristic surveys of a 20m x 20m plot recording all vascular plant species within the plot
- Biometric plot data using the BioBanking assessment methodology within a 20m x 50m plot which included an assessment of:
 - o Native species richness within 20 m x 20 m flora plot
 - Native tree cover and native midstorey cover at regular 5 m intervals along 50 m transect (10 points)
 - Native ground (grass, shrub, other) and exotic cover at regular 1 m intervals along 50 m transect (50 points)
 - Habitat features (number of trees with hollows, length of fallen logs) and proportion of overstorey species regeneration – within 20 m x 50 m plot.

2.2 Fauna monitoring

Fauna surveys were undertaken to provide an inventory of fauna species present within the BOA. Fauna surveys were focused on species which are good indicators of improvements in habitat structure, with birds being the primary focus. Other fauna assemblages were also recorded opportunistically to inform general site diversity. Two monitoring sites established in 2016 were re-surveyed during spring 2022, with their locations shown in Appendix A. Table 1 below details the survey methods undertaken at each of the two fauna monitoring sites.

Table 1: Fauna methodology

Method	Detail	Requirement per site
Bird survey	Timed, fixed area surveys for diurnal birds, observing and listening.	20 minute count morning and afternoon over 2 days
Opportunistic Observations	Opportunistic observations recorded for all birds, mammals, reptiles and amphibian species observed. Any evidence of scats, scratchings and digging recorded with all evidence of feral animal activity noted and recorded with a GPS.	Opportunistic

2.3 Revegetation and Natural regeneration assessment

Field survey of revegetated and naturally regenerating areas across the BOA was undertaken to assess the status of the development of re-established native woodland across the BOA through both active revegetation and assisted natural regeneration. The field survey involved traversing the BOA and recording the following within seven 20 m x 20 m sub-plots:

- Upper-storey and midstorey species that have established
- Height range and average height of species present

- Density of species present
- Type and age of revegetation
- Spatial mapping of revegetation / natural regeneration polygons
- Evidence of pest animals and/or over-abundant native herbivores (e.g. scats, prints, burrows)
- Surface stability and erosion issues.

All occurrences of successful revegetation / natural regeneration (upper-storey species) were recorded using a handheld GPS and any relevant management recommendations were noted in the field.

3. Results

3.1 Weather conditions

The monitoring was undertaken on Monday 17 and Tuesday 18 October 2022 by ELA ecologists Tom Kelly and Lachlan Metzler.

The weather data presented below in Table 2 was taken from the Bureau of Meteorology's (BoM) Lithgow weather station, 14 km south-east of the BOA (BoM 2022). The weather conditions during the survey were mostly fine with no rainfall recorded on either day. In the three and six-month periods preceding the monitoring, the Lithgow region experienced above average rainfall (BoM 2022).

Table 2: Weather observations throughout the monitoring period

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rain (mm)	Relative Humidity (%)	Cloud Cover (%)	Wind Direction	Wind Speed at 9am (km/h)
17/10/2022	9.2	14.9	0	93	8	SE	6
18/10/2022	9.4	16.4	0	88	8	N	4

3.2 Floristic Monitoring

A full list of flora species recorded within the Lamberts North BOA during 2022 monitoring is included in Appendix C.

3.2.1 Species richness

A total of 67 flora species (47 native species, 20 exotic species) were recorded across all floristic monitoring sites, which represents the highest recorded total species richness since the commencement of monitoring in 2016. Three of the four monitoring sites had similar total species richness to one another, ranging from 29 to 36 species, whilst site TD3 recorded only 12 species in total (Table 3). Both total and native species richness was highest at the Analogue site (TD4), with this site also recording the lowest proportion of exotic species (7 of 36 species). These results are reflective of the site's remnant vegetation. Exotic species richness was highest at site TD2 (14 species), with the remaining three monitoring sites recording relatively low exotic species richness (5 to 9 species) (Table 3).

Table 3: Total, native and exotic species richness across floristic monitoring sites

Site	Total species richness	Native species richness	Exotic species richness
TD1	29	20	9
TD2	31	17	14
TD3	12	7	5
TD4	36	29	8

3.2.2 Vegetation structure

Vegetation structure data (incorporating the height range and percentage foliage cover of all structural layers within each monitoring site) is presented below in Table 4. Since the previous round of monitoring in 2020, the growth of canopy (upper-storey stratum) species has continued the development of vegetation structure across the BOA. A native upper-storey was present within two of four monitoring sites (TD1 and TD4), and is developing through eucalypt plantings at the remaining two sites (TD2 and TD3).

Table 4: Vegetation structure of BOA floristic monitoring sites

Site Number	Stratum	Lower Height (m)	Upper Height (m)	Foliage Cover (%)	Dominant Species
TD1	U	5	8	5	Eucalyptus mannifera, Eucalyptus dives, Eucalyptus pauciflora
	М	0.5	4	0.5	Eucalyptus spp. (plantings)
	L1	0.01	0.4	80	Microlaena stipoides, Phalaris aquatica, Anthoxanthum odoratum
	L2	0.01	0.3	8	Hypochaeris radicata, Acetosella vulgaris, Senecio quadridentatus
TD2	М	0.5	2	0.5	Eucalyptus spp. (plantings)
	L1	0.01	0.2	55	Phalaris aquatica, Anthoxanthum odoratum, Rytidosperma spp.
	L2	0.01	0.5	18	Acetosella vulgaris, Hypochaeris radicata, Geranium solanderi
TD3	M	0.4	3	4	Eucalyptus spp. (plantings), Acacia dealbata
	L1	0.01	0.3	80	Anthoxanthum odoratum, Phalaris aquatica, Rytidosperma spp.
	L2	0.01	0.3	8	Hypochaeris radicata, Acetosella vulgaris, Lomandra spp.
TD4	U	6	15	22	Eucalyptus dives, Eucalyptus mannifera, Allocasuarina littoralis
	L1	0.01	0.3	55	Microlaena stipoides, Rytidosperma sp., Anthoxanthum odoratum
	L2	0.01	0.5	5	Lomandra spp., Hydrocotyle laxiflora, Poranthera microphylla

U = upper-storey; M = midstorey; L = lower-storey

3.2.3 Exotic species and cover

A total of 20 exotic species were recorded across the four floristic monitoring sites during 2022 monitoring, with these exotic species including both annual and perennial species. Exotic species richness was consistent with 2020 monitoring (20 species also recorded), however, was higher compared to 2018 monitoring which was undertaken during drought conditions and recorded only five exotic species. Exotic cover ranged from 2.6% at site TD4 to 47.4% at site TD2 and across each site, was

variable compared to 2020, decreasing at sites TD1 and TD3, whilst increasing at sites TD2 and TD4 (see Figure 3).

Two species listed as priority weeds under the *Central Tablelands Regional Strategic Weed Management Plan 2017-2022* (Central Tablelands LLS 2017) were recorded in the BOA, *Hypericum perforatum* (St John's Wort) and *Rubus fruticosus* sp. aggregate (Blackberry). Both Blackberry and St John's Wort were previously recorded in the BOA during monitoring in 2020 (Blackberry was also recorded during 2016), however, were not recorded during 2018 monitoring. *Nassella trichotoma* (Serrated Tussock) previously recorded during 2016 and 2020, was not recorded within the BOA during 2022 monitoring.

3.3 Fauna Monitoring

3.3.1 Bird Surveys

A total of 33 individual species were recorded during the bird surveys completed as part of 2022 monitoring. This included one threatened species *Chthonicola sagittata* (Speckled Warbler), with an additional three threatened species *Artamus cyanopterus* (Dusky Woodswallow) (see Appendix E), *Haliaeetus leucogaster* (White-bellied Sea-Eagle) and *Calyptorhynchus lathami* (Glossy Black-Cockatoo), also recorded opportunistically. These four threatened species are listed as vulnerable under the BC Act, with the Glossy Black-Cockatoo also listed as vulnerable under the EPBC Act.

Species diversity and abundance results for each of the two monitoring sites and survey periods (morning and afternoon) are tabulated below in Table 5 and Table 6. Fauna site 1 recorded consistent species diversity and abundance across both morning and afternoon surveys and overall, recorded a considerably higher species richness and abundance (27 species, 85 individuals) compared to Fauna site 2 (17 species, 61 individuals). Despite recording comparatively lower species richness and abundance, Fauna site 2 also recorded consistent bird species richness and abundance between morning and afternoon surveys, indicating relatively stable temporal bird activity. *Cracticus tibicen* (Australian Magpie) was the most commonly recorded species, recorded at both sites during all survey periods and in the highest total abundance (17 individuals). *Acanthiza chrysorrhoa* (Yellow-rumped Thornbill) was the most abundant species, with a total of 19 individuals recorded across both monitoring sites.

Whilst the overall assemblage of bird species recorded during the surveys is indicative of open habitats, a diverse range of native woodland bird species were recorded including five species from the Honeyeater family. This included a total of nine individuals of *Lichenostomus chrysops* (Yellow-faced Honeyeater), which were recorded across both fauna monitoring sites (see Appendix D). One pest bird species, *Sturnus vulgaris* (Common Starling) was recorded within the BOA, with a total of 2 individuals of this priority pest species recorded at Fauna site 2 (Central Tablelands Local Land Services 2018).

Table 5: Bird survey species diversity results

Site		Species diversity			
	Morning survey	Afternoon survey	Total		
Fauna 1	17	18	27		
Fauna 2	9	13	17		

Table 6: Bird survey abundance results

Site Bird abundance					
	Morning survey	Afternoon survey	Total		
Fauna 1	41	44	85		
Fauna 2	29	32	61		

3.3.2 Opportunistic Observations

An additional 13 bird species were recorded opportunistically within the BOA, along with three amphibian, three mammal and three reptile species. All opportunistic species were identified through either direct observation, identification of scats, diggings and/or calls. The opportunistically recorded bird species included the three abovementioned threatened species, along with three woodland bird species in *Acanthiza pusilla* (Brown Thornbill), *Oriolus sagittatus* (Olive-backed Oriole) and *Calyptorhynchus funereus* (Yellow-tailed Black-Cockatoo). The previously recorded priority pest *Oryctolagus cuniculus* (European Rabbit) was not record in 2022 and whilst *Macropus giganteus* (Eastern Grey Kangaroo) was recorded frequently across the BOA, there was no indication that this species was applying grazing pressure upon plantings or natural regeneration. A list of all fauna observed during monitoring is included in Appendix D. Locations of threatened and pest species observations are displayed in Appendix B.

3.4 Revegetation and Natural regeneration assessment

Revegetation works undertaken across the BOA in 2017 included planting of approximately 2,000 tubestock seedlings. Assessment of the plantings in 2018 identified a total of 547 successfully established plants which increased to 705 in 2020, across both the eastern and western portions of the BOA. Additional direct seeding revegetation works were completed in 2021 to 'infill' small sections of the BOA not subject to previous revegetation works or undergoing natural regeneration.

A total of seven revegetation / natural regeneration polygons were assessed across the extent of the BOA (Figure 1). Each sub-plot contained native upper-storey species characteristic of surrounding woodland from either 2017 tubestock plantings, 2021 direct seeding, natural regeneration, or a combination of these. Dominant native upper-storey species include *Eucalyptus dives* (Broad-leaved peppermint), *Eucalyptus mannifera* (Brittle Gum), *Eucalyptus pauciflora* (Snow Gum) and *Eucalyptus viminalis* (Ribbon Gum), with the proportion of each species varying within each polygon. 2017 tubestock plantings have continued to develop well since 2020 (likely aided by continued above average rainfall), averaging between 1.5 m and 3 m in height, whilst typically younger natural regeneration (excluding some large saplings up to 2.5 m) and 2021 direct seeding were on average below 1 m in height. The stem density of native upper-storey species recorded was well above the target for reestablishing native woodland (160 stems/ha), ranging from 700 stems/ha to 6762 stems/ha. As is expected, stem density declines as revegetation develops, with the oldest and most well-developed revegetation (2017 tube-stock plantings) recording the lowest stem density (i.e. Polygon 4 – see Figure 1 and Appendix E).

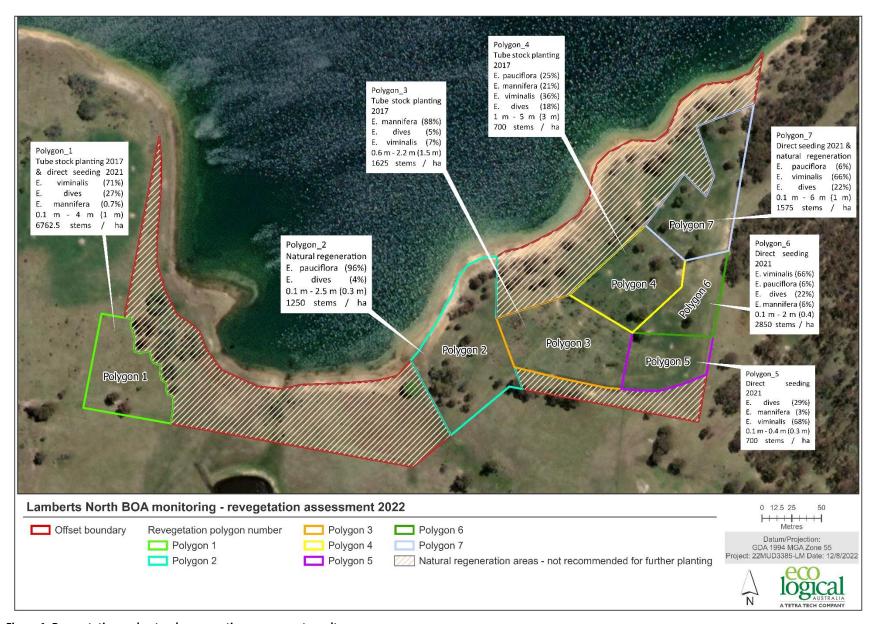


Figure 1: Revegetation and natural regeneration assessment results

4. Discussion and Recommendations

4.1 Floristic monitoring

Across all floristic monitoring sites, total species richness recorded in 2022 was the highest since the commencement of monitoring in 2016, with a total of 67 species recorded. Total native species richness recorded in 2022 (47 species) was also the highest recorded across all monitoring years, with all sites excluding TD3, recording their highest score (Figure 2). Native species richness across the remaining three monitoring sites shows an increased trend since 2018, during which monitoring was undertaken during drought conditions (Figure 2). Relatively high native species richness scores in 2020 and 2022 are likely indicative of above average rainfall experienced across the region since the drought concluded in early 2020 (section 4.1).

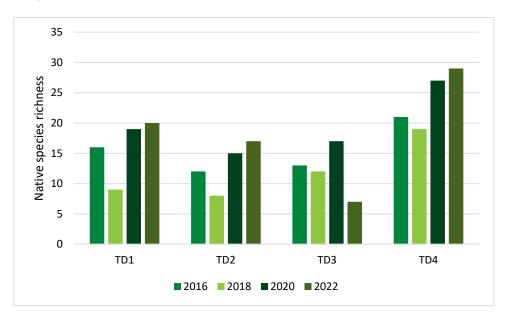


Figure 2: Native species richness at floristic monitoring sites

Exotic ground cover results recorded during 2022 were variable both across sites and previous monitoring years, however, remain relatively low (<11%) at all sites with the exception of TD2 (Figure 3). Site TD3 is the only site with a consistent declining exotic ground cover trend (Figure 3), which is coupled with an increase in upper-storey and midstorey cover from naturally regenerating *Acacia dealbata* (Silver Wattle) and planted Broad-leaved Peppermint. Further monitoring is required to see if this pattern extends across broader areas of the BOA as native woodland re-establishment continues to develop. Given the BOA's history of disturbance, seasonal fluctuations in exotic ground cover are likely to continue, however, as more data is collected during subsequent monitoring periods, greater insight into the patterns and relationships of exotic and native cover will be able to be explored.

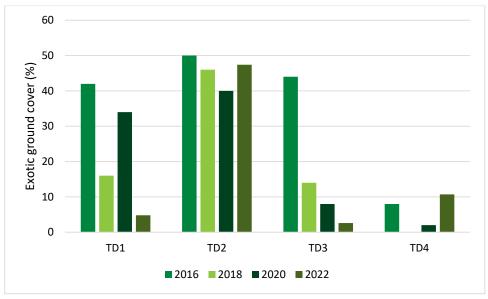


Figure 3: Exotic ground cover at floristic monitoring sites

Two listed weed species, Blackberry and St John's Wort were recorded in the BOA in 2022. St John's Wort was recorded at only one location, whilst Blackberry was scattered throughout the BOA, particularly in the western portion (see Appendix B). Targeted herbicide application is recommended for these listed weed species, with manual removal of Blackberry also recommended post-herbicide treatment, to avoid the potential of re-shooting.

4.2 Fauna monitoring

Total bird species richness across both fauna monitoring sites was the highest recorded since the commencement of monitoring in 2016, with a total of 33 individual species recorded. Similar to native flora species richness (see Figure 2), bird species richness across monitoring years has shown an increasing trend since 2018 (drought conditions), which has coincided with above average rainfall conditions (Figure 4). Fauna site 1 has consistently recorded higher bird species richness than Fauna site 2, likely due to its increased connectivity to surrounding remnant woodland (see Appendix A), combined with the more advanced stage of revegetation and natural regeneration present within the site (see Figure 1). These factors allow for woodland bird species (e.g. the aforementioned Honeyeater species) to travel from remnant woodland outside of the BOA, into developing suitable woodland habitat within the site.

The overall bird species richness (including opportunistically recorded species) was also higher than previous years, with an additional 13 bird species recorded. A total of four threatened species were recorded within the BOA, with Dusky Woodswallow (see Appendix E) and Speckled Warbler recorded for this first time. All three opportunistically recorded reptile species were also recorded within the BOA for the first time since the commencement of monitoring (Appendix D).

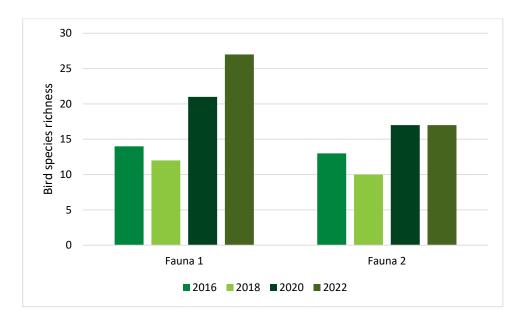


Figure 4: Bird species richness at fauna monitoring sites

4.3 Revegetation and natural regeneration assessment

The revegetation works conducted within the BOA, along with natural regeneration, continues to develop with regards to structure (height and stem density) and composition (a diversity of characteristic native woodland species). Since the previous assessment in 2020, the heights of tubestock plantings have grown substantially (0.5 m - 2m), whilst direct seeding plantings completed in 2021 have grown up to 1 m in height. Stem densities well exceed the target of 160 stems/ha and have been observed to decline as plantings develop (i.e. 2017 tubestock), suggesting a progression to a structure similar to surrounding native woodland over time (see Appendix E).

Whilst exotic species are present across revegetation and natural regeneration areas, they are not limiting the re-establishment of native woodland across the BOA. Given the scale and success of revegetation and active natural regeneration to date, no further revegetation works are recommended for the BOA at this stage.

4.4 Assessment of Performance and Completion Criteria

Table 6 of the BOMP provides the performance and completion criteria for key management actions undertaken within the BOA, with Table 7 below providing an assessment of the relevant criteria against the results of 2022 monitoring.

Table 7: Assessment of BOMP performance and completion criteria

Action	Management Action	Performance criteria	Completion criteria	Comment
Vertebrate pest control	Undertake vertebrate pest control program	Vertebrate pests eradicated and no non-target species affected	Levels of vertebrate pests do not pose a risk to revegetation works	No signs of vertebrate pests impacting upon revegetation works.
	Monitor pest animal populations	Undertake biannual inspections Complete biennial monitoring	Monitoring is ongoing, to determine continuing effectiveness of control program	Previously recorded European Rabbit not recorded in 2022. Two individual Common Starling recorded.
Weed control	Ongoing inspections and monitoring of BOA for weed presence	Undertake biannual inspections and biennial monitoring	Ongoing inspections and monitoring to determine continuing effectiveness of treatment	Two listed weed species, Blackberry, and St John's Wort recorded during monitoring.
	Treat any state or regional priority weeds observed	Control of serrated tussock and blackberry in BOA Records of treatment retained	No listed weeds present within BOA No areas of high density weed infestations present which limit regeneration/ revegetation of the BOA	Targeted herbicide treatment of the above listed species recommended. Weeds / exotic species are not limiting the development of revegetation / natural regeneration.
Assisted Natural Regeneration	Assist natural regeneration through weed and pest animal management strategies	Undertake weed and pest animal inspections and monitoring Control weed and pest animal levels to reduce competition and grazing pressure	Weed and pest animals controlled to a level that does not impact on natural regeneration	Weed and pest animal presence is not limiting the development of natural regeneration. Listed weed species recorded are recommended for management.
	Monitor natural regeneration	Natural regeneration levels recorded during biennial monitoring	Monitoring records continued development of natural regeneration and identifies any requirement for management intervention	Natural regeneration of characteristic woodland upper-storey species recorded and mapped across the BOA.
Active revegetation	Undertake direct seeding	No plantings in the 30 m buffer zone commencing at the edge of the high water mark or 10 m buffer zone from natural regeneration areas	Establishment of locally native species at a density greater than 160 stems/ha	Direct seeding successfully completed in 2021. Native woodland upper-storey species successfully established at densities well in excess of 160 stems/ha.
	Monitoring of revegetated works	Undertake biennial monitoring	Monitoring confirms establishment of native species and densities consistent with the surrounding vegetation communities	Native woodland upper-storey species successfully established via 2017 tubestock plantings and 2021 direct seeding at densities well in excess of 160 stems/ha.

Action	Management Action	Performance criteria	Completion criteria	Comment
Re-establishment of fauna habitat	Re-establish fauna habitat through assisted natural regeneration and active revegetation of the BOA	Re-establishment of native woodland consistent with surrounding vegetation communities	Establishment of locally native species at a density greater than 160 stems/ha	Native woodland upper-storey species successfully established at densities well in excess of 160 stems/ha. 2022 bird monitoring recorded highest bird species diversity to date, including a diverse range of native woodland bird species.
Offset Monitoring	Undertake flora monitoring	Establish permanent monitoring plots and undertake baseline monitoring Biennial floristic monitoring undertaken	Ongoing flora monitoring completed and results reported and implemented for adaptive management of the BOA	Biennial monitoring successfully completed for 2022.
	Undertake fauna monitoring	Undertake baseline monitoring Develop a list of key indicator bird species representative of improvements in habitat structure Undertake biennial systematic fauna monitoring, focusing on bird surveys, as well as opportunistic observations	Ongoing fauna monitoring completed and results reported and implemented for adaptive management of the BOA	Biennial monitoring successfully completed for 2022.

References

Bureau of Meteorology (2022). *Lithgow Weather Station observations*. Available Online: http://www.bom.gov.au/climate/dwo/IDCJDW2075.latest.shtml. Accessed: November 2022.

Eco Logical Australia (2016). *Lamberts North Biodiversity Offset Baseline Flora and Fauna Monitoring Report*. Prepared for Energy Australia NSW.

Eco Logical Australia (2018). *Lamberts North Biodiversity Offset Flora and Fauna Monitoring Report*. Prepared for Energy Australia NSW.

Energy Australia (2019). *Biodiversity Offset Management Plan – Lamberts North*, Energy Australia NSW, NSW Australia.

Eco Logical Australia (2020). *Lamberts North Biodiversity Offset Flora and Fauna Monitoring Report* 2020. Prepared for Energy Australia NSW.

Local Land Services (2017). *Central Tablelands Regional Strategic Weed Management Plan 2017-2022*. Local Land Services, State of New South Wales.

Appendix A Floristic and Fauna Monitoring Sites



Appendix B Management issues and threatened species recorded



Appendix C Flora species recorded

Family	Scientific Name	Species	Native/Exotic
Araliaceae	Hydrocotyle laxiflora	Stinking Pennywort	Native
Asteraceae	Cassinia sifton	Sifton Bush	Native
Asteraceae	Cirsium vulgare	Spear Thistle	Exotic
Asteraceae	Conyza bonariensis	Flax-leaf Fleabane	Exotic
Asteraceae	Euchiton sp.		Native
Asteraceae	Gamochaeta sp.		Exotic
Asteraceae	Hypochaeris radicata	Cat's Ear	Exotic
Asteraceae	Pseudognaphalium luteoalbum	Jersey Cudweed	Native
Asteraceae	Senecio quadridentatus	Cotton Fireweed	Native
Asteraceae	Solenogyne bellioides		Native
Asteraceae	Sonchus sp.		Exotic
Asteraceae	Taraxacum officinale		Exotic
Boraginaceae	Cynoglossum australe		Native
Caryophyllaceae	Cerastium glomeratum	Mouse-ear Chickweed	Exotic
Casuarinaceae	Allocasuarina littoralis	Black She-oak	Native
Convolvulaceae	Dichondra repens	Kidney Weed	Native
Cyperaceae	Cyperus gracilis	Slender Flat-sedge	Native
Cyperaceae	Cyperus sp.		Native
Cyperaceae	Lepidosperma laterale		Native
Dilleniaceae	Hibbertia riparia	Erect Guinea-flower	Native
Dilleniaceae	Hibbertia obtusifolia	Hoary Guinea-flower	Native
Ericaceae	Lissanthe strigosa	Peach Heath	Native
Fabaceae (Faboideae)	Bossiaea obcordata	Spiny Bossiaea	Native
Fabaceae (Faboideae)	Trifolium repens	White Clover	Exotic
Fabaceae (Mimosoideae)	Acacia dealbata	Silver Wattle	Native
Geraniaceae	Geranium solanderi	Native Geranium	Native
Haloragaceae	Gonocarpus tetragynus		Native
Hypericaceae	Hypericum perforatum	St John's Wort	Exotic
Juncaceae	Juncus sp.		Native
Lomandraceae	Lomandra confertifolia	Mat-rush	Native
Lomandraceae	Lomandra filiformis	Wattle Mat-rush	Native
Lomandraceae	Lomandra longifolia	Spiny-headed Mat-rush	Native
Lomandraceae	Lomandra multiflora	Many-flowered Mat-rush	Native
Mrytaceae	Eucalyptus dives	Broad-leaved Peppermint	Native

Family	Scientific Name	Species	Native/Exotic
Mrytaceae	Eucalyptus sp.		Native
Myrtaceae	Eucalyptus mannifera	Brittle Gum	Native
Myrtaceae	Eucalyptus pauciflora	Snow Gum	Native
Myrtaceae	Eucalyptus viminalis	Manna Gum	Native
Nyctaginaceae	Boerhavia dominii	Tarvine	Native
Oxalidaceae	Oxalis perennans		Native
Oxalidaceae	Oxalis sp.		Native
Phyllanthaceae	Poranthera microphylla		Native
Plantaginaceae	Plantago lanceolata	Lamb's Tongues	Exotic
Plantaginaceae	Veronica plebeia	Creeping Speedwell	Native
Poaceae	Anthoxanthum odoratum	Sweet Vernal Grass	Exotic
Poaceae	Austrostipa bigeniculata		Native
Poaceae	Austrostipa scabra	Speargrass	Native
Poaceae	Cynodon dactylon	Couch	Native
Poaceae	Eragrostis leptostachya	Paddock Lovegrass	Native
Poaceae	Eragrostis sp.		Native
Poaceae	Microlaena stipoides	Weeping Meadow Grass	Native
Poaceae	Panicum effusum	Hairy Panic	Native
Poaceae	Paspalum dilatatum		Exotic
Poaceae	Phalaris aquatica	Phalaris	Exotic
Poaceae	Phalaris sp.		Exotic
Poaceae	Poa sieberiana	Snow Grass	Native
Poaceae	Rytidosperma racemosum		Native
Poaceae	Rytidosperma sp.		Native
Poaceae	<i>Vulpia</i> sp.		Exotic
Polygonaceae	Acetosella vulgaris	Sheep Sorrel	Exotic
Polygonaceae	Rumex acetosella	Sorrel	Exotic
Polygonaceae	Rumex brownii	Swamp Dock	Native
Primulaceae	Lysimachia arvensis	Scarlet Pimpernel	Exotic
Pteridaceae	Cheilanthes sieberi	Rock Fern	Native
Rosaceae	Acaena echinata	Sheep's Burr	Native
Rosaceae	Rubus fruticosus	Blackberry	Exotic
Solanaceae	Solanum nigrum	Black-berry Nightshade	Exotic

Appendix D Fauna species recorded

Classification	Scientific Name	Common Name
Amphibian	Crinia signifera	Common Eastern Froglet
Amphibian	Limnodynastes tasmaniensis	Spotted Marsh Frog
Amphibian	Uperoleia laevigata	Smooth Toadlet
Bird	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Bird	Acanthiza pusilla	Brown Thornbill
Bird	Anas superciliosus	Pacific Black Duck
Bird	Anthochaera carunculata	Red Wattlebird
Bird	Aquila audax	Wedge-tailed Eagle
Bird	Artamus cyanopterus^	Dusky Woodswallow
Bird	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo
Bird	Calyptorhynchus lathami^	Glossy Black-Cockatoo
Bird	Carduelis carduelis*	European Goldfinch
Bird	Chenonetta jubata	Australian Wood Duck
Bird	Chthonicola sagittata^	Speckled Warbler
Bird	Cincloramphus mathewsi	Rufous Songlark
Bird	Colluricincla harmonica	Grey Shrike-thrush
Bird	Coracina novaehollandiae	Black-faced Cuckoo-shrike
Bird	Cormobates leucophaeus	White-throated Treecreeper
Bird	Corvus coronoides	Australian Raven
Bird	Corvus mellori	Little Raven
Bird	Cracticus tibicen	Australian Magpie
Bird	Dacelo novaeguineae	Laughing Kookaburra
Bird	Egretta novaehollandiae	White-faced Heron
Bird	Eolophus roseicapillus	Galah
Bird	Falco cenchroides	Nankeen Kestrel
Bird	Fulica atra	Eurasian Coot
Bird	Grallina cyanoleuca	Magpie-lark
Bird	Haliaeetus leucogaster^	White-bellied Sea-Eagle
Bird	Hirundo neoxena	Welcome Swallow
Bird	Lichenostomus chrysops	Yellow-faced Honeyeater
Bird	Malurus cyaneus	Superb Fairy-wren
Bird	Melithreptus brevirostris	Brown-headed Honeyeater
Bird	Neochmia temporalis	Red-browed Finch
Bird	Nesioptilotis leucosis	White-eared Honeyeater

Classification	Scientific Name	Common Name
Bird	Oriolus sagittatus	Olive-backed Oriole
Bird	Pardalotus punctatus	Spotted Pardalote
Bird	Pardalotus striatus	Striated Pardalote
Bird	Petrochelidon nigricans	Tree Martin
Bird	Platycercus elegans	Crimson Rosella
Bird	Platycercus eximius	Eastern Rosella
Bird	Psephotus haematonotus	Red-rumped Parrot
Bird	Ptilotula pecillatus	White-plumed Honeyeater
Bird	Rhipidura albiscapa	Grey Fantail
Bird	Rhipidura leucophrys	Willie Wagtail
Bird	Sericornis frontalis	White-browed Scrubwren
Bird	Strepera graculina	Pied Currawong
Bird	Sturnus vulgaris*	Common Starling
Bird	Vanellus miles	Masked Lapwing
Mammal	Macropus giganteus	Eastern Grey Kangaroo
Mammal	Macropus rufogriseus	Red-necked Wallaby
Mammal	Vombatus ursinus	Common Wombat
Reptile	Amphibolurus muricatus	Jacky Dragon
Reptile	Tiliqua rugosa	Shingleback
Reptile	Tiliqua schinoides	Eastern Blue-tongue Lizard

[^] Threatened Species, * Introduced Species

Appendix E Fauna monitoring photos



2017 tubestock plantings – Polygon 4. Photo Credit: Tom Kelly, 2022



Dusky Woodswallow. Photo Credit: Tom Kelly, 2022





Ap	pendix E Wan	gcol Creek Ec	ological Moi	nitoring Progr	am – Spring 2023
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Wangcol Creek EMP – 2012 to 2023

Ecological Monitoring Program - 2023

October 6, 2024

Prepared for:

EnergyAustralia



WANGCOL CREEK EMP - 2012 TO 2023

Revision	Version	Date	Description
Α	Draft	02-09-24	Stantec Internal Review
0	Final	06-10-24	Final Incorporating
			EnergyAustralia Comments

WANGCOL CREEK EMP - 2012 TO 2023

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Executive Summary

Introduction and Background

EnergyAustralia NSW (EnergyAustralia) operates Mount Piper Power Station (MPPS), near Lithgow NSW. On 16 February 2012, EnergyAustralia was granted approval for the construction and placement of ash at the Lamberts North Ash Placement (the Project). This placement provides a storage area for ash produced from the burning of coal after the previous storage area (Ash Area 1) reached capacity.

The 2010 Environmental Assessment for the Project identified several aspects of construction and ash placement that may affect the aquatic ecology of nearby Wangcol Creek, located just north of the Project site. The primary effect identified was that on water quality, via potential changes to Electrical Conductivity (EC) and concentrations of heavy metals. The approval conditions required an Ecological Monitoring Program (EMP) be established, aimed at detecting potential impacts to aquatic biota and habitat in Wangcol Creek and informing management decisions taken to mitigate, minimise and / or ameliorate any impacts. Construction of the Project commenced in February 2013 and ash placement on the Project site commenced in September 2013.

Stantec, formerly Cardno and Cardno Ecology Lab, was commissioned by EnergyAustralia to undertake the spring (December) 2023 monitoring component of the EMP. In accordance with the EMP, previous sampling was undertaken by Cardno or other specialist consultants in spring (November) 2012, autumn (May) 2013, spring (December) 2013, autumn (May) 2014, spring (November) 2014, spring (December) 2015, spring (December) 2016, autumn (May) 2018, spring (December) 2018, autumn (May) 2020, spring (November) 2020, spring (November) 2021 and spring (December) 2022.

The spring 2023 monitoring consisted of surveys of aquatic habitat, water quality and macroinvertebrate assemblages (using the AUSRIVAS protocol) on 5 December 2023 at the following sites:

- Control NCR1 on Wangcol Creek upstream of the Project area.
- Impact NCR2 on Wangcol Creek adjacent to the Project area.
- Control NCR3 on Wangcol Creek upstream of the Project area.
- Control A16 on the Coxs River at Lidsdale downstream of the confluence with Wangcol Creek.

The primary objectives of this monitoring were to:

- Assess whether any changes to the aquatic ecology of Wangcol Creek had occurred at NCR2 in spring 2023 and determine whether any such changes could be attributable to the Project (i.e., Project-related impact).
- Provide recommendations on actions, if any, that may be required to minimise, mitigate or ameliorate
 any Project-related impacts to the aquatic environment that may have occurred, and on any
 refinements to subsequent monitoring events that would improve the efficacy of the EMP.

Indicators of Aquatic Ecology

The following biotic indices were derived from the macroinvertebrate data collected in spring 2023 and statistically compared with those from previous spring surveys:

- Total number of taxa.
- Number of pollution sensitive Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa.
- OE50 Taxa Score (a biotic index of aquatic habitat and water quality).
- SIGNAL2 Score (a biotic index of water pollution).

Changes through time in the structure of macroinvertebrate assemblages in all samples collected in spring at each site were also explored using graphical multivariate techniques.

Water quality data were collected *in-situ* to supplement the long-term water quality and water discharge data from Wangcol Creek and local rainfall data sourced from EnergyAustralia, the Bureau of Meteorology, and WaterNSW. Water quality data were examined to aid in the interpretation of macroinvertebrate data.

Identified Impacts

There was no evidence of any change in spring 2023 data compared with previous sampling events that would suggest an impact due to the Project. None of the statistical tests indicated any change through time at NCR2 that could have indicated an impact. Although some differences in the macroinvertebrate multivariate assemblage structure compared with the more recent sampling events in spring 2022 and in spring 2021 were detected, these did not provide evidence of any impact related to the Project. There was also no evidence of a change in SIGNAL2 Score in spring of 2020, 2021, 2022 and 2023 following the notable reduction in this indicator observed previously in autumn 2020. The capture of one native mountain galaxiid in the AUSRIVAS dip net at one of the control sites in each of autumn and spring 2018 and spring 2021 indicated Wangcol Creek provides habitat for at least one native species of fish.

Examination of long-term water quality data from Wangcol Creek recorded during and prior to the Project showed variability in the location, timing and magnitude of several measures. This is likely to be related to the heavily modified catchment associated with coal mining, energy generation and other industries, interacting with the influence of local rainfall, flow and hydrology in Wangcol Creek, and the relative effect of evaporation and dilution occurring during low and high flow conditions, respectively. Background concentrations of many metals, some of which often exceed guidelines for the protection of aquatic ecosystems, are likely to be one of the factors influencing the type and abundance of macroinvertebrates and other aquatic biota in Wangcol Creek. However, there was no apparent change in aquatic ecology data collected in 2023 compared with previous years that could be attributed to variations in water quality.

The complex interactions that exist between the various types of disturbance experienced in Wangcol Creek (e.g., those affecting habitat, water quality and flow) make any associated changes in indicators of ecological health difficult to distinguish from those that could be due to the Project. Nevertheless, the Environmental Monitoring Program does add value to the wider monitoring program, and any large-magnitude and / or cumulative impacts to aquatic biota would be detected. Recent changes to the monitoring of aquatic ecology, including the addition of further control sites, will assist in identifying any potential future impacts, and inform future impact minimisation and remediation efforts.

Recommendations

1. Based on Condition B7 of the Project Approval, ongoing monitoring should continue throughout the life of the project (including operation), and for at least two (2) sampling periods following ash

placement. Thus, it is recommended that sampling continue with the next event to be undertaken in spring 2024.

- 2. Sampling should continue at the additional control site established on Wangcol Creek (NCR3). While no baseline data is available from this site, control data collected here during future surveys would improve the power of statistical tests and aid in the detection of impacts.
- 3. Continue collecting three replicate AUSRIVAS samples from each site during all future surveys. This will provide a measure of the variation present at each site, improving the ability to detect any future impact by enabling the use of appropriate statistical analysis.

Based on the results of this 2023 survey, no Project-specific mitigation, impact minimisation or ameliorative actions are recommended.

1.0 INTRODUCTION

1.1 BACKGROUND

EnergyAustralia NSW (EnergyAustralia) operates Mount Piper Power Station (MPPS), near Lithgow, NSW. MPPS comprises two 700 MW steam turbine generators and produces power through the burning of coal sourced from local coal mines. On 16 February 2012, EnergyAustralia was granted approval for the Lamberts North Ash Placement Project (the Project) by the Department of Planning and Infrastructure (DP&I). The Project provides a facility for the storage of ash produced from MPPS following Ash Area 1 reaching its storage capacity. The Project includes construction activities, along with the delivery, placement, and capping of ash, rehabilitation of the site, and ongoing management. Construction began in February 2013 and ash placement began in September 2013.

The Environmental Assessment for the Project (SKM 2010) identified several aspects of construction and ash placement that could affect the aquatic ecology of Wangcol Creek (also known as Neubecks Creek), which flows in an easterly direction just north of the Project. Potential effects included, but were not limited to:

- Impacts to water availability flowing into Wangcol Creek due to changes to on-site water usage and changes to run-off caused by reductions in catchment area.
- Changes to the flood regime of Wangcol Creek due to the modification of the landform of the area to accommodate the ash placement facility.
- Impacts to the water quality of Wangcol Creek, such as changes to electrical conductivity and metal concentrations, due to the mobilisation of sediment and other contaminants during construction and operation.

Condition B7 of the Conditions of Approval (CoA) for the Project required that an Ecological Monitoring Program (EMP) (GHD 2014a) be designed, aimed at detecting potential impacts on the aquatic ecology of Wangcol Creek due to the Project, and informing management decisions taken to mitigate, minimise and / or ameliorate any impacts detected. The EMP would incorporate baseline and ongoing (for at least 5 years after ash capping) monitoring of the ecological health of Wangcol Creek, and implementation of management measures to address any ecological impacts identified. The EMP formed part of the Construction Environmental Management Plan (CEMP) and subsequent Operational Environmental Management Plan (OEMP) for the Project. EnergyAustralia has commissioned Stantec (formerly Cardno and Cardno Ecology Lab) to undertake the spring 2023 monitoring in accordance with the EMP.

1.2 CURRENT STUDY

The specific objectives of the current study were to:

- Sample indicators of ecological health in Wangcol Creek potentially affected by the Project and at unaffected control sites on the creek and on the Coxs River in spring 2023.
- Compare the findings with those of studies undertaken in spring of previous years, completed as part of the EMP.



- Assess whether any impacts to the aquatic ecology of Wangcol Creek have occurred since the
 previous spring survey (completed in early December 2022) and determine whether any such impacts
 were attributable to the Project.
- Provide recommendations on actions, if any, that may be required to minimise, mitigate or ameliorate
 any impacts to aquatic ecology that may have occurred, and on any refinements to subsequent
 monitoring events that would improve the efficacy of the EMP.

Following the recommendations made after the 2015 study (Cardno Ecology Lab 2015a), monitoring incorporated sampling of AUSRIVAS edge habitat only, with no sampling of AUSRIVAS riffle habitat undertaken (**Section 2.1**). Sampling also included an additional reference site on Wangcol Creek upstream of any potential impact that may occur due to the Project. In addition, this monitoring incorporated other recommendations made previously in the review of the EMP by Cardno Ecology Lab in 2014 (Cardno Ecology Lab 2014a) (**Section 2.2**).



2.0 PREVIOUS STUDIES

2.1 MONITORING

In accordance with the EMP, baseline aquatic ecology sampling was undertaken at two sites on Wangcol Creek in spring 2012 (GHD 2014b). Further sampling at these sites was done in autumn 2013 (GHD 2014c), spring 2013 (GHD 2014d), autumn 2014 (GHD 2014e), spring 2014 (Cardno Ecology Lab 2015a), spring 2015 (Cardno 2016), spring 2016 (Cardno 2017), autumn 2018 (Cardno 2018), spring 2018 (Cardno 2019), autumn 2020 (Cardno 2020), spring 2020 (Cardno 2021), spring 2021 (Cardno 2022a) and spring 2022 (Stantec 2023) (**Table 2-1**).

Table 2-1 Timing of aquatic ecology surveys undertaken for the Wangcol Creek EMP and the respective report reference. The timing of key Project activities and the respective monitoring phase are also identified.

Monitoring Phase	Sampling Date	AUSRIVAS Season	Report Reference			
Preparation of EMP n/a		n/a	GHD (2014a)			
Baseline	8 Nov 2012	Spring 2012	GHD (2014b)			
Commencement of Construction – February 2013						
During Construction	6 May 2013	Autumn 2013	GHD (2014c)			
Commencement of Ash Pl	acement – September 2013					
	12 Dec 2013	Spring 2013	GHD (2014d)			
	22 May 2014	Autumn 2014	GHD (2014e)			
	19 Nov 2014	Spring 2014	Cardno Ecology Lab (2015a)			
	14 Dec 2015	Spring 2015	Cardno (2016a)			
	1 to 2 Dec 2016	Spring 2016	Cardno (2017)			
During Ash Placement	9 and 11 May 2018	Autumn 2018	Cardno (2018)			
	11 December 2018	Spring 2018	Cardno (2019)			
	20 May 2020*	Autumn 2020	Cardno (2020)			
	18 November 2020	Spring 2020	Cardno (2021)			
	16 November 2021	Spring 2021	Cardno (2022a)			
	7 December 2022	Spring 2022	Stantec (2023)			
	5 December 2023	Spring 2023	Current study			

^{*}Planned originally to be undertaken in late November / early December of spring 2019, though due to bush fire the survey was postponed to autumn 2020.

The reports listed in **Table 2-1** include background information on the aquatic ecology of Wangcol Creek and present the results of AUSRIVAS sampling and the assessment of aquatic habitat at these sites. Each report assessed whether impacts on the aquatic ecology of Wangcol Creek attributable to the Project may have occurred or been occurring since the 2012 baseline study. No impacts attributable to the Project were identified in data collected soon after the start of construction in autumn 2013 (GHD 2014c). GHD (2014d and e) suggested that impacts to macroinvertebrates may have occurred following



the commencement of ash placement in spring 2013 and autumn 2014, respectively. However, the EMP review (**Section 2.2**) did not find any conclusive evidence of this.

2.2 EMP REVIEW

Cardno Ecology Lab reviewed the EMP following a request by EnergyAustralia in late 2014. The review included the EMP and monitoring undertaken from spring 2012 to autumn 2014 inclusive. The aim was to examine the suitability and efficacy of the EMP and recommend any appropriate amendments to future monitoring to help ensure the objectives of the OEMP are met with respect to aquatic ecology. The specific objectives, scope, identified issues and detailed recommendations associated with the critical review are detailed in Cardno Ecology Lab (2014).

The following recommendations were made, and actions taken:

- Based on its location with respect to Project activities, NCR1 on Wangcol Creek was re-classified as a control site.
- Results from an ongoing in situ and ex situ water quality monitoring program are now used to aid in the interpretation of macroinvertebrate data.
- As construction activities commenced in February 2013, prior to the autumn 2013 sampling event in May 2013, data from May 2013 are now treated as post-baseline data.
- The statistical approach was revised following the re-classification of NCR1 as a control site and confirmation that sampling in autumn provides post-baseline data.

These were incorporated into the current study as appropriate.

2.3 PREVIOUS SURVEYS

Cardno Ecology Lab (2015a) undertook the spring 2014 monitoring event following implementation of the recommended amendments to the EMP (**Section 2.2**). This included a re-assessment of all data collected during the EMP. The findings provided some limited evidence that changes in macroinvertebrates had occurred at the impact site (NCR2) on Wangcol Creek in autumn 2013 that could be associated with the commencement of construction of the Project. These included reductions in the total number of taxa and the number of relatively pollution-sensitive Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa, a lower OE50 Taxa Score, and a change in the structure of the macroinvertebrate assemblage observed at this site. However, appropriate statistical tests, which may have provided strong evidence of the presence or absence of an impact, could not be performed in the absence of autumn baseline data. There was also evidence of a subsequent recovery in most of these indicators, and data from NCR2 in autumn 2013 were comparable with those collected further downstream at the sites on the Coxs River sampled as part of the separate Coxs River Biological Monitoring Program (Cardno Ecology Lab 2015b).

Indicators of water quality varied widely depending on location and sampling date. There was some indication that the elevated concentration of zinc that occurred near NCR2 just prior to the autumn 2013 survey may have contributed to changes in macroinvertebrate assemblages occurring there. However, as macroinvertebrates will likely respond to the combined effect of several elevated water quality indicators as well as several other environmental cues (such as drought and flood events) operating in the creek, it



was unclear how much of the variation in macroinvertebrate data could be explained by levels of zinc and / or other indicators of water quality. The taxa absent from NCR2 in autumn 2013 (i.e., generally those that are pollution tolerant), together with the presence of some pollution sensitive taxa, suggested that other factors, such as habitat fragmentation following reduced flow, may also have been influencing macroinvertebrate assemblages in Wangcol Creek. The cause of elevations in electrical conductivity (EC) in Wangcol Creek such as those observed around the time of ash placement on the Project site (GHD 2014d), which was unclear at the time of the review, was ultimately attributed to low rainfall and flow patterns in the creek rather than any impacts due to the Project (Aurecon 2014).

The following additional recommendations made in Cardno Ecology Lab (2015a), aimed at further improving the robustness and cost effectiveness of the EMP, were incorporated into the current study:

- As no autumn baseline data are available, sampling in spring is preferred. Though no baseline data collected in autumn are available, surveys in autumn would, however, allow assessment of any changes that may manifest in autumn only.
- Due to the paucity of AUSRIVAS data collected from riffle habitat (following frequent low flows during sampling), sampling of riffle habitat (when present) should cease and effort be re-directed to collection of two replicate AUSRIVAS edge samples at each site, thereby improving the ability to detect any future impacts by enabling the use of more fit-for-purpose statistical analysis.
- Establishment of two additional control sites (one on Wangcol Creek and the other on the Coxs River), both located upstream of any potential impacts that may occur due to the Project. While no baseline data would be available from these sites, control data collected here during future surveys would improve the power of statistical tests and aid in the detection of any impact occurring in the future. The additional site on Coxs River was surveyed in spring 2015 and spring 2016, but monitoring has since discontinued due to very low water levels following persistently low rainfall.
- Where appropriate, the more specific recommendations provided in Cardno Ecology Lab (2014a) aimed at improving the overall robustness of the study were also implemented.

The findings of subsequent surveys are summarised as follows:

- The findings associated with the spring 2015 monitoring event did not provide any evidence of an impact due to the Project (Cardno 2016). None of the PERMANOVA tests undertaken on data collected from NCR1 and NCR2 in spring of 2015 indicated any change in aquatic ecology that could be attributed to a Project-related impact.
- There was also no conclusive evidence of any change in spring 2016 data from previous data that would suggest an impact attributable to the Project (Cardno 2017). None of the statistical tests indicated any change through time at NCR2 that could be attributed to a Project-related impact.
- Surveys in autumn 2018 (Cardno 2018) and spring 2018 (Cardno 2019) also provided no evidence of any Project-related impacts on aquatic ecology.
- There was limited evidence to suggest a change in one indicator (SIGNAL2 Score) that occurred at NCR2 in autumn 2020. This change could have been associated with the Project (Cardno 2020); however, detailed examination of trends in this indicator at other sites and of the individual taxa did not provide convincing evidence of a Project-related impact. In any case, the observed small magnitude of the reduction in this indicator did not raise concern for overall aquatic ecology in Wangcol Creek at that time.



- There was no evidence that the reduction in SIGNAL2 Score detected at NCR2 in autumn 2020 had persisted through to spring 2020. There was also no evidence in spring 2020 data of any change in other indicators that would suggest an impact due to the Project (Cardno 2021).
- None of the statistical tests that included data from spring 2021 and spring 2022 indicated any change through time at NCR2 that could otherwise have indicated an impact on aquatic ecology. Although some spatial and temporal differences in the macroinvertebrate multivariate assemblage structure were detected following the spring 2021 and spring 2022 surveys, they did not collectively provide evidence of any impact related to the Project (Cardno 2022a, Stantec 2023). These included differences between surveys at control sites, and between control sites during individual surveys. There were also some differences detected between NCR2 (impact) and A16 (control), but those differences were not considered to be indicative of an impact given that differences among control sites were also detected, and to relatively greater extents and in varying directions.



3.0 EXISTING INFORMATION

3.1 ENVIRONMENTAL CONTEXT

Wangcol Creek (also known as Neubecks Creek) flows in an easterly direction north of the Project site (Figure 3.1). It is a naturally ephemeral creek, though it may appear perennial due to ongoing discharge from industries within its catchment. It has two main tributaries: a western arm that arises in the southwest of Ben Bullen State Forest, several kilometres northwest of the Project, and a northern arm that arises in Blackmans Flat, a few kilometres north of the Project site. These two tributaries join just north of the Castlereagh Highway and to the northwest of the Project site before the creek joins the Coxs River several kilometres further downstream at Blue Hole, a flooded historic quarry approximately 2 kilometres north of Lidsdale. Other tributaries of Wangcol Creek include Lamberts Gully, which flows north into Wangcol Creek from the southeast of the Project Area. The Project includes ash placement over Huons Gully, which otherwise would have flowed into Wangcol Creek upstream of Lamberts Gully. Several unnamed drainage lines also traverse the area.

Wangcol Creek is situated in a substantially disturbed catchment in which water quality, quantity and drainage patterns are influenced by surrounding historical and current mining operations (e.g., Ivanhoe Colliery, Commonwealth Open Cut Coal Mine, Angus Place Coal Mine, Kerosene Vale Mine and Pine Dale Coal Mine), power generation (Mount Piper and Wallerawang Power Stations) and agricultural land practices. The creek has also been re-aligned several times to facilitate nearby mining practices.

3.2 AQUATIC AND RIPARIAN HABITAT

The riparian vegetation of the Wangcol Creek Catchment consists primarily of cleared land with some disturbed native regrowth. The section of creek in the vicinity of Blackmans Flat is almost devoid of native riparian vegetation except for scattered trees and occasional patches of *Leptospermum* sp. (Centennial Coal 2012). Some more established areas of mixed native and invasive trees and shrubs (e.g., willow (*Salix alba*) and blackberry (*Rubus* sp.)) are present along the main channel of the creek in the vicinity of the Project.

Adjacent to the Project, Wangcol Creek consists of faster-flowing riffle and deeper, slower-flowing pools (GHD 2014a). The substratum generally consists of sand, coarse gravel, cobbles and rock. In places there are large deposits of fine sediment.

3.3 WATER QUALITY

3.3.1 Environmental Assessment

Water quality in Wangcol Creek was reviewed as part of the Environmental Assessment for the Project (SKM 2010). The review examined water quality data collected from four previously established water quality monitoring sites located on the creek in the vicinity of the Project (**Figure 3-1**):





Figure 3-1 Location of the Project (Lamberts North Ash Placement Area), the previous ash depository (Ash Area 1), Wangcol Creek, the Coxs River, aquatic ecology monitoring sites and long-term water quality monitoring sites.

- LDP6 (previous MPPS Licensed Discharge Point 1): located upstream of the Project and the previous ash storage area (Ash Area 1). This site has previously been referred to as LDP01 and is now decommissioned.
- WX22: Wangcol Creek gauging station, located adjacent to the Project.
- Site 2: Springvale Coal monitoring site located immediately upstream of the confluence with Lamberts Gully.
- Site 3: Springvale Coal monitoring site located immediately downstream of the confluence with Lamberts Gully.

Data were available from LDP6 and WX22 for the period 2000 to 2009 and from Sites 2 and 3 for 2000 to 2007. Data were compared with Australian Guideline Default Trigger Values (DTVs) (ANZECC/ARMCANZ 2000) for upland rivers in south-eastern NSW. The findings are summarised as follows:

- Electrical Conductivity (EC) often exceeded the upper DTV (350 μs/cm) and was recorded as high as 1333 μs/cm at LDP6 and 1200 μs/cm at Site 3.
- pH was within lower and upper DTVs (6.5 to 8.0).
- Concentrations of metals (aluminium, sliver, arsenic, cadmium, chromium, manganese, copper and zinc) were above the trigger value for 95% protection of freshwater ecosystems at one or more sites.

Additional water quality data from WX22 collected by EnergyAustralia from 2008 to 2012 were presented by GHD (2014a). These data indicated that nickel, boron, copper and lead in Wangcol Creek also exceeded DTVs at times.

3.3.2 Ash Area 1 Monitoring

Aurecon (2014) reviewed water quality data as part of the ongoing monitoring associated with Stages 1 and 2 of the previous Ash Area 1 placement area. This included surface water quality data collected at LDP6, WX22 and NC01 (on Wangcol Creek upstream of the Project site and the confluence with Lamberts Gully) prior to (October 2012 to August 2013) and following (September 2013 to August 2014) ash placement on the Project site. The findings are summarised as follows:

- Median EC ranged from 310 to 640 μs/cm and was often above the upper DTV for upland creeks (noting that Aurecon (2014) used DTVs for lowland rivers) at LDP6 and WX22 before, and after, ash placement, and at NC01 following ash placement.
- pH ranged from 7.0 to 7.8 and was within the DTVs at each site before, and after, ash placement.
- Turbidity ranged from 2.3 to 26 NTU and was slightly above the upper DTV at LDP6 before ash placement.
- Concentrations of heavy metals and indicators of water quality recorded following ash placement were compared with locally derived guidelines (90th percentile of pre-placement data). While the concentrations of several metals (including barium, nickel and zinc) exceeded these local guidelines, it was noted that exceedances could not be attributed to the Project due to the confounding influence of groundwater flow from historic mine workings and Ash Area 1.

It was also noted that elevated ECs and concentrations of metals observed in Wangcol Creek correlate with preceding periods of low rainfall and flow. Relatively high ECs and concentrations of nickel at WX22,



compared with those at LDP6 and NC01, were attributed to inflows from MPPS via Huon Gully. Elevated concentrations of zinc at WX22 were most likely due to local mine water seepage during dry weather.

Groundwater from the Project area flows eastward towards Huons Gully, then into Wangcol Creek (Aurecon 2014). Groundwater from the Ash Area 1 area may also flow eastward through the Project area and into Wangcol Creek via Huons Gully, and potentially northeast towards Wangcol Creek. This pattern of groundwater flow prevented the identification of suitable water quality tracers that could be used to identify potential leachates from the ash deposited on the Project site and discriminate them from those associated with Ash Area 1.

3.4 AQUATIC BIOTA

There is little publicly available information on the aquatic biota of Wangcol Creek. GHD (2014a) reviewed the findings of a 1993 aquatic flora and fauna survey of Wangcol Creek by the former Department of Water Resources (DWR 1994). The findings of this review are summarised in **Sections 3.4.1** and **3.4.2**. Additional information on macroinvertebrates in Wangcol Creek and the wider upper Coxs River Catchment is summarised from the findings of SCA Sydney Drinking Water Catchment Audits (GHD 2013). The findings of an ecotoxicology study in the northern arm of Wangcol Creek (Battaglia *et al.* 2005) are also summarised in **Section 3.4.2.1**.

3.4.1 Flora

The review of DWR (1994) provided by GHD (2014a) noted the following observations of aquatic flora in Wangcol Creek:

- Emergent aquatic flora is relatively diverse, with common species including tall spikerush (*Eleocharis sphacelata*), spikerush (*Eleocharis acuta*), jointed rush (*Juncus articulatus*), common reed (*Phragmites australis*) and cumbungi (*Typha orientalis*).
- Submerged aquatic flora was sparse and consisted of green algae (Chara sp., Nitella sp., Spirogyra sp. and Rhizoclonium sp.).
- A smothering effect due to the presence of fine sediments in the creek was offered as an explanation for the low diversity of submerged aquatic flora.
- Dense beds of tall spikerush and cumbungi were present in some sections of creek, reducing water flow in these sections.

3.4.2 Fauna

3.4.2.1 Aquatic Macroinvertebrates

The review of DWR (1994) suggested that Wangcol Creek supported a diverse macroinvertebrate community, dominated by true flies (Order: Diptera), caddisflies (Order: Trichoptera), damselflies and dragonflies (Order: Odonata), and beetles (Order: Coleoptera).

More recent surveys of AUSRIVAS edge habitat in Wangcol Creek adjacent to the Project and at other nearby sites on the Coxs River were undertaken as part of the SCA Sydney Drinking Water Catchment Audits (GHD 2013). The results of the 2009 survey on Wangcol Creek indicated the aquatic habitat here was severely impaired (AUSRIVAS Band C) relative to reference condition. The aquatic habitat at sites



on the Coxs River upstream and downstream of the confluence with Wangcol Creek sampled in 2009 ranged from severely impaired to significantly impaired (AUSRIVAS Band B) relative to reference condition. Further monitoring at a subset of these sites in 2011 also indicated that the aquatic habitat was severely to significantly impaired. Long-term sampling undertaken at A16 (also included in the EMP, see **Section 4.2**) on the Coxs River downstream of the confluence with Wangcol Creek from 2001 to 2012 indicated that the condition of aquatic habitat ranged generally from severely impaired to equivalent to reference condition (AUSRIVAS Band A). In 2002, the macroinvertebrate assemblage at this site was richer than expected under the AUSRIVAS model (Band X). While the habitat condition at A16 appears to have declined from 2009 to 2012, there has been a general improvement across the Upper Coxs River sub-catchment through that time (GHD 2013).

It was noted in GHD (2014a) that the macroinvertebrate assemblages at most of the sites sampled in the Coxs River catchment (at least prior to 2010), were characterised by pollution-tolerant taxa, and that the invertebrate assemblages and individual taxa were influenced by EC in the river.

A study by Battaglia *et al.* (2005) indicated that the abundance and diversity of macroinvertebrate fauna in Wangcol Creek was much lower than in two reference creeks (Megalong Creek and Jocks Creek) and attributed this difference to acid mine drainage (AMD) from previous mining activities within the area. The study found a strong correlation between water quality (concentrations of several analytes, including nickel and zinc, which were found to be greater in Wangcol Creek than in the reference creeks) and macroinvertebrate data. The study also concluded that poor water quality rather than the quality of the sediment from the creek bed had impacted on macroinvertebrate assemblages within the creek.

3.4.2.2 Fish

The DWR (1994) review indicated three species of fish occurred in Wangcol Creek during the DWR (1994) survey:

- The native mountain galaxias (Galaxius olidus), which represented over 90% of the fish caught.
- The native flathead gudgeon (*Philypnodon grandiceps*).
- The non-native wild goldfish (*Carassius auratus*).

The diversity and abundance of the fish assemblage in Wangcol Creek was considered relatively poor in comparison with other nearby freshwater streams.

Topographical maps show several crossings that may represent barriers to fish movement by reducing longitudinal connectivity and habitat availability, potentially causing population fragmentation.

3.5 SUMMARY

Wangcol Creek is situated in a heavily disturbed and modified catchment. It has experienced substantial environmental stress due to historic and current coal mining activities, power generation and land clearing practices, and continues to do so. Poor water quality (primarily elevated EC and concentrations of heavy metals) due to discharged process water, groundwater flow from historic mine workings, increased sedimentation due to run-off from nearby roads and other impermeable surfaces, and the removal of native vegetation, are likely the major contributing factors to the generally depauperate macroinvertebrate and fish assemblages supported by the creek. SKM (2010) noted that there is sufficient data from the on-



going monitoring and modelling studies undertaken as part of previous and current studies to suggest that the main contributor to impaired water in Wangcol Creek is historic coal mining activities rather than Ash Area 1 or the operation of MPPS. The findings of the review of water quality data collected before and after ash placement on the Project site that was done by Aurecon (2014) suggested a complex interaction among the various water quality impacts in Wangcol Creek (Aurecon 2014), which would also be affected by local rainfall patterns and water flow in the creek.

The 2010 audit (DECCW 2010) indicated that as a whole, the Upper Coxs River sub-catchment was under a high level of stress due to inflows from the sewage treatment plants, inflows of urban stormwater, runoff from roads and grazing lands, regulation of flows by dams, extraction of surface and ground water, occurrence of barriers to fish passage, geomorphological disturbance from past and present mining, and licensed discharges from nearby power stations and coal mines. Despite these observations, Wangcol Creek does support aquatic biota and habitat of ecological value. While the riparian corridor has been impacted by historic vegetation clearing, channel realignments and establishment of exotic species, it is relatively intact along the main channel of the creek and would be an important source of woody debris and bank stabilisation. The creek also supports several native macrophytes, which provide habitat for macroinvertebrates and fish and may also be important in nutrient cycling by limiting the magnitude and duration of elevated concentrations of nutrients and helping to prevent eutrophication due to excess nutrients.

Monitoring programs that aim to detect the potential impact on the aquatic ecology of Wangcol Creek due to specific activities (such as the Project) must take into consideration the various impacts that have occurred in the past or are currently occurring in the creek, along with patterns of rainfall and flow. While any potential impact attributable to the Project would only be due to one of several types of disturbance that the creek currently experiences, the effect of cumulative impacts is also important.



4.0 METHODOLOGY

4.1 STUDY RATIONALE

The primary aim of the study is to identify any changes in the selected indicators of aquatic ecology at the impact site that are in a different direction, or of a different magnitude, to any changes that may be concurrently occurring at the control sites. Any such changes would be considered in relation to variation in environmental (such as water quality) data to attempt to explain the pattern of changes and explore the potential cause(s). It is noted that a potential impact attributable to the Project would not be related to a point source, such as a licensed discharge, for any potential contaminant, but rather a potential diffuse impact such as leaching of potential contaminants from the ash storage area.

The methods utilised in the current study and described in **Sections 4.2** to **4.5** are based on those undertaken previously and prescribed in the EMP (GHD 2014a), and incorporate the modifications and additions described in the review of the EMP (Cardno Ecology Lab 2014a) (**Sections 2.1** and **2.2**).

4.2 STUDY SITES

The following sites were sampled by Cardno on 5 December 2023 within the spring AUSRIVAS sampling season (**Figure 3-1**):

- Control NCR1 located on Wangcol Creek upstream of Huons Gully and the Project area. This site is also located downstream of the now decommissioned LDP01 and the current Mount Piper LDP12. While this site is situated on a section of Wangcol Creek that has been, and continues to be, impacted upon by other disturbances, it is not expected to experience any impacts attributable to the Project (Section 2.2).
- Impact NCR2 located on Wangcol Creek downstream of Huons Gully and adjacent to the Project area.
- Control NCR3 located on Wangcol Creek between the Northern Arm and Huons Gully upstream of the Project area. A control site could not be established farther upstream than this point because the habitat there was unsuitable (consisting of a wide channel with dense aquatic vegetation or a narrow, re-sectioned channel with minimal riparian vegetation) and would not be expected to provide comparable control data for NCR2.
- Control A16 located on the Coxs River approximately 5 km downstream of the ash placement (this site is an ongoing WaterNSW macroinvertebrate monitoring site).

Note that the control site on the Coxs River (A16) is located downstream of the impact site and could conceivably experience impacts attributable to the Project. It is, however, considered unlikely that such impacts would occur because A16 is located some distance downstream and receives substantial flows from the upper Coxs River. The coordinates of each site are presented in **Appendix A**.

4.3 TIMING

The timing of the current and previous sampling undertaken at each site is presented in **Table 4-1**.



Table 4-1 The timing and number of AUSRIVAS edge and riffle habitat samples collected at each of the Wangcol Creek EMP aquatic ecology monitoring sites during 2012 to 2020.

Date	AUSRIVAS Season	NC	R1	NC (Impac	:R2 ct Site)	NCR3	A	16	CR0
AUSRIVAS Habitat		Edge	Riffle	Edge	Riffle	Edge	Edge	Riffle	Edge
8 Nov 2012	Spring 2012	1	1	1	1		1	1	
6 May 2013	Autumn 2013	2		1	1				
12 Dec 2013	Spring 2013	2		2			1	1	
22 May 2014	Autumn 2014	2		2					
19 Nov 2014	Spring 2014	1		1			1	1	
14 Dec 2015	Spring 2015	2		2		2	2		2
1 to 2 Dec 2016	Spring 2016	2		2		2	2		2
9 and 11 May 2018	Autumn 2018	2		2		2	2		
11 December 2018	Spring 2018	3		3		3	3		
20 May 2020	Autumn 2020	3		3		3	3		
18 November 2020	Spring 2020	3		3		3	3		
16 November 2021	Spring 2021	3		3		3	3		
7 December 2022	Spring 2022	3		3		3	3		
5 December 2023	Spring 2023	3		3		3	3		

Note, only spring data were examined in the current report (**Section 2.1**). Riffle habitat was not sampled due to absence of this habitat during low flows. Monitoring was not undertaken at CR0 in autumn 2018 and spring 2018 due to low water level and monitoring here has now ceased due to persistent low water level.

4.4 FIELD SAMPLING

4.4.1 Aquatic Habitat

Aquatic habitat was assessed using methods in the NSW AUSRIVAS Manual (Turak *et al.* 2004). Descriptions of physical habitat included visual assessments of streambed composition, aquatic and riparian vegetation, potential disturbances and sketches of the river profiles.

The condition of aquatic habitat was assessed using the Reference Condition Selection Criteria (RCSC) categories developed by the Queensland Government (QLD DNRM 2001), as per the requirements of the EMP. This assessment rates the level of influence (from 1 to 5, with 1 being a very major impact and 5 an indiscernible impact) that a watercourse experiences from several potential anthropogenic disturbances in relation to the selection of reference aquatic ecology monitoring sites. The condition of aquatic habitat was also assessed using a modified version of the Riparian, Channel and Environmental (RCE) Inventory method (Peterson 1992; Chessman *et al.* 1997). This assessment involves evaluation and scoring of the characteristics of the adjacent land, the condition of riverbanks, channel and bed of the watercourse, and the degree of disturbance evident at each site (**Appendix C**). The maximum score (52) indicates a stream with little or no obvious physical disruption, while the lowest score (13), indicating a heavily channeled stream without any riparian vegetation, can be considered poor condition.

Digital photographs were taken looking upstream and downstream at each site to provide a record of aquatic habitat present at the time of sampling and to aid in the site descriptions.



4.4.2 Water Quality

Water quality was measured *in situ* with a YSI 6920 water quality probe and meter that were calibrated prior to sampling. Water quality was measured before aquatic fauna were sampled to avoid disturbance to the waterway. The following variables were recorded between 10:00 and 15:00 on the day of sampling:

- Temperature (°C).
- Electrical Conductivity, EC (μs/cm).
- pH.
- Dissolved oxygen, DO (mg/L and % saturation).
- Turbidity (NTU).

Duplicate readings of each variable were taken in accordance with Australian Guidelines (ANZECC/ARMCANZ 2000; ANZG 2018).

These water quality data were intended to provide information on environmental conditions at the time of sampling for aquatic ecology. Long term trends in water quality data collected by other specialists were also examined (**Section 4.6.1**).

4.4.3 AUSRIVAS Macroinvertebrates

Aquatic macroinvertebrates associated with edge habitats were sampled using the AUSRIVAS rapid assessment methodology (RAM) (Turak et al. 2004). Three replicate edge samples were collected at each site using dip nets (250 µm mesh) deployed over a period of 3 to 5 minutes along a total of 10 m of edge habitat within a 100 m reach of the river. The dip net was used to agitate and scoop up material from vegetated river edge habitats. Where the habitat was discontinuous, patches of habitats cumulatively totaling a length of 10 m were sampled over the 100 m reach. After the 3 to 5 minutes, each RAM sample was rinsed from the net onto a white sorting tray from which live animals were removed ("picked") using forceps and pipettes. Each tray was picked for a minimum period of forty minutes, after which it was further picked at ten-minute intervals either until no new specimens had been found or until a total of 60 minutes (i.e., the initial 40 minutes plus up to another 20 minutes) had elapsed. Care was taken to collect cryptic and fast-moving animals in addition to those that were conspicuous and / or slowmoving. The animals collected at each site were placed into a labelled jar containing 70% alcohol in water. The aim of the live picking is to pick as many macroinvertebrate taxa as possible within the prescribed picking time. There is no set minimum or maximum number of animals to be collected; however, at least 20 chironomids were collected where possible to help ensure that an adequate representation of all subfamilies was obtained.

Environmental variables, including alkalinity, modal river width and depth, percentage boulder or cobble cover, and latitude and longitude, were recorded in the field. These variables were required for running the AUSRIVAS predictive model for edge habitat. Distance from source, altitude, and land-slope were determined from appropriate topographic maps. Mean annual rainfall was sourced from the regional precipitation maps presented in the AUSRIVAS Sampling and Processing Manual (Turak *et al.* 2004).



4.5 LABORATORY METHODS

AUSRIVAS samples were sorted under a binocular microscope (at 40 X magnification) and identified to Family level, with the exception of Oligochaeta and Polychaeta (Class), Ostracoda (Subclass), Nematoda and Nemertea (Phylum), Acarina (Order) and Chironomidae (Subfamily). Up to ten animals of each family were counted, in accordance with the latest AUSRIVAS protocol (Turak *et al.* 2004).

4.6 DATA ANALYSIS

4.6.1 Water Quality and Hydrological Data

Water quality data were compared with the Australia, New Zealand Environment Conservation Council default trigger values (DTVs) for physical and chemical stressors for slightly disturbed upland rivers in southeast Australia (ANZECC/ARMCANZ 2000). These DTVs are in the process of being updated and more recent DTVs have been used where available. Currently, the concentration of boron in freshwater is the only relevant water quality measure / toxicant with an updated DTV (ANZG 2018), and DTVs provided by ANZECC/ARMCANZ (2000) are used otherwise. The sites on Wangcol Creek and the Coxs River are at an altitude of 885 to 920 m and thus are classified as upland watercourses by ANZECC/ARMCANZ (2000). For metal data, guidelines for 95% protection of species for slightly to moderately disturbed ecosystems were utilised. While Wangcol Creek is probably more accurately described as a heavily modified system, guidelines for slightly to moderately disturbed systems are applied to these systems as a precautionary measure (ANZECC/ARMCANZ 2000).

EC and pH data collected from LDP6, NC01 and WX22 (**Figure 3-1**) by EnergyAustralia between 12 January 2014 and August 2022 were examined to aid in the interpretation of macroinvertebrate data. Concentrations of nickel and zinc (metals identified as exceeding locally derived guidelines following ash placement on the Project site (Aurecon 2014) (**Section 3.3.2**)), and aluminium and boron (previous examination of these data suggested elevated concentrations of these metals occurred around the time of the aquatic ecology survey in spring 2014 (Cardno Ecology Lab 2015a)) recorded from these sites from January 2014 to August 2022 by EnergyAustralia were also examined to aid the interpretation of macroinvertebrate data. Previous examination of data for four other metals of potential concern (barium, copper (Cu-F), iron (Fe-F) and manganese (Mn-F) (Cardno Ecology Lab 2015)) suggested an increase in concentrations above background levels at one or more sites prior to the spring 2015 aquatic ecology survey (Cardno 2016). EC and the concentration of boron, nickel and zinc appeared elevated at WX22 (adjacent to the ash placement and NCR2) in early 2018 prior to the December 2018 survey. Boron also appeared to be elevated at LDP6 and NC01 at that time.

Local monthly rainfall data obtained from the Bureau of Meteorology (BOM) station at Lidsdale (approximately 5 to 6 km southeast of the aquatic ecology monitoring sites on Wangcol Creek) (BOM 2021) and monthly discharge data from WaterNSW station 212055 (WaterNSW 2022) from January 2012 to December 2022 are also presented.

This cursory examination of water quality data was undertaken to help understand any observed patterns in macroinvertebrate data. More detailed assessment of any impacts on water quality in Wangcol Creek attributable to the Project will be undertaken by other specialist consultants.



4.6.2 Macroinvertebrate Indicators

The AUSRIVAS protocol uses a software package to determine the environmental condition of a waterway based on predictive models of the distribution of aquatic macroinvertebrates at reference sites (Coysh *et al.* 2000). The ecological health of the river was assessed by comparing the macroinvertebrate assemblages collected in the field (i.e. 'observed') with macroinvertebrate assemblages expected to occur in reference waterways with similar environmental characteristics. The data from this study were analysed using the NSW models for pool edge habitat sampled in spring. The AUSRIVAS predictive model generates the following indices:

- > OE50 Taxa Score The ratio of the number of macroinvertebrate families with a greater than 50% predicted probability of occurrence that were actually observed (i.e., collected) at a site to the number of macroinvertebrate families expected with a greater than 50% probability of occurrence. OE50 taxa scores provide a measure of the impairment of macroinvertebrate assemblages at each site, with values close to 0 indicating an impoverished assemblage and values close to 1 indicating that the condition of the assemblage is similar to that of the reference rivers.
- > Overall AUSRIVAS Bands, derived from OE50 Taxa scores, which indicate the level of impairment of the assemblage. These bands are graded as described in **Table 4-2**.

Table 4-2 AUSRIVAS Bands and corresponding OE50 Taxa Scores for AUSRIVAS edge habitat sampled in spring.

Band	Description	Spring OE50 Score
X	Richer invertebrate assemblage than reference condition	>1.16
Α	Equivalent to reference condition	0.84 to 1.16
В	Sites below reference condition (i.e., significantly impaired)	0.52 to 0.83
С	Sites well below reference condition (i.e., severely impaired)	0.20 to 0.51
D	Impoverished (i.e., extremely impaired)	≤0.19

The SIGNAL2 biotic index (Stream Invertebrate Grade Number Average Level) developed by Chessman (2003) was also used to determine the environmental quality of sites on the basis of the presence or absence of families of macroinvertebrates. This method assigns grade numbers between 1 (highly tolerant of pollution) and 10 (highly sensitive to pollution) to each macroinvertebrate family, based largely on their responses to chemical pollutants. For a given site, the sum of all grade numbers is divided by the total number of families recorded to obtain an average SIGNAL2 Score for that site. The SIGNAL2 Score therefore uses the average sensitivity of macroinvertebrate families to present a snapshot of biotic integrity at the site. SIGNAL2 values are as follows:

- SIGNAL > 6 = Healthy habitat.
- SIGNAL 5 6 = Mild pollution.
- SIGNAL 4 5 = Moderate pollution.
- SIGNAL < 4 = Severe pollution.

The SIGNAL2 Scores were calculated using un-weighted SIGNAL2 grade data because weighting SIGNAL2 grades according to abundance may bias the SIGNAL2 Score towards naturally more abundant taxa.



Two other biotic indicators: Total Taxon Richness (the number of macroinvertebrate taxa collected in the sample) and Ephemeroptera, Plecoptera and Trichoptera (EPT) Taxon Richness (the combined number of mayfly, stonefly and caddis fly taxa, respectively, which are considered relatively pollution sensitive), were also derived via the AUSRIVAS macroinvertebrate data. The relative contribution of each of the major taxonomic groups (including Trichoptera, Diptera, Coleoptera, Hemiptera, Plecoptera, Odonata, Ephemeroptera, Crustacea and Mollusca) to the total number of taxa present in each sample was also examined visually to provide an indication of any changes that could be indicative of an impact.

4.6.3 Statistical Analysis

4.6.3.1 Interpretation and Data Presentation

The objective of the statistical analyses was to identify and further examine any differences between the Impact site and Control sites in the selected macroinvertebrate indicators. Statistically significant differences associated with an interactive effect of Survey and Site could provide evidence that an impact may have occurred. Such potential evidence is assessed by examining differences between pairs of Surveys and Sites via a suite of pairwise comparisons.

Two statistical designs were utilised according to the availability of replicate sampling (i.e., two or more AUSRIVAS samples per site). The first used data collected from NCR1 and NCR2 in spring of 2013, 2015, 2016, 2018, 2020, 2021 and 2022, while the second used data from NCR1, NCR2, NCR3 and A16 sampled in 2015, 2016, 2018, 2020, 2021 and 2022 (**Section 4.6.3.2**). The first design enabled any changes since 2013 (albeit following commencement of the Project) at NCR1 and NCR2 to be examined, while the second design also included additional control sites NCR3 and A16 (albeit only from 2015 onwards) to help place any changes at NCR2 in the context of the wider catchment area.

Spatial and / or temporal differences in univariate indicators (e.g., Total Taxon Richness and EPT Taxon Richness) associated with AUSRIVAS macroinvertebrate assemblages sampled in edge habitat at each site in spring of each year (2012, 2013, 2014, 2015, 2016, 2018, 2020, 2021 and 2022) were also explored.

4.6.3.2 Multivariate Analyses

A matrix of differences in the types of taxa between all possible pairs of samples was compiled by calculating their respective Bray-Curtis dissimilarity coefficients. Permutational analysis of variance (PERMANOVA+ in Primer v6) was used to examine spatial differences and temporal changes, and their interaction, in macroinvertebrate assemblage presence / absence data sampled using AUSRIVAS (Anderson et al. 2008; Clarke and Gorley 2006). Differences among the levels of main-effects factors and interaction terms may be examined by post-hoc pair-wise permutational t-tests. Only statistical differences with a significance level of $P \le 0.05$ were considered. Significant differences between groups may arise due to differences between group means, differences in dispersion (equivalent to variance) among groups or a combination of both. Either outcome could be indicative of an impact. However, only significant statistical interactions are potentially indicative of an impact, hence significant main effects were not considered in detail.

Two analytical designs were utilised:



- 1. Comparison between the NCR1 and NCR2 sites, sampled in spring of 2013, 2015, 2016, 2018, 2020, 2021 and 2022:
 - Year: A fixed factor with seven levels: 2013, 2015, 2016, 2018, 2020, 2021 and 2022.
 - Site: A fixed factor with two levels: NCR1 and NCR2.
- 2. Comparison among all sites, sampled in spring of 2015, 2016, 2018, 2020, 2021 and 2022:
 - Year: A fixed factor with six levels: 2015, 2016, 2018, 2020, 2021 and 2022.
 - Site: A fixed factor with four levels NCR1, NCR2, NCR3 and A16.

Multivariate patterns in data collected from each site during spring of 2013, 2015, 2016, 2018, 2020, 2021 and 2022 were examined using the Principal Coordinates Analysis (PCoA) routine in PERMANOVA+. This is a generalised form of Principal Components Analysis (PCA) in which samples are projected onto linear axes based on their dissimilarities in a way that best describes the patterns among them using as few dimensions as possible (Clarke and Gorley 2006). The amount of variation 'explained' by each principal axis is indicated and the dissimilarity between data points can be determined from their distances apart on the axes (Anderson et al. 2008). Relative differences among samples were also examined using Hierarchical Clustering in PERMANOVA+ in Primer v6.

4.6.3.3 Univariate Analyses

PERMANOVA + was used to examine spatial differences and temporal changes in the number of taxa, OE50 Taxa Scores, SIGNAL2 Indices and the number of EPT taxa. These analyses were based on a Euclidean distance matrix of all possible pairs of samples of the variable of interest and a statistical significance level of $P \le 0.05$. The analytical designs described in **Section 4.6.3.2** were applied.

As is the case with multivariate analyses, significant differences between groups (e.g., NCR1 and NCR2) that could be indicative of a mining impact may arise due to differences between group means, differences in dispersion (variance) among groups or a combination of both. A potential impact could affect both the magnitude and dispersion of an indicator (e.g., number of taxa). If a statistically significant difference between groups was detected, the proportion of the statistical difference attributable to the difference in variance between pairs of groups would be explored using the PERMDISP procedure to determine whether variances were statistically different. If there is no statistical difference between variances, the statistical difference detected between groups is most likely due to difference between group means. When a statistical difference between variances is detected, the difference between groups could be due to both the difference in variance and the difference in means between groups.

4.6.3.4 QA/QC Procedures

Data generated in the field were checked for accuracy and completeness before leaving each site. On return to the laboratory, field data sheets were photocopied, entered into spreadsheet format and checked. Spreadsheet files were locked prior to analysis to prevent accidental over-writes or corruption.

In the laboratory, the remains of each macroinvertebrate sample were retained and checked by another aquatic scientist to ensure that no animals were missed. A Stantec staff member with appropriate training and experience checked the identifications and counting of samples. These activities were recorded on the Laboratory Management Sheet. Data were entered into an electronic spreadsheet and data for each sample were printed and checked by a second staff member.



5.0 RESULTS

5.1 AQUATIC HABITAT

5.1.1 NCR1

As was the case for previous surveys, in 2023 the aquatic habitat at control location NCR1 appeared relatively undisturbed (**Plate 1a** and **b**). There was no evidence of recent channel re-alignments or resectioning, and several mature trees, albeit including some invasive willows, were present on both banks. This vegetation would help stabilise banks, thereby minimising erosion and associated increases in sedimentation. It would also be a source of woody debris, which provides habitat for fish and macroinvertebrates. The upstream section of the site consisted of a large pool bordered by dense beds of cumbungi. The downstream section consisted of a channel approximately 1 m in width with loose cobble and pebble substratum. Some flow was present at the time of sampling. Rushes (*Juncus* sp.) were common along this section.

5.1.2 NCR2 (Impact Site)

While the section of Wangcol Creek at the impact site NCR2 (**Plate 1c** and **d**) also did not appear to have been subject to recent modification, the banks just downstream of the site previously had been resectioned and reinforced. Riparian vegetation consisted primarily of grasses and a few isolated trees. The absence of substantial bank-stabilising vegetation likely explains the bank slumping and erosion present throughout the site. The channel consisted of loose material covered with fine sediment / diatom layer. A concrete gauging station / ford runs through the centre of the site, acting as a small weir.

5.1.3 A16

The relatively steep banks, uniform bank profile and absence of any trees and other substantial riparian vegetation at A16 (**Plate 1e** and **f**) suggest that this section of the Coxs River has been re-aligned and / or re-sectioned. Bank slumping was present, though bank material was somewhat stabilised by grasses. The channel consisted primarily of loose cobbles and pebbles, with moderate water flow present at the time of sampling.

5.1.4 NCR3

The aquatic habitat at NCR3 (**Plate 2a** and **b**) was very similar to that at NCR2. The riparian vegetation within a few metres of the creek was relatively undisturbed, with several large trees and grasses present. There was no evidence of bank or channel modifications.















Plate 1: Photographs of NCR1 looking a) upstream and b) downstream, NCR2 looking c) upstream and d) downstream and A16 looking e) upstream and f) downstream in 2022.





Plate 2: Photographs of NCR3 looking a) upstream and b) downstream in 2022.

5.1.1 RCE Scores

General observations of aquatic habitat at each site were supported by the results of the RCE inventory. The total RCE scores for Sites NCR1, NCR2, NCR3 and A16 were 36, 25, 36 and 33, respectively (**Appendix D**). These scores were the same as those recorded for these sites in previous surveys. The low score for NCR2 was due primarily to the relatively poor condition of the riparian vegetation, unstable banks and the absence of in-stream habitat (e.g., large woody debris). A16 scored relatively low in categories associated with the condition of riparian vegetation compared with NCR1 and NCR2, though it did score relatively highly in categories associated with channel form, riffle / pool sequence and channel substratum.

The results of the Reference Condition Selection Criteria (RCSC) assessment reflected the disturbed nature of the local and catchment-wide environment (**Appendix D**). Each site scored 1 to 2 (indicative of major influences) in categories associated with the influence of major extractive industry, alteration of riparian vegetation, and point-source wastewater discharge. Influence from intensive agriculture and major dams / weirs were not apparent at any site.

5.2 WATER QUALITY AND HYDROLOGY

5.2.1 Spring 2023 Water Quality

The mean values for each water quality indicator measured at each site in spring 2023 (NCR1, NCR2 and NCR3 on Wangcol Creek and A16 on Coxs River) are presented in **Appendix E**. The results are summarised as follows:

- Temperature ranged from 15.8 °C to 23.5 °C on Wangcol Creek and was 22.9 °C on Coxs River.
- EC ranged from 213 μS/cm to 533 μS/cm on Wangcol Creek and was 1,037 μS/cm on Coxs River. It was above the upper DTV at NRC2 and A16.
- pH ranged from 7.4 to 7.8 on Wangcol Creek and was 7.1 on Coxs River.
- ORP ranged from 101 mV to 122 mV on Wangcol Creek and was 113 mV on Coxs River.
- Dissolved oxygen ranged from 57.6 % to 101.7 % on Wangcol Creek and was 85.5 % and within DTVs on Coxs River. It was below the lower DTV at NCR1, NCR2 and A16.



Turbidity ranged from 15.6 NTU to 95.4 NTU on Wangcol Creek and was 0.0 NTU on Coxs River. It
was below the lower DTV at A16 and above the upper DTV at NCR1 and NCR3.

5.2.2 Long Term Data

Daily discharge data logged at WaterNSW station 212055 (WX22), located on Wangcol Creek immediately downstream of impact site NCR2, from January 2012 to December 2023 (WaterNSW 2024), are presented in **Figure 5-1**. Examination of discharge data alongside daily rainfall logged at BOM station 063132 at Lidsdale (BOM 2024) (**Figure 5-2**), and EC (**Figure 5-3a**) and pH (**Figure 5-3b**) at WX22, NCO1 and LDP6 provided by EnergyAustralia, indicated the following:

- Greater discharge events in Wangcol Creek followed periods of greater rainfall.
- EC measured at WX22 tended to be greater (up to 3,040 μS/cm) and more variable than at NC01 and LDP6 (up to 880 μS/cm).
- The EC at each site was often above the upper DTVs (350 μS / cm). During the majority of 2020, 2021 and 2022, EC did not exceed 1,000 μS/cm. During 2023, EC at WX22 was elevated and often exceeded 1,000 μS/cm.
- The relatively great EC recorded at WX22 in April 2017, January 2018, January 2020 and in 2023 coincided with relatively low rainfall and low discharge. Lower EC at WX22 tended to coincide with periods of high rainfall and discharge. EC at NC01 and LDP6 appeared to be less strongly influenced by rainfall and discharge.
- pH at LDP6, NC01 and WX22 largely remained within DTVs (pH 6.5 to 8.0).
- In some years there was relatively greater variability in pH for some sites, sometimes close to 1 pH unit, and up to 2 pH units (e.g., LDP6 in 2020). The pH at LDP6 was generally greater than that at NC01 and WX22. It also appeared elevated at LDP6 in early 2020.

Patterns in EC and discharge among sites following January 20216 were similar, but less pronounced than for data prior to January 2016 (Cardno Ecology Lab 2015a).

Figure 5-4a to **c** and **Figure 5-5a** and **b** present the concentrations of a selection of heavy metals (those identified previously as exceeding local guidelines or identified as potentially elevated prior to the aquatic ecology surveys (**Section 4.6.1**)) measured at LDP6, NC01 and WX22 on Wangcol Creek between January 2016 and December 2023. These data indicated the following:

- The concentrations of boron and nickel were greater at WX22 than at LDP6 and NC01 during most sampling events.
- Concentrations of boron, nickel and zinc appeared to be elevated at WX22 adjacent to the ash
 placement area during January to February 2018 and January to February 2020. Boron and zinc also
 appeared to be elevated further upstream (i.e., at NC01 and LDP6) at this time.
- Concentrations of zinc, aluminium and copper were elevated above guidelines at LDP6 and NC01 on occasion, with boron, nickel, and zinc all above the guideline value at LDP6 in January 2020. Copper was also elevated at LDP6 in July 2019.
- From around the beginning of 2021 and through to the most recent previous survey in December 2022, there was little evidence substantial elevations greater than observed during 2020 and / or prior. This likely reflects the greater dilution associated with greater rainfall and flow during this time.



 During 2023 and the first six months of 2023 concentrations of boron and nickel, but zinc, copper or aluminium, were elevated (in the case of nickel above the DTV) at WX22. This appeared to coincide with relatively low rainfall, discharge and correspondingly elevated EC.

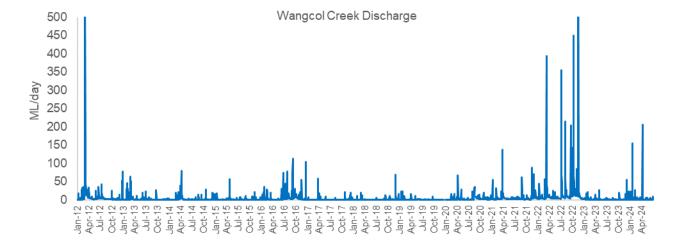


Figure 5-1 Daily discharge at NSW DPI (Water) station 212055 at WX22 on Wangcol Creek January 2012 to December 2023 (WaterNSW 2024). The peak discharge in March 2012 was reported as 2,841 ML/day and on 14 November 2022 as 824 ML/day. For easier interpretation of the other discharge data, the Y axis scale is limited to 500 ML/day.

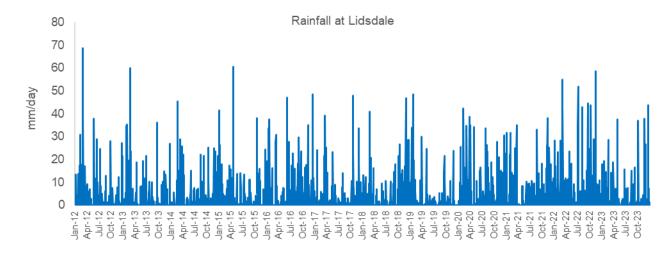
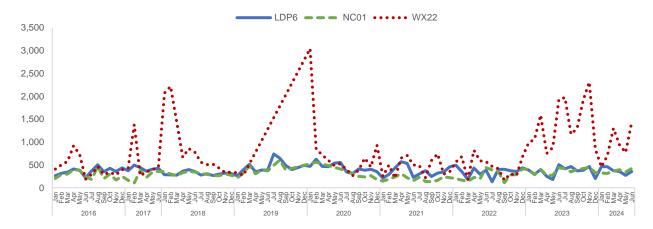


Figure 5-2 Daily rainfall at BOM Lidsdale station 063132 January 2012 to December 2023.

a) Electrical Conductivity (ANZECC/ARMCANZ (2000) DTVs = 30 μ S/cm to 350 μ S/cm)



b) pH (ANZECC/ARMCANZ (2000) DTVs = 6.5 to 8.0)

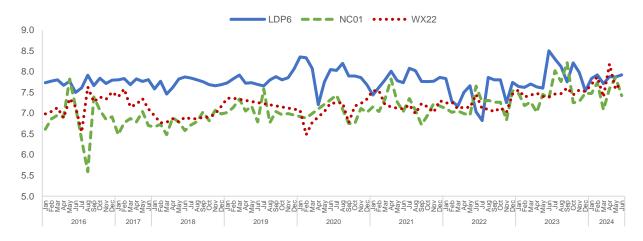
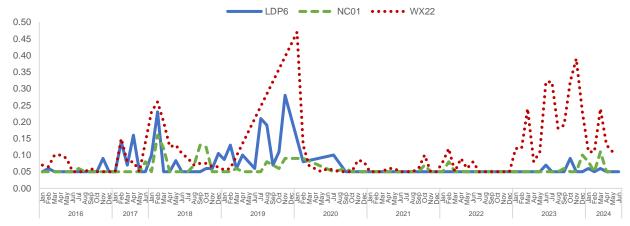
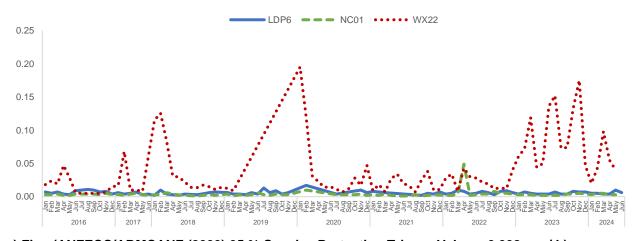


Figure 5-3 a) electrical conductivity and b) pH measured at LDP6, NC01 and WX22 on Wangcol Creek by EnergyAustralia from January 2016 to December 2023.

a) Boron (ANZG 2018) 95 % Species Protection Trigger Value = 0.94 mg / L)



b) Nickel (ANZECC/ARMCANZ (2000) 95 % Species Protection Trigger Value = 0.011 mg / L)



c) Zinc (ANZECC/ARMCANZ (2000) 95 % Species Protection Trigger Value = 0.008 mg / L)

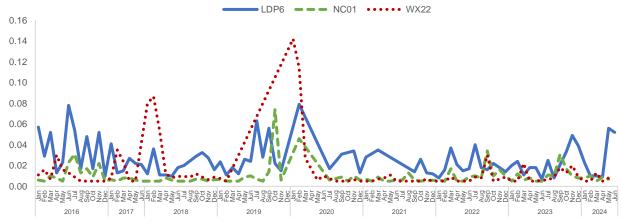
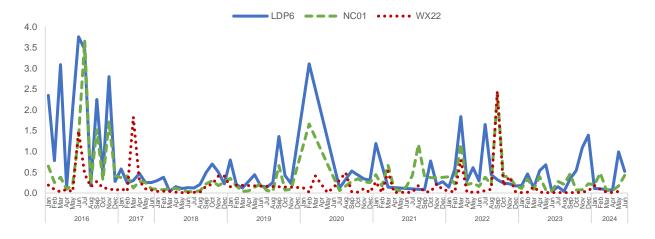


Figure 5-4 Concentration (mg / L) of a) boron, b) nickel and c) zinc measured at LDP6, NC01 and WX22 on Wangcol Creek by EnergyAustralia from January 2016 to December 2023.

a) Aluminium (ANZECC/ARMCANZ (2000) 95 % Species Protection Trigger Value = 0.055 mg / L)





b) Copper (ANZECC/ARMCANZ (2000) 95 % Species Protection Trigger Value = 0.0014 mg/L)

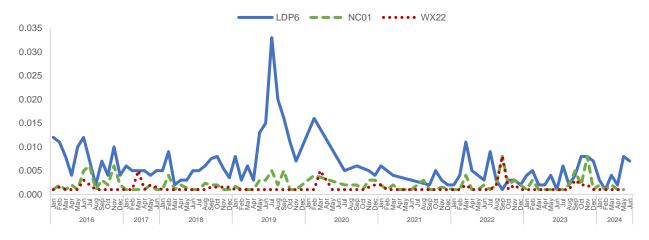


Figure 5-5 Concentration (mg / L) of a) aluminium and b) copper measured at LDP6, NC01 and WX22 on Wangcol Creek by EnergyAustralia from January 2016 to December 2023.

5.3 AUSRIVAS MACROINVERTEBRATES

5.3.1 General Findings

5.3.1.1 Identified Taxa

A total of 47 taxa were identified from the 12 samples collected in spring 2022 (**Appendix F**). Over the course of the EMP, a total of 98 macroinvertebrate taxa have been identified from the 87 edge samples collected in spring. Out of the 84 taxa assigned a SIGNAL2 grade, 64 were assigned a grade of 5 or lower, indicating that most taxa are moderately to very tolerant of pollution. Seven taxa (Athericidae, Gripopterygiidae, Hydrobiosidae, Leptophlebiidae, Telephlebiidae, Glossosomatidae and Philopotamidae) have a SIGNAL2 grade of 8 to 9, indicating they are sensitive to pollution. Leptophlebiidae were found in most samples collected from NCR1, NCR2 and NCR3.



The most common taxa identified from edge samples (those identified in over half all samples from Wangcol Creek and Coxs River) included Dytisidae (diving beetles), Leptophlebiidae (mayflies), Chironomidae (non-biting midge; consisting of the subfamilies: Chironominae, Orthocladiinae and Tanypodinae) and Corixidae (backswimmers). Leptophlebiidae are pollution sensitive; however, most of the other taxa are pollution tolerant (SIGNAL2 grade 2 to 4). Few taxa appeared to be restricted to individual sites or separate watercourses. There was some evidence to suggest that Caenidae are uncommon at NCR1, and that Atyidae are uncommon at A16. These taxa have been assigned SIGNAL2 Grades of 1 to 4. It should be noted, however, that the presence of pollution tolerant taxa does not necessarily indicate poor water quality, as these taxa would be expected to occur in watercourses with good water quality also.

It is worth noting that, in addition to macroinvertebrates, a non-native fish species, eastern gambusia (*Gambusia holbrooki*), was inadvertently caught in the AUSRIVAS dip net in each sample from Wangcol Creek in 2022 and from A16 in 2023. Similarly, an individual of another fish species, mountain galaxiid (*Galaxias olidus*), was inadvertently caught in the AUSRIVAS dip net at NCR3 in 2018 and in 2021, though none were found in 2020, 2022 or 2023.

5.3.1.2 Number of Taxa

The number of macroinvertebrate taxa identified from edge samples has ranged from 10 to 27 at NCR1, 12 to 29 at NCR2, 8 to 25 at NCR3 and 7 to 24 at A16 (Appendix F and Appendix G; Figure 5-6). No site had consistently more or fewer taxa, though there was slight evidence of a decrease in number of taxa at NCR1 and NCR2 through time.

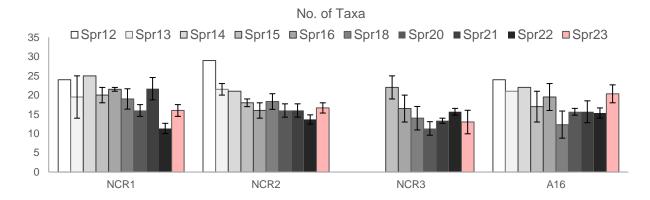


Figure 5-6 Number of Taxa identified in AUSRIVAS samples from each site sampled between spring 2012 and spring 2023 Standard error bars are displayed where n ≥ 2.

5.3.1.3 Number of EPT Taxa

The number of EPT taxa identified from edge samples collected has ranged from 1 to 7 at NCR1 and NCR2, 0 to 6 at NCR3 and 1 to 8 at A16 (**Appendix F** and **Appendix G**; **Figure 5-7**). While the number of EPT taxa sampled at NCR1 and NCR2 has been relatively consistent, larger numbers were sampled at NCR1 in spring 2021 and at NCR2 in spring 2012. Overall, more EPT taxa have been sampled at A16 than at the other sites, particularly NCR3.



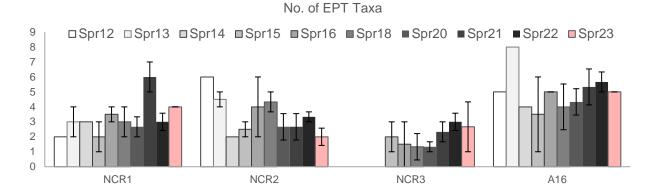


Figure 5-7 Number of EPT Taxa identified in AUSRIVAS samples from each site sampled between spring 2012 and spring 2023 Standard error bars are displayed where n ≥ 2.

5.3.1.4 OE50 Taxa Score

The OE50 Taxa Score has ranged from 0.36 to 0.95 at NCR1, 0.2 to 1.04 at NCR2, 0.19 to 0.85 at NCR3 and 0.34 to 0.91 at A16 (**Appendix F** and **Appendix G**; **Figure 5-8**). OE50 Scores below 0.20 indicate extremely impaired habitat, while scores from 0.20 to 0.51 indicate severely impaired habitat (Band C), from 0.52 to 0.83 indicate significantly impaired habitat (Band B), and from 0.84 to 1.16 indicate habitat equivalent to reference condition (Band A). These results indicated that on all but one occasion (NCR2 in spring 2012) the macroinvertebrate assemblages sampled were less diverse than predicted (i.e., OE50 Taxa Score < 1.0). There was limited evidence to suggest a decrease in OE50 Taxa Score between spring 2012 and spring 2016 at NCR2; however, the OE50 Taxa Score in spring 2018 was relatively high. OE50 Taxa Scores at control sites NCR1 and NCR3 in spring 2020 were also the lowest recorded during the EMP, though there was an apparent increase in the OE50 Taxa Score at these sites in subsequent surveys.

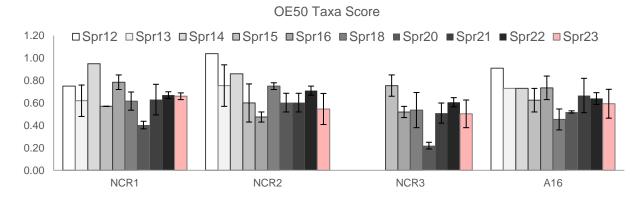


Figure 5-8 OE50 Taxa Scores from AUSRIVAS samples from each site sampled between spring 2012 and spring 2023. Standard error bars are displayed where n ≥ 2.

5.3.1.5 SIGNAL2 Score

The SIGNAL2 Scores ranged from 3.1 to 4.6 (indicative of severe to moderate pollution) at NCR1, 3.4 to 5.0 (indicative of severe to moderate pollution) at NCR2, 2.9 to 5.2 (indicative of severe to mild pollution)



at NCR3 and 3.6 to 5.2 (Indicative of severe to mild pollution) at A16 (**Appendix F** and **Appendix G**; **Figure 5-9**). The SIGNAL2 Score at NCR3 in 2015 was 2.9 and 3.2 (indicative of severe pollution). These results suggest that all of these sites experience some degree of environmental stress due to poor water quality. There were no obvious trends in SIGNAL2 data.

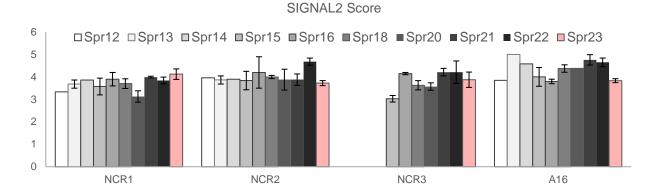


Figure 5-9 SIGNAL2 Scores from AUSRIVAS samples from each site sampled between spring 2012 and spring 2023. Standard error bars are displayed where $n \ge 2$.

5.3.2 Relative Contribution of Taxonomic Groups

The relative contribution of taxonomic groups in edge samples was relatively consistent among sites and surveys, and there was little evidence of any substantial changes in the relative contribution of taxonomic groups occurring at NCR2 that could be indicative of an impact (**Figure 5-10**). Oligochaetes and hydracarina were absent from one of the samples collected at NCR2 in spring 2016. Neither, however, is sensitive to water pollution.

5.3.3 Statistical Analyses

None of the PERMANOVA tests undertaken using data collected from NCR1 and NCR2 in spring of 2013, 2015, 2016, 2018, 2020, 2021, 2022 and 2023 indicated a statistically significant interaction between Survey and Site (**Table 5-1**). There was a statistically significant effect of Survey for Total Number of Taxa, Number of EPT Taxa and multivariate assemblage structure, and of Site for SIGNAL2 Score and multivariate assemblage structure. Statistically significant main effects do not indicate an impact.



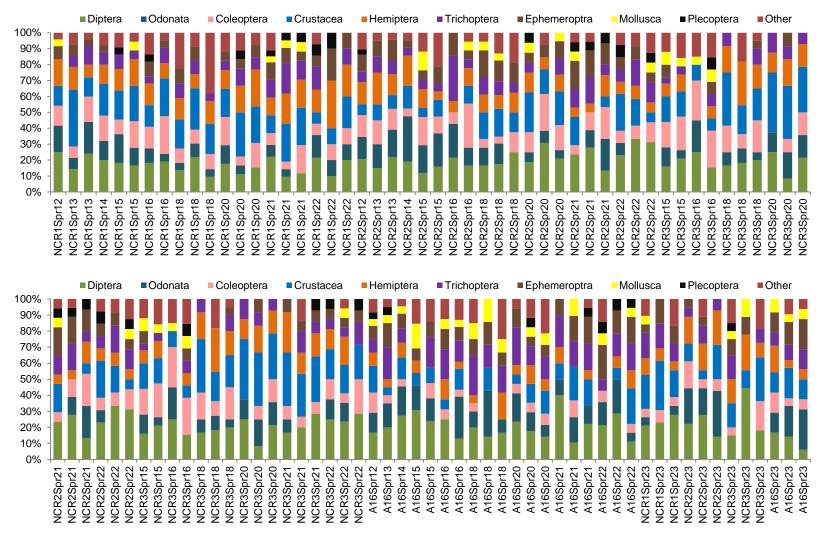


Figure 5-10 Relative contribution of major taxonomic groups identified from AUSRIVAS edge samples collected at NCR1, NCR2 and NCR3 on Wangcol Creek and A16 on the Coxs River during spring of 2013, 2014, 2018, 2020, 2021, 2022 and 2023. 'Other' includes taxa in the Families Pyralidae and Dugesiidae, the Order Temnocephalidae, Subclasses Oligochaeta and Collembola and the taxonomic group Hydracarina.



Table 5-1 Summary of results of PERMANOVA analyses undertaken using AUSRIVAS data collected from NCR1 and NCR2 in spring of 2013, 2015, 2016, 2018, 2020, 2021, 2022 and 2023. * = $P \le 0.05$, ** = $P \le 0.01$, *** = $P \le 0.001$, ns = not statistically significant. See Appendix H for full results.

Indicator	Site	Survey	Survey x Site
Number of Taxa	ns	**	ns
Number of EPT Taxa	ns	*	ns
OE50 Taxa Score	ns	ns	ns
SIGNAL2 Score	*	ns	ns
Assemblage	***	***	ns

None of the PERMANOVA tests undertaken using data collected from all sites in spring of 2015, 2016, 2018, 2020, 2021, 2022 and 2023 indicated a statistically significant interaction between Survey and Site (**Table 5-2**). There was a statistically significant effect of Survey for Number of EPT Taxa and multivariate assemblage structure, and of Site for Number of EPT Taxa, SIGNAL2 Score and multivariate assemblage structure. Statistically significant main effects do not indicate an impact.

Table 5-2 Summary of results of PERMANOVA analyses undertaken using AUSRIVAS data collected from NCR12, NCR2, NCR3 and A16 sampled in spring of 2015, 2016, 2018, 2020, 2021, 2022 and 2023. * = $P \le 0.05$, ** = $P \le 0.01$, *** = $P \le 0.001$, ns = not statistically significant. See Appendix H for full results.

Indicator	Treatment	Survey	Site (Treatment)	Treatment x Survey	Survey x Site (Treatment)
Number of Taxa	ns	ns	ns	ns	ns
Number of EPT Taxa	ns	**	***	ns	ns
OE50 Taxa Score	ns	ns	ns	ns	ns
SIGNAL2 Score	ns	ns	**	ns	ns
Assemblage	ns	**	***	ns	ns

There was also a statistically significant effect of Survey for Total Number of Taxa, Number of EPT Taxa, SIGNAL2 Score, OE50 Taxa Score and of Site for Number of EPT Taxa and SIGNAL2 Score. None of these differences indicated an impact.

The PCoA undertaken for all edge assemblages sampled (except at CR0) during spring of 2012, 2013, 2014, 2015, 2016, 2018, 2020, 2021, 2022 and 2023 is presented in **Figure 5-11**. There is evidence to suggest that assemblages at A16 differed from those at each of the other sites. This is evident in assemblages from A16 tending to group towards the left of the PCoA away from those at the other sites. There was little evidence of other distinct groupings.



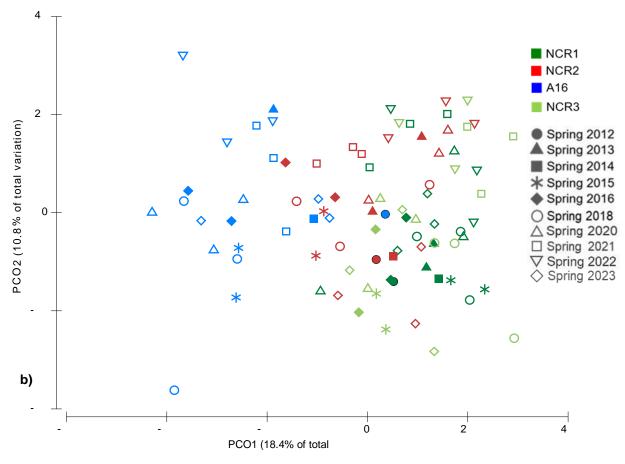


Figure 5-11 a) Principal Coordinates Analysis (PCoA) and b) CLUSTER diagram of AUSRIVAS edge macroinvertebrate assemblages sampled using AUSRIVAS at NCR1, NCR2 and NCR3 on Wangcol Creek and at A16 on Coxs River in spring of 2012, 2013, 2015, 2016, 2018, 2020, 2021, 2022 and 2023.

6.0 DISCUSSION

6.1 AQUATIC HABITAT

The findings of this and previous investigations indicate that aquatic habitat in Wangcol Creek has experienced past degradation due primarily to local industry and historic land clearing. This appears to have been more severe at NCR2, where the condition of the riparian vegetation, creek banks and streambed were poorer compared with those habitats located upstream at NCR1 and NCR3. While these sites have experienced impacts in the past, no further direct impacts to aquatic habitat in Wangcol Creek (e.g., creek realignment, vegetation clearing) attributable to the Project were predicted or have been detected in the current survey in 2022 or previously. Although the current condition of aquatic habitat in Wangcol Creek is not attributable to the Project, the differences in habitat observed between NCR2 and monitoring sites further upstream in Wangcol Creek (NCR1 and NCR3) and the upstream monitoring site



in the Coxs River (A16) could be expected to influence the number and type of macroinvertebrate taxa (and other aquatic biota) found in samples at these sites. Notably, there was greater abundance of riparian and aquatic vegetation at NCR1 and NCR3 compared with NCR2 and A16. The additional food and habitat this would afford may partly explain any differences in the structure of macroinvertebrate assemblages at these sites. The presence of the mountain galaxiid in the dip net at NCR3 in autumn of 2017 and spring of 2018 and 2021 also indicates that the creek is providing habitat for at least one native species of fish.

6.2 WATER QUALITY AND HYDROLOGY

Water quality in Wangcol Creek is influenced by various types of anthropogenic disturbance. This is evident in several indicators (e.g., EC and concentrations of several metals) being outside of default guidelines for the protection of aquatic life. Aurecon (2014) attributed these impacts to previous and current coal mining and power generation activities, among others. While the Project may also be influencing water quality in Wangcol Creek, it has not been possible to discriminate potential changes in water quality associated with the Project from confounding effects of other pre-existing influences (e.g., groundwater seepage from Ash Area 1). The duration and magnitude of elevated measures of some water quality indicators in Wangcol Creek appear to be influenced by flow, which in turn is influenced by patterns in local rainfall (no major flow controlling impoundments are present on Wangcol Creek). During periods of low rainfall and flow, water in Wangcol Creek likely consists of a series of disconnected pools where evaporation results in increased EC and concentrations of metals (Aurecon 2014). Periods of high rainfall and flow will have a diluting effect, thereby reducing the EC and the concentrations of metals. This process likely explains the variation in measures of water quality observed in Wangcol Creek and the elevations in EC and concentrations of metals observed following low rainfall. Differences in the location, duration and magnitude of water quality impairment in Wangcol Creek will depend on a complex set of interactions among anthropogenic influences (e.g., historic and current coal mining activities, power generation and historic land clearing etc.) and local rainfall, discharge and hydrology.

While the relative influence of impacts to water quality from multiple sources in Wangcol Creek remains unclear, the changes that have been observed during the EMP, and variation among sites, would be expected to influence macroinvertebrates (and other aquatic flora and fauna) in the creek. This may have explained the apparent change in biotic indices and structure of the macroinvertebrate assemblage sampled previously at NCR2 in autumn 2013 following the commencement of construction on the Project site (Cardno Ecology Lab 2015a). In any case, elevations in EC at this time were attributed to rainfall and flow patterns in the creek, rather than any impacts due to the Project (Aurecon 2014) (Section 2.3). The depauperate macroinvertebrate assemblage found in Wangcol Creek previously by Battaglia et al. (2005) was attributed to reduced pH (measured at pH 5.1 in Wangcol Creek compared with pH 6.5 to 6.7 in reference creeks), high concentrations of metals, or a combination of these, associated with AMD. pH data collected by EnergyAustralia suggest that, while somewhat variable, pH in Wangcol Creek is generally within DTVs for the protection of aquatic life.

Measures of water quality recorded by Cardno in spring 2023 were generally comparable to those measured previously as part of the EMP by Cardno and others (GHD 2014b to e). Although the EC recorded in Wangcol Creek during the EMP was often above the upper DTV (350 µS/cm), this does not



necessarily mean that this poses a threat to aquatic life. Notably, elevations in EC occurred at both the impact and controls sites, therefore are not indicative of a Project-related impact. The elevated EC noted in 2023 appeared to be localised to WX22 and coincided with lower rainfall and discharge. The relatively lower EC recorded in Wangcol Creek in December 2016 was likely a result of a diluting effect of recent rainfall and higher flows, whereas the elevated EC at WX22 in autumn 2018 and autumn 2020 appeared to be associated with low rainfall.

A review of the sensitivity of Australian freshwater biota to salinity undertaken by Hart et al. (1991) indicates that adverse effects on freshwater macroinvertebrates are likely to become apparent when salinity rises to around 1,000 mg/L (approximately 1,562 μ S/cm). Aquatic macrophytes and riparian plants are slightly more tolerant, being sensitive to salinities from 1,000 mg/L to 2,000 mg/L (1,562 μ S/cm to 3,134 μ S/cm) and above 2,000 mg/L (>3,134 μ S/cm), respectively. Adult fish are tolerant of salinities up to 10,000 mg/L (15,620 μ S/cm). A subsequent review of the effects of increasing salinity on freshwater ecosystems in Australia undertaken by Nielsen et al. (2003) indicates the following:

- Majority of algae do not tolerate salinities > 10,000 mg/L (15,620 μS/cm).
- Diatoms decrease in abundance and richness as salinity increases.
- Freshwater plants tolerate salinities up to 4,000 mg/L (6,250 μS/cm), but adverse effects on growth and development of roots and leaves become apparent above 1,000 mg/L (1,562 μS/cm).
- Macroinvertebrate fauna of rivers appear to be tolerant and resilient to increasing salinity.
- Structurally simple macroinvertebrates such as soft-bodied hydra, insect larvae and molluscs are more sensitive to increased salinity.
- Salinity tolerance testing of 59 macroinvertebrate taxa indicated tolerance ranged from 5,000 to 50,000 mg/L (7,810 to 78,100 μS/cm), with baetid mayflies and macro-crustaceans being the least and most tolerant, respectively.
- A majority of native and introduced fish appear to be tolerant of salinities more than 3,000 mg/L (4,686 µS/cm).

These findings would suggest that for most of the time during the EMP the ECs measured in Wangcol Creek (i.e., approximately 100 to 2,000 μ S/cm), while not ideal, should not have substantial detrimental effects on most macroinvertebrates. Baetid mayflies, which were found to be particularly sensitive to EC, were found in the AUSRIVAS samples collected from Wangcol Creek at NCR2 in May 2020, following recent elevated EC of 3,040 μ S/cm in January 2020 a few 10s of metres downstream at WX22 (Cardno 2020).

Water quality data recorded in 2023 indicated that concentrations of boron and nickel were elevated at WX22, just downstream of impact Site NCR2. Elevated concentrations of some metals were also detected at WX22 adjacent to the ash placement area in early 2018 and early 2020. Elevations in the concentrations of some metals were detected around March 2015, though by the time of the 2015 survey concentrations of these were no longer elevated. Elevations in the concentrations of barium, nickel, aluminium, and zinc in Wangcol Creek have also been previously detected, including prior to previous aquatic ecology investigations. No clear association between water quality and macroinvertebrate data was found during previous surveys, nor during the current survey (Section 2.3). While concentrations of



metals have on occasion been elevated at some sites on Wangcol Creek (**Section 5.2.2**), there was no evidence of any associated effect on macroinvertebrates (**Section 6.3**). The previous finding of a reduction in the number of EPT taxa at NCR2 between autumn 2018 and autumn 2020 could, however, be related to observed changes in water quality in early 2020 (Cardno 2020 and **Section 6.2**).

It is unlikely that any potential impact to water quality due to the Project could be completely isolated from background impacts associated with historic and current coal mining, power generation and historic land clearing activities. A complex interaction between the specific characteristics of each impact (in terms of type and magnitude of impact to water quality), local rainfall, flow and hydrology and water quality in Wangcol Creek would make it almost impossible to definitively attribute any change in water quality, and thus any effect on macroinvertebrates, to the Project. Nevertheless, the collection and interpretation of water quality data during monitoring of aquatic ecology should help in identifying the cause of any changes detected in macroinvertebrate data indicative of an impact. This information would help target any future impact minimisation and remediation efforts.

6.3 MACROINVERTEBRATES

6.3.1 General Findings

The general findings of the current study support those of previous investigations. The macroinvertebrate assemblage supported by Wangcol Creek appears to experience some degree of environmental stress. This is evident in OE50 Taxa Scores and AUSRIVAS Bands generally indicative of macroinvertebrate assemblages that are less diverse than predicted by the AUSRIVAS model, and thus also indicative of relatively poor aquatic habitat and / or water quality. Low individual taxon SIGNAL2 grades and SIGNAL2 indices are also indicative of severe to moderate pollution.

Despite this, some pollution sensitive taxa were also identified. This suggests that while the macroinvertebrate assemblage does experience some degree of environmental stress due to poor habitat and water quality, conditions are not as severe as may be expected considering the sometimes very poor water quality of Wangcol Creek (with several indicators often measured outside of guidelines for the protection of aquatic life) and the degree of historic habitat modification it has experienced. The aquatic ecology of Wangcol Creek also does not appear to be particularly poor in a regional context. AUSRIVAS data collected from Wangcol Creek were comparable to those collected from A16 on the Coxs River, which has been subjected to, and continues to experience similar disturbances (i.e., impacts to water quality and the condition of riparian vegetation) to those in Wangcol Creek. These results were also comparable to those of the ongoing Coxs River Biological Monitoring Program, where the AUSRIVAS Bands at sites on the Coxs River downstream of Wangcol Creek during 2011 to 2022 ranged from Band C to Band B, with most sites on most occasions assigned B (Cardno 2021; 2022).

The presence of Leptophlebiidae in edge samples collected from Wangcol Creek, including in each sample collected from NCR2 in autumn 2020 (Cardno 2020b), in one of the three samples from NCR2 in spring 2020 (Cardno 2020), from all three samples from NCR2 in 2021 (Cardno 2022) and 2022 (Stantec 2023), and in one of the three samples from NCR2 in the current study, also suggests that the effect of poor water quality on macroinvertebrate fauna in the creek is somewhat limited. Previously, in the



Georges River, fewer leptophlebiids have been associated with elevated ECs attributed to mine water discharge (Cardno Ecology Lab 2010a and references therein). This study, and the findings of an Australian Coal Industry Research Program (ACARP) funded study into the effects of saline water discharge on aquatic biota in the Southern and Hunter Coalfields of NSW (Cardno Ecology Lab 2010b), also suggested that elevated EC can influence the abundance of aquatic macroinvertebrates.

While low pH was suggested as a possible cause of depauperate macroinvertebrate assemblages in Wangcol Creek in an earlier study done by Battaglia *et al.* (2005), pH has generally found to have more recently been greater than this and largely within DTVs throughout the EMP. The findings here are similar to those of Soucek *et al.* (2000), where the abundance and diversity of macroinvertebrates was found to be reduced in streams affected by acid mine discharge, irrespective of pH, suggesting other factors such as metal toxicity were more likely responsible.

Any inferences regarding the role of water quality in influencing macroinvertebrates in Wangcol Creek must be made with caution as several other measures of water quality not considered here, such as concentrations of nutrients, or a combination of these, may also be having an influence. It is also likely that assemblages sampled through time on Wangcol Creek (and any other watercourse) are not independent, potentially confounding any associated inferences. It is also possible that the macroinvertebrate fauna present in Wangcol Creek have, over time, become tolerant to impaired water quality and that any short-term elevations in otherwise already elevated measures may have a limited observable effect.

6.3.2 Changes in Macroinvertebrates

PERMANOVA tests did not indicate any Project-related changes to macroinvertebrate assemblages in spring 2023. Likewise, there was no evidence of any trends in data collected in spring that could be indicative of an impact occurring. This is consistent with the findings of previous investigations in spring (**Section 2.3**).

As was the case in spring 2020 (Cardno 2020b), spring 2021 (Cardno 2022a) and spring 2022 (Stantec 2023) and the current study in spring 2023, there was no evidence of a repeat of the reduction in SIGNAL2 Score observed previously in autumn 2020 (Cardno 2020). Overall, data collected over the course of the EMP does not suggest any Project-related impact to macroinvertebrates in Wangcol Creek has occurred. There was also no indication that the apparent elevation in concentrations of boron and nickel at WX22 during 2023 has impacted on indicators of aquatic quality monitored in the EMP. The low OE50 Taxa Score at control sites NCR1 and NCR3 noted in spring 2020 (also the lowest recorded during the EMP (Cardno 2020b)), was not repeated at these sites in spring 2021, 2022 (Cardno 2022a, Stantec 2023) or in the current study in spring 2023.

Previously, the only other evidence of an impact occurring in data collected in spring and autumn was the apparent reduction in the total number of taxa and the number of EPT taxa, a lower OE50 Taxa Score and a change in the structure of the macroinvertebrate assemblage observed at NCR2 in autumn 2013 (**Section 2.3**). However, these observations could not be supported by statistical tests and, in any case, there was evidence of a recovery following that survey. Notably, such changes were not evident in the



current study. Although a statistically significant interactive effect of Site and Survey was detected in the spring 2021 and spring 2022 multivariate assemblage data analysed previously (Cardno 2022a, Stantec 2023), examination of pairwise tests provided no evidence to suggest this was related to the Project. In isolation, significant differences between pairs of surveys at control sites, and between control sites during individual surveys, do not provide conclusive evidence of an impact.



7.0 CONCLUSION AND RECOMMENDATIONS

There was no evidence to suggest a change in macroinvertebrate indicators has occurred at NCR2 in spring 2023 that could be associated with the Project. Furthermore, the condition of aquatic habitat and biota at NCR2 did not differ substantially from the habitat upstream of the Project. There was also no evidence to indicate that the reduction in SIGNAL2 Score that occurred at NCR2 in autumn 2020 persisted to or was repeated in spring of 2020, 2021, spring 2022 or spring 2023.

The complex interaction that exists between the various types of disturbances experienced in Wangcol Creek make any associated changes in water quality and / or macroinvertebrates difficult to distinguish from changes attributable to the Project. Nevertheless, the EMP adds value to the wider monitoring program, and it is expected that any large-magnitude and / or cumulative impacts to aquatic biota would be detected, allowing appropriate management actions to be implemented. Recent changes to the monitoring of aquatic ecology, including the addition of two further macroinvertebrate control sites, will assist in identifying any future impacts, were they to occur, and help inform future impact minimisation and remediation efforts as necessary.

The following recommendations will help to ensure the robustness of the EMP and the detection of potential impacts on aquatic ecology due to the Project:

- 1. Based on Condition B7 of the Project Approval, ongoing monitoring should continue throughout the life of the project (including operation), and for at least two (2) sampling periods following ash placement. Thus, it is recommended that sampling continue with the next event to be undertaken in spring 2024.
- Sampling should continue at the additional control site established on Wangcol Creek (NCR3).
 While no baseline data is available from this site, control data collected here during future surveys would improve the power of statistical tests and aid in the detection of impacts.
- 3. Continue collecting three replicate AUSRIVAS samples from each site during all future surveys. This will provide a measure of the variation present at each site, improving the ability to detect any future impact by enabling the use of appropriate statistical analysis.

At this stage no Project-specific mitigation, impact minimisation or ameliorative actions are recommended.



8.0 REFERENCES

- ANZECC and ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy No. 4, Australian and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand, October 2000.
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. October 2023, https://www.waterquality.gov.au/anz-guidelines.
- Anderson, M.J., Gorley, R.N. and Clarke, K.R. (2008). PERMANOVA+ for PRIMER: Guide to Software and Statistical Methods. Primer-E, Plymouth.
- Aurecon (2014). Lamberts North Water Conditioned Fly Ash Placement Water Quality Monitoring. Annual Update Report 2013/14.
- Aurecon (2015). Lamberts North Water Conditioned Fly Ash Placement Water Quality Monitoring. Annual Update Report for 2014/15.
- Battaglia, M., Hose, G. C., Turak, E., & Warden, B. (2005). Depauperate macroinvertebrates in a mine affected stream: clean water may be the key to recovery. *Environmental Pollution*, **138(1)**, 132-141.
- BOM (2024). Website. Bureau Home. Climate. Climate Data Online. http://www.bom.gov.au/climate/data/. Accessed 9-07-24.
- Cardno (2016a). Neubecks Creek EMP Spring 2012 to Spring 2015. Prepared for EnergyAustralia NSW
- Cardno (2016b). Coxs River Biological Monitoring Program. 2011 to 2015. Prepared for EnergyAustralia NSW
- Cardno (2017). Neubecks Creek EMP Spring 2012 to Spring 2016. Prepared for EnergyAustralia NSW
- Cardno (2017). Neubecks Creek EMP Spring 2012 to Spring 2016. Prepared for EnergyAustralia NSW
- Cardno (2018). Neubecks Creek EMP Autumn 2013 2012 to Autumn 2018. Prepared for EnergyAustralia NSW
- Cardno (2019). Neubecks Creek EMP Spring 2012 to Spring 2018. Prepared for EnergyAustralia NSW
- Cardno (2020). Wangcol Creek EMP Autumn 2013 to Autumn 2020. Prepared for EnergyAustralia NSW
- Cardno (2021). Neubecks Creek EMP Spring 2012 to Spring 2020. Prepared for EnergyAustralia NSW



- Cardno (2022a). Neubecks Creek EMP Spring 2012 to Spring 2021. Prepared for EnergyAustralia NSW
- Cardno (2022b). Coxs River Biological Monitoring Program. March 2002 to June 2022. Prepared for EnergyAustralia NSW
- Cardno Ecology Lab (2010a). West Cliff Colliery. Pollution Reduction Program 10 Discharge of Water from Brennans Creek Dam. PRP 10.1 Report. Prepared for BHP Billiton Illawarra Coal.
- Cardno Ecology Lab (2010b). Effects of Mine Water Salinity on Freshwater Biota. Report to the Australian Coal Association Research Program. January 2010
- Cardno Ecology Lab (2014). Wangcol Creek EMP. Critical Review. Prepared for EnergyAustralia NSW.
- Cardno Ecology Lab (2015a). Wangcol Creek EMP Spring 2012 to Spring 2014. Prepared for EnergyAustralia NSW
- Chessman, B.C Growns, J.E and Kotlash, A.R. (1997). Objective derivation of macroinvertebrate family sensitivity grade numbers for the SIGNAL biotic index: Application to the Hunter River system, New South Wales. Marine and Freshwater Research, 48, pp. 159-172.
- Chessman (2003). SIGNAL2.iv. A Scoring System for Macroinvertebrates ('Water Bugs)' in Australian Rivers. User Manual. September 2003.
- Clarke K.R. and Gorley R.N. (2006). Primer V6: User Manual/Tutorial. Primer-E, Plymouth.
- DECCW (2010). 2010 Audit of the Sydney Drinking Water Catchment. Volume 1 Main report.
- DWR (1994). Aquatic Flora and Fauna Survey of Wangcol Creek. Consultancy Report prepared for Pacific Power by the Environmental Studies Unit, Department of Water Resources, Parramatta, NSW. June 1994. pp. 25.
- SCA (2010). Audit of the Sydney Drinking Water Catchment, Volume 1 Main Report, pp. 227. (http://www.environment.nsw.gov.au/resources/water/10973AuditSDWCvol1.pdf.)
- Coysh, J, Nichols, S. Ransom, G., Simpson, J., Norris, R., Barmuta, L. and Chessman, B. (2000). AUSRIVAS Macroinvertebrate Bioassessment Predictive Modelling Manual.
- Centennial Coal (2012). The Neubeck Coal Project. Briefing Paper.
- GHD (2013). 2013 Audit of the Sydney Drinking Water Catchment.
- GHD (2014a). Wangcol Creek Ecological Monitoring Program. Report Prepared for Delta Electricity. Rev 2 July 2014.
- GHD (2014b). Wangcol Creek Ecological Monitoring Program. Aquatic Ecosystem Baseline Survey Spring 2012. Rev 2 July 2014.



- GHD (2014c). Wangcol Creek Ecological Monitoring Project. Aquatic Ecosystem Annual Report 2012-2013. Rev 3 July 2014.
- GHD (2014d). Wangcol Creek Ecological Monitoring Project. Aquatic Ecosystem Report Spring 2013. Final March 2014.
- GHD (2014e) Wangcol Creek Ecological Monitoring Project. Aquatic Ecosystem Report Autumn 2014. Rev 1 September 2014.
- Hart, B.T., Bailey, P., Edwards, R., Hortle, K., James, K., McMahon, A., Meredith, C., and Swadling, K. (1991). A review of the salt sensitivity of the Australian freshwater biota. *Hydrobiologia* **210**: pp. 105-144.
- Nielsen, D.L., Brock, M.A., Rees, G.N. and Baldwin, D.S. (2003). Effects of increasing salinity on freshwater ecosystems in Australia. *Australian Journal of Botany* **51**: pp. 655-665.
- Peterson, R.C. (1992). The RCE: a Riparian, Channel, and Environmental Inventory for small streams in the agricultural landscape. Freshwater Biology, 27, pp. 295-306.
- QLD Department of Natural Resources and Mines (DNRM) (2001). National River Health Program.

 Australia-Wide Assessment of River Health: Queensland AUSRIVAS Sampling and Processing Manual. Monitoring River Health Initiative Technical Report. Report Number 12.
- SKM (2010). Mt Piper Power Station Ash Placement Project. Environmental Assessment. Sinclair Knight Mertz. Prepared for EnergyAustralia NSW.
- Soucek, D.J., Cherry, D.S., Currie, R.J., Latimer, H.A., Trent, G.C. (2000). Laboratory to Field Validation in an Intergrative Assessment of an Acid Mine Drainage Impacted Watershed. *Environmental Toxicology and Chemistry*, **19**: pp. 1036-1043.
- Stantec (223). Wangcol Creek EMP Spring 2012 to Spring 2022. Prepared for EnergyAustralia.
- Turak, E., Waddell, N. and Johnstone, G. (2004). New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual. Environmental Protection Authority. pp. 45.
- WaterNSW (2024). Website. Real Time Data. Rivers and Streams. https://realtimedata.waternsw.com.au/. Accessed 9-07-24



APPENDICES

Wangcol Creek EMP 2012-2023

Appendix A GPS COORDINATES OF AQUATIC ECOLOGY MONITORING SITES FOR THE WANGCOL CREEK EMP

Appendix A GPS COORDINATES OF AQUATIC ECOLOGY MONITORING SITES FOR THE WANGCOL CREEK EMP

Site	Latitude	Longitude
NCR1	-33.35061	150.04753
NCR2	-33.35822	150.05704
NCR3	-33.35205	150.04852
A16	-33.38001	150.07990
CR0	-33.32678	150.09817

Datum: WGS 84, Zone 56H



Appendix B Reference Condition Selection Criteria

Appendix B REFERENCE CONDITION SELECTION CRITERIA

No.	Reference Condition Selection Criteria Category	Comment
1	Influence of intensive agriculture upstream	Intensive agriculture is that which involves irrigation, widespread soil disturbance, use of agrochemicals and pine plantations. Dry-land grazing does not fall into this category.
2	Influence of major extractive industry (current or historical) upstream	This includes mines, quarries and sand/gravel extraction.
3	Influence of major urban area upstream	This will be relative to population size, river size and distance between the site and the impact.
4	Influence of significant point-source wastewater discharge upstream	Exceptions can be made for small discharges into large rivers.
5	Influence of dam or major weir	Sites within the ponded area of impoundments also fail.
6	Influence of alteration to seasonal flow regime	This may be due to abstraction or regulation further upstream than the coverage by Criterion 5. Includes either an increase or decrease in seasonal flow.
7	Influence of alteration to riparian zone	Riparian vegetation should be intact and dominated by native species.
8	Influence of erosion and damage by stock on riparian zone and banks	Stock damage to the stream bed may be included in this category.
9	Influence of major geomorphological change on stream channel	Geomorphological change includes bank slumping, shallowing, braiding and unnatural aggradation or degradation.
10	Influence of alteration to in-stream conditions and habitats	This may be due to excessive algal and macrophyte growth, by sedimentation and siltation, by reduction in habitat diversity by drowning or drying out of habitats (e.g. riffles) or by direct access of stock into the river



Appendix C RIVER, CHANNEL AND ENVIRONMENTAL (RCE) CATAGORIES

Appendix C RIVER, CHANNEL AND ENVIRONMENTAL (RCE) CATAGORIES

1. Land use pattern bevond the immediate riparian zone Undisturbed native vegetation 4 Mixed native vegetation and pasture/exotics 3 Mainly pasture, crops or pine plantation 2 Urban 1 2. Width of riparian strip of woody vegetation More than 30 m 4 Between 5 and 30 m 3 Less than 5 m 2 No woody vegetation 1 3. Completeness of riparian strip of woody vegetation Riparian strip without breaks in vegetation 4 Breaks at intervals of more than 50 m 3 Breaks at intervals of 10 - 50 m 2 Breaks at intervals of less than 10 m 1 4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4 Banks firm but held mainly by grass and herbs 3
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Riparian strip without breaks in vegetation 4 Breaks at intervals of more than 50 m 3 Breaks at intervals of 10 - 50 m 2 Breaks at intervals of less than 10 m 1 4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Breaks at intervals of more than 50 m 3 Breaks at intervals of 10 - 50 m 2 Breaks at intervals of less than 10 m 1 4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Breaks at intervals of 10 - 50 m 2 Breaks at intervals of less than 10 m 1 4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Breaks at intervals of less than 10 m 1 4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
4. Vegetation of riparian zone within 10 m of channel Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Native tree and shrub species 4 Mixed native and exotic trees and shrubs 3 Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Mixed native and exotic trees and shrubs Exotic trees and shrubs Exotic grasses / weeds only 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Exotic trees and shrubs 2 Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Exotic grasses / weeds only 1 5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
5. Stream bank structure Banks fully stabilised by trees, shrubs etc. 4
Banks fully stabilised by trees, shrubs etc. 4
Banks firm but held mainly by grass and herbs 3
Banks loose, partly held by sparse grass etc. 2
Banks unstable, mainly loose sand or soil 1
6. Bank undercutting
None, or restricted by tree roots 4
Only on curves and at constrictions 3
Frequent along all parts of stream 2
Severe, bank collapses common 1
7. Channel form
Deep: width / depth ratio < 7:1 4
Medium: width / depth ratio 8:1 to 15:1 3
Shallow: width / depth ratio > 15:1 2
Artificial: concrete or excavated channel 1

Descriptor and category	Score
8. Riffle / pool sequence	
Frequent alternation of riffles and pools	4
Long pools with infrequent short riffles	3
Natural channel without riffle / pool sequence	2
Artificial channel; no riffle / pool sequence	1
9. Retention devices in stream	
Many large boulders and/or debris dams	4
Rocks / logs present; limited damming effect	3
Rocks / logs present, but unstable, no damming	2
Stream with few or no rocks / logs	1
10. Channel sediment accumulations	
Little or no accumulation of loose sediments	4
Some gravel bars but little sand or silt	3
Bars of sand and silt common	2
Braiding by loose sediment	1
11. Stream bottom	
Mainly clean stones with obvious interstices	4
Mainly stones with some cover of algae / silt	3
Bottom heavily silted but stable	2
Bottom mainly loose and mobile sediment	1
12. Stream detritus	
Mainly un-silted wood, bark, leaves	4
Some wood, leaves etc. with much fine detritus	3
Mainly fine detritus mixed with sediment	2
Little or no organic detritus	1
13. Aquatic vegetation	
Little or no macrophyte or algal growth	4
Substantial algal growth; few macrophytes	3
Substantial macrophyte growth; little algae	2
Substantial macrophyte and algal growth	1



Appendix D RESULTS OF RCSC AND RCE ASSESSMENTS

Appendix D RESULTS OF RCSC AND RCE ASSESSMENTS

River, Channel and Environmental (RCE) Category in spring 2021)				Site
	NCR1	NCR2	NCR3	A16
Land use pattern beyond the immediate riparian zone	3	2	3	2
Width of riparian strip of woody vegetation	3	2	3	1
Completeness of riparian strip of woody vegetation	2	1	2	1
Vegetation of riparian zone within 10 m of channel	3	2	3	1
Stream bank structure	3	1	3	2
Bank undercutting	4	1	4	3
Channel form	3	3	3	4
Riffle / pool sequence	2	2	2	4
Retention devices in stream	3	1	3	2
Channel sediment accumulations	2	2	2	4
Stream bottom	3	3	3	4
Stream detritus	3	2	3	2
Aquatic vegetation	2	3	2	3
Total	36	25	36	33
Reference Condition Selection Criteria Category				Site
	NCR1	NCR2	NCR3	A16
Influence of intensive agriculture upstream	5	5	5	5
Influence of major extractive industry (current or historical) upstream	1	1	1	1
Influence of major urban area upstream	3	3	3	5
Influence of significant point-source wastewater discharge upstream	2	2	2	2
Influence of dam or major weir	5	5	5	5
Influence of alteration to seasonal flow regime	3	3	3	3
Influence of alteration to riparian zone	1	1	1	1
Influence of erosion and damage by stock on riparian zone and banks	5	5	5	3
Influence of major geomorphological change on stream channel	3	1	3	2
Influence of alteration to in-stream conditions and habitats	3	3	3	3

^{1 =} Very major impact, 2 = Major impact, 3 = Moderate impact, 4 = Minor impact, 5 = Indiscernible impact



Appendix E MEAN WATER QUALITY DATA FROM SITES NCR1, NCR2, NCR3 AND A16 SAMPLED SPRING 2022

Appendix E MEAN WATER QUALITY DATA FROM SITES NCR1, NCR2, NCR3 AND A16 SAMPLED SPRING 2022

Measure	DTV		NCR1		NCR2		NCR3		A16
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Temperature	n/a	15.8	0.0	23.5	0.0	15.8	0.0	22.9	0.0
Conductivity	30-350	221	0	533	0	213	0	1,037	0
pН	6.5-8.0	7.4	0.0	7.8	0.0	7.7	0.0	7.1	0.0
ORP (mV)	n/a	122	0.0	101	0.0	113	0.0	113	0.0
DO (% Sat)	90-110	57.6	0.0	101.7	0.0	57.9	0.0	85.5	0.0
Turbidity (NTU)	2-25	95.4	0.0	15.6	0.0	59.0	0.0	0.0	0.0

DTV: Default Trigger Values for slightly disturbed upland rivers in southeast Australia (ANZECC/ARMCANZ 2000). Grey shading indicates measure outside of DTVs



Appendix F RAW AUSRIVAS DATA SPRING 2023

Appendix F RAW AUSRIVAS DATA SPRING 2023

Site	NCR1	NCR1	NCR1	NCR2	NCR2	NCR2	NCR3	NCR3	NCR3	A16	A16	A16
Rep		2	3		2	3		2	3		2	3
Taxon												
Lvmnaeidae	1						4			2		
Physidae								1		2	2	1
Hirudinidae											1	
Cladocera	10	10	10			2	1			1	4	4
Copepoda	1	3	10	2			6	2	2	1	2	
Ostracoda	2	10	10_			1	1		1	1	1	1
Atvidae	2	10	2	2	1	2			2		5	<u>_</u>
Hvdracarina	2	<u></u>	2		1		2		1		1	
Caenidae		5					1	1		2	5	1
Baetidae			1		2					3	2	8
Leptophlebiidae	1	4	5	1			2			<u>3</u> 4	10	4
Coenagrionidae		4_		1						2	10	4
	l l			1	1	2					1	
Megapodagrionidae Comphidae				1 1	1 1	<u>3</u>						
Gomphidae						1				3	40	2
Aeshnidae			1_	5	7					8	10	4
Hemicorduliidae												1
Svnthemistidae						3					1	
Aphididae						1	1	3	2	4		
Gelastocoridae					1					1		
Corixidae		7		6		7				2	1_	
Notonectidae	1		2	2	2	2	3			3		1
Dvtiscidae	2	6	2	3	2	4				2	2	
Hvdrophilidae				1_					2	1_		1
Scirtidae				3						1_		
Dixidae	1	1_	4				1			2		
Chironominae	5	9	10	1_	5	2	4	4	2	4	44	
Tanvpodinae	1		2	6	9					2	5	
Simuliidae											9	2
Stratiomyidae			4							1		
Hvdroptilidae	10	2			1		3			1_	1_	1
Leptoceridae	1	1	2	2	2	2	2			4	10	9
Pyralidae												1
<u>Lymnaeidae</u>	1						4			2		
Physidae								1		2	2	1
<u>Hirudinidae</u>											1	
Cladocera	10	10	10			2	1			1	4	4
Copepoda	1	3	10	2			6	2	2	1_	2	
Ostracoda	2	10				1	1		11	1_	11	1
<u>Atvidae</u>	2	1	2	2	1	2			2		5	
<u>Hydracarina</u>	2		2		1		2		1		1	
Caenidae		5					1	1		2	5	1
Baetidae			1		2					3	2	8
Leptophlebiidae	1	4	5	1			2			4	10	4
Coenagrionidae	1			1						2	1	1
Megapodagrionidae				1	1	3					1	
Gomphidae				1	1	1				3		2
Aeshnidae			1	5	7					8	10	4
					-							

Note: a maximum of 10 individuals were counted per sample.



Appendix G AUSRIVAS BIOTIC INDICES 2012 to 2023

Appendix G AUSRIVAS BIOTIC INDICES 2012 TO 2023

Date	AUSRIVAS Season	No. of Taxa	No. of EPT Taxa	OE50 Taxa Score	AUSRIVAS Band	SIGNAL2 Score
NCR1						
8 Nov 2012	Spring 2012 Rep 1	24	2	0.75	В	3.3
12 Dec 2013	Spring 2013 Rep 1	14	2	0.48	С	3.5
12 Dec 2013	Spring 2013 Rep 2	25	4	0.76	В	3.9
19 Nov 2014	Spring 2014 Rep 1	25	3	0.95	Α	3.9
14 Dec 2015	Spring 2015 Rep 1	22	3	0.57	В	3.9
14 Dec 2015	Spring 2015 Rep 2	18	1	0.57	В	3.2
1-2 Dec 2016	Spring 2016 Rep 1	22	4	0.85	Α	3.6
1-2 Dec 2016	Spring 2016 Rep 2	21	3	0.72	В	4.2
11 Dec 2018	Spring 2018 Rep 1	20	4	0.75	В	3.9
11 Dec 2018	Spring 2018 Rep 2	23	4	0.63	В	3.9
11 Dec 2018	Spring 2018 Rep 3	14	1	0.47	С	3.3
18 Nov 2020	Spring 2020 Rep 1	17	2	0.47	С	3.1
18 Nov 2020	Spring 2020 Rep 2	18	4	0.36	С	3.2
18 Nov 2020	Spring 2020 Rep 3	13	2	0.38	С	3.1
16 Nov 2021	Spring 2021 Rep 1	27	7	0.85	Α	3.9
16 Nov 2021	Spring 2021 Rep 2	21	7	0.66	В	4.1
16 Nov 2021	Spring 2021 Rep 3	17	4	0.38	С	4.0
7 Dec 2022	Spring 2022 Rep 1	14	4	0.64	В	4.1
7 Dec 2022	Spring 2022 Rep 2	10	3	0.64	В	3.9
7 Dec 2022	Spring 2022 Rep 3	10	2	0.73	В	3.6
5 Dec 2023	Spring 2023 Rep 1	18	4	0.69	В	3.8
5 Dec 2023	Spring 2023 Rep 2	13	4	0.60	В	4.6
5 Dec 2023	Spring 2023 Rep 3	17	4	0.69	В	4.1
NCR2						
8 Nov 2012	Spring 2012 Rep 1	29	6	1.04	А	4.0
12 Dec 2013	Spring 2013 Rep 1	20	4	0.57	В	3.7
12 Dec 2013	Spring 2013 Rep 2	23	5	0.94	А	4.0
19 Nov 2014	Spring 2014 Rep 1	21	2	0.86	А	3.9
14 Dec 2015	Spring 2015 Rep 1	17	2	0.43	С	3.4
14 Dec 2015	Spring 2015 Rep 2	19	3	0.77	В	4.3
1-2 Dec 2016	Spring 2016 Rep 1	14	6	0.52	В	4.9
1-2 Dec 2016	Spring 2016 Rep 2	18	2	0.43	С	3.5
11 Dec 2018	Spring 2018 Rep 1	18	5	0.69	В	3.9
11 Dec 2018	Spring 2018 Rep 2	22	5	0.78	В	4.1



Appendix G AUSRIVAS BIOTIC INDICES 2012 to 2023

Date	AUSRIVAS Season	No. of Taxa	No. of EPT Taxa	OE50 Taxa Score	AUSRIVAS Band	SIGNAL2 Score
11 Dec 2018	Spring 2018 Rep 3	15	3	0.78	В	4.0
18 Nov 2020	Spring 2020 Rep 1	16	3	0.52	В	3.5
18 Nov 2020	Spring 2020 Rep 2	13	1	0.52	В	3.7
18 Nov 2020	Spring 2020 Rep 3	19	4	0.77	В	4.4
16 Nov 2021	Spring 2021 Rep 1	17	6	0.66	В	4.4
16 Nov 2021	Spring 2021 Rep 2	18	7	0.81	В	4.5
16 Nov 2021	Spring 2021 Rep 3	15	4	0.66	В	4.3
7 Dec 2022	Spring 2022 Rep 1	13	3	0.76	В	5.0
7 Dec 2022	Spring 2022 Rep 2	12	3	0.74	В	4.5
7 Dec 2022	Spring 2022 Rep 3	16	4	0.63	В	4.5
5 Dec 2023	Spring 2023 Rep 1	18	2	0.67	В	3.6
5 Dec 2023	Spring 2023 Rep 2	18	3	0.70	В	3.9
5 Dec 2023	Spring 2023 Rep 3	14	1	0.27	С	3.6
NCR3						
14 Dec 2015	Spring 2015 Rep 1	25	3	0.85	А	3.2
14 Dec 2015	Spring 2015 Rep 2	19	1	0.66	В	2.9
1-2 Dec 2016	Spring 2016 Rep 1	20	0	0.47	С	4.2
1-2 Dec 2016	Spring 2016 Rep 2	13	3	0.57	С	4.1
11 Dec 2018	Spring 2018 Rep 1	12	1	0.38	С	3.8
11 Dec 2018	Spring 2018 Rep 2	10	0	0.38	С	3.2
11 Dec 2018	Spring 2018 Rep 3	20	3	0.85	А	3.9
18 Nov 2020	Spring 2020 Rep 1	8	1	0.28	С	4.5
18 Nov 2020	Spring 2020 Rep 2	12	2	0.19	D	3.1
18 Nov 2020	Spring 2020 Rep 3	14	1	0.19	D	3.1
16 Nov 2021	Spring 2021 Rep 1	12	1	0.36	С	4.1
16 Nov 2021	Spring 2021 Rep 2	14	3	0.50	С	4.0
16 Nov 2021	Spring 2021 Rep 3	14	3	0.67	В	4.5
7 Dec 2022	Spring 2022 Rep 1	16	3	0.62	В	4.0
7 Dec 2022	Spring 2022 Rep 2	17	2	0.53	В	3.5
7 Dec 2022	Spring 2022 Rep 3	14	4	0.67	В	5.2
5 Dec 2023	Spring 2023 Rep 1	19	6	0.75	В	4.5
5 Dec 2023	Spring 2023 Rep 2	9	1	0.38	С	3.3
5 Dec 2023	Spring 2023 Rep 3	11	1	0.38	С	3.9
A16						
8 Nov 2012	Spring 2012 Rep 1	24	5	0.91	А	3.9
12 Dec 2013	Spring 2013 Rep 1	20	8	0.73	В	5.0
19 Nov 2014	Spring 2014 Rep 1	22	4	0.73	В	4.6
14 Dec 2015	Spring 2015 Rep 1	13	1	0.52	В	3.6



Appendix G AUSRIVAS BIOTIC INDICES 2012 to 2023

Date	AUSRIVAS Season	No. of Taxa	No. of EPT Taxa	OE50 Taxa Score	AUSRIVAS Band	SIGNAL2 Score
14 Dec 2015	Spring 2015 Rep 2	21	6	0.73	В	4.4
1-2 Dec 2016	Spring 2016 Rep 1	16	5	0.84	А	3.7
1-2 Dec 2016	Spring 2016 Rep 2	23	5	0.63	В	3.9
11 Dec 2018	Spring 2018 Rep 1	19	7	0.64	В	4.4
11 Dec 2018	Spring 2018 Rep 2	7	2	0.36	С	4.7
11 Dec 2018	Spring 2018 Rep 3	11	3	0.36	С	4.1
18 Nov 2020	Spring 2020 Rep 1	17	6	0.50	С	4.6
18 Nov 2020	Spring 2020 Rep 2	16	4	0.53	В	4.5
18 Nov 2020	Spring 2020 Rep 3	14	3	0.53	В	4.1
16 Nov 2021	Spring 2021 Rep 1	10	3	0.36	С	5.2
16 Nov 2021	Spring 2021 Rep 2	19	6	0.82	В	4.5
16 Nov 2021	Spring 2021 Rep 3	18	7	0.82	В	4.6
7 Dec 2022	Spring 2022 Rep 1	14	5	0.55	В	4.3
7 Dec 2022	Spring 2022 Rep 2	14	5	0.73	В	4.9
7 Dec 2022	Spring 2022 Rep 3	18	7	0.64	В	4.7
5 Dec 2023	Spring 2023 Rep 1	24	5	0.68	В	3.7
5 Dec 2023	Spring 2023 Rep 2	21	5	0.76	В	4.0
5 Dec 2023	Spring 2023 Rep 3	16	5	0.34	С	3.8



Appendix H RESULTS OF PERMANOVAS

Appendix H RESULTS OF PERMANOVAS

a) Comparison between NCR1 and NCR2 sampled in spring of 2013, 2015, 2016, 2018, 2020, 2021, 2022 and 2023.

Source of Variation	df	SS	MS	Pseudo-F	Р
Number of Taxa					
Site	1	4.97	4.97	0.459	0.501
Survey	9	458.75	50.97	4.708	0.002
Site x Survey	9	98.71	10.97	1.013	0.466
Residual	26	281.50	10.83		
Total	45	846.00			
Number of EPT Taxa					
Site	1	2.26	2.26	1.311	0.265
Survey	9	48.40	5.38	3.118	0.011
Site x Survey	9	19.47	2.16	1.254	0.302
Residual	26	44.83	1.72		
Total	45	113.48			
SIGNAL2 Score					
Site	1	1.06	1.06	8.089	0.008
Survey	9	2.68	0.30	2.276	0.054
Site x Survey	9	1.57	0.17	1.336	0.261
Residual	26	3.40	0.13		
Total	45	9.00			
OE50 Taxa Score					
Site	1	0.00	0.00	0.180	0.667
Survey	9	0.34	0.04	2.075	0.070
Site x Survey	9	0.25	0.03	1.524	0.188
Residual	26	0.48	0.02		
Total	45	1.08			
Multivariate Assemblage					
Site	1	4105.80	4105.80	4.273	<0.001
Survey	9	20363.00	2262.60	2.355	<0.001
Site x Survey	9	8516.70	946.30	0.985	0.521
Residual	26	24981.00	960.80		
Total	45	58581.00			



Appendix H RESULTS OF PERMANOVAS

b) Comparison among NCR12, NCR2, NCR3 and A16 sampled in spring of 2015, 2016, 2018, 2020, 2021, 2022 and 2023.

Source of Variation	df	SS	MS	Pseudo-F	Р
Number of Taxa					
Treatment	1	0.04	0.04	0.001	0.976
Survey	6	116.48	19.41	0.757	0.611
Site (Treatment)	2	72.53	36.26	2.786	0.071
Treatment x Survey	6	48.96	8.16	0.318	0.923
Survey x Site (Treatment)	12	307.80	25.65	1.971	0.051
Residual	48	624.83	13.02		
Total	75	1267.20			
Number of EPT Taxa					
Treatment	1	0.17	0.17	0.005	0.951
Survey	6	37.87	6.31	4.606	0.007
Site (Treatment)	2	65.44	32.72	13.311	<0.001
Treatment x Survey	6	17.53	2.92	2.132	0.106
Survey x Site (Treatment)	12	16.44	1.37	0.557	0.865
Residual	48	118.00	2.46		
Total	75	258.88			
SIGNAL2 Score					
Treatment	1	0.37	0.37	0.260	0.657
Survey	6	4.25	0.71	2.520	0.092
Site (Treatment)	2	2.84	1.42	7.989	0.001
Treatment x Survey	6	0.58	0.10	0.345	0.889
Survey x Site (Treatment)	12	3.37	0.28	1.581	0.135
Residual	48	8.54	0.18		
Total	75	21.14			
OE50 TaxaScore					
Treatment	1	0.05	0.05	0.789	0.466
Survey	6	0.31	0.05	2.479	0.123
Site (Treatment)	2	0.12	0.06	2.380	0.103
Treatment x Survey	6	0.24	0.04	1.948	0.193
Survey x Site (Treatment)	12	0.25	0.02	0.800	0.652
Residual	48	1.25	0.03		
Total	75	2.46			
Multivariate Assemblage					
Treatment	1	3831	3831	0.394	0.887
Survey	6	20493	3416	1.867	0.004
Site (Treatment)	2	19467	9734	9.434	0.001
Treatment x Survey	6	11396	1899	1.038	0.430
Survey x Site (Treatment)	12	21949	1829	1.773	0.000
Residual	48	49525	1032		



Appendix F Lamberts North Ash Placement Project - Annual Water Qua	ality
Monitoring Report 2023– 2024	

Appendix G Mt Piper Ash Repositor	y & Lamberts North Rehabilitation Plai
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Appendix H EnergyAustralia NSW Community Sponsorships and Donations from 1 September 2023 – 31 August 2024

Date	Name	Project	Туре
Sept 23	Lithgow High School	EnergyAustralia Community Award	Sponsorship
Sept 23	Rydal Show Society	Annual Show	Sponsorship
Sept 23	Lithgow High School	EnergyAustralia Community Award	Sponsorship
Sept 23	Wallerawang Acclimatisation Society	Gone Fishing Day	Sponsorship
Sept 23	St Josephs School Portland	EnergyAustralia Community Award	Sponsorship
Sept 23	Lithgow City Council	Halloween	Sponsorship
Sept 23	Beatlesfest	Beatles Festival	Sponsorship
Oct 23	La Salle Academy Lithgow	EnergyAustralia Community Award	Sponsorship
Oct 23	Portland Central School	EnergyAustralia Community Award	Sponsorship
Oct 23	Jack & Jill Preschool	Wellbeing Program	Grant
Oct 23	Lithgow Bowling Club	Sensory Play Area	Grant
Oct 23	One Mob Aboriginal Corp	Native bush tucker garden	Grant
Oct 23	Pied Piper Preschool Association	Bush Kindy Program Grant	
Oct 23	Portland Central School	Grip Leadership Program Grant	
Oct 23	Lithgow Public School	EnergyAustralia Community Award	Sponsorship
Oct 23	Zig Zag Public School	EnergyAustralia Community Sponsorsh Award	
Oct 23	Blinky Bill Preschool	Fundraiser Donation	
Nov 23	Wallerawang Public School	EnergyAustralia Community Sponsorsh Award	
Nov 23	St Patricks School	EnergyAustralia Community Sponsorsh Award	
Nov 23	St Joseph's Spring Fete	Fundraiser Donation	
Nov 23	Lithgow City Orchestra	Music for Community Mental Grant Wellbeing & Social Inclusion	
Nov 23	Legacy	Fundraiser	\$4\$
Dec 23	Capertee Public School	EnergyAustralia Community Sponsorsh Award	

Dec 23	Cooerwull Public School	EnergyAustralia Community	Sponsorship
Dec 23	Hampton Public School	Award EnergyAustralia Community	Sponsorship
	·	Award	
Dec 23	Lithgow District Chamber of	Black Rose Business Awards	Sponsorship
	Commerce		
Dec 23	Cullen Bullen Rural Fire Service	Christmas BBQ Event	Donation
Dec 23	Movember	Fundraiser	\$4\$
Jan 24	Cullen Bullen Public School	EnergyAustralia Community	Sponsorship
		Award	
Jan 24	Portland Business Association	Portland Soundtrail	Sponsorship
Feb 24	Portland Foundations	Portland Easter Twilight	Donation
		Markets	
March 24	Portland Art Show	Sponsorship of Local Art	Sponsorship
		Show	
March 24	Lithgow Show Society	Annual Show Sponsors	
April 24	Portland Foundations	Ironfest	Sponsorship
April 24	Lithgow Council	Lithglow Sponso	
May 24	Nanna's Touch	Meals for	Sponsorship
		Disadvantaged/Homeless	
June 24	Lithgow Community Projects	Portland Family Fun Day Grant	
June 24	Lithgow High School	Schools Solar & Engineering Grant	
		Challenge	
June 24	Blinky Bill	Uncle Brett Art workshop	Grant
June 24	Oakey Park Resident's Assoc	Meeting Place Grant	
June 24	Brett Battersby Appeal	Fundraiser \$4\$	
July 24	Portland Central School	STEM Robotics Grant	
Aug 24	Meadow Flat Public School	EnergyAustralia Community Sponsors	
		Award	
Aug 24	Lithgow City Womens Bowling Club	2024 Carnival Donation	
Aug 24	Portland Golf Club	Centenary Celebrations	Donation
Aug 24	Dry July	Fundraiser	\$4\$

Appendix I Complaints Register

	Date	Nature (Enquiry /			Corrective Actions Required	Actions Completed	
Complaints No.	Received	Notification / Complaint)	Issue(s)	EA NSW Response		Y / N	Date
No complaints red	 ceived during re	 porting period.					

Annual Operations Compliance Report
Lamberts North Ash Placement Project

2023 - 2024

Appendix J Independent Environmental Audit Finding

Lamberts North Ash Repository Internal Audit 2023 – 2024

Audit Report						
Audit	An Audit was conducted across Mt Pipers operations including a Audit Findings (see Audit Criteria overleaf, for full description)					
Summary	focus on Lamberts North Ash repository against the requiremen	nts NC-H	Non-compliance – High	0		
	 of EnergyAustralia's environmental management system Audit Findings items are summarised in the adjacent table, and 	NC-M	Non-compliance – Medium	0		
	are detailed within the report.	NC-L	Non-compliance – Low	0		
		NC-A	Administrative non-compliance	0		
		С	Compliant	4		
		NA	Not Assessed	0		
		0	Observation	0		
Auditor	Jarvis Lulham					
Audit Date	August 2024					
Audit Type	Internal Audit					
Audit Method Audit Scope	Desktop review and site inspection - A audit of the LNAR Leachate Barrier Management System in St			5.1		
Audit	 Lamberts North Ash Placement Project – Project Approval 09_0186 (Mod 1) 21 September 2021, Condition D5 and the Operation Environmental Management Plan (Section 2.2.4 Leachate Barrier System 5.11.2.1 Liner Installation 5.11.3 Leachate Management 					
Limitations						
Audit		cument Refere	ence			
Documents	Lamberts North Ash Placement Project – Operation Environmental Management Plan (Section 6.5.3 Water Management System) A2074417					
	Lamberts North Ash Placement Project – Project Approval 09_0186 (Mod 1) 21 September 2021	A1959843				

Audit Criteria	Risk Level	Colour Code	Description		
	High	NC-H	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.		
	Medium	NC-M	Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur.		
	Low	NC-L Non-compliance with: Potential for moderate environmental consequences, but is unlikely to occur; or Potential for low environmental consequences, but is likely to occur.			
	Administrative non- compliance	NC-A	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).		
	Compliant	С	The intent and all elements of the requirement of the regulatory approval have been complied with.		
	Not Assessed	NA	Not assessed.		
	Observation	0	Observation, based on identified inconsistency or opportunity for improvement.		

Reference	Conditions	Finding	Comments / Evidence
LNAR PA Cond. D5	Prior to the commencement of operation of each stage of the ash placement process, the Proponent must demonstrate to the satisfaction of the Secretary, in consultation with the EPA, that the design of the leachate management system is generally consistent with the Environmental Guidelines, Solid Waste Landfills (EPA, 2016), including: (a) the leachate barrier system, including liner and leachate collection system; and (b) the leachate storage dam/s including freeboard, appropriate sizing based on site water balance modelling and liner.	С	The EPA were consulted on 4 February 2022 (A2002079) and provided a response to their review on the 25 February 2022 (A2009169). Consultation with EPA and LNAR Leachate Water Balance Assessment was submitted to the DPE portal (now DPHI) on 25 February 2022 (A2009158). Approval was granted by DPE on 27 April 2022 (A2032299).
LNAR OEMP 2.2.4	A leachate barrier system will be installed in the LNAR. The leachate barrier system (or liner) will include staged installation of a single high-density polyethylene (HDPE) or linear low-density polyethylene (LLDPE) liner, geocomposite or equivalent (liner) to suitable design specifications based on EPA (2016) Solid Waste Landfill Guidelines. The leachate barrier system will be supported by a leachate management system to capture, store and transfer leachate generated from the lined areas. The leachate management system will also be operated in accordance with standards presented by NSW Environmental Protection Authority (NSW EPA) (2016), as described in Section 5.11.	C	Details of the leachate barrier system design can be seen in the "Lamberts North Ash Repository: Leachate Management System Water Balance Assessment" Table 1 (A2002314). The leachate management system details and operation are described in Section 3, section 4 of the Lamberts North Ash Repository: Leachate Management System Water Balance Assessment and were found to be generally consistent with Environmental Guidelines, Solid Waste Landfills (EPA, 2016) (A2002314).
LNAR OEMP 5.11.2.1	Staged installation of a single HDPE liner LLDPE liner, geocomposite or equivalent (liner) to encapsulate the BCA, Solid Mixed Salts and other authorised wastes (as per EPL 13007). This will include: - placement of a geotechnical base layer using WCA (and/or other materials as per the detailed design technical specifications) with subsequent drainage/grading preparation (as required) and installation of the liner; - staged installation of the liner (leachate barrier system), including sidewall liner and capping liner, to suitable design specifications based on NSW Environment Protection Authority Solid Waste Landfill Guidelines (2016); and - leachate collection system, including placement of drainage aggregate, drainage pipework (as required) followed by geotextile or other	С	Placement of geotechnical base layers were constructed as per the relevant technical specification for LNAR Stage 1 and 2 as describe in the Inspection and Test Plan (LNAR1A-ITP-004) (Item 2) & (LNAR-2A-ITP-002S) (Item 2) Staged installation of the liner layers was conducted. Each layer has the relevant QA/QC inspections completed and was deemed to meet the required technical specification as described in (LNAR1A-ITP-004) (Items 3.4 – 3.6) & (LNAR-2A-ITP-002S) (Items 3 – 6) see Figures 1 -4. Leachate collection drainage pipework aggregate and geotextile has been installed as required and completed the relevant QA/QC inspection checks and is deemed to meet the required

Reference	Conditions	Finding	Comments / Evidence
	equivalent material(s) for leachate management, and leachate sump		technical specification. (LNAR1A-ITP-004) & (LNAR-2A-ITP-002S)
	and riser and connecting pipework.		(Items 7, 9 & 10) see Figure 3.
LNAR	The leachate storages have the ability to pump water from in between the two	С	The leachate storage areas have the ability to pump water from
OEMP	liners, along with a sump for leak detection using a dip meter, and the ability to		between the liners and a "under liner" sump for leak detection
5.11.3	pump out water leaks. The leak detection sump will be checked on a monthly		see Figure 3. The sumps are checked on a monthly basis and
	basis by the Contractor.		results can be seen in the Service Stream Monthly reports
	The volume of stored leachate will be managed via recycling for dust		Section 7.
	suppression within the lined BCA placement areas of the LNAR, use of vaporisers,		The leachate delivery location is reported in the monthly
	or leachate may be transferred to the MPPS for treatment for use as an		reports in sections 7 also. Daily leachate irrigation volumes as
	alternate source of water for inclusion in the MPPS water management system		well as transfers to MPPS are reported in "LNAR Pond and Ash
	for electricity generation as needed. Section 5.6.3.4 presents a leachate balance		Conditioning Tracking" document.
	with regard to the ability of the LNAR to reuse collected leachate.		



Figure 1 – LNAR Stage 2 preparation



Figure 3 – LNAR Stage 2liner sump pipework installation



Figure 2 – LNAR Stage 2 displaying the different liner layers



Figure 4 – QA/QC evidence on each layer on the liner that is installed for LNAR Stage 2